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Research Article

INDIVIDUAL BRAINSTORMING PERFORMANCE AS A FUNCTION OF VELOCITY AND COMPARISON FEEDBACK[1]

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Abstract

This experimental research aimed to investigate the effect of velocity (control vs. velocity) and comparison (control vs. comparison) on the idea generation performance of individual brainstormers. The participants in the velocity condition were led to write down their ideas as quick as possible, whereas those in the control received no such instruction. Those in the comparison condition were informed that their performance would be compared with someone similar to them, whereas those in the control one received no such feedback. After that, all they brainstormed on the ways to improve the student life in the university for 12 minutes session. Findings showed that those in the velocity condition and comparison one generated more ideas than their counterparts. These effects were mediated by only flexibility. These findings suggest that even though both provision of comparison and velocity were beneficial to idea generation, underlying mechanisms for the effects of these variables on the idea generation performance were the same.

Keywords: *Comparison, Velocity, Brainstorming.*

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HIZ VE KARŞILAŞTIRMA GERİBİLDİRİMİNİN BİR İŞLEVİ OLARAK BİREYSEL BEYİN FIRTINASI PERFORMANSI[2]

Öz

Bu deneysel çalışmanın amacı, hızın (hız ve kontrol) ve karşılaştırmanın (karşılaştırma ve kontrol) bireysel beyin fırtınasında düşünce üretme performansına etkisini incelemektir. Hız koşulundaki katılımcılara, düşüncelerini olabildiğince hızlı yazmaları konusunda bir yönerge verilirken; kontrol koşulundaki katılımcılara herhangi bir yönerge verilmemiştir. Karşılaştırma koşulundaki katılımcılara ise, performanslarının kendilerine benzer biriyle karşılaştırılacağı bilgisi verilirken; kontrol koşulundaki katılımcılara herhangi bir geribildirim verilmemiştir. Tüm katılımcılar, üniversitede öğrenci yaşamını geliştirme yolları hakkında 12 dakika boyunca beyin fırtınası yapmışlardır. Araştırma bulgularına göre hız ve karşılaştırma koşullarındaki katılımcılar, kontrol koşullarındaki katılımcılara göre daha fazla düşünce üretmişlerdir. Ayrıca hız ve karşılaştırma koşullarının bu etkisine, esneklik aracılık etmektedir. Elde edilen bulgular, hem hız hem karşılaştırmanın düşünce üretiminde yararlı olduğunu göstermesine rağmen bu değişkenlerin düşünce üretme performansına etkileri altında yatan mekanizmalar aynıdır.

Anahtar Kelimeler: *Karşılaştırma, Hız, Beyin Fırtınası.*

INTRODUCTION

Creativity is often required to generate new solutions in many areas of life such as from ordinary life situation to highly specialized research and development team situation. As the best –known creativity technique, brainstorming technique developed by Osborn (1957) provides some beneficial rules (i.e. no criticism, unusual ideas are welcome, the quantity of ideas is wanted over quality of ideas and idea combination is sought) for a higher creativity in groups. However, groups do not get benefit from these rules since free-riding, production blocking, evaluation apprehension, and downward-matching are mostly evident in the brainstorming groups as compared to nominal groups who brainstorm individually (Diehl & Stroebe, 1987). As known, in the individual brainstorming technique, the participants generate ideas by oneself.

Despite of these inhibitory factors in group brainstorming performance, researchers tend to examine cognitive and social/motivational factors that have the potential to enhance idea generation performance (i.e., Baas, de Dreu & Nijstad, 2011; Coskun, Paulus, Brown & Sherwood, 2000; Dugosh, Paulus, Roland & Yang, 2000; Paulus & Yang, 2000). For instance, some cognitive stimulation techniques (e.g., memory instruction, incubation, task decomposition, task instructions that facilitate group activities, divergent thinking, exposure to high number of categories or ideas) have been suggested to be effective for increasing

[2] Bu çalışma "11th Interdisciplinary Network For Group Research Conference"te (2016, Helsinki, Finlandiya) poster olarak sunulmuştur.

the idea generation performance of groups (Brown et al., 1998; Coskun, 2005a; 2005b; Coskun et al., 2000; Dugosh et al. 2000; Paulus, Putman, Dugosh, Dzindolet & Coskun, 2002; Paulus, Nakui, Putman & Brown, 2006). Underlying mechanism for the beneficial effects of these techniques is explained from the perspective of associative memory suggesting that ideas are linked to other ideas in the semantic memory. The associative memory approach predicts that the concepts are spatially related to each other and that any stimulus activates concepts that are closely related to it (Collins & Loftus, 1975). In the literature there have been two approaches for how ideas are activated in the brainstorming: input model and process model, albeit being similar to each other in many respects. Input model suggest that stimuli should have some activation parameters. For instance some degree of diverse stimuli and high number of stimuli has higher advantages in activating associative memory than homogenous and low number of stimuli. This perspective, namely cognitive stimulation perspective was advocated by Paulus and his colleagues and found strong empirical support in the literature (Dugosh et al. 2000; Paulus et al., 2002).

Process model also deals with how ideas are processed in the semantic memory. Semantic memory is the memory necessary for the use of language (Tulving, 1972). The Search for Ideas in Associative Memory Model developed by Nijstad, Stroebe and Lodewijkx (2002, 2003) propose a two stage of idea generation; a knowledge activation stage and idea production stage. In the knowledge activation stage, stimuli (i.e., some elements of the brainstorming problem and/or the previously generated ideas) are needed for the activation of an image that is a consequence of a cue-based search in the long term memory. In the idea production stage, when an image has been activated, the features of an image can be used to form new associations, or applying knowledge to a new contexts or domains (Mednick, 1962). This model is also confirmed by the findings of many studies (see Nijstad & Stroebe, 2006, for an overview).

What is missing in the brainstorming literature is that no research has examined the effect of the velocity or speed of activation on the idea generation performance so far to the best of our knowledge. Can the instruction for brainstormers to generate ideas as quick as possible be beneficial to creativity as compared to control condition or no such instruction? A recent research in the field of neuroscience has shown that speed training before performance is related to activation in some brain areas such as prefrontal and parietal cortex (Lin et al., 2016). Here it should be kept in mind that no training was provided in this research and instead, the effect of velocity instruction was investigated since speed training was beyond the aim of the current research. Despite the fact that showing some activations in brain areas are of great importance in scientific advancement, mechanisms underlying such activation should be illuminated. In this regard, there have been two major explanations for the effect of speed or velocity instruction. First, high velocity may facilitate the activation of related concepts in the memory.

It may facilitate the retrieval of ideas from long term memory and the processing in working memory as the previous models mentioned earlier suggest (Nijstad, Stroebe & Lodewijkx, 2002, 2003; Paulus et al., 2002). Such rapid activation may override the effects of delays between ideas, which in turn may hinder production blocking. Moreover, it may sweep away the conscious suppression of ideas, and thereby facilitate the appearance of self-censored ideas. Taken together, these suggest that high velocity may trigger flexibility or consideration of new or diverse ideas. Second, high velocity may re-motivate the participants to generate high number of ideas. There is some evidence that pace or task decomposition leads to the generation of high number of ideas (Coskun et al., 2000). This implies that high velocity may lead persistence to come to play a pivotal role. Albeit created for the link between mood and creativity, a more recent model in the brainstorming literature, namely the Dual Creativity Model developed by Nijstad et al. (2010) suggests that persistence and flexibility play mediator role between mood and creativity. Cognitive flexibility is defined as a facility which people consider a different perspective or switch to a different approach while cognitive persistence is defined as sustain and focus task-directed cognitive effort (Nijstad et al., 2010). In a similar vein, it is plausible that high velocity may trigger both persistence (motivational factor) and flexibility (cognitive factor), which in turn may facilitate the generation of high number of ideas. Thus an experimental research is needed for the validation of these suggestions. Given that persistence and flexibility are potential mediators for the link between the velocity and creativity, the present research may add to the current theoretical attempts targeting an increase in the performance of brainstormers. If these factors are evident with high velocity, then one may wonder which one is more influential than other. So far, no theoretical basis in the literature has been existed for this plausible outcome. That is one of intriguing question that needs to be answered in this research. Taken altogether, the aforementioned studies and explanations lead the researchers to hypothesize that (a) the participants in high velocity condition would generate more ideas than those in control condition; (b) flexibility and persistence would be mediator variables between velocity and idea generation performance.

Along with the investigation of the effect of velocity on the idea generation performance, another important variable that needs to be investigated is the effect of comparison. There is strong evidence in the brainstorming literature indicating that providing high standard or goal enhanced the performance of group members (Larey & Paulus, 1995; Paulus & Dzindolet, 1993; Wegge & Haslam, 2005). A goal setting theory provides a theoretical basis for this outcome. According to this theory, goals may motivate individuals since they provide social compensation and related cognitive processes (Wegge & Haslam, 2005). Another related theory in this regard is the matching theory derived from social comparison theory developed by Festinger (1954). People tend to match their performance that is somewhat above their performance level but not slightly above it since it activates self-improvement motivation. Both theories give much emphasis on the

motivational aspect of providing a comparison. From this perspective, it is expected that comparison may activate persistence of idea generators. Despite the fact that motivation gains in goal setting can be due to social compensation, cognition or identification with goal, the investigation of these underlying mechanisms is beyond the scope of this research. What is valuable here is that to what extent a comparison be provided. For instance, Coskun (2000) showed that provision of an out-group standard increased performance groups. Similarly, Dugosh and Paulus (2005) also found that comparison with similar one or classmates led to the generation of higher ideas than that with a computer. Thus it was expected that that the provision of comparison with classmate would lead to the generation of higher number of ideas than that of no comparison.

One may consider the possible interaction effect between velocity and comparison. Idea generation performance in high velocity and comparison condition would be the highest in all relevant conditions. If motivational and cognitive factors are evident both in velocity and comparison condition, then an interaction effect between these variables should occur. On the other hand, if both motivational and cognitive factors are evident in velocity but not in comparison condition or only motivational factor is evident in comparison, an additive effect should occur. To test these hypotheses, the present experiment investigate the effect of provision of velocity (control vs. velocity) and the presence of comparison (control v.s. comparison) on the idea generation performance of individual brainstormers. Such investigation may shed the effects of these variables on creativity and underlying mechanisms behind these plausible effects.

METHOD

Participants

A total of 238 students between the ages of 18-23 at the Abant Izzet Baysal University (AIBU) participated in this experiment in exchange for an experimental credit. The participants were randomly assigned to either velocity (control vs. velocity) or comparison (control v.s. comparison) condition in the experiment.

Instruments

Brainstorming Rules: All participants were provided Osborn's (1957) rules: (1) 'do not criticize ideas; (2) say whatever comes to mind; (3) generate many ideas without giving much emphasis on quality; (4) develop or combine old ideas with new ones'. A short explanation was also provided for each rule.

Brainstorming Problem: All participants were brainstormed on the ways to improve student life in the university (Nijstad, De Dreu, Rietzschel & Baas, 2010).

Velocity Instruction: The participants were given a written instruction as to manipulate velocity. The participants in the velocity condition were instructed to

write down their ideas or come up with ideas as quick as possible by considering brainstorming rules. On other hand, those in the control received no such instruction but received the written instruction that re-emphasized brainstorming rules.

Comparison Instruction: The provision of comparison was manipulated by a means of a written instruction. The participants in the comparison condition were informed that their performance or ideas would be compared with someone similar to them. Those in control condition received no such written information but received the written instruction that re-emphasized brainstorming rules.

Questionnaire: After the brainstorming session, the questionnaire was used for perceptual measurement of the participants. All participants were instructed to rate the quality and quantity of their ideas generated, how interesting they found the problem, how they liked it, how fast they generated ideas, how fast the time passed, how relaxed they felt, how anxious they felt on 11 point Likert scale ranging from 0 (none) to 10 (always). There were also questions concerning the perception of comparison in the next page. They were also asked to rate to what extent their given situation motivated them, how important they thought the comparison was important, how relaxed they felt, and how anxious they felt on 11 point Likert scale ranging from 0 (not all) to 10 (very much).

Procedure

All participants were tested in a classroom setting. They were randomly scheduled one week before the experiment. The participants being randomly assigned to the relevant condition were informed about the time and place of the experiment. They were seated in the desk alone. Upon their arrival, they were given an informed consent form that provided general information about the nature of the research. After signing it, the participants were given a second page that included a paragraph as to measure the typing speed of the participants. The paragraph developed by Larsen and Ketelaar (1991), adapted by Grawitch, Munz, and Kramer (2003) was used to neutralize the mood of the participants before the manipulation. Upon the completion of this test, they were provided the detailed instructions about the brainstorming procedure and its four rules. The experimenter read a copy of these instructions aloud to the participants as they followed along. Brainstorming problem was about improving the university in many ways.

Then the participants were assigned to all the relevant experimental conditions. In the same paper sheet all manipulations were made but also read aloud by the experimenter since only participants in the relevant condition were present in the classroom at a time (The number of participants in a given situation was roughly 15 at a time). All participants were given A4 sized paper. At the end of a 12-minute brainstorming session, the participants were given a questionnaire to evaluate their own perceptions about the experiment.

RESULTS

Coding

The two independent raters, who first coded the total number of ideas, checked the repetitive ideas and then extracted from the total number of ideas. By this way the number of nonrepetitive ideas, which was the main dependent variable in this experiment, were calculated for each participant. The interrater reliability coefficients (Cronbach alfa's) for the total and nonrepetitive ideas were 0.99 (see Paulus et al., 2002). The number of category they scanned was also coded and the reliability coefficient for these measures was 0.99.

Performance Analyses

The number of unique ideas

The main effect of velocity was significant on the number of nonrepetitive or unique ideas, F (1, 234) = 31.59, $p < .0001$, eta = .12. The participants in the velocity condition (M = 25.02) generated more unique ideas than those did in the control one (M = 17.70). The main effect of comparison was also significant, F (1, 234) = 12.45, $p < .001$, eta = .05. The participants in the comparison condition (M = 23.66) generated more ideas than those did in the control one (M = 19.07). However, the interaction effect between these variables was not significant, F (1, 108) = 1.19, $p > .05$.

Table 1: The number of unique, flexible and deep ideas in term of type of velocity and comparison

Standard	Velocity		Control	
Comparison	Comp.	Control	Comp.	Control
Unique ideas	26.61 (12.90)	23.44 (9.62)	20.71 (8.44)	14.69 (6.93)
Flexible ideas	4.63 (1.09)	4.17 (1.24)	3.63 (1.28)	2.92 (1.28)
Deep ideas	35.90 (2.79)	6.03 (2.79)	6.51 (3.92)	5.74 (3.82)

Standard deviations are listed in parentheses.

The number of category usage (flexibility)

The main effect of velocity was significant on the number of flexible ideas, F (1, 234) = 49.87, $p < .0001$, eta = .18. The participants in the velocity condition (M = 4.39) generated more flexible ideas than those did in the control one (M = 3.27). The main effect of comparison was also significant, F (1, 234) = 13.41, $p < .001$, eta = .05. The participants in the comparison condition (M = 4.12) generated more flexible ideas than those did in the control one (M = 3.54). However, the

interaction effect between these variables was not significant, F (1, 108) = 0.59, p >.05.

The number of deep ideas (persistence)

The number of deep ideas was calculated by dividing the number of unique ideas by the number of unique categories (Nijstad, Stroebe, & Lodewijkx, 2002, 2003). The main effect of velocity, comparison and the interaction effect between these variables were not significant, F (1, 234) = .13, p >.05, F (1, 234) = .559, p >.05, and F (1, 234) = 1.07, p >.05, respectively.

Mediational analyses

Mediation analyses were only conducted for velocity since flexibility and persistence were correlated with this variable (see Table 2).

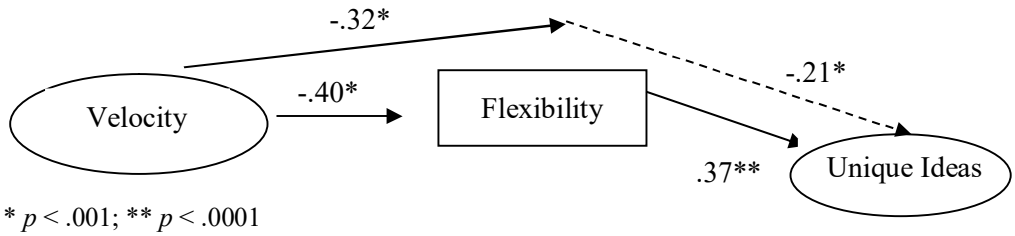
Table 2: Correlation matrix for velocity, comparison and performance data

	Velocity	Comparison
The Number of Unique Ideas	-0.32*	-0.20*
Flexibility	-0.40*	-0.20*
Persistence	0.03	-0.04

* p < .001

Since flexibility was correlated with both velocity and the number of unique ideas, mediation analysis was performed according to the criteria developed by Baron and Kenny (1986) by holding the effect of comparison as constant. As can be seen in Figure 1, after entering flexibility into the equation, the initial effect of velocity (B = -.32) on the number of unique ideas dropped to -.21. The sobel test showed that drop in beta weights from -.32 to -.21 were significant (sobel test Z = 2.01, p < .001).

Figure 1: Mediation role of flexibility and persistence on the relationship between velocity and creativity

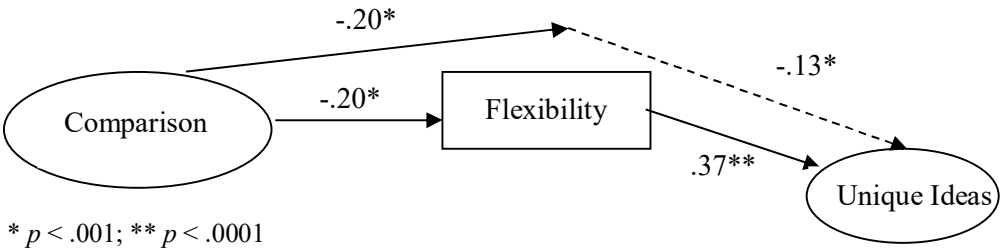


* p < .001; ** p < .0001

Since flexibility was correlated with both comparison and the number of unique ideas, mediation analysis was performed according to the criteria developed by Baron and Kenny (1986) by holding the effect of velocity as constant. As can be seen in Figure 1, after entering flexibility into the equation, the initial effect of

comparison (B = -.20) on the number of unique ideas dropped to -.13. The sobel test showed that drop in beta weights from -.20 to -.13 were significant (sobel test Z = 2.12, $p < .001$).

Figure 2: Mediation role of flexibility and persistence on the relationship between comparison and creativity



* $p < .001$; ** $p < .0001$

Perceptual Measures

The results obtained were not statistically significant and were not reported here because of limited space.

DISCUSSION

The findings of the present experiment showed that velocity increased the performance up to 40 per cent as compared to control condition. This effect was mediated by only flexibility. This suggests that velocity increased flexible ideas, which in turn lead to a high level of creativity. This result is consistent with the finding of the recent study (Coskun & Gocmen, 2015). The beneficial effect of velocity and its pathway, namely flexibility, are in line with the one major explanation. First, high velocity may facilitate the activation of related concepts in the memory. It may facilitate the retrieval of ideas from long term memory and the processing in working memory as the previous models mentioned earlier suggest. Such rapid activation may override the effects of delays between ideas, which in turn may hinder production blocking. Moreover, it may sweep away the conscious suppression of ideas, and thereby facilitate the appearance of self-censored ideas. Taken together, these suggest that high velocity may trigger flexibility or consideration of new or diverse ideas.

However, no significant effect was found for the role of persistence as a mediator. It is possible that high velocity may re-motivate the participants to generate high number of ideas. There is some evidence that pace or task decomposition leads to the generation of high number of ideas (Coskun et al., 2000). This implies that high velocity may lead persistence to come to play a pivotal role. Such no evidence may be related to the type of task. For instance, relevant task may motivate the participants to go deeper into idea generation processes more than irrelevant task. One should keep in mind that a university

problem was used in this experiment. If the problem is related to generating ideas about the ways to improve one's financial situation, a person is more likely to be more motivated than a situation requires generating ideas on the university problem that is relatively impersonal. The future studies should investigate the role of tasks on mediators.

Comparison of performance with similar ones enhanced idea generation performance thorough flexibility. This is very new evidence that should be clarified in the future. The given literature focused on the motivational aspects of comparison but ignored cognitive aspect of it. The current evidence suggest that some parts of comparison information may be related to the consideration of the brainstorming topic from different perspectives. The future research should examine the effects of various comparison information with regard to activating pathways to creativity.

In conclusion, this experimental research aimed to investigate the effect of velocity (control vs. velocity) and comparison (control vs. comparison) on the idea generation performance of individual brainstormers. Findings showed that those in the velocity condition and comparison one generated more ideas than their counterparts. These findings suggest that even though both provisions of comparison and velocity were beneficial to idea generation, underlying mechanisms for the effects of these variables on the idea generation performance were the same. The effects of both variables were mediated by only flexibility. The future studies should illuminate various types of comparison and their relationships with creativity pathways. They also should investigate such potential influences in interactive group settings.

The present findings may have important implications on educational settings. For instance, students should be compared with similar ones on the same tasks. This can be beneficial for their performance. On the other hand, they may be de-motivated when they are compared with dissimilar ones. Being compared with someone may produce devastating effects on one's motivation and future performance. The performance of students can be enhanced by providing the speed instruction. Sometimes slow activities may block cognitive processing during the learning phase. Such inhibition may also generate negative emotions such as boredom and exhaustion in classroom settings. The future studies should also investigate emotions that can be associated with the speed. The present findings may imply that therapy settings may get benefit from speed and comparison. To get uncensored ideas, a therapist may instruct the client and patients to come up with many ideas without a delay. Such activity can facilitate the emergence of negative ideas, emotions as well as positive ones that can be processed one at a time during the phases of treatment. Obviously, the future studies should illuminate the implementation of these techniques into not only education and therapy settings but also organizational and health ones.

REFERENCES

Baas, M., De Dreu, C. K. & Nijstad, B. A. (2011). When prevention promotes creativity: the role of mood, regulatory focus, and regulatory closure. *Journal of personality and social psychology*, *100*(5): 794.

Baron, R. M. & Kenny, D. A. (1986). The Moderator-Mediator variable distinction in social psychological research : Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51*(6): 1173–1182.

Brown, V., Tumeo, M., Larey, T. S. & Paulus, P. B. (1998). Modeling cognitive interactions during group brainstorming. *Small group research*, *29*(4): 495-526.

Cohn, M. & Moscovitch, M. (2007). Dissociating measures of associative memory: Evidence and theoretical implications. *Journal of Memory and Language, 57*: 437– 454. doi: 10.1016/j.jml.2007.06.006

Collins, A. M. & Loftus, E. F. (1975). A spreading activation of semantic processing. *Psychological Review, 82*: 407–428.

Coskun, H., (2000). The effect of out-group comparison, social context, intrinsic motivation, and collective identity in brainstorming groups. *Unpublished Doctoral Dissertation.* The University of Texas Texas at Arlington.

Coşkun, H. (2005a). Beyin fırtınasında sosyal kimlik değişiminin üretkenlik üzerine etkisi. *Hacettepe Üniversitesi Edebiyat Fakültesi Dergisi, 22*(1): 79-94.

Coskun, H. (2005b). Cognitive stimulation with convergent and divergent thinking exercising in brainwriting: Incubation, sequence priming, and group context. *Small Group Research, 36*: 466-498.

Coskun, H**.** (2009). The effects of associative exercises on the idea generation during brainstorming. *Turkish Journal of Psychology*, *24*: 34-44.

Coskun, H. (2011). Close associations and memory in brainwriting groups. *The Journal of Creative Behavior, 45*(1): 59-75.

Coskun, H., & Gocmen, O. (2015). Individual brainstorming performance as a function of velocity and the provision of high standard. Poster Presentation in 14th European Congress of Psychology. Milano: Italy.

Coskun, H., Paulus, P. B., Brown, V. & Sherwood, J. J. (2000). Cognitive stimulation and problem presentation in idea-generating groups. *Group Dynamics: Theory, Research and Practice, 4*: 307–329. doi: 10.1037//1089-2699.4.4.307

Coskun, H. & Yılmaz, O. (2009). A new dynamical model of brainstorming: Linear, nonlinear, continuous (simultaneous) and impulsive (sequential) cases. *Journal of Mathematical Psychology, 53*: 253-264.

De Dreu, C. K. W., Baas, M. & Nijstad, B. A. (2008). Hedonic tone and activation level in the mood-creativity link: toward a dual pathway to creativity model. *Journal of Personality and Social Psychology, 94*(5): 739–756. doi: 10.1037/0022-3514.94.5.739

De Dreu, C. K. W., Nijstad, B. A., Baas, M., Wolsink, I. & Roskes, M. (2012). Working memory benefits creative insight, musical improvisation, and original ideation through maintained task-focused attention. *Personality & Social Psychology Bulletin, 38*(5): 656–669. doi:10.1177/0146167211435795

Diehl, M. and Stroebe, W. (1987). Productivity loss in brainstorming groups: Toward the solution of a riddle. *Journal of Personality and Social Psychology*, *53*: 497–509.

Dugosh, K. L. & Paulus, P. B. (2005). Cognitive and social comparison processes in brainstorming. *Journal of experimental social psychology*, *41*(3): 313-320.

Dugosh, K. L., Paulus, P. B., Roland, E. J. & Yang, H. (2000). Cognitive stimulation in brainstorming. *Journal of Personality and Social Psychology*, *79*: 722–735. doi:10.1037//0022-35I4.79.5.722

Festinger, L. (1954). A theory of social comparison processes. *Human relations*, *7*(2): 117-140.

Gasper, K. (2003). When necessity is the mother of invention: Mood and problem solving. *Journal of Experimental Social Psychology, 39*: 248–262. doi:10.1016/S0022-1031(03)00023-4

Grawitch, M. J., Munz, D. C., Elliott, E. K. & Mathis, A. (2003). Promoting creativity in temporary problem solving groups: The effects of positive mood and autonomy in problem definition on idea-generating performance. *Group Dynamics: Theory, Research, and Practice, 7*: 200–213. doi: 10.1037/1089-2699.7.3.200.

Grawitch, M. J., Munz, D. C. & Kramer, T. J. (2003). Effects of member mood states on creative performance in temporary workgroups. *Group Dynamics: Theory, Research, and Practice, 7*: 41–54. doi: 10.1037/1089-2699.7.1.41

Goldenberg, O., Larson, J. R. & Wiley, J. (2013). Goal instructions, response format, and idea generation in groups. Small Group Research, *44*: 227-256. doi:10.1177/1046496413486701.

Guo, L. & McLeod, P. L. (2014). The impact of semantic relevance and heterogeneity of pictorial stimuli on individual brainstorming: An extension of SIAM model. *Creativity Research Journal, 26*: 361-367. doi: 0.1080/10400419.2014.929433.

Larey, T. S. & Paulus, P. B. (1995). Social Comparison and Goal Setting in Brainstorming Groups1. *Journal of Applied Social Psychology*, *25*(18): 1579-1596.

Larsen, R. J., & Ketelaar, T. (1991). Personality and susceptibility to positive and negative emotional states. *Journal of personality and social psychology*, *61*(1), 132.

Lin, F., Heffner, K. L., Ren, P., Tivarus, M. E., Brasch, J., Chen, D. G., et al. (2016). Cognitive and Neural Effects of Vision-Based Speed-of-Processing Training in Older Adults with Amnestic Mild Cognitive Impairment: A Pilot Study. *Journal of the American Geriatrics Society*, *64*(6), 1293-1298.

Marsh, R. L., Landau, J. D. & Hicks, J. L. (1996). How examples may (and may not) constrain creativity. *Memory & Cognition, 24*: 669–680.

Mednick, S. (1962). The associative basis of the creative process. *Psychological Review*, *69*(3): 220.

Neely, J. H. (1991). Semantic priming effects in visual word recognition: A selective review of current findings and theories. In Besner, D. and Humphreys, G. W. (Ed.), *Basic processes in reading: Visual word recognition* (pp. 264-350). Hillsdale, NJ: Lawrence Erlbaum.

Nijstad, B. A., De Dreu, C. K. W., Rietzschel E. F. & Baas, M. (2010). The dual pathway to creativity model: Creative ideation as a function of flexibility and persistence. *European Review of Social Psychology, 21*(1): 34–77. doi:10.1080/10463281003765323

Nijstad, B. A. & Stroebe, W. (2006). How the group affects the mind: A cognitive model of idea generation in groups. *Personality and Social Psychology Review, 10*(3): 186-213.

Nijstad, B. A., Stroebe, W. & Lodewijkx, H. F. M. (2002). Cognitive stimulation and interference in groups: Exposure effects in an idea generation task. *Journal of Experimental Social Psychology, 38*: 535–544. doi:10.1016/S0022-1031(02)00500-0.

Nijstad, B. A., Stroebe, W. & Lodewijkx, H. F. M. (2003). Production blocking and idea generation: Does blocking interfere with cognitive processes*?* *Journal of Experimental Social Psychology, 39*: 531-548.

Osborn, A. F. (1957). *Applied imagination*. New York: Scribner.

Paulus, P. B. & Brown, V. (2007). Toward more creative and innovative group idea generation: A cognitive-social-motivational perspective of group brainstorming. *Social and Personality Psychology Compass, 1*: 248–265. doi: 10.1111/j.1751-9004.2007.00006.x

Paulus, P. B. & Dzindolet, M. T. (1993). Social influence processes in group brainstorming. *Journal of Personality and Social Psychology*, *64*(4): 575.

Paulus, P. B., Nakui, T., Putman, V. L. & Brown, V. R. (2006). Effects of task instructions and brief breaks on brainstorming. *Group Dynamics: Theory, Research, and Practice*, *10*(3): 206.

Paulus, P. B., Putman, V. L., Dugosh, K. L., Dzindolet, M. T. & Coskun, H. (2002). Social and cognitive influences in group brainstorming: Predicting production gains and losses. *European Review of Social Psychology*, *12*(1): 299-325.

Paulus, P. B. & Yang, H. (2000). Idea generation in groups: A basis for creativity in organizations. *Organizational Behaviour and Human Decision Processes, 82*: 76–87. doi: 10.1006/obhd.2000.2888

Tulving, E. (1972). Episodic and semantic memory. *Organization of memory*, *1*, 381-403.

Wegge, J. & Haslam, S. A. (2005). Improving work motivation and performance in brainstorming groups: The effects of three group goal-setting strategies. *European Journal of Work and Organizational Psychology*, *14*(4): 400-430.