An Update and Generalization of Group Unconscious Orientation in OMIE[1] Group Training for Therapists

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ABSTRACT

Introduction: this paper presents an update of a previous study we conducted to explore the presence and behavior of a common orientation among the participants to a group training for therapists via their answers to an "absurd questionnaire". Having measured a second class of trainees during their training, we are able to compare the results with those obtained by the first measurement.

Methods: as in the previous study, during the training we have submitted to the trainees 11 questionnaires composed of 50 pairs of images asking them to choose one image from each pair. We have then analyzed their initial picture choices and how they evolved over time. We also present the analysis of the combined data of both experiments.

Results: In both experiments we found statistical evidence that both the initial choices of the pictures and their evolution during the training are not simply governed by randomness. The initial picture choice in each pair is highly skewed toward one of the two pictures, and there is a statistically significant change in the picture choice in the first part of the training in both experiments.

Conclusions: The results could be interpreted as a manifestation of group dynamics postulated by Bion with his "basic assumptions". We see patterns that suggest an initial "honey moon" (dependence from the leader) followed by a "fight-flight" attitude (frustrated dependence from the leader) and finally a "mourning" of the group and of the training experience. In spite of some statistically significant differences between the two experiment, the behavior is largely compatible. Bion himself used to say that "as you never bath yourself twice in the same river, you never enter twice the same group", being every human assembly unique and singular.

Key Words: Group dynamics, Entropy, Basic assumptions, Group work, Group orientation

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Introduction

The human being is a gregarious animal in its essence, and group phenomena occupy and determine a very large portion of our everyday life (Anzieu and Martin, 1997). Group phenomena have been exploited since the dawn of human civilization to organize social life, and they have been studied even before the invention of the psychoanalysis (le Bon, 1895). With the advent of psychoanalysis, group phenomena have been studied in-depth (Bion, 1961; Foulkes, 1964) on the basis of the complementary hypotheses of the existence of a "group psyche" similar in nature to the

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psyche of the single individual and of the "groupal" nature of the individual psyche (Kaës, 2010). These studies have been at the origin of the so called "group-analysis", whose object of study is the psychodynamic of the group as an entity and of the relations between its members and the group itself.

In its seminal work on group dynamics, once established the hypothesis of the existence of a group psyche, Bion (1961) proceeds to describe the universal principles ("basic assumptions") that govern the behavior of the group and its evolution in time, in constant interaction with the specific realities and contingent conflicts that characterize any gathering of human beings (Bion, 1961; Foulkes, 1964; Vergopoulo, 1983).

The beginning of the 20th century has witnessed other major intellectual revolutions beyond the invention of the psychoanalysis, most notably the discovery of the quantic nature of physic reality at very small scales. It is remarkable that two of the first and most profound scholars from each of these two disciplines, the physicist W. Pauli and the psychoanalyst C.J. Jung have acquired a shared and deep conviction that the same laws that govern Nature at the smallest scale can be employed to describe the human psyche (Jung and Pauli, 1952). Following their lead, several authors have explored this field (Baaquie and Martin, 2005; Martin and Galli Carminati, 2007; Martin *et al.,* 2010; Martin *et al.,* 2013; Beck and Eccles, 1992; Galli Carminati and Carminati, 2006; Galli Carminati and Martin, 2008; Hameroff and Penrose, 1996; Penrose, 1989; Penrose, 1994; Pitkanen, 1998; Vitiello, 2003; Conte *et al.,* 2003; Zurek, 1981) that has come to be known as psychophysics. One of the hypotheses that have been formulated is the existence of a universal psychic field of quantum nature (Orlov, 1982; Baaquie and Martin, 2005) encompassing all human beings and possibly extending to all living creatures. In a recent series of works (Galli Carminati and Carminati, 2006; Galli Carminati and Martin, 2008; Martin *et al.,* 2010; Martin *et al.,* 2013), some of the authors of the present paper have focused on the possibility to describe also the group psyche with concepts and models borrowed from quantum mechanics.

The problem of measure is central in quantum mechanics, but also in psychophysics: the unconscious is, by definition, unknowledgeable and this not only because it is "unconscious", but also because the "detector" is the cognitive part of the individual that is itself "built upon" and deeply influenced by the unconscious.

It has been suggested that the only way to study the unconscious is to observe its manifestation in groupal situations where its effect could be amplified.

This idea relies on the observation that group dynamics, as described by the "basic assumptions", is similar to individual dynamics, in particular in the crucial aspect of the analogy of the mourning process in the individual with the mourning of the whole group when it realizes the loss of the ideal leader.

Bion's hypothesis of the existence of a group psychical apparatus, which stands as the cornerstone of group analysis, postulates that, when the "working group" recedes and the behavior of the group is governed solely by its psyche, the individual members cease to be separated and the group behaves, and can be studied only, as a single system, as long as it remains unperturbed. Formally, this is exactly what happens in the quantum world when a number of microscopic entities interact and form an entangled quantum state (Einstein *et al.,* 1935; Bohr, 1935; Schrödinger and Born, 1935; Schrödinger and Dirac, 1936; Bell, 1964; Bell, 1966; Aspect *et al.,* 1982; Richens *et al.,* 2017). In such a state, it becomes impossible to describe the behavior of the single elements, which are bound by a relation that transcends space and time and it becomes very similar to a *causa formalis* in the Aristotelic terminology (Hankinson, 1998).

Previous studies

Some of the authors of this paper have described the interaction between the unconscious of two individuals in terms of quantum entanglement (Galli Carminati and Martin, 2008; Martin *et al.,* 2010; Martin *et al.,* 2013) formulating the hypothesis that parts of the unconscious of two individuals together form a single entangled (non-separable) quantum system, in which distinct quantum entities become a single one, losing their individuality in favor of a single collective behavior.

Such a model can naturally be extended to a group of individuals (Galli Carminati and Martin, 2008; Grinberg-Zylberbaum *et al.,* 1994; Martin and Galli Carminati, 2007), where the entanglement between the different unconscious can cause the formation of a single entity with a distinct behavior, explaining the correlations observed between group members (Marshall, 1989).

Considering the presence of a number of individuals potentially connected, we have made the hypothesis that the entanglement effects could be more pronounced, and hence easier to measure, in case of a group setting. We call this "quantum amplification".

According to Jung (1962) "the amplification is the extension and the deepening of a dream-like image by means of associations centered on the dream theme and parallels based upon social studies and history of symbols (mythology, mysticism, folklore, religion, ethnology, art, etc.). Thanks to this the dream becomes accessible to interpretation".

In quantum physics, during a measurement, a microscopic process is "amplified" so that it can be observed macroscopically via its entanglement with a macroscopic device and the formation of a "pointer state" into which the wave function collapses (Zurek 1981). It is only after such an irreversible act of amplification that a microscopic quantum process can be observed as a physical phenomenon.

If we consider the analogy carried by the term "amplification" in both contexts, unconscious mental processes such as dreams can be considered as "microscopic" quantum processes, becoming accessible to conscience only via an amplification / measurement process, in this case operated by consciousness or insight. This is one more example of the interesting parallels that can be drawn between quantum physics and psychodynamic.

The difficulty of verifying any theory about the unconscious is that we have no way to perform a direct measurement (Cerf and Adami, 1997; Cerf and Adami, 1998; Atmanspacher, 2006). To circumvent this problem, we have devised an indirect measure based on a questionnaire to be answered by the participants in a group situation. This experiment has actually been conducted for the first time in the years 2009-2010 at the OMIE[1] group training for therapists that is part of the curriculum for psychologist at the University of Deusto (Bilbao, Spain). The analysis of the data of this experiment has been reported in three publications (Trojaola-Zapirain *et al.,* 2014; 2015; 2016). The main conclusion of the study was that the data were suggesting evidence in favor of the building of a group unconscious in accordance with Bion's "basic assumptions", where a strong interaction between the psyches of the group participants is established at the very beginning of the group experience, and then it slowly evolves in accordance with the group dynamics. To describe this phenomenon, Bion (1961) has introduce the concept of "valency", indicating the immediacy of the onset of the basic assumptions, more analogous to tropisms than to purposive behavior. This effect is enhanced in the group setting by an amplification process whereby groups "amplify emotional reactions, resulting in a combustible process of emotional contagion" (*ibid*, p. 54).

It is interesting to note that such an experiment is actually trying to determine whether a psychic situation – the supposed entanglement of the individuals' unconscious in a group situation – has an actual effect on the material world – the answers provided to a questionnaire. In this sense, such an experience has the ambition to breach the duality mind – matter and offers a possible window into the supposed holistic *Unus Mundus* (Atmanspacher and Fach, 2013; Dorn, 1602).

This experiment has now been repeated in the years 2014-2015 in much the same conditions and this paper reviews the results of the second experiment and compares them with the first one. To avoid any confusion we will refer to the first experiment as Bilbao-I and to the present one as Bilbao-II.

Materials and methods

The setting of this experiment has been extensively described in the previous publications (Trojaola-Zapirain *et al.,* 2014; 2015; 2016). For the purpose of this work it will be enough to recall that we have used a questionnaire composed of 50 pairs of figures. Participants were asked to select one picture in each pair and to complete the questionnaire in three minutes. The choice of the figures aimed at minimizing the sociocultural bias introduced by a word questionnaire (Zanello *et al.,* 2004). The figures in each pair were always the same but the order in which the pairs were presented was randomly reshuffled at each repetition of the test to minimize mnemonic effects. Fig 1 reports a sample page from the questionnaire with fictional picture choices.

The demographics of the participants to this study is reported in Table 1, together with the demographics of the previous experiment.

In Bilbao-II, we had 40 participants (25 women and 15 men) following the group analysis training

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given by the Basque Foundation for the Investigation of Mental Health (OMIE). There were 31 attendees the training, 10 members of the training staff and 4 members of the organizing staff. In the previous study we had 45 participants (31 women and 14 men) in 4 groups.

The training was organized in three groups, with 13 staff members and 27 participants. The age distribution of the participants presents significant differences between Bilbao-I and Bilbao-II (Wilcoxon two-tailed U test p = 0.04). The distributions of professional status (Wilcoxon signed rank test p = 1) do not present a significant difference. Gender distribution is also compatible (68.9% of women in the first test and 62.5% in the second), as is the distribution of marital status (p=1).

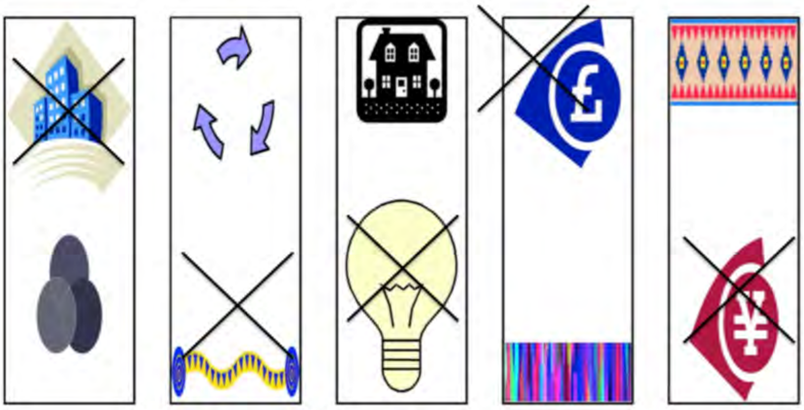

Figure 1. A page from the questionnaire with “fake” answers

Table 1. Demographic, socio-economical and group composition of the participant sample expressed in numbers and percentage for Staff, Trainees and for all participants. Quantities reported are: the number of participants in each age class, the median age with the interquartile range (Q1 and Q3: 25th and 75th percentiles respectively), the gender distribution expressed as numbers and percentages of female subjects, the number of participants in each socio-economic subcategory, the number of participants in each enrolment year and in each of the sub-groups of the training. In Bilbao-I, groups from A to D were the four “small groups”. Group E were the conductors of the “large group” and group F the organizing staff. In Bilbao-II groups from A to C were the three “small groups”. Group D were the conductors of the “large group” and the organizing staff.

Bilbao-I							
	Subcategories	Staff		Trainees		All	
		(n = 14)		(n = 31)		(n = 45)	
Age (years)	20-30	1	7.1%	21	67.7%	22	48.9%
	31-40	5	35.7%	8	25.8%	13	28.9%
	41-50	4	28.6%	2	6.5%	6	13.3%
	>50	4	28.6%	0		4	8.9%
	Median (Q1-Q3)	42.5	(33-50.5)	29	(27-32.5)	31	(28-38)
Sex	Female	7	50.0%	24	77.4%	31	68.9%
Marital status	Married	4	28.6%	29	93.5%	33	73.3%
	Divorced/widowed	3	21.4%	0		3	6.7%
	Single	7	50.0%	2	6.5%	9	20.0%
Professional status	Psychologist	13	92.9%	17	54.8%	30	66.7%
	Psychiatrist	1	7.1%	4	12.9%	5	11.1%
	Social worker	0		4	12.9%	4	8.9%
	Nurse	0		3	9.7%	3	6.7%
	MD	0		2	6.5%	2	4.4%
	Public servant	0		1	3.2%	1	2.2%
Enrolment year	1	0		10	32.2%	10	22.2%
	2	0		14	45.2%	14	31.1%
	3	0		7	22.6%	7	15.6%
	4	8	57.1%	0		8	1.8%
	5	6	42.9%	0		6	13.3%
Sub-groups	A	2	14.3%	8	25.8%	10	22.2%
	B	2	14.3%	9	29.0%	11	24.4%
	C	2	14.3%	6	19.4%	8	17.8%
	D	2	14.3%	8	25.8%	10	22.2%
	E	2	14.3%	0		2	4.4%
	F	4	28.6%	0		4	8.9%

Bilbao-II							
	Subcategories	Staff		Trainees		All	
		(n = 13)		(n = 27)		(n = 40)	
Age (years)	20-30	0	0.0%	10	37.0%	10	25.0%
	31-40	4	30.8%	13	48.1%	17	42.5%
	41-50	2	15.4%	3	11.1%	5	12.5%
	>50	7	53.9%	1	3.7%	8	20.0%
	Median (Q1-Q3)	51.0	(38.0-52.0)	32.0	(27.5-37.5)	37	(30.8-48.3)
Sex	Female	7	53.8%	18	66.7%	25	62.5%
Marital status	Married	7	53.8%	4	14.8%	11	27.5%
	Divorced/widowed	3	23.1%	2	7.4%	5	12.5%
	Single	3	23.1%	21	77.8%	24	60.0%
Professional status	Psychologist	7	53.9%	13	48.1%	20	50.0%
	Psychiatrist	3	23.1%	6	22.2%	9	22.5%
	Social worker	1	7.7%			1	2.5%
	Nurse						
	MD	2	15.4%	2	7.4%	4	10.0%
	Public servant Other			6	22.2%	6	15.0%
Enrolment year	1	0		10	37.0%	10	25.0%
	2	0		8	29.6%	8	20.0%
	3	0		9	33.3%	9	22.5%
	4	2	15.4%			2	5.0%
	5	3	23.1%			3	7.5%
	6	3	23.1%			3	7.5%
	7	1	7.7%			1	2.5%
	8	4	30.8%			4	10.0%
Sub-groups	A	2	15.4%	9	33.3%	11	27.5%
	B	2	15.4%	9	33.3%	11	27.5%
	C	2	15.4%	9	33.3%	11	27.5%
	D	7	53.8%	0		7	17.5%

As in the previous case, the training extended over 10 sessions, with the participants filling the questionnaire at the beginning of the first training session and then at the end of each training sessions, providing 11 questionnaires per participant (11 data collections).

Approval for this work was granted by the OMIE Foundation. All participants gave written informed consent after receiving oral and written information about the experiment. All participant data were coded so that they were completely anonymous, including for the researchers analyzing the data.

Procedure

OMIE teaching is a 5-year program to train group therapists in group analysis. Practical training is based on 10 modules per year, each one lasting one day and half: Friday from 9h00 to 21h00 and Saturday from 9h00 to 13h50. Participants of different years are divided in groups of 8 to 10 people including a conductor (group leader) and an observer (who does not speak during the session) who are members of the staff. In the present study, there were three such groups (A to C, see Table 1). These groups met 3 times for 1h30 each time during each module. At the end of each day, all groups meet for 1h30 in a "large group" lead by "large group" leaders (included in group D in our table). Also, included in group D are the members of the direction committee, which meet during the course of the module.

During the first data collection, participants filled a socio-demographic form indexed with a code to render data anonymous. The same code was used to mark the "absurdum questionnaires".

Data Analysis

For the purpose of the data analysis, the most frequently chosen picture in each pair during the first data collection will be indicated as picture A (A_i, i=1,50), while the other picture will be designed as B (B_i, i=1,50). Obviously $A_i+B_i=50$. Frequency tables were computed for each pair of pictures and each one of the 11 data collections. Because the present work is devoted to evaluate the influence of the group unconscious on the measured effects, i.e. the answers to the questionnaire, all statistics were carried out on the proportion of the number of participants choosing picture A or B for each of the 50 questions and 11 data collections, irrespectively of how the individual participant's choice evolved.

Selection Bias

Biases in selecting A pictures for each of the 50 questions were tested.

A one-sample binomial test was used to test the hypothesis that selecting pictures A and B had equal probabilities (i.e., null hypothesis p(A) = p(B) = 0.5).

A chi-squared test was used to test the hypothesis that the probability to select picture A remained constant over time (i.e., null hypothesis p(A at follow-up tests) = p(A at first test)). (see Equation 1).

$$p(A_i) = \frac{A_i}{n} = nb \text{ of A choices for session } i \text{ / n}$$

$$p(A) = \sum_{i=1}^{11} p(A_i)/11;$$

$$\sigma_i^2 = np(A_i)(1-p(A_i));$$

$$\chi^2 = \sum_{i=1}^{11} \frac{(\mu_j - x_{ij})^2}{nP(A)(1-P(A)} \; ;$$

Equation 1: $p(A_i)$: observed A frequency for a given question and for the test i; P(A): average (over all sessions) probability to get A; x_{ij}: number of A choices for a given question j during test i; n: total number of participants; σ_i: standard deviation of the binomial distribution; χ^2: chi-square value; μ_j: average (over all sessions) number of A choices for test j. Results will be assumed to be significant for p<0.025 for the one-tailed test, which corresponds to a two-tailed test alpha significance threshold of 0.05.

This analysis was performed also for Bilbao-I and we report the corresponding table in the Results section below.

Comparison Bilbao-I – Bilbao-II

In order to compare the picture choice between Bilbao-I and Bilbao-II we have performed a Mann-Whitney test between the number of times the upper picture was chosen for each of the 50 pairs pictures along the 11 data collections.

To gain a better understanding of the evolution of the choices, we have also performed the following comparisons, via Mann-Whitney tests, between Bilbao-I and Bilbao-II:

The number of 0's (lower picture chosen) and 1's (upper picture chosen) after renormalization to the number of participants, (i.e. multiplying the data of Bilbao-II by 45/40) for each session.

The number of A's (majority choice at the first data collection) along the 11 data collections.

The number of transitions A➛B (tendency to depart from initial choice);

The number of transitions B➛A (tendency to converge to initial choice);

The sum of transitions A➛B + B➛A (total activity);

The difference of transitions B➛A - A➛B (net tendency to alignment to the initial choice);

In case the differences between the initial image choice in Bilbao-I and Bilbao-II are not significant, we could imagine to combine the data of the two experiments and perform a combined analysis. In this case we will indicate this set of results as Bilbao-All and in the follow-up we will present results for Bilbao-I, Bilbao-II and Bilbao-All for comparison.

Evolution of selected picture

To evaluate whether the selection of the preferred pictures evolved randomly or as a possible effect of the group activity, two analyses were carried out.

Analysis of A. A Wilcoxon signed rank test was performed between consecutive data collections to compare the proportion of participants who choose picture A (initially preferred) for each of the 50 questions.

Paired analysis of A➛B and B➛A. Wilcoxon signed rank tests were performed on the numbers of changes from A to B and the corresponding changes from B to A occurring between the same pair of consecutive data collections for the 50 questions across the 11 data collections.

The absolute amount of changes is the result of the difference in the changes of choice from A to B and from B to A. These two quantities are, in principle, not directly related, apart from the obvious boundary conditions that there cannot be more transitions from A to B than A's in the first place, and the same holds for B's. This measure gives an idea of the group activity, independently from the net result of this activity.

Flux analysis. We have analyzed with the Wilcoxon test the consecutive transitions A➛B and B➛A, A➛B + B➛A and A➛B - B➛A between successive data collections, comparing the transitions between data collection N and the following N+1 and data collection N+1 and the following N+2.

Entropy analysis

We consider the evolution of entropy in the answers provided by the group. In the mid of the 19th century Rudolf Clausius (1850) introduced the concept of entropy, which was reinterpreted in terms of statistical mechanics by Ludwig Boltzmann (1886) toward the end of the century. Entropy has often been loosely associated with the concepts of order, disorder and chaos. One of the more powerful (and confusing) aspects of the concept of entropy is that it provides a powerful abstract link between thermodynamics, statistical mechanism, information theory and quantum mechanics (Balian 2004). Although the concept of entropy was originally a thermodynamic construct, it has been adopted in other fields of study, including information theory, psychodynamics, thermo- and ecological economics, demography, evolution and genetics (Brooks and Wiley 1988, Avery 2003, Yockey 2005, Demongeot and Demetrius 1989, Demongeot *et al.* 2014).

In this work, we are mainly interested in the interpretation of entropy as measure of information and, implicitly, as measure of order and disorder.

In this sense, we can think of entropy as the amount of information needed to fully define the microscopic state of the system, which is otherwise left unspecified by the macroscopic description. The first to notice the connection between entropy and information was Claude Shannon (Shannon and Weaver 1949).

In information theory, entropy is the measure of the amount of information in a transmitted message and is sometimes referred to as Shannon entropy. In this context, the definition of entropy is expressed as the sum of terms depending on a set of discrete probabilities:

$$H(X) = \sum_{i=1}^{n} p(x_i) \log p(x_i)$$

Where $p(x_i)$ is the probability that a particular message x_i is actually transmitted. We note here that the question of the relation between information and thermodynamic entropy has been, and still is, subject to controversy (Brillouin 1956, Georgescu-Roegen 1971, Tribus and McIrvine 1971, Balian 2004, Chen 2005, Frigg and Werndl 2010).

In case all probabilities are equal, the formula for the information entropy reduces to:

$$H = -k \log(p)$$

where *k* is the unit of entropy. It is interesting to note that, in this case, the Shannon entropy (in bits) is the number of yes/no questions needed to determine the content of the message. It is also instructive to note that this expression of the entropy is identical to the Boltzmann formula based on statistical mechanical considerations. Indeed, the equivalence of Shannon and Boltzmann entropy can be demonstrated in several ways, however some authors argue that the use of entropy for the former is arbitrary and should be dropped in favor of *uncertainty.*

In our case, the choice of one of the two pictures can be described as binary process whose outcome can be either 1 (upper picture) or 0 (lower picture). This kind of process is also called a Bernoulli process, in which there can be only two outcomes, mutually exclusive and exhaustive, success with a probability of *p* and failure with a probability of (1-*p*). If *X* denotes a random variable, we have:

$$\Pr(X = 1) = p = 1 - \Pr(X = 0) = 1 - q$$

A classical Bernoulli process is a single toss of a coin, and is defined fair if p=1/2. The Bernoulli distribution is a special case of a binomial distribution with *n=1,* hence we have:

$$f(k; p) = p^k (1-p)^k \text{ for } k \in \{0,1\}$$

$$E(X) = p \text{ and } Var(X) = p(1-p)$$

In information theory, the entropy of a Bernoulli process is called Bernoulli entropy and is defined as:

$$H(X) = H_b(p) = -p \log(p) - (1-p)\log(1-p)$$

When *p*=1/2, the binary entropy function attains its maximum value. This is the case of the unbiased bit, the most common unit of information entropy.

Results

In Bilbao II, 58 missing data point out of 22,000 were found in the overall data set, which were filled in as follows. For the first data collection, the missing response was replaced by the top or bottom selection of the picture in the preceding answer, and for the following data collections (2-11) the answer to the same question in the preceding data collection was used instead (last observation carried forward approach or LOCF, Hamer and Simpson 2009).

Cognitive Bias

Table. 2

Table 2. Binomial analysis of the choices. p-values are given for each question, i.e., each pair of pictures. At the 1st data collection (p_1) we assume E(0)=E(1)=0.5, i.e. a 50% probability, while for the overall data collections (p_o) we have calculated the χ^2 using the average of A choices as expectation value. Significant differences from a binomial distribution is assumed for p<0.025, and are indicated in italic and by stars. p-values for the 11 distributions have been calculated with the χ^2 tables for 10 degrees of freedom and in the table we have reported the values $\chi^2/10$ for easier inspection. A_1 is the number of A selected per question at the first data collection.

Bilbao-I									
	1st data collection		All data collections			1st data collection		All data collections	
Question	$A_1/45$	p_1	$\chi^2(10\ df)/10$	p_o	Question	$A_1/45$	p_1	$\chi^2(10\ df)/10$	p_o
1	0.87	<0.001**	1.06	0.39	26	0.56	0.28	1.53	0.12
2	0.53	0.38	1.77	0.06	27	0.56	0.28	0.76	0.67
3	0.87	<0.001**	1.37	0.19	28	0.67	0.018*	0.91	0.52
4	0.64	0.036	0.62	0.80	29	0.76	<0.001**	1.21	0.28
5	0.51	0.5	1.66	0.08	30	0.56	0.28	0.8	0.63
6	0.84	<0.001**	1.57	0.11	31	0.51	0.5	1.57	0.11
7	0.64	0.036	1.12	0.34	32	0.73	0.0012**	1.66	0.08
8	0.78	<0.001**	0.57	0.84	33	0.62	0.068	1.22	0.27
9	0.67	0.018*	0.79	0.64	34	0.53	0.38	0.92	0.51
10	0.82	<0.001**	0.27	0.99	35	0.69	0.008**	1.35	0.2
11	0.89	<0.001**	2.92	<0.005**	36	0.73	0.001**	1.17	0.31
12	0.78	<0.001**	1.26	0.25	37	0.73	0.001**	1.71	0.07
13	0.69	0.008**	2.87	<0.005**	38	0.82	<0.001**	0.54	0.87
14	0.76	<0.001**	0.42	0.94	39	0.67	0.018*	0.99	0.45
15	0.67	0.018**	0.53	0.87	40	0.82	<0.001**	2.42	0.01*
16	0.67	0.018**	1.03	0.42	41	0.69	0.008**	0.47	0.91
17	0.56	0.28	0.78	0.65	42	0.60	0.12	1.79	0.06
18	0.51	0.5	0.74	0.69	43	0.67	0.018*	0.43	0.94
19	0.53	0.38	1.46	0.15	44	0.62	0.068	0.46	0.92
20	0.62	0.068	0.53	0.87	45	0.82	<0.001**	1.24	0.26
21	0.69	0.008**	0.69	0.74	46	0.51	0.5	0.81	0.62
22	0.60	0.12	0.63	0.79	47	0.84	<0.001**	1.31	0.22
23	0.80	<0.001**	0.93	0.5	48	0.84	<0.001**	0.95	0.49
24	0.53	0.38	2.24	0.01*	49	0.87	<0.001**	0.48	0.91
25	0.87	<0.001**	2.32	0.01*	50	0.91	<0.001**	1.07	0.35
Bilbao-II									
	1st data collection		All data collections			1st data collection		All data collections	
Question	$A_1/40$	p_1	$\chi^2(10\ df)/10$	p_o	Question	$A_1/40$	P_1	$\chi^2(10\ df)/10$	p_o
1	0.84	<0.001**	0.48	0.90	26	0.68	0.02**	1.53	0.12
2	0.68	0.02**	1.43	0.16	27	0.58	0.21	0.56	0.85
3	0.66	0.04**	1.09	0.36	28	0.61	0.13	0.69	0.73
4	0.79	<0.001**	1.07	0.38	29	0.71	0.01**	0.63	0.79
5	0.53	0.44	1.14	0.32	30	0.63	0.07	0.74	0.69
6	0.95	<0.001**	1.43	0.16	31	0.53	0.44	0.84	0.59
7	0.61	0.13	0.72	0.71	32	0.95	<0.001**	1.56	0.11
8	0.74	<0.001**	1.01	0.43	33	0.66	0.04	0.94	0.49
9	0.53	0.44	1.07	0.38	34	0.71	0.01**	1.25	0.25
10	0.92	<0.001**	0.88	0.55	35	0.61	0.13	0.93	0.50
11	0.84	<0.001**	1.07	0.38	36	0.82	<0.001**	1.14	0.33
12	0.84	<0.001**	1.11	0.35	37	0.68	0.02**	0.45	0.92
13	0.68	0.02**	0.68	0.74	38	0.79	<0.001**	1.13	0.34
14	0.71	0.01**	0.67	0.75	39	0.79	<0.001**	0.87	0.56
15	0.82	<0.001**	0.76	0.67	40	0.82	<0.001**	0.57	0.84
16	0.66	0.04**	0.46	0.92	41	0.53	0.44	0.88	0.55
17	0.66	0.04**	1.23	0.27	42	0.76	<0.001**	0.60	0.81
18	0.61	0.13	0.36	0.97	43	0.79	<0.001**	0.73	0.70
19	0.61	0.13	0.57	0.84	44	0.63	0.07	0.96	0.48
20	0.82	<0.001**	1.32	0.21	45	0.82	<0.001**	0.86	0.58
21	0.55	0.31	1.23	0.27	46	0.58	0.21	1.38	0.18
22	0.53	0.44	1.16	0.31	47	0.84	<0.001**	0.93	0.51
23	0.84	<0.001**	0.69	0.74	48	0.82	<0.001**	0.52	0.88
24	0.5	0.56	0.90	0.53	49	0.68	0.02**	0.63	0.79
25	0.71	0.01**	1.41	0.17	50	0.87	<0.001**	0.59	0.82

We warn the reader against the possible confusion between the *p* used in this table, which are the significance levels and the symbol *p* used in Equation 1 that corresponds to the frequency of A answers used as estimator of the probability of A answer.

Comparison Bilbao-I – Bilbao-II

The results of this comparison are summarized in Table 3. We note that the transitions are generally statistically compatible between Bilbao-I and Bilbao-II apart from those between the first and the second data collection. If we refer to Fig. 3 and Fig. 5 we clearly see this difference, where it seems that in Bilbao-II there is a net tendency to "diverge" from the initial choice after the first group session. There is also a difference in the last transition, and again, with the help of Fig. 5 we clearly see a tendency of Bilbao-II to "diverge" from the initial choice at the end of the training, while Bilbao-I has the tendency to re-confirm the initial choice at the last session (Table 3).

Evolution of the selected picture

Analysis of A's (Fig.2).

We have analyzed the A answers of each successive data collection with the Wilcoxon test for repeated tries. The averages are shown in Fig. 2. The results of the statistical comparison between the A's of the different data collections are shown in Table 4.

As it could have been expected from the previous analysis, Bilbao-II shows a significant difference between the first data collection (before the beginning of the training) and the second one (at the end of the first session). It seems that the effect of the first session was to "defocus" the group (we define the focusing as the maintaining of the first decision, in other words, the choice of the "A" image). As found in the previous works, a defocusing happens also in Bilbao-I, but between data collections 4 and 5, in the middle of the training (Fig.3).

Paired analysis of A➛B and B➛A. We have compared the transitions A➛B and the corresponding transition B➛A for each data collection using the Wilcoxon test (Table. 5).

In Table 5 we note a similar behavior between Bilbao-I and Bilbao-II, i.e. the transitions between session 4 and session 5 show a significant difference. However while in Bilbao-I this translates also in a difference in the average and hence in a difference in the number of A's between the two sessions, in Bilbao-II this difference does not translate in a decrease in the average number of A's, and in a consequent

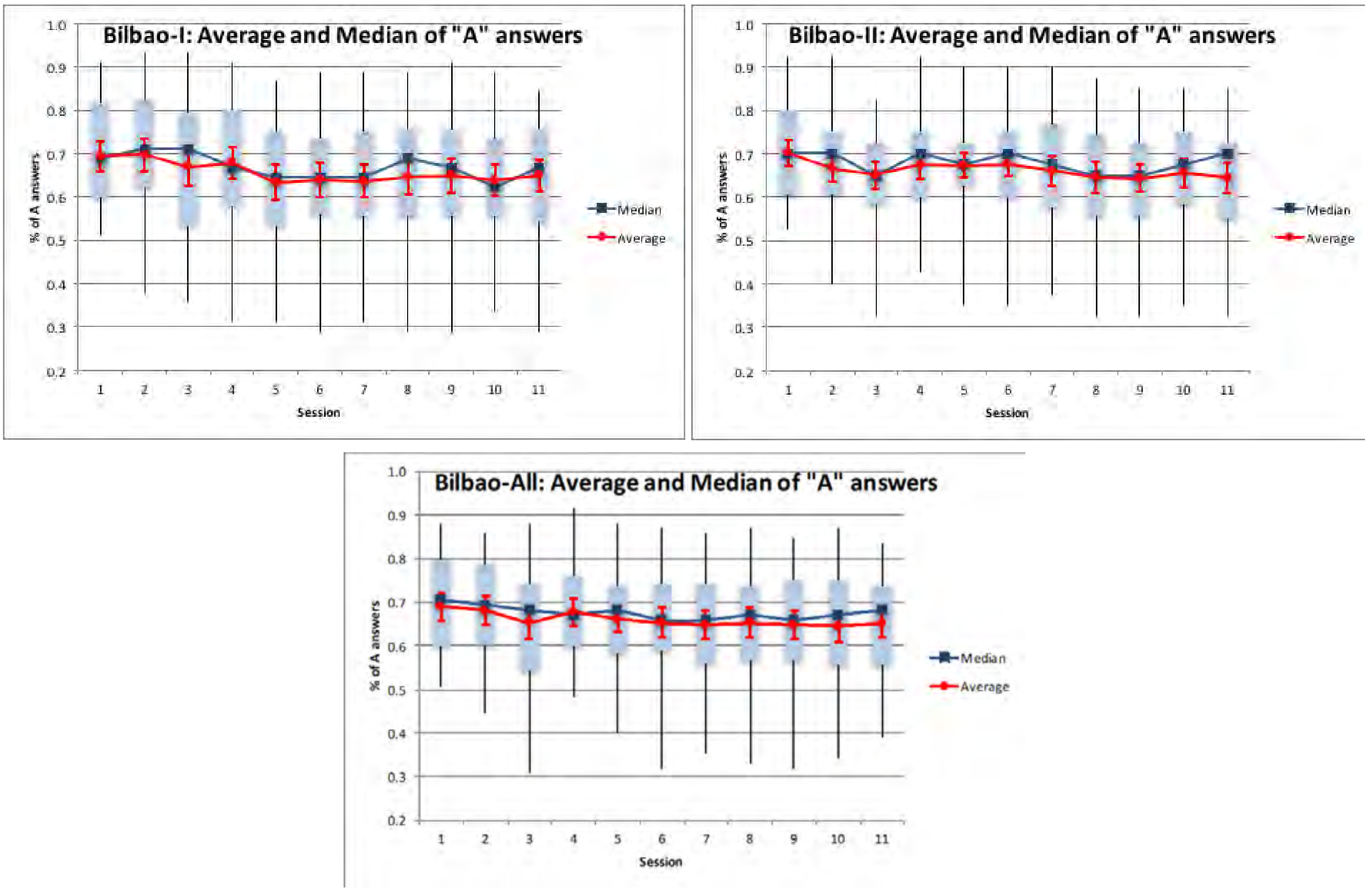

Figure 2. Evolution of the average proportion of the picture initially most selected (picture A). The proportions of participants (± 95% confidence interval shown on average points, red line) who have chosen the initially preferred picture (A) are averaged over the 50 questions for each of the 11 data collections (abscissa). The figure also shows the median and interquartile evolution, for the previous experiment, the current one and the combined sample

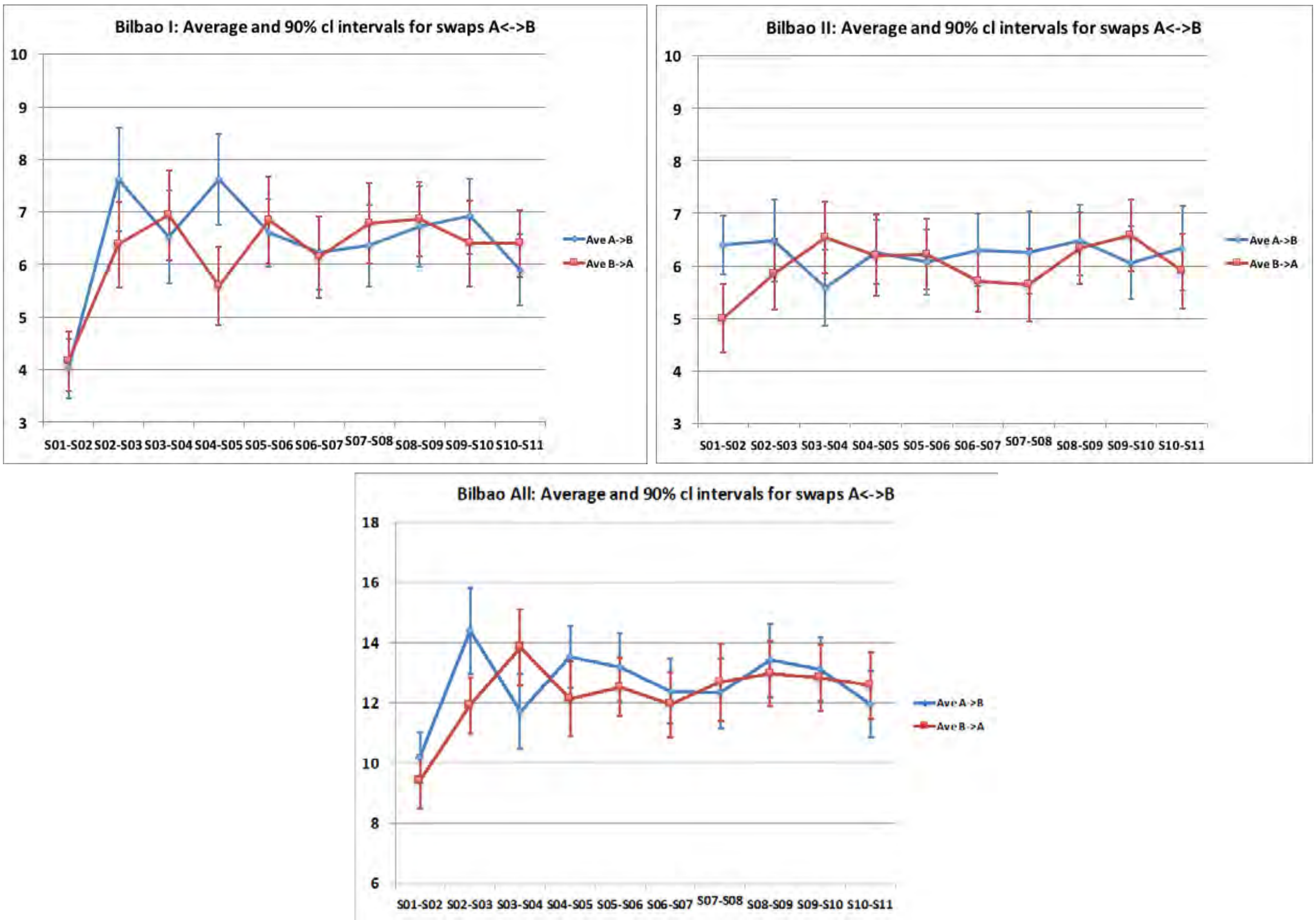

Figure 3. Average number of transitions with 90% confidence intervals (ordinate) observed between consecutive data collections (abscissa) for the transitions from pictures A to B and for the transitions from pictures B to A

Table 3. Comparison Bilbao-I Bilbao-II. In the columns we report the p of the Mann-Whitney sum test.

Data collection	1's	A's	Data collection	Transitions A→B	Transitions B→A	Transitions A→B+B→A	Transitions B→A-A→B
1	0.86	0.70					
2	0.50	0.26	1→2	0.00	0.00	0.00	0.01
3	0.73	0.38	2→3	0.51	0.84	0.98	0.62
4	0.42	0.93	3→4	0.56	0.59	0.68	0.49
5	0.64	0.18	4→5	0.50	0.06	0.34	0.07
6	0.53	0.18	5→6	0.96	0.79	0.39	0.98
7	0.63	0.41	6→7	0.10	0.56	0.12	0.59
8	0.42	0.74	7→8	0.86	0.64	0.96	0.45
9	0.50	0.67	8→9	0.63	0.56	0.58	0.67
10	0.72	0.44	9→10	0.57	0.15	0.17	0.18
11	0.87	0.86	10→11	0.05	0.96	0.03	0.20

Table 4. Comparison of A's of successive data collections

Data collection	Bilbao-I	Bilbao-II	Bilbao-All
1 vs 2	0.50	0.01	0.31
2 vs 3	0.08	0.35	0.03
3 vs 4	0.41	0.08	0.03
4 vs 5	0.00	0.91	0.10
5 vs 6	0.77	0.89	0.53
6 vs 7	0.61	0.21	0.52
7 vs 8	0.38	0.24	0.64
8 vs 9	0.84	0.85	0.40
9 vs 10	0.37	0.36	0.76
10 vs 11	0.30	0.50	0.53

Table 5. Comparison with the Wilcoxon test of the transitions A➛B and the corresponding transitions B➛A for the same couple of data collections.

Data collection	Bilbao-I	Bilbao-II	Bilbao-All
1➛2	0.50	0.10	0.31
2➛3	0.08	0.06	0.03
3➛4	0.41	0.11	0.03
4➛5	0.00	0.01	0.10
5➛6	0.77	0.50	0.53
6➛7	0.61	0.28	0.52
7➛8	0.96	0.56	0.64
8➛9	0.84	0.81	0.40
9➛10	0.37	0.88	0.76
10➛11	0.30	0.98	0.53

"defocusing" effect. It is however interesting to remark that in the middle of the training something happens in both experiments. Technically this is the moment where the "group illusion" has receded and the group moves into the "fight or flight" attitude.

Flux analysis

Table. 6

We find (see Fig. 4) expressed differently, some of the features we have remarked before. Bilbao-I has a strong activity during the first session, but that does not change the general alignment of the group. Bilbao-II has also some sign of activity at the beginning of the training, but this leads to a defocusing (difference in the average A). Bilbao-I shows significant activity between sessions 4 and 5, while Bilbao-II shows an significant activity in the transition from sessions 7➛8➛9. It is interesting to notice that, overall, the behavior of the two trainings is very similar.

The above statistical tests allow us to capture some of the features of the two trainings. It could be instructive to have also a "qualitative" look at the "net focusing" behavior reported in Fig. 5. Bilbao-II shows a strong defocusing behavior after the first test, i.e. during the first session. Then both trainings evolve toward a stronger focusing toward the initial choice (peaking in the transition between session 3 and session 4). This is well consistent with the formation of the "group illusion". The transition between 4 and 5 shows a strong defocusing that in classical group theory could be the loss of the group illusion and the onset of the "fight of flight" mode. The second part of the training mark some differences between the two groups. We could say that in Bilbao-I the disappointment is deeper and shorter, with a recovery till the last but one session, where the mourning of the group sets in. Still, the last session seems to have overcome also this moment. The evolution of Bilbao-II is similar but less sharp, and, particularly in the second half, it seems to react more "slowly" with a longer "descent" into the "disappointment" phase and a late recovery followed by the sudden mourning of the group at the last session (Fig.4 and Fig.5).

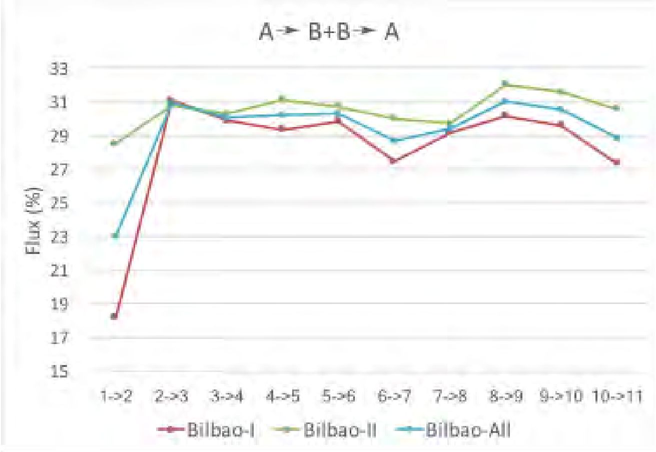

Figure 4. Average percentage flux A➛B + B➛A

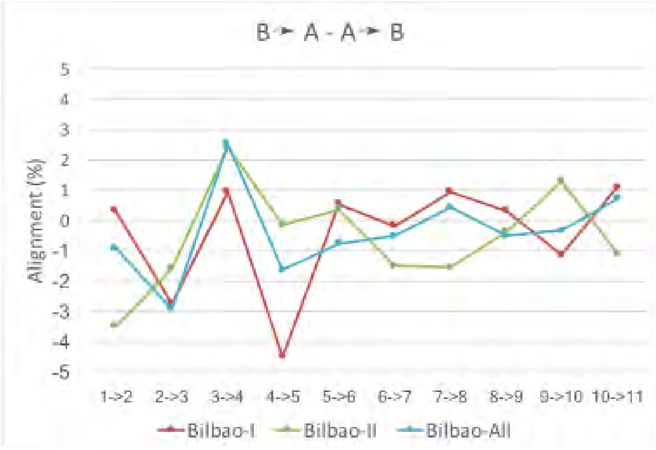

Figure 5. Average alignment defined as B➛A-A➛B in percentage

Entropy

We define the Bernoulli entropy as

$$H = -p\log(p) - (1-p)\log(1-p)$$

We calculate the total entropy for the 50 questions supposing that the expected outcome is 0.5, i.e. considering "a priori" that either pictures of each couple have the same probability to be chosen. In Fig. 6 we show the evolution of the total entropy for the 50 questions along the 11 data collections.

In Table 7 we show the statistical comparison of the entropy in each data collection with the Wilcoxon test for repeated trials. As we can see, there is no significant difference between any of the successive data collections. We also report the statistical comparison between the first and the last data collection (Table. 7).

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Table 6. Comparison A➛B, B➛A, A➛B + B➛A, B➛A - A➛B

Data collection	Bilbao-I				Bilbao-II				Bilbao-All			
	A➛B	B➛A	A➛B + B➛A	B➛A - A➛B	A➛B	B➛A	A➛B + B➛A	B➛A - A➛B	A➛B	B➛A	A➛B + B➛A	B➛A - A➛B
1-2 vs 2-3	0.00	0.00	0.00	0.09	0.98	0.11	0.05	0.42	0.00	0.00	0.00	0.20
2-3 vs 3-4	0.11	0.36	0.33	0.16	0.19	0.26	0.63	0.17	0.01	0.05	0.37	0.02
3-4 vs 4-5	0.02	0.01	0.78	**0.01**	0.24	0.44	0.45	0.24	0.03	0.03	0.81	**0.02**
4-5 vs 5-6	0.12	0.06	0.84	0.04	0.63	0.99	0.83	0.81	0.54	0.38	0.87	0.41
5-6 vs 6-7	0.44	0.12	0.05	0.57	0.56	0.33	0.42	0.31	0.24	0.40	0.03	0.98
6-7 vs 7-8	0.45	0.34	0.31	0.51	0.76	0.95	0.99	0.92	0.87	0.42	0.42	0.44
7-8 vs 8-9	0.93	0.50	0.57	0.87	0.60	0.15	0.05	0.58	0.08	0.77	0.07	0.43
8-9 vs 9-10	0.60	0.38	0.49	0.41	0.42	0.89	0.77	0.56	0.79	0.93	0.41	0.95
9-10 vs 10-11	0.09	0.83	0.05	0.31	0.48	0.25	0.54	0.33	0.15	0.80	0.08	0.47

Table 7. Comparison between the entropy of successive data collection for the 50 questions in the three cases considered. We report the Wilcoxon signed rank test for repeated trials probability p.

Data Collection	Wilcoxon p		
	Bilbao-I	Bilbao-II	Bilbao-All
1 ➛ 2	0.172	0.325	0.247
2 ➛ 3	0.616	0.369	0.236
3 ➛ 4	0.772	0.395	0.436
4 ➛ 5	0.708	0.553	0.937
5 ➛ 6	0.641	0.955	0.376
6 ➛ 7	0.371	0.18	0.662
7 ➛ 8	0.861	0.705	0.687
8 ➛ 9	0.398	0.759	0.118
9 ➛ 10	0.55	0.707	0.768
10 ➛ 11	0.491	0.401	0.755
1 ➛ 11	0.469	0.042	0.702

We note that there is no statistical difference between any two consecutive data collection, however there is a statistically significant ($p < 0.05$) evolution in the entropy value for the group Bilbao-II (Fig.6).

It has to be noted that the entropy values cannot be compared directly since the populations differ in number and therefore the picture can only help appreciating the trend of the entropy, which, as could be expected, has a slight tendency to increase. Still we see again a hint of the fact that even if the trend is globally similar, Bilbao-II seems to react more slowly than Bilbao-II, almost as if the Bilbao-II were "shifted" right with respect to Bilbao-I.

Discussion

The first outcome of the present study is that, similarly to what we have noted in the previous one, the initial answer to the test is not a 50%-50% random choice between the pictures of each pair, despite the fact that the pairs of pictures were chosen trying to not induce social or cultural bias. The initial choices could be due to a cognitive or social bias, or to the fact that the group forms, according to the basic assumptions, immediately when it meets, before the first training session. In this case, the choices of the A pictures could be the manifestation of the initial orientation of the group.

According to Bion, group effects should be seen as soon as people are actually put together. They do not even need to interact actively, and the mere assembling of individuals should be enough to connect unconscious and to provoke group phenomena. So this orientation could be indeed a group effect. Unfortunately our protocol does not allow discriminating between the hypothesis of cognitive bias and Bion's basic assumption.

To help deciding this question, we should have asked each participant to answer the questionnaire individually, however this was impractical. This training for psychotherapists involves a selection process, where the staff meets with each participant. To pass a first questionnaire before the group meets, a second one-to-one meeting only with the selected participants would be necessary, which would double the cost and time of the selection procedure. For these reasons, for the moment, the data collection before the training has not been possible.

Whatever the origin of the initial orientation, it does not affect the statistical significance of the group effects that occur in the following data collections and therefore the results obtained in this experiment.

Considering the binomial analysis of the choices, we note that, in both experiments there is

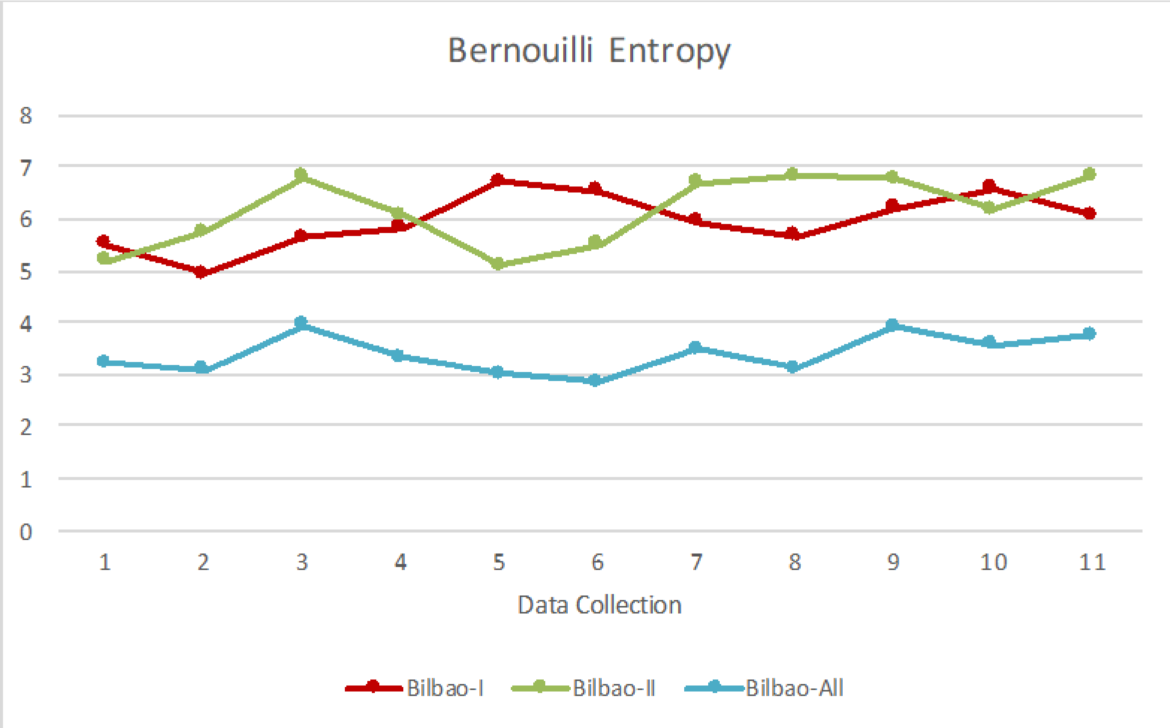

Figure 6. Total entropy with 0.5 as probability of choosing upper or lover picture

a significant departure from a 50%-50% random significant for the following questions: 1,2,6,8,10 to 16, 23, 25, 32, 36 to 40, 43, 45, 47 to 50. Therefore, 25 question out of 50 present a statistically significant departure from a purely random choice between the two images in both in Bilbao-I and Bilbao-II. There is a large if not complete correspondence in these "polarized" choices in the two experiments. When we take in account the number of preferences for the most chosen picture of each pair (answer A in our definition) there are no significant differences in Bilbao-I versus II.

In what follows we will analyze our data under two different angles. First of all we will consider what is the distribution of the choice for the different figures and what is their evolution during the experiment.

Whatever the reason for the rather strong initial orientation, the evolution of the choices and frequency of swaps of A and B choices during the experiment can be attributed to group dynamics rooted in the "basic assumptions" described by Bion (1961).

The common orientation of the group unconscious during the training was investigated considering the impact on the similarity of choices by measuring choices and the frequency of their active changes at the level of the questionnaire.

The transitions A➛B, B➛A, A➛B+B➛A and A➛B-B➛A between two following data collections are statistically different in Bilbao I versus II between for the 1st to 2nd data collection transition, and the transitions A➛B and A➛B+B➛A for the 10th to the 11th data collection.

As shown in Fig. 2, we decided to analyze the combined data of Bilbao I and II, determining a new "A" as the most chosen answer for all the participants (Bilbao I and II) as a combined sample. No participant was presents in both the trainings.

Considering the choices of the A answer, we found (with the Wilcoxon test for repeated tries, see Table 4) that in Bilbao-I there was a statistical difference between the 4th and 5th data collection, in Bilbao II between the 1st and 2nd data collection, and in Bilbao-All between 2nd and 3rd, 3rd and 4th data collection. These results are not conclusive in deciding whether there is a common dynamic in the two trainings and the combined sample.

When we consider the number of changes from one choice of picture to the other made by the participants in the different data collections (transitions), we found some similarities in Bilbao-I and II with statistically significant differences

(Wilcoxon test) in the transitions A➛B and B➛A for 4th to 5th data collections. The statistically significant differences in the transitions A➛B and B➛A between 2nd and 3rd and 3rd and 4th session in Bilbao-All are not present in Bilbao I or Bilbao-II.

It was postulated that group dynamics orientation should result in the evolution of picture preference. In other words, if the group has an effect at some stages of the training, picture choices evolution should not be random across testing data collections, but at this point of the analysis of data the dynamics in Bilbao-I, Bilbao-II and Bilbao-All did not show an univocal trend.

The transitions A➛B and the corresponding transitions B➛A for the same pair of successive data collections, are an indication of the "flux" of changes in both directions (see Table 5). In case of random fluctuations, one would expect the two distributions to be compatible. It is remarkable that both in Bilbao-I and in Bilbao-II there is a statistical "imbalance" of the flux in the transition 4➛5. This leads to a statistical change in the number of A's in Bilbao-I but not in Bilbao-II.

If we now move to analyze Table 6, a significant difference is present between Bilbao I and Bilbao-All for A➛B, B➛A and (B➛A - A➛B) in 3-4 vs 4-5 data collection; for (B➛A + A➛B) in 5-6 vs 6-7 data collection and for A➛B and B➛A in 1-2 vs 2-3 data collections.

In Bilbao I, alone, there are significant differences for (B➛A - A➛B) in 4-5 vs 5-6 and (B➛A +A➛B) in 9-10 vs 10-11 data collections.

In Bilbao II, alone, there are significant differences for (B➛A +A➛B) in 7-8 vs 8-9 data collections.

In Bilbao-All alone, there are significant differences for A➛B, B➛A and (B➛A - A➛B) in 2-3 vs 3-4 data collections.

Even if there are some differences in the trend of Bilbao I and Bilbao II the more important finding, justifying also the creation of Bilbao-All, has been in fact similar significant differences in Bilbao I, II and Bilbao-All concerning (A➛B + B➛A) in 1-2 vs 2-3 data collections, in other words at the beginning of the training.

The transitions we measured across sessions could be interpreted as a manifestation of a group dynamics similar to that postulated by Bion (1961) with his "basic assumptions". For instance, the "honey moon" (dependence from the leader) at the beginning of the training and the successive "fight-flight" attitude (reaction against the dependence from the leader) in the middle of the training, could be represented by greater number of choice swaps (further away from randomness). The "fight-flight" attitude is followed by the "mourning" of the group and of the training experience.

It seems intuitive that an increase of the transitions could be linked to an increased group activity or a group dynamics event. As we said the swaps could be the result of different trend in group dynamic with "honeymoon", the successive "fight-flight" and the "mourning" at the end.

The observed behavior is very suggestive of classical group dynamics. During the first sessions there is a "honeymoon" period where the group forms and enjoys the so-called "group illusion". After that the group faces disillusion toward the leader and sees the end of the training approaching, so the cohesion is reduced, but remains present (in Bilbao I and Bilbao II, less so in Bilbao-All) to the end of the training with a change in the very last part of the training, in which the participant are in a "mourning " state. Although these simple measure cannot be said to catch the complexity and richness of group dynamics, it seems however that its behavior is consistent with what we know and observe as group analysts.

As expected the Bilbao-All shows a trend between Bilbao-I and Bilbao-II (see Fig. 4 and Fig. 5) in the average percentage flux A➛B + B➛A, the trend being more dispersed in the average percentage flux A➛B - B➛A.

Concerning Entropy (Table 7) we found no significant difference between any of the successive data collections. We reported only a statistically significant comparison between the first and the last data collection in Bilbao II (with a slight tendency to increase).

The Entropy increases along the experience as in a closed system, with some mild change during the data collections and a slight increase.

As we have remarked in the result session, there is a general similarity between the trend in Bilbao-I and Bilbao-II, and some differences. In both trainings we have a strong orientation at the beginning of the training, the nature of which we cannot yet determine. This strong initial orientation is definitely compatible with Bion's theory. In both trainings this initial "honeymoon" suffers from the group disappointment with the leader and there follows a recovery and, eventually, another moment of "crisis" at the end of the training. The group we study in this paper (Bilbao-II) seems to be less cohesive and "slower" to react than the group of Bilbao-I. Bilbao-II is composed by less participants (10% less) who are globally older than those of Bilbao-I, but we are in no position to draw any conclusion by these two facts.

We should probably be more interested (and surprised) in the similitudes than the differences of the two groups. Bion himself used to say that "as you never bath yourself twice in the same river, you never enter twice the same group", being every human assembly unique and singular.

Conclusions

Our study aimed at detecting measurable effects of the psychical dynamics that takes place during a group training session. For this we used the answers given to a questionnaire aimed at reducing cognitive and social bias. Although our results are subject to interpretation, we believe that this study presents strong indications for evidence in favor of an influence of group dynamics on the answers to the questionnaire.

In particular we believe that there is evidence in favor of the building of a group unconscious according to Bion's "basic assumptions", as it is shown by the evolution in the frequency of the swaps in the choices of the images across sessions. The present study confirms the mechanisms at work in group dynamics as general and probably similar in group situation, as, in our experience, a training for therapists and indicates support for Bion's theory of group dynamics effect.

Because of the precocious group orientation of the unconscious it would be important in following studies to test the group of participants with an absurd test before personal interaction in group experience .

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