



HAL
open science

Leadership-driven Ideation: The Cognitive Effects of Directive Feedbacks on Creativity

Hicham Ezzat, Marine Agogu , Mathieu Cassotti, Pascal Le Masson, Benoit Weil

► **To cite this version:**

Hicham Ezzat, Marine Agogu , Mathieu Cassotti, Pascal Le Masson, Benoit Weil. Leadership-driven Ideation: The Cognitive Effects of Directive Feedbacks on Creativity. European Academy of Management - EURAM, Jun 2016, Paris, France. halshs-01298791

HAL Id: halshs-01298791

<https://shs.hal.science/halshs-01298791>

Submitted on 9 May 2016

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destin e au d p t et   la diffusion de documents scientifiques de niveau recherche, publi s ou non,  manant des  tablissements d'enseignement et de recherche fran ais ou  trangers, des laboratoires publics ou priv s.

Leadership-driven Ideation: The Cognitive Effects of Directive Feedbacks on Creativity

Hicham Ezzat¹, Marine Agogu ², Mathieu Cassotti³, Pascal Le Masson¹, and Benoit Weil¹
¹Mines ParisTech, France ²HEC Montr al, Canada ³University of Paris Descartes, France

Abstract

Leadership and creativity have usually been viewed as antagonist concepts, compromised between two contradictory variables: control and freedom. There is growing evidence that too much leadership control could kill subordinates' creativity, while in contrary, too much freedom could lead them to chaos and disorder. In the past decades, countless studies suggested that in order for creativity to emerge, leaders should grant more freedom and autonomy to their followers. Our hypothesis is that leaders could foster subordinates' creative ideation capacities by controlling their ideation processes through directive feedbacks. In this study, we explored the influence of directive feedbacks interactively given by a leader at each idea generated by his/her subordinate, throughout a classical creative problem-solving task done online via a distant text conversation. The task consisted of generating as many original solutions as possible that allows that a hen's egg dropped from a height of ten meters does not break. Results confirmed that leaders' directive feedbacks were able to drive and guide subordinates' ideation paths in two distinctive directions, according to leaders' domain-relevant knowledge and vision for creativity.

Keywords: Leadership, Creativity, Ideation, Functional Fixedness, Directive Feedback.

1. Introduction

In today's world, creativity is considered a highly appreciated, not to say indispensable element. In almost every occupation, there is a place for a certain level of creativity and innovative thinking required. Creativity of employees has always been seen as the fundamental element for organizations' success and continuous development. Creativity has been described as the ability to generate ideas that are both novel and useful, while innovation extends this definition, and involve taking those creative ideas and carrying them through to implementation (Amabile, 1983).

However, generating creative ideas is not an easy task, and despite the favourable conditions and necessary resources available in organizations to innovate, most people have been facing serious difficulties to continuously generate creative ideas. Explanations and enlightenments regarding the obstacles to creativity are well known and studied in cognitive sciences' contexts. Various studies in cognitive sciences have underlined the negative role of cognitive biases to creativity. The most famous one is called functional fixedness or fixation effect (Jansson & Smith, 1991), which is the fact that some existing knowledge or known solutions are spontaneously activated in individual's minds, therefore constraining the ability of individuals to generate more creative ideas in creativity contexts. This mental block limits the ability of individuals to see certain objects in different ways in spite of solving particular problems.

Recent findings demonstrated that overcoming these cognitive biases to creativity could be made through expansive examples, i.e. examples of ideas and solutions that are outside the fixation effect, and consequently helps increasing the creative generation capacities of individuals (Agogu e et al., 2014). Nevertheless, not only cognitive sciences have been interested in overcoming these cognitive biases. In the field of design sciences, several theorists and scholars have identified creativity stimulation techniques (Kowaltowski,

Bianchi, & De Paiva, 2010). For instance innovative design methods like C-K theory (Hatchuel & Weil, 2003), and KCP method (Hatchuel, Le Masson, & Weil, 2009) are well recognized to help bypassing cognitive biases' effects (particularly functional fixedness) occurring in creative design contexts.

Numerous researches have lately paid attention on the significant role that can be played by leadership for creativity (Mumford, Connelly, & Gaddis, 2003; Reiter-Palmon & Illies, 2004; Sternberg, Kaufman, & Pretz, 2003). Consequently, considering leadership as a key and central factor to foster creativity among subordinates, much effort has been made by management scholars to design new forms of leadership behaviors that could strongly manage and control the necessary conditions for creativity (Agbor, 2008; Amabile & Gryskiewicz, 1987). As a matter of fact, leadership researchers showed that creative leaders could manipulate multiple critical contextual factors for creativity stimulation, using among others, leadership tools like: goal-settings, instructions, feedbacks, etc ...

In this study, we were interested to emphasize this important role leadership could play for creativity stimulation, by exploring the cognitive effects of leadership feedbacks on subordinates' idea generation processes. Feedbacks are defined as the modification or control of a process by its results, in which the output of an action is returned to modify the subsequent action. Our hypothesis is that leadership feedbacks could have a significant role to play to control ideation processes, and most importantly drive it in certain potential directions for creativity.

2. Leadership: A Major Function for Creativity

2.1. Introduction to Leadership

Although leadership has multiple definitions depending on the perception of leadership theorists (Stogdill, 1974), it can be generally described as “a process of social influence in which an individual (the leader) is able to enlist the support of others (subordinates or followers) in the accomplishment of a common task” (Chemers, 2014).

Leadership has multiple types and styles that can be classified broadly by their behaviors towards their followers and their decision-making styles. It is important to note that a leader is hardly belonging to only one specific type of leadership, but is rather a mixture and combination of different types. Lewin examined for instance three leadership styles related to the relations of power existing between leaders and subordinates, which are: autocratic, democratic and laissez-faire types (Lewin, Lippitt, & White, 1939). Autocratic leaders are easily known by their unilateral and authoritarian decisions, as they command work processes and constrain significantly subordinates’ participation. On the contrary, democratic leaders involve subordinates through joint and cooperative decision-making, after facilitating consensus and agreement with their teams, and usually realize tasks collectively. Finally, laissez-faire leaders (known as the most passive type of leadership style) are recognized by their delegated decision making style, or even sometimes their decision avoidance, and thus usually create a comfortable work climate that could easily lead to chaos and disorder.

Other recent leadership types exist as well in the rich leadership bibliography. Transactional leaders are characterized by their cold social exchange with subordinates, depending on rewards and punishments as transaction exchanges to ensure followers’ fulfillment, based on job descriptions to complete well-defined goals (Weber, 1947). Transactional leadership continues to subsist well among leadership types, and still has a

significant place in contemporary leadership theories. Moreover, recognized as an extension of transactional leadership, transformational leadership is more than a leadership style. Transformational leadership is a process that changes and transforms people, whereby subordinates feel trust, and appreciation towards their leaders. It is recognized today as one of the most promised leadership type in the evolutionary tree leadership theories (Van Seters & Field, 1990). Transformational leaders behave according to the following factors: employing idealized influence, inspirational motivation, intellectual stimulation, and individualized considerations (Bass & Avolio, 1993).

Recently, and among various new leadership types that emerged lately throughout the last decade, new types like servant, rotated, authentic, and virtual or e-leadership (to cite only the most famous ones) also emerged and took their positions among existing leadership traditional types.

Although leadership theorists recognized that many of these types (specifically transactional and transformational leadership styles) could have certain interesting relationship with creativity, there is clear evidence that they were not specifically designed and modeled for creativity stimulation.

2.2. A Growing Importance of Creativity in Leadership Theories

Studies on leadership have produced numerous theories all sorted according to a varying number of leadership study eras (Bolden, Gosling, Marturano, & Dennison, 2003; Brungardt, 1997; Daft, 2014; Van Seters & Field, 1990; Yukl, 1994). Most important study eras are: personality and traits, power and influence leadership, behavioral, situational, contingency, transactional, and transformational leadership eras.

However, in most of these leadership study eras, leadership scholars seem to have directly integrated creativity in the broader and larger concept of efficiency. But recently, being a subject of interest among scholars from different disciplines ranging from

neurosciences to management, and as a consequence of its growing importance, leadership theorists and academics have finally begun to add the element creativity as an imperative variable of the conceptualization equation of today's leadership definition.

2.3. Leadership Competencies: A Focus on Creativity

In 2010, IBM made a survey to more than 1500 Chief Executive Officers from 60 different countries, asking them what are the most important leadership qualities for the next five years. Results revealed that 60% of CEOs considered creativity as the most important quality and competency for leaders in future years (Carr & Tomasco, 2010).

Leadership competencies are personal skills and behaviors contributing to better subordinate performance. There is no doubt that leaders must have minimum competencies to inspire their subordinates. Besides classical leadership skills as planning, organization and goal setting, literature has highlighted four main categories of non-traditional leadership skills, which are: social, behavioral, emotional, and cognitive competencies (Day, 2001). The ability of a leader to tailor his competencies according to the current situation turns out to be his distinctive and personalized competency. All these competencies are well linked to leader's cognitive competencies, which refers to leader's degree of integration and ability to use knowledge structure to organize, interpret and process big amount of complex information within his/her cognitive space.

Today, creativity is considered as a principal competency and quality for any leader. "Being creative" or "being innovator" for a leader become today a fundamental element. Very early studies on creative leadership have emphasized the importance of the creativity of leaders themselves, assuming that by being creative, leaders will be having the appropriate vision and guidance methodologies to enhance followers creativity (Mumford et al., 2003).

3. Literature Review

3.1. Leadership versus Creativity: A Balance between Control and Freedom

As we have previously indicated, creativity and innovation were newly added to today's leadership design. Management scholars argue that in order for creativity to appear, a certain level of autonomy and freedom is needed (Amabile, Conti, Coon, Lazenby, & Herron, 1996; McLean, 2005). As a matter of fact, researchers in management tended to believe that the most important aspect of works' environments leading to creativity and innovation is autonomy, described as the degree to which individuals have freedom to decide how to carry out their work task. In this regard, Amabile et al. have identified that, in order for creativity to flourish, leaders should allow followers to decide how to climb a mountain, rather than letting them choose which one to climb (Amabile, 1998).

From another point of view, leadership's literature demonstrated that creativity could as well emerge with a certain level of leadership control and guidance. In this regard, leadership should be able and competent enough to stimulate creativity among subordinates. Literature review on creative leadership has underlined the role played by leaders for creativity (Mumford, Scott, Gaddis, & Strange, 2002). Prior works have majorly reduced and concentrated leaders' role as facilitators, mentors, or mediators to organizational creativity (Woodman, Sawyer, & Griffin, 1993). However, numerous studies have examined varied factors that can either foster or hinder employees' creativity at individual, group, and organizational levels, and have then introduced the role of creative leaders in this regard. Literature has shown that leaders can enhance subordinates' creativity by directly or indirectly adapting appropriate contextual factors like group climate, group composition, resources, knowledge management, or even human resources issues (Hemlin, Allwood, & Martin, 2008; Shalley & Gilson, 2004). These various contextual factor could be managed and manipulated using leadership tools, among others: leadership goal-settings (Carson &

Carson, 1993; Locke & Latham, 1990), leadership instructions (Paulus, Kohn, & Arditto, 2011; Runco, Illies, & Eisenman, 2005; Runco, Illies, & Reiter-Ralmon, 2005; Runco & Okuda, 1991), leadership feedbacks (De Stobbeleir, Ashford, & Buyens, 2008; Zhou, 1998, 2003; Zhou & Li, 2013), and even less conventional and usual leadership tools like non-verbal devices (Brun, Ezzat, & Weil, 2015).

3.2. Feedbacks: A Central Leadership Tool to Foster Creativity

Among the long list of tools leaders could use to foster creativity among subordinates (or at least avoid hindering it), there is no doubt that feedbacks maintain a central position. Feedbacks could be used to regulate and control subordinates' performance in real-time. Although the concept of feedback itself is widely used in management theories, its definitions vary considerably depending on management theorists perception (Ramaprasad, 1983). As a basis for improvement and goal attainment, leaders provide subordinates with certain information and reactions about followers' performance to tune it according to their visions.

Very few studies have focused on the close relationship existing between feedbacks and creativity. Indeed, some researchers explored the effect of feedbacks from a relatively broad angle, focusing on the social interaction perspective. Generally, these researches analyzed the exchange of evaluative information on creative performance, arguing that it could have a strong impact on enhancing creative processes (De Stobbeleir, Ashford, & Buyens, 2011). These studies incorporated feedbacks in the broader concept of interactions existing between employees and supervisors or between employees themselves, underscoring the importance of being exposed to others' ideas and perspectives to boost the generation of creative ideas. Other researches studied for instance feedbacks from a more self-monitoring and regulation perception, noting that it helps regulate individuals' creative performance (Zhou & Li, 2013). However, most of the researches that have explored more deeply the question of feedbacks, from a creative ideation perspective, share common views with

management scholars encouraging a certain level of autonomy for creativity. In fact, these findings have emphasized that delivering negative and controlling feedbacks to employees could damage their creative performance, while in contrary delivering constructive or developmental feedbacks to employees could have a positive impact on creativity (Carson & Carson, 1993; Zhou, 1998, 2003; Zhou & Li, 2013).

Nevertheless, most of the abovementioned studies have evaluated feedbacks from a relatively large angle, and none of these studies have focused on the real utility of interactive feedbacks, which is regulating the ideation process depending on leader's vision.

4. Research Question

In line with the above, could leadership feedbacks tune and regulate subordinates' ideation processes according to certain creativity goals and visions? In other words, could leadership feedbacks direct and guide ideation processes towards certain potential directions that could most likely lead to creative outcomes? Are creative leaders capable of driving subordinates' path of ideation in certain directions?

Our general hypothesis is that despite the negative perception of "controlling" feedbacks on creativity as reported by management and creativity literature encouraging more freedom and autonomy for creativity to arise, feedbacks could in contrary enhance employees' creative performance in certain cases, provided that leaders have appropriate visions and domain-relevant knowledge, and this in order to manage appropriately ideation processes in real time.

To test this general hypothesis, we first modeled the ideation process followed by a feedback sub process, in order to use it as a basis of our experiment. We then modeled five different leadership behaviors, depending on two types of directive feedbacks that could guide subordinates' ideas generation paths in two opposite directions, either in fixation or

expansion. We then analyzed the obtained results in the subsequent sections. Finally, we ended our paper with the conclusion, limitations, and future works.

5. Methodology

5.1. Experimental Protocol Design

5.1.1. Ideation and Feedback Process Modeling

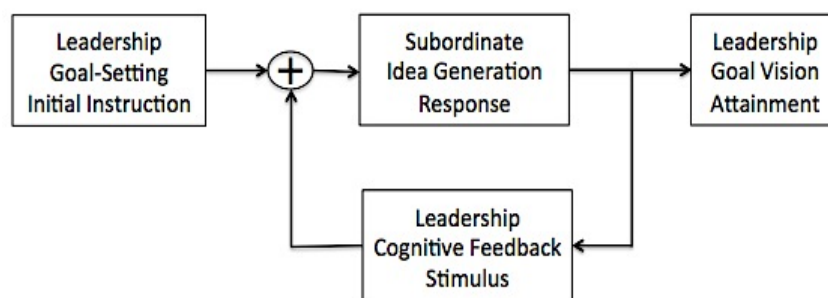


Fig. 1: Modeling Leader-Member Ideation/Feedback Process

We first modeled our experimentation as a process of idea generation based on an initial instruction and guideline (leadership goal-setting), where leader clarifies the goals and objectives to his/her subordinates via an instructional process (input). The system is then regulated and tuned according to leader’s goal vision attainment or not by subordinates (output), and this via another process of cognitive feedback stimulus given by the leader to influence subordinate’s subsequent ideation response.

5.1.2. Modeling Directive Feedbacks using C-K Theory

In line with the above, we were interested in this study to model new approaches of leadership directive feedbacks that could guide subordinates’ ideas generation paths exclusively inside a restrictive zone, i.e. a conceptual space associated to the fixation effect;

or in contrary to guide the generation of ideas in an expansive zone (outside the fixation effect zone).

To do that, we chose to model leadership cognitive feedback stimulus as directive feedbacks type using C-K (Concept-Knowledge) theory (Hatchuel & Weil, 2002), since this theory of cognitive reasoning is well recognized to have strong effects on overcoming cognitive biases' effects occurring in creative design contexts. C-K theory defines two distinct spaces: a space of concept ("C") and a space of knowledge ("K"). The process of design is described as a double expansion of both C and K spaces, and this via four operators as illustrated in Figure 2 below:

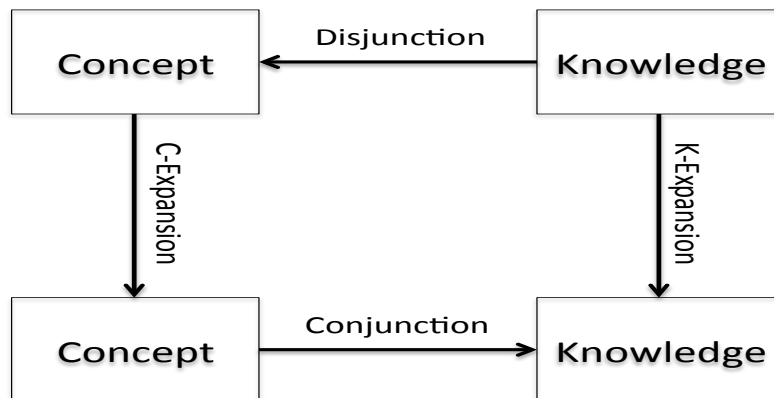


Fig. 2: Concept-Knowledge Diagram Operators

- $C \rightarrow K$: this operator named “conjunctions” pursues for added (or subtracted) properties in K space to reach propositions having a logical status (true or false).
- $K \rightarrow C$: this operator name “disjunctions” in contrary to conjunctions, adds (or subtracts) some properties coming from K space to new concepts in C space having no logical status.
- $C \rightarrow C$: this operator expands the C space by adding a new partition to it. This new partition can be “restrictive” if it does not change object’s definition or

attributes, or “expansive” if it transforms object’s definition and identity by adding (or removing) unexpected attributes.

- $K \rightarrow K$: this operator expands the K space by adding new knowledge basis to it, and indicates the knowledge structures created within concept designs.

5.1.3. Identifying Fixations and Expansions

We tested our experiment using a classical creative task, which consists of designing a process that allows that a hen’s egg dropped from a height of ten meters does not break.

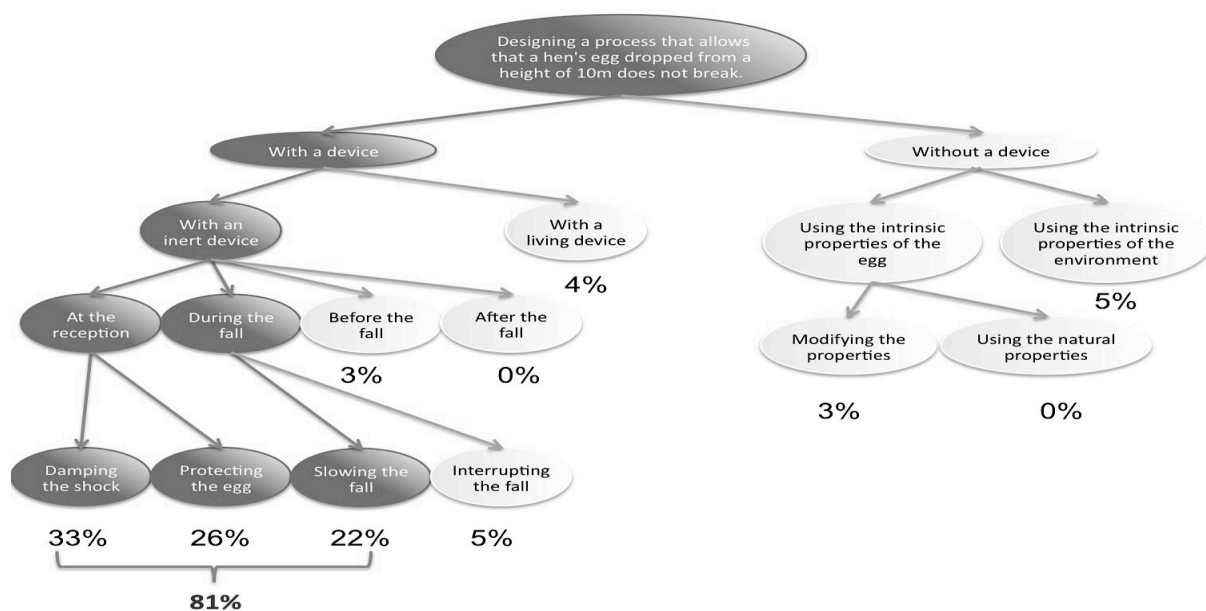


Fig. 3: Identifying Fixation/Expansion Paths in the Egg’s Task (Agogu  et al., 2014)

We chose this particular creativity task among others since we have a vast existing database of ideas and solutions of more than thousands subjects from different profiles that have performed this task within the past years. This database reveals that more than 80% of previous participants generated ideas around three main categories of conventional “restrictive” solutions (which are damping the shock, slowing the fall, and protecting the egg). However, only 20% of participants usually generate unconventional “expansive”

solutions (for instance: before and after the fall, with a living device, using the intrinsic properties of the environment, etc..) as presented in the C-K diagram in Figure 3.

Using CK theory, we were able to differentiate between restrictive paths of ideas and solutions (dark partitions) and expansive ones as shown in Figure 3 above. By doing this, two distinct sub-spaces could be identified: fixation and expansion zones (Agogu e et al., 2014).

Subsequently, we modeled two types of feedback stimulus given by leaders by participants at each idea generated by them throughout this creative task, according to Table 1. Those directive feedbacks consisted on stimulating the generation of expansive or restrictive ideas and solutions, by forcing subordinates' idea generation paths into two opposing directions (fixation or expansion) depending on the following stimuli:

- Stimulus 1 (“continue in this path”): This stimulus underscores the supposedly approval and agreement of the leader with the type of ideas generated by followers. We hypothesized that this leadership cognitive feedback stimulus should force the following generation of ideas and solutions to be consistent with the type of ideas and solutions generated by subordinates.
- Stimulus 2 (“search for another path”): This stimulus underscores the supposedly disapproval and disagreement of the leader with the idea generated by followers. We hypothesized that this leadership cognitive feedback stimulus should force the following generation of ideas and solutions to be different and dissimilar from the type of ideas and solutions generated by subordinates.

We considered the third type of stimulus (“I confirm receipt of your idea, and await for the next one”) to stand neutral and unbiased vis- -vis of the two other stimuli, with no major effects on subordinates' ideation response, and in order to be used as a control case for the comparison study of expansion-oriented and fixation-oriented groups.

5.2. Participants

Participants (N=90) of the Faculty of Psychology of Paris Descartes University have participated in this study. Subjects were between 17 and 30 years old, with a mean age of 20,5. All subjects recruited to perform this task didn't know the egg's task and haven't done any creativity tasks previously.

5.3. Procedure

Participants were recruited from the Faculty of Psychology of Paris Descartes University. They were asked to perform a creative task via an online text conversation with their experimenter. We chose to perform the complete task online via a text (written) chat conversation on Skype to avoid any type of social biases that could appear and affect our experimentation, as a consequence of the physical presence of experimenters face to face in front of participants (Belletier et al., 2015). The task duration was accurately set to 10 minutes for each participant.

Leadership Cognitive Feedback Stimulus		
Groups	Generation of Restrictive Idea	Generation of Expansive Idea
Group 1 (Control case)	“I confirm receipt of your idea, and await for the next one”	“I confirm receipt of your idea, and await for the next one”
Group 2 (Expansion-oriented)	“Continue in this path”	“Search for another path”
Group 3 (Fixation-oriented)	“Search for another path”	“Continue in this path”
Group 4 (independent type A)	“Continue in this path”	“Continue in this path”
Group 5 (independent type B)	“Search for another path”	“Search for another path”

Table 1: Directive Feedbacks Stimuli

Participants were randomly divided into five groups (20 subjects in each of the groups 1, 2 and 3; and 15 subjects in each of the groups 4 and 5). Each participant was assigned a different leadership behavior type (neutral case, expansion-oriented or fixation-oriented or independent) depending on the group he/she was randomly assigned to, as shown in Table 1.

Leadership goal-setting initial instruction consisted of explaining the task guidelines to subordinates (“the aim is to propose the maximum number of original solutions to ensure that a hen’s egg dropped from a distance of ten meters does not break.”), specifying to them to “be as creative as possible in this task”.

Participants of the first group were chatting with a neutral leader, which simply acknowledges reception of ideas generated by subordinates, awaiting the next one. We considered group 1 as a referential case for studying the other four groups.

Participants of the second group were chatting with an expansion-oriented leader trying to push the ideation process towards expansion; if the idea is generated by subordinates in fixation zone, leader asks subordinates to search for another path (stimulus 2), while in contrary if the idea is generated by subordinates in expansion zone, leader supports subordinates to continue in this path (stimulus 1). We considered that this leader behavior should force the stimulation of expansive solutions.

Contrary to group 2, the third group was having a fixation-oriented leader trying to mislead the ideation process towards fixation; if the idea is generated by subordinates in fixation zone, leader supports subordinates to continue in this path (stimulus 1), while in contrary if the idea is generated by subordinates in expansion zone, leader asks subordinates to search for another path (stimulus 2). We considered that this leader behavior should force the stimulation of restrictive solutions.

Group 4 and 5 were having leaders that permanently send them the same stimuli independently from the type of ideas generated: group 4 always sent the stimulus “continue in this path” (stimulus 1), and group 5 the stimulus “search for another path” (stimulus 2), and this throughout the complete task duration. We considered that leader behavior of group 4 should force the generation of similar types of solutions (whether expansive or restrictive), while leader behavior of group 5 should force the generation of dissimilar types of solutions.

6. Results

6.1. Statistical Analysis of Groups' Creativity Performance

Creative people usually exhibit a high ideational fluency, which is the aptitude to come up with many new ideas, high degree of novelty, and also flexibility known as the ability to stimulate variety among new ideas (Guilford, 1959). Divergent thinking has been known to consider three main elements for evaluating a creative ideation process, which are the ideational fluency, ideational originality, and ideational flexibility.

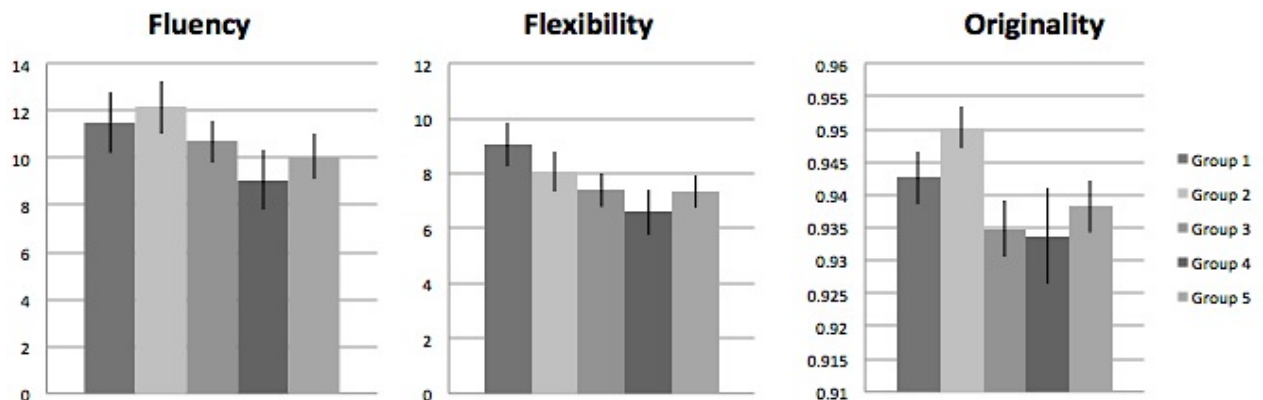


Fig. 4: Statistical Analysis of Groups' Results

In terms of fluency, we computed the mean number of ideas generated by participants in each group. Results showed that participants exposed to expansion-oriented leader proposed slightly more ideas than referential group, while participants of fixation-oriented

group where somewhat inferior than group 1 and group 2 in this regard. Groups 4 and 5 were respectively able to generate fewer ideas than other groups.

In terms of flexibility of solutions, we calculated the mean number of different types of ideas generated by participants in each group. In this regard, all groups were below the referential group. Interestingly, the presence of directive feedbacks perturbed the variety of solutions of subordinates.

Finally, we analyzed originality of ideas generated in each group by computing the frequency of occurrence of type of solutions given across all the subjects in each group. In this regard, we found that participants of group 2 generated more original and unique ideas than other groups, while participants of group 3 and 4 generated the lowest number of original and unique ideas. This result indicates the opposite effects of the expansion-oriented leader in overcoming fixation effects among subordinates, and the fixation-oriented leader in considerably forcing subordinates' exploration inside the fixation effects zone.

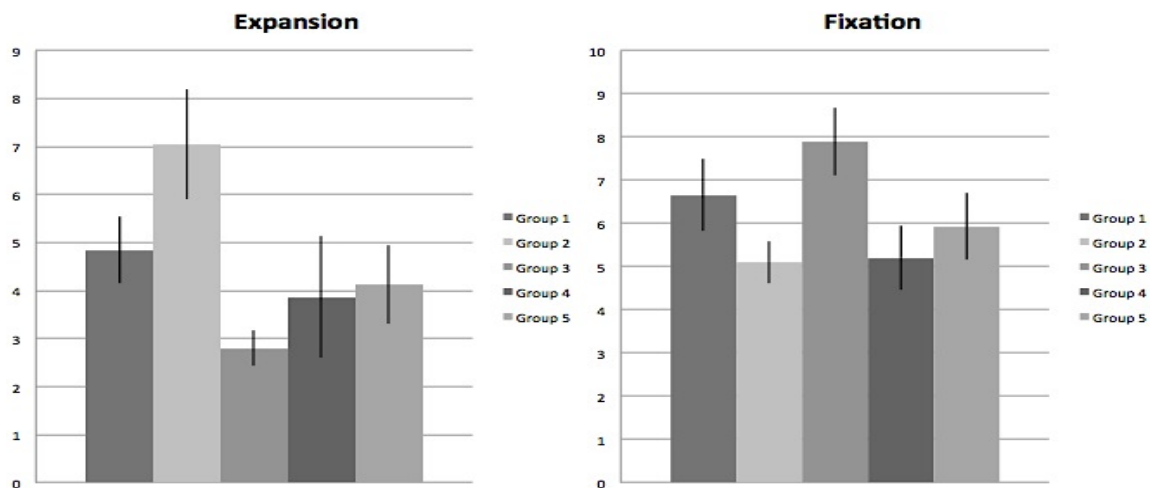


Fig. 5: Mean Number of Solutions inside/outside Fixation

To have a clearer view of the abovementioned facts, we analyzed as well the mean number of ideas and solutions that individuals were able to generate inside the fixation zone (restrictive solutions), and inside the expansion zone, i.e. outside the fixation zone (expansive solutions). Results in Figure 5, show that leader of group 2 and 4 notably forced participants

to generate more expansive ideas, and in parallel reduced the number of restrictive ideas; whereas leader of group 3 and group 5 had an impact on enhancing participants' generation of restrictive ideas, and at the same time decreased the number of expansive ideas.

From a general perspective, these results confirm that leaders' involvement in subordinates' ideation processes without clear task domain knowledge and vision is blocking their creative performance (groups 4 and 5), which confirms the point of view of most management scholars that leaders should grant more freedom to subordinates for creativity to emerge. In contrary, if leaders have enough task domain knowledge and vision (groups 2 and 3), they can lead subordinates into two opposite directions, either towards expansion (group 2) or towards fixation (group 3).

6.2. Ideas Sequential Analysis

6.2.1. Two State Markov Chain Analysis

Nevertheless, analyzing mean number of solutions in each group in terms of fluency/flexibility/originality and in terms of the ratio fixation/expansion is not enough in this study. For this reason, we analyzed the sequential train of ideas generated by participants of each group, by computing the probabilities of transitions from: fixation to expansion, and vice versa. Moreover, we also computed the probabilities of consecutively remaining in one of the two states, or oscillating between the two states (as shown in Figure 6).

Using these probabilities computations, we were interested to illustrate the effect of leadership feedbacks in each group on the probabilities of transitions from a state of fixation to a state of expansion and vice versa. To do so, we considered our system as a stochastic process representing the evolution of ideation process over time. We could then estimate a two state Markov chain as illustrated in Figure 7.

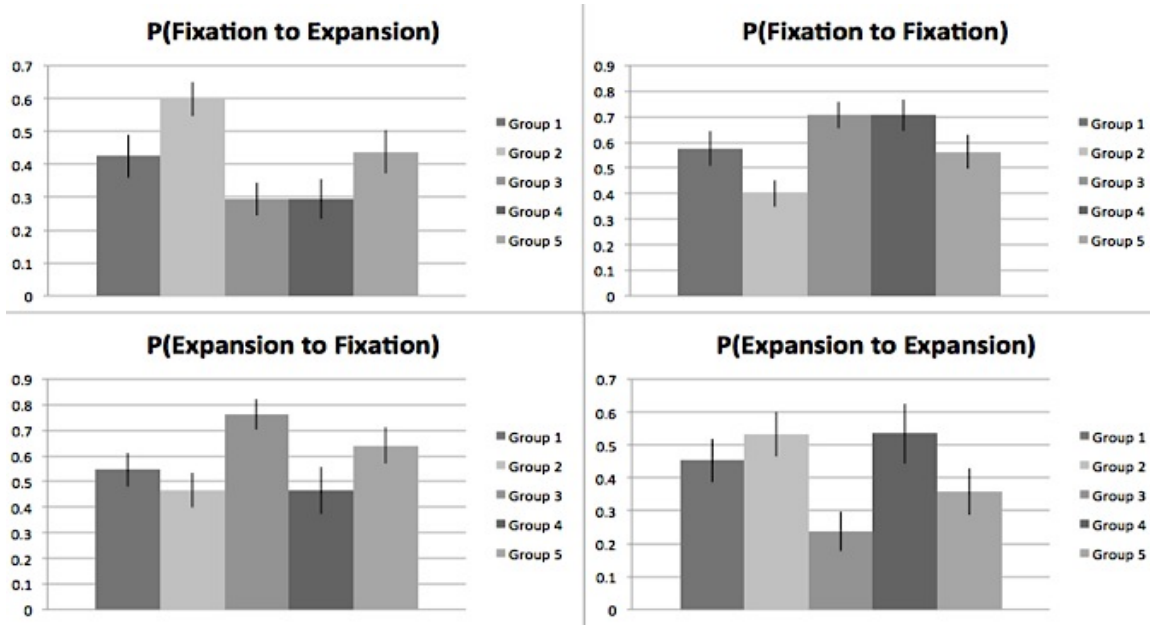


Fig. 6: State Transition Mean Probabilities and Standard Deviations

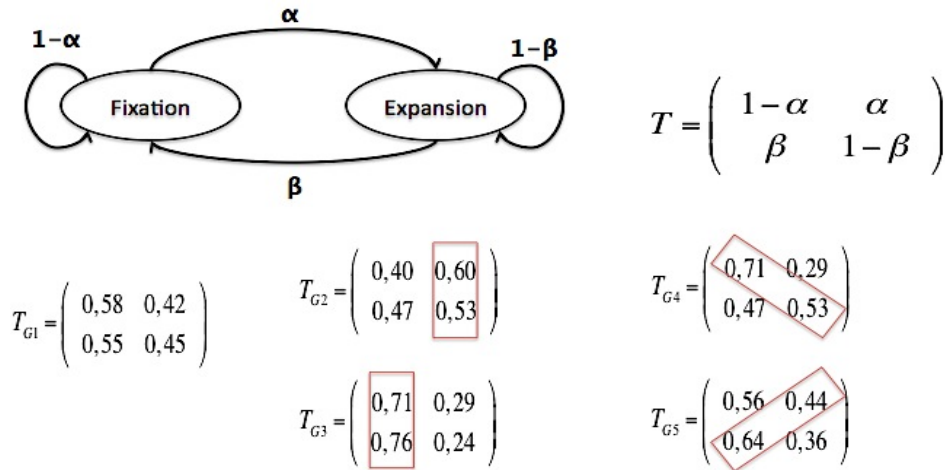


Fig. 7: Two-State Markov Chain Analysis

Interestingly, transition matrix of group 2 illustrates significantly, that leader's feedback stimuli in group 2 forced subordinates' ideation transition from fixation to expansion, and enhanced their probability to stay in expansion zone. On the other side, leader' feedback stimuli in group 3 forced subordinates' ideation transition from expansion to fixation, and increased their probability to stay in fixation zone. Comparably, leader's feedback stimuli in group 4 forced subordinates to stay and remain in each state, knowing

that independently from the idea generated, this leader continuously asked to continue in the same path. Otherwise, leader's feedback stimuli in group 5 forced subordinates to oscillate between states of fixation and expansion.

6.2.2. Timing Analysis

Moreover, we were interested to explore the emergence of expansive and restrictive ideas over time only for leaders of group 2 and 3, and the effects of their stimuli in this regard. To do so, we divided the task duration (10 minutes) into 15 periods of 40 seconds each, in which we computed the mean number of expansive and restrictive ideas generated by participants in each of these periods as shown in Figure 8. We chose to discard the analysis for group 4 and group 5, as their timing results were not necessarily significant and meaningful for this study.

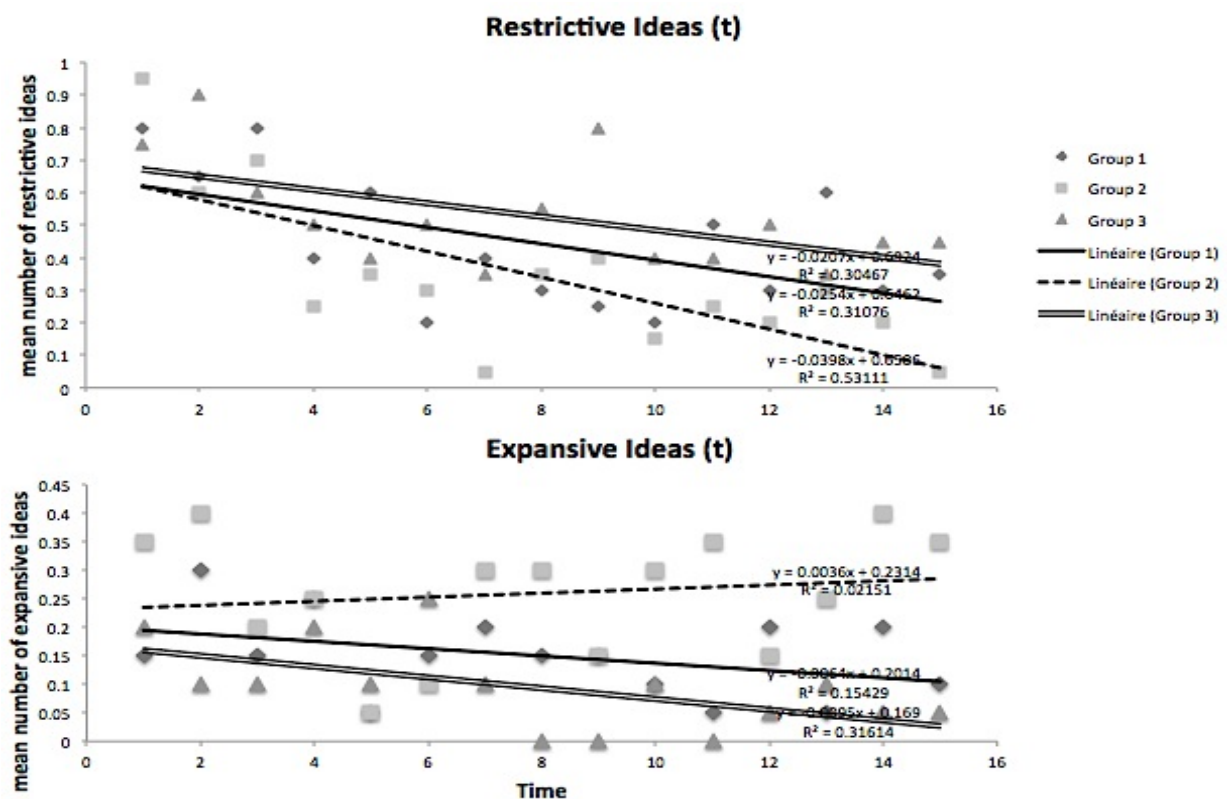


Fig. 8: Linear Regression: Expansive/Restrictive Ideas' Timing Analysis

Linear regression analyses demonstrates that, comparing to the referential case (leader of group 1), leader of group 2 was able to gradually direct the ideation path towards expansion. In contrary, leader of group 3 somewhat progressively impacted the direction of the ideation path towards fixation over time.

7. Conclusions, Limitations and Future Works

In this study, we explored the effect of leadership directive feedbacks interactively given on subordinates' creative idea generation capacity, according to five leadership behaviors. We performed this on a creative task where the aim was to propose the maximum number of original solutions to ensure that a hen's egg dropped from a distance of ten meters does not break.

The major finding in this study is that leaders could in a certain case improve, and in most cases obstruct, subordinates' creative idea generation capacities by driving their ideation processes through directive feedbacks. Indeed, we explored the influence of two different types of directive feedbacks given by a leader to his/her subordinate ("continue in this path" or "search for another path"), using an online text conversation in order to avoid any social biases that could be resulted from the presence of the leader in front of participants. Results confirmed that leaders' directive feedbacks were able to: (i) control the fluency and originality of subordinates' ideas generated (ii) drive and guide subordinates' ideation paths in two distinctive states (inside or outside fixation), and this according to leaders' domain-relevant knowledge and vision for creativity.

From a management sciences perspective, these results confirm (i) the point of view of most management scholars and academics that leaders should grant more freedom and autonomy to their followers in order for creativity to emerge, since leadership directive feedbacks without knowledge and vision noticeably obstructed the generation capacity of

subordinates; (ii) but at the same time these study showed that ideation processes could be controlled and directed towards potential directions for creativity (expansion zone) via directive feedbacks, using certain type of expansion-oriented leadership behavior (group 2), provided that leaders have minimum knowledge and vision for creativity, i.e. if leaders know the dominant design, and are at least able to identify and recognize the principal categories of restrictive ideas and solutions.

A limitation of our study is its high level of abstraction comparing to a typical leader-member situation, taking into account the complexity of the numerous contextual factors that define leadership conceptual equation (real leader-member contexts with incentives, real hierarchical issues with subordinates of different levels, team-level and organizational-level contextual factors, etc..).

Future works will consist in exploring the cognitive effects of particular directive feedbacks that could be less dependent from the type of ideas generated by subordinates, and this in order to examine if “expert-less” leaders, not necessarily having solid domain-relevant knowledge and well-defined vision for creativity, could also improve the creative generation capacities of followers, by driving their ideation paths in potential directions for creativity.

Acknowledgements

This research was financed by a grant from the French National Research Agency (project ANR-13-SOIN-0004-02 IDéfixE). The authors would also like to thank Clara Jonquières for helping us to perform this experiment.

References

- Agbor, E. 2008. Creativity and innovation: The leadership dynamics. *Journal of Strategic Leadership*, 1(1): 39-45.
- Agogu , M., Kazak i, A., Hatchuel, A., Masson, P., Weil, B., Poirel, N., & Cassotti, M. 2014. The Impact of Type of Examples on Originality: Explaining Fixation and Stimulation Effects. *The Journal of Creative Behavior*, 48(1): 1-12.
- Amabile, T., & Grysiewicz, S. S. 1987. *Creativity in the R&D laboratory*: Center for Creative Leadership.
- Amabile, T. M. 1983. The social psychology of creativity: A componential conceptualization. *Journal of personality and social psychology*, 45(2): 357.
- Amabile, T. M. 1998. How to kill creativity: Harvard Business School Publishing Boston, MA.
- Amabile, T. M., Conti, R., Coon, H., Lazenby, J., & Herron, M. 1996. Assessing the work environment for creativity. *Academy of management journal*, 39(5): 1154-1184.
- Bass, B. M., & Avolio, B. J. 1993. Transformational leadership: A response to critiques.
- Belletier, C., Davranche, K., Tellier, I. S., Dumas, F., Vidal, F., Hasbroucq, T., & Huguet, P. 2015. Choking under monitoring pressure: being watched by the experimenter reduces executive attention. *Psychonomic bulletin & review*: 1-7.
- Bolden, R., Gosling, J., Marturano, A., & Dennison, P. 2003. A review of leadership theory and competency frameworks: Centre for Leadership Studies, University of Exeter Exeter.

- Brun, J., Ezzat, H., & Weil, B. 2015. *Managing the impacts of non-verbal devices on idea generation: a new challenge for creative leaders*. Paper presented at the European Academy of Management-EURAM, Warsaw, Poland.
- Brungardt, C. 1997. The making of leaders: A review of the research in leadership development and education. *Journal of Leadership & Organizational Studies*, 3(3): 81-95.
- Carr, A., & Tomasco, S. 2010. The most important leadership quality for CEOs? Creativity. *Fast Company*(May 18).
- Carson, P. P., & Carson, K. D. 1993. Managing Creativity Enhancement Through Goal - Setting and Feedback*. *The Journal of Creative Behavior*, 27(1): 36-45.
- Chemers, M. 2014. *An integrative theory of leadership*: Psychology Press.
- Daft, R. 2014. *The leadership experience*: Cengage Learning.
- Day, D. V. 2001. Leadership development: A review in context. *The Leadership Quarterly*, 11(4): 581-613.
- De stobbeleir, K. E., Ashford, S. J., & Buyens, D. 2008. Feedback-Seeking Behavior as a Self-Regulation Strategy for Creative Performance. *Academy of Management Journal*, 54(4): 811-831.
- De Stobbeleir, K. E., Ashford, S. J., & Buyens, D. 2011. Self-regulation of creativity at work: The role of feedback-seeking behavior in creative performance. *Academy of Management Journal*, 54(4): 811-831.
- Guilford, J. P. 1959. Traits of creativity. *Creativity and its cultivation*: 142-161.

- Hatchuel, A., Le Masson, P., & Weil, B. 2009. *Design theory and collective creativity: a theoretical framework to evaluate KCP process*. Paper presented at the International conference on engineering design, ICED.
- Hatchuel, A., & Weil, B. 2002. *CK theory*. Paper presented at the Proceedings of the Herbert Simon International Conference on «Design Sciences.
- Hatchuel, A., & Weil, B. 2003. *A new approach of innovative Design: an introduction to CK theory*. Paper presented at the DS 31: Proceedings of ICED 03, the 14th International Conference on Engineering Design, Stockholm.
- Hemlin, S., Allwood, C. M., & Martin, B. R. 2008. Creative knowledge environments. *Creativity Research Journal*, 20(2): 196-210.
- Jansson, D. G., & Smith, S. M. 1991. Design fixation. *Design studies*, 12(1): 3-11.
- Kowaltowski, D. C., Bianchi, G., & De Paiva, V. T. 2010. Methods that may stimulate creativity and their use in architectural design education. *International Journal of Technology and Design Education*, 20(4): 453-476.
- Lewin, K., Lippitt, R., & White, R. K. 1939. Patterns of aggressive behavior in experimentally created “social climates”. *The Journal of Social Psychology*, 10(2): 269-299.
- Locke, E. A., & Latham, G. P. 1990. *A theory of goal setting & task performance*: Prentice-Hall, Inc.
- McLean, L. D. 2005. Organizational culture’s influence on creativity and innovation: A review of the literature and implications for human resource development. *Advances in Developing Human Resources*, 7(2): 226-246.

- Mumford, M. D., Connelly, S., & Gaddis, B. 2003. How creative leaders think: Experimental findings and cases. *The Leadership Quarterly*, 14(4): 411-432.
- Mumford, M. D., Scott, G. M., Gaddis, B., & Strange, J. M. 2002. Leading creative people: Orchestrating expertise and relationships. *The Leadership Quarterly*, 13(6): 705-750.
- Paulus, P. B., Kohn, N. W., & Arditto, L. E. 2011. Effects of quantity and quality instructions on brainstorming. *The Journal of Creative Behavior*, 45(1): 38-46.
- Ramaprasad, A. 1983. On the definition of feedback. *Behavioral Science*, 28(1): 4-13.
- Reiter-Palmon, R., & Illies, J. J. 2004. Leadership and creativity: Understanding leadership from a creative problem-solving perspective. *The Leadership Quarterly*, 15(1): 55-77.
- Runco, M. A., Illies, J. J., & Eisenman, R. 2005. Creativity, originality, and appropriateness: What do explicit instructions tell us about their relationships? *The Journal of Creative Behavior*, 39(2): 137-148.
- Runco, M. A., Illies, J. J., & Reiter-Ralmon, R. 2005. Explicit Instructions to Be Creative and Original. *The International Journal of Creativity & Problem Solving*, 15(1): 5-15.
- Runco, M. A., & Okuda, S. 1991. The instructional enhancement of the flexibility and originality scores of divergent thinking tests. *Applied Cognitive Psychology*, 5(5): 435-441.
- Shalley, C. E., & Gilson, L. L. 2004. What leaders need to know: A review of social and contextual factors that can foster or hinder creativity. *The Leadership Quarterly*, 15(1): 33-53.

- Sternberg, R. J., Kaufman, J. C., & Pretz, J. E. 2003. A propulsion model of creative leadership. *The Leadership Quarterly*, 14(4): 455-473.
- Stogdill, R. M. 1974. Handbook of leadership: A survey of the literature: New York: Free Press.
- Van Seters, D. A., & Field, R. H. 1990. The evolution of leadership theory. *Journal of organizational change management*, 3(3): 29-45.
- Weber, M. 1947. The theory of economic and social organization. *Trans. AM Henderson and Talcott Parsons. New York: Oxford University Press.*
- Woodman, R. W., Sawyer, J. E., & Griffin, R. W. 1993. Toward a theory of organizational creativity. *Academy of management review*, 18(2): 293-321.
- Yukl, G. A. 1994. *Leadership in organizations*: Pearson Education India.
- Zhou, J. 1998. Feedback valence, feedback style, task autonomy, and achievement orientation: Interactive effects on creative performance. *Journal of applied psychology*, 83(2): 261.
- Zhou, J. 2003. When the presence of creative coworkers is related to creativity: role of supervisor close monitoring, developmental feedback, and creative personality. *Journal of applied psychology*, 88(3): 413.
- Zhou, M.-j., & Li, S.-k. 2013. *Can supervisor feedback always promote creativity? The moderating role of employee self-monitoring*. Paper presented at the Information Management, Innovation Management and Industrial Engineering (ICIII), 2013 6th International Conference on.