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Abstract

This study investigates the effect of off-task breaks, where individuals engage in a collective off-task activity, on group creativity. Using an experimental method comprising 36 groups of 5 individuals, the relationships between different types of off-task group break and performance in creative tasks post-break are explored. When compared to the no-break case, it is seen that off-task breaks, in which all individuals participate in the group activity, lead to more original ideas being generated post-break. On the other hand, individual incubation breaks and self-organizing group breaks, lead to lower levels of post-break idea originality when compared with the no-break case. This research thus highlights the positive benefits of off-task breaks involving full member participation, on the creative process in groups.

Key words: creativity, groups, social processes, off-task breaks

Off-Task Social Breaks and Group Creativity

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The positive effects of taking time away from a creative task have been known and studied for some time (Wallas, 1926). The incubation effect attributed to off-task breaks has been shown to increase creative performance in individuals (Paulus, Nakui & Putman, 2006, Simon, 1996, Smith, 1995). What is less clear however, are the effects of breaks, where individuals engage in a collective off-task activity, on group creativity. The link between socialization and the group creative process has been put forward to explain the underperformance of groups relative to individuals, (Diehl & Stroebe, 1987; Rietzschel, Nijstad, & Stroebe, 2006), with scholars pointing to social inhibitors in groups including production blocking (Nijstad, Stroebe, & Lodewijkx, 2002), free riding (Karau & Williams, 1993) and evaluation apprehension (Camacho & Paulus, 1995). It is here that social breaks might influence the emerging creative process in groups, and understanding the role different types of social breaks have on group creativity is important for our understanding of the creative process in organizations.

The group creative process is shaped by an interplay between cognitive, social and motivational factors (Paulus & Brown, 2007). In this way, the process of association through which ideas emerge occurs through interpersonal interactions, as ideas are triggered through the contributions of other members (Dugosh, Paulus, Roland, & Yang, 2000; Paulus, 2000). These contributions in turn are attended to through intensified social interactions (Paulus & Brown, 2007). Off-task breaks can be seen to affect this interplay of social and cognitive forces in a number of ways, impacting the fluency of the creative process, and the quality of ideas generated

and selected. Using an experimental method comprising 36 groups of 5 individuals, this study thus explores the relationships between different types of off-task group break and performance in creative tasks post-break. Experimental groups completed two creativity exercises, interpolated by three different break interventions. Post-break changes in creative performance were then compared to the control groups, in which no break took place. Identifying the differential effect of different types of breaks on the group creative process has important implications for educational and work settings.

Theory and Hypotheses

Group Creativity and Social-Cognitive Factors

Past research has identified a positive link between off-task breaks and the creative process in individuals (Simon, 1996; Smith, 1995). It is seen that taking time away from a problem can boost creativity, when the individual returns to the task. This incubation period thus refers to the temporary shift away from an unsolved problem to allow a solution to emerge (Wallas, 1926). It is unclear however what impact incubation might have on the creative process in groups. Do off-task breaks in which group members reflect individually on the group task improve group performance post-incubation? Do off-task breaks, in which individuals socialize together, have a positive or negative effect on the creative process in groups? The group creative process is shaped by an interplay between cognitive, social and motivational factors (Paulus & Brown, 2007). First, the group setting allows individuals to share ideas, and to contribute towards the ideas of others. Compared to individuals working on their own, contributions from others can trigger a process of association, as individual ideas become exhausted. This process of association leads to unique combinations being generated (Dugosh, Paulus, Roland, & Yang, 2000; Paulus, 2000), and can also result in the retrieval of less common ideas (Dugosh & Paulus,

2005). Second, heightened levels of social interaction facilitate exchanges between individuals, and a back-and-forth conversation flow (Harvey, 2013; Van Oortmerssen et al., 2015). This can lead to an interaction flow (Van Oortmerssen et al., 2015) as one individual builds on the ideas of others, in a snowballing of concepts. The greater the interaction and production of ideas, the greater the opportunity for the cross fertilization of ideas noted above. Third, as individuals become more involved in the group process, through intensified social interactions, they are increasingly motivated to share and listen to the contributions of others (Paulus & Brown, 2007). These three interconnected factors thus act to facilitate the group creative process. Social forces facilitate the production of larger pools of ideas, which in turn provide the cognitive stimulation for each member to generate new ideas (Dugosh et al., 2000). Generated ideas in turn need to be noticed and attended to as members integrate them into their own knowledge systems. The more motivated members become, then the more open they are to communication, and to attending to the contributions of others (Paulus & Brown, 2007). Conversely, without motivation to attend to ideas, cognitive processes are limited, detrimentally affecting group outcomes. In this way, social forces influence the motivation of individuals to engage (Paulus & Brown, 2007). Off-task breaks can be seen to affect this interplay of social and cognitive forces in a number of ways, impacting the fluency of the creative process, and the quality of ideas generated and selected. In the following discussion, the impact of individual breaks, collective breaks in which groups self-organize, and breaks in which all members participate equally in a collective task are considered.

Breaks and Group Creative Fluency

Breaks can influence social processes within the group, and with this, the production of ideas through interactions. Off-task breaks in which individuals reflect separately on the group

task can interfere with these socialization processes, impairing the development of group cohesion and familiarity. For example, in a study of negotiation processes, Harinck & De Dreu (2008) found that when individuals took individual breaks after a group session, they spontaneously reflected on competitive aspects of the group task. After the break, these competitive thoughts impaired collective efforts towards joint outcomes. In this same study, when groups took no break, or breaks in which they were cognitively distracted, joint outcomes post-break were improved (Harinck & De Dreu, 2008). Harinck & De Dreu (2008) concluded that taking individual off-task breaks is unhelpful for the group task. Competitive thoughts during these breaks act to increase self-interest, resulting in less integrative behaviors after the break (Harinck & De Dreu, 2008). Following this line of argument, individual breaks can be seen to interfere with the process of socialization occurring in groups. This constrains the interaction of group members post-break, and with this the creative fluency, or total number of ideas generated, in the group (Paulus, 2000). Therefore, one would expect the creative fluency to decrease post-break, in groups where individuals are alone during the break, relative to the no break case.

If, on the other hand, group members continue to interact during the off-task break, then the process of socialization may even be facilitated relative to the no break case. As individuals gain knowledge of each other through working together, they are better able to predict and explain behavior of others (Okhuysen & Bechky, 2009; Rockett & Okhuysen, 2002). Through contact, individuals thus learn who knows what, and so can define roles and responsibilities within the group (Reagans, Argote, & Brooks, 2005). Gersick (1988) found that such patterns of behavior emerge rapidly following group formation, influencing subsequent behaviors long after this first encounter. By coordinating the contributions of competing participants, interaction

patterns allow members to speak without one blocking each other, as each individual takes turns within a play of interactions (Gittell, 2002; Jehn & Shah, 1997). The blocking of others has been shown to impair the group creative process relative to individuals working on their own (Nijstad, Stroebe, & Lodewijkx, 2002; Rietzschel, Nijstad, & Stroebe, 2006). Working together on a collective incubation task might also further increase interpersonal familiarity relative to the no break case (Jehn & Shah, 1997). Increasing familiarity has two key effects. First, familiarity acts to break down social inhibitory factors, such as evaluation apprehension (Karau & Williams, 1993; Rietzschel et al., 2006), where one individual may fear negative feedback by another, or feel inhibited to express ideas due to social anxiety (Camacho & Paulus, 1995; Rietzschel, Nijstad, & Stroebe, 2006). Familiarity can act to reduce these fears as individuals are more likely to give and receive negative feedback (Jehn & Shah, 1997). Second, as individuals invest more into the group, and with this group outcomes, they are increasingly motivated to share and listen to the contributions of others (Paulus & Brown, 2007). As a result, one would expect the number of ideas generated post-break to increase, in cases where groups continued to work together during breaks, relative to no break case. The greater the participation of members during off task group activities, then the greater the positive effects due to emergent order and familiarity relative to the no break case. In summary, the following is put forward.

> *Hypothesis 1*: Breaks in which individuals engage in an off-task group activity, lead to more ideas being generated post-break, relative to the no-break case. The greater the participation of individuals in the group break activity, the greater this increase in creative fluency. The no-break case in turn leads to more ideas being generated post-break relative to the individual break case.

Breaks and the Quality of Ideas Generated

It has been argued that breaks, in which group members individually reflect on the task following the group activity, can allow the individual to integrate ideas from the group session with their own generated ideas, resulting in new ideas and combinations of ideas post incubation (Dugosh et al., 2000; Paulus & Yang, 2000). Off-task breaks thus allow time for individuals to process ideas from the group. Alternatively, when group activities follow sessions spent alone, ideas generated by individuals may be carried over into the group session, leading to more ideas overall (Baruah and Paulus, 2008). Paulus et al. (1995) however found no difference in performance between cases in which individual brainstorming followed group creative tasks, and cases where group brainstorming followed individual creative exercises. This would suggest that the benefits derived from the cognitive stimulation of individuals following the group creative process are questionable. When one considers the group process, there is an interplay between the socialization processes noted above and key cognitive processes underpinning group creativity (Paulus & Brown, 2007). In this manner, intensifying the degree of social interaction and participation can be seen to also increase the quality of those ideas generated. As individual off-task breaks impair the process of socialization within the group, the generation of ideas through interaction is constrained, and with this the opportunity for members to attend to and build on the contributions of others. It is thus argued that the quality of ideas is decreased post-break, in groups where individuals are alone during the break, relative to the no break case

Higher quality ideas are generated through unique associations between concepts. Face-to-face interaction can stimulate associations, as one becomes aware of an idea one would not have thought of if isolated (Paulus, 2000). As noted above, increasing levels of coordinated social interaction act to overcome key social inhibitory functions. By reducing the negative impact of production blocking, the contributions of others are increased, thereby improving the

chances of making unique associations between individuals. As individuals assume roles within the group activity, the back and forth of contributions becomes better coordinated, with the emergence of an interaction flow (Van Oortmerssen et al., 2015) as one individual builds on the ideas of others, in a snowballing of concepts. Harvey (2013) defined this convergent creativity as a process which involves both the generation of ideas in a divergent sense, and the ability and willingness of members to build on and combine one another's ideas. As social breaks increase cohesion within the group, individuals assume interdependent roles. In this manner both the stimulation and elicitation of responses from individuals is increasingly coordinated, as one attends to the contributions of the other, stimulating associations and the cross-fertilization of ideas (Harvey, 2013; Van Oortmerssen et al., 2015; Paulus, 2000). Therefore, one might expect that the quality of ideas is increased post-break, in groups where individuals continue to work together and self-organize as they complete a collective activity during the break, relative to the no break case. Moreover, the greater the participation of individuals in the group activity, the greater the opportunity for individual contributions to lead to new associations (Dugosh, Paulus, Roland, & Yang, 2000; Dugosh & Paulus, 2005; Paulus, 2000), as individuals build on and give new meaning to others' contributions (van Oortmerssen et al., 2015). Encouraging participation in this way untaps concepts held within the heads of all members, increasing opportunities to make new associations. Therefore, one can argue that the quality of ideas is further increased post-break, in groups where all individuals participate equally in a collective activity during the break, relative to the no break case. Idea quality can be defined in terms of both originality and feasibility of ideas (Amabile, 1996; Diehl & Stroebe, 1987; Runco & Charles, 1993; Sternberg & Lubart, 1999). In summary, considering different types of off-task breaks, the following are put forward.

Hypothesis 2a: Breaks in which individuals engage in an off-task group activity, lead to more original ideas being generated post-break, relative to the no-break case. The greater the participation of individuals in the group break activity, the greater this increase in generated quality. The no-break case in turn leads to more original ideas being generated post-break relative to the individual break case.

and

Hypothesis 2b: Breaks in which individuals engage in an off-task group activity, lead to more feasible ideas being generated post-break, relative to the no-break case. The greater the participation of individuals in the group break activity, the greater this increase in generated quality. The no-break case in turn leads to more feasible ideas being generated post-break relative to the individual break case.

Breaks and the Quality of Ideas Selected

When one considers the process of idea selection, more familiar individuals may avoid conflict in order to maintain emerging relationships, including avoiding to critically evaluate each other's views (Kelley & Thibaut, 1978). As groups become more familiar through social interaction, a consensus of opinion emerges (Janis, 1972; Van de Ven, 1986), and this familiarity can inhibit evaluative processes (Putman and Paulus, 2009; Stasser & Birchmeier, 2003). The emergence of roles and norms further act to promote convergent thinking (Nemeth & Ormiston, 2007), undermining divergence in opinion. As a result, members become increasingly homogenous in their behavior spending less time on critical discussion, evaluation and environment scanning (Katz, 1982). By interfering with processes of socialization, individual off-task breaks can limit the extent to which more familiar groups can constrain evaluative

processes post-break. Therefore, it can be argued that the quality of selected ideas is higher post-break, in groups where individuals are alone during the break, relative to the no break case

Adarves-Yorno, Postmes, and Alexander Haslam (2006) found that when the social identity of group members is more salient than individual identity, ideas that agree with the in-group norm are seen as creative. In addition, there is a tendency within groups to focus on ideas that reflect shared or common perspectives instead of more original ideas (Stasser, Vaughan & Stewart, 2000; Stewart & Stasser, 1995; Wittenbaum, Hubbell & Zuckerman, 1999). In this way, pressure to conform (Janis, 1972) can have an adverse effect on the process of selection, as individuals seek to minimize conflict in favor of group cohesion and consensus (Van de Ven, 1986). Individuals can act to maintain emerging relationships and as a result are unwilling to critically evaluate the other (Kelley & Thibaut, 1978; Mikula & Schwinger, 1978). High levels of cohesion and consensus may thus result in the premature selection of a poor idea (Paulus, 1998), as individuals self-censor differences in opinion (Nijstad & Paulus, 2003), and fail to consider all available alternatives (Stasser, 1999). One would expect that the development of group norms and related consensus, would be facilitated by off-task breaks in which the groups were allowed to continue to self-organize as they work together. Therefore, the quality of selected ideas is lower post-break, in groups where individuals self-organize as they complete a collective activity during the break, relative to the no break case. Increasing levels of participation in group interaction can act to overcome some of these constraining influences of dominant individuals and coalitions. Thus in groups which include more participating members, one would expect more critical voices in the evaluative processes. Considering different types of off-task breaks, the following is put forward.

Hypothesis 3a: Breaks in which individuals engage in an off-task group activity, lead to less original ideas being selected post-break, relative to the no-break case. The lower the participation of individuals in the group break activity, the greater this reduction in selected quality. The no-break case in turn leads to less original ideas being selected post-break relative to the individual break case.

and

Hypothesis 3b: Breaks in which individuals engage in an off-task group activity, lead to less feasible ideas being selected post-break, relative to the no-break case. The lower the participation of individuals in the group break activity, the greater this reduction in selected quality. The no-break case in turn leads to less feasible ideas being selected post-break relative to the individual break case.

The Present Study

In the experimental study reported here, off-task breaks were designed to trigger different levels of social interaction and participation, with a view to exploring their impact on post-break group creativity. All groups performed two creativity tasks, namely Unusual Uses Tasks (UUT). In UUTs participants are asked to generate as many unusual uses as possible for a common object, such as a coat hanger, within a set amount of time (Baird, Smallwood, Mrazek, Kam, Franklin, & Schooler, 2012). The productivity and quality of the responses are taken as measures of creative thinking. Groups completed these two consecutive UUTs, interpolated with a task designed to stimulate different levels of social interaction and participation. In the control group, there was no intervention, and groups completed the two UUTs without any break. In the other groups three different intervention tasks were applied; building a model brick tower, sorting model bricks into colors, and rest case. In the first tower building case, groups together

built a tower using model bricks. This task required groups to work physically close together as they built a tower, communicating continually, and working towards the common goal. The groups were allowed to self-organize and allocate tasks as they saw fit. Given the tight physical proximity needed to build an increasingly unstable brick tower, it was very unlikely all five group members are equally involved. In the second color sorting case, groups had to sort five different colored bricks, and so allocated each color to a group member. Groups first decided and communicated roles, or who does what. For example, one nominated person would sort the color red etc. While groups again worked towards a common goal, all members were involved as they each worked on the activity in hand. In brief the design of the sorting and building tasks differed in terms of the participation of individuals involved in the group effort. In the third rest case, groups had no interaction or communication, and no common goal was set. The study was thus set up to explore the impact of different levels of social interaction and participation on the group creative process. To confirm hypothesis 1, one would expect the sorting task to produce the greatest increase in fluency, followed by the building task, the no break case and finally the individual rest case. To confirm hypotheses 2a and 2b, one would expect the same effect. For hypotheses 3a and 3b, one would expect the opposite relationship, with the rest case producing the greatest improvement in idea selection quality, followed by the no break, sorting and tower building task.

Method

Participants

A total of one hundred and eighty participants took part in the study as partial fulfillment of a course requirement. The course taken by the students was Enterprise, and the topic of the class was group creativity. The majority of the participants were between the ages of 19 and 21

years old (mean 20.24; SD, 1.40), 94 were male. Informed consent was obtained from all participants, and institutional ethical approval given for the study. Participants were randomly divided into 36 groups of 5 individuals each.

Procedure

All groups completed two UUTs. The 5 individuals in each group were arranged around a table, as they completed these tasks together as a group. The 36 groups were evenly divided between the four interventions (no break, rest case, sorting case and building case), and three different objects used in the UUT; a coathanger, a blank A4 sheet of paper and a paper cup. Sessions were organized with three groups at a time in the same room. Groups were physically separated into different corners of the room, and given different objects to prevent intergroup contagion of ideas. The three groups in each session were exposed to the same interventions (i.e. no break, rest etc). Finally, in light of the changing creative performance of groups across the working day (Breslin, 2018), groups and interventions were equally spread across both morning and afternoon sessions.

Baseline UUT. The baseline UUT consisted of the following series of tasks. At the beginning of the exercise, one individual in each group was nominated to record the ideas. Groups were then given 10 minutes together to generate as many uses as possible for the given object. Following this idea generation stage, groups were asked to select their best ideas (Ritter, van Baaren, & Dijksterhuis, 2012), and then rank these in terms of their preference 1, 2, 3 (Rietzschel, Nijstad, & Stroebe, 2006). Groups were not given any further advice on whether this ranking referred to the originality or feasibility of ideas selected. This selection phase lasted a total of 5 minutes, following which the object and the written list of ideas were removed from the table.

Intervention. At the completion of this first creativity task, and whilst remaining in the same room, each experimental group was set a different interpolated task, consisting of a) rest case, in which the group remained silent in the room for 5 minutes, with lights switched off and students asked to close their eyes, b) color sorting case, in which groups were given the task of sorting a set number of model bricks by color within a maximum time limit of 5 minutes, and c) tower building task, in which groups were asked to build a tower together as high as possible, within a time limit of 5 minutes using a similar set number of model bricks.

Post Break UUT. Following this intervention, the same object and new writing materials were given to the group. All groups were then asked to complete the same creativity task outlined above for a second time, using the same object, but this time asked to generate new ideas not previously written down. In the no break case, groups completed the second UUT without any break.

Break Effect. The effect of the interpolated task on fluency, and the quality of both ideas generated and selected, was calculated in absolute and percentage terms. In the absolute case, the intervention effect was given by the following expression, [(post-intervention UUT average value – baseline UUT average value)]. The percentage increase in average idea originality was calculated as follows, [(post-intervention UUT average value – baseline UUT average value)/(baseline UUT average value)] x 100.

Dependent Variables

Creative fluency. The fluency of the group was measured by the total number of non-redundant ideas generated in each of the UUTs (Paulus, 2000).

Quality of Ideas Generated: As in previous studies idea quality has been defined in terms of both originality and feasibility (Amabile, 1996; Diehl & Stroebe, 1987; Runco & Charles, 1993; Sternberg & Lubart, 1999).

- **Idea Originality**. The originality of each idea generated was assessed based on the frequency of its occurrence in the wider pool of all ideas generated across all groups (Dennis et al., 1997). A breakdown of the total number of separate ideas identified and frequency of occurrence (e.g. a frequency of 1 indicates that the idea occurred only once) is given in table 1 for each object. For example, in the case of the coat hanger the idea of a 'whisk' appears just once in the larger pool of all ideas. The 'skewer' idea on the other hand appeared 6 times. Therefore, the lower the score given, then the more original the idea generated. The average originality of ideas generated in each separate creativity task was then calculated.

Insert Table 1 about here

- **Idea Feasibility**. For each session, the feasibility of each idea was scored on a 5-point scale (Putman & Paulus, 2009). This rating was carried out independently by two trained raters blind to the conditions of the cases. A score of 4 or 5 on this scale would indicate that the idea could be realised within the confines of the lab setting. For example, using a coat hanger to hang jewellery could be achieved straight away, and therefore would be given a score of 5. Alternatively, reworking the coat hanger into a twisted shape to as a piece of art would be given a score of 4. The agreement among the raters was assessed by counting the number of times that the two raters were within one rating point of each other, as a percentage of the total number of ideas rated by both (Putman & Paulus, 2009). The overall reliability for feasibility was 0.86%.

Quality of Idea Selection. As in other studies both the generation and selection of ideas was measured (Rietzschel, Nijstad, & Stroebe, 2010). In this manner, both the originality and feasibility of the top idea selected in each task were recorded.

Results

Within-Group Changes in Dependent Variables

Creative Fluency. To explore changing trends over the two creativity tasks, a series of one-way within-subjects ANOVA were carried out, for each dependent variables for all groups. Significant differences in fluency were found between tasks ($F(1,35)=7.90$, $p=.008$), with all groups generating a mean of 21 ideas in the second UUT versus 26 in the first. Therefore, groups generated fewer ideas over the course of the two creativity tasks. This shows how groups exhaust ideas over the course of the two UUTs.

Quality of Ideas Generated. In terms of idea quality, significant differences were also found for all groups. First the average originality in the second UUT was 3.29 versus 4.89 in the first ($F(1,35)=54.4$, $p<.0005$). This finding reflects prior research which found that individuals and groups tend to generate more common ideas first (Baruah & Paulus, 2016; Paulus & Brown, 2007). Regarding feasibility, significant differences were also found for all groups between the two UUTs ($F(1,35)=22.85$, $p<.0005$), with an average score of 3.24 in the first creativity exercise compared to 2.77 in second. In summary, groups tended to generate more original, but less feasible ideas over the course of the two creativity tasks.

Quality of Ideas Selected. When examining the originality of ideas selected, there was a significant difference found ($F(1,35)=28.49$, $p<.0005$) between the originality of the top idea chosen in task 1 (average 6.88) versus task 2 (average 2.71). The difference between tasks in terms of the feasibility of the top idea selected was not significant ($F(1,35)=4.03$, $p=.053$).

However, as with generation, the trend was towards less feasible ideas over the course of the two UUTs. In sum, the trend towards more original and less feasible ideas being generated over the course of the two creativity exercises, was repeated in the data for selection.

Hypotheses Testing

To investigate hypotheses 1-3, a series of univariate analyses (ANOVA) was used to explore the effect of interpolated tasks on change in UUT performance for each of the dependent variables. The ANOVA method was used to explore differences in change scores across interventions, as no significant differences in pre-scores were found across intervention groups.

Creative Fluency. There was no significant difference found between intervention type and the absolute change in the number of ideas produced, $F(3,35)=0.23$, $p=.88$. No significant difference was found between the percentage change in fluency of groups before and after the intervention, $F(3,35)=0.65$, $p=.59$. Therefore hypothesis 1 is not confirmed.

Quality of Ideas Generated

Originality of Idea Generated. A significant difference was found between intervention type and absolute change in generated idea originality over the two creativity tasks, $F(3,35)=3.75$, $p=0.021$. There was also a significant difference in the percentage change in idea originality between the two UUTs, $F(3,35)=5.43$, $p=.004$. Descriptive statistics for the change in originality of average ideas generated in both absolute and percentage terms is given in table 2, and represented in figure 1. As noted above, the originality for all groups increased over the two UUTs, with 12% for the rest case, 39% for the no break case, 27% for the tower building task, and 46% for the color sorting task. A Tukey post hoc test revealed that the percentage change in idea originality in the rest case was statistically significantly lower than the no break case (12% versus 39%, $p=.029$). There was no statistically significant difference between the no break case

and the sorting or building tasks (p=.84 and p=.58 respectively). The post hoc test further revealed that the percentage change in idea originality in the rest case was statistically significantly lower than the sorting task case (12% versus 46%, p=.003). There was no statistically significant difference between the rest case and the building tasks (p=.36 respectively). There was no significant difference found between the building task, and the no break (p=.58), rest (p=.36) or sorting tasks (p=.17). Therefore, with regards originality, hypothesis 2a is partially confirmed.

Insert Table 2 about here

Insert Figure 1 about here

Feasibility of Idea Generated. There was no significant difference found between intervention type and the absolute change in idea feasibility over the two creativity tasks, $F(3,35)=0.42$, p=.74. No significant difference was found between the percentage change in idea feasibility between the two UUTs, $F(3,35)=0.68$, p=.57. Therefore, with regards feasibility, hypothesis 2b is not confirmed.

Quality of Ideas Selected

Originality of Idea Selected. There was no significant difference found between the intervention type and the absolute change in the average originality of the top idea chosen, $F(3,35)=0.20$, p=.90. Similarly there was also no significant difference found in the percentage change in the average originality of top selected idea following the intervention, $F(3,35)=1.17$, p=.34. Therefore, with regards the originality of ideas selected, hypothesis 3a is not confirmed.

Feasibility of Idea Selected. There was no significant difference found between the intervention type and the absolute change in the feasibility of the top idea chosen, $F(3,35)=1.48$, p=.24. Similarly there was also no significant difference found in the percentage change in the

originality of top selected idea following the intervention, $F(3,35)=1.44$, $p=.25$. Therefore, with regards the feasibility of ideas selected, hypothesis 3b is not confirmed.

Discussion

It is seen above that there was a significant difference found between intervention type and change in generated idea originality over the two creativity tasks. This finding partially confirms hypothesis 2, with the rest case and sorting task resulting in the lowest and highest changes in idea quality when compared to the no break case. The building case also resulted in lower overall changes in idea quality post-break when compared to the no break case. No significant effect was found for idea feasibility or the quality of ideas selected. No significant effect of the different breaks was also found for creative fluency. Rowatt, Nesselroade, Beggan & Allison (1999) found that individuals valued idea quality over quantity in brainstorming tasks, and this effect is even more pronounced with in-groups versus out-groups. This would suggest that the quality and not quantity is more affected by the socialization process, given its higher perceived value.

One can explore the implications of these findings in more detail by considering the different levels of social interaction and participation in the design of each intervention. In the no break condition, groups continued to develop interpersonal relations and roles with respect to the task-in-hand. These would include differing levels of participation, and be prone to the effects of production blocking and free riding noted above. By taking a break, this process of self-organization towards the task-in-hand was interrupted. The breaks thus acted to increase or decrease levels of social organization relative to the no-break case. As noted above, this process might have a number of effects. First, taking a break individually decreases levels of interpersonal interaction and social organization. By interrupting the interaction flow (Van

Oortmerssen et al., 2015) in this way, the generation of ideas through interaction post-break is constrained, and with this the opportunity for members to attend to and build on the contributions of others (Paulus & Brown, 2007). Some have argued that individual breaks allow members to integrate ideas from the group session with their own generated ideas, resulting in new ideas and combinations of ideas post incubation (Dugosh et al., 2000; Paulus & Yang, 2000). However, the results of this study would suggest that social effects as opposed to cognitive processes drive the creative performance of the group post-break.

Second, this interference in socialization processes is further reflected in the higher performance of group breaks relative to individual breaks. As individuals work together during the break, processes of self-organization continue to bring order to the interaction of members, positively influencing the generation of ideas post-break. By gaining knowledge of each other, individuals assume interpersonal roles and are better able to predict and explain behavior of others (Okhuysen & Bechky, 2009; Reagans, Argote, & Brooks, 2005; Rockett & Okhuysen, 2002). Patterns of interacting behaviors have been found to form quickly in groups as they work towards a common goal (Gersick, 1988). This provides an order to competing contributions as individuals engage in an interaction flow (van Oortmerssen et al., 2015), building on the ideas of others in a convergent sense (Harvey, 2013), and stimulating associations as one attends to the contributions of the other (Paulus, 2000). Whilst specific measures of interaction have not been captured in this study, the findings nonetheless point to a group effect linked to interactions during the breaks. Further investigating the impact of varying degrees of interaction, patterns and roles, would shed important light on the link between socialization processes and the group creative process. Moreover, in this study tasks designed to increase the participation of individuals during the break (i.e. the sorting task), resulted in higher creative quality post-break.

Participation increases the opportunity for individual contributions to lead to new associations (Dugosh, Paulus, Roland, & Yang, 2000; Dugosh & Paulus, 2005; Paulus, 2000), as individuals build on and give new meaning to others' contributions (van Oortmerssen et al., 2015). Encouraging participation in this way untaps concepts held within the heads of all members, increasing opportunities to make new associations. Therefore, whilst individual breaks impede the social processes at play in group creativity, participative group breaks act to enhance this.

Third, whilst not significant in this study, it was seen that group breaks in which individuals self-organized, under-performed relative to the no break case (whilst still outperforming the individual break case). In these building cases, not all individuals were equally involved in the group task, with typically one or two individuals dominating the tower construction exercise. It was also observed that groups who completed the building tasks did so in a more competitive manner, as they attempted to build the tower as tall as possible within the time frame given (many groups in the sorting task did not complete or appear to attempt to complete the exercise within the time given). This suggests an additional competitive effect influencing the performance of the groups post-break. In prior research of group negotiation, it has been seen that individual breaks tend to be characterized by competitive thoughts, where individuals reflect on the negotiation process, which then impede joint outcomes post break (Harinck & De Dreu, 2008). Harinck and De Dreu (2008) found however that distraction during breaks acts to reduce the negative competitive effects of breaks on joint outcomes. The findings of this study therefore suggest that completing the low effort sorting task, in which all members participated, acted to distract individuals away from negative emotions impeding joint action (Zillmann et al., 1980). In addition, the inclusion of all group members in the process can carry

over into the task post-break. On the other hand, potentially increasing competitive factors (building case), might act to undermine the joint enterprise post-break.

These findings thus point to the importance of collective off-task breaks, in which all members are encouraged to contribute to the group effort post-break. Individual breaks on the other hand, are seen to impede the group creative process post-break. Some have argued that when individual breaks follow the group creative task, this allows members to integrate ideas from the group session with their own generated ideas (Dugosh et al., 2000; Paulus & Yang, 2000). As a result, new associations are made, which can be shared with the group when they reconvene (Paulus et al., 2006). However, this argument rests on the assumption that those same individuals are able to share those ideas within the group post-break. By interrupting the flow of the socialization process, individual off-task breaks do little to counteract the negative effects of production blocking or evaluation apprehension (Nijstad et al., 2002; Rietzschel et al., 2006), or motivate individuals to share and listen to the contributions of others (Paulus & Brown, 2007). It is possible however that the short duration of the off-task breaks used in this study, was insufficient to allow time for individuals to reflect fully on the previous group session. It is also possible that a different research design, using for instance brain-writing, would enhance the expression of individual ideas within the group.

This research thus points to important social processes at play during breaks, and understanding the impact this has on the creative process is an important avenue for future research. A key limitation of this study is that measures for social interaction within the groups have not be taken. Future research should therefore seek to include measures of social interaction, participation and familiarization at play in different intervention tasks relative to the no break case. For example, to what degree do individuals experience cooperation and

competition with different off-task tasks, and how does this this impact on post-break processes. Research might also seek to identify patterns of interaction in groups pre-and post-break (Lei, Waller, Hagen, & Kaplan, 2015; van Oortmerssen, van Woerkum, & Aarts, 2015; Zijlstra, Waller, & Phillips, 2012), and the impact this might have on the creative process. Interaction patterns can be captured by a detailed discourse analysis on group conversations. Whilst this study has focused on newly formed groups, further studies might investigate the impact of off-task breaks on established groups. Future studies might also explore the duration and timing of off-task breaks, and the changing impact these have on processes of socialization and creativity within the group. Finally, whilst the no break case has been used as the control in this study, alternative controls might have included individual off-task breaks, thereby equalizing the total amount of task times across the groups.

Conclusion

Whilst past research has identified a positive link between incubation breaks and individual-level creativity (Paulus et al., 2006, Simon, 1996, Smith, 1995), the effects of social off-task breaks on the group creative process have received less attention. Understanding the role different types of social breaks have on group creativity is clearly important for our understanding of the creative process in organizations, with important implications for educational and work settings. While taking time away from the task might have positive benefits for individual-level creativity, only breaks involving full member participation have a positive benefit on groups with respect to taking no break at all. This research thus points to the benefits of social breaks which enhance collaboration not competition.

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Table 1

Frequency of UUT Ideas for each Task Type

Object	Total Ideas	Frequency within Larger Pool of Ideas																
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Coat Hanger	166	107	32	10	4	6	2	0	2	1	1	1	0	0	0	0	0	0
A4 Blank Sheet	158	83	29	17	10	4	1	4	3	2	1	1	0	1	1	0	0	1
Paper Cup	137	84	26	9	6	3	4	2	1	0	1	0	0	0	0	0	1	0

Table 2

Descriptive Statistics for Between Task and Change in Idea Originality (Percentage) against Intervention Type

Intervention Tasks	N	Mean	SD	Std. Error	95% Confidence Interval for Mean		Min	Max
					Lower Bound	Upper Bound		
No Break	9	-0.39	0.21	0.07	-0.55	-0.22	-0.65	-0.02
Rest Case	9	-0.12	0.27	0.09	-0.33	0.08	-0.47	0.39
Color Sorting Task	9	-0.46	0.09	0.03	-0.53	-0.39	-0.66	-0.36
Tower Building Task	9	-0.27	0.15	0.05	-0.39	-0.16	-0.54	-0.12
Total	36	-0.31	0.23	0.04	-0.39	-0.24	-0.66	0.39

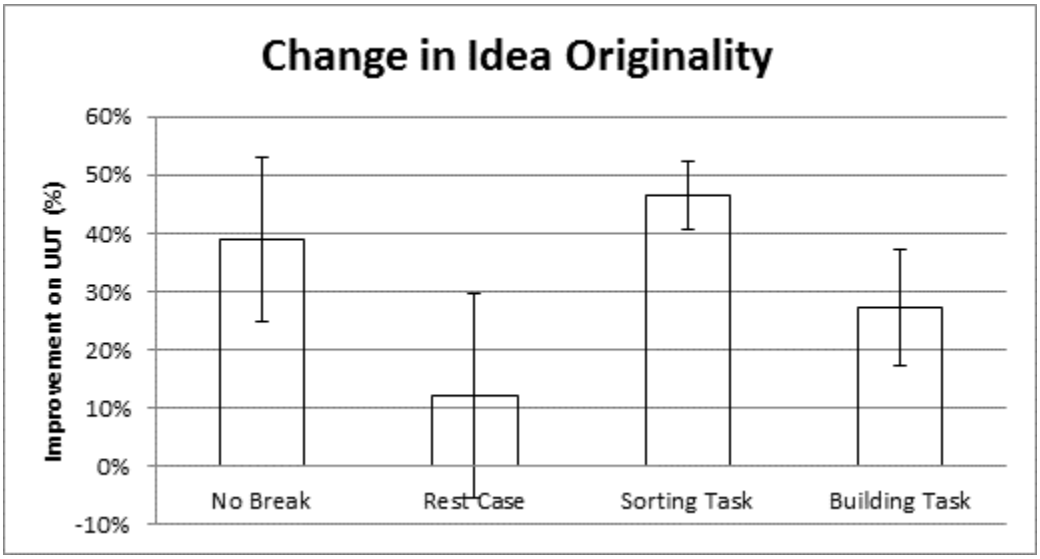

Figure 1. Improvement in Unusual Uses Task (UUT) average idea originality (second UUT relative to first UUT) as a function of intervention. Error bars indicate standard errors of the mean.