



MASTERARBEIT / MASTER'S THESIS

Titel der Masterarbeit / Title of the Master's Thesis

„Effects of authority structures in small groups, solving
explorative or exploitative tasks “

verfasst von / submitted by

Maximilian Benedikt Boss B.Sc.

angestrebter akademischer Grad / in partial fulfilment of the requirements for the degree of
Master of Science (M.Sc.)

Wien, 2017 / Vienna 2017

Studienkennzahl lt. Studienblatt /
degree programme code as it appears on
the student record sheet:

A 066 915

Studienrichtung lt. Studienblatt /
degree programme as it appears on
the student record sheet:

Business Administration, Betriebswirtschaftslehre

Betreut von / Supervisor:

Univ.-Prof. Dipl.-Chem. Dr. Markus Georg Reitzig

Mitbetreut von / Co-Supervisor:

Content

1. ABSTRACT	3
2. INTRODUCTION	4
3. LITERATURE REVIEW	8
3.1. HIERARCHIES	8
3.2. VOICE AND SILENCE BEHAVIOUR	11
3.3. SMALL GROUPS	13
3.4. DECISION MAKING OF SMALL GROUPS.....	14
3.5. EFFECTS OF HIERARCHIES ON SMALL GROUPS' DECISIONS	15
3.6. EXPLORATIVE AND EXPLOITATIVE LEARNING	19
4. RESEARCH GAP & QUESTION	23
5. HYPOTHESIS	26
5.1. EXPLORATIVE LEARNING	26
5.2. EXPLOITATIVE LEARNING	28
6. EXPERIMENTAL DESIGN	30
6.1. EXPERIMENTAL DESIGN EXPLORATIVE TASK	31
6.2. EXPERIMENTAL DESIGN EXPLOITATIVE TASK.....	33
7. EXPECTANCIES	34
8. RESULTS	36
8.1. RESULTS OF THE EXPLORATIVE STUDY	36
8.2. RESULTS OF THE EXPLOITATIVE STUDY 1.....	42
8.3. HYPOTHESIS CHECK EXPLORATIVE STUDY	48
8.4. HYPOTHESIS CHECK EXPLOITATIVE STUDY 1.....	50
9. DISCUSSION	53
9.1. DISCUSSION EXPLORATIVE STUDY	53
9.2. DISCUSSION EXPLOITATIVE STUDY 1.....	59
10. MODIFICATIONS EXPERIMENTAL DESIGN EXPLOITATIVE STUDY	62
10.1. RESULTS OF EXPLOITATIVE STUDY 2.....	63
10.2. DISCUSSION OF EXPLOITATIVE STUDY 2.....	67
11. CONCLUSION & FURTHER RESEARCH	68
12. LIMITATIONS	75
13. ACKNOWLEDGE	76
14. APPENDIX	77
15. BIBLIOGRAPHY	81

1. Abstract

This master's thesis helps to answer the question, of how authority structures influence small groups or "a small group", when exploring or exploiting something, with the help of experiments. So far, this question has been overseen by the literature, which handles small groups, authority structures and/or the big exploration, exploitation learning bloc. The main question that has interested scholars with regard to explorative or exploitative learning had been organisational design questions. However, the connection of small groups and explorative/exploitative learning is not hard to find. Moreover hierarchies are often found in small project teams as well. Consequently the question of how authority structures influence a small group's performance, when engaging in explorative or exploitative learning could be of high interest for scholars and practical managers, who design these groups.

In the experiments of this thesis some unexpected errors occurred, which could partly be removed. Due to a weak used authority framing method, which displays the independent variable of the studies, no significant insights could be generated. However, what can be said is that both learning types are more complex than initially thought. Exploration cannot be compared to a simple creative task, but integrates diverse needs like risk taking, experimentation and structure in one. Similar can be stated about exploitative behaviour, which not solely benefits from structure but requires creativity as well.

The main benefits of this thesis are the practical recommendations made for future researchers, who want to examine this topic with the help of experiments as well. The presented tasks and measurement methods, represent a suitable experimental design for future studies.

2. Introduction

Hierarchies are prevalent in most aspects of our daily life. In social groups, in the soccer team, in dyadic work constellations (Tiedens, Unzueta, & Young, 2007) and most obvious in companies and organisations. Even if hierarchies are in general disliked (Anderson & Brown, 2010), they still have an appealing effect on us, in specific situations (Paunova, 2015). We feel more safe and productive when working in hierarchical settings (Friesen, Kay, Eibach, & Galinsky, 2014; Oedzes, Vegt, Rink, & Walter, 2015).

Still the negative consequences of hierarchies are hard to deny. Although functional theorists praise their motivational powers, besides other beneficial effects, most scholars found mixed results or even negative effects of hierarchical settings (Anderson & Brown, 2010; Nir Halevy, Chou, & Galinsky, 2011).

Due to the fact that hierarchies are so prevalent in our society, scientists of fields like psychology, social studies and economics have been interested in the topic.

Scholars building the voice and silence literature, revealed that in steeper hierarchical organisations, agents more often do not communicate ideas or improvement suggestions up the hierarchy chain (Fang, Kim, & Milliken, Frances, 2014; Festinger, 1950; Reitzig & Maciejovsky, 2015).

Likewise the prevalence of hierarchies in organisations, small working groups can be found in most organisations nowadays. Small groups are used by most organisations to make decisions and/or solve issues (Guzzo & Shea, 1992; Taggar & Brown, 2001), because more people have theoretically more knowledge and diverse perspectives, which results in more decision alternatives and theoretically in better decisions in the end (Dennis, 1993; Van Ginkel & Van Knippenberg, 2012).

However, the emphasis is on knowledge sharing, which can be a problem for small groups.

Steep hierarchies not only influence the communication patterns company wide, (Fang et al., 2014; Festinger, 1950; Reitzig & Maciejovsky, 2015), but also the communication within small groups (Tost, Gino, & Larrick, 2013).

The big advantage of an authority structure is, that they coordinate the working process, due to a clear understanding of everybody's role in the team (Friesen et al., 2014; F. P. Morgeson, DeRue, & Karam, 2010; Oedzes et al., 2015). Authority structures enable groups to work in a more structured and coordinated way, which is of use in specific situations, but not always.

Therefore, the question if an authority structure is beneficial or not in small teams , depends on many aspects, likewise the task they work on (Anderson & Brown, 2010). Not all tasks in organisations are routine and simple, some involve highly complex and creative aspects.

If looking at creative group outcomes in a company related view, the topic of innovations is often not far. Creativity and the resulting innovations help companies to survive the constant competition on the markets. Before an innovation can be generated, an idea has to be vocalised (Lopez-Cabarales, Perez-Luno, & Valle Cabrera, 2009). However creative ideas and innovations do not always have to represent something completely new, but can be a modification or improvement as well. Creativity scholars call that incremental creativity, in contrast to divergent creativity, which represents something completely new (Audia & Goncalo, 2007).

A similar differentiation is made in the organisational learning literature. March (1991), who introduced the terms, distinguishes between explorative learning, which requires new knowledge and exploitative learning, which improves existing knowledge.

After the introduction of both organisational learning types, literature mostly has been interested in the question, of how organisations have to be designed in order to ensure both learning types. Companies have to explore new knowledge to gain a competitive advantage, which can be costly and risky, due to possible failures and high investments. That's why they also have to exploit their existing knowledge to further improve themselves and gain profits (Levinthal & March, 1993).

How to ensure an optimal balance is disputable, some claim that Punctual Equilibrium is the right way (Burgelman, 2002; Gupta, Smith, & Shalley, 2006), while others state that Ambidexterity ensures the balance between search and stabilising processes (Benner & Tushman, 2003; O'Reilly III & Tushman, 2011; Yang, Zhou, & Zhang, 2014).

Nevertheless, most scholars are united in stating that both learning types display different characteristics, with different resulting needs (Lavie, Stettner, & Tushman, 2010). Despite this insight, most scholars overlooked smaller working units in a company.

To the best of my knowledge however, the question of how authority structures in small groups influence their ability to explore or exploit could not be clearly answered.

Yet, the connection between the three topics is not hard to find, because in organisations mostly smaller groups will be responsible for explorative or exploitative actions and the omnipresence of hierarchies can be found in these teams, as well.

But how do authority structures influence explorative groups' ability to take the required risk, allow them to experiment and search for new solutions. The negative effects of authority structures on the groups' communication processes could hinder them to integrate new knowledge and find new solutions.

In order to come up with new ideas a vital discussion process is of importance (Lopez-Cabarales et al., 2009). However simple brainstorming is not automatically connected to explorative learning. The groups not only have to generate diverse ideas but also have to follow one goal in the end. Authority structures enable groups to work in a structured way (Friesen et al., 2014; F. P. Morgeson et al., 2010; Oedzes et al., 2015) but hinder open communication processes, which could result in overseen ideas (Tarakci, Greer, & Groenen, 2015; Tost et al., 2013). The study of Ylinen & Gullkvist, (2014), already emphasized the importance of open communication in explorative actions. Therefore I claim, that groups without an authority structure are more suitable for explorative actions than groups with an authority structure.

Exploitative learning on the other hand, is more connected with efficiency, which can be improved by clear roles and goals (Brown & Miller, 2000; Oedzes et al., 2015).

Nevertheless exploitation is not simple achieved by structuring the work in a better way, incremental creativity is needed in order to modify and improve something existing (Audia & Goncalo, 2007). Yet, the required knowledge to improve something existing is already part of the group (March, 1991), which could make a vital communication process not so relevant. Consequently, in my opinion authority structures enable teams to exploit their existing knowledge in a more effective way.

With the help of experiments this thesis tries to find answers to the above stated questions.

Still the thesis has a pre-study character, meaning that the thesis and the generated insights primary have the function of giving valuable recommendations for scholars, who want to engage in this topic in more detail. Especially the experimental design, developed and evaluated in this thesis can help future studies.

The experiments in the thesis suffered from some unexpected errors, which lead to the fact that no useable statistical results could be generated. However, even if no

results could be displayed, the issues and the possible solutions in the experiments can be used for future research, in order to prevent similar design mistakes.

This thesis is structured as follows: First a literature review will present all relevant research and findings within this topic.

After presenting some interesting findings I will reveal the research gap and explain my hypothesis. Moreover, the experimental design and the results will be discussed.

In the end of the thesis a conclusion will be drawn, thoughts for future research presented and possible limitations will be addressed.

3. Literature Review

3.1. Hierarchies

One of the most common characteristics of companies in the past and today is their hierarchical structure. Organisations around the world rely on hierarchy structures in order to coordinate their agents' behaviour and facilitate the cooperation among them (Lawrence & Lorsch, 1967; March & Simon, 1958).

Hierarchies can be defined as authority layers in groups (Reitzig & Maciejovsky, 2015), which allow people higher in the hierarchy chain to make decisions, which have to be followed by lower hierarchical agents (Fehr, Herz, & Wilkening, 2012). Additionally, the person who can make the final decision of a group is often claimed to be the leader of the group (Bedeian & Hunt, 2006; Carletta, Garrod, & Fraser-Krauss, 1998; Oedzes et al., 2015). However, if hierarchies with their inhibited authority differences lead to solely positive or negative effects in groups and organisations is hard to say. Scholars supporting the functional theories, emphasize the positive effects of hierarchies on the groups' or organisations' performance. According to these studies, hierarchies have an enhancing motivational effect on agents, who are

lower in the hierarchy due to the resulting social, material and psychological incentives (Anderson & Brown, 2010; Nir Halevy et al., 2011). Also, people having authority provide more effort while solving tasks (Fehr et al., 2012). Consequently the motivational aspect of hierarchies can be observed in both groups, the ones with authority and the others without it. Another functional benefit of hierarchies is that predefined authority structures in groups hinder status conflicts (Anicich, Fast, Halevy, & Galinsky, 2016; Greer & van Kleef, 2010; Kilduff, Willer, & Anderson, 2016). Especially upward status conflicts occur in formally equalitarian groups, meaning that two persons of a group or more believe to have a higher status than the other one. These kind of conflicts lead to less contributions of the conflicting parties, hampering the group's potential (Kilduff et al., 2016). What comes next is that formal hierarchies entitle specific roles and responsibilities to the group members, which enables them to cooperate and coordinate their actions in a more efficient way (Oedzes et al., 2015). Scholars showed that if group members are confused about their own role in the group, productive behaviour can be replaced by antagonistic one (Moss & Wilson, 2014).

The contingency theories on the other hand, emphasize the situational factors, which influence the effects of hierarchies. They claim that the type of task, the kind of leader, the influence on the group's coordination, the effect of having power on the leader and the effects of hierarchies on the motivation of the lower group members have to be considered in order to determine if hierarchies are beneficial or not (Anderson & Brown, 2010). Not every task for example shows the same needs. For instance, conjunctive tasks rely on coordinated actions by the team members, which makes it more suitable for hierarchies than additive or disjunctive ones. Likewise, if a task displays many interdependencies, hierarchies are beneficial as well, due to their coordinating function (N. Halevy, Chou, Galinsky, & Murnighan, 2012). Another argument

of the contingency theorists, is that the type of leader influences the effect of a hierarchy on the group. Highly competent leaders will bring groups to a superior performance level, even if the task is generally said to be more suitable for leaderless groups (Tarakci et al., 2015). Even if it is hard to find an overall suitable statement about the effects of hierarchies, they are still part of most western lives.

Nevertheless, despite their prevalence in organisations, hierarchies are generally not popular in the society and many organisational agents dislike steep hierarchical structures (Anderson & Brown, 2010). Organisations answered to this by designing increasingly more equalitarian work groups, without clear formal authority layers (Oedzes et al., 2015). However, if no formal hierarchies are set, informal ones emerge quickly (Anderson, Hildreth, & Howland, 2015; DeRue, Nahrgang, & Ashford, 2015; Friesen et al., 2014; Paunova, 2015; Yoo & Alavi, 2004). Even if disliked, hierarchies lead to feelings of stability, and efficiency whilst clarify the roles in the group, which can be appealing for people in specific cases. They lead to a feeling of being more effective, because agents understand their own role in a better way (Friesen et al., 2014). Especially uncertain situations, which endangered the members' feeling of structure, lead to the formation of strong informal authority structures (Oedzes et al., 2015). Hierarchies are perceived as desirable when organisational agents do not have control over specific situations, which leads to the evolvement of informal hierarchies (Paunova, 2015). General hierarchies satisfy the people's certainty needs, which can lead to a higher organizational identification in hierarchical companies (Nir Halevy et al., 2011). Not only was the literature interested when such informal hierarchies evolve but also who is granted more informal authority in formally equalitarian groups. The results indicate that in the beginning phase of new groups, status allocation is mostly based on personality traits (Paunova, 2015). In more progressed phases of the groups, especially task contributions and group oriented behaviour are the

sources for enhanced informal authority (Ridgeway, 1982). However, when members perceive their group as 'warm', more than one group leader can emerge. Similar effects can be observed, when multiple group members are highly competent (DeRue et al., 2015).

However even if formal and informal hierarchies are so common in organisations and even dyadic work constellations (Tiedens et al., 2007), hierarchical structures not only lead to advantages in organisations.

3.2. Voice and Silence Behaviour

Numerous scholars building the voice and silence literature, examined the influence of steeper hierarchies on the communication patterns of organisational agents.

Employee voice is defined as communication of ideas, improvement proposals and information by organisational agents. The opposing behaviour is called organisational silence, which is related to the withholding of employees' voice (Greenberg and Edwards, 2009).

Scholars have shown that in steeper hierarchies, agents pass on less information and ideas upward the organisation's hierarchy chain (Fang et al., 2014; Festinger, 1950; Reitzig & Maciejovsky, 2015). Hierarchies are layers of authorities (Reitzig & Maciejovsky, 2015), consequently higher hierarchical agents have influence on their subordinates' promotion, salary and their evaluation in general (Fang et al., 2014). This leads to one reason for silence behaviour, called evaluation apprehension. Evaluation apprehension means that subordinates fear negative feedback from their higher hierarchical colleagues when suggesting ideas or passing on information (Fang et al., 2014; Reitzig & Maciejovsky, 2015). Furthermore, groups and organisa-

tions are social constructs. People relate a good working organisation with consensus and agreement, which hinders them to communicate issues or ideas for improvements. What comes next is that agents fear to be labelled as trouble makers by their superiors or peers, when communicating issues or improvement proposals (Morrison & Milliken, 2000).

Detert & Trevino, (2010) argue that it is not about the content that makes people unable to communicate with their superiors but rather the simple fact that people in general have issues to talk to people of higher authority, due to socially acquired behaviour. They state that even if the superior generally encourages voice behaviour, people still fear to communicate to them. Despite these social reasons of why people do not communicate up the hierarchy chain, the most powerful reason for silence behaviour is connected to feelings of control. People do not communicate their ideas because the process is related to effort and costs but does not lead to the anticipated changes. Subordinates think that their voice or proposal, is not heard by higher authorities. Thus, communicating ideas or improvements is a waste of time and especially effort for them (Fang et al., 2014; Milliken, Frances, Morrison, & Hewlin, 2003; Reitzig & Maciejovsky, 2015).

An interesting study found that the general fear of communicating negative news leads to the frequency that many agents convey the news more positively and appealing than they actually are. Fang et al., (2014) found out that this kind of dishonest behaviour could lead, to important investments of the company, which would not have been done if bad news would have been conveyed. However it has to be mentioned that the positive effects only occur if the dishonesty is minimal, which normally is not the case in reality.

Despite this special finding of Fang et al., (2014), silence behaviour of agents do not lead to favourable effects. The restricted idea communication and diffusion due to

steep hierarchies, decreases the organisation's decision making efficiency and constrain the processes that lead to change (Morrison & Milliken, 2000).

All these negative effects of hierarchies on the communication patterns inside the organisations hinder their development, innovations (Carletta et al., 1998) and collective learning (Lawrence et al., 2005), which is necessary to survive on the market. Still organisations without hierarchies are still perceived as prototypes or experimentation.

3.3. Small Groups

Not only hierarchies can be observed in most organisations but also small project or task groups, which work closely together (Guzzo & Shea, 1992; Taggar & Brown, 2001). Companies often use small groups for making decisions or solving tasks, due to the fact that theoretically groups have access to a more diverse information pool. Group decisions could benefit from its members' varying perspectives, expertise (Van Ginkel & Van Knippenberg, 2012) and preferences (Dennis, 1993). Even in creative aspects, groups can generate better outcomes if the members share their knowledge with each other (Seo, Chae, & Lee, 2015). However, likewise with hierarchies, not every task or decision is suitable to be made in a group. Laughlin, (2011) states that especially in intellectual and judgemental tasks diverse knowledge, which is provided by groups, is beneficial. In intellectual tasks single correct answers exists, whereas in judgemental tasks there are no single correct answers.

Not every task is suitable for groups but still many decisions and tasks are handled by groups due to their mentioned advantage of more available knowledge and information.

3.4. Decision making of Small Groups

However the mentioned benefit of groups can only show its power if the diverse information and expertise is sufficiently communicated. Yet, groups are exposed to natural negative processes like production blocking, meaning that in group discussions only one person can speak (Diehl & Stroebe, 1987). Consequently, the current passive members first have to process the newly gained information, before making their own contribution. Additionally, people tend to forget what they wanted to contribute before the other group member started to speak or their information has no relevance for the current phase of the discussion anymore. This leads to the effect that even if desired, agents insufficiently share their knowledge with the rest of the group (Dennis, 1993). These effects are especially disadvantageous in so called Hidden Profile tasks, where all members know partially shared information but crucial information is only available for single individuals. In these special tasks it is necessary that all members communicate their individual information and knowledge to find the optimal decision alternative (Stasser & Titus, 2003). The topic Hidden profile tasks and the resulting group member behaviour have been studied by numerous scholars and represents a famous topic in the group decision literature. The common results indicate that one of the major issues of groups handling such tasks is that all members focus extensively on common knowledge, hampering the group's advantage for more available information (Paulus, 2000; Stasser & Titus, 2003). Another aspect of groups is the fact that they are social constructs, influencing the information that is offered by its members. The members only communicate aspects, which seem suitable for the current discussion phase, therefore groups often get stuck in one aspect of the discussed topic (Dennis, 1993). Group members not only fear negative evaluation by their superiors but of the other group members as well.

This leads to people sharing information in favour of the majority's preference. People tend to evaluate the opinion of the majority as correct and deny the validity of minorities' opinions (Dennis, 1993). Supporting this effect, normative influence theorists claim that people have a higher self-perception, if conforming the opinions of others (Myers & Lamm, 1976). Another often observed phenomena in group activities is called 'social loafing' or 'free riding', which means that group members are unwilling to provide effort in a group task if their own contribution seems not to make a difference in completing the task (Kerr & Tindale, 2004). Here again the theoretical advantage of groups is weakened by negative social behaviour of the members.

Nevertheless, even if groups are exposed to multiple negative processes, they are still prevalent in most modern organisations. However as stated above hierarchies are prevalent in teams and small groups as well, influencing the internal processes further. Therefore scholars tried to answer the question if groups make better decisions or perform better in specific tasks if authority structures are prevalent.

3.5. Effects of Hierarchies on Small Groups' decisions

Group decisions often suffer from suboptimal communication patterns, unfortunately authority structures in groups further worsen these negative processes.

If a team leader is part of a group discussion, the other members with less authority expect and encourage specific behaviour of her (Tost et al., 2013). The person, who has the most authority in the group, is stereotypically responsible for the group's coordination. Consequently the other group members encourage the group leader to talk more. Additionally, people tend to believe that leaders have their position with reason, which entitles them to dominate the discussion (Tost et al., 2013). The result-

ing majority of speaking time of higher status members hinders an optimal information exchange in groups and results in lower performances, compared to leaderless groups (Haslam et al., 1998; Tost et al., 2013). However, it has to be stated that groups with highly competent leaders perform better than leaderless ones (Tarakci et al., 2015), showing that if the most competent person dominates the discussion good outcomes can be generated. Nevertheless, even if authority structures in groups hinder free communication, hierarchies and authority structures foster coordination and cooperation in small groups (Oedzes et al., 2015). Formal group leaders are enabled to structure the group's effort (F. P. Morgeson et al., 2010) without triggering power related conflicts (Berkowitz, 1953). Also social loafing and the so called 'start up problem' can be reduced by structured contribution mechanisms, which are promoted by an authority structure in the team (Simpson, Willer, & Ridgeway, 2012).

F.P. Morgeson et al. (2010), exemplified the positive effects of an authority structure with the help of different phases of group tasks. Generally group tasks can be split into two phases, which both benefit from an authority structure. During the transition phase group leaders, with enhanced authority facilitate the goal setting process, clarify the team's mission and the members' roles in the team. In the following action phase of groups, people with more authority are able to structure the members' actions, enable high quality communication and monitor the group's activities in a better way (F. P. Morgeson et al., 2010).

As shown above, hierarchies restrict communication patterns (Cardinal, 2001; Dennis, 1993; Tarakci et al., 2015; Tost et al., 2013) but facilitate coordination and a structure in the team, besides other aspects (Haslam et al., 1998; F. P. Morgeson et al., 2010; Oedzes et al., 2015). However, the consequences of these effects on the group's outcome depend on the needs of the specific decision or task. In some tasks

open communication and a free flow of information seems more important than a structured approach and vice versa.

Generally tasks and decisions differ in multiple aspects, influencing their needs and natural processes during the task. It can be shown that in specific tasks, groups naturally behave differently.

Brown & Miller, (2000) showed in their study that in more complex tasks, decentralized communication patterns evolve, displaying the importance of open and free communication channels in these tasks. However, task complexity can differ from person to person, due to multiple aspects, which influence the complexity of the task. First, task complexity can be explained by the intrinsic objective task characteristics. Second, it can be explained by psychological aspects, originating from the subjective perception of the complexity. And lastly, it can be seen as a combination between the agent's characteristics and the task itself (S. W. Chae, Seo, & Lee, 2015). But not every task has to be complex. The knowledge required in routine tasks is already part of the group; therefore open communication and a free flow of ideas do not have a big effect on their solution. Routine tasks rather rely on a structured, centralized approach (Brown & Miller, 2000).

Tasks and decisions not only differ in their complexity but also show differences in their requirements and goals. Judgemental tasks, for example, do not have a single correct answer, but rely on suitable judgements of its members. This task structure benefits from vital knowledge sharing in order to generate more alternatives and to benefit from the diverse information of their members. Consequently judgemental tasks are said to be less suitable for formal hierarchies (Lu, Yuan, & McLeod, 2012). Other decisions or tasks require creativity in order to get solved. Scholars claim that creativity in groups is an interactive process, meaning that the members have to present their ideas, evaluate them and recombine the diverse ideas to generate a crea-

tive output. Consequently the creative potential of groups starts with the ability of its members to state their ideas (Drazin, Glynn, & Kazanjian, 1999). S. Chae, Seo, & Lee, (2015) showed that knowledge sharing in groups enhances the creativity of the individuals, claiming that groups who actually share their knowledge produce more creative solutions and ideas. Therefore, creative task groups would benefit from equalitarian teams, without formal authority layers, which encourage the communication of diverse ideas and information.

Moreover, innovations are necessary for a competitive advantage of a company and they are the result of creative ideas made by their employees (Audia & Goncalo, 2007; Lopez-Cabarales et al., 2009). It is common to state that a creative idea has to be novel and useful. Most scholars, who examined creativity in groups or individuals, have used this definition. However, a creative idea not only reflects something completely new but also can display an improvement or modification of something existing. New theories of creativity differentiate between these creativity forms. Divergent creativity reflects the traditional understanding of creativity and incremental creativity shows the improving, modifying character of creativity (Audia & Goncalo, 2007). Exploration and exploitation will be the topic of the last chapter of the literature review, which draws attention on the research gap, which this thesis wants to fill.

Positive effects of hierarchies/authority structures	Negative effects of hierarchies/authority structures	Authors:
Provide psychological incentives		Halevy, Chou, & Galinsky, (2011)
People with authority provide more effort		Fehr, Herz, & Wilkening, (2012)
Hinder status conflicts		Kilduff, Willer, & Anderson, (2016)
Clarify roles, enable coordination		Oedzes, Vegt, Rink, & Walter, (2015)
Provide feeling of stability		Friesen, Kay, Eibach, & Galinsky, (2014)
'Start up' problem & 'social loafing' can be reduced		Simpson, Willer, & Ridgeway, (2012)
	Hinder communication of ideas (Voice & Silence behaviour)	Fang, Kim, & Milliken, Frances, (2014); Milliken, Frances, Morrison, & Hewlin, (2003); Reitzig & Maciejovsky, (2015)
	Leader dominates discussions	Tost, Gino, & Larrick, (2013)

Table1: Overview of the differing effects of hierarchies

3.6. Explorative and Exploitative learning

Research about innovative companies and different types of innovations is vast. These terms not only had been of interest in the innovation literature but also had an influence in the organisational learning literature.

Scholars connected the term of radical innovation with the exploration concept of March, (1991), which had been introduced in the organisational learning literature and had been of high interest in science, since then. He stated that exploration is related to terms like "search, variation, risk taking, experimentation, play, flexibility, discovery and innovation" (March, 1991, p.71). Additionally, exploration means the acquisition of new knowledge (Gupta et al., 2006), which is connected to a high un-

certainty likewise radical innovations (Ylinen & Gullkvist, 2014). March also introduced the term of exploitation, which is related to terms like “refinement, choice, production, efficiency, selection, implementation and execution” (March, 1991,p.71). Exploitation is connected to incremental innovations, the improvement of existing knowledge (Subramaniam & Youndt, 2005) and a recombination of existing skills (Kostopoulos & Bozionelos, 2011). Additionally, Hansen, Podolny, & Pfeffer, (2001) state that exploitation does not require diverse knowledge and several alternative ideas.

Still some scholars argue that exploitation not only relies on existing knowledge but also on new one. Therefore some activities can be claimed as explorative for specific organisations and exploitative for others (Gupta et al., 2006), making it sometimes difficult to generalize both concepts. The definition differences of scholars can be explained by their differing focus. Some scholars focused on individual levels and some on corporate levels. The type of industry, which had been observed leads to different understandings as well (Li, Vanhaverbeke, & Schoenmakers, 2008). In this thesis I will use and structure my hypothesis on the initial exploration and exploitation definitions provided by March, (1991), which have already been presented.

Despite some definition differences, most scholars state that both concepts have differing needs due to their contrasting characteristics (Lavie et al., 2010). Exploration and exploitation differ in their timing. Exploration concentrates on long term performance, which is connected to a high uncertainty, due to late possible feedback. On the other hand exploitation improves existing skills and knowledge, which enables a prompt evaluation of these activities. Not only the time aspect and the uncertainty level differ in both learning types but also the part of organisation, which benefits from these activities. Exploration initially enhances individual or unit based knowledge and exploitative learning represents gains in the collective knowledge of a

company (March, 1991). Even if some scholars claim that both learning types require similar control mechanisms (Cardinal, 2001), most scholars emphasize that due to their contrasting characteristics and needs both concepts have to be managed differently (Lavie et al., 2010).

Notwithstanding the inconsistencies in how to handle both concepts, scholars are mostly united in stating that organisations have to do both, explore and exploit in order to be successful and survive in the long run.

Exploitation focuses on short term goals and enables an organisation to survive current challenges. Exploration, on the other hand, prepares organisation for future challenges (Levinthal & March, 1993).

If companies only focus on short term issues or aspects they will have problems to adapt to new environmental changes (Fang, Lee, & Schilling, 2010). In order to gain a competitive advantage in an industry, exploration is necessary. But, firms that solely concentrate on exploration have to bear the costs of experimentation, without benefiting from improved existing knowledge or products. Additionally, a competitive advantage due to exploration can be extended and defended when it is exploited (Levinthal & March, 1993). Scholars are mostly united in the need for a balance of exploration and exploitation or said differently for a balance between search and stability ensuring activities (Andriopoulos & Lewis, 2009; Fang et al., 2010; Lavie et al., 2010; Levinthal & March, 1993; Rivkin & Siggelkow, 2003). However, the question of how to do best is still questionable. Some scholars claim that companies should temporarily engage in one of these activities. Organisations should normally exploit their existing knowledge but switch to short periods in which they explore new knowledge to generate innovations. This periodically balancing mechanism is called 'Punctual equilibrium' (Burgelman, 2002; Gupta et al., 2006).

Another concept, which became popular in science, is called 'Ambidexterity'

(Andriopoulos & Lewis, 2009; Benner & Tushman, 2003; Jansen, van den Bosch, & Volberda, 2006; O'Reilly III & Tushman, 2011; Yang et al., 2014). Companies employing ambidextrous mechanisms are able to exploit and explore at the same time (Andriopoulos & Lewis, 2009) and not only temporarily engage in one of the activities. Ambidextrous organisations consist of highly differing units, which are weakly integrated. Explorative units are smaller, decentralized structured and are characterized by loose cultures. In contrast exploitative units are bigger, centralized and display tight cultures. Management mechanisms have to ensure an integration of both kinds of generated knowledge (Gupta et al., 2006).

Some studies tried to answer the question of how to design an organisation to successfully explore and/or exploit, with the help of NK landscape models, which simulate organisations' search and stability processes. Rivkin & Siggelkow, (2003) found out with the help of these models, that companies, who decentralize their search/exploration activities in subunits and integrate them in later stages of the model, most likely don't get trapped in suboptimal peaks in the NK-landscape. They call it temporarily decentralized organisations because without any integrating mechanisms the gained knowledge of the subunits cannot spread inside the company, resulting in suboptimal long term performance. Fang et al., (2010), support the idea of decentralized subunits with random links between them. However her study emphasizes the importance of a high diversity in the organisation in order to effectively explore new knowledge. The isolation of explorative units in the organisation enables them to experiment with new solutions, which are not influenced by company norms and cultures. But an organisation has to ensure to spread the newly gained knowledge inside the company, with the help of semi-isolated and not completely isolated sub-units (Fang et al., 2010).

All these results support the ambidexterity approach, which highlights the idea of

loosely connected nearly independent subunits, which are integrated by specific management positions.

How to manage explorative/exploitative	
Both concepts have to be managed differently	Lavie et al., (2010)
Effects of organic & mechanic control mechanism	Ylinen & Gullkvist, (2014)
Effects of centralized decision making	Jansen et al., (2006)
How to design organisations	
Punctual Equilibrium	Burgelman, (2002); Gupta et al., (2006)
Ambidexterity	Andriopoulos & Lewis, (2009); Benner & Tushman, (2003); Kostopoulos & Bozionelos, (2011)
Semi isolated subunits	Rivkin & Siggelkow, (2003)
Semi isolated subunits to ensure diversity in the organisation	Fang et al., (2014)
Team composition for explorative/exploitative units	Perretti & Negro, (2006)

Table 2: Overview of explorative/exploitative learning studies

4. Research Gap & Question

Most studies about March's, (1991) term of exploration and exploitation focus on holistic organisational decision making mechanisms or structural design components, which facilitate or hinder search and stability processes but exclude internal unit processes.

Only few scholars concentrated on smaller groups, combined with the question, what enables them to explore or exploit in a more sufficient way. They found out that organic control mechanisms, which are characterized by decentralized decision making, flexibility, open communication and less formal rules (Slevin & Covin, 1997) lead to positive effects on both learning types (Ylinen & Gullkvist, 2014).

Ylinen & Gullkvist, (2014) state that organic control mechanisms enhance the innova-

tiveness in explorative projects and the performance in exploitative ones. Organic control mechanisms enable the teams to communicate in an open and informal way. Therefore teams can explore new alternatives, which in the end create new knowledge. Similar studies concentrating on teams and units, came to the conclusion that the centralization of decision making in units hinders exploratory search, but do not facilitate exploitative innovations as anticipated by the scholars (Jansen et al., 2006; Ylinen & Gullkvist, 2014). Moreover psychological safety in units and whole organisations promotes explorative learning due to open communication channels, which create room for experimentation (Kostopoulos & Bozionelos, 2011).

The generated results indicate that open communication and the ability of information and knowledge exchange is of high importance in explorative teams, likewise in Hidden Profile tasks. However if authority structures in these groups hamper the teams' performance could not clearly be explained, due to the fact that organic control mechanisms not only entail authority patterns but many other aspects, like the existence of formal rules, as well. Furthermore what kind of authority structure is beneficial in exploitative teams could not be answered, except that formalization is beneficial in exploitative activities (Jansen et al., 2006; Ylinen & Gullkvist, 2014). A study concentrating on the composition of teams by Perretti & Negro, (2006) showed that high status members in explorative teams can enhance their performance. Yet, the scholars explain their results with the enhanced freedom and increased visibility of the teams, which entail high status organisational agents and not due to structural reasons. The study had been conducted in the Hollywood film industry, which shows some unique characteristics. Additionally, the paper of Rivkin & Siggelkow, (2003) used a simple hierarchy in their NK model. However their focus had not been on the hierarchy in general but more on other design aspects like the CEO's abilities, the reward structure etc.. Consequently no insights about the effects of hierarchies on

search and stability processes in general can be made. Nevertheless the study of Jansen et al., (2006), which data had been generated by financial service companies, helped to answer the question about the effects of hierarchies in groups, who engage in exploration or exploitation, by showing that decentralized decision making is positively related to explorative learning of teams. However in order to eliminate industry specifics an experiment, which examines the influence of hierarchies in these specific task types, has not been conducted by the scholars yet.

Even if the literature about hierarchies, small groups and exploration/exploitation is vast, a general answer, if hierarchies with their entailing advantages and disadvantages are suitable for explorative or exploitative teams, has not been given, as far as I know. Moreover the exploration and exploitation literature insufficiently answers the questions about the effects of authority structures on both learning types. Consequently this thesis will try to answer these questions.

Research Question: What are the effects of authority on small groups' performance in solving explorative and exploitative tasks?

The question if hierarchical structures lead to benefits in exploitative or explorative task teams, will bring new insights about the needs for these special types of teams. Additionally, the results could practically show companies how to design such groups. As general known both functions are extremely important for organisations. Consequently teams or units engaging in these activities should be optimally designed in order to provide a competitive advantage. Therefore this thesis not only broadens the scientific knowledge about exploration, exploitation and small groups but also will generate strategic practical knowledge.

5. Hypothesis

5.1. Explorative learning

As stated above, explorative learning is not based on existing knowledge but on new one (Gupta et al., 2006; March, 1991), which is connected to a high uncertainty (Ylinen & Gullkvist, 2014). Therefore experimentation, variation and risk taking (March, 1991) are necessary in order to explore and find solutions for such tasks. Furthermore exploration is related to radical innovations (Benner & Tushman, 2003; Ylinen & Gullkvist, 2014), which benefit from diverse knowledge and information (Lu et al., 2012).

Hierarchies enable groups to approach issues in a more structured way, due to clarified roles (Simpson et al., 2012). Negative power struggles can be eliminated by pre-defined authority layers in groups (Kilduff et al., 2016; Moss & Wilson, 2014). In general hierarchies structure groups' planning and action phases, which leads to a coordinated approach of groups, when solving tasks (F. P. Morgeson et al., 2010). Additionally problems like social loafing or production blocking can be reduced by structured contribution mechanisms, which are promoted by hierarchies (Simpson et al., 2012).

However the necessity of a highly structured approach is questionable in explorative tasks, which rely on divergent creativity (Audia & Goncalo, 2007) and unrestricted communication (Ylinen & Gullkvist, 2014). Risk taking and experimentation is facilitated if the group members do not fear negative feedback of their peers or superiors (Bunderson & Reagans, 2011).

Scholars state that in explorative activities divergent creativity is needed in order to produce new knowledge and solutions (Audia & Goncalo, 2007). Divergent creativity

and exploration can be compared to “outside the box” thinking (Madjar, Greenberg, & Chen, 2011).

Yet, it is generally known that authority structures and hierarchies not only restrict open communication companywide (Fang et al., 2014; Festinger, 1950; Reitzig & Maciejovsky, 2015) but also hampers the free exchange of ideas in small groups and their creative potential (Paulus & Brown, 2007; Tost et al., 2013). Higher authority group members intimidate the lower status group members into not freely state their ideas. Group leaders do not encourage their subordinates to offer ideas, because they are engaged in dominating the discussion (Carletta et al., 1998). Additionally, high power group members are often unaffected by the information provided by members of lower power (Galinsky, Magee, Gruenfeld, Whitson, & Liljenquist, 2008). Showing that even if lower authority members do offer information or ideas, the leader and the other group members do not consider them as important (Galinsky et al., 2008).

It has been shown by Ylinen & Gullkvist, (2014) that, informal and open communication patterns enabled by organic control mechanisms positively affected explorative search. Similar results could be generated by Jansen et al., (2006), who showed that centralized decision making harms explorative learning. Moreover it is proven that psychological safety in groups promote exploration (Kostopoulos & Bozionelos, 2011) but is restricted by authority structures in teams (Edmondson, 2002; Oedzes et al., 2015). The previous examinations and results indicate that open communication in teams and not a structured approach is the critical point, when solving explorative tasks. Consequently my first hypothesis states that, authority structures in small groups will negatively influence their ability to solve explorative tasks.

H1: Groups lacking an authority structure will perform better in explorative tasks, compared to groups with an authority structure.

5.2. Exploitative learning

Exploitation is closely connected to terms like efficiency, refinement and execution (March, 1991) and is based on existing knowledge (Subramaniam & Youndt, 2005), which has to be recombined and improved (Kostopoulos & Bozionelos, 2011). Exploitation is related to incremental creativity, which means to improve and generate ideas in existing boundaries and systems (Audia & Goncalo, 2007). The required knowledge for exploitation can be found inside the organisation. Therefore no existing norms have to be broken down (Madjar et al., 2011).

That does not mean that exploitative activities do not benefit from creativity. But the type of creativity differs from the normal understanding. Not divergent creativity likewise in explorative activities is beneficial here, but incremental creativity, which uses existing methods and knowledge to improve things (Audia & Goncalo, 2007). Creativity scholars state that creative ideas not only have to represent something completely new but can display modifications of existing procedures, organizational structures and so on. Consequently exploitative learning represents a specific type of creativity (George, 2007).

However, it is known that hierarchies in groups hinder open communication and collective learning in teams (Lawrence et al., 2005), which negatively affects the group's creativity (Paulus, 2000; Sutton & Hargadon, 1997). Creativity in these studies represented something completely new, which had been generated by uncommon ideas (Paulus, 2000). Yet, due to the fact that exploitative learning is based on existing

knowledge, which has to be refined, an extensive idea exchange to bring in new insights to the groups, does not play such an important role. The routine character of exploitative tasks (Tuncdogan, Van Den Bosch, & Volberda, 2015) displays the lessened importance of information exchange when solving such tasks (Brown & Miller, 2000).

Additionally, exploitation is related to efficiency (March, 1991), which can be explained by quicker or more economical task completions. It is known that authority structures facilitate task division and allocation (Frederick P Morgeson, 2005), which could lead to more efficient processes in hierarchical groups.

If one person is in charge the other members will adapt the view of their leader, without power struggles (Kilduff et al., 2016; Oedzes et al., 2015), which could otherwise result in antagonistic behaviour of the members (Moss & Wilson, 2014). What comes next is that powerful people can recognize group goals quicker (Overbeck & Park, 2006) and adjust their behaviour accordingly (N. Halevy et al., 2012; Magee & Galinsky, 2008). Despite these behavioural effects of hierarchies, authority structures in groups can facilitate their members' role attribution (Friesen et al., 2014), which leads to an efficient cooperation among them (F. P. Morgeson et al., 2010; Oedzes et al., 2015).

All these effects of hierarchies can improve existing processes and facilitate exploitative learning in the teams.

Even if the study of Ylinen & Gullkvist, (2014) could not provide a clear picture about the positive effect of mechanistic control mechanisms in exploitative settings I argue that authority structures lead to positive effects when solving exploitative tasks. Said differently, I argue that the structural benefits generated by an authority layer in the teams will outperform the negative effects on their communication patterns. Consequently, I claim that groups with an authority structure benefit from the resulting en-

hanced structural coordination, which leads to better performance compared to equalitarian groups.

H2: Groups lacking an authority structure will perform worse in exploitative tasks, compared to groups with an authority structure.

6. Experimental Design

In order to check the two hypotheses an experiment will be conducted. For each task type, one treatment and one control group will be tested, meaning there will be a 2x2 matrix to test.

The subjects for the experiment will be students from an European business university. Both tasks, the explorative and the exploitative one, will use similar materials like the marshmallow challenge of Tom Wujec, who presented his results of team building workshops in a popular Ted Talk. The tasks in the experiment will use similar materials as Tom Wujec, which are dry spaghettis, tape and marshmallows. In order to ensure that the teams of three people will be of a random constellation, every subject will receive a random number. The three following numbers will form a team. Random team constellations are necessary because some business students know each other from other courses etc., which could create bias in the initial team structure.

The treatment groups will entail a simple hierarchy. The procedure to generate an authority structure in the groups will be similar like in the study of Haslam et al., (1998). In their random authority treatment, the subject whose last name is first in the alphabet has enhanced decision-making authority in the group. Consequently, the treatment group consists one superior and two subordinates. The teams will get told

that the group leader is responsible for the group’s outcome and has the power to make decisions, which has to be followed by the other members. The control groups are equalitarian groups, in which everybody has formally the same authority and decision-making rights. After the actual task all subjects have to answer a similar questionnaire to find out some facts about their communication patterns and how they approached the task. Besides that some overall information about the subjects’ age and sexuality will be collected in order to gain more information to come to more meaningful conclusions.

	No authority structure	Authority structure
Exploration	Control group 1	Treatment group1
Exploitation	Control group 2	Treatment group2

Table 3: Experimental study 2x2 matrix

6.1. Experimental Design Explorative task

The term of explorative learning or task is described by words like “experimentation, search, uncertainty, creativity, novelty and usage of outside the company’s knowledge” (March, 1991,p. 71). The explorative task in the experiment will be nearly the exact marshmallow challenge of Tom Wujec’s team building workshops. The groups have to build a free standing tower out of 20 sticks of spaghetti, one meter tape and one marshmallow, which has to be placed at the top. The groups will have 18 minutes time to complete the task. The treatment groups, who entail an authority structure will get two minutes before the experiment starts in order to find their group leader. The group leader will be responsible for the teams’ actions and has the power

to make decisions, which has to be followed by the rest of the group. Afterwards, the treatment and control group will receive the same short instructions about the task.

Such a task displays non-routine and novel challenge for the groups, due to the fact that most business students never have built such a tower, especially with this kind of material. However it has to be mentioned that students from a design or architecture university are not suitable, because this task can have a routine character for them. Additionally because no design inputs are presented, the subjects cannot orientate on existing knowledge but have to find new ways to come to a solution. The given instructions are kept short in order to provide the teams with high freedom in their completion. Both aspects are related to new 'outside the company' knowledge of March's exploration definition. Moreover because this kind of task displays something new for business student, which cannot be generated by a recombination of existing knowledge, divergent creativity is required (Audia & Goncalo, 2007).

Furthermore in order to build a construction, which can handle the marshmallow's weight in the end, the groups have to experiment during the construction process and take risks.

Furthermore to complete the task successfully a creative approach is needed. Tom Wujec stated that kindergarten classes showed great performance, due to their creative approaches and their willingness to experiment during the construction process.

The groups initially have to find a suitable design for the tower and have to cooperate in order to build it in the limited available time.

the task is completed successfully, if the construction can handle the marshmallow's weight, otherwise the groups failed. The performance indicator will be the height of the tower itself.

All these aspects of the Marshmallow Challenge make the task a suitable explorative group exercise, which is easy to measure. Moreover normally students have fun during the task, which enhances their motivation to show good performance here.

6.2. Experimental Design Exploitative task

Exploitation is based on existing knowledge and can be explained as routine work (Tuncdogan et al., 2015), which has to be refined and improved (March, 1991). The exploitative task in the thesis will be broken down to the terms of existing knowledge and efficiency, which are related to the exploitation definition of March, (1991, p.71).

A construction made by dry spaghetti and marshmallows will be presented to the teams, which have to be rebuilt by them. To emphasize the existing knowledge of exploitation, the teams will get presented a short video, showing them one possible process how to build the construction. I claim that due to the displayed construction and the presented construction process, the required knowledge for this task is part of the team. However, it will be highlighted that the shown process is only one possible way and does not have to be the cleverest one. The construction will be a Cub-octahedron, a polyhedron consisting of eight triangular faces and six square faces. This construction enables the teams to structure their work efficiently due to smart task division and allocation. Moreover, it leaves room for multiple ways to rebuild it. To ensure that the groups structure their ideas and have sufficient time to find a group leader, all teams will get five minutes preparation time at the beginning. The creative aspect here is not connected to something completely new but to improvements due to modifications of the existing knowledge.

The teams' goal will be to produce as many Cuboctahedrons as possible in 20 minutes. Successful teams will build more constructions in the given time, displaying a more efficient process, which is in line with the exploitation term provided by March, (1991).

The presented task requires existing knowledge, which is provided by the displayed video and the picture of the Cuboctahedron. Moreover the goal of the task is to improve the procedure of the construction, which displays a modification but not a completely new approach likewise in explorative tasks. Incremental creativity and coordinated actions will lead to good performance. All these aspects fit into the exploitation thought of March, (1991), which makes this task a suitable one for the experiment.

Example of a finished Cuboctahedron made out of spaghetti and small marshmallows:

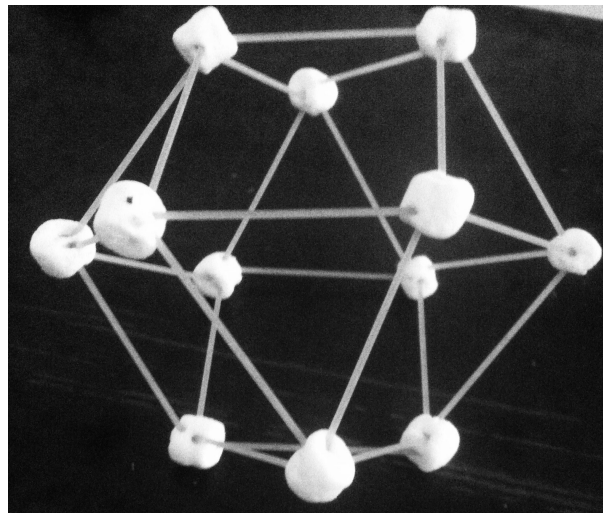


Figure 1: Example of Cuboctahedron made of spaghetti and marshmallows

7. Expectancies

Due to the characteristics of the different tasks of the experiment, I expect that some groups will perform better with an authority structure and some without one.

The tower building tasks in the explorative setting, involves a divergent like creativity. People initially have to collect their ideas in order to find the best way how to solve the task. A free and informal communication process seems of high importance here. However, what should not be forgotten is that without a coordinated approach the teams will have troubles to complete the task in the provided time. Power struggles about whose idea to follow could complicate the process further and lead to time constraints as well. Nevertheless, the goal of the task is to build a high tower, which requires creativity, risk taking and experimentation for the realization. The time constraint is of importance but is a side element of the task, which can be handled by equalitarian groups too. In my opinion, a creative interchange is the prime factor that leads to success in this experience. Consequently, I expect that teams without a formal authority structure will benefit in building a higher tower. The reason is that authority structures in groups generally hinder open communication and idea exchange (Carletta et al., 1998; Lawrence et al., 2005). The positive structural effects of an hierarchy in the group (Frederick P Morgeson, 2005) and the lessened power struggles (Kilduff et al., 2016) will not out perform the disadvantages of hierarchies on the communication patterns (S. W. Chae et al., 2015).

In the exploitative task, which represents a rebuilding process, requires a structural approach with clear roles. Moreover, to ensure real teamwork, a team leader can allocate roles and starts the contribution mechanism, which can be hampered by unclear responsibilities. Power struggles would complicate the process further, leading to a waste of time. Due to the fact that authority structures facilitate these processes (Kilduff et al., 2016; Frederick P Morgeson, 2005), I expect that teams with an hierarchy solve the task in an more efficient way, which is the goal here.

8. Results

In the result section, first some descriptive results are presented. First, the individual questionnaire results and the grouped questionnaire results of both studies will be analysed. Afterwards, the two hypotheses will be checked in more detail.

8.1. Results of the Explorative study

After the explorative experiment, the subjects had to fill in a small questionnaire. This had the purpose to generate some additional data about the subjects' age, sex and how they approached the task. I analysed the individual answers of the subjects, which had not been grouped in this first analysis. Consequently, the results regarding the dependent variable height tripled, because always three people of one group stated the same answer. This has to be taken into account if looking at the multi-correlation analysis, which includes the dependent variable, especially when regarding the significance level.

Yet, other individual answers can bring insights about the subjects' approach and how they rated specific aspects inside their group, because not every group member rated particular aspects equally.

In total, 57 subjects participated in the explorative experiment, building 9 control groups without an authority structure and 10 groups with an authority structure. The sexuality of the subjects had been balanced, 29 had been female and 28 male. 15 males and 15 females were in the treatment group. In the control group, without an official authority structure, 14 females and 13 males were examined. Even if the distribution is nearly completely balanced the groups' constellation were random. Re-

Regarding the age of the subjects, no big surprise were revealed, because most of them were business students in master classes. The youngest person was 19 years old and the oldest was 30 years old. The mean value was about 23.8 years. In the treatment group the mean age had been 23.8 and in the control group 23.5.

Regarding the studies of all subjects, 70% are in their master studies and 30% in their bachelor studies. In the treatment group 63% are in their master studies and 37% in their bachelor studies. In the control group 78% are master students and only 22% bachelor students.

Coming to some more insight bringing results: The questionnaire contained questions about how the subjects approached the task. I collected this information from the individuals and not from the groups, to receive a more honest answer. If the subjects would have answered the question in a group they would have marked the answer, which seems right for them, but not how they really felt. The results clarify that not every individual in a group feels or experienced the approach equally.

The subjects could state, that they initially made a plan before starting the actual task or that they started immediately experimenting with the spaghettis. According to Tom Wujec's Ted Talk, kindergarten kids are so successful in this tower building challenge, because they experimented more than other groups. It can be shown that 21% (12 subjects) of the people stated that they started experimenting and 79% (45 subjects) of the subjects initially discussed the task with their teammates. In the groups without an official authority structure only 18% (5 subjects) of the subjects started experimenting. Here an inconsistency has to be emphasized. Because each group consisted of 3 subjects, not all subjects rated their approach in the same way. 82% (22 subjects) in the control group claimed that they first discussed the task with each other before actually working on it. In the treatment group, 23% (7 subjects) immediately started to experiment with the task and 77% (23 subjects) discussed it first.

Here again it can be shown that not every team member has the same view on her or his team's approach.

Furthermore, 63% (19 subjects) of the subjects in the treatment group and 52% (14 subjects) of the subjects in the control group reported that they divided the task into subtasks. About 42% (24 subject) of all the subjects did not divide the task at all. Nevertheless, still 58% (33 subjects) of all subjects divided the task.

In order to get a clearer picture about the authority framing method and the official leader behaviour in the treatment group, the subjects had to answer a question about the behaviour of their leader.

77% (23 subjects) of the subjects in the treatment group stated that the leader behaved perfectly and 23 % (7 subjects) that she did not do enough in order to perform her role appropriately. The subjects could have rated her as overreacting as well, meaning that she overcompensated her official role. However, none actually felt that way. These results and their implication will be discussed later in more detail.

The control groups, which had no official leader, had to answer, if one specific person in the group took over the leading role, acting like an 'unofficial' leader. Only 37% (10 subjects) of the subjects claimed that one person took over the leading role and 63% (17 subjects) claimed that nobody took over this role.

Moreover, I asked the subjects if everybody in the group had a specific role during the task. In the control group without an official leader, 33% (9 subjects) stated that in their group everybody had her specific role. In the treatment group with one official leader a different result can be observed. Here 67% (18 subjects) of the subjects stated that everybody had a role in the group. This makes sense, because we know that role attribution is facilitated by an authority structure in the group (Friesen et al., 2014; F. P. Morgeson et al., 2010; Oedzes et al., 2015).

Furthermore only 5 subjects of 57 did not like to work with their team and only 2 stated that a conflict during the task occurred. Interestingly, no entire group claimed the existence of a conflict, showing that not all members had the same feeling.

Regarding their self perceived performance, 42% (24 subjects) of subjects found themselves below than average, 23% (13 subjects) like average and 35% (20 subjects) above average, showing that this kind of task and their performance displayed something new for them, in which they have no skills (Kruger, 1999).

Answer	Treatment Group	Control Group
The group discussed the approach first	77%	82%
The group started experimenting	23%	18%
The group divided the task	63%	52%
The leader acted appropriately	77%	/
The leader did to less	23%	/
The leader overdid her role	0%	/
Someone took over the unofficial leader role	/	37%
Everybody had a role in the group	67%	33%

Table 4: Overview individual questionnaire results, explorative study

The descriptive table uses an alpha value of 10 % instead of 5% due to the small sample size. Table 5 shows the results in more detail. I will only focus on the significant results here.

p=0.1	height	authority	approach	subtask	leader	leadingrole	roles	sympathy	self	sex	age
height	1.000										
authority	0.3152*	1.000									
approach	-0,009	0.1452	1.000								
subtask	0,2397*	0.0974	0.0826	1.000							
leader	0.4366*	0.0788	-0,118	0.5615*	1.000						
leadingrole	0.1042	/	0.3656*	-0,0284	/	1.000					
roles	0.0328	0.2996*	0.0951	0.5125*	0.2786	-0,2169	1.000				
sympathy	0.4358*	0.2942*	-0,008	0.2380*	0.3366*	-0,3278 *	0.1915	1.000			
self	0.4724*	0.125	0.1991	0.1395	0.4317*	0.1844	0.1607	0.2985*	1.000		
sex	0.1024	0.0518	-0,0951	-0,015	0.2364	0.0284	-0,0172	-0,1915	0.1664	1.000	
age	-0,839	0.0091	0.2305*	-0,1588	-0,3358 *	0.1052	-0,099	-0,3875 *	-0,1177	0.0846	1.000

Table 5: Multi-correlation analysis explorative study, individual answers

Firstly, it can be observed that authority and the tower height are positively and significantly ($p=0.1$) correlated. However, due to the individual answers, which are examined here, the sample size is artificially blown up. The valid analysis of the independent and dependent variable will be checked in the hypothesis section later on. The significant positive connection here is not valid.

What can be stated is that an official authority structure inside the teams did positively and significantly affected the role attribution in the groups but had no influence on the approach on how to solve the task, in other words: the task division.

The self-evaluation positively and significantly correlated with the height of the tower and the leader-behaviour. Showing that the individuals had the feeling of being more successful if working in a predefined authority structure and when producing higher towers, which is logical. Yet, teams with an authority structure in general produced higher towers, which could be the main reason for the positive connection of the authority structure and the individuals' self-evaluation.

Moreover, the variable measuring the official leader performance shows a positive and significant connection to task division inside the teams. Additionally, task division significantly lead to higher towers, when regarding the individual answers. However, leader-behaviour only had been documented if an official leader had been part of the group and the groups with an authority structure in total had built higher towers.

If in the control groups one person claimed the leading-role, a positive and significant effect on the groups' approach can be observed, which means that they discussed the matter first. Yet, an official authority or the leader-performance in the treatment group did not show such an effect. What can be shown as well is that specific roles in the teams and task division are positively correlated with one another. This results seems reasonable as well, because task division and allocation goes hand in hand with specific roles in the teams.

Nevertheless, the results have to be viewed with caution because, as stated above, especially the dependent variable has an artificially blown up size, due to triple statements of one group. The observed results will be discussed in more detail in the discussion section of this thesis.

I clustered the individual questionnaire results to form group answers. To do so the average answer was generated. For example, when two subjects stated that they divided the task and one person of the group stated the opposite, I claimed that the group answer is: divide the task. If all three of one group gave a different answer, which occurred once, the answer is not marked as valid and has not been considered in the examination. I run a correlation analysis with a p-value of 0.1 next.

The authority structure in the team and the role allocation in the teams are significantly and positively correlated, likewise in the examination of the individual answers. Roles and subtasks are positively and significantly related, which makes sense because if the teams divided the task, they have to allocate the sub tasks as well, which leads to specific roles inside of the teams. It can be seen that the performance of the leader has a positive influence on the groups' task division. Showing that appropriate leader behaviour has a positive effects on structuring variables, like task division here.

p=0.1	height	authority	approach	subtask	leader	leadingrole	roles
height	1.000						
authority	0.2624	1.000					
approach	-0,0382	0.0272	1.000				
subtask	0.2897	0.1495	0.1409	1.000			
leader	0.3957	/	-0,2500	0.7638 *	1.000		
leadingrole	0.1727	/	0.3780	0.1581	/	1.000	
roles	0.1096	0.5778*	0.0272	0.5866*	0.3750	-0,378	1.000

Table 6: Multi-correlation analysis explorative clustered answers

The correlation analysis between authority and leader performance did not generated any results, because after clustering the individual answers only two groups stated

that their leader did not do enough. Interestingly, the authority structure inside the teams did not influence the teams' approach, like task division when examining the grouped results.

In general, the grouped answers generated less significant results than the individuals, because the grouped sample size had been one third of the individuals. Moreover, due to the averaging mechanism, many types of answers just fall out of the examination.

8.2. Results of the Exploitative study 1

The results of the first exploitative study are presented in the following.

Initially, some details about the subjects who participated in the first exploitative experiment will be shown. 36 students participated the first exploitative experiment, 20 females and 16 males, building 6 treatment and control groups. In the treatment groups 12 females and 6 males took part. In the control group it was more balanced with 10 males and 8 females.

The youngest subject was 21 and the oldest 33, with a mean of 25.2 years in these experiments. Moreover, 58% (21 subjects) were students currently enrolled in a master program and 42% (15 subjects) in a bachelors program. When looking at the control group 38% (7 subjects) were enrolled in a master program and 62% (11 subjects) in a bachelors program. In the treatment group, 56% (10 subjects) were enrolled in a masters program and 44% (8 subjects) in a bachelor one.

The subjects had 5 minutes before commencing the task to organise themselves. I enquired about the communication during this preparation time and whether or not everyone had the chance to say something. They could choose from the statements,

that nobody communicated, one person dominated the discussion and that everybody was able to speak equally. The results show that 92% (33 subjects) felt that everybody had the chance to speak equally during the preparation time. However 8% (three people) stated that there was no communication at all in their group during the preparation time. All three subjects were part of a group without an authority structure. Additionally, I wanted to check how the communication during the task looked like. Again, the subjects could choose from no communication at all, everybody was able to speak equally and that one person dominated the discussion. In the control groups without an official leader 62% (11 subjects) of the people stated that everybody was able to speak equally, 28% (5 subjects) stated that there was no communication at all and 9% (2 subjects) claimed that one person dominated the communication during the task. Here, again, it becomes visible that not everybody in the same team felt equally. In the treatment group 95% (17 subjects) of the subjects answered that everybody had the chance to speak and one person (5%) that there had been no communication during the task. Interestingly, in the groups who had an official leader more people stated that everybody was able to speak and that nobody dominated the communication. However, normally a leader in a group dominates the discussions (Haslam et al., 1998; Tost et al., 2013), which represents one of the major disadvantages in creative tasks. This unexpected result will be discussed later in more detail.

Additionally, I expected that groups would change their building approach during the task. Meaning that after really understanding the construction's characteristics, the groups would keep on modifying and improving their approach further. However, 49% (17 subjects) of the subjects did not change their process and 51% (19 subjects) of them changed it. In the control groups 48% (8 subjects) did not change the process but 52% (10 subjects) did. In the groups with an official leader 50% (9 sub-

jects) changed the process and 50% (9 subjects) kept on doing it the way they started, displaying exactly half of the subjects.

In order to solve the exploitative task efficiently, task division could be helpful. Consequently, only 23% (8 subjects) of the students did not divide the task into subtasks and 77% (28 subjects) did. In the control group, 72% (13 subjects) of the subjects divided the task and in the treatment group even 83% (15 subjects) did. These results support my expectancies about the characteristics of the exploitative task, which had been used in the experiment.

While observing the groups I was able to find out, that one group without an official leader discussed exactly this matter and came to the conclusion that task division is not so beneficial in this case as initially thought. Due to this observation it becomes clear that the groups actively focused on the question whether or not task division is beneficial.

Another question, which I tried to answer, was the performance of the leader or simply how the official leader in the group behaved. Of course, this question was only posed to the subjects who were engaged in the treatment condition. 61% (11 subjects) of the subjects stated that the leader behaved accordingly and performed her role in an appropriate manner. But 39% (7 subjects) of these subjects had the feeling that the leading person did to little. This result will be talked about later in more detail, as another possible answer would have been that she overdid her role, but nobody felt that way.

The subjects in the control group, without an official leader, had been asked if one person took over the unofficial leading role. Surprisingly, 76% (14 subjects) of the subjects claimed that nobody in the group had taken over the leading role, even when I expected that such a task would require a structure.

71% (26 subjects) of the subjects claimed that everyone in the group had a specific role. In the leaderless groups, however, only 57% (11 subjects) felt this way. In the treatment group with an initial authority structure, the feeling of different roles had been stronger. Here, 89 % (16 subjects) claimed that everybody in the group had her own role.

Answer	Treatment Group	Control Group
Everybody was able to speak in the preparation time	100%	85%
There was no communication at all during the preparation time	/	5 %
Everybody was able to speak during the task	95%	62%
There was no communication at all during the task	5%	28%
One person dominated the communication process during the task	0%	9%
The group changed the construction process during the task	50%	51%
The group divided the task	83%	72%
The official leader behaved according to her role	61%	/
The official leader did to little for her role	39%	/
The official leader overdid her role	0%	/
Someone took over the unofficial leader role in the group	/	24%
Everybody in the group had a specific role	89%	76%

Table 7: Overview individual questionnaire results, exploitative study1

The initial results of the questionnaire revealed some interesting results. Firstly, the fact that not so many groups divided the task and allocated it to their members seems puzzling. Secondly, the rating of the official leader makes me wonder whether

or not the mechanism to specify a group leader worked in the anticipated way. But all these aspects will be examined in more detail in the discussion section of the thesis.

P=0.1	many	authority	comprep	Comtask	change	divide	leaderperf	leadingrole	role	sex	age
many	1.000										
authority	-0,2673	1.000									
comprep	-0,1875	0.2673	1.000								
Comtask	-0,1279	0.1453	0.5436*	1.000							
change	-0,0074	-0,0237	-0,0889	-0,0483	1.000						
divide	0.1010	0.1409	-0,1581	-0,1517	0.4402*	1.000					
leaderperf	-0,5887 *	/	/	0.3040	0.1140	0.2548	1.000				
leadingrole	0.1647	/	-0,7303 *	-0,3899*	0.0853	0.3536	/	1.000			
role	-0,0864	0.3517*	0.2467	0.0726	0.4151*	0.4681*	0.4432*	-0,1936	1.000		
sex	-0,1567	-0,1915	-0,1343	-0,0916	0.2361	-0,1322	0.0806	0.0853	-0,1385	1.000	
age	0.0882	-0,3129*	-0,2648	-0,1428	-0,2051	-0,2504	0.3024	0.2898	-0,3962*	0.1768	1.000

Table 8: Multi-correlation analysis, exploitative study 1, individual questionnaire

Only the significant results of the multi-correlation analysis (Table 6) will be presented here. The multi-correlation analysis shows that groups with an official authority structure allocated significantly more often specific roles to the members. Furthermore, roles in the groups positively affected task division and a change of the approach while performing the task.

The communication during the preparation time and during the task are positively connected with one another but had no influence on the dependent variable. However, if someone took over a leading role in the team, negative effects on both communication variables can be shown. This negative effect on the communication pattern cannot be supported for an official authority structure in the groups.

From the individual questionnaire results no other interesting and significant results can be generated.

Again, the grouped questionnaire answers were analysed as well. These were generated in the same way as in the explorative setting. A multi-correlation analysis with a p-value of 0.1 was calculated.

The variables 'divide' and 'change' are significant and positively correlated. Meaning that if the groups divided the task, they mostly changed their approach as well. The variables 'divide' and 'role' are perfectly correlated. Always when groups divided the

task they also allocated roles in their teams. 'Role' and 'change' are positively and significantly correlated as well. However, an authority structure did not significantly influence the role attribution, task division or a change in the process as in the explorative task. 'Leader-performance' and the leading role do not show any significant influence on the dependent variable 'many'.

P=0.1	many	authority	comprep	Comtask	change	divide	leaderperf	leadingrole	role
many	1.000								
authority	-0,2294	1.000							
comprep	/	/	/						
Comtask	0.0760	0.3464	/	1.000					
change	-0,1163	0.1690	/	0.4183	1.000				
divide	-0,1026	0.4472	/	-0,1000	0.5292*	1.000			
leaderperf	-0,6623	/	/	/	0.000	/	1.000		
leadingrole	0.2739	/	/	0.2500	-0,4472	-0,6325	/	1.000	
role	-0,1026	0.4472	/	-0,1000	0.5292*	1.000*	/	-0,6325	1.000

Table 9: Multi-correlation analysis, exploitative study 1, clustered questionnaire

It has to be stated that leader-performance and authority did not bring any results, because the variable 'leader-performance' was only taken in groups with an authority structure. In groups with an authority structure the 'leader-performance' was perfectly balanced with three groups stating that she did too little and three groups that she acted appropriately. Furthermore, no results were generated with the variable communication during the preparation time, due to the fact that when the questionnaire result were clustered, every group stated that everybody was able to speak equally. 'Leader-performance' and the variable measuring the communication during the task, did not generate any results, because it was perfectly balanced as well. The same can be said for 'role' and 'leader-performance', if the groups rated the leader-behaviour as perfect, which was the case in half of the groups then everyone gained a role in the team.

8.3. Hypothesis check Explorative study

After talking about the descriptive findings, the hypothesis H1 will be checked. In this analysis the individual answers are not required but the group results, which the teams had to fill in. In order to check the hypothesis I first conducted a two-sample t-test, knowing that due to the small sample size a normal distribution of the dependent variable is hard to acquire. Nonetheless, I used a two-sample t-test, which tested whether or not the dependent variable, height, is significantly influenced by the independent variable, authority.

ttest		height,		by authority		
two-sample ttest		with		equal variances		
Group	Obs	Mean	Std.Err.	Std.Dev.	(95% Conf.	Intervall
0	9	38.33	1.109.805	3.329.424	1.274.119	6.392.548
1	10	53.2	7.664.927	2.423.863	3.586.073	7.053.927
combined	19	4.615.789	6.667.221	2.906.174	3.215.058	6.016.521
diff		-14,8667	1.325.853		-4.283.971	1.310.638
diff= mean(0)- mean(1)					t=-1.1213	
H0=diff=0					degrees of freedom=	17
Ha:diff<0		Ha:diff!=0		Ha:diff>0		
Pr(T<t)=0.1389		pr(T> t)= 0.2778		Pr(T<t)=0.8611		

Table 10: T-test, explorative study

The t-test, with 17 degrees of freedom, reveals that no significant difference between the treatment and the control groups exists. Even when working with a p-value of 0.1 and not the more commonly used value of 0.05, the results are not significant. However, with the p-value at 0.1389 the results are close to a significance level. Additionally, the means of the results show that the groups with an authority structure have built towers that were 14 centimetres higher in the mean. Also, the standard deviation of the authority groups is smaller compared to the one of the treatment groups. Interestingly the confidence interval is bigger in authority missing groups, showing that their performance varied more.

Yet, my hypothesis, which states that authority structures are harmful in this setting, cannot be accepted. The results even indicate that an authority structure in the team leads to better performance, which is the exact opposite of what I was expecting. However, due to the fact that the dependent variable is not normally distributed a t-test seems unsuitable in this case.

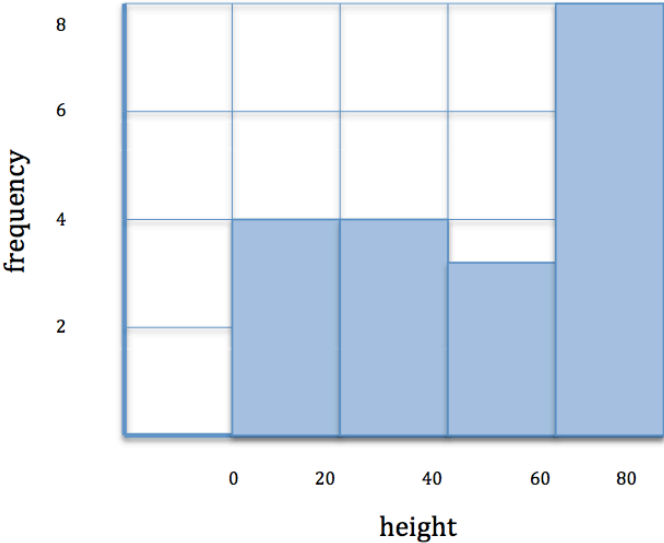


Table 11: Histogram height, explorative study

Therefore, I conducted a non-parametric-test as well. Here the conditions are less strict, which makes it suitable for such a small sample size. Non-parametric tests do not require the dependent variable to be normally distributed. Non-parametric tests and especially the Mann-Whitney-U test, which I used, can work with smaller sample sizes.

Ranksum height,	by authority		
Two-sample	Wilcoxon	rank-sum	(Mann-Whitney) test
authority	obs	rank sum	expected
0	9	79.5	90
1	10	110.5	100
combined	19	190	190
unadjusted variance		150	
adjustment for ties		-1,45	
adjusted variance		148.55	
H0:	many(authority==0)	=	many(authority==1)
	z=	-0,861	
	Prob> z =	0.3890	

Table 12: Mann-Whitney-U test, explorative study

The Mann-Whitney-U test or rank-sum test checks if major characteristics of the two independent samples are different, like their mean value.

The rank-sum test reveals that even if the groups with an authority structure built higher towers the result cannot be called significant, due to a p-value of 0.389. The t-test and the rank-sum test show that the results of my explorative experiment do not show any significant results. Consequently, the authority structure has no influence on the group's explorative performance. Still, the results let me suspect that an authority structure can be beneficial in these teams and not harmful like initially thought. A closer look on these results will be made in the discussion part of the thesis.

8.4. Hypothesis check Exploitative study 1

Coming to the hypothesis H2 check in the first exploitative setting: I claimed that in an exploitative task an authority structure is beneficial. Consequently, I expected that

groups with a leader produce more Cuboctahedrons in the provided time. Again, first a two-sample t-test had been made in order to check the H2 hypothesis.

ttest	many,	by authority				
two-sample ttest	with	equal variances				
Group	Obs	Mean	Std.Err.	Std.Dev.	(95% Conf.	Intervall
0	6	3	0.7302967	1.788854	1.122712	4.877288
1	6	2	1.125.463	2.75681	-0.8930944	4.893094
combined	12	42.857	0.6571287	2.276361	1.053669	3.946331
diff		1	1.341.641		-1.989362	3.989362
diff= mean(0)-mean(1)					t=0.7454	
H0=diff=0					degrees of freedom =	10
Ha:diff<0		Ha:diff!=0			Ha:diff>0	
Pr(T<t)=0.7634		pr(T> t)= 0.4732			Pr(T<t)=0.2366	

Table 13: T-test, exploitative study 1

The t-test with 10 degrees of freedom reveals no significant implications. The p-values are neither close to 0.05 nor 0.1. The mean values are close to each other. The only interesting fact is that the standard deviation is higher in the treatment groups.

However, if the distribution of the dependent variable is regarded, it can be said that it is not normally distributed. Due to the missing normal distribution and the small sample size, a Mann-Whitney-U test seems more suitable compared to the t-test.

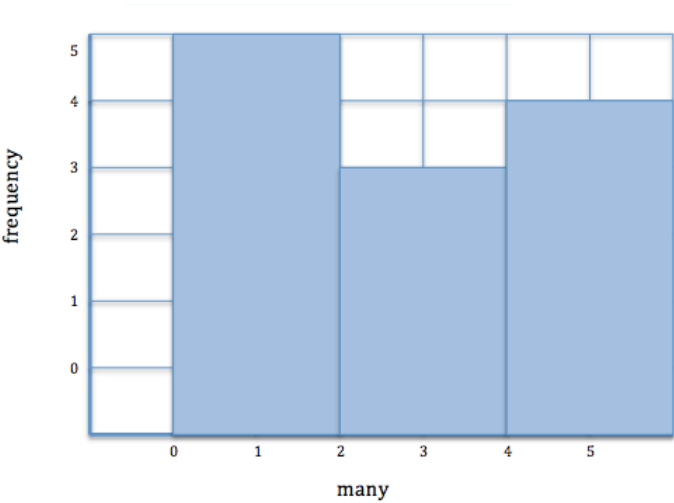


Table 14: Histogram, many exploitative study 1

Ranksum many,	by authority		
Two-sample	Wilcoxon	rank-sum	(Mann-Whitney) test
authority	obs	rank sum	expected
0	6	46	39
1	6	32	39
combined	12	78	78
unadjusted variance		39.00	
adjustment for ties		-0,95	
adjusted variance		38.05	
H0:	many(authority==0)	=	many(authority==1)
	z=	1.135	
	Prob> z =	0.2564	

Table 15: Mann-Whitney-U test exploitative study 1

The rank-sum test reveals that no significant results can be found.

Both groups show nearly the same mean value. Because the Mann-Whitney-U test uses variables like the mean value to compare both groups, no significant differences can be shown here. Consequently, it seems that in an exploitative task the authority structure, as framed in this study, had no influence on the teams' performance.

If the results are viewed in more detail, it can be seen that three groups with an authority structure could not finish one completely correct Cuboctahedron in the experiment. In such a small sample size, this has a high influence on the total results. These results have to be discussed in more detail, due to the fact that obviously some unexpected errors occurred.

Many	Frequency	Authority
0	3	yes
1	1	yes
5	1	yes
6	1	yes
1	1	no
2	2	no
3	1	no
4	1	no
6	1	no

Table 16: Detailed performance of groups in the exploitative study 1

9. Discussion

First the results of the explorative task will be discussed and in the following the results of the exploitative task. Additionally, some recommendations are made for future experiments.

9.1. Discussion Explorative study

The statistical tests revealed that the authority structure inside the teams has no influence on their tower building performance. But the results, even if not predicted, show a tendency that groups with an authority structure even perform better in this explorative task. Consequently the Hypothesis 1 cannot be supported.

However, if the results are examined in more detail, it becomes obvious that the groups without an authority structure had three times more tower building failures. This means, that their tower was not able to stand alone for at least one minute with a marshmallow on the top. You can see the detailed performance in table 17. If the tower broke, the group gained a performance value of 0 (height). In this small sample, it seems like groups without an official leader were more risk seeking. Still, a leaderless group had built the highest and the second highest tower of all groups. We know that an explorative task is connected to high risk, because of its novelty and the necessary of experimenting (March, 1991).

Height of tower	Authority structure	Height of tower	Authority structure
0 cm	Yes	0 cm	No
46 cm	Yes	0 cm	No
73 cm	Yes	0 cm	No
69 cm	Yes	83 cm	No
37 cm	Yes	55 cm	No
70 cm	Yes	75 cm	No
32 cm	Yes	40 cm	No
61 cm	Yes	65 cm	No
73 cm	Yes	27 cm	No
71 cm	Yes		

Table 17: Detailed performance of explorative teams

It is unfortunate that even if the authority missing groups experimented more and took over more risk, which is necessary and useful in explorative tasks, had not been rewarded with high stable towers. In the real world explorative activities often fail and generate no useful products or ideas (Levinthal & March, 1993). This could be shown in the spaghetti tower building task as well, which is displayed in the high variance of the performance value. Exploration is highly connected to failures, which is why it results in high costs (Levinthal & March, 1993). In the experiment this can be translated in broken down towers and the costs of not gaining any performance value. However, if something can be successfully explored after multiple failures, it represents something new, which could lead to a competitive advantage (Levinthal & March, 1993). The groups with an authority structure nearly never failed the task completely. It seems that these groups preferred a secure approach, with the main goal of building a stable tower and secondly a high one. Here in the experiment leaderless groups had produced the two highest towers. In these two examples the risk taking was rewarded. This fact leads to an issue of how to measure the performance of explorative teams.

Explorative actions, with their innate behavioural implications, can easily result in failure, which in general is not a big issue when exploring something new. But when measuring the performance in a onetime made experiment, a failure in the task leads to an extremely bad performance.

Nevertheless, explorative performance cannot be measured by pure failures either. Even if they are expected and tolerated in the corporate world, explorative learning has to have its useable outcome in the end. Consequently, experimenting and risk seeking alone will not lead to explorative results in the experiment, but an approach, which integrates the chance of failure and tries to avoid it.

Even if the results and especially the statistical tests show the opposite, I still claim that an authority structure is unsuitable for explorative teams. The higher risk taking of leaderless groups sometimes exceeds the mark but sometimes produces great performance as the two highest towers in the experiment revealed. It can be said that the subjects in the leaderless groups behaved in a more explorative way.

The main disadvantage of authority structures in small teams, which lead to my hypothesis, was the fact that open communication is hindered. My results show that nobody stated that the official leader overdid her role. Showing that the major negative effect of authority structures in small creative groups did not occur in the study. This leads to the question whether or not the authority framing mechanism did not show the anticipated effects. This thought is strengthened by the fact that groups with an authority structure experimented more at the beginning of the task, compared to leaderless groups. The literature claims that hierarchical groups structure their approach (Friesen et al., 2014; F. P. Morgeson et al., 2010; Oedzes et al., 2015), which means less experimenting. Due to the literature, I expected that the leaderless groups are the ones, who started the task by experimenting. However, the results reveal that even in the leaderless groups 81% stated to discuss the approach first, in comparison to only 77% in the groups with an authority structure. In detail, that means that both kind of groups nearly equally followed the same approach of first discussing the matter. This can, of course, be related to the education of the subjects, who all had been business students. In business classes a structured approach, which entails an initial discussion is often advantageous. Tom Wujec had mentioned this in his Ted talk already. However, if the sample would be mixed regarding the education, this result could be different. Additionally, in randomly formed groups, which never worked together before, a hands-on mentality of one person could be viewed as inappropriate. Therefore the initial discussion of the groups could

be used for them to get used to the group and not solely for the task. However, more detailed observations with a video camera, for example, are able to reveal if this statement is true or not. Additionally, the approach of how the groups solved the task did not have a significant influence the groups' performance. However, more groups would probably be necessary in order to check the approach's influence on the tower height.

Yet, the results also reveal that the treatment groups significantly stated more often that everybody in the groups had a specific role during the task. Role attribution and a structured approach are normally facilitated by authority structures (Friesen et al., 2014; F. P. Morgeson et al., 2010; Oedzes et al., 2015). Additionally, the official leaders, who acted according their role, had a positive effect on task division, which can be called a structural variable, as well.

These results lead to a contrary picture of the question: if the random authority priming mechanism actually worked. On the one hand nobody stated that the leader overdid her role and on the other hand, an authority structure significantly and positively influenced the role attribution and other structural aspects in the groups.

What comes next is that in leaderless groups nobody were responsible if the tower failed, in contrast to the groups with an official leader, who were theoretically responsible for the group's outcome. This, theoretical responsibility, could lead to the effect that the leader managed the risk taking of her members more effectively. This may explain why hierarchical groups performed better in the explorative task in this pre-study.

However, this enhanced feeling of responsibility was only of theoretical nature.

Due to the fact that no explicit incentives were given and that the leader had no chance and power to really evaluate the other group members, this effect probably was rather weak.

These mixed results of the effects of an authority structure complicate the interpretation of the results further. It seems like the authority structure did not hamper communication but led to a more structured approach (role attribution & task division), which avoided too much risk taking in the task.

Yet, if in groups with three people one person has an official role, the other roles are easier to fill, compared to a group in which every of the three possible roles has to be filled.

The resulting advices for a real study will be discussed in the conclusion and future research section.

Furthermore, even if people normally tend to rate themselves as above average, most subjects in the experiment rated themselves as lower than average in the explorative task.

This can have two reasons, first due to the pre-study character of this thesis the experiment had been hold in normal classrooms, which enabled the groups to observe the other groups and consequently their performance. But it can also be explained by the fact that most students do not have engineering or architectural design skills. If people consider themselves to not have the needed skills for a task, they rate themselves as below than average (Kruger, 1999). That means that business students mostly do not have the required skills to build a tower with this kind of material or said differently this kind of task represented something new for them. This emphasizes the suitability of the marshmallow challenge for the usage of an explorative task for business students, which should represent new knowledge. Another argument speaking for the marshmallow challenge as an explorative task, is the fact 63% of the subjects stated that nobody in their group took over the unofficial leading role. This emphasizes the creative and complex character of the task, because in these kind of

tasks seldom leaders evolve in order to provide more structure (Brown& Miller, 2000).

To sum up, the official authority structure in the teams had neither any influence on the teams' performance nor their approach. Only the role attribution was facilitated by the initial structure. However, the performance was not influenced by structural variables.

What can be said is that an authority structure in the teams made them less risk seeking than equalitarian ones. Consequently, groups without an authority structure risked more, which resulted in many fails but still in the two highest built towers. However, the method of measuring explorative performance has to be reconsidered, in order to generate more insight bringing results.

9.2. Discussion Exploitative study 1

The results of the exploitative study revealed that no big differences between the groups could be observed and consequently the hypothesis cannot be supported. However, this result seems to be influenced by the difficulties, which the teams had, both control and treatment, to construct the Cuboctahedron.

The major issue in the exploitative task had been that the subjects did not manage to produce completely correct Cuboctahedrons. Often the first Cuboctahedron had small or sometimes even incremental mistakes. The problem was that the groups did not realize that their construction was not the anticipated one. After the first wrong constructed Cuboctahedron they kept on rebuilding the wrong one. Even if they improved their process and changed to a more practical approach, the teams kept building false constructions. In the end these constructions did not count.

It was clear that some groups would have issues with the construction, but not to this extent. Moreover, a small pre-experiment of the pre-study, which had the purpose to see if the construction is suitable for the experiment, revealed that the subjects do not have any issues to reconstruct the Cuboctahedron. This first results lead to the conclusion that the task and the way in which it was presented had been suitable (table18) for an exploitative task.

Control group	Number of Cuboctahedrons	Treatment group	Number of Cuboctahedrons
1	7	1	10
2	9	2	9
3	1	3	5
4	5	4	8

Table 18: Detailed performance exploitative pre-study

After the initial pre-test some small modifications at the experimental design had been made. Due to observations it looked like some teams in the pre-test did not communicate at all and the ones with an authority structure had no time to appoint one leader and get to know each other, consequently the following exploitative experiments contained a five minute preparation time.

After the main experiments with the extra 5 minutes preparation time, it has to be said, that the way of bringing the knowledge of the construction and the building process inside the teams, had to be reconsidered.

The goal of most teams had not been to build as many as possible but more to build one single correct one; it was quality over quantity. The exact characteristics of the Cuboctahedron lead to incremental issues in most teams.

This is further supported by questionnaire results. Due to the fact that no approach variable like task division or the roles in the teams had a significant influence on the dependent variable, I conclude that merely the fact that one group understood the characteristics of a Cuboctahedron, led to better performance.

Yet, I have claimed that all groups have already this knowledge and the performance is solely influenced by other variables. Said differently, in the experiment not the authority structure, approach or process influenced the dependent variable but only if a group was able to build correct ones, which displays more of an explorative than an exploitative task. Consequently, the assertion that due to the displayed video and the pictures on the instructions sheets, the knowledge about the construction is part of the group cannot hold. Moreover, the teams mostly oriented on the displayed process, even if the instructions and the experimenter emphasized that this is not the best possible way. Most of the teams (51%) changed their construction process but the observations clarified that this happened in the end of the experiment or not at all. To sum up, both groups had incremental issues in rebuilding the construction and they mostly concentrated on the displayed process, without trying to understand the structure of the Cuboctahedron. Nevertheless both issues probably can be solved with small changes in the experimental design.

As handled before, the authority framing method did not show the wished results in the explorative experiment. Even if the subjects had five minutes preparation time to discuss the matter, the focus of the groups had been solely on the construction and not about specific roles inside the groups. This can be displayed by the fact that when examining the clustered questionnaire results, an authority structure neither

had a positive significant influence on role attribution, task division or change of process. If the individual answers are checked it can be seen that only role attribution is significantly and positively connected to an authority structure. However, when the individual answers are examined, it can be shown that in the leaderless control groups a negative effect on the communication in the teams occurred, if someone took over the leading role. This effect should have been theoretically observed in groups with an official leader. Yet, the official authority structure in general had no influence on the groups' communication. To sum up, the authority structure in the teams neither had an influence on their approach nor on the communication in the teams.

In order to solve some experimental design issues a second exploitative study had been conducted. Unfortunately, the results of the first exploitative experiment do not let room for more discussion, due to the mentioned issues in the design.

10. Modifications Experimental Design Exploitative study

Due to presented issues of the exploitative groups, I modified or extended the method, of bringing the knowledge of the Cuboctahedron inside the groups. In my feelings the biggest issue in most groups had been the fact that they simply produced wrong constructions without realizing it. The problem of the right characteristics, took over all their cognitive attention. Consequently, the main goal of modifying and improving the process, which had been my intention, became secondary.

In the second exploitative study, the groups not only get the video displayed and can see a picture of a Cuboctahedron but they also receive a correct 3-D Cuboctahedron model made of the same materials. This has the purpose of the teams being able to

compare their own constructions with the given model. Still, the displayed video ensures that not only the knowledge of the right characteristics of the Cuboctahedron is inside the teams but also the knowledge of how to construct one.

This modification is just a small one, but should be suitable to solve the major issue of the first exploitative study. Moreover, the experimenter and the instructions make the subjects aware that it is of high importance to produce Cuboctahedrons with completely correct characteristics, which had not been part of the first exploitative study. Still the Cuboctahedron is kept as construction of choice, because it is not easy too rebuild but still not too complicated. If the construction is too easy, a better process displays only quicker constructing subjects. The form of the Cuboctahedron still offers room for multiple construction processes, which are more or less suitable, displaying the groups' ability to actually improve a process, without mainly accelerating the building speed.

In a small initial test of the new, modified way of how to bring the knowledge inside the groups it can be seen that even if the number of constructed Cuboctahedrons is lower than in the initial pre-study, the groups performed better as in a comparable test with only two groups without a given model.

10.1. Results of Exploitative study 2

First, the individual questionnaire results are presented, which had been filled in after the experiment.

In the second exploitative study 18 subjects participated in total. 8 were female and 10 were male. Moreover the youngest person was 22 and the oldest 34, which generates a mean age of 26.1 years. 78% (14 subjects) were currently enrolled in a mas-

ters program and 22% (4 subjects) were enrolled in a bachelors program. If the communication in the groups is regarded, it can be stated that all 18 subjects had the feeling that everybody was able to speak during the preparation time. During the task, 17 people stated the same while only one person of a treatment group had the feeling that during the task no communication happened in the group.

44% (8 subjects) stated that they did not change their approach and 56% (10 subjects) did change it. Interestingly, the groups with an authority structure and the groups without one had the same distribution as the total subject pool, regarding the question of a changed process.

33% (6 subjects) of the subjects did not divide the task and 67% (12 subjects) did. In the treatment groups all subjects stated that they divided the task, while in the control one only 33% (3 subjects) divided the task.

Regarding the leader behaviour of the official leaders, 45% (4 subjects) stated that she did to little and only 56% (5 subjects) stated she acted according to her role. In the control group, 33% (3 subjects) stated that someone took over the leading role and 67% (6 subjects) that nobody took over this role. However, 56% of all subjects stated that everybody in the group had her specific role and 44% (8 subjects) claimed that nobody had a role. In the treatment group with an authority structure, 89% (8 subjects) stated that everybody had a role. In contrast, only 22% (2subjects) of the control groups subjects reported that everybody had a role in the group.

The minimum value of produced Cuboctahedrons had been 4 and the maximum 11, leading to a mean value of 7.2 finished constructions.

P=0.1	many	authority	comprep	Comtask	change	divide	leaderperf	leadingrole	role
many	1.000								
authority	0.4635*	1.000							
comprep	/	/	/						
Comtask	-0,2873	-0,2425	/	1.000					
change	-0,6104*	0.000	/	-0,2169	1.000				
divide	0.1457	0, 7071 *	/	-0,1715	0.0791	1.000			
leaderperf	-0,6325 *	/	/	0.3953	0.5500	/	1.000		
leadingrole	-0,5000	/	/	/	0.1581	1.000 *	/	1.000	
role	0.1152-	0.6708 *	/	-0,2169	0.3250	0.5534*	0.3953	0.1890	1.000

Table 19: Multi correlation analysis, exploitative study 2, individual questionnaire

I conducted a multi-correlation analysis with a p-value of 0.1 using the individual answers. Consequently the variable 'many' is artificially blown up. Likewise with the other analysis of the individual answers and thus have to be viewed with caution.

The dependent variable 'many' is significantly negatively correlated with the change process and the leader performance. Moreover the authority structure and the dependent variable are significantly correlated but due to the independent variable being blown up, the result is invalid.

However, the authority structure shows a positive effect on task division and role attribution, same as in the first study.

I clustered the individual answers of one group, as well. Here, I used the majority answer again; meaning that if two group members stated that they changed the process and one said that they did not do it, the group answer is still that they changed the process.

P=0.1	many	authority	comprep	Comtask	change	divide	leaderperf	leadingrole	role
many	1.000								
authority	0.4635*	1.000							
comprep	/	/	/						
Comtask	/	/	/	/					
change	-0, 6191	0.000	/	/	1.000				
divide	0.1457	0, 7071	/	/	0.2500	1.000			
leaderperf	-0,5000	/	/	/	1.000*	/	1.000		
leadingrole	-0,5000	/	/	/	0.5000	1.000 *	/	1.000	
role	0.4635	1.000*	/	/	0.000	0.7071	/	/	1.000

Table 20: Multi correlation analysis, exploitative study 2, clustered questionnaire

After grouping the individual answers, the only significant relationship can be observed between the authority structure and role attribution in the groups.

Some variables generated no results, because 100% of the answers had been the same.

Because this is the second exploitative study, the second hypothesis had been checked again with the help of a rank sum test. The utilised Mann-Whitney-U test is suitable for such a small sample size, due to it not requiring a normal distribution of the dependent variable.

Ranksum many,	by authority		
Two-sample	Wilcoxon	rank-sum	(Mann-Whitney) test
authority	obs	rank sum	expected
0	3	8	10,5
1	3	13	10,5
combined	6	21	21
unadjusted variance		25,5	
adjustment for ties		-0,75	
adjusted variance		4,5	
H0:	many(authority==0)	=	many(authority==1)
	z=	-1.179	
	Prob> z =	0.2386	

Table 21: Mann-Whitney-U test, exploitative study 2

The rank-sum test generated no significant result and consequently the hypothesis cannot be supported. There had been no significant difference between groups with an authority structure and equalitarian groups when solving an exploitative task.

However, the second study had the main purpose of solving issues, which evolved in the first exploitative study. The newly gained insights and results will be discussed in the next section.

10.2. Discussion of Exploitative study 2

After the first exploitative experiments the assertion that the groups already have the knowledge of how to construct a Cuboctahedron could not be held. Therefore, the groups in the second study received a correct Cuboctahedron model to understand its characteristics in more detail. Furthermore, the correct model can be used to make sure that their own are correct. Incorrectly constructed Cuboctahedrons were the main issue in the first study.

The second study wanted to eliminate these issues, which eventually worked.

The mean value exceeded extremely from 2.5 Cuboctahedrons in the first study to 7.1 ones in the second one. Moreover, the observations made clear, that especially in the preparation time the groups not only discussed the displayed construction process but also talked about the real characteristics of the Cuboctahedron model. Moreover, the discussion had been mostly about the process and how to split the task instead of solely discussing how a completely correct one looks like. The new way of bringing the knowledge inside the groups worked perfectly fine. Two groups produced 11 Cuboctahedrons, which is the maximum result of all exploitative studies. The Cuboctahedron model not only enables them to recheck their own constructions but also to understand the construction in a better way, which enabled them to evolve better working construction processes.

Tab many if			
many	freq	percent	Cum.
4	3	50	50
9	1	16,67	66,67
11	2	33.33	100.00
total	6	100.00	

Table 22: Detailed performance, exploitative study 2

Still this small sample size could not generate any insights regarding the hypothesis. Furthermore, the authority framing method still had been the same, which did not show that it had been affected greatly, even if role attribution is facilitated inside the groups. The results indicate that the performance suffered, when the groups changed their process during the task. This could be explained with the help of learning effects. If the groups changed their construction process after a while, the initial one could already benefit from learning effects. The newly used one could represent a more effective process in general but would need some time to benefit from learning effects, likewise with the initial process. Due to the short time frame of only 20 minutes, this could lead to lower performance quality compared to groups who kept their initial building process. Another interesting result, generated from individual questionnaire results, is that the dependent variable had been negatively influenced by the leader performance of the authority groups. Showing that if in a group with an authority structure a leader did to little compare to her role, the group generated more Cuboctahedrons. This could emphasize the creative aspect in exploitative settings. Yet, only 6 groups had been tested, which represents a small sample size and makes a reasonable interpretation of the results difficult.

11. Conclusion & Further Research

This section mostly handle the occurred problems of the study and how they can be solved, in order to design more valid experiments in order to examine the hypothesis. Role attribution in the explorative experiment had been positively and significantly connected with the authority structure in the group, which makes me conclude that the framing mechanism worked. However, in the exploitative task, which would natu-

rally benefit from specific roles, the authority structure had no significant influence on the roles in the groups. Nevertheless, in both experiments the framing method had been equal. The groups in the exploitative study even had 5 minutes extra to prepare themselves, which could be used to specify roles in the groups and enable the authority framing method to unfold its power. However it did not.

Yet, due to the fact that the authority structure had been the independent variable in the thesis, its functioning is of high importance. Even if role attribution had been facilitated by an authority structure in the explorative experiment, the same effect could not be shown in the exploitative experiment. The fact that both used the same simple framing method, makes me conclude, that the positive effect of the authority structure on role attribution in the explorative setting, could have a random nature.

Due to the fact that the experiments took place in normal business classes and just had been pre-studies, the authority framing mechanism had to be fast and simple. Otherwise, the experiments would have required too much time in order to be run in the provided time.

However, in bigger scaled experiments, which try to answer the research question in more detail a better functioning framing method would be necessary.

Multi scholars used a method, which included a leadership questionnaire. After the subjects filled in this questionnaire, the leader of their groups had been appointed according to her questionnaire result. However, even if differently communicated the real mechanism was still random. Yet, this structured leader appointment method leads to the fact that the appointed leaders behaved accordingly, showing that this method leads to an valid authority structure in the teams (Galinsky, Gruenfeld, & Magee, 2003; Haslam et al., 1998; Oedzes et al., 2015). This method is still a simple one, but requires extra time for evaluating the questionnaire results, even if they not really have to be evaluated. But the subjects need to have the feeling that their lead-

er was appointed because of her superior questionnaire results, which evaluation theoretically needs some time. This extra time was not given in the pre-study experiments, but would be feasible in bigger scaled experiments.

Another simple but promising method could work with the members' motivation to lead the group. A simple small initial questionnaire, asking the subjects how much fun or satisfaction they get from leading, could make clear who is willing to lead the group. The random used method could have made subjects to leaders, who do not like that role at all. Consequently, they did not even try to behave like an official leader. This weakness could easily be eliminated with the motivational based questionnaire.

Moreover, even if this method is simple and quick, it has a structure, which is visible for all the group members and consequently can reveal its power unlike random mechanisms.

Due to the fact that the used mechanism in this thesis, could not lead to working authority structure in the teams, the hypothesis, which mainly examined the effect of the intended structure could not sufficiently been tested.

Besides the issues with the authority framing mechanism, I state that in general the Marshmallow challenge of Tom Wujec is suitable for an explorative task. However some modifications would be necessary to generate more insights.

The method of how to measure the teams' explorative performance should be refined. Here, the main issue is that exploration is related to failures, which are not encouraged but tolerated on the path to generate new knowledge. Consequently if groups took over too much risk in order to experience something completely new, the performance had to suffer incrementally. The problem is that an experiment is a one shot situation, unlike explorative learning in the real world. In a realistic view, explorative teams can fail today but succeed tomorrow. Consequently, the performance

measurement should involve the risk taking as a positive performance variable. Therefore, if a tower breaks, it should not automatically generate zero performance, but should include the groups approach or theoretical result.

Therefore, more than one height measurement should be taken. One directly after the finishing process, here the tower only has to stand alone for five seconds, to ensure that the teams do not cheat by just sticking spaghettis to a long line which is solely hold together by their members. This theoretical height of the tower indicates, how much the groups tried out, how much they risked in order to arrive at the main goal of a high tower. After the five seconds, the tower has to stand for one minute on its own. If the tower survives the minute, the teams' performance will be calculated with the help of both aspects. This ensures that teams, whose tower breaks do not simply get a performance indicator of zero. Additionally, teams, whose tower survives, get extra points. These extra points still should have a rewarding power, which motivates the teams to gain these points. Moreover, the one-minute could be divided even more, with different results giving different possible points.

An example could help to provide a clearer picture. Group A has built a tower of 65cm height after 20 minutes and group B of 50 cm height, which both can stand alone for the first 5 seconds. After 30 seconds both towers still stand, for which both teams get rewarded with 10 points. But after one minute only team group B's tower survived. This results in 20 extra points for group B. The end points are now 75 points for group A and 80 points for group B. Even if group A's tower collapsed the team did not gain zero points. The team's willingness to take over risk is still rewarded, not as much as group B's tower, but their engagement still generates a performance value. This approach of measuring the performance, should display the high chance of failure in explorative tasks, which is tolerated in such settings. Nevertheless, explorative activities cannot be measured by pure failures as well. In the end, a

useable result has to be generated. Therefore, stable and high towers are rewarded accordingly. Nevertheless, such a performance measurement system, will lead to more strategic approaches of the groups in order to gain points instead of just building the highest possible tower.

Still I am convinced that, with the new performance measuring method, explorative behaviour can be rewarded with more accuracy, compared to the way it is used in this study.

Additionally, a bigger study leaves room for a more detailed questionnaire, which the subjects have to fill in. Especially, more questions about the groups' approach and internal processes would bring more insights about how the explorative teams worked and what influenced them.

Furthermore, in large scale experiments, the possibility that subjects have already heard about the marshmallow challenge or even participated in it enhances. Generally, this is not a big issue, when only one person of the group has this knowledge, due to the fact if the whole group is regarded the knowledge is still new. The experienced person has to bring in her knowledge to all or the majority of the group, until the knowledge is part of the group. Nevertheless, business students or subjects, who are not engaged in architecture, design or engineering would be suitable for this explorative task.

With the help of these modifications the experiment becomes even more suitable for testing an explorative action of small teams.

To summarise, even if some issues occurred during the experiments, it can be stated that explorative learning seems more complicated, compared to simply creative tasks, likewise brainstorming. It is clear that an open discussion and knowledge sharing is of high importance in explorative learning activities (Ylinen & Gullkvist, 2014). Yet, when generating the ideas in useable practical ones, a structured approach can

be of high importance as well. It seems like explorative learning integrates creativity needs and structuring practical ones. Creative ideas are the starting point of explorative learning, which require some structure if they are translated into something useable. The mixed and contrary results of this thesis should, even if some issues occurred, encourage scholars to gain more insights about this complex and highly important learning type. More detailed observations could reveal, if explorative learning has diverse internal phases, which cannot simply be compared to a creative ideation process. These insights could lead to a better understanding of explorative learning and its needs.

In the following, the exploitative studies are discussed, its implications and recommendations for future possible experiments.

After the initial issues in the exploitative task, which are not connected with the authority framing a second exploitative experiment had been conducted. The new experimental design had the intention to solve the initial problems. Here a handed out 3-D Cuboctahedron model should ensure that the subjects do not keep on producing wrong Cuboctahedrons. This small modification lead to the initiated changes.

Not only that the groups produced incrementally more Cuboctahedrons, they produced nearly no wrong constructions anymore. Only three groups still produced wrong ones.

Even if no significant results could have been generated, I claim that roles in the groups could have a positive effect. For example, one person, who checks the finished constructions, could avoid the problem of wrong constructed ones. Moreover, observations made clear that groups who divided the task and used methods, which can be compared to an assembly line, showed better performance. Often teams without an authority structure did not act as real interactive teams. Even if this observation is counterintuitive, teams without an authority structure acted more as individ-

uals. Often all three individuals worked on their own construction process, without pooling their knowledge and benefit from task division. In authority groups, this kind of behaviour could only seldom be observed. In my feelings the enhanced responsibility of the group leader, encouraged her to approach the task in a more structural way and that an authority structure made clear whose approach to use

Yet, if the better results, even if not significant, have their origin in simple learning effects or the enhanced structure cannot be answered in detail here.

Nevertheless, the simple and small modification in the second exploitative study, led to the hoped and anticipated results.

Even if no significant results regarding the hypothesis could have been generated, the observations clarified that not a simply structured proceeding nor individual creative approaches lead to superior performance in this exploitative task. Creative discussions in the preparation time are necessary to understand the Cuboctahedron and find a quick, convenient and team-related construction process. If this period is hampered by the authority structure, is hard to answer in this pre-study. However, after the initial creative discussion a structured approach is advantageous. Groups, who divided the task and allocated roles, did not show significantly better results, but observations made clear that this structure is of large aid.

Nevertheless, the question whether or not an authority structure is beneficial in exploitative learning could not be answered in this pre-study. But what is clear is that exploitative learning seems more complex than initially thought, which makes it necessary to observe the matter in more detail in large scale experiments.

The recommendations made in this thesis about the experimental design, can be incredibly useful for future research and experiments, which want to engage in similar questions.

Both experiments revealed interesting needs of explorative and exploitative learning, which makes it clear that the research gap is worth to be examined in more detail. Moreover, both experiments, with their recommended modifications, are suitable to explore both learning types, with the help of laboratory experiments.

All in all this thesis, with its pre-study character, can be of great help for scholars who are interested in the question of how small teams have to be designed in order to explore or exploit perfectly.

12. Limitations

The limitations of the thesis have two origins. First of all, experiments can never display the reality with all its facets perfectly or even close to it. However, with controlled experiments many interesting insights would have been undiscovered, which are worth focusing on in real world scenarios as well.

The fact that this thesis has a pre-study character leads to some weaknesses as well. The main point is the small sample size, whose subjects had more or less the same education and age. Moreover, the weak authority frame mechanism used in this thesis has to be rethought. The independent, and consequently one of the most important, variables of this thesis has to be generated in a better and universal working way. However the main issues had been handled in the discussion and conclusion section already.

Nevertheless, the tasks and displayed research gap are worth to be looked at in more detail.

13. Acknowledge

I want to thank everybody who kept me motivated and helped me to overcome difficult periods when writing this thesis. First of all, I want to thank Helge Klapper, for his encouraging support during the whole time. Without the interesting and fruitful discussions with him, likewise his motivational character, it would have been hard to overcome all the obstacles of this thesis. Moreover, without him I would not have written this kind of thesis at all.

Furthermore, Yonnas Tesfamicael who had been my thesis-writing partner since the beginning, who always had the time to listen my thoughts and made me stay focused.

Additionally, I want to thank Cornelia Schwemmer, who supported me in endless brainstorming walks around Vienna and who did not get tired about philosophising with me around the whole topic, likewise with Vinzenz Greger and Ferdinand Schlutius.

Moreover, I want to thank the whole team of the strategic management chair of the University of Vienna, who gave me the chance to use their classes for my experiments.

Without all the mentioned people this thesis would still be in progress or would have made me given up hope long time ago. Thank you all!

14. Appendix

Deutsche Zusammenfassung/ Abstract:

Diese Masterarbeit möchte helfen, die Frage zu beantworten, wie eine Autorität Struktur in kleinen Gruppen ihre Fähigkeit beeinflusst, etwas Neues zu entdecken (explore) oder etwas bestehendes zu verbessern (exploit). Diese Arbeit ist eine Vorstudie und möchte Mithilfe von Experimenten, zukünftigen Arbeiten nützliche Anregungen und Empfehlungen geben. Die hier behandelte Forschungsfrage wurde bisher von den großen Forschungsblöcken: kleine Gruppen, Hierarchien und , Exploratives und Exploitives' lernen übersehen. Meist haben sich Forscher mit der Frage beschäftigt, wie man eine Organisation am besten entwirft/plant damit beide Lernfunktionen sichergestellt sind.

Man muss jedoch nicht lange suchen um die Verbindung zwischen explorativen, exploitativen lernen und kleinen Gruppen zu finden. Hinzu kommt, dass Autoritätsstrukturen meist auch in kleinen Gruppen zu finden sind. Somit könnte die Frage wie sich Autoritätsstrukturen auf kleine Gruppen auswirken, welche Explorativen oder Exploitativen Aktivitäten nachgehen, von großem Interesse für Forscher und Manager sein.

Um mehr über dieses Thema herauszufinden, wurden Experimente durchgeführt.

Leider sind einige unerwartete Probleme aufgetaucht, welche nur zum Teil behoben werden konnten. Die Studie musste zum Beispiel mit einer sehr einfachen Methode arbeiten, um eine Autoritätsstruktur in den Gruppen zu etablieren. Aufgrund der kleinen Stichprobe und den Problemen mit der unabhängigen Variable (Autorität) konnten keine signifikanten Ergebnisse erzielt werden.

Nichtsdestotrotz kann man sagen, dass beide Lernarten komplexer sind als angenommen. So kann man Exploratives lernen nicht einfach einen kreativen Prozess gleichsetzen, sondern muss andere Aspekte miteinbeziehen. Ähnliches kann über

Exploitatives lernen gesagt werden, welches mehr braucht als eine klare Struktur. Trotz dieser Erkenntnisse sind vor allem die praktischen Empfehlungen für andere Forscher, welche diese Frage mit Hilfe von Experimenten beantworten wollen, hervorzuheben.

Questionnaire Explorative:

Explore

Please only mark one answer per question.

1. Sex: Male Female

2. Age: _____

3. Your tower height: ____ cm

4. Study program: Bachelor Mas- ter

5. How did you approached the task?

- First we discussed different ways how to built the tower
- We started experiment- ing

6. Did you divided the task into sub steps in order to work more efficient?

Yes No

Please answer question no.7 only if you had an official leader in your team:

7. Did your group leader performed her/his role appropriately?

Yes No she/he did to less No she/he overdid the role of a leader

Please answer question no.8 only if you did **not** have a official leader in your group:

8. Did someone in the group took over the leading role ?

Yes No

9. Did everybody in your group had her/his own role during the task?

Yes No

10. Did you liked to work with your group?

Yes No

11. Do you think your group's performance was:

- Worse than average
- Average
- Better than average
-

12. Had there been a conflict in your group during the task?

Yes No

Questionnaire Exploit:

Exploit.

Please only mark one answer per question.

1. Sex: Male Female

2. Age: _____

3. How many Cuboctahedrons produced your group? _____

4. Study program: Bachelor Master

5. How was the communication in your group during the preparation time?

- No communication at all
- One person dominated the discussion
- Everybody was able to bring in ideas

6. How was the communication in your group during the task?

- No communication at all
- One person dominated the discussion
- Everybody was able to bring in ideas

7. Did you changed the way how you constructed the Cubocthadron during the task?

Yes No

8. Did you divided the task into sub steps in order to work more efficient?

Yes No

Please answer question no.9 only if you had an official leader in your team:

9. Did your group leader performed her/his role appropriately?

Yes No she/he did to less No she/he overdid the role of a leader

Please answer question no.10 only if you did **not** have a official leader in your group:

10. Did someone in the group took over the leading role ?

Yes No

11. Did everybody in your group had her/his own role during the task?

Yes No

12. Had there been a conflict in your group during the task?

Yes No

15. Bibliography

- Anderson, C., & Brown, C. E. (2010). The functions and dysfunctions of hierarchy. *Research in Organizational Behavior*, 30(C), 55–89. <http://doi.org/10.1016/j.riob.2010.08.002>
- Anderson, C., Hildreth, J. A. D., & Howland, L. (2015). Is the Desire for Status a Fundamental Human Motive ? A Review of the Empirical Literature. *Psychological Bulletin*, 141(3), 574–601. <http://doi.org/10.1037/a0038781>
- Andriopoulos, C., & Lewis, M. W. (2009). Exploitation-Exploration Tensions and Organizational Ambidexterity: Managing Paradoxes of Innovation. *Organization Science*, 20(4), 696–717. <http://doi.org/10.2307/25614688>
- Anicich, E. M., Fast, N. J., Halevy, N., & Galinsky, A. D. (2016). When the Bases of Social Hierarchy Collide: Power Without Status Drives Interpersonal Conflict. *Organization Science*, 27(1), 123–140. <http://doi.org/10.1287/orsc.2015.1019>
- Audia, P. G., & Goncalo, J. A. (2007). Past Success and Creativity over Time : A Study of Inventors in the Hard Disk Drive Industry. *Management Science*, 53(1), 1–43. <http://doi.org/10.1287/mnsc.1060.0593>
- Bedeian, A. G., & Hunt, J. G. (2006). Academic amnesia and vestigial assumptions of our forefathers. *Leadership Quarterly*, 17(2), 190–205. <http://doi.org/10.1016/j.leaqua.2005.12.006>
- Benner, M. J., & Tushman, M. L. (2003). Exploitation , Exploration , and Process Management : The Productivity Dilemma Revisited. *The Academy of Management Review*, 28(2), 238–256. Retrieved from <http://www.jstor.org/stable/30040711>
- Berkowitz, L. (1953). Sharing leadership in small, decision-making groups. *Journal of Abnormal Psychology*, 48(2), 231–8. <http://doi.org/10.1037/h0058076>
- Brinsfield, C. T., Edwards, M. S., & Greenberg, J. (2009). Voice and silence in organizations: Historical review and current conceptualizations. *Voice and silence in organizations*,
- Brown, T. M., & Miller, C. E. (2000). Communication Networks in Task-Performing Groups: Effects of Task Complexity, Time Pressure, and Interpersonal Dominance. *Small Group Research*, 31(2), 131–157. <http://doi.org/10.1177/104649640003100201>

- Bunderson, J. S., & Reagans, R. E. (2011). Power , Status , and Learning in Organizations. *Organization Science Publication*, 22(5), 1182–1194.
- Burgelman, R. a. (2002). Strategy as Vector and the Inertia of Coevolutionary Lock-in. *Administrative Science Quarterly*, 47(2), 325–357.
<http://doi.org/10.2307/3094808>
- Cardinal, L. B. (2001). Technological Innovation in the Pharmaceutical Industry: The Use of Organizational Control in Managing Research and Development. *Organization Science*, 12(1), 19–36. <http://doi.org/10.1287/orsc.12.1.19.10119>
- Carletta, J., Garrod, S., & Fraser-Krauss, H. (1998). Placement of Authority and Communication Pattern in Workplace Groups---The Consequences for Innovation. *Small Group Research*, 1–20. Retrieved from
<http://homepages.inf.ed.ac.uk/jeanc/sgr.pdf>
- Chae, S. W., Seo, Y. W., & Lee, K. C. (2015). Task difficulty and team diversity on team creativity: Multi-agent simulation approach. *Computers in Human Behavior*, 42, 83–92. <http://doi.org/10.1016/j.chb.2014.03.032>
- Chae, S., Seo, Y., & Lee, K. C. (2015). Effects of task complexity on individual creativity through knowledge interaction: A comparison of temporary and permanent teams. *Computers in Human Behavior*, 42, 138–148.
<http://doi.org/10.1016/j.chb.2013.10.015>
- Dennis, A. R. (1993). Information Processing in Group Decision Making: You Can Lead a Group To Information, But You Can'T Make It Think. *Academy of Management Best Papers Proceedings*, 8(1), 283–287.
<http://doi.org/10.5465/AMBPP.1993.10317036>
- DeRue, D. S., Nahrgang, J. D., & Ashford, S. J. (2015). Interpersonal Perceptions and the Emergence of Leadership Structures in Groups: A Network Perspective. *Organization Science*, 26(4), 1192–1209. <http://doi.org/10.1287/orsc.2014.0963>
- Detert, J. R., & Trevino, L. K. (2010). Speaking Up to Higher-Ups: How Supervisors and Skip-Level Leaders Influence Employee Voice. *Organization Science*, 21(1), 249–270. <http://doi.org/10.1287/orsc.1080.0405>
- Diehl, M., & Stroebe, W. (1987). Productivity loss in brainstorming groups: Toward the solution of a riddle. *Journal of Personality and Social Psychology*, 53(3), 497–509. <http://doi.org/10.1037/0022-3514.53.3.497>
- Drazin, R., Glynn, M. A., & Kazanjian, R. K. . (1999). Multilevel Theorizing about Creativity in Organizations : A Sensemaking Perspective, 24(2), 286–307.

- Edmondson, A. C. (2002). The local and variegated nature of learning in organizations. *Organization Science*, 13(2), 128–146.
<http://doi.org/10.1287/orsc.13.2.128.530>
- Fang, C., Kim, J.-H., & Milliken, Frances, J. ; (2014). WHEN BAD NEWS IS SUGAR-COATED: INFORMATION DISTORTION, ORGANIZATIONAL SEARCH AND THE BEHAVIORAL THEORY OF THE FIRM. *Strategic Management Journal*, 35(2), 1186–1201. <http://doi.org/10.1002/smj>
- Fang, C., Lee, J., & Schilling, M. a. (2010). Balancing Exploration and Exploitation Through Structural Design: The Isolation of Subgroups and Organizational Learning. *Organization Science*, 21(3), 625–642.
<http://doi.org/10.1287/orsc.1090.0468>
- Fehr, E., Herz, H., & Wilkening, T. (2012). The Lure of Authority : Motivation and Incentive Effects of Power, 103(November), 1325–1359.
<http://doi.org/10.1257/aer.103.4.1325>
- Festinger, L. (1950). Informal social communication. *Psychological Review*, 57(5), 271–282. <http://doi.org/10.1037/h0056932>
- Friesen, J. P., Kay, A. C., Eibach, R. P., & Galinsky, A. D. (2014). Seeking structure in social organization: Compensatory control and the psychological advantages of hierarchy. *Journal of Personality and Social Psychology*, 106(4), 590–609.
<http://doi.org/10.1037/a0035620>
- Galinsky, A. D., Gruenfeld, D. H., & Magee, J. C. (2003). From Power to Action. *Journal of Personality and Social Psychology*, 85(3), 453.
<http://doi.org/10.1037/0022-3514.85.3.453>
- Galinsky, A. D., Magee, J. C., Gruenfeld, D. H., Whitson, J. a, & Liljenquist, K. a. (2008). Power reduces the press of the situation: implications for creativity, conformity, and dissonance. *Journal of Personality and Social Psychology*, 95(6), 1450–1466. <http://doi.org/10.1037/a0012633>
- George, J. M. (2007). 9 Creativity in Organizations. *The Academy of Management Annals*, 1(1), 439–477. <http://doi.org/10.1080/078559814>
- Greer, L. L., & van Kleef, G. a. (2010). Equality versus differentiation: the effects of power dispersion on group interaction. *The Journal of Applied Psychology*, 95(6), 1032–44. <http://doi.org/10.1037/a0020373>
- Gupta, A. K., Smith, K. E. N. G., & Shalley, C. E. (2006). THE INTERPLAY BETWEEN EXPLORATION AND EXPLOITATION. *Academy of Management Journal*, 49(4), 693–706.

- Guzzo, R. a., & Shea, G. P. (1992). Group Performance and Intergroup Relations in Organizations. *Handbook of Industrial and Organizational Psychology*, Vol. 3.
- Halevy, N., Chou, E. Y., & Galinsky, A. D. (2011). A functional model of hierarchy Why, how, and when vertical differentiation enhances group performance. *Organizational*
- Halevy, N., Chou, E. Y., Galinsky, a. D., & Murnighan, J. K. (2012). When Hierarchy Wins: Evidence From the National Basketball Association. *Social Psychological and Personality Science*, 3(4), 398–406.
<http://doi.org/10.1177/1948550611424225>
- Hansen, M. T., Podolny, J. M., & Pfeffer, J. (2001). So many ties, so little time: A task contingency perspective on corporate social capital in organizations. *Research in the Sociology of Organizations*, 21–57. [http://doi.org/10.1016/S0733-558X\(01\)18002-X](http://doi.org/10.1016/S0733-558X(01)18002-X)
- Haslam, S. A., McGarty, C., Brown, P. M., Eggins, R. A., Morrison, B. E., & Reynolds, K. J. (1998). Inspecting the emperor's clothes: Evidence that random selection of leaders can enhance group performance. *Group Dynamics: Theory, Research, and Practice*, 2(3), 168–184. <http://doi.org/10.1037/1089-2699.2.3.168>
- Jansen, J. J. P., van den Bosch, F. A. J., & Volberda, H. W. (2006). Exploratory Innovation, Exploitative Innovation, and Performance: Effects of Organizational and Environmental Moderators. *Management Science*, 52(11), 1661–1674.
<http://doi.org/10.1287/mnsc.1060.0576>
- Kerr, N., & Tindale, S. (2004). Group Performance and Decision Making. *Annual Review of Psychology*, 55(1), 623–655. <http://doi.org/doi:10.1146/annurev.psych.55.090902.142009>
- Kilduff, G. J., Willer, R., & Anderson, C. (2016). Hierarchy and Its Discontents: Status Disagreement Leads to Withdrawal of Contribution and Lower Group Performance. *Organization Science*, 7039(April), orsc.2016.1058.
<http://doi.org/10.1287/orsc.2016.1058>
- Kostopoulos, K. C., & Bozionelos, N. (2011). Team Exploratory and Exploitative Learning: Psychological Safety, Task Conflict, and Team Performance. *Group & Organization Management*, 36(3), 385–415.
<http://doi.org/10.1177/1059601111405985>
- Kruger, J. (1999). Lake Wobegon Be Gone! The “Below-Average Effect” and the Egocentric Nature of Comparative Ability Judgements. *Journal of Personality and Social Psychology*, 77(2), 221–232.
- Laughlin, P. R. (2011). *Group problem solving*. Princeton University Press.

- Lavie, D., Stettner, U., & Tushman, M. L. (2010). Exploration and Exploitation Within and Across Organizations. *The Academy of Management Annals*, 4(1), 109–155. <http://doi.org/10.1080/19416521003691287>
- Lawrence, T. B., Mauws, M. K., Dyck, B., Kleysen, R. F., Lawrence, T. B., & Kleysen, R. F. (2005). The Politics of Organizational Learning : Integrating Power into the 4I Framework, 30(1), 180–191.
- Levinthal, D. A., & March, J. G. (1993). THE MYOPIA OF LEARNING. *Strategic Management Journal*, 14, 95–112. <http://doi.org/10.1002/smj.4250141009>
- Li, Y., Vanhaverbeke, W., & Schoenmakers, W. (2008). Exploration and Exploitation in Innovation: Reframing the Interpretation. *Creativity and Innovation Management*, 17(2), 107–126. <http://doi.org/10.1111/j.1467-8691.2008.00477.x>
- Lopez-Cabarales, A., Perez-Luno, A., & Valle Cabrera, R. (2009). KNOWLEDGE AS A MEDIATOR BETWEEN HRM PRACTICES AND INNOVATIVE ACTIVITY. *Human Resource Management*, 48(4), 485–503. <http://doi.org/10.1002/hrm>
- Lu, L., Yuan, Y. C., & McLeod, P. L. (2012). Twenty-Five Years of Hidden Profiles in Group Decision Making: A Meta-Analysis. *Personality and Social Psychology Review*, 16(1), 54–75. <http://doi.org/10.1177/1088868311417243>
- Madjar, N., Greenberg, E., & Chen, Z. (2011). Factors for radical creativity, incremental creativity, and routine, noncreative performance. *The Journal of Applied Psychology*, 96(4), 730–743. <http://doi.org/10.1037/a0022416>
- Magee, J. C., & Galinsky, A. D. (2008). Social Hierarchy: The Self Reinforcing Nature of Power and Status. *The Academy of Management Annals*, 2(1), 351–398. <http://doi.org/10.1080/19416520802211628>
- March, J. G. (1991). Exploration and Exploitation in Organizational Learning. *Organization Science*, 2(1), 71–87.
- March, J. G., & Simon, H. A. (1958). *Organizations*.
- Milliken, Frances, J. ; Morrison, E. W., & Hewlin, P. (2003). An Exploratory Study of Employee Silence : Issues that Employees Don ' t Communicate Upward and Why *. *Journal of Management Studies*, 40(6), 1453–1476. <http://doi.org/10.1111/1467-6486.00387>
- Morgeson, F. P. (2005). The external leadership of self-managing teams: intervening in the context of novel and disruptive events. *The Journal of Applied Psychology*,

90(3), 497–508. <http://doi.org/10.1037/0021-9010.90.3.497>

Morgeson, F. P., DeRue, D. S., & Karam, E. P. (2010). Leadership in Teams: A Functional Approach to Understanding Leadership Structures and Processes. *Journal of Management* (Vol. 36). <http://doi.org/10.1177/0149206309347376>

Morrison, E. W., & Milliken, F. J. (2000). Organizational Silence : A Barrier to Change and Development in a Pluralistic World, 25(4), 706–725.

Moss, S. A., & Wilson, S. G. (2014). A hole in the ladder: How to reconcile the benefits of equality with the merits of hierarchy. *European Management Journal*, 32(4), 636–645. <http://doi.org/10.1016/j.emj.2013.09.006>

Myers, D. G., & Lamm, H. (1976). The group polarization phenomenon. *Psychological Bulletin*. US: American Psychological Association. <http://doi.org/10.1037/0033-2909.83.4.602>

O'Reilly III, C. a, & Tushman, M. L. (2011). Organizational ambidexterity in action: How managers explore and exploit. *California Management Review*, 53(4), 5–22. <http://doi.org/10.1007/978-3-8349-6859-3>

Oedzes, J., Vegt, G. van der, Rink, F., & Walter, F. (2015). Formal Hierarchy as Antecedent of Informal Hierarchy: A Laboratory Experiment and Field Study. *Academy of Management Proceedings*, (No.1), p.14537.

Overbeck, J. R., & Park, B. (2006). Powerful perceivers, powerless objects: Flexibility of powerholders' social attention. *Organizational Behavior and Human Decision Processes*, 99(2), 227–243. <http://doi.org/10.1016/j.obhdp.2005.10.003>

Paulus, P. B. (2000). Groups, teams, and creativity -The creative potential of idea-generating groups - Paulus, 49(2), 237–262. <http://doi.org/10.1111/1464-0597.00013>

Paulus, P. B., & Brown, V. R. (2007). Toward More Creative and Innovative Group Idea Generation: A Cognitive-Social-Motivational Perspective of Brainstorming. *Social and Personality Psychology Compass*, 1(1), 248–265. <http://doi.org/10.1111/j.1751-9004.2007.00006.x>

Paunova, M. (2015). The emergence of individual and collective leadership in task groups: A matter of achievement and ascription. *Leadership Quarterly*, 26(6), 935–957. <http://doi.org/10.1016/j.leaqua.2015.10.002>

Perretti, Lf., & Negro, G. (2006). Filling Empty Seats : How Status and Organizational Hierarchies Affect Exploration Versus Exploitation in Team Design, 49(4), 759–777.

- Reitzig, M., & Maciejovsky, B. (2015). CORPORATE HIERARCHY AND VERTICAL INFORMATION FLOW INSIDE THE FIRM—A BEHAVIORAL VIEW. *Strategic Management Journal*, 51(2), 315–334. <http://doi.org/10.1002/smj>
- Ridgeway, C. L. (1982). Status in Groups: The Importance of Motivation. *American Sociological Review*, 47(1), 76. <http://doi.org/10.2307/2095043>
- Rivkin, J. W., & Siggelkow, N. (2003). Balancing Search and Stability: Interdependencies Among Elements of Organizational Design. *Management Science*, 49(3), 290–311. <http://doi.org/10.1287/mnsc.49.3.290.12740>
- Seo, Y. W., Chae, S. W., & Lee, K. C. (2015). The impact of absorptive capacity, exploration, and exploitation on individual creativity: Moderating effect of subjective well-being. *Computers in Human Behavior*, 42, 68–82. <http://doi.org/10.1016/j.chb.2014.03.031>
- Simpson, B., Willer, R., & Ridgeway, C. L. (2012). Status Hierarchies and the Organization of Collective Action. *Sociological Theory*, 30(3), 149–166. <http://doi.org/10.1177/0735275112457912>
- Slevin, D. P., & Covin, J. G. (1997). Strategy formation patterns, performance, and the significance of context. *Journal of Management*, 23(2), 189–209.
- Stasser, G., & Titus, W. (2003). Hidden Profiles: A Brief History. *Psychological Inquiry*, 14(3), 304–313. http://doi.org/10.1207/S15327965PLI1403&4_21
- Subramaniam, M., & Youndt, M. A. (2005). The Influence of Intellectual Capital on the Types of Innovative Capabilities. *The Academy of Management Journal*, 48(3), 450–463.
- Sutton, R. I., & Hargadon, A. (1997). Brainstorming Groups in Context: Effectiveness in a Product Design Firm. *Administrative Science Quarterly*, 42(4), 716–749. <http://doi.org/10.2307/2393655>
- Taggar, S., & Brown, T. C. (2001). PROBLEM-SOLVING TEAM BEHAVIORS Development and Validation of BOS and a Hierarchical Factor Structure, 32(6), 698–726. <http://doi.org/10.1111/j.1540-5915.1996.tb00842.x>
- Tarakci, M., Greer, L. L., & Groenen, P. J. F. (2015). When Does Power Disparity Help or Hurt Group Performance? *Journal of Applied Psychology*, No Pagination Specified. <http://doi.org/10.1037/apl0000056>

- Tiedens, L. Z., Unzueta, M. M., & Young, M. J. (2007). An unconscious desire for hierarchy? The motivated perception of dominance complementarity in task partners. *Journal of Personality and Social Psychology*, 93(3), 402–414. <http://doi.org/10.1037/0022-3514.93.3.402>
- Tost, L. P., Gino, F., & Larrick, R. P. (2013). WHEN POWER MAKES OTHERS SPEECHLESS : THE NEGATIVE IMPACT OF LEADER POWER ON TEAM PERFORMANCE, 56(5), 1465–1486. <http://doi.org/10.5465/amj.2011.0180>
- Tuncdogan, A., Van Den Bosch, F., & Volberda, H. (2015). Regulatory focus as a psychological micro-foundation of leaders' exploration and exploitation activities. *Leadership Quarterly*, 26(5), 838–850. <http://doi.org/10.1016/j.leaqua.2015.06.004>
- Van Ginkel, W. P., & Van Knippenberg, D. (2012). Group leadership and shared task representations in decision making groups. *Leadership Quarterly*, 23(1), 94–106. <http://doi.org/10.1016/j.leaqua.2011.11.008>
- Yang, Z., Zhou, X., & Zhang, P. (2014). Discipline versus passion: Collectivism, centralization, and ambidextrous innovation. *Asia Pacific Journal of Management*, 32(3), 745–769. <http://doi.org/10.1007/s10490-014-9396-6>
- Ylinen, M., & Gullkvist, B. (2014). The effects of organic and mechanistic control in exploratory and exploitative innovations. *Management Accounting Research*, 25(1), 93–112. <http://doi.org/10.1016/j.mar.2013.05.001>
- Yoo, Y., & Alavi, M. (2004). Emergent leadership in virtual teams: what do emergent leaders do? *Information and Organization*, 14(1), 27–58. <http://doi.org/10.1016/j.infoandorg.2003.11.001>