Group Unconscious Common Orientation: Exploratory Study at the Basque Foundation for the Investigation of Mental Health Group Training for Therapists

Begona Trojaola Zapirain[1], Federico Carminati[2], Miguel Angel Gonzalez Torres[1,3,4], Ernesto Gonzalez de Mendivil[1], Claire Fouassier[5], Marianne Gex-Fabry[6], François Martin[7], José Labarere[8], Jacques Demongeot[9], Erika Nora Lorincz[10], Giuliana Galli Carminati[11]

ABSTRACT

Group phenomena have been used since antiquity in therapeutic, social, economic and political domains. According to Bion, the interactions between group members generate a "group unconscious" and its behavior is governed and oriented by Bion's "basic assumptions." The present work has been conducted during group analysis training at the Basque Foundation for the Investigation of Mental Health (OMIE) at Bilbao, consisting of eleven sessions. The participants are presented with an "absurd questionnaire" proposing 50 pairs of images, in each of which one image has to be chosen. The results are used to search for evidence in favor of the influence of group dynamics on individual choices of the images proposed in the questionnaire. Our analysis finds some evidence for an effect of group dynamics both on the initial choice of the pictures and on the evolution of the number of changes (swaps) of picture choices across the eleven sessions. We interpret these effects in the light of Bion's view of group dynamics, which postulates an immediate onset of the unconscious and its evolution during the group activity.

Key Words: group dynamics, synchronicity, basic assumptions, group orientation

DOI Number: 10.14704/nq.2014.12.1.709 **NeuroQuantology 2014; 1: 139-150**

1. Introduction

Group phenomena have been used since antiquity for different purposes in therapeutic, social, economic and political domains (Anzieu and Martin, 1997; pp.17-156). Studies dealing with the group psychology that we can define as modern go back to the XIX century, even before the appearance of psychoanalytical methods (le Bon 2006). W.R. Bion (1961) and S.H. Foulkes (1964), two psychoanalysts disciples of M. Klein for the former, and of S. Freud for the latter, were the first to elaborate a psychoanalytic framework for the interpretation of group phenomena and their evolution (group dynamics).

Although we realize that "There are many re-editions of Bion's formulation about groups but none can replicate the richness of the original [...]." (Lawrence *et al.*, 1996), for the purposes of this work we will venture to give yet another account of his working hypotheses. Bion's model is that, when any set of people gathers for an activity or a task, there is an immediate creation of a group and that the ensuing group dynamics consist actually in two kinds of groups, or rather in two configurations of mental activity, which are simultaneously present. At the surface there is the more or less sophisticated work group, referred to as the W group, which is directed at the accomplishment of the purpose for which the group has

Corresponding Author: Giuliana Galli Carminati
Address: Please see end of article.
e-mail ✉ Giulianagallicarminati@hotmail.com
Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.
Received: Oct 21, 2013; **Revised:** Dec 2, 2013;
Accepted: Feb 9, 2014

originally been formed (the organization of a party, the management of a multinational company, planning of a war, deciding a strike and so on...). However underlying the W group is the other group, governed by universal principles that Bion calls "basic assumptions". This is what Bion calls the BA group. The W group is, in Bion's words, "constantly perturbed by influences that come from other group mental phenomena" (Bion, 1961; p.129).

To explain this, Bion (1961) postulates that a group situation leads to the formation of a group psyche generated by the interaction of the group members and that behaves according to the "basic assumptions". The group requires the protection of a leader, on whom it feels dependent for its survival. The refusal or inability of the leader to protect the group leads to conflicts, and ultimately to a "fight-flight" attitude where the group either gathers to fight against the dangers outside or it tries to run from them. This stressful situation may lead to the formation of sub-groups or couples. Coupling or sub-groups, although they represent a danger for the group integrity, promote the messianic expectation, i.e. the hope for a new, better, perfect and powerful leader. This behavioral pattern is repeated during the life of the group.

Therefore, according to Bion the evolution of the group is governed both by these universal "basic assumptions" and by the conflicts that are rooted in the contingent reality of each specific group (Bion, 1961; Vergopoulo, 1983; Foulkes, 1964).

Since the discovery of quantum mechanics, a tantalizing similarity has been noted between the quantum description of the world and the functioning of our psyche. Several authors have elaborated on this, developing physico-mathematical models of our psyche (Baaquie and Martin, 2005; Beck and Eccles, 1992; Zurek, 1991; Hameroff and Penrose, 1996; Penrose, 1989; Penrose, 1994; Pitkanen, 1998; Jung and Pauli, 1955; Vitiello, 2003; Conte *et al.,* 2003; Pauli and Jung, 2001; Zurek, 1981). Some researchers (Baaquie and Martin, 2005) have even postulated the existence of a universal psychic field of quantum nature. In a recent series of works, Galli Carminati and colleagues (Galli Carminati and Carminati, 2006; Galli Carminati and Martin, 2008; Martin *et al.,* 2010; 2013) extended this description to the group unconscious, proposing that this too could be described with a model similar to those used in quantum physics. This analogy relies on the observation that, as for the individual, the group reacts to losses with a mourning process. In other words, mediated by the "basic assumptions", group dynamics are similar to individual dynamics, in particular if one considers the loss of the ideal group leader.

The correlations that appear between the groups and members of a group during group analysis sessions seem comparable in nature to the remote correlations that appear between two related quantum systems (Einstein *et al.,* 1935; Schrödinger and Born, 1935; Schrödinger and Dirac, 1936; Bell, 1964; 1966; Aspect *et al.,* 1982). This phenomenon is called quantum entanglement: two entangled quantum particles can be separated by thousands of kilometers and nevertheless form a single (whole) non-separable system, as long as no measurements are performed on one of the two particles. It is by analogy with this well-known phenomenon of quantum physics that we decided to investigate the similar entanglements between two individuals, and tried to generalize these correlations to individuals belonging to a group.

The correlations we tried to observe are between the unconscious of two individuals. In the model of Carminati and Martin (Galli Carminati and Martin, 2008; Martin *et al.,* 2010; 2013), the mechanism that brings parts of the unconscious of two individuals together to form a single entangled (non-separable) quantum system is the so called Bose-Einstein condensation (Pitaevskii and Stringari, 2004), in which distinct particles can form a single quantum system, where they lose their individuality in favor of a single collective behavior.

Such a "condensation" could well appear between some parts of the unconscious of individuals and as a result, cause the formation of the group unconscious. Bose-Einstein condensation and quantum entanglement, if applied to psyche, may explain the remote correlations that exist between group members and consequently group phenomena (Marshall 1989). According to this model, a group situation would influence group members to orient their individual unconscious in a common direction (Galli Carminati and Martin, 2008; Grinberg-Zylberbaum *et al.,* 1994; Martin and Galli Carminati, 2007) hence promoting the emergence of a group quantum state.

The goal of the current study is to provide experimental evidence in support of the model proposed above (Galli Carminati and Martin, 2008; Martin *et al.,* 2010). Consequently, our first objective is to observe the behavior of individuals belonging to a group.

Table 1. Demographic, socio-economic 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 sex 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. Groups from A to D were the four "small groups". Group E were the conductors of the "large group" and group F were the organizing staff.

	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%

Because unconscious phenomena cannot so far be investigated using conventional measurements or direct observations (Cerf and Adami, 1997; 1998; Atmanspacher, 2006) we propose an indirect measure of the group orientation based on a questionnaire. The objective is to investigate whether group analysis situations can lead the unconscious of the participants to adopt a common orientation in the choice of pictures. In other words, we would like to test whether the presence of an orientation of the group unconscious has a measurable effect on the real world.

We could say that, at the philosophical level, this work aims at detecting an effect of mind on reality, and therefore to verify if, in spite of the dualism between them, there can be an influence of the former on the latter. This is certainly not a new problem in philosophy, and approaches that describe mind and matter as manifestations of one underlying reality in which they are reunited, go back to a holistic reality, *unus mundus*, the "one world" of the 16th century alchemist Gerhard Dorn (Atmanspacher and Fach, 2013; Dorn, 1602).

Doing this in a group setting gives leverage to Bion's idea of "valence", by which Bion describes the immediacy of the onset of the basic assumptions, more analogous to tropisms than to purposive behavior. This tropism, and its effects on reality, is enhanced in the group setting by an amplification process whereby groups "amplify emotional reactions, resulting in a combustible process of emotional contagion" (Bion, 1961; p.54).

To try to minimize biases that can be introduced by common cultural background such as news, politics, arts, and so forth, we designed an "absurdum" questionnaire so that answers would rely as little as possible on logical thinking and acquired knowledge, using pictures as unrelated as possible with each other.

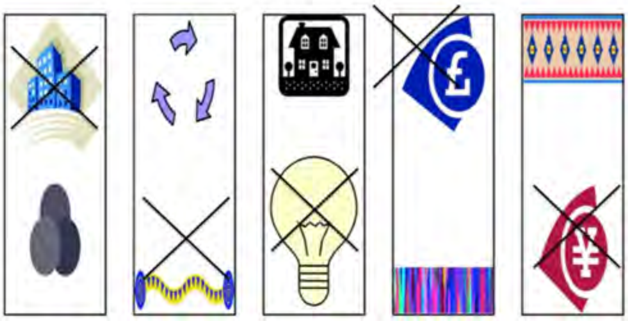

Figure 1. A page from the questionnaire with "fake" answers.

2 Materials and methods

2.1 *Participants*

For this study we used forty-five adult participants (31 women and 14 men) involved in the group analysis training given by the Basque Foundation for the Investigation of Mental Health (OMIE). This group was composed of 31 people attending the training, 10 members of the training staff and 4 members of the organizing staff. Two participants in this training were excluded from the study because they did not complete the experiment. The training consisted of 10 sessions, and at the beginning of the first session and the end of each session the participants were asked to fill in the questionnaire. Demographic data and socio-economic characteristics of participants are presented in Table 1.

The Ethics Committee of Geneva University Hospitals approved the experimental protocol, in adherence to the Helsinki Declaration for research with human subjects, and approval was also 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.

2.1 *Questionnaire*

To evaluate to what extent participants could act according to a common group unconscious, we used an "absurdum questionnaire" of 50 pairs of pictures. For each of the fifty pairs, participants were asked to choose one of the two pictures. A typical page with hypothetical answers can be seen in Figure 1. The questionnaire had to be filled within 3 minutes and no correction was allowed. The pictures were color or black and white drawings and photographs selected from the Web, so that the choice could have minimal correlation with a common cultural background, logical thinking or common knowledge. This method aims at avoiding multiplier effects that a classical word questionnaire (Zanello *et al.*, 2004) can introduce, because the latter requires conscious reflection peculiar to one's own unconscious.

The one hundred images chosen for the questionnaire were randomized to form 50 pairs presented on 10 A4 format landscape oriented sheets with 5 pairs per page. Each pair occupied about 4 cm (horizontal) by 11.5 cm (vertical). For the 11 testing sessions, the pairs were randomly ordered on the 10 sheets to avoid mnemonic or learning effects.

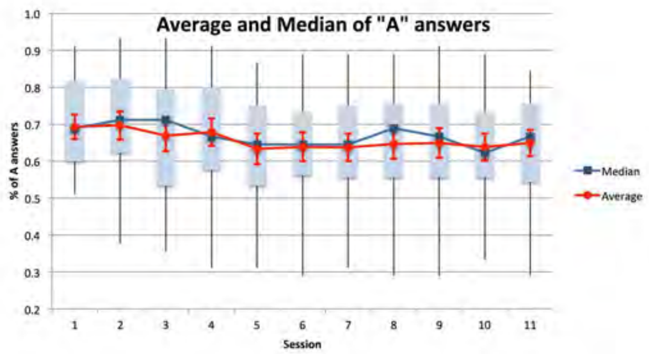

Figure 2. Evolution of the average proportion of the picture initially most selected (picture A). The proportions of participants (± 95% confidence interval shown on average points, red line) who have chosen the initially preferred picture (A) are averaged over the 50 questions for each of the 11 sessions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

Procedure

OMIE teaching is a 5-year program to train group therapists in group analysis. Trainees follow courses on group analysis theory, methods and applications, and they also participate in analytical groups to gain practical experience with group dynamics. 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 are members of staff. In the case under study there were four such groups (A to D, see Table 1). These groups met 3 times for 1h30 in the course of a module. At the end of each day, all four groups meet for 1h30 in a "large group" that includes also the "large group" leaders (who form group E in our table). Finally, group F is composed of the members of the directing committee, who include the other staff and meets during the course of the module. During the first test session, participants filled in the socio-demographic form indexed with a code to render data anonymous. The same code was used to mark the "absurdum questionnaires". The overall experiment includes 11 tests, in which participants had to select one picture for each of the 50 pairs of the questionnaire. The first test was taken the first day before the training actually started. The remaining 10 tests were taken at the end of the second day (Saturday) of each module. For administrative reasons, the staff did not take the second test at the end of the first module.

2.2 Data Analysis

For the purpose of the data analysis, the most frequently chosen picture in each pair during the first test 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). Frequency tables were computed for each pair of pictures and each one of the 11 sessions. Because the present work is devoted to evaluating the influence of the group unconscious on the measured effects, in this case 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 tests, irrespectively of how the individual participant's choice evolved.

a) First of all, potential biases in selecting A pictures for each of the 50 questions were tested. (1) 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). (2) 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):.

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

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

$$(iii) \sigma_i^2 = n\, p(A_i)\,(1 - p(A_i))$$

$$(iv) \chi 2 = \sum_{j=1}^{11} \frac{(\mu_i - x_{ij})^2}{nP(A)(1-P(A))}$$

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

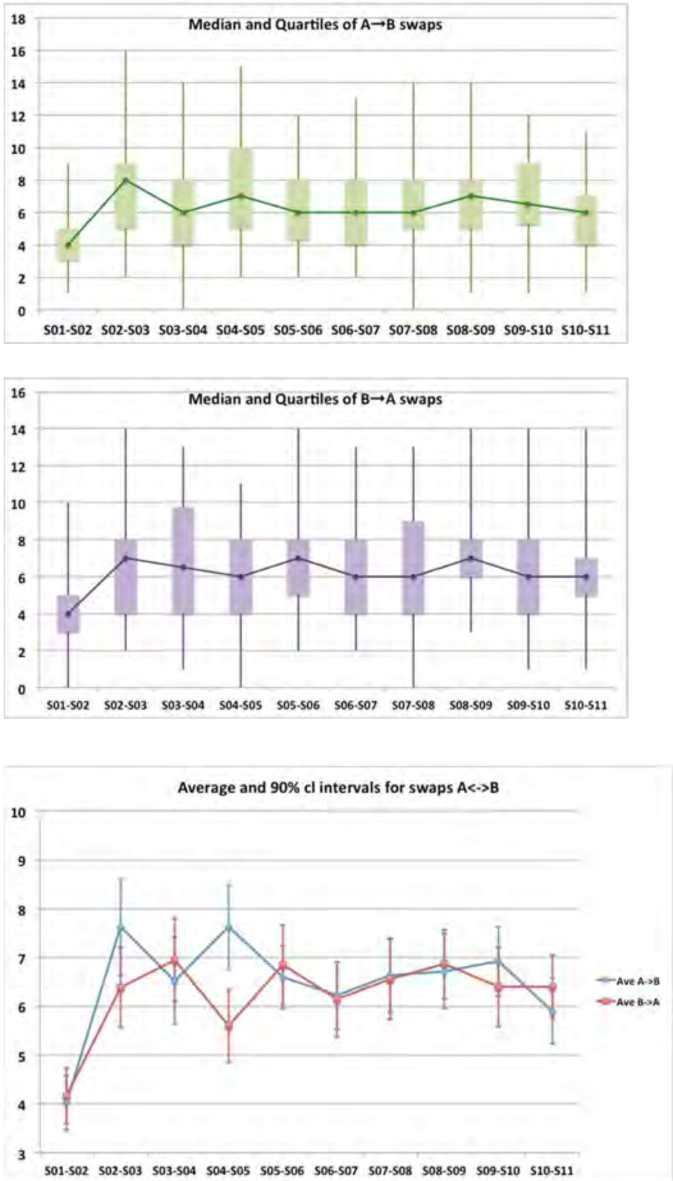

Figure 3. Median and inter-quartile number of changes (ordinate) observed between consecutive sessions (abscissa) is plotted for the swaps from pictures A to B (picture above) and for the swaps from pictures B to A (picture in the middle). We report also average number of swaps with 90% cl intervals (picture below).

b) To evaluate whether the selection of the preferred pictures evolved randomly or as an effect of group sessions, two analyses were carried out. (1) A Friedman test was performed to compare the proportion of participants who choose picture A (initially preferred) for each of the 50 questions at each session. Planned post-hoc statistics between consecutive sessions were carried out with Wilcoxon signed rank tests with Bonferroni's adjustment (n_s = 10, i.e. the number of transition between sessions). (2) 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 swaps 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. Using a Friedman test, we analyzed the number of changes from picture A to picture B, and conversely from picture B to picture A. For each time interval, Wilcoxon signed rank tests with Bonferroni's adjustment (n_s = 10) were run on the numbers of changes from A to B and from B to A occurring for the 50 questions across the 11 sessions, to estimate whether there was an evolution in the frequency of swaps between A and B choices.

c) Random or group dynamics driven swaps of pictures across time were investigated using Friedman tests on the total number of changes from picture A to picture B and from picture B to A, occurring between consecutive sessions (10 intervals) for each of the 50 pairs of questions, as well as on each type of swaps (A to B and B to A) independently. Planned post-hoc statistics between consecutive time intervals were conducted with Wilcoxon signed rank tests with Bonferroni's adjustment ($n_i = 9$ tests between consecutive time intervals).

d) To assess whether changes occurred just by chance or as a consequence of group member common orientation, we compared the mean similarity for each studied group across test sessions. To do so, we computed a measure of pairwise similarities based on the proportion of concordant pictures for each pair of participants within a studied group (Zubin, 1938). Subsequently, the mean similarity for each participant with the other participants within the same studied group was calculated for each test's session. To compare mean similarities across test sessions, we used a permutation test based on the raw data matrix that accounts for the non-independence of observations (i.e., 45 participant x 50 pairs) (Hepworth, 2007). For each permutation of the rows of the raw data matrix, a similarity matrix was computed. The mean similarities were calculated for each session and the corresponding Kruskall-Wallis statistic was computed. For each comparison, 100'000 permutations were performed and the *p*-value was determined based on the proportion of values lower than the observed statistic value. Two-sided *p*-values less than 0.05 were considered as statistically significant.

3 Results

2,143 missing data out of 24,750 data points were found in the overall data set, which was filled in as follows. For the first session, the missing response was replaced by the selection of the picture at the same spatial location in the preceding answer (top or bottom), and for the following sessions (2-11) the answer to the same question but in the preceding session was used instead (last observation carried forward approach or LOCF). We repeat that the staff (14 members) did not complete the second questionnaire, which represents a total of 700 (i.e., 50 x 14) missing data.

Cognitive versus group biases in choosing a picture of a pair

The probability in selecting randomly A or B pictures at the first session was tested against a binomial distribution with a probability of 0.5. A significant result would indicate some kinds of cognitive biases for a picture of a given pair (that we indicate with A) or a very rapid onset of the group unconscious, which would be consistent with Bion's theory of the group psychic apparatus. Significant preferences for pictures A were found in 31 out of 50 pairs, for which initial choices do not seem to have been made randomly (Table 2). We are not in a position to determine whether this was due to cognitive biases or to group dynamics, but we can definitely say that, globally, the initial choice of pictures was not made with a 50-50% probability.

Picture choice evolution

The evolution of the probability of selecting the preferred pictures was examined over the 11 sessions, to assess whether the initial rationale in selecting a picture of a pair would be maintained across time.

Table 2. Binomial analysis of the choices. P-values are given for each question, i.e., each pair of pictures, at the 1st session (p_1), and for the overall sessions (p_o). 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 session.[2]

	1st session		All sessions			1st session		All sessions	
Question	A1/45	p1	χ2(10 df)/10	po	Question	A1/45	p1	χ2(10 df)/10	po
1	0.87	<0.001**	10.62	0.39	26	0.56	0.28	15.29	0.12
2	0.53	0.38	17.66	0.06	27	0.56	0.28	7.58	0.67
3	0.87	<0.001**	13.71	0.19	28	0.67	0.018*	9.11	0.52
4	0.64	0.036	6.22	0.8	29	0.76	<0.001**	12.07	0.28
5	0.51	0.5	16.56	0.08	30	0.56	0.28	8.02	0.63
6	0.84	<0.001**	15.69	0.11	31	0.51	0.5	15.67	0.11
7	0.64	0.036	11.21	0.34	32	0.73	0.0012**	16.59	0.08
8	0.78	<0.001**	5.74	0.84	33	0.62	0.068	12.17	0.27
9	0.67	0.018*	7.91	0.64	34	0.53	0.38	9.2	0.51
10	0.82	<0.001**	2.7	0.99	35	0.69	0.008**	13.48	0.2
11	0.89	<0.001**	29.23	<0.005**	36	0.73	0.0012**	11.67	0.31
12	0.78	<0.001**	12.6	0.25	37	0.73	0.0012**	17.09	0.07
13	0.69	0.008**	28.72	<0.005**	38	0.82	<0.001**	5.35	0.87
14	0.76	<0.001**	4.24	0.94	39	0.67	0.018*	9.87	0.45
15	0.67	0.018**	5.29	0.87	40	0.82	<0.001**	24.24	0.01*
16	0.67	0.018**	10.28	0.42	41	0.69	0.008**	4.72	0.91
17	0.56	0.28	7.83	0.65	42	0.60	0.12	17.91	0.06
18	0.51	0.5	7.38	0.69	43	0.67	0.018*	4.25	0.94
19	0.53	0.38	14.57	0.15	44	0.62	0.068	4.6	0.92
20	0.62	0.068	5.28	0.87	45	0.82	<0.001**	12.42	0.26
21	0.69	0.008**	6.88	0.74	46	0.51	0.5	8.13	0.62
22	0.60	0.12	6.28	0.79	47	0.84	<0.001**	13.11	0.22
23	0.80	<0.001**	9.34	0.5	48	0.84	<0.001**	9.47	0.49
24	0.53	0.38	22.41	0.01*	49	0.87	<0.001**	4.78	0.91
25	0.87	<0.001**	23.21	0.01*	50	0.91	<0.001**	11.06	0.35

Table 3. Wilcoxon signed rank tests between sessions on the proportion of participants. Z and p-values given by the Wilcoxon signed rank tests are provided for the comparisons between consecutive sessions (S k-S (k+1), k=1 to 10) of the proportions of participants who chose picture A at each question. A statistical significance (*) is assumed for p-values < 0.005 (i.e., α = 0.05/10 comparisons).

Sessions	S1-S2	S2-S3	S3-S4	S4-S5	S5-S6
Z	-0.487	-1.694	-0.908	-2.859	-0.224
P	0.626	0.090	0.364	0.004*	0.823
Sessions	S6-S7	S7-S8	S8-S9	S9-S10	S10-S11
Z	-0.543	-0.935	-0.045	-0.880	-1.081
P	0.587	0.350	0.964	0.379	0.280

Table 4. Wilcoxon signed rank tests' statistics. Z and p values given by the Wilcoxon signed rank tests are provided for the comparisons performed between changes from pictures A to B (AB) and B to A (BA) at each time interval (e.g., S1S2BA = B chosen at test 1 and A chosen at test 2). A statistical significance (*) is assumed for p values < 0.005.

Time	S1S2BA	S2S3BA	S3S4BA	S4S5BA	S5S6BA
Intervals	S1S2AB	S2S3AB	S3S4AB	S4S5AB	S5S6AB
Z	-0.671	-1.742	-0.829	-2.893	-0.304
P	0.502	0.081	0.407	0.004*	0.761
Time	S6S7BA	S7S8BA	S8S9BA	S9S10BA	S10S11BA
Intervals	S6S7AB	S7S8AB	S8S9AB	S94S10AB	S10S11AB
Z	-0.510	-0.055	-0.199	-0.902	-1.043
P	0.610	0.956	0.842	0.367	0.297

[2] 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 are the frequencies of A answers used as estimators of the probability.

The null hypothesis was that the variations of the choices are consistent with the fluctuations of a binomial distribution and therefore that chance drives the evolution of the picture choice and not the group dynamics. Evolution in choices appeared significant for 5 out of the 50 questions (Table 2) according to a classical $\chi 2$ test with 10 degrees of freedom. These 5 questions all have a frequency p(Ai) > 0.8 significantly (p=0.05) more frequent (60%) than the whole set of 50 questions (27%). In the table we report the $\chi 2(10\, df)/10$ for easier reading.

Figure 2 represents the evolution across sessions of the choices for the most selected (A) pictures determined in session 1, i.e., before the start of the group training. During the first 4 modules (i.e., sessions 2 to 4), the selection of picture A decreases slightly and progressively shifts toward picture B, without however inverting the preference. From session 5, the preference for pictures A remains steady to the end of the training (session 11). The Friedman test conducted on the proportion of participants who chose picture A during the 11 sessions, revealed a significant evolution effect, i.e. the choice of pictures changed with time during the training ($\chi 2 = 34.092$, N = 50, df = 10, $p < 0.0001$*). The Wilcoxon signed rank tests carried out between consecutive sessions determined that there is a significant change in the choices between the 4th and the 5th tests ($p < 0.005$, Table 3) with a change of the median proportion of A from 66.6% to 63.3%.

To evaluate whether swaps from pictures A to B or from pictures B to A evolved, Wilcoxon signed rank tests were performed on the swaps A→B and B→A for each session. As for the previous tests, this revealed a significant change in the selection of picture A (initially preferred) between the 4th and 5th tests ($p < 0.005$, Figure 3, Table 4) with a difference between the average number of swaps A→B and B→A of peaking at 2.02 (see Figure 3). This is consistent with the previous Wilcoxon test and it tells us that a statistically significant change in the balance between A→B versus B→A swaps between sessions 4 and 5 determines a significant change in the number of A (and B) choices between these two sessions.

Group dynamics driven swaps of pictures

If we now turn to consider the frequency of swaps A→B, B→A and A→B+B→A across the 11 sessions, Friedman analysis tells us that their evolution is statistically relevant (A→B + B→A: $X^2 = 93.7$, N = 50, df = 9, $p < 0.0001$*; A→B: $X^2 = 61.3$, N = 50, df = 9, $p < 0.0001$*; B→A: $X^2 = 45.4$, N = 50, df = 9, $p < 0.0001$*) (Figure 3). If we then analyze which of these changes is relevant with a Wilcoxon signed rank test, we discover that the frequency of swaps increases significantly only between the first (i.e., from session 1 to session 2) and the second (i.e., from session 2 to session 3) interval, for all three swaps considered, e.g. the total number of swaps (Table-5a), the swaps A→B (Table-5b) and the swaps B→A (Table-5c) ($p < 0.0056$). In other word, swaps A↔B increased after the second training session (after a total of 4 days spent together), and remained almost constant until the end of the training. However it is interesting to highlight that independent analyses on A to B and B to A swaps both showed a marginal significance between time intervals 3-4 and 4-5 (p = 0.019 and p = 0.010 respectively), reflecting the significant decrease in choosing picture A between the 4^{th} and the 5^{th} testing sessions as revealed in the previous analyses (see § b2 and Figure 2).

Mean similarity measures

The computed similarity measures were devoted to assessing whether a picture's selection, i.e., answers to the questionnaire, occurred just by chance or conversely, if they were driven from group members' common orientation.

Consequently Kruskall-Wallis tests were carried out for each group (A, B, C, D and F, see Table 6) and for the overall groups, which met together once per training day with group E (large group conductors). Statistics indicate that taken together, groups seemed to adopt a common orientation in their choice of pictures (p = 0.003). However, at the level of the individual groups, the effect is more ambivalent. If groups D and F still displayed similar behavior (p = 0.02 and 0.007), statistics were only marginally significant for group B (p = 0.05), and not at all for groups A and C (p = 0.97 and 0.79 respectively), indicating a choice by chance.

4 Discussion

4.1 Cognitive versus group dynamics biases

The first outcome of our study is that the initial answer to the test is not a 50%-50% random choice between the two pictures of each pair, despite the fact that the pairs of pictures were chosen with an attempt to avoid inducing social or cultural bias. This initial bias could be the reflection of our shortcoming in avoiding these effects, but it could also have another explanation. 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 promote an unconscious connection and to provoke group phenomena. So this orientation could indeed be the result of a group effect. Unfortunately our protocol does not allow discrimination between these two explanations.

A future version of such a protocol should include a provision to determine bias that could be attributed to common social and / or cognitive preferences for one picture of the pairs, driven for instance by visual attributes (e.g., color, spatial frequency contents, etc.) or meaning contents. One possible alternative would be to use some type of fractal pictures. Another approach would be to ask future participants to fill in the questionnaire before they actually meet for the first time. Alternatively the questionnaire could be composed of pairs of questions previously tested for perfect randomization. Whatever the origin of the initial orientation, it does not affect the statistical significance of group effects that occur in the following sessions and therefore the results obtained in this experiment.

In what follows we will analyze our data under two different angles. First of all we will consider the distribution of the choice of the different figures and its evolution during the experiment. The second quantity we will consider is the number of changes from one choice to another made by the participants in the different sessions (swaps). The rather strong initial orientation could be due to the influence of group dynamics following Bion's idea that the group is immediately created, or it could be the effect of social and cognitive phenomena, or a combination of the two effects. However, 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).

Table 5. Wilcoxon signed rank tests on the number of swaps between time intervals. Z and p-values given by the Wilcoxon signed rank tests are provided for the comparisons between consecutive time intervals (S_iS_{i+1} $S_{i+1}S_{i+2}$) of the total number of swaps from pictures A to B and B to A (a), swaps from A to B (b) and swaps from B to A (c). A statistical significance (*) is assumed for p-values < 0.0056 (i.e., α = 0.05/9 comparisons).

Time Intervals		S1S2	S2S3	S3S4	S4S5	S5S6	S6S7	S7S8	S8S9	S9S10
		S2S3	S3S4	S4S5	S5S6	S6S7	S7S8	S7S8	S9S10	S10S11
a	A to B + B to A swaps									
	Z	-6.014	-0.968	-0.279	-0.208	-1.986	-1.023	-0.566	-0.687	-1.973
	p	<0.0001*	0.333	0.780	0.835	0.047	0.306	0.572	0.492	0.048
b	A to B swaps									
	Z	-5.252	-1.581	-2.336	-1.576	-0.770	-0.750	-0.092	-0.523	-1.678
	p	<0.0001*	0.114	0.019	0.115	0.441	0.453	0.927	0.601	0.093
c	B to A swaps									
	Z	-3.964	-0.920	-2.563	-1.869	-1.548	-0.959	-0.669	-0.873	-0.217
	p	<0.0001*	0.357	0.010	0.062	0.122	0.338	0.503	0.383	0.828

We recall that, as explained at the beginning, the evolution of the group psyche according to the basic assumptions can largely be seen as a reaction to the inability of the supposedly almighty leader to assume his mythical role of protecting the group.

Group unconscious common orientation during the training was investigated at two levels. First its impact on similarity of choices was explored and second, its influence on the environment was examined by measuring choices and the frequency of their active changes at the level of the questionnaire.

4.2 Similarity of participant choices

Similarities of participant choices were examined at the level of the individual small group (8-10 people), which is supposed to represent the "family", and at the large group level, which symbolizes the "society". We could have expected a greater coherence in choices at the “family” rather than at the “society” level. However this was not the case. The large group as a whole showed a common orientation across sessions, i.e., participants were collectively more likely to select the same response to questions. This orientation was less identifiable in the individual small groups. It seems that “society” is the driving force that directs the group unconscious to adopt similar behavior, rather than smaller communities. This explanation tends to be in favor of the postulate of a universal psychic field proposed by Baaquie and Martin (2005).

4.3 Group unconscious

The evolution of the answers to the questionnaire was analyzed to provide two kinds of information about group phenomena, designed to check whether the group unconscious actually adopts a common orientation measurable on the environment, i.e., the answers to the questionnaire.

4.3.1 Evolution of group dynamics choices

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, the evolution of picture choices should not be random across testing sessions. The analysis showed that the evolution of the selection of the A picture is compatible with random fluctuations between the 1st and the 4th and between the 5th and 11th tests. Between the 4th and the 5th test (corresponding to the transition between the 3rd and the 4th sessions, as there were two tests in the first session) there was a “defocusing” in the choice of the preferred picture that is non-random with a high significance. This effect can clearly be seen also in the comparison of the A→B and B→A swaps between sessions. The A→B and B→A swaps for the same interval between two sessions are compatible with each other except for the transition from the 3rd to the 4th session, where they are clearly different, revealing significantly more A→B swaps in favor of the least selected picture and fewer B→A swaps in the direction of the favorite one. Both analyses show that the choice stayed constant (without statistically significant variation) from the 1st to the 3rd and from the 4th to the 10th sessions, after the number of A’s had decreased.

Table 6. Temporal variations in mean similarity measures within studied groups. Mean similarity measures are given for the 11 sessions of each group and for the overall group. P-values of the Kruskall-Wallis tests are also given. Significance (*) is assumed for $p < 0.05$.

	Sessions											
Studied	1 (Baseline)	2	3	4	5	6	7	8	9	10	11	*p*
groups	Mean similarity measures											
A	.57	.56	.60	.60	.59	.59	.58	.59	.59	.60	.58	0.97
B	.58	.62	.57	.58	.53	.54	.54	.53	.53	.55	.55	0.05
C	.63	.59	.63	.60	.61	.61	.63	.60	.60	.59	.59	0.79
D	.60	.61	.59	.56	.54	.52	.53	.56	.57	.53	.53	0.02*
F	.63	.63	.59	.57	.56	.56	.50	.53	.49	.49	.54	0.007*
All	.59	.60	.59	.59	.57	.57	.56	.57	.58	.56	.57	0.003*

This behavior is very suggestive of group dynamics. During the first three 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 constant to the end of the training. Although this 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.

It is also very interesting to note that this effect is very visible at the level of the global group and less at the level of the individual group, while group illusion and disillusion and mourning are effects that are also strongly felt at the level of the “small groups”. It seems that even if the evolution is individually felt more powerfully at the level of the small community (“family”), it is an effect that involves the whole society. So while there are individual variations in the way the small groups move across time, the global (“social”) picture maintains a high degree of coherency.

4.3.2 Evolution of swaps and group dynamics

The swaps we measured across sessions could be interpreted as a manifestation of group dynamics similar to that postulated by Bion (1961) with the "basic assumptions". For instance, "honeymoon" (dependence on the leader) and the successive "fight-flight" (reaction against the dependence on the leader) attitude could be represented by a greater number of group dynamics swaps (further away from pure randomness). It seems intuitive that an increase in the swaps could be linked to increased group activity or to a group dynamics event.

Statistics carried out on the total number of swaps or individually on A→B or B→A changes evidenced a significant increase in those swaps between the 1st (S1S2) and the 2nd (S2S3) time intervals, i.e., between the 2nd and the 3rd testing sessions, incompatible with a random fluctuation. In other words the change of choice increased significantly between the 1st and the end of the 2nd training module, and then remained essentially constant to the end of the training, while the frequency of choices for the initially preferred picture changed significantly only between the 3rd and the 4th training sessions. Between these two sessions there is no sign of change in the evolution of the sum A→B+B→A, while the number of A→B and B→A swaps showed a fluctuation close to significance. This is consistent with the "defocusing" in the choice of A observed.

Again the pattern emerging is very suggestive. Even if the onset of the group is immediate (with a distribution of answers far from 50%-50% at the very beginning of the training) the group activity needs the group to meet and exchange for some time before being set in motion. Group dynamics really start after a few days spent together (here 3-4 days training, i.e., about 9-12 hours), and remain essentially constant as long as the group exists, whatever the group evolution.

At this point we could propose two possible interpretations of the data. In the first one we postulate that, according to Bion's theory, the group exists from its earliest stage, and the modification of picture selection observed at mid-training, which corresponds to an evolution towards a more random or "less focused" choice, is coherent with a decreased group coherence, possibly caused by the group disillusion with the leaders or the prospect of the end of the training (the death of the group).

Alternatively, the initial choices are due to a cognitive or social bias and the group forms according to the basic assumption with a timescale compatible with the increase of the swap frequency, i.e. during the first training session. In this case the decrease in the choice of the A pictures is rather the manifestation of a new equilibrium introduced by group dynamics, where initial cognitive choices are modified by increased group unconscious activity aimed at fulfilling the group desires or needs.

It is difficult to be more specific with this first questionnaire and a single evaluation at the end of each module.

5. Conclusions

Our study aimed at detecting measurable effects of the psychical dynamics that take place during a group training session. For this we used the answers given to a questionnaire designed to minimize or at least reduce cognitive and social bias. Although our results are subject to interpretation, we believe that this study presents strong indications 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 is shown by the evolution in the frequency of swaps in the choices of images across sessions. The present study brings additional insight into the mechanisms at work in group dynamics, and indicates support for Bion's theory of both an immediate and a more progressive group dynamics effect.

Acknowledgements
We would like to thank Ms. Catherine Forsyth for her insightful reading of the manuscript and her precious suggestions.

Author Addresses
[1]OMIE, Fundación Vasca para la Investigación en Salud Mental / Osasun Mentalaren Ikerketarako Ezarkundea, Bilbao, Spain, [2]Physicist at CERN, 1211 Geneva 23, Switzerland; email: Federico.Carminati@cern.ch, [3]Psychiatry Service, Basurto Hospital, Bilbao, Spain, [4]Basque Country University, Bilbao, [5]Training Centre, Human Resource Division, Geneva University Hospitals, Geneva, Switzerland, [6]Department of Psychiatry, Geneva University Hospitals, Geneva, Switzerland, [7]Honorary research fellow at CNRS; e-mail: martin@lpthe.jussieu.fr, [8]TIMC-IMAG, UMR CNRS 5525, Faculté de Médecine, Université J. Fourier, 38700 La Tronche, [9]AGIM, FRE CNRS 3405, , Faculté de Médecine, Université J. Fourier, 38700 La Tronche, [10]Units of Mental Development Psychiatry, Specialized Psychiatry Department, Geneva University Hospital, Geneva, Switzerland, [11]Association pour le TRAvail Groupal thérapeutique et social (ASTRAG) and Simposietto.

References

Anzieu D and Martin J. La dynamique des groupes restreints. 11th ed. Presses Universitaires de France. Paris, 1997.

Aspect A, Grangier P, Roger G. Experimental Realization of Einstein-Podolsky-Rosen-Bohm Gedankenexperiment: A New Violation of Bell's Inequalities. Physical Review Letters 1982; 49(2): 91–94. doi: 10.1103/PhysRevLett.49.91.

Atmanspacher H. Quantum Approaches to Consciousness. Stanford Encyclopedia of Philosophy, 2006.

Atmanspacher H and Fach W. A structural-phenomenological typology of mind-matter correlations. J Anal Psychol 2013; 58(2): 219-244. doi: 10.1111/1468-5922.12005.

Baaquie B and Martin F. Quantum Psyche - Quantum Field Theory of the Human Psyche. NeuroQuantology 2005; 3(1):7-42.

Beck F and Eccles J. Quantum aspects of brain activity and the role of consciousness. Proceedings of the National Academy of Sciences of the USA 1992; 11357-11361.

Bell J. On the Einstein- Poldolsky-Rosen paradox. Physics 1964; 1:195-200.

Bell J. On the problem of hidden variables in quantum mechanics. Rev Mod Phys 1966; 38: 447.

Bion W. Experiences in groups and other papers. Tavistock Publications Ltd., 1961.

Cerf N and Adami C. Quantum mechanics of measurement. 1997; eprint quant-ph/9605002, unpublished.

Cerf N and Adami C. What Information Theory can tell us about Quantum Reality. 1998; arXiv:quant-ph/9806047

Conte E, Todarello O, Federici A, Vitiello F, Lopane M, Khrennikov A. A Preliminar Evidence of Quantum like Behavior in Measurement of Mental States. 2003; arXiv:quant-ph/0307201

Dorn G. Clavis totius philosophiae chemisticae per quam potissima philosophorum dicta reserantur. In L Zetzner (ed.), Theatrum Chemicum, Oberursel and Strasbourg, 1602.

Einstein A, Podolsky B, Rosen N. Can Quantum-Mechanical Description of Physical Reality Be Considered Complete? Phys Rev 1935; 47(10): 777–780. doi:10.1103/PhysRev.47.777.

Foulkes SH. Therapeutic Group Analysis, International Universities Press. New York, 1964.

Galli Carminati G and Carminati F. The mechanism of mourning: an anti-entropic mechanism. NeuroQuantology 2006; 4(2):186-197.

Galli Carminati G and Martin F. Quantum Mechanics and the Psyche. Physics of Particles and Nuclei 2008; 39: 560-577.

Grinberg-Zylberbaum J, Delaflor M, Attie L, Goswami A. The Einstein-Podolsky-Rosen Paradox in the Brain: The Transferred Potential. Physics Essay 1994; 7(4):422.

Hameroff S and Penrose R. Conscious events as orchestrated spacetime selections. Journal of Consciousness Studies 1996; 3(1): 36-53.

Hameroff S. Orchestrated Reduction of Quantum Coherence in Brain Microtubules: A Model for Consciousness. NeuroQuantology 2007; 5(1): 1-8.

Hepworth G, Gordon IR, McCullough MJ. Accounting for dependence in similarity data from DNA fingerprinting. Statistical Applications in Genetics and Molecular Biology 2007; 6(1).

Jung C and Pauli W. The Interpretation of Nature and the Psyche, Pantheon. New York, 1955.

Translated by P. Silz; German original: Natureklärung und Psyche, Rascher. Zürich, 1952.

Lawrence W, Bain A, Gould L. The fifth basic assumption. Free Associations 1996; 6-1(37): 2855.

le Bon G. Psychologie des foules, Presses Universitaires de France. Paris, 2006.

Marshall I. Consciousness and Bose-Einstein condensates. New Ideas in Psychology 1989; 7: 73-83.

Martin F, Carminati F, Galli Carminati G. Quantum Information, oscillations and the Psyche. Physics of Particles and Nuclei 2010; 41(3): 425-451.

Martin F, Carminati F, Galli Carminati, G. Quantum Information Theory Applied to Unconscious and Consciousness. NeuroQuantology 2013; 11(1): 16-33.

Martin F and Galli Carminati G. Synchronicity, Quantum Mechanics and Psyche. In Atmanspacher H, Primas H (Eds.). Wolfgang Pauli's Philosophical Ideas and Contemporary Science, Springer, 2007

Pauli W and Jung C. Atom and Archetype: The Pauli/Jung Letters 1932-1958, Princeton University Press. Princeton, 2001.

Penrose R, The Emperor's New Mind, Oxford University Press. Oxford, 1989.

Penrose R. Shadows of the Mind, Oxford University Press. New York, 1994.

Pitaevskii L and Stringari S. Bose-Einstein Condensation, 2nd edn, Oxford University Press. Oxford, 2004.

Pitkanen M. Quantum Mind Archives 1998; 88 21. http://listserv.arizona.edu/archives/quantum-mind.html

Schrödinger E and Born M. Discussion of probability relations between separated systems. Mathematical Proceedings of the Cambridge Philosophical Society 1935; 31(4): 555–563. doi:10.1017/S0305004100013554.

Schrödinger E and Dirac PM. Probability relations between separated systems. Mathematical Proceedings of the Cambridge Philosophical Society 1936; 32(3): 446–452. doi:10.1017/S0305004100019137.

Vergopoulo T. La sensibilisation à la dynamique de groupe d'après W.R. Bion et S.H. Foulkes. Médecine et Hygiène, 1983. pp. 3149-3155.

Vitiello G. Quantum dissipation and information: a route to consciousness modeling. NeuroQuantology 2003; 2: 266-279.

Zanello A, Rouget-Weber B, Gex-Fabry MG, Maercker A, Guimon J. New instrument to assess social functioning in mental health settings. European Journal of Psychiatry 2004; 18: 76-78.

Zubin J. A technique for measuring like mindedness. Journal of abnormal and social psychology 1938; 33: 508-516.

Zurek H. Pointer basis of quantum apparatus: into what mixture does the wave packet collapse? Phys Rev D 1981; 24: 1516.

Zurek H. Decoherence and the transition from quantum to classical. Phys Today 1991; 44(10): 36.