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**Per lo sviluppo, la competitività e l'innovazione del sistema
economico: il contributo degli studi di organizzazione
aziendale**

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ORGANIZING COLLECTIVE CREATIVITY.
FROM PEOPLE TO GROUPS:
A MULTILEVEL ANALYSIS

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***Abstract.** There are evidences that creative collectives produce higher creative results than the mere collection of individual creativity (Hargadon & Bechky, 2006). But, on which conditions? What is the relationship between individual and collective creativity? Does the sum of the most creative people lead to the most creative group? We developed a wide research programme aiming at going deeper in creativity dynamics to understand what factors and which processes contribute to increase or reduce the creative performance at group level. Within the Responsive Creativity framework, multiple measures of both individual and group creativity were considered. Group creativity was measured considering the creativity of a collective product and was operationalized as multiple variable according to the Besemer scales (1986). Individual creativity was measured by multiple indicators coming from the psychological literature (both Williams and Torrance test – 1993, 1974). According to our research aims, we designed an experiment to analyse, ceteris paribus, the relationship between individual and team creativity. Results confirmed our main proposition: individual creativity is positively related with group creativity but it does not fully explain it. Moreover, different individual creativity sub-dimensions have different significant impact on product creativity dimensions. Also some distinctions can be made considering different individual creativity dimensions and product creativity components. Finally, the Critical Incident analysis revealed some*

intervening processes, such as leadership and interpersonal trust, as particularly relevant in determining the overall result.

1 Introduction

Recently, given the strategic importance of innovation in developing and sustaining competitive advantage, we are seeing more and more emphasis being placed on creativity as a product of organizational action. This approach shifts the analysis from the individual to the organization, with the goal of studying aspects such as organizational context and design, which can either promote or inhibit creativity.

But creative organizations can be designed? Is ‘organizing creativity’ an oxymoron?

This paper is part of a broader study, the goal of which is to better understand and define the key moments in group creativity, i.e. those moments in which new ideas are born out of a collective process and not merely as moments of individual “genius”.

This is of particular importance for a number of reasons. First of all, in the literature on the topic, we find repeated calls for rigorous empirical studies because of the relative lack of verification in the field compared with the body of theoretical work (Woodman et al. 1993). Moreover creativity has been traditionally studied as an individual attitude and, more recently, as a collective process, thus making it difficult to compare them (Barron and Harrington 1981; Amabile 1996). Only a few studies consider the relationship between individual and collective creativity, and these researches have certain limitations that restrict the comparability and general application of the findings (Taggar 2002; Pirola Merlo & Mann 2004). Within the above mentioned research program, this article aims at going deeper in the empirical research on the relationship between individual and group creativity, thus advancing some arguments on how to design creative groups.

2 Multilevel Approaches to Individual and Group Creativity: Stock Variables

Creativity is the production of new, useful ideas by an individual or small group of people working together (Rank et al. 2004, Amabile et al. 1996, Woodman, Sawyer & Griffin 1993).

Traditionally, creativity has been described as an individual characteristic and, as such, the earliest studies on creativity have focused primarily on personality traits associated with creative behavior, on cognitive factors, and on the intrinsic level of motivation from a psychological perspective (MacKinnon 1965, Barron & Harrington 1981, Singh 1986).

The definitions of creativity as well as the differences and connections between its various dimensions have been theorized in a number of articles exclusively dedicated to the creation of multilevel analysis models (Ford 1996).

Interest in the organizational relevance of creativity is more recent, coinciding with recognition of its strategic value in a business setting (Amabile 1988; Woodman et al. 1993). Several works in business and academia have been dedicated to defining the contextual and organizational variables enhancing individual creativity within business activities (Shalley, 1995; Amabile et al. 1996; Majar, Oldham, Pratt, 2002; West, 2002; Perry-Smith Shalley, 2003). Paradoxically, organizational research is much more focused on individual analysis, thus neglecting empirical research focused on creativity as group outputs (Shalley et al. 2004; George 2008). Among this literature, just a few studies cope with the relationships between individual and group creativity, according to a multilevel perspective (Glynn 1996; Drazin et al., 1999; Taggar, 2002; Pirola-Merlo & Mann, 2004). According to these researches the individual creativity of the team members is positively related to the group creativity, even if there are limits in assessing creativity at both levels, that evidence some difficulties to generalize this result. Measures, if there are any, are essentially based on self-assessment or peer subjective evaluation. Furthermore in the previous multilevel studies there are also some controversies considering the measures and the various collective creative activities performed; open-ended versus closed-ended problems (Unsworth, 2001).

These observations suggest that, as premise of a wider research programme, deeper empirical results are required on the following hypothesis.

H. 1: ceteris paribus, the aggregated individual creativity of a team is positively related with the overall team creativity.

Creativity is a very complex construct, that the traditional psychological literature defines in various way, using a multidimensional approach.

As already mentioned it is defined as the production of new, useful ideas by an individual or small group of people working together (Woodman et al. 1993; Amabile et al. 1996; Rank et al. 2004).

Many author suggest that creativity is a composite concept. Guilford (1967) identifies four components of creativity: fluency, related to the ability to generate many ideas, flexibility, i. e. the ability to generate a wide rage of ideas, originality, the ability to generate a novel idea and elaboration, defined as the ability to develop and embellish ideas. Ochse (1990) similarly defines creativity as bringing something in being that is original (new, unusual, novel, unexpected) and also variable (useful, good, adaptive, appropriate). Amabile (1988, 1996) defines creativity using two dimensions: novelty and usefulness. Zhou & George (2001) consider as creative, ideas and output that are new and valuable.

Oldham & Cummings (1996) defined a creative performance as novel, original, useful and relevant. Woodmann et al. (1993) use the three concepts of valuable, new and useful, to define creative outputs. Moreover, some scholars specifically focus on product-level creativity, as the result of a designing activities (Besemer 1998; O'Quin & Besemer, 2006) defining a creative product characterized by high level of originality (i.e. new), resolution (i.e. functionality) and elaboration (i.e. organic and well-crafted). These definitions support the multidimensionality of the creativity concept and especially underline the 'double' nature of this construct: on one side there are dimensions that are related to novelty and originality, on the other side attention is devoted to functionality and feasibility. These observations underline the relevance of the creativity measurement both at individual and group levels and suggest that different and more complex relationships can occur among all their components, especially which seem to be of opposite nature.

H2: ceteris paribus, the aggregated individual creativity of the team members has different degrees of association with different components of group creativity (novelty, resolution; elaboration & synthesis).

And in particular:

H3: ceteris paribus, the aggregated individual creativity of the team members has a higher degree of association with the novelty

component of group creativity than with the one related to functionality (resolution and elaboration & synthesis).

3 Multilevel Approaches to Individual and Group Creativity: Process Variables

More recently, a growing attention is devoted to analysing creativity as group process. One of the most significant contributions in this direction is that of Drazin, Glynn & Kazanjian (1999), which shifts the focus of creativity onto the process of commitment in creative action, regardless of whether or not the outcome is new, useful, or creative. Sensemaking comes about at the individual, intersubjective, and collective levels (Weick 1995). From this perspective, the effects of sensemaking on each level and those that arise from the interaction of the various levels that emerge during the creative process are analyzed. More recent studies place even greater emphasis on the dynamics of process interaction, abandoning the distinction of levels and focusing solely on identifying phases and activities that lead to a collective creative output (Hargadon & Bechky 2006).

Particularly, among this literature, different process and behavioral dynamics seem to affect the group creative performance. Woodman et al. (1993) assume that rules of conduct for the group, level of cohesion, formal roles are relevant for group creativity. Drazin et al. (1999) theorize that relationships among team member are involved in creative processes, such as negotiation dynamics, power relationships, causes, management, and method of solving moment of crises. Task motivation, goal setting, strategies for goal achieving, participation, group belonging, performance management, effective communication, involvement, feedback, reacting and managing conflict are all relevant processes while performing creative activities and tasks that intervene in a creative process, according to Taggar (2002). Hargadon & Bechky (2006) identify help seeking, help giving, reflective reframing and reinforcing as behavior patterns that produce the overall results.

These observations suggest that there are different relevant organizational (such as formalized rules, coordination roles) and social (such as communication, group relationships processes, group involvement)

processes and variables that can together affect creative results at group level together with the aggregated individual creativity.

This allows to advance the following hypothesis:

H.4a: ceteris paribus, team social processes intervene in the relationship between individual creativity and group creativity.

H.4b: ceteris paribus, team organizational processes intervene in the relationship between individual creativity and group creativity.

4 The research design

In spite of most of the empirical projects on creativity that generally refer to creativity as a unique and undifferentiated concept, our study provides results explicitly applied to a specific kind of creativity. A distinctive feature of our proposal is the recognition (and measurement) of the various factors and types of creativity, at both the individual and group levels. Our program seeks both to take these differences into consideration and to measure the relationships among the different components. In particular we take into consideration the Unsworth's matrix (2001) and consistently defined our study as pertaining to an externally requested creative task applied to a defined problem (i.e. responsive creativity).

In accordance with our research aims, we designed an experiment to analyse, all else being equal, the relationship between individual and team creativity. Our research sample was composed of 737 undergraduate students. They formed 67 eleven-person groups, which were in charge of performing a creative task. An observer was assigned to each group to watch the process together with the two researchers (in accordance with the Critical Incident Technique). Group creativity levels were evaluated by a jury of 12 students, two researchers and two "experts" (an architect and a psychologist). A total of 820 people were involved. We also checked for certain control variables (i.e. gender, age). At the end of the experiment, each participant (including the observers and researchers) was asked to prepare a semi-structured observation report to narrate his/her experience (Czarniawska, 1998).

The data was gathered by means of questionnaires (given both before and after the experiment to the participants and observers), direct observation of group dynamics, and semi-structured individual self-assessment by the

participants (for content analysis and encoded using a collective-process analysis grid).

Variables and operationalization

The literature has amply demonstrated the importance of context variables (Amabile, 1988, 1996) as antecedents to the level of team creativity. However, in that regard, we would like to specify that it is our intention to adopt a strategy based on simulated experiments in order to monitor the dimensions external to the individuals (i.e. the context), focusing on the relationship between individual and collective creativity, all else being equal. For the same reason, when designing the tools and the experiment, we also eliminated the effect that different “structures of creative objectives” could have on group behavior and have chosen to structure the experiment around a problem of responsive creativity (Unsworth, 2001), i.e. asking the group to come up with a creative solution (a creative “product”) to a given, specific problem.

The variables involved in the study are described and operationalized below.

1) Level of creativity of the group performance (dependent variable – collective level)

The variable has been operationalized in terms of its creative output. The scales used are those that have been validated by Besemer and O’Quin (1986, 1998, 2006) for the analysis of creative outputs. There are three dimensions that jointly measure the creativity of an output:

- (a) *degree of novelty*, i.e. how innovative the output is in terms of the number and extension of new processes, new techniques, or new concepts, which can be rated as germinal, original, and revolutionary;
- (b) *degree of resolution*, i.e. how well the output meets the expressed needs, which can be rated as adequate, appropriate, logical, useful, and valuable;
- (c) *degree of elaboration and synthesis*, i.e. an assessment of the overall design and integration and quality of the components, which can be rated as attractive, complex, elegant, expressive, organic, and well-crafted.

Each dimension was operationalized using the items proposed in the literature (Besemer & O’Quin, 1986, 1999; O’Quin & Besemer, 2006, 2007; Besemer, 2000), and the scales were organized into a questionnaire

to be given to a group of experts called upon to express an opinion concerning the final output of the group's efforts, individually and based on the dimensions above. The final score for each dimension of creativity and the overall measurement of creativity was calculated as the average of the jury members assessments, after processing a factor analysis to strengthen our measures.

The experts who composed the jury and were asked to assess the creativity of the output were two researchers, one architect, one psychologist, and a group of students, who were asked to express their opinion on each dimension of the output using a questionnaire prepared in accordance with the creative product semantic scales designed by Besemer & O'Quin (1986).

2) Level of individual creativity (independent variable – individual level)

The variable was operationalized here, as opposed to previous experiments already available in the literature on these dimensions, using validated measurements (and not self-assessments or evaluations by other members of the group). For the test, we used both versions available in the literature (versions A and B) of Williams' test on lateral thinking (1993). We also used an additional test of individual creativity, SOLAT (Torrance 1974), in order to take account of as many dimensions of individual creativity as possible.

3) Other intervening independent variables (process level)

In order to account for process dimensions, all else being equal, we arranged for two distinct moments in which to gather data:

- a) While conducting the experiment, an observer is asked to codify the intervening processes using a semi-structured observation grid.
- b) At the end of the experiment, each participant is asked to briefly describe the points that hindered or facilitated achievement of the group's final objective and to provide an assessment of the processes using the same grid used by the observers.

4) Control variables

Other individual and collective data was gathered in order to verify other potential antecedent or intervening variables, namely:

- the degree of diversity with the group: in terms of gender, age (despite the variance here, given the composition of the sample population, it is not particularly high).

The experiment

The data were gathered by assigning the same structured creative task to each group of students as part of their normal coursework. The experiment is the “egg drop”, a well-known, longstanding learning simulation that has been adapted to suit the purpose of this study.

Each group involved in the experiment was given a certain amount of time and standard materials with which to design and create a complex creative product (a protective box for an egg and a jingle to advertise it).

Prior to the experiment, the individual participants are given tests of individual creativity, and at the end of the experiment, the single participants are given the individual process feedback forms. The members of the jury are given the collective creativity questionnaires.

5 Data Analysis

The goal of the study and the strategy behind its design required that we compare the individual data (concerning the individual participants) with the collective data (regarding the teams). Because of the manner in which the individual data was gathered, we were able to calculate individual creativity indexes as the total score for right-brain thinking from the SOLAT test and the total score on the Williams test. With regard to the Williams test, we felt it was important to keep the values related to each component (fluidity, flexibility, originality, elaboration, and title), as well. For each team, collective creativity was measured both considering the single components (novelty, elaboration and synthesis, and resolution) based on the Besemer & O’Quin measurements and as an overall index calculated as the sum of the component scores.

In order to continue on to the next statistics, for each group we calculated the average of each individual creativity score and the control variable “year of birth”. As a summary index of variety in team composition, we calculated the standard deviation of the individual creativity index measured by the Williams test.

As mentioned, group creativity was measured according to the Besemer & O’Quinn scales (Besemer & O’Quinn 1986). To validate the scales, data on the 70 items were first synthesized in the 11 mid-factors all showing significant results of the related factor analysis models. In table 1 the synthesis factors and the explained variance of each model are shown.

Table 1 - Synthesis factors and the total variance explained

Items No.	Synthesis Factor	Total variance explained
9 items	ORIGINAL	85,95%
6 items	SURPRISING	86,96%
3 items	GERMINAL	87,7%
6 items	VALUABLE	67,1%
6 items	LOGICAL	82,43%
9 items	USEFUL	78,15%
8 items	ORGANIC	69,54%
5 items	ELEGANT	88,01%
5 items	COMPLEX	73,33%
6 items	UNDERSTANDABLE	72,18%
7 items	WELL CRAFTED	86,07%

Using these 11 synthesis dimensions, a further factor analysis model was performed. The new model indicates three factors that correspond to the three elements of the output creativity: component 1 corresponds to novelty, component 2 to elaboration & synthesis, and component 3 to resolution. The model results (table 2) statistically demonstrate the significance of the three dimensions proposed by Besemer & O'Quin, as a consequence of the collected data.

Table 2 - Factor analysis: rotated component matrix.

	Component		
	1:	2	3
Factor Elaboration/Complex	.954	.103	
Factor Novelty/Original	.892	.164	.385
Factor Novelty/Surprising	.884	.195	.356
Factor Novelty/Germinal	.877	.187	.388
Factor Resolution/Useful		.977	.123
Factor Resolution/Logical	.180	.828	.480
Factor Elaboration/Organic	.242	.701	.623
Factor Resolution/Valuable	.517	.600	.540
Factor Elaboration/Elegant	.543	.243	.783
Factor Elaboration/Understandable	.246	.547	.746

Factor Elaboration/Well crafted	.464	.503	.688
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The table of correlations between the summary and component measurements of individual and collective creativity point to the significance of interesting connections between a number of the variables considered (see table 3). First of all, group creativity has proven to be positively correlated with the average individual creativity of the group (calculated on the values of the Williams test), even though the intensity of the connection is not particularly high ($\rho = 0.268$). Looking at the various components, the most significant correlation arises between product novelty and average individual creativity ($\rho = 0.307$). Further data analysis highlights, in turn, at the component parts of individual creativity, that the greatest correlation arises between novelty and elaboration (measurement of asymmetry and detail of forms proposed by the Williams test) ($\rho = 0.348$). The correlation with average individual creativity loses significance, while remaining positive, in the case of elaboration and synthesis ($\rho = 0,090$) as well resolution ($\rho = 0.067$). As for the control variables, the table shows a negative, although insignificant, correlation between the year of birth of the participants and total group creativity ($\rho = -0.031$). The index becomes positive, although non significant, when looking at the second control variable i.e. the female presence in the group ($\rho = 0.72$).

Table 3 - Correlation table.

		Group Creativity	Factor NOVELTY	Factor RESOLUTION	Factor ELABORATION	Individual Creativity (average group)	Individual Creativity (group std dev)	% Female	Birth year (group average)
Group Creativity	Pearson Correlation	1	.577(**)	.577(**)	.577(**)	.268(*)	-.019	.004	-.234
	Sig. (2-tailed)		.000	.000	.000	.028	.878	.974	.056
	N	67	67	67	67	67	67	67	67
Factor NOVELTY	Pearson Correlation	.577(**)	1	.000	.000	.307(*)	-.019	-.206	.066
	Sig. (2-tailed)	.000		1.000	1.000	.012	.879	.095	.597
	N	67	67	67	67	67	67	67	67
Factor RESOLUTION	Pearson Correlation	.577(**)	.000	1	.000	.067	-.012	.005	-.248(*)
	Sig. (2-tailed)	.000	1.000		1.000	.593	.923	.966	.043
	N	67	67	67	67	67	67	67	67
Factor ELABORATION	Pearson Correlation	.577(**)	.000	.000	1	.090	-.002	.207	-.224
	Sig. (2-tailed)	.000	1.000	1.000		.468	.986	.092	.069
	N	67	67	67	67	67	67	67	67
Individual Creativity (average group)	Pearson Correlation	.268(*)	.307(*)	.067	.090	1	-.059	.165	-.031
	Sig. (2-tailed)	.028	.012	.593	.468		.634	.181	.805
	N	67	67	67	67	67	67	67	67
Individual Creativity (group std dev)	Pearson Correlation	-.019	-.019	-.012	-.002	-.059	1	.072	-.129
	Sig. (2-tailed)	.878	.879	.923	.986	.634		.565	.300
	N	67	67	67	67	67	67	67	67
% Female	Pearson Correlation	.004	-.206	.005	.207	.165	.072	1	-.220
	Sig. (2-tailed)	.974	.095	.966	.092	.181	.565		.074
	N	67	67	67	67	67	67	67	67
Birth year (group average)	Pearson Correlation	-.234	.066	-.248(*)	-.224	-.031	-.129	-.220	1
	Sig. (2-tailed)	.056	.597	.043	.069	.805	.300	.074	
	N	67	67	67	67	67	67	67	67

5.1 Regression analysis

The regression analysis was conducted considering, first, the overall group creativity measure as the dependent variable. Then the single components of group creativity were used as independent variable in further regression models (see Table 4). The main result is that a significant positive relationship between individual creativity and group creativity emerged. Specifically we obtained the following results:

1. there is a positive relationship between average individual creativity and group creativity with a good significance, but with a low predictive power ;
2. the different dimensions of group creativity (i.e. novelty, elaboration and synthesis and resolution) show different levels of significance when considered as independent variables. According to correlation analysis results, there is a positive and quite strong relationship between novelty and individual creativity with a still quite low R^2 (0,162), whereas the significance of the regression model of individual creativity to resolution and elaboration is not relevant ($t > 10\%$).

Table 4 - Regression model.

Dependent variable	Predictors (input)	R Square	Global Statistical significance Model	Standardized Coefficients	Statistical sig. coefficient
Group Creativity	Individual Creativity (average group) Individual Creativity (group std dev) Birth year (group average) Brain Right %Female	12.3%	sig. F< 5%	Individual Creativity (average group) 0,2608 Birth year (group average) -0,2265	sig. t<5% sig. t<6%
Factor Novelty	Individual Creativity (average group) Individual Creativity (group std dev) Birth year (group average) Brain Right %Female	16.2%	sig. F< 1%	Individual Creativity (average group) 0,3506 %Female -0,2638	sig. t<1% sig. t<5%
Factor Resolution	Individual Creativity (average group) Individual Creativity (group std dev) Birth year (group average) Brain Right %Female	6.2%	sig. F< 5%	Birth year (group average) -0,2483	sig. t<5%
Factor Elaboration	Individual Creativity (average group) Individual Creativity (group std dev) Birth year (group average) Brain Right %Female	5%	sig. F= 6.9%	Birth year (group average) -0,2236	sig. t= 6.9%

5.2 Cluster analysis

To go in deep with the analysis of the relationships among the considered variables, we performed a two-steps cluster analysis according with the following variables: mean individual creativity, standard deviation of the individual creativity within the team, overall group creativity, resolution, novelty and elaboration & synthesis.

We identify four clusters.

The first cluster is composed by low-creative people in a very homogeneous way. The second cluster collects medium-creative people (on the average), with a high degree of diversification within each group. The third cluster collects low-creative people also with a high degree of

diversification within each group. Finally, cluster four is composed by very homogeneous and high-creative people.

Cluster analysis shows the cluster 4 is the best considering group creativity levels, with the exception of elaboration and synthesis (where the cluster 3 is the best performer).

Cluster 2 is characterized by low creative performance with reference to all the group creative dimensions.

Cluster 1 is the worst one. Finally, what is interesting is that cluster 3 obtains the best performance for resolution and the second-best performances for elaboration & synthesis and novelty, even if it is composed by low-creative people.

The correlation analysis among cluster shows significant values just in two cases: in cluster 1 there is a significant reverse correlation between novelty and the feminine presence in the group (-0,925), whereas in cluster 4 the average individual creativity is significantly correlated with the birth year (0,556). Even if not statistically relevant, interesting suggestions refer to the sign of the correlation value among different variables. As for correlation between average individual creativity and group creativity, cluster 3 proves to have the highest value (0,373) with all the components of group creativity (i.e. novelty, elaboration & synthesis and resolution) having a positive correlation value. Cluster 1 is the second best for correlation between average individual creativity and group creativity (0,317), but looking at the components of group creativity, differences among their correlations with group creativity come to evidence. In particular, resolution demonstrate to be high related to mean individual creativity (0,566), whereas novelty is negatively correlated with it (-0,247). A positive even if lower correlation between mean individual and group creativity is also the case of cluster 4 (0,169). Novelty and resolution are positively related with average individual creativity, whereas the correlation with elaboration & synthesis is negative (-0,126). The correlation between average individual and group creativity shows a negative sign in cluster 2. As for the components, the lower correlation values with average individual creativity refer to novelty and resolution (-0,252 and -0,251 respectively).

6 Discussion and main theoretical implications

This article is part of a wide research programme on organizational issues intervening in collective creativity processes. It concerns in particular the first step of the programme which focuses on the relationship between individual and group creativity. This appeared to be worthwhile as theoretical and empirical results on the matter are limited and in some way appear to lack in rigour. Our research confirmed that individual creativity is positively related with group creativity. This proves hypothesis n. 1 to be true confirming results produced in previous studies as well (i.e. Taggar 2002, Pirola Merlo & Mann 2004). Comparing with other projects, our research design includes more articulated and complete creativity measures. At individual level in fact well-established measures of individual creativity were used (Williams test and Solat survey), whereas other studies just considered peer evaluation among group members. The assumed group creativity measures as multifaceted as well. These allowed to compare the influence of individual creativity on each components (novelty, elaboration & synthesis and resolution). As for this aspect, our results demonstrate that novelty is particularly related to individual creativity, elaboration & synthesis is lesser influenced by individual creativity, and resolution even lesser (hypothesis n. 2 and n. 3).

Nevertheless regression analysis results demonstrate that individual creativity do not have a significant predictive effect on group creativity. This confirms our main hypothesis that individual creativity is positively related but does not fully explain group creativity. Such consideration opens up to the fourth hypothesis (4a and 4b), which assume that organizational and social dynamics probably intervenes in collective processes thus contributing to determine group creativity results.

To go deeper in our analysis, we than considered the identification of four different clusters. This allowed to remark that collective interactions lead to different results in cluster composed by groups that are different for mean individual creativity and its variance. As for the analysis, results suggest that the most creative and homogeneous groups (cluster 4) seem to obtain the main advantage from the collective interaction, in particular with reference to novelty and elaboration & synthesis. Positive effects also concern groups characterized by a low mean individual creativity and a high level of variance (cluster 3), that is composed of groups made up of most poorly creative people and of one or few creative leaders. These groups were the best for resolution and obtained an high score for elaboration & synthesis too. Cluster analysis made evident that intervening processes has a broadening effect on individual creativity thus making group activities advantageous in particular for certain kinds of groups. With reference to the organizational and social dynamics, we took into consideration the semi-structured survey completed by observers and identify five more relevant and synthetic categories of intervening processes (communication processes, leadership processes, processes of interpersonal collaboration and trust, emerging processes of structuring group activities and roles, cognitive processes, motivational processes, diversity processes). The next step in data analysis will concentrate in particular on the interaction analysis of such processes with collective creativity so that deeper insights on the influence of organizational and group dynamics will be provided. We also took into consideration the qualitative process description of each cluster 3 groups components. The content analysis of these texts points out that in particular effective communication (social process) as well as emerging processes of structuring group activities and roles (especially coordination roles, time awareness and rules setting) enhanced performing the collective creative process and obtaining of their creative output.

7 Research limits and future directions

Research limits of our study refer in particular to the sample composition. Students who participated were nearly homogeneous as regard to many aspects such as faculty, age and national culture. Therefore it would be interesting to enlarge the sample to consider students from other countries, multicultural groups or collecting data in manager or post-graduated courses. More qualitative and quantitative data are also needed to find out relevant suggestions and results in order to validate measures of intervening processes and to find out what are the most important ones. As for these further research steps, we think that cluster identification could be an effective way to undergo our analysis and obtain relevant suggestions on the topic. A further interesting research direction could be the replication of the experiment and consequently of the data analysis in cases of different kinds of creativity as suggested by Unsworth (2001). In this way relevant insights about different contents of creativity kinds could be compared as well as the differences in the relationship between the individual and collective level of creativity could come to evidence.

Bibliography

- Amabile T. M. (1996), *Creativity in Context: Update to the social psychology of creativity*, Westview Press, Boulder CO.
- Amabile, T. M. (1988), "A Model of Creativity and Innovation in Organizations", *Research in Organizational Behavior*, 10, pp. 123-167.
- Amabile T. M., Conti R., Coon H., Lazenby J., Herron M. (1996), "Assessing the work environment for creativity", *Academy of Management Journal*, 39, pp. 1154-1184.
- Amabile T. M., Conti R. (1999), "Changes in the work environment for creativity during downsizing", *Academy of Management Journal*, 42(6), pp. 630-640.
- Amabile T. M., Barsade S. G., Staw B. M., 2005, "Affect and Creativity at Work", *Administrative Science Quarterly*, 50, pp. 367-403.
- Barron F., Harrington D. M. (1981), "Creativity, Intelligence, and Personality", *Annual Review of Psychology*, 32, pp. 439-476.
- Besemer S. (1998), "Creative Product Analysis Matrix: Testing the Model Structure and a Comparison Among Products – Three Novel Chairs", *Creativity Research Journal*, 11(4), pp. 333-346.
- Besemer S., O'Quin K. (1986), "Analyzing Creative Products: Refinement and Test of a Judging Instrument"; *Journal of Creative Behavior*, 20(2), pp. 115-126.
- Besemer S., Treffinger D. J. (1981), "Analysis of Creative Products: Review and Synthesis", *Journal of Creative Behavior*, (15)3, pp. 158-178.
- Czarniawska, B. (1998) *A narrative approach to organization studies*, Sage Publications, Londra.
- Cummings L. L. (1965), "Organizational climates for creativity", *Academy of Management Journal*, 3, pp. 220-227.
- Drazin R., Bird Schoonhoven C., 1996, "Community, Population, and Organizational Effects on Innovation: A Multilevel Perspective", *Academy of Management Journal*, 39(5), pp. 1065-1083.
- Drazin R., Glynn M. A., Kazanjian R. K. (1999), "Multilevel theorizing about creativity in organizations: a sensemaking perspective", *Academy of Management Review*, 24 (2), pp. 286-307.
- Ford, C. M. (1996), "A theory of individual creativity in multiple social domains" *Academy of Management Review*, 21(4), pp. 1112-1134.
- George, J. M. (2008), "Creativity in Organizations", *The Academy of Management Annuals*, 1 (1), pp. 439-477.
- Glynn M. A. (1996), "Innovative Genius: A framework for relating individual and organizational intelligences to innovation", *Academy of Management Review*, 21, pp. 1081-1111.
- Guilford J. P. (1967), *The Nature of Human Intelligence*, McGraw-Hill, New York.
- Hargadon A. B., Bechky B. A. (2006), "When Collections of Creatives Become Creative Collectives: A Field Study of Problem Solving at Work", *Organization Science*, 17(4), pp. 484-500.
- MacKinnon D. W. (1965), "Personality and the realization of creative potential", *American Psychologist*, 20, pp. 273-281.
- Madjar N., Oldham G. & Pratt M. G., 2002, "There's no place like home? The contributions of work and nonwork creativity support to employees' creative performance", *Academy of Management Journal*, 45 (4), pp. 757-767.
- O'Quin K., Besemer S. P. (2006), "Using the Creative Product Semantic Scale as a Metric for Results-Oriented Business", *Creativity and Innovation Management*, 15(1), pp. 34-44.
- Ochse, R. (1990), *Before the Gates of Excellence: The determinants of creative genius*, Cambridge University Press, Cambridge.
- Oldham G. R., Cummings A. (1996), "Employee creativity: Personal and contextual factors at work", *Academy of Management Journal*, 39, pp. 607-634.
- Perry-Smith J. E., Shalley C. E. (2003), "The social side of creativity: a static and dynamic social network perspective", *Academy of Management Review*, 28 (1), pp. 89-106.
- Perry-Smith J. E., 2006, Social yet creative: the role of social relationship in facilitating individual creativity, *Academy of Management Journal*, Vol. 49, No. 1, pp. 85-101.
- Pirola-Merlo A., Mann L. (2004), "The relationship between individual creativity and team creativity: aggregating across people and time", *Journal of Organizational Behavior*, 25, pp. 235-257.
- Rank J., Pace V. L., Frese M. (2004), "Three Avenues for Future Research on Creativity, Innovation, and Initiative", *Applied Psychology: An International Review*, 53 (4), pp. 518-528.
- Shalley C. E. (1995), "Effects of coaction, expected evaluation, and goal setting on creativity and productivity", *Academy of Management Journal*, 38 (2), pp. 483-503.
- Shalley, C. E., Zhou J. & Oldham, G. R. (2004), "Effects of personal and contextual characteristics on creativity: Where should we go from here?", *Journal of Management*, 30, pp. 933-958.
- Singh, B. (1986), "Role of personality versus biographical factor in creativity. Psychological Studies, 31: 90-92.
- Sundgren M., Dimenaes E., Gustafsson J. E. & Selart, 2005, Drivers of organizational creativity: a path model of creative climate in pharmaceutical R&D, *R&D Management*, Vol. 35, No. 4 , pp. 359-374.
- Taggar S. (2002), "Individual Creativity and Group Ability to Utilize Individual Creative Resources: A Multilevel Model", *Academy of Management Journal*, 45 (2), pp. 315-330.
- Torrance E. P. (1974), *The Torrance tests of creative thinking*, Scholastic Testing Service, Bensenville, Illinois.
- Unsworth K. (2001), "Unpacking Creativity", *The Academy of Management Review*, 26 (2), pp. 289-297.
- Weick K. E. (1995), *Sensemaking in organizations*, Sage, Thousand Oaks CA.

-
- West, M. A. (2002), "Fountains or stagnant ponds? An integrative model of creativity and innovation implementation in work groups", *Applied Psychology*, 51(3), pp. 355-387.
- West M. A., Farr J. L., (edited by) (1990), *Innovation and creativity at work: Psychological and organizational strategies*, Wiley, Chichester.
- Williams F. (1993), "Test TCD della creatività e del pensiero divergente", Erickson, Trento, *Creativity Assessment Packet* (1993) PRO-ED, Austin, Texas.
- Woodman R. W., Sawyer J. E., Griffin R. W. (1993), "Toward a theory of organizational creativity", *Academy of Management Review*, 18(2), pp. 293-321.
- Zhou J., George J. M. (2001), "When Openness to Experience to Experience and Consciousness are Related to Creative Behaviour: an Interactional Approach", *Journal of Applied Psychology*, 86(3), pp. 513-524.

