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The Interaction Between Global Task Motivation and the Motivational Function of Events on Self-Regulation: Is Sauce for the Goose, Sauce for the Gander?

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The Interaction Between Global Task Motivation and the Motivational Function of Events on Self-Regulation: Is Sauce for The Goose, Sauce for The Gander?

Marc R. Blais[*] *and Ursula Hess*[*]

Résumé / ***Abstract***

Une expérimentation a été réalisée afin d'évaluer (1) l'interaction entre la motivation globale vis-à-vis une tâche et différents styles de mobilisation (degré d'un style d'intervention contrôlant et de soutien à l'autonomie) et (2) le rôle du genre dans cette interaction. Quarante hommes et quarante femmes ayant un niveau soit élevé ou faible d'autodétermination envers une tâche de relaxation ont participé à une tâche d'apprentissage à la relaxation à l'aide de biofeedback avec un intervenant qui présentait un style soit contrôlant soit de soutien à l'autonomie. Les résultats confirment la présence d'effets d'interactions entre le niveau d'autodétermination (motivation globale) et le style de l'intervention. Le genre du participant qualifie également cette interaction. L'interaction triple suggère l'existence de différentes formes de relations entre les aspects mobilisateurs de l'environnement et le niveau d'autodétermination pour les hommes et les femmes.

An experiment was conducted to assess (1) the interaction between global task motivation and motivational aspects of the environment (level of controls and autonomy-support present in the environment) and (2) gender differences with regard to this interaction. Forty male and forty female participants with high and low levels of self-determination towards relaxation attempted to learn relaxation using biofeedback in an either controlling or autonomy-supportive environment. The results confirm the notion that global task motivation and intervention style interact. Further, this interaction is qualified by a gender effect. The resulting triple interaction suggests that a different pattern of relations between the motivational aspects of the environment and level of self-determination emerges for men and women.

Mots clés: Style d'intervention contrôlant-soutien à l'autonomie, motivation globale-d'état vis-à-vis une tâche, théorie de l'autodétermination, interaction environnement-personne, genre, réactions physiologiques, apprentissage auto-régulation

Keywords: Controlling and autonomy-supportive intervention style, global-state task motivation, self-determination theory, gender, person-environment interactions, physiological responses, self-regulation learning

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The interaction between global task motivation and the motivational function of events on self-regulation: Is sauce for the goose, sauce for the gander?

Autonomous or self-determined behaviors have been linked with several important elements of human adaptability, creativity, energy, and well-being. More than 25 years of research have shown that, in general, events experienced as controlling can undermine highly self-determined forms of motivation (for reviews see Cameron & Pierce, 1994; Rummel & Feinberg, 1988; Wiersma, 1992).[1] However, this line of research has focused mainly on individuals with high levels of intrinsic or self-determined motivation, neglecting the study of the influence of controlling events on individuals with low levels of self-determined motivation. Recent reviews of the literature show that the research paradigms commonly chosen in this domain focus on tasks which are intrinically interesting to all subjects - thereby assuring initial intrinsic motivation towards the task (Cameron & Pierce, 1994; Rummel & Feinberg, 1988; Wiersma, 1992).

Yet, common folklore maintains that controls, that is, external structure and directives, although detrimental for the motivation and performance of high self-determined individuals, who require an autonomy-supportive style, are facilitative for individuals low in autonomy.[2] This notion has also been expressed in a number of different domains such as the literature on management and therapeutic intervention styles as well as in the educational literature. For example, Vroom (1960) as well as Hersey and Blanchard (1969, 1988) suggests that leadership style should be chosen in function of the "level of maturity" of the subordinates, with less mature subordinates profiting more from a more directive leadership style. Maturity in this context is defined as "willingness (motivation) and ability (competence) to take responsibility for directing their own behavior in a particular area, (...) " (Hersey, Blanchard, & Hambleton, 1980). This notion has been adopted in the therapeutic domain. Specifically, Howard, Nance,

and Myers (1987) developed an adaptive counseling and therapy model where the concept of maturity is replaced by the concept of patient readiness. They point out that "With clients at a low readiness level, a great deal of direction behavior by the therapist is needed in order to initialize movement in therapy" (p. 44). Similarly, Deci and Ryan (1985) suggest that a more directive style might be more appropriate in therapeutic interventions for highly non self-determined individuals at least in a transitory phase of the therapeutic process. A directive style in this context is characterized by external contingencies and directives, which are the central elements of a controlling environment as defined by Deci & Ryan (1985). In summary, these authors point to the possible benefits of a controlling intervention style in certain circumstances in a developmental perspective aiming towards more self-determined forms of self-regulation.

Similar notions seem to be reflected in people's belief systems on how to motivate individuals with low initial motivation. Recent studies show that supervisors who perceive their subordinates as non self-determined tend to adopt a controlling supervisory style (e.g., Pelletier, 1989). Further, Boggiano and colleagues showed that people tend to believe that rewards enhance interest in uninteresting activities (Boggiano & Hertel, 1983) and that teachers as well as parents generally believe in the effectiveness of controlling techniques to motivate students (Flink, Boggiano, & Barrett, 1990).

In summary, some theorists and common folklore agree on the advantages of adjusting supervisory styles to individuals such that high self-determined or intrinsically motivated individuals benefit from an autonomy-supportive style while low-selfdetermined individuals benefit form a more controlling style.

Further, Perron (1981), based on notions first expressed by Feather (1975), contends that adjusting styles to indivuals is not only more efficient but that individuals seek out environments whose values correspond to their own values. With regard to school choices he distinguishes between impressive and expressive values, a distinction which corresponds closely to the distinction between low and high self-determined

motivation. Thus, low self-determined individuals should seek out environments that provide more external controls and high self-determined individuals should seek out environments providing more autonomy-support. This idea is central to Causality Orientation Theory which is part of self-determination theory (Deci & Ryan, 1985).

In summary, the applied/intervention literature and common folklore agree that for low self-determined individuals a controlling style may have advantages as regards performance and increased future motivation. However, a contradictory position has also been advocated. For example, it has been hypothesized that controlling events may actually reduce self-determination even further in already low self-determined individuals rendering them amotivated (Boggiano et al., 1992).

While the hypothesis that intervention style and self-determination interact has received some attention it has generally not been followed up by research. However, a number of empirical studies have been conducted to assess the interaction of controls with a number of related individual difference such as locus of control, high/low initial interest, and high/low achievers. Regarding the hypothesis that clients with internal locus of control should profit more from a non directive therapeutic style while clients with more external locus of control should profit more from a directive therapeutic style no cohesive findings emerged (see Abramowitz, Abramowitz, Roback, & Jackson, 1974; Baker, 1979; Butler, 1986; Messer & Meinster, 1980 for a review). However, the hypothesis that external rewards erode motivation for tasks for which participants had high initial interest and foster motivation for tasks for which participants had low initial interest has found some support (e.g., Daniel & Esser, 1980; Loveland & Olley, 1979; McLyoyd, 1979). Also, Harackiewicz and Manderlink (1984) found evidence that external rewards positively affect performance in low as compared to high achievers.

In this context it is important to note, that self-determination is a concept which has to be considered apart from related concepts such as locus of control, self-efficacy, or perceived control. External locus of control and low levels of self-efficacy or perceived

control should go along with amotivation and represent the highest forms of non self-determination. However, individuals may have high levels of either self-efficacy, perceived control, or internal locus of control without feeling self-determined. In fact, these latter constructs can be associated with any form of motivation ranging from external regulation to intrinsic motivation (for a more detailed discussion of this issue see Deci & Ryan, 1985). For instance, Blais et al. (1993) found evidence suggesting that feelings of competence are highly correlated with non self-determined types of extrinsic motivation.

The present paper has the goal to investigate the interaction between the motivational function of events and individual differences. In the following, we will therefore briefly define the relevant concepts for the framework of this article. Motivation in this context will be defined according to the theoretical framework provided by Self Determination Theory (SDT, see Deci & Ryan, 1985, for an extensive treatment of the theory), the most widely cited theory explaining the antecedents and consequences of self-determined behaviors.

A basic assumption of SDT asserts that individuals strive to fulfill the fundamental psychological needs to feel self-determined, competent, and related, and that motivation is determined by a dialectic process between the persons' strivings and the degree to which the (internal or external) environment is responsive to these needs. SDT predicts that in most cases autonomy-supportive events increase self-determination whereas controlling events decrease high levels of self-determination, a notionwhich has received empirical support from a wide range of life domains using a variety of methodologies (e.g., Blais et al., 1993; Cameron & Pierce, 1994; Rummel & Feinberg, 1988; Wiersma, 1992).

It is important to note, that SDT views the impact of these events as mediated and moderated by the way they are experienced by the person. Hence, different individuals may experience an objectively identical motivational event in different ways and

consequently experience different motivational impacts. Further, it is presumed that people differ in their general orientation to be autonomous (i.e., self-determined), or controlled. For example, a control oriented person is more likely to attend to and interpret initiating and regulatory events as controlling rather than as autonomy-supportive.

An important feature of SDT regards its focus on the qualitative as well as the quantitative aspects of motivation. These qualitative aspects consist of different forms of motivation that distinguish themselves according to different levels of self-determination ranging from intrinsic motivation over self-determined extrinsic motivations and non self-determined extrinsic motivations to amotivation. Within this continuum two major distinctions can be made. The first is the distinction between intrinic and extrinsic motivation. Intrinsic motivation refers to a situation were the individual engages in an activity for the simple pleasure devrived from it. Extrinsic motivation refers to a situation were an individual engages in an activity for an instrumental purpose or as a means to an end. For example, an individual may swim regularly for the pleasure of swimming or because of the expected health benefits.[3]

Further, within extrinsic motivation a distinction can be made between external and internalized regulations. This distinction refers to the source of the regulation process involved. External regulation refers to the situation were the contingencies are provided by an external source. For example, an individual swims regularly to conform to a regime proposed by his or her doctor and to avoid critique.

To the degree that individuals in the course of their socialization internalize external regulations these regulations become internal but often can remain extrinsic to the individual. The more the regulations are integrated into the individual's sense of self, that is, the more the individual endorses and identifies

with these regulations, the more self-determined they are. Thus, high levels of self-determination refer to motivations which are well integrated while low levels of self-determination refer to motivations which are grounded in external sources (e.g., the approval of a significant other). Further, the lowest level of self-determination is represented by amotivation, a situation were the individual perceives noncontingency between intentions and outcomes.

These different types of motivation as well as their antecedents and consequences have been studied with regard to a number of domains such as work motivation (Blais et. al. , 1993; Blais, Lachance, & Richer, 1992), couple relationships (Blais, Sabourin, Boucher, & Vallerand, 1990), and education (Grolnick & Ryan, 1987). In general, studies investigating the motivational styles posited by Deci and Ryan (1985) agree that these motivations are associated with important behavioral, cognitive, and affective outcomes such that the more self-determined motivations are related to a more positive perception of the activity and to more persistence.

In summary, SDT distinguishes different forms of motivation which can be located on a self-determination continuum. The theory predicts that certain types of events, such as autonomy-supportive versus controlling events influence the individual's level of self-determination. Also, individuals differ with regard to their general tendency to perceive events as controlling or autonomy-supportive.

Gender differences

As mentioned above, controlling events are events which pressure the individual to think, feel, or behave in a certain way. Specifically, the use of evaluations and/or rewards tends to be perceived as controlling. It is important to note that with regard to the effects of evaluations/rewards gender differences have been observed (e.g., Blank, Reis, & Jackson, 1984; Boggiano, Main, & Katz, 1991; Daubman & Lehman, 1993; Roberts, 1991; Roberts & Nolen-Hoeksema, 1994; Zinser, Young, & King, 1982). Despite these findings, authors of three recent meta-analyses on the effects of rewards on

intrinsic motivation have not included this factor (Cameron & Pierce, 1994; Rummel & Feinberg, 1988; Wiersma, 1992). In an informal review of the published studies presented in these meta-analyses we noted that out of 68 studies in which both men and women participated only 24 tested for gender differences. However, the limited evidence suggests that women may interpret external rewards differently than men (e.g., Koestner, Zuckerman, & Koestner, 1987).

This is in accordance with developmental literature strongly suggesting that boys and girls, on one hand, can interpret the same motivational event differently and, on the other hand, can react differently to these perceived motivational events; for example, girls have been shown to experience more positive affect when receiving competence feedback in a controlling condition (Boggiano, Main, and Katz, 1991). In a similar vein, Roberts (1991) found evidence that women's self-evaluations tend to be more influenced by external feedback than men's. Thus, gender differences should be considered more carefully when studying the interaction between individual differences and the motivational aspects of the environment.

Global versus state motivation

Motivation has been conceptualized as varying between a stable personality trait (e.g., McClelland, Atkinson, Clark, & Lowell, 1953) and a transitory state (e.g., Deci, 1972; Ryan, Koestner, & Deci, 1991). Similarly, we propose a trait-state continuum for self-determination. That is, levels of self-determination towards activities or life domains in general may be considered to be trait-like such that an individual might be described as being more or less self-determined towards the various aspects of her life. In this context we consider the global self-determination towards a task as a relatively stable trait-like component of task motivation. On the other hand, the self-determination exhibited by an individual in response to an intervention, for instance during a free choice period, can be considered to represent a more state-like aspect of task motivation. For example, while some individuals engage in everyday tasks such as cooking for the pleasure the activity

provides them and may therefore be considered to exhibit a self-determined motivational style towards that activity in general, they may nonetheless at specific times engage in the task under external pressures and thus show low self-determined state motivation. It follows that for a given task an individual may have a global trait-like self-determination towards a task which differs from the individual's state motivation at that time. Consequently, global self-determination and the motivational aspects of events interact to influence state motivation.

In this context we also need to consider the subject's behavior during a motivational event. For example, the subject's success in learning during a learning task. In fact, if a task is relatively easy (so that differences in learning are not due to differences in ability), as well as novel (so that previous experience does not influence learning) we may assume that participants' learning is correlated with at least the quantitative aspects of their motivation towards the task. However, based on the above discussion on the interaction between motivational events and global self-determination we expect that individuals for whom global self-determination and the motivational aspects of the environment do not match might experience uneasiness and tension in the situation. These feelings would be likely to be detrimental for learning regardless of the quantitative level of motivation (for a related concept, performance motivation, see Kanfer, 1987).

Based on the above discussion, we propose to distinguish between three types of motivation. First, global task motivation which is a relatively stable disposition towards a task which will typically not be changed by only one or two motivational events but which may change over the course of the development of the individual. That is, individuals with high levels of self-determination towards a domain of their life will become less self-determined when repeatedly faced with controlling events. Second, state motivation which is the level of self-determination in a specific situation and which reflects the joint influence of both global self-determination and the motivational event experienced. In this paper we refer to this type of motivation as state motivation.[4] Third, we consider the

individual's behavior during a motivational event as potentially correlated with their motivation during this event. We will refer to this marker of motivation as process motivation. However, we are cognizant that the individuals performance is only a marker of motivation and not a direct measure.

Overview

The present study had two goals. First, to investigate the interaction between levels of global task motivation and the motivational aspects of the situation. Second, to investigate whether men and women react differently to autonomy-supportive and controlling environments. For this, behavioral as well as self-report measures were employed. The use of multiple measures has recently been advocated (Ryan, Koestner, & Deci, 1991; Anderson & Rodin, 1989) and seems to us to be of special importance for the assessment of the complex interactions between the motivational aspects of the situation and individual differences.

Specifically, the present study aims to assess the subject's affective and behavioral reactions during a self-regulation task, which is either controlling or autonomy-supportive, in function of global task motivation and gender. We invited participants who were interested in learning relaxation techniques to the laboratory where they were taught relaxation using biofeedback. The instructor employed either an autonomy-supportive or a controlling style. Learning was assessed continuously and operationalized as reduction in muscle activity in the target muscle as compared to a baseline period.

Participants' state motivation was assessed using a free choice task while global motivation towards learning about relaxation techniques in the future was assessed using an adaptation of measures of global motivation previously developed in our laboratory (The Couple Motivation Questionnaire, Blais, Sabourin, Boucher, & Vallerand, 1990; The Blais Work Motivation Inventory, Blais et al. 1993). In addition, self-report measures assessing the participants' affective state and their perception of the learning situation were taken.

In this context one should note two other important motivational factors specified in self-determination theory, which have not been addressed so far, feelings of competence and the issue of relatedness. The motivation towards a task as well as the affect experienced during performance of the task are also fostered by perceived competence and reduced by perceived incompetence while the subject's behavior in the situation may be influenced by the degree of relatedness with the instructor. Since the present study focuses on the issues of self-determination towards the task and the degree of control present in the learning environment, we decided to control for the former factors by giving all participants success feedback and by attempting to establish a positive rapport.

In summary, the present paper is concerned with the interaction between motivational events, specifically, controlling versus autonomy-supportive events and global task motivation. In this context, it is recognized that the influence of motivational events is mediated by the individual's perception of the event and we noted previous research suggesting that key elements of controlling events are perceived differently by men and women. Further, two dependent variables are considered. State motivation which should reflect the situational effect of the motivational event[5] and process motivation which should index the influence of a lack of adjustment between level of self-determination and the motivational aspects of the situation. The proposed relationship between these variables is depicted in the following model (see Figure 1).

Insert figure 1 here

In this context, it is important to reiterate that global motivation towards a task is conceptualized as a relatively stable characteristic of the person. Thus, the motivational aspects of a specific event should have a direct influence on the state or the process motivation of the individual but not on global task motivation. However, repeated

exposure to certain types of motivational events (e.g., a controlling interaction style) should over time influence global task motivation.

Method

Participants: Forty men and 40 women participated individually. Data from three participants was lost due to technical problems. The average age was M = 36.1 (SD = 7.5) and M = 34.93 (SD = 7.3) years for women and men respectively. Participants were recruited by advertisements asking people interested in learning relaxation techniques to contact the laboratory. Respondents were screened for the following criteria: participants should not (a) have previous experience in using relaxation techniques (b) be under psycho-therapy, c) take drugs (e.g., sedatives or amphetamines), or (d) have epilepsy. Participants were divided into groups with high and low self-determination based on a post-questionnaire assessing global task motivation using a median split. Mean levels of self-determination were M = 18.67 (SD = 7.51) and M = 24.42 (SD = 3.67) for the low and high self-determination groups respectively. Males and females differed by less than one scale point for both groups.

Procedure. When participants first arrived in the laboratory they were greeted by a same-sex experimenter (see Deci, Eghrari, Patrick, & Leone, 1994) and were shown the laboratory and the equipment. They were informed that the goal of the experiment was to study relaxation, that a number of physiological measures would be taken, and that they could interrupt the procedure at any moment. After they had signed a consent form repeating this information the electrodes were attached.

Following a 6 minute baseline period the experimenter gave the subject relaxation instructions. Participants were instructed in using biofeedback on the Frontalis Medialis (Burish, Hendrix, & Frost, 1981; Tarler-Benlolo, 1978). Participants were randomly assigned to either a controlling or an autonomy-supportive interaction style. Biofeedback instructions were the same in both conditions. However, in the controlling condition the experimenter employed the terms “should” and “absolutely necessary” to relate the

instructions while instructions were framed in terms of an option in the autonomy-supportive condition. The biofeedback sound was a chime descending in frequency with relaxation. The synthesized sound was pretested to assure its pleasantness. Following a two minute waiting period participants started the biofeedback by pressing one of two buttons. Participants performed 5 relaxation trials of 4 minutes length each followed by further feedback from the experimenter. To control for competence all participants were given positive performance feedback following each trial[6]. A post measure was taken for which participants were asked to try to relax as deeply as possible without the help of the biofeedback.

Following this, the experimenter left the room under a pretext. He/she told the subject that they could continue to practice biofeedback or listen to relaxing music[7] by pressing the other button (free choice period); the length of time during which the participants engaged in the biofeedback task was measured.

Finally, the participants were asked to complete a series of questionnaires. The questionnaire intended to measure the participants' global motivation towards performing the type of task they had just performed in the future was given last. The scale consists of five subscales measuring amotivation, external regulation, introjected regulation, identified regulation, and intrinsic motivation respectively (see Annex 1 for sample items and psychometric characteristics). A global score was computed by weighing the subscales according to their position on the self-determination continuum such that amotivation receives the highest negative weight and intrinsic motivation the highest positive weight (for more information on this procedure see Blais et al., 1990). To classify participants with regard to high vs. low global self-determination a median split was performed.

Dependent measures

Physiological measures. Facial EMG and SCL were taken during the baseline period, the relaxation trial, the waiting periods following each instruction, and for the post measure.

Facial EMG. Facial activity was assessed using two pairs (bipolar placement) of Beckman Ag/AgCl miniature surface electrodes at the Frontalis Medialis and the Corrugator Supercilii sites.[8] Electrode placements were according to Fridlund and Cacioppo (1986). The pairs were referenced to a forehead electrode placed near the midline. Parker Laboratories electrolyte (signal gel) was used as the conducting medium and the skin was cleansed with alcohol. An Autogenic Systems system with a 60Hz notch filter was used to amplify the raw EMG signals, which were integrated with a 200 ms time constant. The smoothed EMG signal was sampled at 4 Hz and averaged over 2 minute epochs.

Skin conductance level. Skin conductance level (SCL) was measured using Beckman miniature electrodes placed on the second segment of the first and third fingers of the left hand. A saline/Unibase preparation was used as the conducting medium (Lykken & Venables, 1971). An Autogenic systems SCL module was used. The signal was sampled at 4 Hz and averaged over 2 minute epochs.

Data analysis. The physiological data for the two 2 minute epochs were averaged for each trial. Difference scores from baseline were calculated for each trial mean.

Self-report measures: Following the experiment the participants filled out a series of questionnaires assessing their perception of their performance during the trials. Specifically, participants were asked to indicate whether they felt that the biofeedback had helped them to learn to relax (0 - no; 1 - yes) and to what they attribute their success or failure in learning to relax as well as what strategy they had employed to relax. Further, participants were asked to indicate their subjective feeling state during the experiment (positive / negative affect), how controlling / autonomy-supportive they felt the learning environment to be, and how competent they felt regarding the task.

Free choice. The act of choosing an activity without external contingencies has been conceptualized to be indicative of high self-determined forms of task motivation and has consequently been used as the measure of first choice for the behavioral assessment of intrinsic motivation in the laboratory (e.g., Cameron & Pierce, 1994; Deci, 1972; Deci, 1975; Rummel & Feinberg, 1988; Ryan, Koestner, & Deci, 1991; Wiersma, 1992). However, it has been argued that participants can engage in free choice for less self-determined reasons (cf. Ryan, Koestner, & Deci, 1991). For example, a subject who is strongly performance oriented and feels unsatisfied with the learning period may use the free choice period to enhance his self-esteem rather than for the pleasure derived from the activity.

Results and Discussion

A series of 2 (high vs. low global Self-determination) x 2 (Condition: controlling vs. autonomy-supportive interaction style) x 2 (Gender) analyses of variance were performed to assess: (a) the subject's self-regulated learning; (b) the subject's state motivation following the learning phase as indexed by free choice; and (c) the subject's reactions to the situation, as assessed by self-report as well as SCL and EMG measured during the waiting period. All tests were conducted with an alpha of .05.

Relaxation

Relaxation was operationalized by the reduction in muscle activity in the target muscle as compared to baseline and was assessed using facial EMG on the Frontalis Medialis. Two different measures were considered: (1) the degree of relaxation over the course of the five training trials (i.e., relaxation with the help of biofeedback on the target muscle) and (2) the degree of relaxation during the post-trial without help of the biofeedback.

Relaxation with biofeedback. Participants attempted to relax the Frontalis Medialis during five trials with the help of biofeedback. A 2 (Condition) x 2 (Gender) x 2 (Self-determination) x 5 (Trial) analysis of variance was conducted on the Frontalis

Medialis EMG difference scores. A Condition x Gender as well as a Condition x Gender x Self-determination interaction emerged ($F_{(1,63)} = 6.34$; $p < .05$ and $F_{(1,63)} = 5.87$; $p < .05$ respectively). A trend analysis on the five time periods revealed a significant linear trend over time ($F_{(1,63)} = 24.32$; $p < .001$) indicating that, in general, participants improved relaxation during the course of the five trials. However, as Figure 1 shows, different patterns of results emerged for high and low self-determined participants.[9] High self-determined participants show a different pattern of results depending on gender and interaction style with women in the autonomy-supportive condition and males in the controlling condition failing to learn to relax. However, one should note that high self-determined women in the autonomy-supportive condition show very low muscle activity at baseline, the apparent failure to learn may therefore be due to a floor effect.

Low self-determined participants, on the other hand, show equal relaxation in the controlling and autonomy-supportive conditions with levels of relaxation similar to the high self-determined males in the autonomy-supportive condition.

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insert Figure 2 here

It is interesting to note, that the tendency to relax or not during training trials is already established at the first trial. While all other groups show on average already more relaxation of the Frontalis Medialis during the first trial than during baseline, the high self-determined males in the controlling condition actually show significantly higher levels of muscle activity during this trial than during baseline.

The findings for high self-determined participants are only partially conform to predictions. Specifically, the findings for males follow predictions, while the findings for women in the controlling condition are contrary to predictions.

Relaxation without biofeedback. Following the five practice trials participants were asked to attempt to relax the Frontalis Medialis without the help of the biofeedback. This trial served to assess whether participants were able to maintain the relaxation

achieved during the biofeedback trials. EMG scores from baseline, trial 5, and the post-trial were compared in a 2 (high vs. low global Self-determination) x 2 (Condition) x 2 (Gender) x 3 (Trial) analysis of variance. Main effects of Gender, Condition, and Trial emerged (F (1,63) = 4.85; $p < .05$, F (1,63) = 4.48; $p < .05$, F (2,62) = 12.98; $p < .001$ respectively) as well as a Gender x Trial, a Gender x Condition x Trial, and a Gender x Condition x Self-determination x Trial interaction (F (2,62) = 4.27; $p < .05$, F (2,62) = 3.48; $p < .05$, F (2,62) = 3.72; $p < .05$ respectively).

In general, women tended to be more relaxed than men (see Figure 3). Further, participants in general relaxed from baseline to trial 5 (i.e., the activity of the Frontalis Medialis is significantly lower than during baseline) and maintained the relaxation during the post-trial. Only one group, the low self-determined women in the autonomy-supportive condition did not maintain relaxation during post-trial. Also, high-self determined males in the controlling condition failed to relax and maintained their high level of muscle activity during post-trial. Further, high self-determined women in the autonomy-supportive condition are not more relaxed at trial five and post-trial than at baseline; however, they already have very low muscle activity at baseline.

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insert Figure 3 here

State motivation

This form of motivation was assessed using free choice. Self-determination theory predicts that high self-determined participants in the controlling condition should experience a diminution of intrinsic or high self-determined motivation towards the task and consequently should be less likely to choose the biofeedback task during the free-choice period. Further, we predict that global task motivation and situational factors interact such that high self-determined participants experience a diminution of their state motivation in the controlling condition while low self-determined participants experience a diminution of their state motivation in the autonomy-supportive condition.

To assess this hypothesis, the percentage of participants who pursued the relaxation task was used. A significant main effect of Gender ($F_{(1,66)} = 6.89$; $p < .05$) as well as a significant Condition x Gender ($F_{(1,66)} = 5.08$; $p < .05$) and a marginally significant Condition x Self-determination interaction ($F_{(1,66)} = 2.81$; $p = .09$) emerged.

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insert Figure 4 here

In general, more men than women choose to pursue the task more (see Figure 4). Further, more high self-determined participants than low self-determined participants choose to pursue the task; however, this is not the case for the high self-determined women in the controlling condition who pursued the task significantly less than either high self-determined men in both conditions or high self-determined women in the autonomy-supportive condition.

That is, when motivation was assessed using a free choice measure the predicted motivation eroding effects of the controlling environment emerged only for the high self-determined females while for males no difference due to Condition emerged. This is in contrast to the findings obtained by considering the participant's success in learning where the reverse pattern was observed.

Free Choice versus self-regulated learning

How can we explain that high self-determined men in the controlling condition do not learn to relax but engage to 100% in the free choice task while high self-determined women learn well but do not engage in the free choice task? Learning to relax is a self-regulated activity that reflects to some degree the participant's motivation towards the task; thus one might expect learning and free choice to correlate to some degree. However, one should note that the task of learning to relax may be performed under more or less self-determined forms of motivation. Therefore, learning to relax may reflect a different form of motivation than is tapped by the free choice task. Moreover, lack of relaxation may be interpreted as an indication of arousal or stress. Self-determination

theory predicts that high self-determined individuals exposed to a controlling environment should experience more stress and tension. This suggests that high self-determined men in the controlling condition may be under less self-determined forms of state motivation, i.e., they may feel pressured to perform and thus try too hard -- making it difficult for them to relax.

In the following we will present data concerning the participants' reactions to the situation. Two types of data were considered, physiological data from the first waiting period and self-report data collected following the relaxation task.

Subjective reactions to the situation

Physiological reactions to motivational events. To test the hypothesis that participants' failure to learn is due to their reaction to the experimenter's interaction style, we analyzed the facial EMG and the SCL data from the first waiting period. That is, the time period immediately following the first controlling versus autonomy-supportive instructions received, before the beginning of the biofeedback training, and before participants received any competence feedback.

A significant main effect of Gender as well as a Condition x Gender and a marginally significant Condition x Gender x Self-determination interaction emerged for the EMG measure ($F_{(1,63)} = 10.93$; $p < .01$, $F_{(1,63)} = 5.03$; $p < .05$, and $F_{(1,63)} = 2.70$; $p = .1$ respectively). For SCL, significant main effects of Gender and Condition emerged ($F_{(1,63)} = 7.58$; $p < .01$ and $F_{(1,63)} = 7.17$ $p < .01$ respectively).

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insert Figure 5 here

Inspection of the means (see Figure 5) suggests that both high self-determined and low self-determined females in the controlling condition are significantly more relaxed than at baseline in reaction to the first instruction, likewise they show very low SCL. That is, the high-self-determined women in the controlling condition, albeit being in an environment that is at mismatch with their global motivation, do not only not show any

negative reaction but even respond positively. Contrarily, high self-determined males in the controlling condition are significantly tenser than during baseline. All other groups are at baseline levels of muscle relaxation. Further, participants in the autonomy-supportive condition, with the exception of the high self-determined females, have higher SCL than participants in the controlling condition who were, except for the low self-determined males, at baseline levels.[10]

These results suggest that the motivational impact of the interaction style is established from the very beginning of the interaction between participant and experimenter. One may speculate that the women are relatively more comfortable with the controlling interaction style while the high self-determined men are not and consequently become tense. Comparing the findings from EMG and SCL we find that, with the exception of the high self-determined women in the controlling condition, those participants who are at baseline levels of relaxation show above baseline levels of SCL which might indicate positive arousal in the sense of interest.

It is interesting to note, that the impact of the interaction style on learning is faster in the controlling condition than in the autonomy-supportive condition. This finding may be expected assuming that a highly controlling style is easier discernible than an autonomy-supportive style.

Self-report data

Affective reactions. According to self-determination theory, specifically Causality Orientation Theory, individuals who are characterized by more global self-determination towards a task should feel more positive and less negative affect during the experiment. In addition, an autonomy-supportive learning environment should also foster positive affect. However, we predict that participants' self-determination and interpersonal style of the instructor interact such that high self-determined participants in the autonomy-supportive condition experience more positive and less negative affect than the high self-determined participants in the controlling condition. Low self-determined participants

should feel less negative affect in the controlling condition and more negative affect in the autonomy-supportive condition than high self-determined participants.

To assess this hypothesis participants were asked to rate their subjective feeling state. A composite scale was constructed by reverse scoring the negative affect items and calculating the mean over all items (alpha = .76).

Only a main effect of Global task motivation was found $\underline{F}_{(1,69)} = 7.68$; $\underline{p} < .010$. Congruent with self-determination theory, high self-determined participants reported more positive affect than low self-determined participants. However, post-hoc tests revealed that this difference is significant only in the autonomy-supportive condition (see figure 6). As expected for this condition, low self-determined participants -- and particularly low self-determined women -- experience less positive affect than do high self-determined participants. One should note, that with the exception of low self-determined women in the autonomy-supportive condition, almost all participants report relatively high levels of positive affect. Interestingly, high self-determined males in the controlling condition report high levels of positive affect even though they do not relax during the experiment and are at some points even more tense than during baseline. That is, for females the level of positive affect seems to be in correspondence with their level of relaxation while for males this does not seem to be the case. Could this suggest that male and female participants' self-reported affects were determined by different processes?

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insert Figure 6 here

In an effort to better understand this pattern of results, correlations between self-reported affect and self-report measures of the participants' perception of the situation as well as the EMG scores for the fifth trial and the post-trial -- as a measure of relaxation -- were computed separately for males and females. The results suggest an interesting pattern of findings.

For women but not for men positive affect is significantly related to both self-report and objective measures of success in learning to relax as well as to attributions of why they were successful. Specifically, women but not men who ascribed their success to the fact that the task was easy, the feedback sound was pleasant, and the experimenter was helpful felt more positive affect. Further, for both men and women positive affect was significantly related to feelings of autonomy and competence in the situation.

In summary, while for both men and women positive affect was linked to feelings of competence and autonomy, for women but not for men positive affect was also linked to their feeling of success in learning, their actual learning, and to the attributions they made for their success. This finding seems to imply that women are either more aware of their self-regulated learning process, that is, they are more aware of their physiological state or that the learning process is more important for their affective state.

The former notion is supported by the finding that the self-report item "feeling tense during the experiment" correlates with objective measures of relaxation (EMG for trial five and post-test) for women but not for men (see Table 1).

Manipulation check

The post-experiment questionnaire contained a series of questions which were intended as manipulation checks. Specifically,participants respondent to a scale measuring their feelings of competence at the task, their feelings of autonomy during the task, as well as their feelings of being controlled during task. In addition, participants were asked whether they had employed a specific strategy during biofeedback; the responses were coded to assess whether the strategy described by the participants was the one proposed by the experimenter.

We expected that participants in the controlling condition should feel less autonomous and more controlled, as well as report having used the strategy imposed by the experimenter while participants in the autonomy-supportive condition were expected to feel more autonomous, less controlled, and to report a wider range of strategies. All

participants received competence feedback, therefore we expected high levels of reported competence in all conditions.

Further, global motivation towards the task should influence feelings of competence; specifically, causality orientation theory predicts that high self-determined participants feel more competent than low self-determined participants. Moreover, high self-determined participants are likely to feel more autonomous and less controlled in general.

Feelings of competence. A significant main effect of self-determination emerged ($F_{(1,69)} = 4.79$; $p = .032$) with high self-determined participants reporting a higher level of perceived competence than low self-determined participants ($M = 5.1$, $SD = .80$ versus $M = 4.6$, $SD = 1.1$). As expected, all participants report relatively high levels of competence.

Feelings of autonomy. Participants were asked to indicate to what degree they felt having had the choice to use their own relaxation strategy during the task. One should note, that in the controlling condition participants were told that they had to use a specific strategy imposed by the experimenter.

A significant main effect for condition in the expected direction emerged F (1,69) $= 4.58$; $p < .05$. That is, in general, participants in the controlling condition reported less choice than participants in the autonomy-supportive condition ($M = 5.41$, $SD = 1.63$ and $M = 6.23$, $SD = 1.49$). However, for high self-determined women a slight reversal in pattern was observed ($M = 5.89$, $SD = 1.27$ in the controlling condition and $M = 5.56$, $SD = 2.35$) in the autonomy-supportive condition).

Feelings of being controlled. Further, participants were asked to indicate to what degree they felt they were under surveillance by the experimenter. A significant main effect of Global task motivation as well as a Sex x Condition interaction emerged (F (1,69) $= 4.39$; $p <. 05$ and F (1,69) $= 7.57$; $p < .01$). Inspection of the means revealed that high self-determined participants felt significantly less monitored than low self-

determined participants (M = 2.36, SD = 1.65 and M = 1.76, SD = 1.32). Further, men in the controlling condition felt significantly more monitored than men in the autonomy-supportive condition (M = 2.78, SD = 1.73) and M = 1.77, SD = 1.27) while for women no significant difference emerged. This seems to be due to the high self-determined women who indicate low levels of felt surveillance in both conditions (M = 1.33, SD = 0.50 in the controlling condition and M = 1.56, SD = 1.13 in the autonomy-supportive condition).

Use of proposed biofeedback strategy. No significant main effects or interactions emerged. Overall, 11% of participants indicated not having used a specific strategy during biofeedback. In the controlling condition 43% of participants reported having used the proposed strategy while in the autonomy-supportive condition 34% report having used the proposed strategy. However, two groups were noteworthy. In the controlling condition, only 22% of the high self-determined women indicate having used the proposed strategy compared to 67% of the high self-determined men. This difference is marginally significant ($t(16) = 2.00$, $p = .063$).

Learning attributions

Following the experiment participants were asked to indicate whether they felt that they had learned to relax with the help of the biofeedback. No significant main effects or interactions emerged in function of gender, condition, and self-determination. Participants who indicated having learned with the help of the biofeedback were then asked to indicate with the help of a list of statements their attributions for learning.

External attributions were the pleasantness of the biofeedback sound, the helpfulness of the experimenter, the relaxing qualities of the environment, and task difficulty. For the biofeedback sound a main effect of Gender emerged $F(1,59) = 4.80$, $p < .05$ with women (M = 5. 91, SD = 1.14) attributing more to the pleasantness of the sound than men (M = 5.17, SD = 1.22). No significant main effects or interactions

emerged for helpfulness of the experimenter, the relaxing qualities of the environment, and task difficulty.

Internal attributions were ability and effort. For effort a significant Gender x Condition x Self-determination interaction emerged F (1,57) = 6.61, $p < .05$. Inspection of the means shows a different interaction between level of global task motivation and condition for men and women. High self-determined women attribute more to effort in the autonomy-supportive condition than in the controlling condition while the reverse is the case for low self-determined women. For men the opposite pattern emerges. That is, low self-determined men attribute more to effort in the autonomy-supportive condition than in the controlling condition while the reverse is the case for high self-determined men. Interestingly, the group that attributes most to effort are the high self-determined men in the controlling condition (M = 5.56, SD = 1.42) who did not learn to relax while the high self-determined women in the controlling condition, who showed the most learning, indicate (together with the high self-determined men in the autonomy-supportive condition) the lowest attributions to effort (M = 4.00, SD = 1.66 and M = 4.00, SD = 2.00 respectively). No significant main effects or interactions emerged for ability attributions.

Summary

In summary, an interaction between the level of self-determination, the motivational aspect of the situation, and gender was found. First, while participants in general tended to engage to a moderate degree in the relaxation task during the free choice period, two groups were an exception. In the controlling condition, only 20% of the high self-determined women engaged in the task while 100% of the high self-determined men did. Second, while participants in general learned to relax, high self-determined men in the controlling condition did not.[11] Third, while participants in general maintained the learned relaxation without biofeedback in the post-trial low self-determined women in the autonomy-supportive condition did not. Fourth, while

participants in general experienced a moderate level of positive affect low self-determined women in the autonomy-supportive condition did not. Fifth, participants in general attributed their success to a moderate degree to effort; however, high-self determined men in the controlling condition attributed their success strongly to effort, while high self-determined women in the controlling condition and high self-determined men in the autonomy-supportive condition did so to a very low degree. Sixth, women's self-report of relaxation during the experiment correlates significantly with objective measures of relaxation while for men a correlation close to zero was observed.

These results indicate a pattern such that men show moderate levels of learning and positive affect with a moderate participation in the free choice task for all groups except high self-determined men in the controlling condition. This latter group while not achieving relaxation, attributes success in the task strongly to effort. These findings may be explained by the fact that strong effort may produce tension and men seem to be less aware of their actual levels of relaxation.

For women the pattern is somewhat more complicated. Women show high levels of relaxation for all groups, [12] but low self-determined women in the autonomy-supportive condition do not maintain learning when deprived of the biofeedback. This latter group of women also experiences the lowest level of positive affect. Interestingly, the high self-determined women in the controlling condition, while showing high levels of relaxation combined with relatively high levels of positive affect, do engage in the free choice task to a very small percentage only.

General discussion

The present study was conducted to assess (1) the interaction between global task motivation and motivational aspects of the environment and (2) gender differences with regard to this interaction. The results of the present study confirm the notion that global task motivation and intervention style interact. Further, this interaction is qualified by a gender effect. The resulting triple interaction suggests that a different pattern of relations

between the motivational aspects of the environment and level of self-determination emerges for men and women.

Global task motivation and the motivational aspects of the environment

First, we addressed the question of whether low self-determined participants react better to a controlling environment while high self-determined participants react better to an autonomy-supportive environment. As mentioned above, this hypothesis has been promoted by common folklore as well as in the literature regarding management, therapy, and educational domains. However, it has also been suggested that controlling events may actually reduce self-determination even further in already low self-determined individuals rendering them amotivated (Boggiano et al., 1992).

To address this question we compared high and low self-determined participants with regard to the influence of the level of controls and autonomy-support present in the environment on both self-regulation, i.e., learning to relax, and free choice. Low self-determined participants learned moderately well and pursued relaxation during free choice to a moderate degree in both the controlling and the autonomy-supportive environment. That is, regarding the acquisition phase no differences due to condition emerged. However, low self-determined women in the autonomy-supportive condition do not maintain learning during the post-trial and experience significantly less positive and more negative affect than the other groups. This suggests, that at least for low self-determined women, a controlling intervention style is more facilitating than an autonomy-supportive style.

Thus in the context of the present study, the hypothesis proposing a controlling interaction style for low self-determined individuals can be supported in a limited sense. That is, a controlling environment seems to at least not impede self-regulation and does not induce negative affect. As regards the influence of the controlling environment on the participants' level of self-determination, the results from the free choice period do not support Boggiano et al.'s (1992) contention that a controlling environment leads to

amotivation or extrinsic regulation in already low self-determined individuals. Although it has been argued that free choice may not necessarily measure intrinsic motivation, there is general accord that it measures internalized regulation (Anderson & Rodin, 1989; Ryan et al., 1991). Thus, the present results indicating a moderate participation in the free choice task for low self-determined participants regardless of interaction style, suggest that neither the controlling nor the autonomy-supportive environment eroded or fostered low self-determined participants' level of self-determination.

While the present research did not replicate previous findings suggesting that a controlling environment induces negative affect and erodes internalized motivation in low self-determined individuals (Anderson & Rodin, 1989; Boggiano et al., 1992; Freedman & Phillips, 1984; Kernis, 1982 cited in Deci & Ryan, 1985), one should keep in mind, that in our experiment relatedness and competence information were kept constant between conditions. Thus, while the controlling environment was characterized by a strongly directive style, these directions were given in a friendly atmosphere and complemented by positive performance feedback. The importance of the relatedness and competence dimensions has been stressed in the literature regarding therapeutic interventions (e.g., Bandura, 1977; Rogers, 1957; Truax & Carkhuff, 1967; see also Baumeister & Leary, 1995) but their interplay with self-determination has not been fully explored. This points to the need for future research to carefully keep separate the three dimensions of autonomy, relatedness, and competence.

For high self-determined participants a different pattern emerges. Although high self-determined men do not achieve relaxation in the controlling condition, high self-determined women seem equally relaxed and experience similar levels of positive affect in both the controlling and the autonomy-supportive environment.[13] However, high self-determined women in the controlling condition show an erosion of self-determined motivation as evidenced by their low level of participation during the free choice period. Thus, the hypothesis suggesting an autonomy-supportive environment for high self-

determined individuals also received support in so far as an autonomy-supportive environment does not impede self-regulation for both men and women.

Gender differences

Regarding gender, we found that men engaged more in relaxation during the free choice period than women. Given that all participants received positive verbal competence feedback, this replicates previous findings (e.g., Deci, 1972; Zinser, Young, & King, 1982; Koestner, Zuckerman, & Koestner, 1987) which generally have been explained by men's tendency to be more intrinsically motivated by verbal praise than women.

One of the most intriguing findings in the present study regards the differences between high self-determined men and women, specifically in the controlling condition. As described above, when exposed to a controlling environment women but not men achieve and maintain relaxation, while men but not women engage in relaxation during the free choice period, that is, show high levels of state motivation. Both groups report high levels of positive affect. How can we explain that the self-determination eroding consequences of a controlling environment emerge for women with regard to choice motivation and for men with regard to self-regulation?

A look at the self-report data collected following the experiment might provide an answer to this question. A picture emerges suggesting that high self-determined women attribute more importance to the biofeedback sound than men and are more aware of their actual state of relaxation. One should note that anatomical studies indicate that facial muscles do not have sufficient proprio-receptive muscle spindles to allow for feedback of muscle tension (Rinn, 1984).[14] Further, research on facial expressions indicates that people have generally low awareness of their actual level of facial expressiveness (Barr & Kleck, 1995). In addition, it has been shown that women rely more on external cues to assess their performance than men (e.g., Harter, 1978, 1981). This leads to the hypothesis that the women in our study use the biofeedback sound to accurately assess their level of

tension and that they modify their relaxation strategy in consequence, thus achieving the goal they are motivated towards. Yet, the controlling environment seems to erode their motivation to continue during the free choice period. The high self-determined women in the controlling condition are aware of their successful self-regulation and generally report adopting a different strategy than the one imposed by the experimenter. This type of behavior has been suggested for introjected motivation. Specifically, it has been noted that individuals who are introjected and are certain of their competence tend to engage less in free choice and that individuals under introjected motivation in a controlling environment tend to react by lack of compliance (Deci & Ryan, 1985).

On the other hand, high self-determined men in the controlling condition strive to achieve relaxation by using the strategy imposed by the experimenter and by applying more effort. This type of compliant behavior is typical of external regulation. As a consequence, they may actually try too hard which is counter-productive for a relaxation task. However, the "removal" of the experimenter for the duration of the free choice period may have been perceived as an autonomy creating cue. This is in contrast to the autonomy-supportive condition where high self-determined men attribute success considerably less to effort and only one man reported using the proposed strategy. Thus, these men seemed to have experimented more with the task, under less effortful conditions and, consequently, have been able to achieve a moderate level of relaxation.

These findings suggest that high self-determined women react to the controlling environment by adopting an introjected regulation while men react by adoption an external regulation. This possible differential effect of controlling interventions on high self-determined men and women may be due to a differential interpretation of the controlling feedback by men and women because of socialization. Most importantly, more emphasis tends to be placed on boys' than girls' independence and on their ability to formulate standards of success (e.g., Hoffman, 1972; Grieb & Easley, 1984). Further, it has been shown that high self-determined girls but not boys show more mastery

strivings in the presence of controlling cues (Boggiano, Main, & Katz, 1991) which might have been of advantage for the present task. Also, as mentioned above, women tend to rely more on external cues while men tend to rely more on internal cues and the present task provided more accurate external than internal feedback.

Global, state, and process motivation

The differential impact of the interaction between global task motivation and the control present in the environment on self-regulation becomes especially obvious when measures of both state motivation and self-regulated learning are considered. The participant's self-regulated behavior during the learning process is influenced by global task motivation and also represents a specific motivation towards the activity as such. This form of motivation which represents an individual's ongoing self-regulatory behavior during an activity can be conceptualized as process motivation. Thus, the present study points to the importance of distinguishing between global task motivation, state motivation, as indexed by the free choice period, and process motivation.

One of the most important findings regards the fact that these different forms of task motivation may respond differentially to the motivational aspects of events. This conceptualization leads to the question how these different forms of motivation relate to each other. Namely, it may be argued that global self-determination towards a task should be considered a consequence of the learning experience and not an antecedent, for two reasons. First, SDT posits that motivational events influence the level of self-determination towards a task. Second, in the present experiment global task motivation was assessed following the experiment.[15] However, this argument can be refuted on both theoretical and empirical grounds. First, global task motivation is conceptualized as a more enduring disposition towards a task and as such can be expected to show some temporal stability. Second, structural equation modeling allows to explicitly test the notion that global task motivation may be a consequence rather than an antecedent. Structural equation modeling allows the comparision of the relative merits of competing

causal models. Thus, a model assuming global task motivation as assessed in this study to be antecedant to the the learning experience can be compared with a model which assumes it to be a consequence.

For this, we tested two competing models based on the model presented in Figure 1. [16] In the first model global task motivation was defined as an exogenous variable while in the second model global task motivation was defined as an outcome variable, i.e., as a consequence of gender, perceived controls, self-regulation, and state motivation. The results indicate that the model conceptualizing global task motivation as an exogenous variable is more adequate to the data (see Figure 6). Specifically, when global task motivation is defined as an outcome variable none of the posited exogenous variables except for the participation in the free choice task, had beta's larger than .07. These results strongly support the notion that global task motivation as assessed in this study can be considered an independent variable.

Conclusion

The present research makes a number of important theoretical and methodological contributions. First, the use of a biofeedback task for the experimental manipulation allowed the continuous on-line measure of self-regulated behavior as participants strived to relax. This measure, in addition to the traditional free choice period, allowed conclusions regarding not only the participants' self-determination after but during a motivational event. Second, the use of physiological measures to immediately and directly assess participants' reactions to the experimenter's intervention allowed to show that a controlling intervention style affects participants' level of stress from the very first exposure. Third, the use of multiple behavioral and self-report measures allowed a more in depth assessment of the participants' complex reactions to a motivational event. In addition to the retrospective measures of affect and of participants' perceptions of the situation, which have been previously advocated (Ryan, Koestner, & Deci, 1991), the use

of psychophysiological measures allowed concurrent assessment of the participants' reactions to the environment.

Therefore, we believe that the present approach represents an interesting new paradigm for the study of the influences of motivational events on self-regulation. Further, the setting closely mimics interactions such as teacher/student, but also therapist/client, trainer/trainee or health technician/patient interactions in which the establishment and maintenance of self-determined motivation is highly desirable. Since follow-up measures regarding the maintenance of relaxation can be easily obtained the present paradigm lends itself naturally to the study of the influence of self-determination and motivational aspects of events on maintenance and integration of changes.

The present findings hint that in situations were an intervention style has to be chosen for a group without prior knowledge regarding the levels of self-determination of the individuals, a controlling intervention style combined with high levels of relatedness and competence feedback may be a good first approach. Yet, some high self-determined individuals may not benefit from this style and for these individuals a more autonomy-supportive approach should be chosen. Future theory and research should be more explicit regarding the intricate interplay between self-determination, relatedness, and competence while considering gender as an important moderator.

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[1] Controlling events in the context of this paper will be defined as events were pressure to think, feel, and behave in a certain way is exerted. However, individual differences, particularly in level of self-determination, may modulate the perception or experience of events as controlling. Thus, one might argue that the effect of controlling events should be determined on the basis of perceptions of control and not on the basis of the objective event. However, this would lead to circular reasoning by which the effects of self-determination serve to define the nature of events purportetly influencing self-determination.

[2] Similar ideas have been expressed in the framework of Organismic integration theory (a subtheory of Self-determination theory, Deci & Ryan, 1985). A basic hypothesis derived from Cognitive Evaluation Theory (another subtheory of SDT) states that in most cases autonomy-supportive events increase self-determination whereas controlling events decrease high levels of self-determination. However, Organismic integration theory recognizes that individuals low in self-determination might appreciate the structure provided by a more controlling style and that the judicial use of the right level of control might faciliate an indidual's move towards self-determined motivation over time (see Deci & Ryan, 1985, p. 146).

[3] It is important to note that the quantitative and the qualitative aspects of motivation are theoretically independent. That is, higher levels of self-determination are not necessarily associated with higher levels of quantitative motivation and low levels of self-determination are not indicative of low levels of quantitative motivation. For

example, an individual who runs fast to escape a threat will likely be very highly motivated to run, but under low levels of self-determination (external regulation).

[4] In this context it is important to note that the term global refers to the temporal aspect of motivation. That is, global task motivation refers to the level of self-determination that an individual experiences usually towards a specific activity or a domain. The term state motivation refers to the level of self-determination experienced towards a task or domain at a specific point in time. This implies that a global motivation may refer to a very specific task (e.g., swimming) just as state motivation can refer to a whole life domain (e.g., leisure activities).

[5] That is, while the global motivation of an individual towards the same task in general, or in the future, does usually not change due to having experienced a controlling event the situational motivation may have changed. To come back to a previous example: if a person who usually experiences intrinsic motivation towards cooking has been "forced" to cook under external pressures, we may assume that the person is likely to decline to do any more than necessary to meet the external standard at that specific time -- thus showing the well-established loss of intrinisc motivation under external controls. However, the person will still experience intrinsic motivation towards cooking when faced with the task the next day.

[6] For both experimenters one example for each of the two conditions (controlling and autonomy-supportive) was videotaped and rated as satisfactory by experts with regard to the three dimensions which were manipulated (controlling versus autonomy-supportive, competence feedback, and relatedness).

[7] The music was pretested to assure that it would be perceived as pleasant and relaxing.

[8] Due to technical problems data for the Corrugator Supercilii site was not available for most participants.

[9] Note that for ease of representation, the sign was reversed; that is, positive values indicate increased relaxation.

[10] Inspection of the means over all six reaction periods suggests that, in general, SCL decreases over the course of the experiment. This suggests that the inital higher levels in the autonomy-supportive condition are due to nerveousness caused by the inherent openness of the situation.

[11] While high self-determined women in the autonomy-supportive condition also did not learn to relax this is probably due to their low levels of tension at baseline.

[12] While high self-determined women in the autonomy-supportive condition also did not learn to relax this is probably due to their low levels of tension at baseline.

[13] While high self-determined women in the autonomy-supportive condition also did not learn to relax this is probably due to their low levels of tension at baseline.

[14] At suffienctly high levels of muscle contraction participants may feel the facial skin stretching and thus have a certain feedback in their facial expressiveness (Johansson,Trulsson, Olsson, & Abbs, 1988). However, in the present context this is unlikely.

[15] The decision to measure global task motivation following the experiment was based on the results of pre-tests which suggested that a global task motivation measure asking subjects to endorse statements regarding relaxation tasks in the future had

unsatisfying psychometric characteristics. This may be expected since the inclusion criteria for participants excluded individuals with previous experience in relaxation techniques. Thus, subjects did not actually dispose of the knowledge base enabling them to respond to a detailed enquiry regarding future relaxation experiences.

[16] The number of cases employed in this test (n = 68) is probably to low to allow a confident generalization of the findings. However, the sample is large enough for a descriptive model of the specific data set under consideration (Anderson & Gerbing, 1988).

Global task motivation (high versus low self-determination), objective environment (experimental condition: the higher score refers to an autonomy-supportive environment) and gender (the higher score refers to men) were specified as exogenous variables. Individuals high in self-determination and women perceived the environment as less controlling. Participants in the controlling condition perceived the environment as more controlling (perceived environment: higher scores indicate that the environment was perceived as more controlling). Process motivation and choice motivation were both influenced by self-determination, perceived environment, and gender. Individuals high in self-determination showed more process and choice motivation. Similarly, individuals who perceived the environment as more controlling showed more process and choice motivation. Finally men showed more process and choice motivation.

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Table 1: Correlations between objective (EMG difference scores for trial five and post-test) and self-report ("feeling tense during the experiment") measures of relaxation

	Male		female	
EMG	high SD	Low SD	high SD	low SD
Trial 5	.09	-.27	-.50	-.56
post-trial	.03	-.28	-.79	-.34

Figure captions

Figure 1. Model representation of the relationship of global, process, and state motivation with gender as well as perceived and objective environment.

Figure 2. Relative relaxation as a function of self-determination, gender, and interaction style (positive values indicate more relaxation)

Figure 3. Muscle activity as a function of self-determination, gender, and interaction style for baseline, trial five, and post-trial

Figure 4. Percentage of participants and time spent pursuing biofeedback training during free choice in function of self-determination, gender, and interaction style

Figure 5. Relative relaxation and SCL in function of self-determination, gender, and interaction style for the first waiting period (positive EMG difference scores indicate more relaxation)

Figure 6. Self-reported affective state in function of intervention style, gender, and level of self-determination towards relaxation.

Figure 7. Model representation of the relationship of global, process, and state motivation with gender as well as perceived and objective environment (Chi^2 (5) = 0.47, n.s.; IFI = .99).

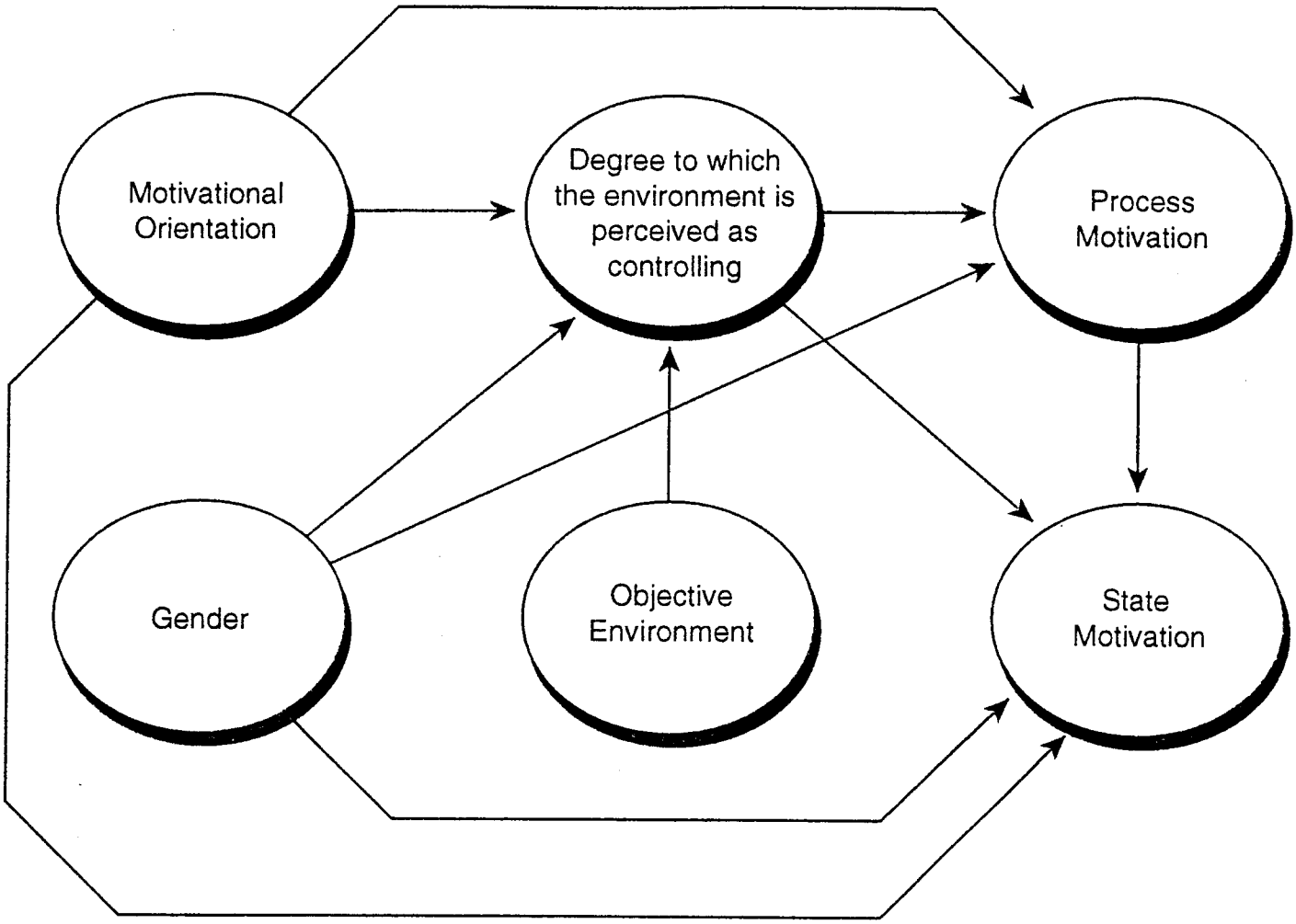
Annex 1

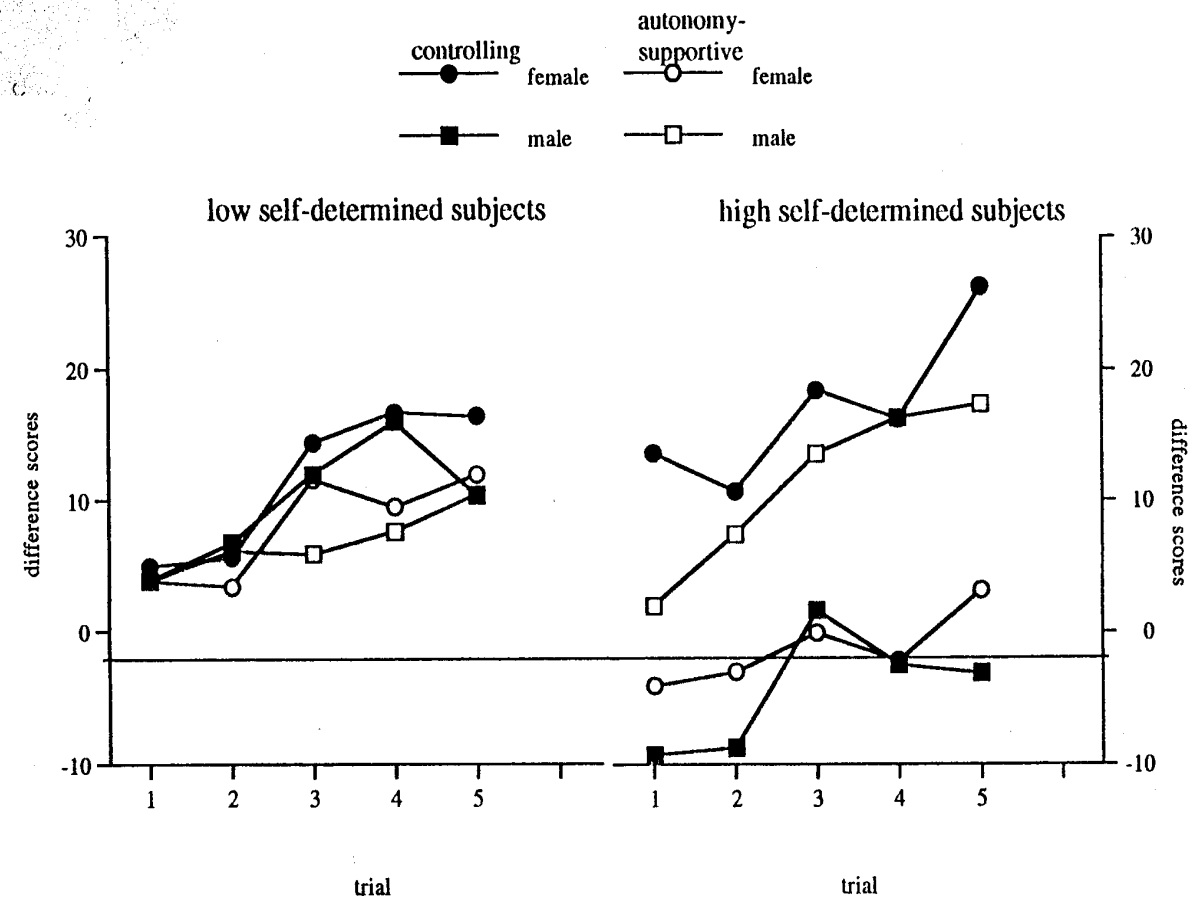
Table 1. Psychometric characteristics of the scales used in the post-questionnaire.

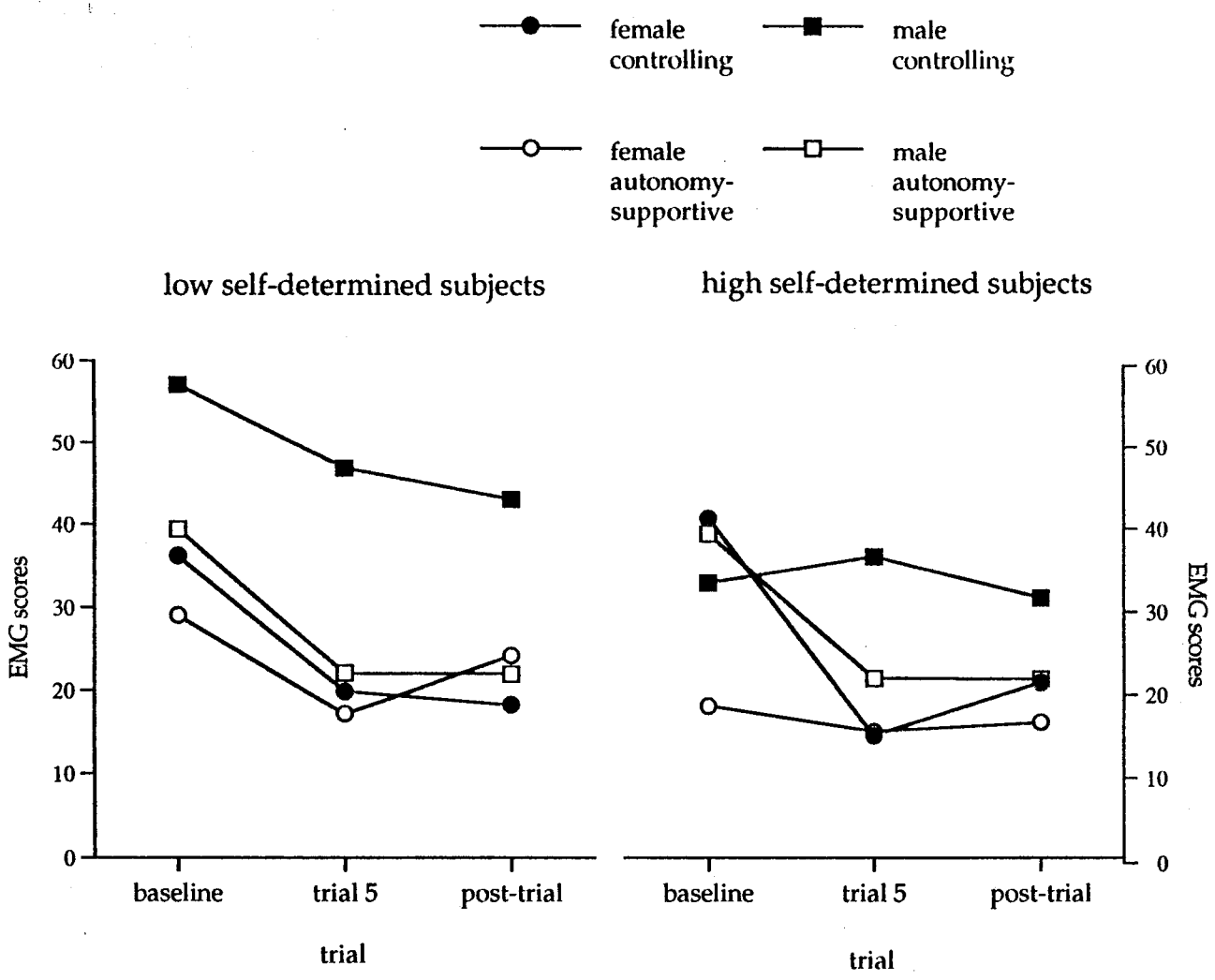
Global Task Motivation				
			Example item	Reliability
	Number	Range		Cronbach
Subscales	of items		If you could do biofeedback again, why would you do it ?	alpha
1- Amotivation	6	1 - 7	I do not really know, I do not see what this activity brings me	0.84
2- Extrinsic Motivation: external regulation	7	1 - 7	Because my stress/my anxiety is stressful for some of the people important to me	0.83
3- Extrinsic Motivation: introjected regulation	7	1 - 7	Because it is absolutely necessary to control oneself and relaxation allows this	0.82
4- Extrinsic Motivation: identified regulation	7	1 - 7	Because for me this activity seems to be a good way to learn a bit more about my abilities	0.87
6- Intrinsic motivation	5	1 - 7	Because I like the sensation of being deeply relaxed	0.79
Composite scale	32			

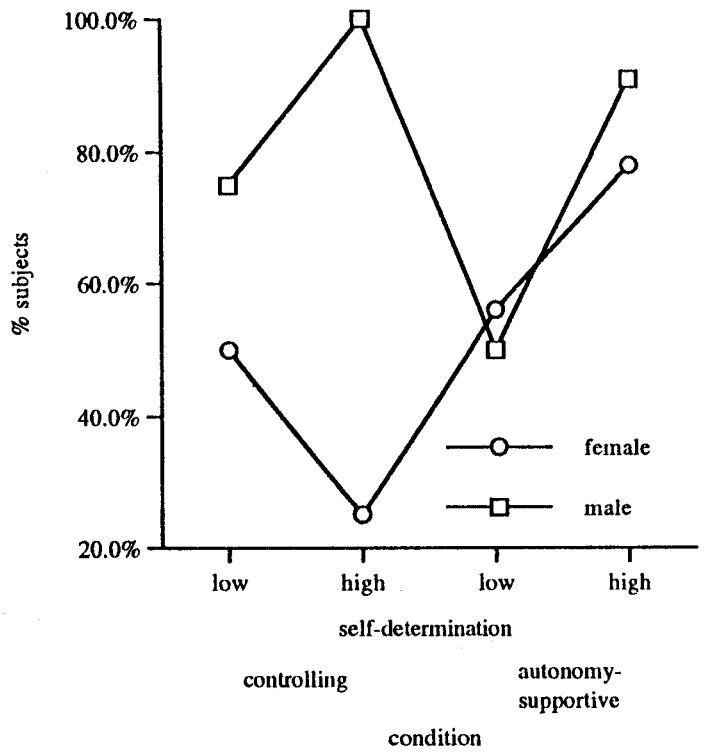
Affect				
			Example item	Reliability
	Number	Range	Please indicate how you felt, in general, during the session.	Cronbach
Subscales	of items		In general, I felt ...	alpha
1- Negative affect	4	1 - 7	... impatient	0.57
2- Positive affect	5	1 - 7	... satisfied	0.73
Composite scale	9			0.76

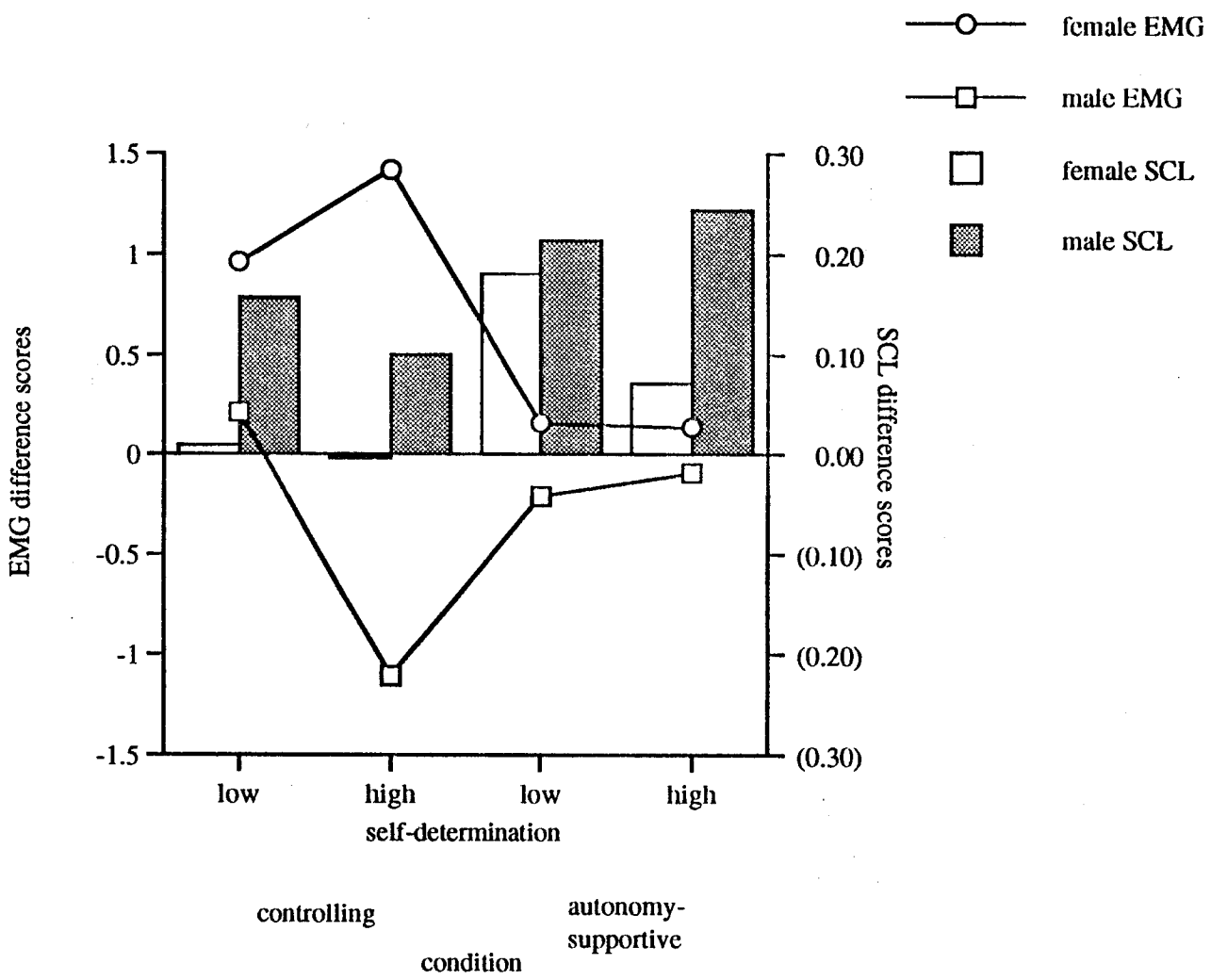
Feeling ...				
			Example item	Reliability
	Number	Range	Please indicate how you felt, in general, during the session.	Cronbach
	of items		In general, I felt ...	alpha
... controlled	6	1 - 7	... watched over by the experimenter	0.62
... autonomy-support	6	1 - 7	... free to do the task the way I want	0.81
... competent	5	1 - 7	... confident that I am good at this task	0.72

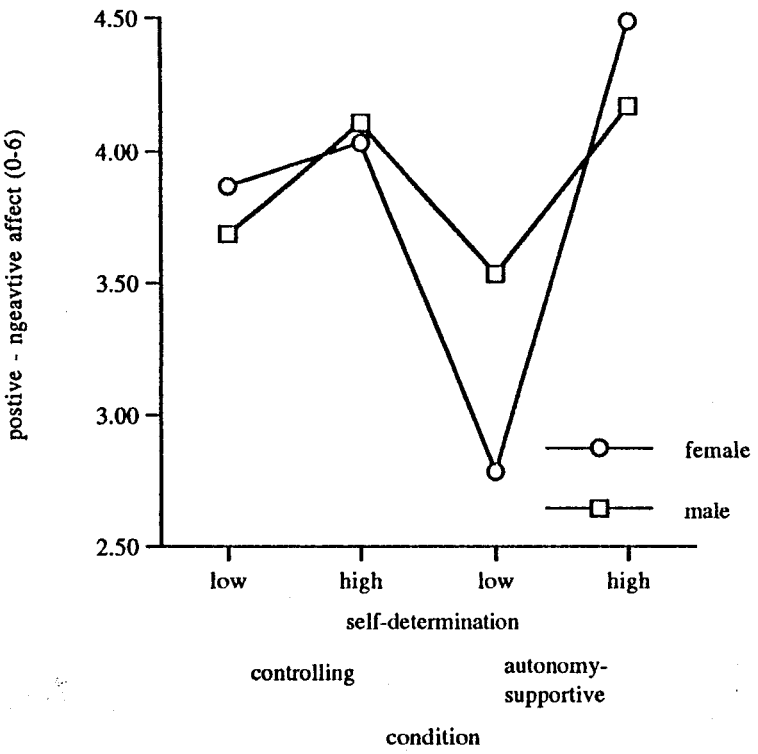

Motivational Orientation
Degree to which the environment is perceived as controlling
Process Motivation
Gender
Objective Environment
State Motivation

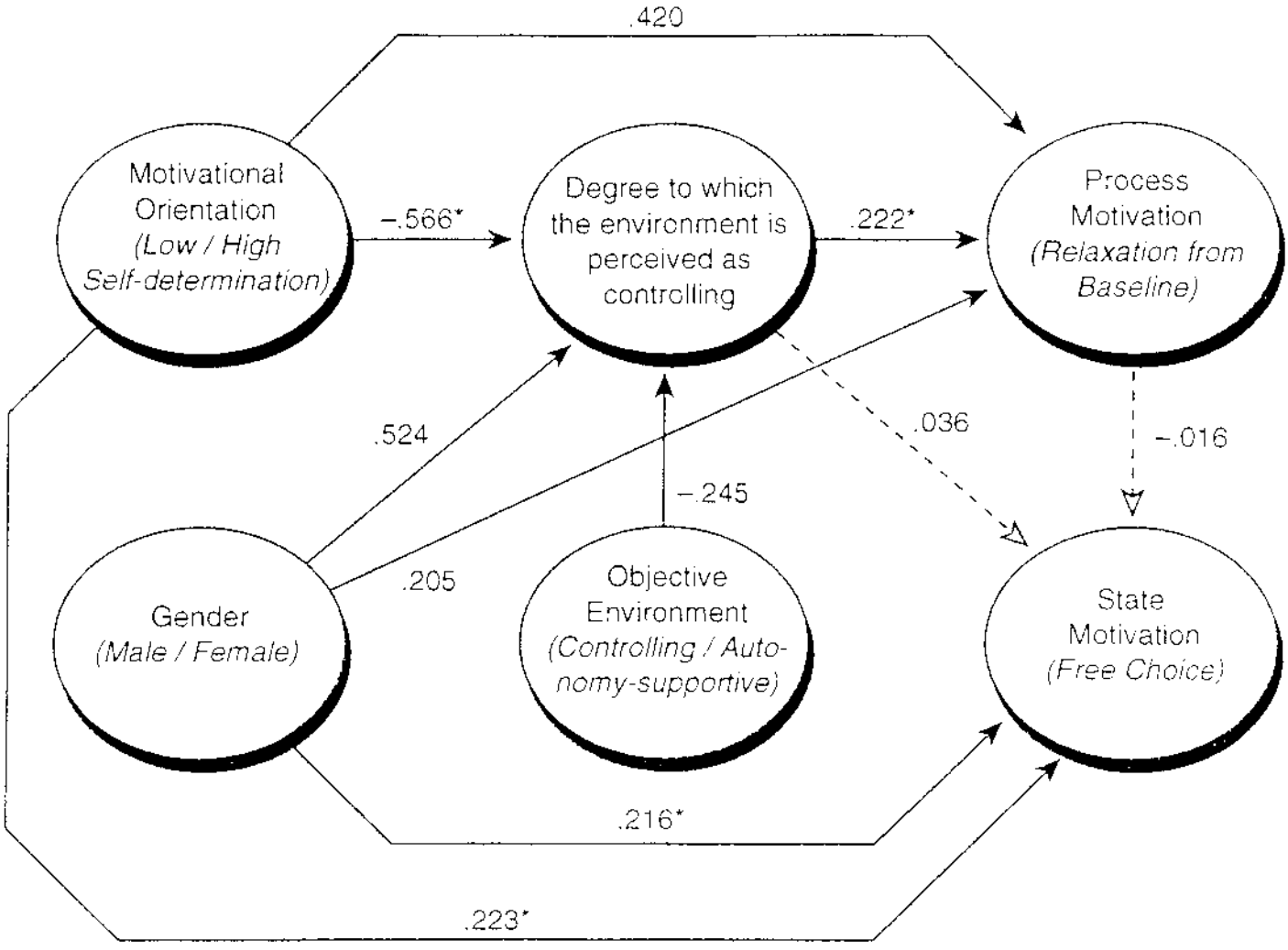

controlling
female
male
autonomy-
supportive
female
male
low self-determined subjects
high self-determined subjects
30
20
10
0
-10
difference scores
1
2
3
4
5
trial


female controlling
male controlling
female autonomy-supportive
male autonomy-supportive
low self-determined subjects
high self-determined subjects
EMG scores
60
50
40
30
20
10
0
baseline
trial 5
post-trial
trial


100.0%
80.0%
60.0%
40.0%
20.0%
% subjects
female
male
low
high
low
high
self-determination
controlling
autonomy-supportive
condition


female EMG
male EMG
female SCL
male SCL
1.5
1
0.5
0
-0.5
-1
-1.5
EMG difference scores
0.30
0.20
0.10
0.00
(0.10)
(0.20)
(0.30)
SCL difference scores
low
high
low
high
self-determination
controlling
autonomy-supportive
condition


4.50
4.00
3.50
3.00
2.50
postive - ngeavtive affect (0-6)
female
male
low
high
low
high
self-determination
controlling
autonomy-
supportive
condition


.420
Motivational Orientation (Low / High Self-determination)
−.566*
Degree to which the environment is perceived as controlling
.222*
Process Motivation (Relaxation from Baseline)
.524
.036
−.016
−.245
Gender (Male / Female)
.205
Objective Environment (Controlling / Autonomy-supportive)
State Motivation (Free Choice)
.216*
.223*

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