Exchange of Ideas and Creative Productivity: An Experiment*

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Abstract

This paper reports the results of idea generation experiment. Observing ideas generated by others causes increase in individual's output. The magnitude of this effect grows with the ability to generate ideas by her own, reaching 20% productivity increase for a median participant. Consistent with this result, more creative individuals are ready to pay more to acquire ideas of others. However, more than 25% of the participants fail to make an efficient investment decision (7% underinvest and 20% overinvest). Two possible explanations of this finding are suggested: over-/under- confidence of the participants with different creative ability and differences in their risk attitudes.

Keywords: Creativity, Productivity, Exchange of Ideas, Efficiency.
JEL Classification: A12, C91, D24, D81.

1 Introduction

Multiple anecdotal evidence and modern network analysis suggest that creative productivity and the structure of social connections are interrelated. The academia turns to be a small world network with a core consisting of the most active authors (Goyal et.al. [12]), the most successful managers span the structural holes in the professional networks (Burt [3]). This can occur for two (or a combination of both) reasons: (i) more productive individuals *choose* to form more connections and (ii) one *becomes* more productive because of the connections. Productivity and the structure of connections might have endogenous nature in real networks. Pessimistic expectations about potential benefits of collaboration may limit the connections possibility set for the individuals of low productivity when the relationship requires reciprocity. Highly

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productive individuals may have little time to dedicate to collaboration. Availability of resources, personal traits may affect both: the productivity and the strategy of connections formation. This paper uses experimental approach to assess the casual effects that productivity and connections yield, overcoming the biases due to endogeniety.

In addition to classical communication channels used by creative professionals (e.g., conferences for scientists, exhibitions for artists, etc.), online platforms are becoming adjusted or created for similar purposes (e.g., facebook, myspace, flikr, ideas, Kublai, etc.). In spite of being very different in their design and the essence (some provide an opportunity to get feedback, discuss, find potential collaborators, etc.), all of them have one common feature - exchange of ideas. In the present paper we shall concentrate our attention exclusively on information (ideas) exchange attribute of connections, as a universal for any creative profession.

This paper reports a two-phase experiment on creative production. In the first phase, agents face an idea generation task, which we use to estimate subjects' creativity. Then, the most original ideas are collected to the 'bank of ideas', observed by the treatment group participants and unavailable to the control group. We compare subsequent performance of these two groups to infer if ideas of others help to increase productivity in creative tasks. In the second phase of the experiment, agents face similar creative environment, but unlike in the previous one, the participants *decide* whether to make a costly investment in the acquisition of ideas or not. Using the information from both phases, we evaluate efficiency of the decisions made by the agents.

We find that observing ideas of others leads to significantly higher creative performance. The magnitude of the effect grows with individual's ability to generate ideas by her own, reaching 20% productivity increase for a participant of median creative ability. It implies that the opportunity cost of investment in ideas of others rises with own creativity. Consistent with this result, we find that more creative individuals are ready to pay more to acquire ideas of others. However, a significant portion of the participants fails to make an efficient investment decision: 7% of individuals underinvest, 20% - overinvest. Two possible explanations of this finding are suggested: over-/under- confidence of the participants with different creative ability and differences in their risk attitudes.

As to our knowledge, there are no studies in economics reporting casual effects of productivity on willingness to acquire ideas of others. However, it was demonstrated that observing ideas of colleagues has positive impact on own performance in idea generation task (Paulus and Yang [17], Dugosh et. al. [8], Nijstad et. al. [15]). Nijstad and Stroebe [16] explain: "ideas of others help to retrieve categories of ideas, they will increase the diversity of idea production".

The present paper contributes to idea generation analysis by relating own creativity with the effect of idea exchange on own productivity. It also makes a first attempt to evaluate the efficiency of investment decisions in a creative environment

in the laboratory. Given the results, in order to achieve social efficiency in a system with ideas exchange, an external intervention (in form of advise, monetary or non-monetary subsidies, etc.) is required.

The paper is arranged as follows. Section 2 describes the experiment design, Section 3 sketches the model of idea generation in our environment, Section 4 reports and discusses results on opportunity cost distribution and investment decisions and Session 5 concludes, lists possible applications and outlines the guideline for further development of the project.

2 Experimental design

2.1 Background

There are two main approaches to measuring creativity. The first relies on expert opinion regarding the quality of participants' performance in non-quantifiable creative tasks (such as thinking of heading for a story in Eisenberg and Rhoades [9], and developing rebus-puzzles in Kachelmeier et. al. [14]). Alternatively, creativity can be measured as a number of different ideas generated. We take the second approach in this quality/quantity trade-off , being motivated by three following considerations. First, as Stroebe and Diehl [18] show - quantity and quality of ideas are strongly correlated. Second, incentivizing just quantity (opposed to incentivizing both quantity and quality) produces higher quality-weighed quantitative results as suggested by experiment of Eisenberg and Rhoades [9]. And third, expert opinion can be noisy, subjective and effort-demanding. Keeping all this in mind, we believe that (properly incentivized) number of ideas generated gives a reliable measure of individual's overall creativity.

In our experiment we rely on [modified] graphical part of Torrance's test of divergent thinking[1] (Torrance [19]), which consists in following. A participant is given a sheet of paper containing the same repetitive workpiece (a geometric form). The task is to make as much as possible schematic drawings of *different* objects incorporating only one given geometric element in each drawing. Creative output is measured as a total number of distinct drawings produced. Figure 1 contains examples of outputs corresponding to the different geometrical forms used in the experiment in three consecutive phases: circles, crosses and Ts. This Torrance's task is easy to implement in the lab as it takes short time and doesn't require any specific knowledge or skill other than divergent thinking, thus is appropriate for participants with any educational/professional background.

The experiment is designed to assess the individual productivity in idea generation, effect of observing output of others on own consequent performance and efficiency of investment decisions in ideas acquisition. One can interpret the individual effects of observing ideas as an opportunity cost of investment. The artificial environment created in the laboratory allows for 'ideas exchange' - the main feature

[1] Divergent thinking is a thought process or method used to generate creative ideas by exploring many possible solutions (Wikipedia, [21]).

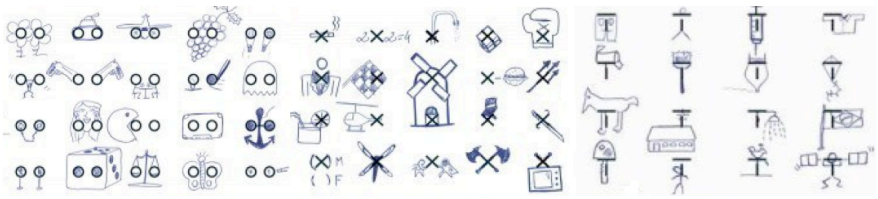

Figure 1: Examples of creative exercise

of all interaction channels used by creative professionals.

The experiment itself consists of two parts: (i) Creative production part (one phase) and (ii) Investment part (two phases), each described in the following subsections. It was conducted in LaTeX laboratory of University of Alicante in July 2012. Subjects were randomly selected from a pool of undergraduate students of different fields of study. In total 52 subjects have participated: (A) 30 subjects played both (i) and (ii), forming the Treatment Group; and (B) 22 subjects played just (i), constituting the Control Group. Each individual participated only in one session. The participants of type (A) were paid one randomly selected phase of the experiment, the participants of type (B) - the only phase that they have played, with average payment of 9,5 EUR per hour. After performing the experimental tasks all the participants were asked to complete a brief questionnaire containing questions on their basic socioeconomic and demographic background. Full instructions of the experiment can be found in the Appendix.

2.2 Creative production part (Phase 1)

The participants were randomly assigned to Treatment and Control group, corresponding to different sessions of the experiment. Both groups were performing Torrance's graphical task (with double-circle geometrical form) for 10 minutes. Treatment group participants have observed two relevant[2] drawings during this time at zero cost, while Control group didn't observe any example. The timeline of this part is described in Table 1.

Table 1: Creative Production Part Timeline

Stage/Time	Treatment Group (T)	Control Group (C)
Stage 1/min [0,7)[3]	Torrance's graphical task	
Receive	1st free example	Nothing
Stage 2/min [7,9)	Torrance's graphical task	
Receive	2nd free example	Nothing
Stage 3/min [9,10]	Torrance's graphical task	

[2] Distinct from what an individual has already done. All the ideas were taken from the common 'Bank of Ideas' formed by pooling the least common ideas of a pilot experiment, see Appendix, Figure A.

[3] 6 minute was enough to draw all the ideas the participants had. Only 2 participants have reported that they still had non-drawn ideas at the beginning of Stage 2.

The subjects were encouraged to develop their own ideas and not to copy by considering only distinct (from each other and from examples provided) drawings for payment. Control group participants were paid 0,25 EUR per drawing, Treatment group - 0,5 EUR in case this phase was chosen to be paid.

Observing an example of drawing represents the result of costless ideas' exchange. The results of this part allow to estimate individual effects of 'idea sharing' on the future creative output and calculate opportunity costs of investment in ideas.

2.3 Investment part (Phases 2 and 3)

Only Treatment group was subject to this part [4]. Here the participants had to make investment decisions while performing Torrance's graphical task: to pay a price and acquire a relevant example or not to invest. Investment cost was randomly assigned to each individual and ranged from 0,5 EUR to 3 EUR per example. The tasks of this part were consecutively repeated for two remained geometrical forms: x-form (Phase 2) and T-form (Phase 3). Table 2 provides the timeline of this part.

Table 2: Investment Part Timeline

Stage/Time	Task
Stage 1/min [0,7)	Torrance's graphical task
Observe price	Investment decision
Stage 2/min [7,9)	Torrance's graphical task
	Investment decision
Stage 3/min [9,10]	Torrance's graphical task

In case the phase was chosen to be paid, the participants received 0,5 EUR for each of the drawings produced in a given phase minus the total investment cost (if occurred) in this phase.

This part of the experiment is designed to assess efficiency of investment decisions made by the participants in the creative environment.

3 Model

Consider an individual i facing a creative task. In the contest of our experiment there are two factors, which determine creative production: individual's ability to create, c_i and availability of ideas produced by other people, d.

In this environment availability of other's ideas is the only [but not necessary] variable input for production of ideas. Individual's ability to create constitutes an individual-specific production technology. The total output produced, y_i is a sum of own initial output and additional output due to observing ideas of others. The first can be represented as an increasing function of ability to create - $f(c_i)$, constituting technology in production without inputs, and the second by $g(c_i)$ - representing

[4] Control group participants didn't have costless investment experience and thus didn't have sufficient information to make rational decisions.

technology according to which individual exploits or interprets ideas. The general form of production function is:

$$y_i(c_i, d) = f(c_i) + d \times g(c_i), \tag{1}$$

where $d = 1$ when input is available and $d = 0$ otherwise. Note that in absence of any creative ability nothing should be produces, i.e. $y_i(0, d) = 0$. The production function is additively separable due to different technologies used to produce parts of output.

When our individual faces investment cost θ, she should invest if $c_i > g^{-1}(\theta)$ in case of increasing function $g(c_i)$ and $c_i < g^{-1}(\theta)$ otherwise.

Linear approximation of (1) through origin will be:

$$y_i(c_i, d) = \alpha c_i + \beta(d \times c_i) + u_i \tag{2}$$

and can be estimated by OLS. If β is positive, we can conclude that more creative people are better interpretators too. The opportunity cost of an investment can be approximated with $\hat{\beta} c_i$.

4 Results

4.1 Creative Production part: Treatment Effects

In this Section we estimate the productivity increases in our idea generation task due to observation of ideas of others.

The average number of drawings during the first 6 minutes of Torrance's task is not statistically different between Treatment and Control Groups participants[5] (10,5 vs 10,77). At individual level, the creative production of this stage is determined exclusively by individual's creative ability. We use it a proxy for person's creativity when estimate (2).

Figure 2 reports on the additional pictures drawn in Stages 2, 3 and their sum for all population and two subgroups of individuals. The Treatment Group (TR) participants have produced on average 1,07 (18%) drawings more in two stages compared to the Control Group (C) participants (6,93 and 5,86 respectively) as 'Total' depicts. 'Lower' includes the individuals performed worse than the median participant in the Stage 1, 'Upper' includes those who performed better than the median. For Upper group the difference between creative production of TR and C is greater than in the Lower group, and the gap observed in Total can be attributed to the Upper group, suggesting increasing returns to inputs for more creative individuals.

[5] There is no systematic difference across treatments in age, sex composition and other observable characteristics. For more statistics see Appendix, Table A.

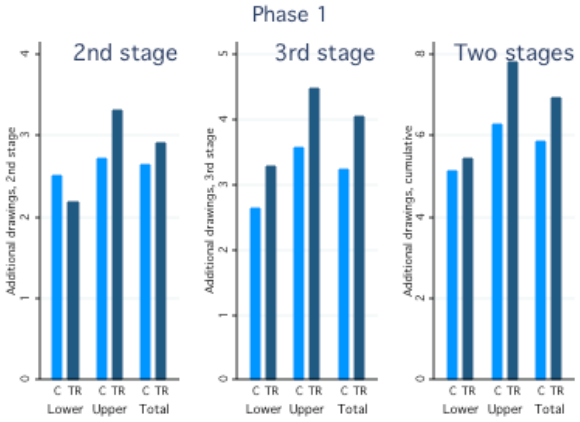

Figure 2: Treatments effect: total and by initial creative ability

Table 3: Additional drawings: Average Treatment Effects Phase 1
Dependent variable - number of pictures drawn in Stages 2 and 3

	(1)		(2)	
	(a)	(b)	(a)	b
Treatment dummy	1,1914	1,3734		
	(0,5956)*	(0,5598)**		
Initial creative ability	0,4462	0,5295	0,3923	0,5240
(drawings in Stage 1)	(0,0996)***	(0,0386)***	(0,9993)***	(0,3987)***
Treatment dummy*			0,1248	0,1332
Initial creative ability			(0,0533)**	(0,0535)**
Constant	1,0562	NA	1,5597	NA
	(1,1637)		(1,0873)	

Standard errors in parentheses: * significant at 90%, ** at 95%, *** at 99%

(1) ATE with control, (2) Non-constant ATE,

(a) non-zero constant term, (b) zero constant term

Table 3 reports the estimates of treatment effect (receive two examples of drawing) on the additional output produced (Stages 2 and 3 of Phase 1). Results are similar with and without imposing zero constant term (as discussed in Section 3). The Average Treatment Effects are estimated to be 1,19 (non-zero constant term) and 1,37 (zero constant term) additional pictures compared to the Control Group (p-value=0,051 with non-zero and p-value=0,016 in case of zero constant term, two-sided t-test).

Column (2) of Table 3 contains the estimates of Non-Constant Treatment Effect by interacting the Treatment Dummy with initial creative ability of an individual. The additional drawings grow on average by 0,1248 (0,1332 in the specification with zero constant term) for each initial drawing, the estimate is statistically significant

at 95% level. So, confirming the intuitive results from Figure 2, the estimated $\hat{\beta}$ from equation (2) is positive, suggesting that the individuals with higher initial creative ability are better 'interpretators' as well, they deduct more use of examples and convert them into output at higher rate than their less creative experiment-mates. Using this estimate, we calculate the predicted opportunity cost of investment for each individual as $\hat{\beta}c_i$. Given these results, a person of average initial creativity (10 in our sample) should be ready to pay up to 0,6 EUR to obtain the examples.

Only initial creativity has significant impact on the size of Treatment Effect - neither of collected socio-demographic characteristics does alter it as indicated by insignificant estimated effects on additional drawings of interactions with dummies for gender, field of study and with the age of subject.

4.2 Investment Part: Buying Examples

This Section analyses the efficiency of individuals' investment decisions. More creative individuals are predicted to invest more due to higher opportunity costs of such investment, so we expect to find differences in the investment behavior by initial creativity levels.

Figure 3 (Panel A) depicts the investment decisions by initial creativity subgroups: Upper Group, as predicted, invests significantly more than the Lower, and, in general, more investment occurred in the stage with x-geometric form compared to Ts.

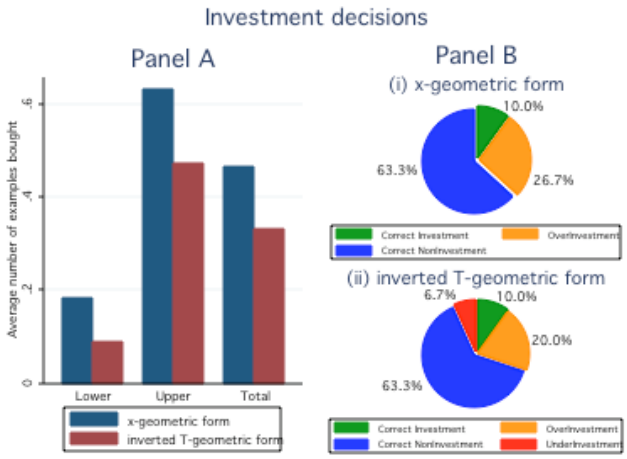

Figure 3: Panel A: Purchases. Panel B: Efficiency analysis.

Regression analysis suggest that each additional drawing in the very first stage is associated with 6% *increase* in probability to invest at least once (the coefficient is significant at 95% level), confirming our earlier predictions. The price of an example also is important for a decision to invest: an increase in price in 1 EUR is associated with significant 25% *decrease* in probability to invest at least in one example during

a Phase, as the Law of Demand suggests. The investment decisions are not affected neither by previously drawn in this phase pictures, nor by additional drawings in the previous phase, nor by total number of drawings in the previous stage[6], nor by any socio-demographic variable that we trace in our dataset.

Using the estimates from the previous Section, we calculate predicted opportunity cost of investment for each participant. Basing on these predicted values, we categorize the participants' investment decisions: Correct investment (invested and had predicted opportunity cost higher than the price), Overinvestment (invested while opportunity cost was lower than the price), Correct non-investment (not invested, opportunity cost higher than the price) and Underinvestment (not invested while had opportunity cost exceeding the price).

As Panel B of Figure 3 depicts, 73,3% of all participants made the 'correct' investment decisions: 10% have invested and 63,3% haven't in both Phases 2 and 3. 26,7% and 20% have overinvested in the examples in Phase 2 and Phase 3 respectively. There is no underinvestment in Phase 2 while 6,7% underinvested in Phase 3. More than a quarter of the participants failed to make an efficient investment decision according to our estimates.

Looking closer at the profile of inefficient investors gives the following evidence. Overinvestors are significantly more creative in comparison to underinvestors (12 vs 9 initial drawings, p-value=0,06), however, there is no difference neither in initial creativity nor in any observable demographic factors for correct investors and overinvestors as well as for correct non-investors in comparison to underinvestors[7]. So characteristics other than initial creativity might lead to this inefficient behavior. A plausible explanation is that some individuals over- and under-estimate the effect of example or their ability. Our finding is quite in line with overconfidence literature, suggesting that people tend to overestimate own ability when facing an easy task (as those initially highly creative) and underestimate when facing a difficult task (as those with low levels of initial creativity) as in Hoelzl and Rustichini [13]. An alternative explanation would point to the possible difference in risk or ambiguity attitudes between the subjects of different creative ability. Those who are willing to tolerate more risk or more ambiguity might overinvest, while extremely risk- or ambiguity- averse - underinvest.

As the more creative individuals are expected to self-select into investment, the effect of observing an example cannot be interpreted as Average Treatment Effect[8]. If all the investment decisions were efficient, we should expect upward biased estimate of investment on the output and profits. But the investment dummy (as well as its interaction with initial creativity) has insignificant effect on the additional pictures produced. In terms of average profit the investors are not better-off than non-investors. It cannot occur due to prevailing effect of over- investment in compar-

[6] See appendix, Tables B and C

[7] Females make less efficient decisions but not significantly, which may be a problem of small sample size

[8] See appendix, Tables D and E

ison to under-investment effect since removing inefficient individuals holds the same result. It only can be driven by the fact that a lot of very creative (and possibly rational) individuals couldn't afford buying examples since the randomly assigned price was too high for them in comparison to potential benefits (as indicated by high share of correct non-investors in Figure 2, Panel B).

5 Conclusions

Our experiment relies on a very simple creative environment aimed to mimic communication between creative professionals (exhibitions, conferences, etc.), excluding any communication channel distinct from observing: no discussions, no feedback. In this sense, our experimental environment is close in spirit to on-line communities with restricted opportunities to discuss or noisy feedback (like youtube, facebook or flikr), where observing what others are doing is the main activity one can undertake. In broader view, one can view the experimental results as a lower bound of potential benefits from creative communication.

Under our findings, level of own creative ability positively influences the productivity increase when observing creative output of others. We don't observe the prevalence of 'secondary' creators who are better in interpreting or exploiting ideas of others than in creating their own. If we were about to establish a community with costly entry, only the ones with opportunity cost greater than a fee (or other non-monetary cost of entry such as effort, time cost, etc.) would enter. These people are the most creative part and thus, have valuable things to share. So under the hypothesis that the entry decisions are efficient, such a community would create social surplus. Our results indicate that significant share of the participants fail to make efficient investment decisions: more creative overinvest, less creative underinvest, questioning the surplus generation and overall system efficiency.

The experiment discussed in this paper constitutes a first step in our future project "Creativity and networking", which aims building a network of interacting creators (where they share *own* ideas, instead of buying them from the experimentor), facing the risk to get a bad one. Previous experiments conducted to deal with equilibrium network structure and the process of network formation (see for example Callander and Plott [4], Berninghaus et. al. [2], Charness et. al. [5], Corbae and Duffy [7], Goeree et. al. [11]) impose the agent's heterogeneity in costs of forming a link. The aim of this project is to evaluate an equilibrium structure and efficiency of a network with an endogenous mechanism of cost determination.

Being defined as a sum of all participants' payoffs (Bala and Goyal [1]), the efficiency of a network with heterogeneous agents is determined by its structure (Galeotti et. al. [10]). Observing agent's inefficient decisions to connect, network manager might adjust certain parameters (e.g. individual connection costs or benefits) to induce 'better' network structure according to her purpose: total social welfare or other output of interest. This kind of analysis may be useful for evaluating investment in establishing new networks of creative professionals.

References

[1] Bala, V., Goyal, S., "A Noncooperative Model of Network Formation", *Econometrica*, 68(5), 2000, 1181-1229

[2] Berninghaus, S. K., Ehrhart, K. M., Ott, M., "A Network Experiment in Continuous Time: The Influence of Link Costs", *Experimental Economics*, 9, 2006, 237-251

[3] Burt, R. S., "Structural Holes and Good Ideas", *American Journal of Sociology*, 110(2), 2004, 349-399

[4] Callander, S., Plott, C. R., "Principles of Network Development and Evolution: An Experimental Study", *Journal of Public Economics*, 89, 2005, 1469-1465

[5] Charness, G., Corominas-Bosch, M., Frechette, G. R., "Bargaining and Network Structure: An experiment", *Journal of Economic Theory*, 136, 2007, 28-65

[6] Christensen, P. R., Guilford, J. P., Wilson, R. C., "Relations of Creative Responses to Working Time and Instructions", *Journal of Experimental Psychology*, 53 (2),1957, 82-88

[7] Corbae, D., Duffy, J., "Experiments with Network Formation", *Games and Economic Behavior*, 64, 2008, 81-120

[8] Dugosh, K. L., Paulus, P. B., Roland, E. J., Yang, H., C., "Cognitive Stimulation in Brainstorming", *Journal of Personality and Social Psychology*, 79, 2000, 722-735

[9] Eisenberg, R., Rhoades, L., "Incremental effects of Reward on Creativity", *Journal of Personality and Social Psychology*, 81, 2001, 728-741

[10] Galeotti, A., Goyal, S., Kamphorst, J., "Network Formation with Heterogeneous Players", *Games and Economic Behavior*, 54, 2006, 353-372

[11] Goeree, J. K., Riedl, A., Ule, A., "In Search of Stars: Network Formation among Heteroheneous Agents", *Games and Economic Behavior*, 67, 2009, 445-466

[12] Goyal, S., van der Leij, M.J., Moraga-Gonzalez, J.L., "Economics: An emerging small world", *Journal of Political Economy*, 114(2), 2006, 403-412

[13] Hoelzl, E., Rustichini, A., "Overconfident: Do You Put Money On It?", *The Economic Journal*, 115, 2005, 305–318.

[14] Kachelmeier, S. J., Reichert, B. E., Williamson, M. G., "Measuring and Motivating Quantity, Creativity, or Both", *Journal of Accounting Research*, 46, 2008

[15] Nijstad, B. A., Stroebe, W., Lodewijkx, H. F. M., "Cognitive Stimulation and Inference in Groups: Exposure Effects in an Idea Generation Task", *Journal of Experimental Social Psychology*, 38, 2002, 535-544

[16] Nijstad, B. A., Stroebe, W., "How the Group Affects the Mind: A Cognitive Model of Idea Generation in Groups", *Personality and Social Psychology Review*, 10(3), 2006, 186-213

[17] Paulus, P. B., Yang, H., C., "Idea Generation in Groups: A Basis for Creativity in Organizations", *Organizational Behavior and Human Decision Process*, 82, 2000, 76-87

[18] Stroebe, W., Diehl, M., "Why Groups Are Less Effective than Their Members:

On Productivity Losses in Idea-Generating Groups", *European Review of Social Psycholigy*, 5, 1994, 271-303

[19] Torrance, E.P., "Torrance Tests of Creative Thinking", 1974, Scholastic Testing Service, Inc.

[20] Wikipedia, Online Encyclopedia, http://en.wikipedia.org/wiki/Creativity

[21] Wikipedia, Online Encyclopedia, http://en.wikipedia.org/wiki/Divergent_thinking

6 Appendix

6.1 Additional Figures and Tables

Figure A: Examples suggested to the participants[9].

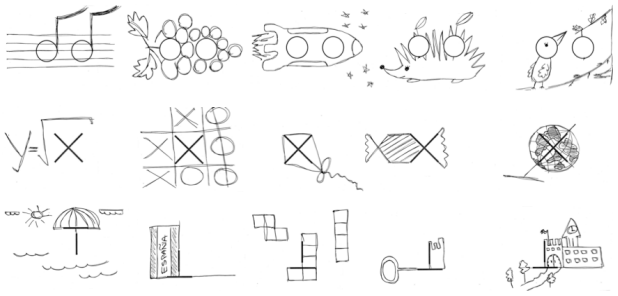

Table A: Discriptive statistics, Phase 1

	All observations	Control group	Treatment group
Drawings in Stage 1	10,6153	10,7727	10,5000
	(2,9846)	(3,4769)	(2,6228)
Drawings in Stage 2	2,7884	2,6364	2,9000
	(1,3480)	(0,9535)	(1,5833)
Drawings in Stage 3	3,6923	3,2272	4,0333
	(1,6749)	(1,6599)	(1,6291)
Drawings in Stages 2 and 3	6,4808	5,8636	6,9333
	(2,5243)	(2,0998)	(2,7409)
Female	0,4807	0,4545	0,5000
	(0,5045)	(0,5096)	(0,50854)
Age	22,7308	23,4091	22,2333
	(3,1506)	(3,7117)	(2,6220)
Observations	52	22	30

Standard errors in parentheses

[9] The examples were suggested in the presented order for each geometric form. In case the individual already had the example proposed, the next by order was suggested and so on. Never more then one change was needed, one change was needed in 4 cases.

Table B: Investment decision, Phase 2

Dependent variable - decision to invest at least once (dummy)

	(1)	(2)	(3)	(4)
Drawings in Stage 1,	0,0204			
Phase 2	(0,0232)			
Drawings in Stage 1,		0,0668		
Phase 1		(0,0300)**		
Drawings in Stages 2 and 3			0,0212	
Phase 1			(0,0317)	
Total drawings				0,02770
Phase 1				(0,1720)
Price of an example	-0,2365	-0,2240	-0,2552	-0,2527
Phase 2	(0,0969)**	(0,0906)**	(0,1000)**	(0,0944)**
Constant	0,5700	0,0573	0,6641	0,3375
	(0,3100)	(0,3720)	(0,2619)**	(0,3394)

Table C: Investment decision, Phase 3

Dependent variable - decision to invest at least once (dummy)

	(1)	(2)	(3)	(4)
Drawings in Stage 1,	0,0250			
Phase 3	(0,0213)			
Drawings in Stage 1,		0,0746		
Phase 1		(0,0301)**		
Drawings in Stages 2 and 3			0,0449	
Phase 1			(0,0327)	
Total drawings				0,0378
Phase 1				(0,0174)**
Price of an example	-0,1186	-0,1061	-0,0775	-0,0752
Phase 3	(0,0981)	(0,0910)	(0,1032)	(0,0955)
Constant	0,2170	-0,2980	0,1244	-0,2267
	(0,3215)	(0,3743)	(0,3448)	(0,3885)

(1) Price and drawings in Stage 1 Phase 2, (2) Price and drawings in Stage 1 Phase 1, (3) Price and drawings in Stages 2 and 3 Phase 1, (4) Price and total drawings Phase 1

Standard errors in parentheses: * significant at 90%, ** at 95%, *** at 99%

Table D: Additional drawings: Investment Effects Phase 2
Dependent variable - number of pictures drawn in Stages 2 and 3

	(1)	(2)		(3)	
		(a)	(b)	(a)	(b)
Investment dummy	1,1196	-0,2297	-0,1724		
	(1,0327)	(0,9260)	(0,8908)		
Initial creative ability		0,6483	0,5992	0,6813	0,6084
(drawings in Stage 1)		(0,1731)***	(0,0498)***	(0,1815)***	(0,0503)***
Investment dummy*				-0,0455	-0,0345
Initial creative ability				(0,0802)	(0,0749)
Constant	5,7894	-0,5226	NA	-0,7571	NA
	(0,6254)***	(1,7624)		(1,8100)	

(1) Mean comparison, (2) With control, (3) Non-constant effect
(a) non-zero constant term, (b) zero constant term
Standard errors in parentheses: * significant at 90%, ** at 95%, *** at 99%

Table E: Additional drawings: Investment Effects Phase 3
Dependent variable - number of pictures drawn in Stages 2 and 3

	(1)	(2)		(3)	
		(a)	(b)	(a)	(b)
Investment dummy	0,4286	-0,9872	-1,1385		
	(1,0625)	(1,0291)	(0,9731)		
Initial creative ability		0,5754	0,6658	0,6049	0,6715
(drawings in Stage 1)		(0,1828)***	(0,0493)***	(0,1908)***	(0,0787)***
Investment dummy*				-0,0933	-0,1050
Initial creative ability				(0,0862)	(0,0787)
Constant	6,5714	0,9539	NA	0,6905	NA
	(0,5819)***	(1,8557)		(1,9087)	

(1) Mean comparison, (2) With control, (3) Non-constant effect
(a) non-zero constant term, (b) zero constant term
Standard errors in parentheses: * significant at 90%, ** at 95%, *** at 99%

6.2 Instructions sample (translation from Spanish)

The purpose of this experiment is to study the behavior on decision making. Do not think that it is expected a special behavior from you. However, be aware that your decisions will affect the money you can earn during the experiment. These instructions will explain you the rules of the experiment. Instructions are identical for all participants. The anonymity of the participants and their decisions is also guaranteed.

Please, it is important that you do not talk to nor disturb other participants. If you need help, raise your hand and wait in silence. Someone will come to you as soon as possible.

The experiment

This experiment consists of three Stages (and each stage consists of 3 phases). Your total earnings in the experiment will be determined at the end of it, as a sum of three phases of a randomly chosen stage.

Stage 1

Phase 1

All the task of this phase have to be done with BLUE color pen, which you already have on your table. Phase 1 begins once we finish reading instructions and will last 6 minutes.

In this phase you will get a sheet of paper containing cells with geometric forms, some of them you will complete to get a drawing of a concrete object (precise, definite). Each drawing has to stay inside of a cell. A drawing can be very schematic, the quality of the drawing doesn't have any importance, but it has to be clear which object are you referring to. You are free to rotate the form and skip some cells.

Figure 1

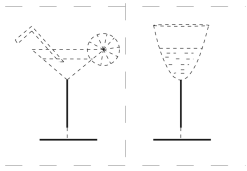

Figure 2

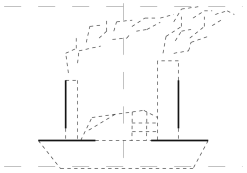

Figure 3

Your earnings in this phase will be determined as follows. For each unique drawing you will receive 50 cents. So, to earn more money, you task is to make as much as possible different drawings.

Figure 1 contains an example of the sheet. In this example each drawing should contain just one of the T-inverses.

Figure 2 shows two examples of drawings with this form. Given that both use T-inverse as a base for the glass, these two drawings cannot be considered as different. In this case the participant will receive just 50 cents as for one drawing.

Figure 3 gives an example of a drawing using two geometric forms. This drawing intersects the boundary of the cell, which is prohibited by the rules. In this case the participant will receive 0 cents for the drawing of a boat.

Summarizing, the total amount of money you can get in this phase depends on the number of conceptually unique drawings that you do.

Phase 2

All the task of this phase have to be done with BLACK color pen, which you already have on your table. Phase 2 starts after reading the instructions and will last 2 minutes. In this phase we will give you an example of a drawing which you haven't done in the previous phase and which uses given geometric form. This example is just for you, it is important not to show it to any other participant and not to try

to see the examples of others. To assure that you receive a NEW example, please, if the envelope contains the drawing that you already did, rise your hand and we will give you another drawing.

After receiving an example, in the same sheet of paper we gave you at the beginning of the experiment, your task is to continue drawing as much drawings as you can, that contain given geometric form.

The requirements are the same as in the previous phase: each drawing has to be inside of a cell, can be very schematic, the quality doesn't matter, but has to be understandable which object you are referring to. It's OK to skip some cells. It's not OK to draw the same example we gave you.

Your earnings in this phase have the same structure as the previous one: for each unique drawing you can receive 50 cents. So, the total earnings in this phase depend just on the number of unique drawings you produce in these 2 minutes.

Phase 3

Repeats Phase 2 with another examples suggested.

Stages 2 and 3

Phase 1

Repeats Stage 1 Phase 1 (without examples)

Phase 2

All the task of this phase have to be done with BLACK color pen, which you already have on your table. Phase 2 starts after reading the instructions and will last 2 minutes. In this phase you can BUY an example of a drawing which you haven't done in the previous phase and which uses given geometric form. This example would be just for you, it is important not to show it to any other participant and not to try to see the examples of others. To assure that you receive a NEW example, please, if the envelope contains the drawing that you already did, rise your hand and we will give you another drawing.

After this an example, in the same sheet of paper we gave you at the beginning of the experiment, your task is to continue drawing as much drawings as you can, that contain given geometric form.

The requirements are the same as in the previous phase: each drawing has to be inside of a cell, can be very schematic, the quality doesn't matter, but has to be understandable which object you are referring to. It's OK to skip some cells. It's not OK to draw the same example we gave you.

Your earnings in this phase have the following structure: for each unique drawing you can receive 50 cents minus the total investment cost (if occurred). So, the total earnings in this phase depend on the number of unique drawings you produce in these 2 minutes AND your investment decision.

Phase 3

Repeats Phase 2 with another examples suggested.