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EMOTIONS IN COOPERATIVE WORK: AN EXPERIMENTAL-LONGITUDINAL LAB STUDY

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SUMMARY

The main aim of this paper is to analyse the effects of Computer Aided Technology (CAT) on collective and individual emotions and group performance through two longitudinal lab experiments. The sample was made up of 143 Psychology students who were distributed in 19 experimental groups each made up of 5 members –who used an «IRC-chat» during the group task– and in 10 control groups who used face-to-face conditions. In the first study, regression analysis and Multivariate analysis of covariance using repeated measures were performed. Results show the main effects of attitudes toward technology on affective psychological well-being. Thus, subjects with a more positive attitude toward technology showed greater satisfaction and enthusiasm, and did not feel anxiety. However, subjects who used CAT showed higher levels of anxiety. In addition, while enthusiasm decreased in Chat-groups, this emotion increased with time in Face-groups. Thus, subjects with very positive attitudes showed a tendency to decrease their enthusiasm more than those with less positive attitudes. In the second study, multiple regression analyses were carried out. Results show significant relationships in two directions: individual towards group and group towards individual. Enthusiasm (individual and group) is the most predictive of the rest of the variables. These results confirm the emotional contagion hypothesis in computer-aided communication,

in which non-verbal communication is not present. Limitations of the study and practical implications of these findings are discussed.

Keywords: mental health, computer aided technology, lab, emotional contagion

INTRODUCTION

Emotions are a fundamental aspect of much work (Briner, 1999). The increasingly more frequent introduction of Computer-Aided Technology (CAT) at work is an important factor which can have negative and positive consequences on workers' emotions. However, the impact of CAT on work is a complex process. Most studies agree that high exposure to technology is related to a decrease in anxiety (Bohlin & Hunt, 1995; Colley, Brodzinski, Scherer & Jones, 1994; Crable, Brodzinksi, Sherer & Jones, 1994; Igbaria & Chakrabarti, 1990; Jones & Wall, 1990; Kalimo & Lepeenon, 1985; Kay, 1990; Okebukola, Smith, Caputi & Rawstorne, 2000; Summamopouw & Jegede, 1992; Todman & Managhan, 1994). However, other studies stress that the mere exposure to technology is not responsible per se for its consequences on users' health. Instead, types of exposure and mediating variables (such as job characteristics and appraisal of exposure) influence their mental health (Chua et al., 1999; Korunka & Vitouch, 1999; Leso & Peck, 1992; Majchrzak & Borys, 1998; Rousseau, Jamieson, Rogers, Mead & Sit, 1998; Salanova & Schaufeli, 2000; Woodrow, 1991). For instance, in a study on technology exposure and burnout in 202 Spanish workers using computer-aided technology, Salanova & Schaufeli (2000) found that types of exposure (time and frequency of usage) do not have a direct effect on burnout, but mediated users' appraisal of the exposure.

Thus, the aim of this research is to analyse the effects of using CAT on collective and individual emotions and the role played by cognitive variables as intermediate variables. We have organized the article in two specific studies about this topic and we present the main results of both studies.

STUDY I

The use of technology in work is becoming more and more frequent nowadays. The concept of working in teams is changing

as technology allows for computer mediated communication (CMC), and the use of e-mail, chats or videoconference are becoming common work instruments. Previous research has shown the negative consequences on psychological well-being of using CMC, such as anxiety, tension and depression (Prieto, Zornoza, Orengo & Peiró, 1996; Korunka, Weiss, Huemer & Karetta, 1995 & Smith, 1997). However, recent studies emphasize the positive effects, which are associated with individual and collective enthusiasm (Cifre, Llorens, Martínez & Salanova, 2000), self-confidence and goal-setting (Salanova & Schaufeli, in press) and, finally, motivation and self-efficacy (Coffin & MacIntyre, 1999).

Furthermore, mere exposure to technology does not have a direct effect on the users' well-being, but it is mediated by other variables such as the appraisal of cognitive experience (Martínez, Gimeno & Prieto, 2001; Salanova & Schaufeli, 2000; Chua, Chen, & Wong, 1999; Leso & Peck, 1992; Majchrzak & Borys, 1998; Rousseau, Jamieson, Rogers, Mead & Sit, 1998; Woodrow, 1991), and attitudes toward CMC (Beas, Llorens & Salanova, 2000; Grau et al., 2000; Salanova & Schaufeli, 2000; Salanova et al., 2000).

Finally, there is a lack of longitudinal and laboratory studies on this topic and most of them are correlational and transversal. It is, nonetheless a very important tendency. An example of this type of studies is the work by Salanova, Martínez, Bravo & Rodríguez (1998), in which they analyse the creation of «shared mental models» by group members. In the study, different kinds of technology (e-mail, videoconference and face-to-face) were taken into account in two moments in time.

Consequently, the objective of our first study is to analyse the effects of CAT use («IRC-chat») on psychological well-being (satisfaction, [lack of] anxiety and enthusiasm), and the modulatory effects of attitudes towards technology in their relationship. Specifically, the hypotheses are:

Hypothesis 1: The effect of the Group Communication System (i.e. chat vs. face-to-face) on well-being (i.e. satisfaction, anxiety and enthusiasm) will be moderated by attitudes toward technology.

Hypothesis 2: Attitudes toward technology will be positively associated to satisfaction and enthusiasm and negatively associated with anxiety.

STUDY II

Darwin (1872) was the precursor of the first studies about the emotional contagion. These previous studies showed that people can be emotionally influenced or tainted with other people's emotions. Hatfield, Cacioppo & Rapson (1992, 1994) defined the emotional contagion as the tendency to automatically mimic and synchronize facial expressions, vocalizations, postures and movements with those of another person and, consequently, to converge emotionally. When one individual comes into contact with another emotionally expressive person, the former will very often reflect the emotional behaviour of the more expressive one. This is a non-conscious process. However, other people's non-verbal expressions, whether they are facial, mimic, movements, or whatever, become part of the receiver's conscious experience (Bavelas, Black, Lemery & Mullet, 1987).

A second kind of emotional contagion (Schaufeli, Bakker & LeBlanc, 1998) is related to the similarity with the emotions which are felt by other people. In this case, the process is totally conscious and it is produced when one is able to «catch onto» the emotions of others (sympathy), imagine their feelings and feel the same.

The imitation of motor and mimic behaviours has been analysed in children and in adults, in order to investigate the contagion of emotional states through motor expressions. A great deal of research has pointed out the role of individual variables in facilitating or in hindering the emotional contagion (Kellerman & Laird, 1982; Laird & Bresler, 1990; Laird & Crosby, 1974). Moreover, in lab studies (Doherty, 1998) the relationship between the contagion of the emotion and its external outcomes is studied. Other studies have analysed the influence of personal experiences from one person on the people around them. Transfer or contagion of emotional states themselves are aspects that have been submitted to less study.

A classic study related to depression contagion was performed by Howes, Hokanson & Lowenstein (1985). Using a longitudinal design, they showed an increase in depression levels in individuals who had lived together with depressive partners for three months. This result was corroborated by Joiner (1994). In general, the burnout contagion has been studied a lot (Groenestijn, Buunk y Schaufeli, 1992; Schaufeli et al., 1998), because individuals affected show clear symptoms. Westman & Etzion (1995) studied stress, burnout and coping strategies on a sample made up of servicemen and their wives. The results highlight positive

relationships between the members of a couple in burnout and perceived levels of control. Thus, individuals transmitted burnout to their partners and this process was bi-directional. In the same way, the burnout contagion has been seen to occur in work groups (Rountree, 1984).

Most of the research is based on real face-to-face (FF) interaction between individuals at the same time, as a necessary condition to the contagion. In this interactive process, expressions and non-verbal behaviours are very relevant. However, there is a lack of research on emotional contagion in situations in which individuals interact using technology (technology systems, computer mediated communication). The negative emotional contagion (burnout, depression, anxiety) has been studied in depth, but the positive emotional contagion (enthusiasm, satisfaction and well-being) has received less attention. In this context, the objective of study II was to analyse the positive emotions (enthusiasm and relax) contagion in a bi-directional way (individual to group, group to individual) in the CAT context. More specifically, the hypotheses were:

Hypothesis 1: Contagion of positive emotions is expected, but it will be stronger in face-to-face conditions (expression and experience of emotions).

Hypothesis 2: We expect the contagion process to be bi-directional (individual to group and group to individual).

METHOD

Procedure and participants

An experimental lab study with a longitudinal design (T1 and T2) was carried out from September 1999 to February 2000. The study was based on two laboratory group tasks, using Computer Mediated Communication. The «*mIRC32*» IRC-chat software was used. The first task (T1) was a creative task and the second one (T2) was an intellective task. Control groups performed the same tasks with face-to-face sessions. When subjects finished each task (T1 and T2), all of them filled in a questionnaire «Experiences Related to Work Questionnaire–Group (CET-G)» (Salanova et al., 2000) about the main issues of the research.

The sample was made up of 143 Psychology students, who were randomly distributed in 19 experimental groups and 10 control group of 5 members each. The *experimental group*, (EG) (92.6% females and 7.4% males) used the «mIRC32» IRC-chat software during the group tasks. Ages ranged from 21 to 39 years old (mean=23.3 years (*s.d.*=3.06). 50% of the subjects used CAT in their daily work, with 11% frequency of use per week and with an average of 20 months using CAT (s.d.=14.79).

In addition, we used 10 control groups (CG), (89.6% females and 10.4% males) who performed the task in face-to-face conditions. Ages ranged from 22 to 34 years old (mean=24.6 years; *s.d.*=3.03) and 75% of the subjects used CAT in their jobs, with 22% frequency of use per week and with an average of 41.2 months using CAT (s.d.=28.09).

Measurements

Study I

Work psychological well-being

Warr's (1987, 1990) bi-dimensional model of subjective well-being was used in this study. This model proposes three axes to measure psychological well-being at work: unpleasure-pleasure, anxiety-relax and depression-enthusiasm.

To assess job satisfaction, we used the «Satisfaction Questionnaire» (S10/12), which has been validated by Meliá & Peiró (1989). Items are scored on a seven-point Likert scale, ranging from (1) «very unsatisfied» to (7) «very satisfied». The internal consistency is a=.78 in T1 and α=.83 in T2. An example of an item is «the opportunity to learn new things during the realization of the work».

Axes two and three (anxiety-relax and depression-enthusiasm) were measured using a Spanish version of Warr's «Subjective Well-being Questionnaire» (Warr, 1990), which was formulated by Lloret & Tomás (1994). The instrument has 12 adjectives about anxiety-relax and depression-enthusiasm. An example of an anxiety item is «During my work *I have felt tense*». Items are scored on a six-point Likert scale, ranging from (1) «never» to (6) «always». The internal consistency is a= .86 (anxiety scale) and a= .88 (enthusiasm scale).

CMC attitudes

The «Attitude towards New Technologies» scale (WONT, 1998) was used. It consists in three items that refer to the positive attitude towards technology implementation at work (α=.82). Items are scored on a seven-point Likert scale, ranging from (1) «totally disagree» to (7) «totally agree». An example of an item is «They are valuable and necessary».

Study II

Individual emotions

We used a Spanish version of Warr's «Subjective Well-being Questionnaire» (Warr, 1990), which was formulated by Lloret & Tomás (1994) and validated by Cifre (2000). The instrument consists in 12 adjectives which constituted two main dimensions about psychological well-being at work: anxiety-relax and depression-enthusiasm. An example of an item is «During my work, <u>I have felt</u>…». Items are scored on a six-point Likert scale, ranging from (1) «never» to (6) «always». The higher the score on the scale, the higher the psychological well-being (relax or enthusiasm).

Collective emotions

We used a Spanish version of Warr's «Subjective Well-being Questionnaire» (Warr, 1990). An example of an item is «During my work, <u>my group</u> have felt…». Items are scored on a six-point Likert scale, ranging from (1) «never» to (6) «always».

RESULTS

Study I

To analyse the impact of attitudes on the relationship between CMC use and well-being, regression analysis was carried out. The results showed significant relationships in all cases (Table 5.1).

Table 5.1: Linear Regression analysis: attitude toward technology as a predictor

(PREDICTOR) Attitude toward technology					
Criterion	F	R^2	Beta	*error*	Constant
Satisfaction	18.64 p<.001	.12	.35 p<.001	.079	.024
Anxiety	15.63 p<.001	.10	-.32 p<.001	.080	.023
Enthusiasm	18.13 p<.001	.12	.34 p<.001	.080	.019

As we expected, attitudes toward CMC are positively associated to satisfaction and enthusiasm, and negatively associated with anxiety. Thus, hypotheses one and two are fulfilled.

Further analysis using a Multivariate Analysis of Covariance with repeated measures was made for all the psychological well-being variables. Thus, the values of these variables in T1 and T2 as an intra-subject factor, the experimental condition (CMC, face-to-face) as an inter-subject variable and the attitude toward CMC as a covariable, have been taken into account (Table 5.2).

In this case, regarding inter-subject effects, the analysis showed that the main effects of attitude occurred on the three measures of well-being – as the previous regression analysis had revealed. There are positive relationships with satisfaction and enthusiasm. Thus, the more positive the attitude towards technology, the more satisfaction is experienced. This result was independent of the mechanism (technology or traditional process) used by the subject performing the task. However, the main effect of attitude towards anxiety is negative. Thus, when attitude towards technology is positive, the level of anxiety is lower in T1 and in T2. Moreover, the

Table 5.2: Multivariate Analysis of Covariance using repeated measures

	Satisfaction	Anxiety	Enthusiasm
Inter-subject	F	F	F
Condition	3.26	21.03***	2.23
Attitude	21.02***	11.91***	15.87***
Intra-subject	F	F	F
Time (T1-T2)	2.9	2.59	3.3
Time X Condition	3.5	.75	20.79**
Time X Attitude	1.48	1.41	3.35+

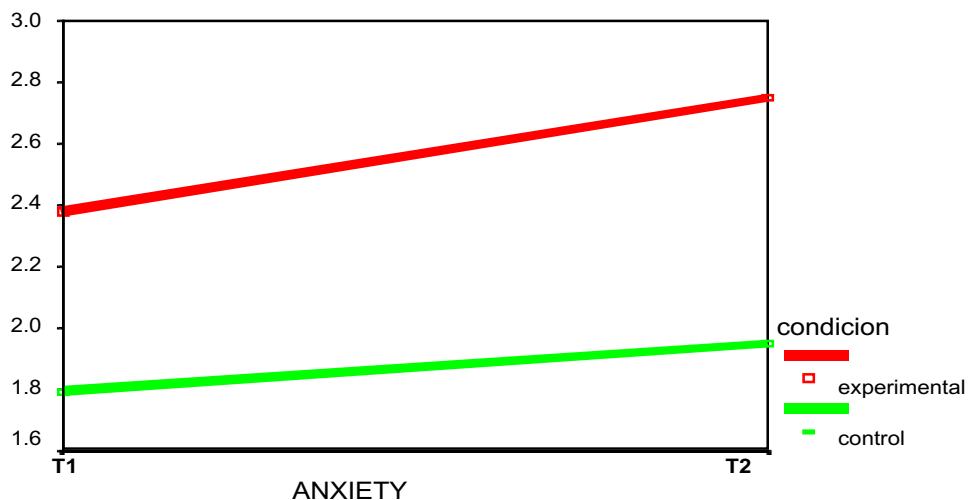+ *p<=.07* *p<=.05; **p<=.01; ***p<=.001
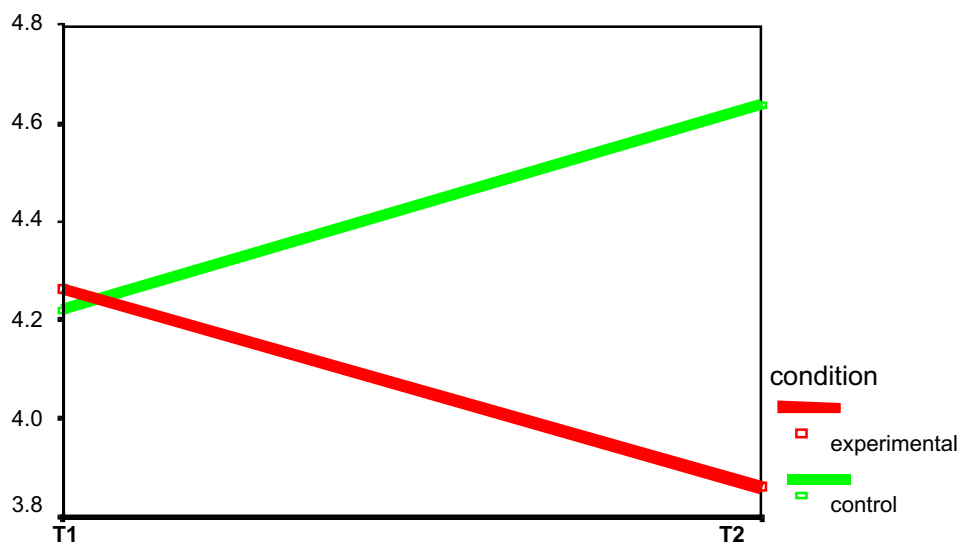
Figure 5.1. Main effect: condition on anxiety

Figure 5.2. Interaction effect: time x condition on enthusiasm

main effects of experimental condition (CAT or face-to-face) on anxiety, both in T1 (F=14.38***) and in T2 (F=23.91***), have been shown (see Table 5.2). CAT groups, then, showed greater anxiety levels than face-to-face groups.

Regarding intra-subject effects, the longitudinal study showed no important effects due to time on the three measures of well-being and an interaction effect of time x condition on enthusiasm,

and finally, an interaction effect of time x attitude on enthusiasm. Thus, people with a positive attitude towards CMC decrease enthusiasm more quickly than people with a negative attitude (see Table 5.2).

Moreover, as can be seen in Figure 1, subjects in the experimental condition showed higher levels of anxiety than subjects in the control condition. And these results are significant in T1 and T2 (see Figure 5.1).

Moreover, the experimental groups decrease in enthusiasm from T1 to T2, but the control groups increase in this emotion (see Figure 5.2).

Study II

Table 5.3 shows the descriptive analysis of the variables studied about experimental and control groups (see Table 5.3). The alpha coefficients are internally consistent since Cronbach's alpha (α) meets the criterion of .70 (Nunnaly, 1978) with the exception of individual enthusiasm in T1 (α=.64) and collective relax in T1 (α=.58) in control groups (Table 5.4).

Multivariate lineal model analysis with individual emotions in T1 (as independent variables) and collective emotions in T2 (as dependent variables) was carried out in order to test the hypotheses of this study. With the experimental groups, «individual enthusiasm» was the best predictor (contagion) of collective emotions (relax and enthusiasm) in T2. Besides, in accordance with R^2 coefficient, the percentage of explained variance in both cases is very similar, but the best predictor of the collective emotion is the individual emotion with the same level of arousal (enthusiasm) (see Table 5.5).

Table 5.3: Descriptive analysis of the variables in experimental group (EG) and control group (CG) (T1, T2)

	T1-EG			T2-EG			T1-CG			T2-CG		
	N	M	s.d.	N	M	s.d.	N	M	s.d.	N	M	s.d.
Individual emotions												
- Relax	94	4.58	.41	95	4.13	.54	48	5.06	.29	48	4.99	.44
- Enthusiasm	94	5.00	.32	95	4.74	.40	48	4.99	.31	48	5.27	.30
Colletive emotions												
- Relax	94	4.55	.42	95	4.12	.57	48	5.08	.18	48	4.92	.49
- Enthusiasm	94	5.11	.33	95	4.71	.34	48	5.11	.26	48	5.33	.30

Table 5.4: Reliability analysis

	Cronbach's alpha EG	Cronbach's alpha CG
Individual relax T1	.87	.74
Individual enthusiasm T1	.80	.64
Collective relax T1	.82	.58
Collective enthusiasm T1	.75	.77
Individual relax T2	.86	.78
Individual enthusiasm T2	.79	.76
Collective relax T2	.85	.72
Collective enthusiasm T2	.77	.74

Table 5.5: Multivariate linear model analysis (individual emotions (VI) on collective emotions (VD) in experimental group

VD	VI	B	Typical error	P
Collective relax				
	- Individual relax	-.07	.14	.63
	- Individual enthusiasm	.943	.18	.000
Collective enthusiasm				
	- Individual relax	.030	.10	.76
	- Individual enthusiasm	.822	.13	.000
F Collective relax	26.01			.000
F Collective enthusiasm	33.28			.000
R^2 Collective relax	.35			
R^2 Collective enthusiasm	.41			

The picture is quite different for the control groups. Collective emotions are «tainted» with individual emotions in both cases. However, the individual relax is negatively associated to the collective enthusiasm. The more individual relax, the less collective enthusiasm there is.

Only in this case, does relax predict enthusiasm. Finally, the explained variance is higher in the model for control groups. Therefore, the emotional contagion is stronger in face-to-face interaction in the case of contagion from individual to group emotions (Table 5.6). The results are presented graphically in Figure 5.3.

Next, we constructed another multivariate lineal model with collective emotions in T1 as independent variables and individual emotions as dependent variables in T2. In this case, the collective emotions predict the individual emotions in both conditions (experimental and control),

Table 5.6: Multivariate linear model analysis. Individual emotions (VI) on collective emotions (VD) in control groups

VD	VI	B	Typical error	P
Collective relax				
	- Individual relax	-660	.24	.009
	- Individual enthusiasm	.719	.23	.003
Collective enthusiasm				
	- Individual relax	-.739	.15	.000
	- Individual enthusiasm	.1.126	.14	.000
F Collective relax	36.24			.000
F Collective enthusiasm	32.24			.000
R² Collective relax	.60			
R² Collective enthusiasm	.57			

especially in the case of collective enthusiasm. This emotion (collective enthusiasm) predicts the individual relax and enthusiasm, but both individual emotions are tainted to the same degree (see R²) in experimental groups (see Table 5.7).

However, in control groups, individual enthusiasm is explained in a greater percentage than individual relax. It is important to stress
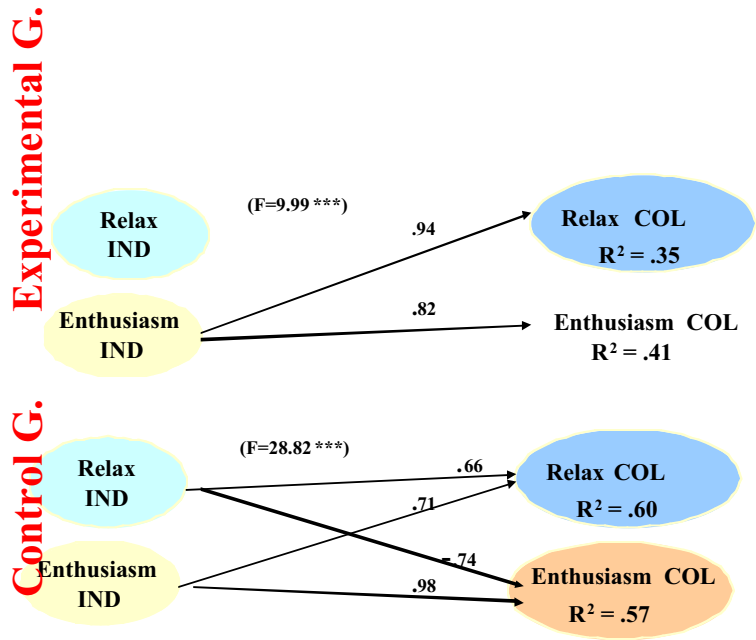

Figure 5.3. Multivariate linear models (individual to collective effect)

Table 5.7. Multivariate linear model analysis. Collective emotions (VI) on individual emotions (VD) in experimental groups

VD	VI	B	Typical error	P
Individual relax		.45	.15	.003
	Collective relax	.39	.19	.042
	Collective enthusiasm	.004	.11	.969
Individual enthusiasm		.65	.14	.000
	Collective relax			
	Collective enthusiasm			
F Individual relax	18.14			.000
F Individual enthusiasm	18.39			.000
R^2 Individual relax	.27			
R^2 Individual enthusiasm	.27			

Table 5.8. Multivariate linear model analysis. Collective emotions (VI) on individual emotions (VD) in control groups

VD	VI	B	Typical error	P
Individual relax		1.133	.33	.001
	Collective relax	.471	.22	.043
	Collective enthusiasm	-.195	.15	.203
Individual enthusiasm		1.064	.10	.000
	Collective relax			
	Collective enthusiasm			
F Individual relax	16.05			.000
F Individual enthusiasm	65.99			.000
R^2 Individual relax	.39			
R^2 Individual enthusiasm	.73			

that the R^2 is higher in the control groups, especially in the case of individual enthusiasm (73%) (see Table 5.8).

When we compare them with the models of individual-group contagion, these models are similar in both conditions (experimental and control), but the contagion is stronger in the face-to-face condition (see Figure 5.4).
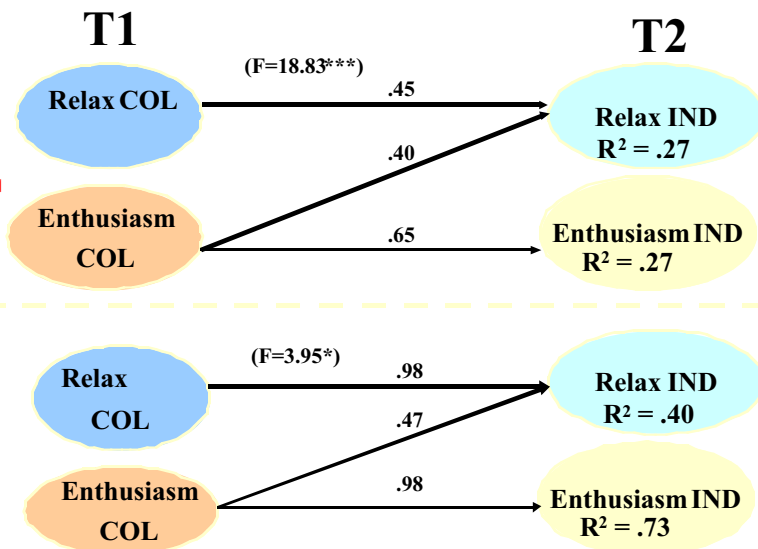
Figure 5.4. Multivariate Linear Model Analysis. Collective to individual emotions

DISCUSSION

Study I

The main aim of this study was to analyse the effects of technology («IRC-chat») on psychological well-being (satisfaction, [lack of] anxiety and enthusiasm) and the modulatory effects of attitudes toward technology. To do so, we designed a longitudinal laboratory experiment. Through this longitudinal laboratory design, the main effects of the attitudes towards technology on affective psychological well-being have been demonstrated. Results indicated that subjects with a more positive attitude towards technology showed more satisfaction and enthusiasm, and they did not feel anxiety.

Moreover, subjects that have used technology («IRC-chat») to communicate in the work sessions, showed significantly more anxiety, in both times T1 and T2. If we look at the longitudinal study, we can say that groups behave in a different way. Whole enthusiasm decreases in Chat-groups, this emotion increases with time in Face-groups. On the other hand, those subjects with a very positive attitude show a tendency to decrease their enthusiasm less than

those with a less positive attitude. It is possible that the technology can be a motivator and source of satisfaction because it can be perceived as a novelty and challenging at first, but with time this positive situation changes because it loses its attraction ('Novelty effect').

Study II

The objective of study II was to analyse the positive emotions (relax and enthusiasm) contagion in a bi-directional way (individual to group, group to individual) in CMC situations. We expected a contagion of positive emotions, but it would be stronger in face-to-face conditions and the contagion process would be bi-directional (individual to group, group to individual). An experimental lab study with a longitudinal design (T1 and T2) was carried out to reveal development in individual and collective emotion contagion. The results confirm our hypothesis about the bi-directional contagion process of positive emotions, from individual to group and vice versa, even when non-verbal communication is not present (IRC-chat condition). These results agree with other studies using face-to-face interaction and negative emotions such as burnout and depression (Doherty, 1998; Groenestijn *et al.,* 1992; Howes *et al.,* 1985; Rountree, 1984; Schaufeli *et al.,* 1998 and Westman & Etzion, 1995). However, our results show that the emotional contagion is stronger in face-to-face settings, probably due to the influence of non-verbal communication that is not present in IRC-chat interaction (non-conscious process of emotional contagion).

In addition, it is important to stress that the most powerful emotion for the contagion process is enthusiasm (both in an individual and a collective way). It is particularly interesting to stress that the contagion of emotions at a high level of arousal similar to that of «Enthusiasm» is more likely to occur. Maybe this means that there is a general contagion of positive emotions, although the contagion is stronger when the level of activation is high (Enthusiasm).

Thus, in this way, this study represents a scientific step forward because it takes into account not only the negative emotions studied up to the moment, but also the positive emotions (enthusiasm and relax). We did not find negative emotion contagion. A possible explanation is that the work with CMC is more related to positive emotions. In other studies, we have found that exposition to CAT

increases professional efficacy and decreases cynicism when the appraisal of the experience is positive (Salanova & Schaufeli, 2000). So, the self-efficacy related to CAT plays a moderating role between the exposition to CAT and burnout (Salanova, Grau, Cifre & Llorens, 2000).

The present findings may have important implications for future practice. First of all, it is important to point out the need to promote the development of positive emotions in work-teams. Thus, it is important to favour people with a more positive role which can facilitate positive emotions in the group because this can generate consequences for the development and the social climate of work-teams in organizations.

Taking into account the results of the two studies we have presented before, future research should consider the collection of a bigger sample, especially face-to-face groups, and a larger number of males in order to avoid possible gender differences. Moreover, it is important to test Task Demands/Resources on Burnout and Engagement, to test the moderating role played by collective and individual self-efficacy and, finally, to test the full model.