JOURNAL OF CREATIVITY AND BUSINESS INNOVATION

Journal of Creativity and Business Innovation, Vol. 2, 2016.

www.journalcbi.com
ISSN 2351 – 6186

This paper is available at: http://www.journalcbi.com/self-organisation-and-group-creativity.html

Self-Organisation and Group Creativity

Tomas Backström, Tobias Söderberg
Malardalen University, School for Innovation, Design and Engineering,
Department for Innovation Management,
Eskilstuna, Sweden.

Abstract

The team has become the basic organisational unit of development and innovation work and an understanding of creativity at the collective level is crucial for long-term sustainability. This article takes a process perspective and understands group creativity as emerging from the interaction among group members. It is about the possibility to enable the emergence of self-organisation, thereby increasing group creativity. This paper presents an experiment where four out of eight randomly formed groups of students were given a work order structured according to the group process model "GroPro". In groups using the GroPro ideas were significantly more often promoted, observed and used by other group members, and used in the final solution. Further, the two best solutions and the more creative solutions of the task were found among the GroPro groups. A work process structured according to the GroPro model seems to increase self-organisation as well as the creativity of the group. Further, the group process is shown to be more important for group creativity than the individual creativity of the group members. Our results encourage more focus on the group process by both academia and practitioners.

Keywords: group creativity, interaction, emergence, group dynamics, process theory, creativity, innovation, team, complex systems, theoretical model, management tool.

Introduction

Creativity is important for organisations as a part of progress and innovation processes to reach a competitive advantage (Anderson, Potocnik, & Zhou, 2014; Grant & Ashford, 2008; Nonaka, 1991) and has recently become increasingly present within current managerial discourse (see for example Florida & Goodnight, 2005). For an organisation to be innovative, the creativity of its employees is crucial (Kratzer, Leenders, & van Engelen, 2006; Nijhof, Krabbendam, & Looise, 2002; H. K. Tang, 1998; Xu et al., 2007) and research on employee creativity has thus flourished in the past few decades (Shalley & Zhou, 2008).

Along with the development of industry, creative ideas and problem-solving have become increasingly complicated and require solutions that combine knowledge, efforts and abilities of people with diverse perspectives (Brown & Eisenhardt, 1998; Hargadon & Bechky, 2006; Jiang & Zhang, 2014). Owing to the synergetic potential of diverse knowledge, collaborating individuals can often find better solutions for complex situations (Rubenson & Runco, 1995). Consequently, the team has become the basic organisational unit of development and innovation work (Burke, Stagl, Salas, Pierce, & Kendall, 2006;

JOURNAL OF CREATIVITY AND BUSINESS INNOVATION

Journal of Creativity and Business Innovation, Vol. 2, 2016.

www.journalcbi.com
ISSN 2351 – 6186

This paper is available at: http://www.journalcbi.com/self-organisation-and-group-creativity.html

Huang, 2009; Kozlowski & Bell, 2003; Kratzer, Leenders, & van Engelen, 2004; Rubenson & Runco, 1995; H. K. Tang, 1998).

The creativity of the individual is often in focus, both among managers (Bissola & Imperatori, 2011) and academics (Paulus & Nijstad, 2003; West & Wallace, 1991). This is curious, since the collective level is more crucial in modern organisations (Hargadon & Bechky, 2006; Sonnenburg, 2004). The focus on individual creativity leads in consequence to an additive understanding of collaborative creativity, and both theories (Nijstad & Paulus, 2003; Rubenson & Runco, 1995; Woodman, Sawyer, & Griffin, 1993) and empirical research (Bissola & Imperatori, 2011; Saad, Cleveland, & Ho, 2015) point at group creativity as being more than the sum of different individuals' creativity.

This article takes a process perspective and understands group creativity as emerging from the interaction among group members. The paper is about whether it is possible to enable the emergence of self-organisation and group creativity. It is written within the InnovationsGym®-project, which is an answer to a call from public as well as the private organisations for more knowledge of how to develop innovation competence involving all kind of employees. The paper presents an experiment where eight randomly formed groups either had to tackle a problem freely or by following a structured work plan. The two research questions of the paper are:

1. Is the self-organisation of a group influenced by the work process of the group?
2. Is group creativity influenced by the self-organisation of the group?

Theory

Creativity is generally conceptualised as the production of ideas that are novel as well as useful (Anderson et al., 2014). The focus may be on the creative output, the creative process (e.g. Stein, 1953) or the creative capacity (e.g. Torrance, 1971). The definition of creativity has a social dimension, since the degree of novelty and usefulness is something others have to judge (Csikszentmihalyi, 1996). The creativity of the individual is often in focus, but empirical research shows that group creativity is more than the sum of the different individuals' creativity; for example in an experiment comparing creativity in groups composed of individualistic Canadian and collectivistic Taiwanese participants respectively, it is shown that the Canadians scored higher in individual creativity, but the Taiwanese higher in group creativity (Saad et al., 2015). And in an experiment including over a thousand individuals, the groups with relatively uncreative members more often produced creative results (54%), than the groups with creative members (42%) (Bissola & Imperatori, 2011). It seems as though the emergence of unique collaborative creativity crystallises first at the social level (Jiang & Zhang, 2014; Sonnenburg, 2004). It is possible to distinguish at least two perspectives of group creativity (see for example Anderson et al., 2014; Glăveanu, 2010). Firstly, the componential theories, where the environment has an impact on creativity by affecting

JOURNAL OF CREATIVITY AND BUSINESS INNOVATION

Journal of Creativity and Business Innovation, Vol. 2, 2016.

www.journalcbi.com
ISSN 2351 – 6186

This paper is available at: http://www.journalcbi.com/self-organisation-and-group-creativity.html

components that contribute to creativity (see for example the KEYS instrument Amabile, Conti, Coon, Lazenby, & Herron, 1996)). Here the other members of the group are seen as an external environment to the individual, a set of stimulations that facilitate or constrain the creative act. Three major components contributing to small group creativity according to this perspective are expertise, creative-thinking skill and intrinsic motivation (Anderson et al., 2014).

Secondly, the process theories, where creativity is a result of a collective process. They focus for example on interactions (Woodman et al., 1993), sense making (Drazin, Glynn, & Kazanjian, 1999) or procedures (Hargadon & Bechky, 2006). Here creativity is a complex interaction between the individual and her situation, and there is interdependence between the individual and the others in the group. According to this perspective the creativity of the group is a consequence of for example individual creative behaviour, interaction between group members, group characteristics, group processes and contextual influences (Anderson et al., 2014).

This article uses a process theory focusing on interactions. We define group creativity as the extent to which group members suggest and promote novel ideas, which are recognised and used by the group. A creative process can be divided into recurring transition and action phases (Marks, Mathieu, & Zaccaro, 2001). The action phases, including actions and activities that contribute directly to task or goal accomplishment, are, of course, positively related to group creativity. But the importance of the transition phases, including actions and activities that focus primarily on planning activities that guide the goal accomplishment, is less studied and often questioned. Planning and structuring is shown to decrease intrinsic motivation, which is important for creativity (Isen & Reeve, 2005), and Curseu (2010), for example, states that creativity demands spontaneity and is difficult to plan in advance, and concludes: “when considering team creativity as an outcome, transition phase processes are disadvantageous” (p. 101).

But even process theories of group creativity “neglect to examine the link between individual creative capability and the level of collective creativity” (Bissola & Imperatori, 2011, p79). McGrath, Arrow, and Berdahl (2000) criticise the study of groups for using mostly chain-like unidirectional cause-effect relationships. They describe dynamics as consisting of *local dynamics* of group members engaged in the tasks of the group, *global dynamics* of group-level variables (for example norm structures, group identity, and leadership) which emerge from and shape the local dynamics, and *contextual dynamics* which refer to the interaction between global dynamics and the embedding context of the group. Thus, to study dynamics one must consider multilevel influence relationships (Cronin, Weingart, & Todorova, 2011). Using this strict definition of dynamics, group dynamics is rarely studied not only in creativity research, but also in the study of groups generally (Cronin et al., 2011; Kozlowski & Bell, 2003; McGrath & Argote, 2001; McGrath, Arrow, & Berdahl, 2000). We need to “better

JOURNAL OF CREATIVITY AND BUSINESS INNOVATION

Journal of Creativity and Business Innovation, Vol. 2, 2016.

www.journalcbi.com
ISSN 2351 – 6186

This paper is available at: http://www.journalcbi.com/self-organisation-and-group-creativity.html

distinguish the individual and the collective level and the emergence of team coordination" (Kozlowski & Bell, 2003, p 366).

Cronin, et al. (2011) suggests a model for the study of group dynamics that includes three dynamic profiles of phenomena: contextual, cumulative and emergent. The contextual constructs apply to group properties that are imposed on the group by external forces. The cumulative ones are based on stable individual properties, which come about when the group members are assigned. And the emergent constructs are group level phenomena that emerge over time in the interaction between group members. They also conclude that the emergent constructs are the most dynamic.

All three constructs have been shown to be important for the creativity of the group; for example contextual factors such as goal interdependence of the task, team size, and support for innovation and cumulative factors such as job-relevant diversity between group members (Hülsheger et al., 2009).
Emergence, the most important feature of the group creativity system (Jiang & Zhang, 2014), is a concept from complex systems theory. It deals with the link between the individual and the group (Sawyer, 2005) and understands it as a circular causality (Haken, 1996). Organising structures at the collective level emerges through interactions between individuals and influences this interaction. This article is about whether it is possible to design a contextual construct, in this case a specific work process, which enables the emergence of self-organisation, because of a belief that a self-organised group will be more creative.

The "GroPro" model

The focus of our research has been on two parallel processes of emergence of importance for group creativity: the emergence of self-organisation in the group and the emergence of group ideas from individual ideas (Köping Olsson & Florin, 2011). We have developed a model to be able to study, describe and enable the emergence of self-organisation in creative groups; the Group process (GroPro) model. It is based on the more general Human Interaction Dynamics (HID) model (Hazy & Backström, 2013).

Human interactions can be studied and enabled from both the individual and the collective perspectives. The two perspectives can be described as a duality, between individual details and plurality, and collective structure and unity. The GroPro-model is divided between three levels of structures with these two perspectives on each level: 1. *The relation level with both individual autonomy and socialisation into the group and its task, 2. The information flow level with both individual divergent ideas and convergent group ideas common to all group members, and 3. The action level with both individual exploring and experimentation, and the exploiting of the group's resources to meet the tasks of the group. These three levels times two perspectives form the six dynamic islands of the* GroPro-model. The model suggests that a group, in order to be creative, has to recurrently visit each island during the creative process. Each island

JOURNAL OF CREATIVITY AND BUSINESS INNOVATION

Journal of Creativity and Business Innovation, Vol. 2, 2016.

www.journalcbi.com
ISSN 2351 – 6186

This paper is available at: http://www.journalcbi.com/self-organisation-and-group-creativity.html

includes different kinds of competencies, procedures and tools needed to be creative. On three of the islands group members work individually and on three they interact as a collective. The name of the islands, a description of the island, including references to research showing its importance for creativity, and the instruction given to the group in the experiment is presented below:

1. The island of autonomous individuals.

The focus in this island is on the autonomy of each individual. The aim is to strengthen the feeling of self-control and self-efficacy, to make each individual aware of the specific competencies, knowledge and experience she has that is of importance for the group task, and to free them from the structures and limitations of their workplace and everyday life.

Examples from research are: ego-identification, individual differentiation and individualism are associated with group creativity (Goncalo & Staw, 2006; Janssen & Huang, 2008).

Instruction to the group: Work individually and be quiet. Think of what you are especially good at when it comes to each respective task in creative group processes.

2. The socialisation island.

The focus on this island is to integrate the participants into one cooperating group, where you learn to know, accept and trust one another. The aim is to increase the ability to listen to others, take one another's perspectives, and build on one another's ideas. An improvisational attitude, where you trust the group process and let go of control and forget about your individual plans, is important.

Examples from research are: a supportive cooperative work atmosphere, where group members help one another and collaborate, increases group creativity (Amabile et al., 1996; Keller, Julian, & Kedia, 1996). Cohesion is important for a group to be creative; group members need to identify with the group, desire to continue to be part of the group, share a sense of group purpose, potency and responsibility, and be committed to its vision and objectives (Cardinal, 2001; Hirst, van Dick, & van Knippenberg, 2009; Hoegl, Gibbert, & Mazursky, 2008; Huang, 2009; Rickards, Chen, & Moger, 2001; Santos, Uitdewilligen, & Passos, 2015; West & Anderson, 1996; West & Wallace, 1991).

Instruction to the group: Tell one another what you are especially good at and discuss possible organisation of the work.

3. The idea generation island.

The focus on this island is on the generation of new and divergent ideas. The aim is to formulate as many and as novel ideas as *possible*. The individuals are encouraged to go beyond the frames; no idea is too far out. Inspiration is sought for in different odd places.

Examples from research are: the number of ideas is sometimes also meant to be a measure of creativity.

Instruction to the group: Work individually and be quiet. Generate ideas for the task.

JOURNAL OF CREATIVITY AND BUSINESS INNOVATION

Journal of Creativity and Business Innovation, Vol. 2, 2016.

www.journalcbi.com
ISSN 2351 – 6186

This paper is available at: http://www.journalcbi.com/self-organisation-and-group-creativity.html

4. The idea management island.

The work on this island is to structure, select and combine ideas to formulate the best possible ideas for innovation. The goal is to have the ideas to converge to one or a few dominant ideas that all participants accept as a basis for further development.

Examples from research are: the extent to which group members share information, ideas, knowledge and experience is of importance for creativity (Nijstad & Stroebe, 2006; Okhuysen & Eisenhardt, 2002; Somech, 2006; Tjosvold, Tang, & West, 2004).

Instruction to the group: Tell one another about your ideas, and try to develop them further.

5. The island for exploration.

The focus on this island is on exploration and individual learning. The exploration can either be to experiment, test and try out different ideas developed in the idea management island, or to explore ideas or solutions from other contexts that can be used as an input to the work on the idea generation island. *Examples from research are:* there is a positive relationship between external communication and creativity (Ancona & Caldwell, 1992; Denison, Hart, & Kahn, 1996; Keller, 2001; McAdam, O'Hare, & Moffet, 2008; Perry-Smith & Shalley, 2003; Wong, Tjosvold, & Su, 2007).

Instruction to the group: Work individually and be quiet. Now you are allowed to use the material to experiment on ideas.

6. The island for exploitation.

The focus on this island is on using the knowledge of the participants, the work done and experiences drawn on to build one or a few concepts of innovations that have a chance to be implemented, to make use of the resources of the group and act in a well-coordinated way to create value.

Examples from research are: the theory of team adaptation (Burke et al., 2006) considers mutual performance monitoring and feedback to be important for creative group performance.

Instruction to the group: Perform the task together.

Partly similar to the GroPro-model is a model formulated by Jiang and Zhang (Jiang & Zhang, 2014). It is also based on emergence as the most important feature of the group creativity system and on theories of complex systems. They also divide the individual actions and the emergent collective organising structures into three levels: Creative thinking, Creative action and Creative outcome. Two of the levels are similar: Creative thinking and Information flow level, and Creative action and Action level respectively. But the GroPro model sees the identity and the relations of the group members as being too important for the social dynamic to be ignored. This relational level is included in another model with similarities to GroPro, formulated by Tang, Shang et.al. (C. Y. Tang, Shang, Naumann, & von Zedtwitz, 2014). Similar to *Autonomy* they talk about *Ego-identification*, the extent to which individual group members see themselves as different from the other group members in their thoughts,

JOURNAL OF CREATIVITY AND BUSINESS INNOVATION

Journal of Creativity and Business Innovation, Vol. 2, 2016.

www.journalcbi.com
ISSN 2351 – 6186

This paper is available at: http://www.journalcbi.com/self-organisation-and-group-creativity.html

feelings and behaviour. Similar to *Socialisation*, Tang, Shang et.al. (2014) use the concept *Team identification,* which refers to the perception of belonging to a group, a feeling that their faith is closely linked with that of the group. And similar to *Idea generation* and *Idea management,* Tang, Shang et.al. (2014) state that knowledge sharing occurs in two ways: through the combination of existing knowledge and through the exchange of knowledge and information. Further, divergence (generating options) and convergence (selecting options) can be seen as necessary steps in the groups' creative process (Leonard & Swap, 1999).

One important consequence of letting group members work individually part of the time is that everyone is lured and forced into becoming more active during the collective phases. This is partly because they have prepared things to present and partly because others expect everyone to present their ideas (Döös & Backström, 1997). Research on the human brain function gives an additional cause to facilitate both an individual and a collective part of the creative process. Human beings are shown to have two competing, mutually exclusive, ways for the brain to work: one associated with mechanical and one with social reasoning (Jack et al., 2013). Thus it is good for a group working on a task, where there is a need to reason about physical objects, to take breaks from working together with others and using the brain network for social reasoning, to be able to use their brain network for mechanical reasoning as well.

Method

The study was designed as a laboratory experiment with undergraduate students. Groups were formed for this specific occasion, and the students had no earlier experience of working together in these groups. The experiment can be described (using the concepts of contextual, cumulative and emergent constructs (Cronin et al., 2011)) as:

Contextual constructs. The creative task for the group was to build a bridge as long as possible. All groups had the same task, material, and time. Half of the groups, the free groups, were free to work as they preferred during their 50 minutes. Half of the groups, the GroPro groups, were given the dynamic islands of the GroPro-model as a work process, see above. The contextual constructs were thus the same for all groups, except that half of the groups received a structured work process. None of the groups received any coaching, and except from timekeeping the facilitator kept quiet during the fifty minutes.

Cumulative constructs. 41 students volunteered to be part of the study (24 women and 17 men, 29 between 20-25 years old and 12 over 25). They were divided into eight groups: four free groups of 21 students in all and the four GoPro groups of 20 students in all. They were randomly selected into groups in order to have the cumulative construct as equal as possible for all groups. The fact that the groups were reasonably equal was confirmed by using questionnaires about personality before the experiment. As expected there were no significant differences between groups towards cumulative constructs.

Emergent constructs. Two questionnaires about emergent constructs were

JOURNAL OF CREATIVITY AND BUSINESS INNOVATION

Journal of Creativity and Business Innovation, Vol. 2, 2016.

www.journalcbi.com
ISSN 2351 – 6186

This paper is available at: http://www.journalcbi.com/self-organisation-and-group-creativity.html

answered after the experiment: one about intrinsic motivation with eight questions about the individual experience of intrinsic motivation during the experiment (Isen & Reeve, 2005); these were transformed into one scale, *Intrinsic Motivation*, consisting of the mean value of the answers. And one questionnaire about self-organisation, with 24 questions about the respondents' experience of participating in the group processes, four questions for each aspect in the HID model. The answers were transformed into six scales, one for each aspect by using the mean value of the answers: *Autonomy, Integration, Divergence, Convergence, Exploring,* and *Exploiting*. Since the HID model is based on complex systems theory and is supposed to indicate how to reach self-organisation, this questionnaire is expected to measure the degree of self-organisation in a group. This questionnaire is newly constructed and is to be further developed.

The creative outcomes of the experiment. The experiments were videotaped and the videos have been used to observe the flow of ideas. Each idea, how the group members responded to the idea, whether the idea was used to produce new ideas or in the building of the bridge has been recorded in writing into a protocol. Three variables have been produced from the protocol to measure creativity:

- *The number of suggested ideas*, a measure of individual creativity.
- *Promotion and use* of ideas, a measure of group creativity, is between zero and three. One point to the value is added in each case if a) a group member encourages or criticises the idea, b) the idea is used to produce a new idea and c) the idea is used in the bridge. It is zero if nobody seems to hear the idea.
- *Idea novelty,* a measure of both individual and group creativity, has a value of one or two. It is one if the idea is an incremental development of another idea and two if the idea is a radical new idea starting a new thread of ideas.
- Finally, as indications of the creativity of the groups, the lengths of the bridges were measured and the creativity of the solutions in the bridge were assessed by the authors of this article.

Results

At the individual level (n=41) *the number of ideas* (n=604) was significantly correlated with *Intrinsic motivation* (Pearson correlation 0.476, significant at the 0.01 level), but with none of the other scales or variables of the experiment (including the the big five personality domains and the creative traits questionnaire). The more intrinsically motivated an individual was, the more ideas he/she produced.

At the group level mean values of the intrinsic motivation and the six self-organisation scales have been compared between the GroPro groups (four groups with 21 participants) and the free groups (four groups with 20 participants) using a t-test, see table 1. *Intrinsic motivation* was marginally lower

JOURNAL OF CREATIVITY AND BUSINESS INNOVATION

Journal of Creativity and Business Innovation, Vol. 2, 2016.

www.journalcbi.com
ISSN 2351 – 6186

This paper is available at: http://www.journalcbi.com/self-organisation-and-group-creativity.html

for the GroPro groups. Five of the six scales measuring self-organisation were higher for the GroPro groups: *Autonomy* was close to significantly higher and the difference for *Divergence* and *Convergence* was also rather high. One scale, *Integration,* had slightly lower values for the GroPro groups.

The number of suggested ideas was lower for the GroPro groups with 260 ideas, compared with 344 in the free groups, but the novelty of ideas was a bit higher, see table 1. For one measure of creative outcome of the experiment the mean value difference was significant; *Promotion and use* of ideas were significantly higher in the GroPro groups, which means that ideas were more often observed and used by other members of these groups. Of the 260 ideas in the GroPro groups 87 percent were observed and used by others compared with 79 percent of the 344 ideas in the free groups.

For the four free groups the length of the bridges varied between 135 and 216 centimetres, with a mean of 164. One of the GroPro groups did not finish their bridge in time, so if we do not count that group, their bridges varied between 104 and 325 centimetres, with a mean of 217. The two free groups with the most ideas built the shorter bridges, (#ideas/length = (52/167, 90/216, 91/135, 111/136)), but for the GroPro groups there is a positive correlation between the number of ideas and the length of bridge, (#ideas/length = (54/0, 63/145, 69/222, 74/325)). The two longest bridges were produced by 6δ groups, and the solutions in their bridges were assessed by the authors of this article to be more creative. For example only GroPro groups used the room (the floor and the ceiling) in their solutions.

Method	*Scale/variable*	*Mean for Free groups*	*Mean for GroPro groups)*	*Mean differences, t-value*	*Significance*
Intrinsic motivation	Intrinsic motivation	5.69	5.65	-0.15	0.88
Self-organisation	Autonomy	4.35	4.86	1.57	0.12
	Integration	4.72	4.65	-0.31	0.76
	Divergence	4.86	5.08	1.05	0.30
	Convergence	4.85	5.13	1.05	0.30
	Exploring	4.98	5.14	0.60	0.55
	Exploiting	4.42	4.53	0.28	0.78
Creativity	Promotion and use	1.10	1.33	3.54**	0.000
	Novelty	1.43	1.45	0.49	0.62

** Significant on a 0001 level

Table 1. Mean values for the groups and ideas without and with a structured work process, the t-values measuring mean differences between the groups and the significance level of the differences.

JOURNAL OF CREATIVITY AND BUSINESS INNOVATION

Journal of Creativity and Business Innovation, Vol. 2, 2016.

www.journalcbi.com
ISSN 2351 – 6186

This paper is available at: http://www.journalcbi.com/self-organisation-and-group-creativity.html

Discussion

In the experiment of this study four of the eight randomly formed groups of students were given a group process structured according to the Group process (GroPro) model. The two research questions of the paper are:

1. Is the self-organisation of a group influenced by the work process of the group?
2. Is group creativity influenced by the self-organisation of the group?

The study is planned to be a first test of our theories. Three out of four common limitations in studies of interacting groups (McGrath et al., 2000) are also found in our study. The groups are studied as if they were isolated from embedding contexts, as entities with no past and future, and studied as generic entities made up of generic people.

Self-organisation was measured by six scales based on answers to a questionnaire. Five of the six scales were higher for the GroPro groups: The *Autonomy* scale, measuring whether the participants felt that they contributed in an autonomous way in the experiment, was close to significantly higher. And for the two scales measuring in what way participants contributed in the information flow, *Divergence* and *Convergence*, the difference was also rather high. But *Integration* had slightly lower values for the GroPro groups.

This questionnaire is newly constructed and differences could possibly be sharper with a further developed version. Above this, the experiment is small, including only eight groups. That *Integration* was lower for the GroPro groups could be interpreted as that the dynamic group process in itself gave the group an integration which led to a reduced need for each individual to work on integration in the GroPro groups. This, plus the fact that five out of six pointed in the same direction, made it reasonable to conclude that self-organisation was higher in the GroPro groups, even though none of the differences were significant.

The answer to the first research question is thus Yes. To structure the work process of a group according a model can increase self-organisation of the group. But will it also increase the creativity of the group? We define group creativity as the extent to which group members suggest and promote novel ideas which are recognised and used by the group. Two variables were used to measure individual creativity: *The number of suggested ideas* was lower for GroPro groups, but *the novelty of ideas* was a bit higher. The Group process demands individuals to be quiet for periods, so the ideas suggested after such periods can be expected to be fewer, but of higher quality, as shown in the results. Above *the novelty of ideas*, one variable was used to measure group creativity: *Promotion and use* of ideas, which mean value differences, were significantly higher in the GroPro groups. Further, the outcome of the creative process also indicates that the GroPro groups were more creative, and able to build the longer and more novel bridges. Even though these groups in reality had only about half of the time to build their bridges, since most of the first 25 of the 50 minutes were spent on relations between the members and to the

JOURNAL OF CREATIVITY AND BUSINESS INNOVATION

Journal of Creativity and Business Innovation, Vol. 2, 2016.

www.journalcbi.com
ISSN 2351 – 6186

This paper is available at: http://www.journalcbi.com/self-organisation-and-group-creativity.html

task, and on idea generation and management, while the free group could start their building process at once.

Thus, the answer to the second research question is also Yes. The emergence of self-organisation in a group seems to increase the emergence of group ideas and thus the creativity of the group.

At the individual level *the number of ideas* was significantly correlated with *Intrinsic motivation*, which confirms earlier research showing intrinsic motivation to be of central importance for individual creativity (Isen & Reeve, 2005). At the group level the structured work process of the GroPro groups decreased intrinsic motivation of the participants, as Curseu (2010) assumed and the number of ideas, but the GroPro groups were still more creative. The number of ideas in the groups seems not to be correlated to group creativity. Differences in individual creativity thus seem not to be of central importance at the group level. Group creativity is not the sum of the individuals' creativity. This is in line with other experiments indicating that creative members in a group can even *decrease* group creativity (Bissola & Imperatori, 2011; Saad et al., 2015).

The transition phase (Marks et al., 2001) is shown to be important, since it is possible to plan for and facilitate a group process which enables the emergence of self-organisation and group ideas. The promotion of ideas by other group members is more important for group creativity than the number of ideas. The group process is relevant for group creativity, as shown by other researchers (Bissola & Imperatori, 2011; Taggar, 2002; West & Anderson, 1996). And emergence is shown to be more important for group creativity than the individual creativity of the group members. This experiment confirms the suggestion that the emergence of unique collaborative creativity crystallises first at the social level (Jiang & Zhang, 2014; Sonnenburg, 2004).

To structure the work process of a group according to the "GroPro" model increased self-organisation of the group and the emergence of group ideas and thus the creativity of the group. But other mechanisms may also have contributed to these results. For example, because of the way the human brain functions it could be good for a group to switch between individual and social problem-solving (Jack et al., 2013). This can for example be one reason why only the GroPro groups came up with the idea to use the room in their solutions.

Practical implementations

Before any certain practical implications can be drawn there is a need to perform new studies using the experiences of this study to improve the design and the questionnaires, using existing groups or teams in their real setting and following them over time to see the emergence of self-organisation. Nevertheless, here are some preliminary conclusions:

- A structured work process may increase self-organisation as well as creativity of a group.
- The Group process (GroPro) model is a functional base for structuring the creative work process of a group.

JOURNAL OF CREATIVITY AND BUSINESS INNOVATION

Journal of Creativity and Business Innovation, Vol. 2, 2016.

www.journalcbi.com
ISSN 2351 – 6186

This paper is available at: http://www.journalcbi.com/self-organisation-and-group-creativity.html

It is a huge waste of an organisation to focus only on individual creativity as these individuals normally have to do their creative work in groups. When the group processes fail it does not matter how creative the individual members of the group are, and with a good group process any group has the possibility to be creative. Our results encourage more focus on the group process by both academia and practitioners.

References:

Amabile, T. M., Conti, R., Coon, H., Lazenby, J., and Herron, M. (1996) Assessing the work environment for creativity. Academy of Management Journal, 39, 1154-1184.

Ancona, D. G., and Caldwell, D. F. (1992) Demography and design: Predictors of new product team performance. Organization Science, 3, 321-341.

Anderson, N., Potocnik, K., and Zhou, J. (2014) Innovation and creativity in organizations: A state-of-the-science review, prospective commentary, and guiding framework. Journal of Management, 5, 1297-1333.

Bissola, R., and Imperatori, B. (2011) Organizing individual and collective creativity: Flying in the face of creativity clichés. Creativity and Innovation Management, 2, 77-89.

Brown, S. L., and Eisenhardt, K. M. (1998) Competing on the edge: Strategy as a structured chaos, Harvard Business School Press, Boston.

Burke, C. S., Stagl, K. C., Salas, E., Pierce, L., and Kendall, D. (2006) Understanding team adaptation: A conceptual analysis and model. Journal of Applied Psychology, 91, 1189-1207.

Cardinal, L. B. (2001) Technological innovation in the pharmaceutical indistry: The use of organizational control in managing research and development. Organization Science, 12, 19-36.

Cronin, M. A., Weingart, L. R., and Todorova, G. (2011) Dynamics in groups: Are we there yet? The Academy of Management Annals, 1, 571-612.

Csikszentmihalyi, M. (1996) Creativity, Harper Collins Publishers, New York.

Curseu, P. L. (2010) Team creativity in web site design: An empirical test of a systematic model. Creativity Research Journal, 1, 98-107.

Denison, D. R., Hart, S. L., and Kahn, J. A. (1996) From chimneys to cross-functional teams: Developing and validating a diagnostic model. Academy of Management Journal, 39, 1005-1023.

Drazin, R., Glynn, M. A., and Kazanjian, R. K. (1999) Multilevel theorizing about creativity in organizations: A sensemaking perspective. Academy of Management Review, 24, 286-307.

Döös, M., and Backström, T. (1997) The Riv Method: A participative risk analysis method and its application. New Solutions, 3, 53-60.

Florida, R., and Goodnight, J. (2005) Managing for creativity. Harvard Business Review, July-August, 124-131.

Glăveanu, V. P. (2010) Paradigms in the study of creativity: Introducing the perspective of cultural psychology. New Ideas in Psychology, 28, 79-93.

Goncalo, J. A., and Staw, B. M. (2006) Individualism-collectivism and group creativity. Organizational Behavior and Human Decision Process, 100, 96-109.

Grant, A., and Ashford, S. J. (2008) The dynamics of proactivity at work. Research in Organizational Behavior, 28, 3-34.

Haken, H. (1996) Principles of brain functioning. A synergetic approach to brain activity, behavior and cognition, Springer, Berlin.

Hargadon, A. B., and Bechky, B. A. (2006) When collections of creatives become creative collectives: A field study of problem solving at work. Organization Science, 17, 484-500.

Hazy, J. K., and Backström, T. (2013) Human interaction dynamics (HID): An emerging paradigm for management research. Emergence: Complexity and Organization, 4, i-ix.

JOURNAL OF CREATIVITY AND BUSINESS INNOVATION

Journal of Creativity and Business Innovation, Vol. 2, 2016.

www.journalcbi.com
ISSN 2351 – 6186

This paper is available at: http://www.journalcbi.com/self-organisation-and-group-creativity.html

Hirst, G., van Dick, R., and van Knippenberg, D. (2009) A social identity perspective on leadership and employee creativity. Journal of Organizational Behavior, 30, 963-982.

Hoegl, M., Gibbert, M., and Mazursky, D. (2008) Financial constraints in innovation projects: When is less more? Research Policy, 37, 1382-1391.

Huang, C. C. (2009) Knowledge sharing and group cohesivness on performance: An empirical study of technology RandD teams in Taiwan. Technovation, 29, 786-797.

Hülsheger, U. R., Anderson, N., and Salgado, J. F. (2009) Team-level predictors of inovation at work: A comprehensive meta-anlysis spanning three decades of research. Journal of Applied Psychology, 5, 1128-1145.

Isen, A. M., and Reeve, J. (2005) The influence of positive affect and intrinsic motivation: facilitating enjoyment of play, responsible work behavior, and self control. Motivation and Emotion, 4, 297-325.

Jack, A. I., Dawson, A. J., Begany, K. L., Leckie, R. L., Barry, K. P., Cicca, A. H., and Snyder, A. Z. (2013) fMRI reveals reciprocal inhibition between social and physical cognitive domains. NeuroImage, 66, 385-401.

Janssen, O., and Huang, X. (2008) Us and me: Team identification and individual differentiation as complementory drivers of team members citizenships and creative behaviors. Journal of Management, 34, 69-88.

Jiang, H., and Zhang, Q.-p. (2014) Development and validation of team creativity measures: A complex systems perspective. Creativity and Innovation Management, 3, 264-275.

Keller, R. T. (2001) Cross-functional project groups in research and new product development: Diversity, communicatons, job stress, and outcomes. Academy of Management Journal, 44, 547-555.

Keller, R. T., Julian, S. D., and Kedia, B. L. (1996) A multinational study of work climate, job satisfaction, and the productivity of RandD teams. !EEE Transactions in Engineering Management, 43, 48-55.

Kozlowski, S. W. J., and Bell, B. S. (2003) Work groups and teams in organizations. In Borman W. C., Ilgen D. R. and Klimoski R. J. (eds.), Handbook of psychology: Industrial and organizational psychology, Wiley, London.

Kratzer, J., Leenders, R. T. A. J., and van Engelen, J. M. L. (2004) Stimulating the potential: Creative performance and communication in innovation teams. Creativity and Innovation Management, 1, 63-71.

Kratzer, J., Leenders, R. T. A. J., and van Engelen, J. M. L. (2006) Managing creative team performance in virtual environments: An empirical study in 44 RandD teams. Technovation, 26, 42-49.

Köping Olsson, B., and Florin, U. (2011) Idea exchange and shared understanding: Tools stimulating thought and conveying ideas. Design principles and practices: An international journal, 5, 3-17.

Leonard, D. A., and Swap, W. C. (1999) When sparks fly: Igniting creativity in groups, Harvard Business School Press, Boston.

Marks, M. A., Mathieu, J. E., and Zaccaro, S. J. (2001) A temporally based framework and taxonomy of team processes. Academy of Management Review, 26, 256-376.

McAdam, R., O'Hare, T., and Moffet, S. (2008) Collaborative knowledge sharing in composite knew product development: An aerospace study. Technovation, 28, 245-256.

McGrath, J. E., and Argote, L. (2001) Group processes in organizational contexts. In Hogg M. A. and Tindale T. S. (eds.), Blackwell handbook of social psychology: Group processes, Blackwell, Oxford.

McGrath, J. E., Arrow, H., and Berdahl, J. L. (2000) The study of groups: Past, present and future. Personality and Social Psychology Review, 4, 95-105.

Nijhof, A., Krabbendam, K., and Looise, J. C. (2002) Innovation through exemptions: Building upon the existing creativity of employees. Technovation, 22, 675-683.

Nijstad, B. A., and Paulus, P. B. (2003) Group creativity: Common themes and future directions. In Paulus P. B. and Nijstad B. A. (eds.), Group creativity: Innovation through collaboration,

JOURNAL OF CREATIVITY AND BUSINESS INNOVATION

Journal of Creativity and Business Innovation, Vol. 2, 2016.

www.journalcbi.com
ISSN 2351 – 6186

This paper is available at: http://www.journalcbi.com/self-organisation-and-group-creativity.html

Oxford University Press, New York.
Nijstad, B. A., and Stroebe, W. (2006) How the group affects the mind: A cognitive model of idea generation in groups. Personality and Social Psychology Review, 10, 186-214.
Nonaka, I. (1991) The knowledge-creating company. Harvard Business Review, 69, 96-104.
Okhuysen, G. A., and Eisenhardt, K. M. (2002) Integrating knowledge in groups: How formal interventions enable flexibility. Organization Science, 13, 370-386.
Paulus, P. B., and Nijstad, B. A. (2003) Group creativity: An introduction. In Paulus P. B. and Nijstad B. A. (eds.), Group creativity: Innovation through collaboration, Oxford University Press, New York.
Perry-Smith, J. E., and Shalley, C. E. (2003) The social side of creativity: A static and dynamic social network perspective. Academy of Management Review, 28, 89-106.
Rickards, T., Chen, M. H., and Moger, S. (2001) Development of a self-report instrument for exploring team factor, leadership and performance relationships. British Journal of Management, 12, 243-250.
Rubenson, D. L., and Runco, M. A. (1995) The psycheconomic view of creative work in groups and organizations. Creativity and Innovation Management, 4, 232-241.
Saad, G., Cleveland, M., and Ho, L. (2015) Individualism-collectivism and the quantity versus quality dimensions of individual and group creative performance. Journal of Business Research, 68, 578-586.
Santos, C. M., Uitdewilligen, S., and Passos, A. M. (2015) Why is your team more creative than mine? The influence of shared mental models on intra-group conflict, team creativity and effectiveness. Creativity and Innovation Management.
Sawyer, R. K. (2005) Social emergence: Societies as complex systems, Cambridge University Press, Cambridge.
Shalley, C. E., and Zhou, J. (2008) Organizational creativity research. In Zhou J. and Shalley C. E. (eds.), Handbook of organizational creativity, Lawrence Erlbaum Associates, New York, pp. 3-31)
Somech, A. (2006) The effects of leadership style and team process on performance and innovation in functionally heterogeneous teams. Journal of Management, 32, 132-157.
Sonnenburg, S. (2004) Creativity in communication: A theoretical framework for collaborative product creation. Creativity and Innovation Management, 4, 254-262.
Stein, M. I. (1953) Creativity and culture. Journal of Psychology, 2, 311-322.
Taggar, S. (2002) Individual creativity and group ability to utilize individual creative resources: A multilevel model. Academy of Management Journal, 2, 315-330.
Tang, C. Y., Shang, J., Naumann, S. E., and von Zedtwitz, M. (2014) How team identification and expertise identification affect RandD employeees' creativity. Creativity and Innovation Management, 3, 276-289.
Tang, H. K. (1998) An integrative model of innovation in organizations. Technovation, 18, 297-309.
Tjosvold, D., Tang, M. M. L., and West, M. (2004) Reflexivity for team innovation in China. Group and Organization Management, 29, 540-559.
Torrance, E. P. (1971) Are the Torrance tests of creative thinking biased against or in favor of disadvantaged groups? Gifted Child Quarterly, 2, 75-80.
West, M. A., and Anderson, N. R. (1996) Innovation in top management teams. Journal of Apllied Psychology, 81, 680-693.
West, M. A., and Wallace, M. (1991) Innovation in health care teams. European Journal of Social Psychology, 21, 303-315.
Wong, A., Tjosvold, D., and Su, F. (2007) Social face for innovation in strategic alliances in China: Mediating roles of resource exchange and reflexivity. Journal of Organizational Behavior, 28, 961-978.
Woodman, R. W., Sawyer, J. E., and Griffin, R. W. (1993) Toward a theory of organizational creativity. Academy of Management Review, 18, 293-321.
Xu, Q., Chen, J., Xie, Z., Liu, J., Zheng, G., and Wang, Y. (2007) Total Innovation Management: a

JOURNAL OF CREATIVITY AND BUSINESS INNOVATION

Journal of Creativity and Business Innovation, Vol. 2, 2016.

www.journalcbi.com
ISSN 2351 – 6186

This paper is available at: http://www.journalcbi.com/self-organisation-and-group-creativity.html

novel paradigm of innovation management in the 21st century. Journal of Technology Transfer, 32, 9-25.

Corresponding author:
Prof. Tomas Backström can be contacted at: tomas.backstrom@mdh.se