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ORIGINAL PAPER

The mediating role of positive and negative affect in the situational motivation-performance relationship

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Abstract Based on self-determination theory (Deci and Ryan in Intrinsic motivation and self-determination in human behavior. Plenum Publishing Co., New York, 1985) and the broaden-and-build theory (Fredrickson in Am Psychol 56:218–226, 2001), the purpose of the present research was to propose and test an integrative model on the role of positive and negative affect as mediators of the situational motivation-performance relationship. Specifically, the hypothesized model posits that autonomous motivation predicts positive affect, while controlled motivation and amotivation both lead to negative affect. In addition, amotivation negatively predicts positive affect. In turn, positive and negative affect positively and negatively predict performance, respectively. The model was confirmed in three studies using correlational (Studies 1 and 2) and experimental designs (Study 3) with a cognitive task (anagrams). In addition, the role of individual differences (Study 2) and situational factors (Study 3) as triggers of the "Motivation-Affect-Performance" sequence was confirmed. Theoretical implications and directions for future research are discussed.

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Introduction

Over the years, much research has dealt with motivational processes (see Bargh et al. 2010; Shah and Gardner 2008). One theory that has led to an impressive amount of research is self-determination theory (SDT; Deci 1975; Deci and Ryan 1985, 2000, 2008). One important contribution of SDT is that it posits that motivation varies in kind and that the quality of motivational processes determines the quality of outcomes that will be experienced. While SDT has led to much research on the role of motivation in a variety of outcomes (e.g., satisfaction, enjoyment, persistence), additional research is needed to identify the nature of the psychological processes at play in the motivation-performance relationship. The present research seeks to address this issue.

Motivation, affect, and performance

Self-determination theory (Deci and Ryan 2000) posits that there are three major forms of motivation, namely, autonomous motivation, controlled motivation, and amotivation. Autonomous motivation refers to engaging in an activity out of pleasure and/or volition and choice. In contrast, controlled motivation is defined as engaging in an activity for internal (e.g., guilt) or external pressure (e.g., external rewards). Finally, amotivation refers to a lack of intention to perform a behavior and thus to the relative absence of motivation (see also Vallerand 1997). These three types of motivation constructs vary in terms of the inherent

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presence of self-determination, with autonomous forms of motivation having the highest level and amotivation the lowest level of self-determination. SDT posits that autonomous motivation should lead to the most positive outcomes, while controlled motivation and especially amotivation should lead to the most negative outcomes. Research has clearly supported these hypotheses with a number of cognitive, affective, and behavioral outcomes (see Deci and Ryan 2000; Vallerand 1997, 2007 for reviews). However, as discussed below, the results with performance has yielded some inconsistencies.

Motivation and performance

According to SDT, individuals who are autonomously motivated have internalized the values and behaviors endorsed as pertains to the behavior, while with controlled motivation and amotivation such internalization has not taken place. Thus, autonomous motivation should be conducive to optimal performance because such motivation accurately reflects the values and interests of one's true self, thereby allowing the individual to fully partake in the activity and to focus on the task at hand (see Roelofs 2010; Wilding et al. 2007). In contrast, controlled motivation should lead to low performance as such a motivational state is not aligned with one's values and interests thereby preventing one from fully focusing on the activity. In fact, controlled motivation should be negatively related to performance as individuals' focus is oriented toward elements external to activity pursuit such as others' approval and rewards, and because controlled motivation leads to activity engagement of lower quality (e.g., Mouratidis and Michou 2011; Pelletier et al. 2001). Finally, because it amounts to low levels of motivation, amotivation should be conducive to low levels of performance, especially when the task is demanding.

Self-determination theory research using various analysis strategies has provided support for some of these hypotheses. Indeed, past studies examining the relationships between motivation and performance within the SDT framework has used one of three strategies: (1) assessing the relationship of each type of motivation independently (e.g., autonomous motivation), (2) using the self-determination index which entails giving weights to each construct as a function of their level of self-determination and summing all products into one score (Grolnick and Ryan 1987), or (3) using cluster analyses to identify motivational profiles. It has been consistently found that autonomous motivation positively predicts performance (e.g., Amabile 1985; Black and Deci 2000; Boiché et al. 2008; Burton et al. 2006; Fortier et al. 1995; Gillet et al. 2010; Gottfried 1985; Grolnick and Ryan 1987; Grolnick et al. 1991; Guay and Vallerand 1997). These results were obtained in different contexts (e.g., sport, education), with participants of different ages (e.g., children, adolescents, adults), and with different measures of performance and types of task (e.g., cognitive tasks, motor tasks). For instance, in a sample of 1,623 ninth-grade French-Canadian students, Guay and Vallerand (1997, Study 1) have shown that autonomous school motivation (assessed by the self-determination index) positively predicted academic achievement (in French, Mathematics, and Geography). These results were replicated in Study 2 with a sample of 1,098 tenth-grade students while controlling for participants' prior achievement. Gillet et al. (2010) have also shown that autonomous motivation for a judo competition (assessed 1–2 h before the beginning of the competition) had a positive influence on athletes' performance (official ranking for the competitive event).

The picture with controlled motivation is less clear. Specifically, while some research has demonstrated that controlled motivation can undermine creativity and performance (e.g., Amabile 1982; Benware and Deci 1984; Condry 1977; Joussemet and Koestner 1999; Koestner et al. 1984; Lepper et al. 1973; McGraw and McCullers 1979), other research has not found such negative effects (e.g., Cameron et al. 2005; Chantal et al. 1996; Konheim-Kalkstein and van den Broek 2008). Finally, only a few studies (e.g., Chantal et al. 1996; Gillet et al. 2010) have looked at the relationship between amotivation and performance. Because it refers to a relative lack of motivation, amotivation should be negatively related to performance. This hypothesis was confirmed by Gillet et al. (2009; Study 1) with a sample of French junior national tennis players.

Affect as a mediator of the motivation-performance relationship

Given that motivation (and especially autonomous motivation) influences performance, then what are the processes mediating such effects? Research reveals that the experience of positive and negative affect during the course of task engagement may be at play in this relationship (e.g., Meyer and Turner 2002; Pekrun et al. 2009). The broaden-and-build theory (Fredrickson 1998, 2001) proposes that positive emotions predict positive outcomes because positive emotions help individuals build resources such as cognitive repertoires that lead to adaptive benefits (Fredrickson 1998; Fredrickson and Branigan 2001). Past research has provided direct evidence for the broadening impact of positive affect on attention and thought-action repertoires relative to a neutral state, whereas negative affect, relative to a neutral state, narrowed thought-action repertoires (Fredrickson and Branigan 2005). In their review, Friedman and Förster (2010) also reported studies that have shown that arousing positive emotional states increases, and that arousing negative states constricts, the scope of attention. Positive affect may thus be beneficial to performance because it allows individuals to allocate greater resources to the task at hand (Fredrickson 2001; see also Isen 1987). In contrast, when individuals experience negative affect while completing a task, their attention and functioning are not optimal (Friedman and Förster 2010; Keenan 2002; Meyer and Turner 2002) because such resources are momentarily decreased.

Research does reveal that people typically perform better when they experience positive affect (e.g., Amabile et al. 2005; DeLuga and Mason 2000; Hill et al. 2005; Isen 1987; Koy and Yeo 2008; Park et al. 2005; Wright et al. 2004). This is likely to take place on "heuristic tasks" (where performance requires some conceptual reasoning and thus much more than simply effort; see McGraw 1978). It should be noted that the negative effect of negative affect on performance remains to be confirmed (see Isen et al. 1987). However, a paucity of research has focused on the role of negative affect in performance. In addition, because the influence of anxiety on performance may vary as a function of the type of tasks (see Hainaut and Bolmont 2005), future research is needed to examine the relationship between negative affect and performance with cognitive tasks.

If positive affect facilitates, and negative affect possibly undermines, performance, then, does motivation influence affect? The answer is a resounding yes. Indeed, much research reveals that autonomous motivation positively, and amotivation negatively, predicts positive affect. Furthermore, controlled forms of motivation and amotivation typically lead to negative affect, although some studies have shown no relationship. Overall, these findings have been obtained in a variety of life domains (e.g., education, work, sport), as well as a plethora of tasks (e.g., Edmunds et al. 2007; Gagné et al. 2003; Knollman and Wild 2007; Koestner et al. 2002; Kowal and Fortier 1999; Miquelon and Vallerand 2006; Sheldon et al. 2004; Vallerand et al. 1993; see Vallerand 1997, 2007 for reviews).

The present research

The purpose of the present research was to test an integrative model based on the above reasoning. Specifically, we have sought to integrate self-determination and broaden-and-build theories because these approaches are deemed to provide complimentary explanations of the various psychological processes involved in the relationships between motivation, affect, and performance. First, there is ample evidence in the SDT framework to support the notion that autonomous motivation as opposed to controlled motivation and amotivation is positively associated with positive affect (e.g., Miquelon and Vallerand 2006; Sheldon et al. 2004). Second, the broaden-and-build theory (Fredrickson 1998, 2001) proposes that positive affect broadens the scope of attention, facilitates holistic attentional processes and cognitive resources, and performance, while a negative relationship has been found between negative affect and performance (see Friedman and Förster 2010).

The hypothesized model proposes that autonomous motivation predicts positive affect, while controlled motivation and amotivation both lead to negative affect. In addition, amotivation negatively predicts positive affect. In turn, positive and negative affect positively and negatively predicts performance, respectively. Three studies were conducted to test the hypothesized model. Using a correlational design, the purpose of Study 1 was to test the basic hypothesized model through structural equation modeling. The purpose of Study 2 was to further test the basic model while incorporating individual differences as determinants of each of the three forms of motivation, namely global autonomous and controlled motivation and global amotivation (see Vallerand 1997). Finally, in Study 3, we assessed the role of situational determinants as triggers of the hypothesized causal sequence. Specifically, using an experimental design we induced autonomous motivation (or a control group condition) using paraliminal priming (e.g., Bargh and Chartrand 2000). Then, assessing the various types of situational motivation and positive and negative affect and performance, the hypothesized model was further tested. Overall, it was posited that the hypothesized model would be supported in all three studies.

Study 1

The main purpose of Study 1 was to test the integrative model presented above. Using a correlational design, the three forms of motivation, positive and negative affect, and objective performance on an anagram task were assessed.

Method

Participants

Participants were 240 university students (158 women and 82 men) enrolled in different programs (e.g., accounting, sexology, sociology) with a mean age of 23.75 years (SD = 5.00). Participants' first language was French in all cases.

Procedure

Participants were recruited in classrooms and asked to participate in a study on attitudes and cognitions during an anagram task. It can thus be considered that participants were naïve to the purpose of the study. After signing an informed consent form, participants were told what anagrams were, provided with two anagram samples, and were told that they would have 5 min to solve as many anagrams as possible and that all anagrams were solvable and in French. They received no information on their performance relative to others. After the 5-min period, participants were asked to complete a questionnaire individually including basic demographic questions, as well as the scales described below.

Measures

Situational motivation Participants' situational motivation toward the anagram task was assessed with an adapted version of the Situational Motivation Scale (SIMS; Guay et al. 2000). The SIMS typically measures four types of motivation to engage in a task (here the anagrams) at a specific point in time, with four items per subscale: intrinsic motivation, identified regulation, external regulation, and amotivation. In addition, four items assessing introjected regulation (e.g., "Because I would feel bad not doing it") were also added to the SIMS. Participants were asked to indicate, on a 7-point Likert scale (1 = "Does not correspond at all" and 7 = "Corresponds exactly"), the extent to which each item represented a reason why they engaged in the anagram task. The SIMS has demonstrated acceptable levels of reliability and validity in past research. However, because the SIMS was modified in the present study, a confirmatory factor analysis was conducted on the data. Although the χ^2 value was significant, χ^2 (153) = 267.95, $p < .05$, the other fit indices were acceptable: $\chi^2/df = 1.75$, CFI = .98, IFI = .98, RMSEA = .06, and SRMR = .04. All factor loadings were significant and levels of internal consistency for the five subscales were all satisfactory with Cronbach alphas ranged from .79 to .93. These results provide support for the validity of the modified SIMS. In line with past research (e.g., Vansteenkiste et al. 2005), we computed an autonomous motivation index by adding and averaging the intrinsic motivation and identified regulation items ($\alpha = .93$) and a controlled motivation index by summing and averaging the introjected and external regulations items ($\alpha = .90$).

Positive and negative affect Participants' affective experiences during the anagram task were measured using two 5-item subscales assessing positive ("Interested", "Determined", "Relaxed", "Alert", and "Enthusiastic"; $\alpha = .81$) and negative ("Nervous", "Angry", "Hostile", "Sleepy", "Irritable"; $\alpha = .65$) affect taken from the Positive and Negative Affect Schedule (PANAS; Watson et al. 1988). Participants were asked to rate each item on the basis of how they felt during the anagram task using a 5-point Likert scale, ranging from "Not at all" (1) to "Extremely" (5).

Performance A list of 25 French four-letter solvable anagrams was presented to the participants. Each participant had five minutes to solve the anagrams. The number of anagrams solved during the five-minute period served as a measure of objective performance in the present study.

Results and discussion

Means, standard deviations, and correlations among all study variables appear in Table 1. Inspection of the skewness indices for all variables proved to be normal (skewness values ranged from −.50 to 1.60). All analyses were performed using structural equation modeling with EQS 6.1 (Bentler 1993) and only robust statistics are reported. The model tested in the present study was composed of one observed (i.e., performance) and nine latent variables. Intrinsic motivation, identified, introjected, and external regulations, amotivation, and positive and negative affect were defined by their corresponding items. Moreover, two second-order variables were created. First, autonomous motivation was defined by intrinsic motivation and identified regulation and, second, controlled motivation was defined by introjected and external regulations. Paths were specified according to the hypotheses mentioned above. Furthermore, covariance paths among motivation types and between positive and negative affect were estimated.

We used well established indices to assess model fit of the hypothesized model: the significance of the Chi-square value (χ^2), the normed Chi-square (χ^2/df), the Comparative Fit Index (CFI), the Incremental Fit Index (IFI), the Root Mean Square Error of Approximation (RMSEA), and the Standardized Root Mean Residual (SRMR). Bollen (1989) suggested that a normed χ^2 value lower than 3.0 indicates a reasonable fit to the data. According to Tabachnick and Fidell (2007), the χ^2 value should not be significant ($p > .05$), and the CFI and IFI should be .90 or higher, for a good model fit. Finally, the RMSEA and SRMR should be .08 or lower (Kline 2005). The model had an acceptable fit to the data, χ^2 (419, N = 240) = 700.70, $p < .05$, $\chi^2/df = 1.67$, CFI = .91, IFI = .91, RMSEA = .06, and SRMR = .06.

As shown in Fig. 1, all estimated paths were significant, with the exception of the path between controlled motivation and negative affect that was marginally significant ($t = 1.68$, $p = .09$). Indirect effects were investigated to further test the mediating role of positive and negative affect between motivation and performance. Consequently, bootstrapped confidence interval estimates of the indirect effect (see Preacher and Hayes 2008) were calculated to confirm the significance of mediations. Bootstrapping is a statistical

Table 1 Means, standard deviations, and correlations among the study variables (Study 1)

Variables	M	SD	1	2	3	4	5
1. Situational autonomous motivation	3.58	1.45					
2. Situational controlled motivation	2.79	1.45	.04				
3. Situational amotivation	2.77	1.42	−.35***	.38***			
4. Positive affect	3.26	.93	.66***	−.04	−.36***		
5. Negative affect	1.55	.60	−.14*	.22**	.28***	−.32***	
6. Performance	14.35	4.26	.26***	.00	−.23***	.45***	−.31***

Items for the motivation subscales were measured on a 7-point scale, while those for positive and negative affect were measured on a 5-point scale

* $p < .05$; ** $p < .01$; *** $p < .001$

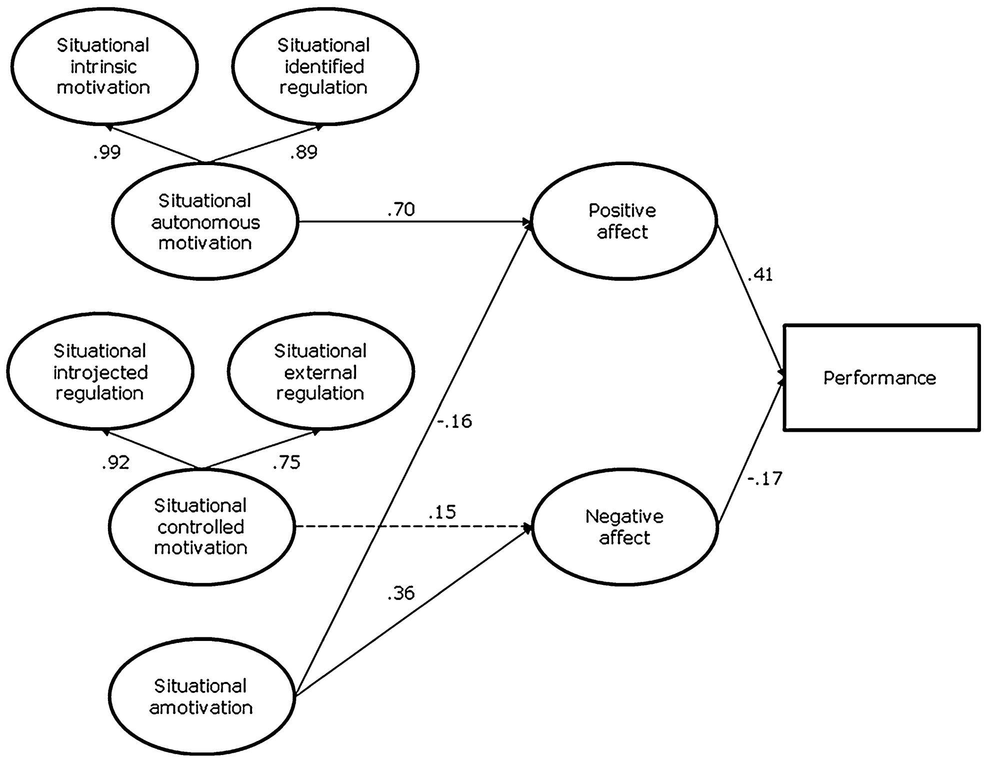

Fig. 1 Results from Study 1. *Notes* All coefficients were standardized. All relationships are significant ($p < .05$) with the exception of that identified by a *dashed line*. For sake of clarity, covariances and indicators of latent variables are not shown

method that randomly constructs a number of resamples of the original sample in order to estimate parameters. In the present study the 95 % confidence interval of the indirect effects was obtained with 5,000 bootstrap resamples. Using bootstrap methods to estimate indirect effects is especially recommended in small-to-moderate samples (Shrout and Bolger 2002). It should be noted that the indirect effect is significant at $p < .05$ if the 95 % confidence intervals do not include the value of zero. In the present study, the confidence interval was bias corrected given that this correction is believed to improve power and Type 1 error rates (MacKinnon et al. 2004). Results (see Table 2) confirmed the mediating role of positive affect between autonomous motivation and performance ($\beta = .27$; CI = .17 to .37) and the mediating role of positive and negative affect between amotivation and performance ($\beta = -.11$; CI = −.20 to −.04). Given that there was no direct path between situational motivation and performance, all mediations can be seen as full.

We next tested two alternative models. In the first one, autonomous motivation, controlled motivation, and amotivation predicted performance that, in turn, predicted positive and negative affect. In the second one, autonomous motivation, controlled motivation, and amotivation simultaneously predicted positive and negative affect and performance. Results revealed that these two alternative models exhibited a worse fit than the hypothesized model (see Table 3). The hypothesized model was thus judged the

Table 2 Bias-corrected bootstrapped estimates of the indirect effects of all studies

	Indirect effect	95 % confidence interval
Study 1		
Situational autonomous motivation → performance	.27	(.17; .37)
Situational amotivation → performance	−.11	(−.20; −.04)
Study 2		
Global autonomous motivation → positive affect	.20	(.08; .33)
Global controlled motivation → negative affect	.06	(.01; .15)
Global amotivation → negative affect	.04	(.01; .11)
Situational autonomous motivation → performance	.23	(.13; .34)
Global autonomous motivation → performance	.06	(.03; .12)
Study 3		
Experimental conditions → positive affect	.21	(.04; .41)
Experimental conditions → negative affect	−.06	(−.18; −.02)
Situational autonomous motivation → performance	.15	(.01; .35)
Situational controlled motivation → performance	−.07	(−.28; −.00)
Situational amotivation → performance	−.09	(−.18; −.00)
Meta-analysis of Studies 1, 2, and 3		
Situational autonomous motivation → performance	.26	(.19; .32)
Situational controlled motivation → performance	−.04	(−.08; −.01)
Situational amotivation → performance	−.08	(−.12; −.03)

most plausible model on the basis of both theoretical and empirical grounds.[1]

Study 2

Results from Study 1 supported the positive role of autonomous motivation, and the negative role of controlled motivation and amotivation, in performance. Furthermore, positive and negative affect mediated these positive and negative effects, respectively. In light of these results, motivation can be considered as a distal predictor of performance and affect a proximal predictor of performance. Thus a first goal of Study 2 was to replicate the model obtained in Study 1. The second goal was to test the role of an individual difference variable, namely global motivation (Guay et al. 2003), as a determinant of situational motivation. Global motivation refers to a general motivational orientation to interact with the environment in an autonomous, controlled, or amotivated way. The Hierarchical Model of Intrinsic and Extrinsic Motivation (HMIEM; Vallerand 1997, 2007) posits that motivation at a given level (e.g., situational motivation) results from a top-down effect from motivation at a higher level (in this case, global motivation). While much research supports the top-down effect between the contextual and situational levels, no research so far has tested the top-down effect from the global level to the situational level. Thus, in line with the HMIEM, it was hypothesized that each type of global motivation would predict its corresponding type of situational motivation (autonomous, controlled, and amotivation), thereby triggering the hypothesized causal sequence involving positive and negative affect and objective performance.

Method

Participants

Participants were 262 French-speaking university students (199 women and 63 men) enrolled in different programs with a mean age of 23.54 years (SD = 5.35 years).

Procedure and measures

The procedures and measures were exactly the same as those of Study 1 with the only exception being that students also completed the Global Motivation Scale (Guay et al. 2003) before engaging in the anagram task. This scale contains 28 items assessing intrinsic motivation, identified, introjected, and external regulation, and amotivation toward life in general. Participants responded to items on a 7-point Likert-scale anchored by (1) “Does not correspond at all” and (7) “Corresponds exactly”. This scale has demonstrated acceptable reliability and validity in past research (e.g., Guay et al. 2003; Ratelle et al. 2004; Stephan et al. 2008).

[1] We have tested other alternative models. Results revealed that these alternative models exhibited a worse fit than the hypothesized model. For sake of brevity these alternative models are not reported here. They can be obtained through the first author.

Table 3 Goodness-of-fit indices of the two alternative models for Study 1

Model	χ^2	*df*	Normed χ^2	CFI	IFI	RMSEA	SRMR	AIC
Hypothesized model	700.70	419	1.67	.91	.91	.06	.06	−137.30
Alternative model 1	833.58	420	1.99	.87	.87	.07	.08	−6.42
Alternative model 2	738.06	418	1.77	.90	.90	.06	.07	−97.94

The intrinsic motivation and identified regulation items, and the introjected and external regulations items, were summed and averaged to form scores of global autonomous motivation and global controlled motivation, respectively. All scales used in Study 2 displayed adequate levels of reliability (alphas ranged from .79 to .93).

Results and discussion

Means, standard deviations, and correlations among all study variables appear in Table 4. Inspection of the skewness indices for all variables proved to be normal (skewness values ranged from −.69 to 1.47). The model tested in the present study was composed of one observed (i.e., performance) and sixteen latent variables. Global intrinsic motivation, global identified, introjected, and external regulations, global amotivation, situational intrinsic motivation, situational identified, introjected, and external regulations, situational amotivation, and positive and negative affect were defined by their corresponding items. Moreover, four second-order variables were created. First, global autonomous motivation was defined by global intrinsic motivation and global identified regulation. Second, global controlled motivation was defined by global introjected and external regulations. Third, situational autonomous motivation was defined by situational intrinsic motivation and situational identified regulation. Finally, situational controlled motivation was defined by situational introjected and external regulations. The model tested was the same as the one tested in Study 1, with the exception that autonomous motivation, controlled motivation, and amotivation toward the anagram task were predicted by autonomous motivation, controlled motivation, and amotivation at the global level, respectively. Furthermore, covariance paths among global motivation types, among situational motivation types, and between positive and negative affect were estimated. The model had an acceptable fit to the data, χ^2 (1,621, N = 262) = 2,341.83, $p < .05$, $\chi^2/df = 1.45$, CFI = .90, IFI = .90, RMSEA = .05, and SRMR = .08.

As shown in Fig. 2, all estimated paths were significant with the exception of the path between situational amotivation and positive affect that was non significant ($t = -.21$, $p = .83$) and the path between negative affect and performance that was marginally significant ($t = 1.84$, $p = .07$). Indirect effects were investigated to further test the mediating role of situational motivation between global motivation and positive and negative affect, and the mediating role of positive and negative affect between situational motivation and performance (see Table 2) using bootstrapped confidence interval estimates of the indirect effect (Preacher and Hayes 2008). Results confirmed the mediating role of situational autonomous motivation between global autonomous motivation and positive affect ($\beta = .20$; CI = .08 to .33), the mediating role of situational controlled motivation between global controlled motivation and negative affect ($\beta = .06$; CI = .01 to .15), and the mediating role of situational amotivation between global amotivation and negative affect ($\beta = .04$; CI = .01 to .11). Results also supported the mediating role of positive affect between autonomous motivation and performance ($\beta = .23$; CI = .13 to .34). Furthermore, results confirmed the significance of the indirect effect between global autonomous motivation and performance ($\beta = .06$; CI = .03 to .12). Given that there was no direct path between global motivation and affect, and between situational motivation and performance, all mediations can be seen as full.

As in Study 1, two alternative models were then tested. The two models were identical to those tested in Study 1 with the exception that global autonomous motivation, global controlled motivation, and global amotivation were exogenous variables in the two models. Results revealed that the first alternative model yielded a worse fit than the hypothesized model (see Table 5). Moreover, a χ^2 difference test revealed that the second alternative model was not significantly different from the hypothesized model, $\Delta\chi^2$ (1) = 2.22, $p = .14$. However, this alternative model was rejected given that it was less theoretically plausible than the hypothesized model. In sum, the hypothesized model was judged the most plausible model on both theoretical and empirical grounds.[2]

Results from Study 2 replicated the mediating role of positive affect in the situational motivation-performance relationship as in Study 1. In agreement with previous research (e.g., Gillet et al. 2010; Lavigne and Vallerand 2010), the present findings also provided support for the

[2] As in Study 1, we have tested other alternative models. Results revealed that these alternative models exhibited a worse fit than the hypothesized model. For sake of brevity these alternative models are not reported here. They can be obtained through the first author.

Table 4 Means, standard deviations, and correlations among the study variables (Study 2)

Variables	M	SD	1	2	3	4	5	6	7	8
1. Global autonomous motivation	5.47	.74								
2. Global controlled motivation	3.84	1.01	.29***							
3. Global amotivation	2.84	1.11	−.06	.46***						
4. Situational autonomous motivation	3.85	1.40	.30***	.23***	.15*					
5. Situational controlled motivation	3.17	1.59	−.00	.28***	.16*	−.10				
6. Situational amotivation	2.82	1.43	−.11	.09	.14*	−.42***	.45***			
7. Positive affect	3.41	.84	.21**	.17**	.08	.69***	−.12	−.35***		
8. Negative affect	1.58	.61	−.16*	.14*	.16*	−.11	.32***	.27***	−.20**	
9. Performance	14.67	4.21	.05	.05	−.03	.24***	−.10	−.22***	.32***	−.21**

Items for the motivation subscales were measured on a 7-point scale, while those for positive and negative affect were measured on a 5-point scale

* $p < .05$; ** $p < .01$; *** $p < .001$

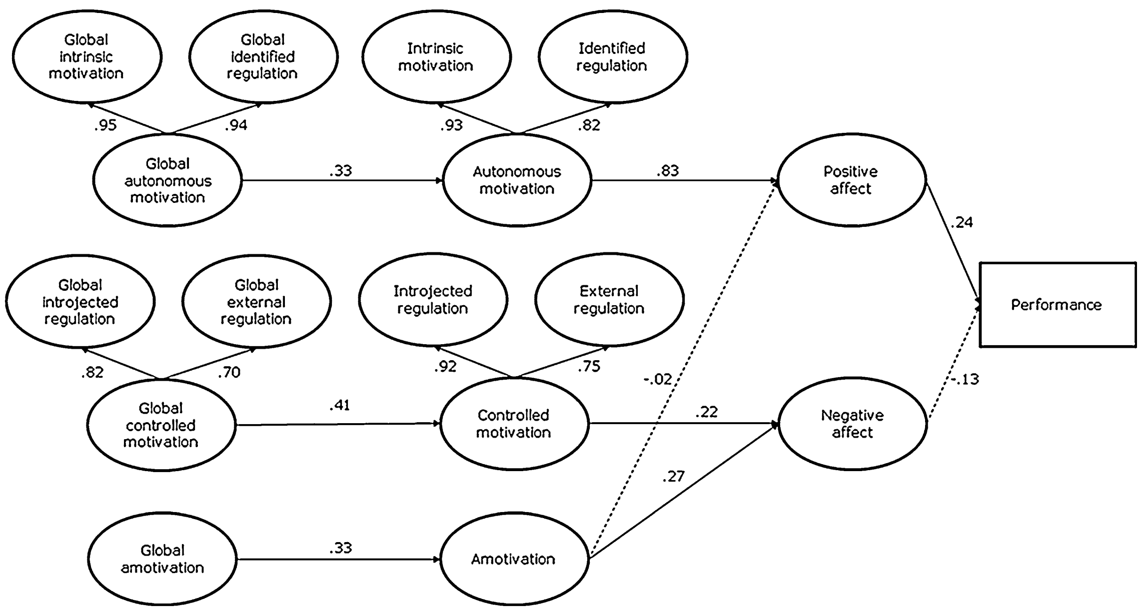

Fig. 2 Results from Study 2. *Notes* All coefficients were standardized. All relationships are significant ($p < .05$) with the exception of those identified by a *dashed line*. For sake of clarity, covariances and indicators of latent variables are not shown

Table 5 Goodness-of-fit indices of the two alternative models for Study 2

Model	χ^2	*df*	Normed χ^2	CFI	IFI	RMSEA	SRMR	AIC
Hypothesized model	2,341.83	1,621	1.45	.90	.90	.05	.08	−900.17
Alternative model 1	2,496.94	1,622	1.54	.87	.87	.05	.10	−747.06
Alternative model 2	2,339.63	1,620	1.44	.90	.90	.05	.08	−900.38

top-down effect (Vallerand 1997) between global and situational motivation where each type of global motivation influences its respective type of motivation at the situational level while trying to solve the anagrams. These findings thus suggest that an individual difference, namely global motivation, can trigger the situational motivation-affect-performance sequence.

Study 3

Results from Studies 1 and 2 provided support for a basic model where situational motivation predicts performance (i.e., distal predictor) via affect (i.e., proximal predictor). However, because these studies used a correlational design, we cannot infer causality from these results. The purpose of

Study 3 was to provide a more direct test of the proposed model by using an experimental design. Specifically, we intended to show the triggering role of motivation in the proposed model by experimentally inducing high levels of autonomous motivation (and, thus, the opposite, that is low levels of controlled motivation and amotivation) toward the anagram task and assess the effects of the manipulation on affect and performance. Because autonomous motivation and controlled motivation, and amotivation are conceptualized as opposite ends of the same continuum (see Deci and Ryan 2008, for a review), participants in the autonomous condition should also experience lower levels of controlled motivation and amotivation than those in the control condition. These experimental manipulations allowed us to determine if participants in the autonomous motivation condition reported higher levels of autonomous motivation, positive affect, and performance, and lower levels of controlled motivation, amotivation, and negative affect than participants in the control group. Furthermore, incorporating the dummy coding of experimental conditions in the structural model, we tested the hypothesized model using this dummy coding as a determinant of situational autonomous motivation that, in turn predicted positive affect that predicted objective performance. The dummy coding variable was also hypothesized to negatively predict situational controlled motivation and amotivation. In turn, both controlled motivation and amotivation were hypothesized to positively predict negative affect, and amotivation was also hypothesized to negatively predict positive affect. Finally, as in Studies 1 and 2, these two types of affect were hypothesized to positively and negatively predict performance, respectively.

Method

Participants

Participants were 77 French-speaking university students (52 women and 25 men) enrolled in different programs with a mean age of 23.26 years (SD = 3.67 years).

Procedure

Participants were recruited at the university library. They were informed that the researchers were interested in knowing more about attitudes and cognitions of people during an anagram task. Participants were informed that their participation was voluntary, anonymous, and that their responses would remain confidential. They were offered the option to withdraw from the study at any time without negative repercussions. All participants completed their questionnaire individually in a quiet environment.

The first section of the questionnaire contained the definition and one example of an anagram as well as the motivation manipulation. Participants were randomly assigned to one of two conditions: autonomous motivation and control. In line with the procedures used by Burton et al. (2006), the first part of the manipulation consisted of a list of eight statements with which participants were asked to indicate whether each proposition corresponds at least partially to one of the reasons for which they were actually ready to engage in the anagrams task. Participants circled the word "Yes" (to denote "Yes, corresponds at least partially") or the word "No" (to denote "No, does not correspond at all") next to each statement. In the autonomous motivation condition, participants were presented with four intrinsic motivation (e.g., "Because I love playing with letters and words") and four identified regulation statements (e.g., "I choose to do anagrams because it allows me to improve my cognitive skills"). Participants in the control condition were presented with neutral statements reflecting general points about anagrams such as "Because numerous linguists and poets are interested in anagrams" or "Because many riddles and secrets in the literature are based on anagrams".

The second part of the manipulation entailed asking participants in the autonomous motivation condition to explain why they believed that engaging in anagrams is fun and interesting and why they chose to do such activities. In the control condition, participants were asked to answer the two following questions: "Have you ever done anagrams? If so, in which situations have you done anagrams?" Following the manipulation, participants were given five minutes in order to solve as many anagrams as possible, and then were asked to complete the same questionnaire used in Study 1 (alphas varied from .66 to .92).

Results and discussion

Means, standard deviations, and correlations among all study variables appear in Table 6. Inspection of the skewness indices for all variables proved to be normal (skewness values ranged from −.61 to 1.20). To confirm that the two experimental conditions operated as intended, a MANOVA was conducted on the study variables (i.e., autonomous motivation, controlled motivation, amotivation, positive affect, negative affect, and performance) as dependent variables, and the experimental conditions as independent variable. The MANOVA showed a significant main effect, $F(6, 70) = 2.61$, $p < .05$. Univariate F values revealed that compared to participants in the control condition, those in the autonomous motivation condition expressed higher levels of autonomous motivation (Ms = 4.07 vs. 3.38), lower levels of amotivation (Ms = 2.29 vs. 2.95), higher levels of positive affect (Ms = 3.44 vs. 3.01), lower levels of negative affect (Ms = 1.46 vs. 1.84), and higher levels of

Table 6 Means, standard deviations, and correlations among variables of Study 3

Variables	M	SD	1	2	3	4	5	6
1. Experimental condition								
2. Situational autonomous motivation	3.73	1.39	.25*					
3. Situational controlled motivation	2.80	1.46	−.03	−.11				
4. Situational amotivation	2.62	1.24	−.27*	−.49***	.28*			
5. Positive affect	3.23	.73	.29*	.68***	.02	−.47***		
6. Negative affect	1.65	.60	−.32**	−.24*	.30**	.31**	−.23*	
7. Performance	13.69	3.73	.25*	.16	−.17	−.20	.29*	−.33**

Items for the motivation subscales were measured on a 7-point scale, while those for positive and negative affect were measured on a 5-point scale

For the dummy coding variable, the experimental conditions were coded +1 for autonomous motivation and −1 for control

* $p < .05$; ** $p < .01$; *** $p < .001$

performance (Ms = 14.62 vs. 12.74). However, contrary to initial hypotheses, there were no differences on the controlled motivation variable between the experimental conditions (Ms = 2.75 vs. 2.85). Nevertheless, these results yielded clear evidence that the manipulation was globally effective at inducing outcomes as expected with the exception of controlled motivation.

The model tested in the present study was composed of nine observed and two latent variables. In light of the relatively low number of participants, average scores of intrinsic motivation, identified, introjected, and external regulations, amotivation, and positive and negative affect were used in the model in order to maintain an acceptable ratio of cases to free parameters. Moreover, two second-order variables were created. First, autonomous motivation was defined by intrinsic motivation and identified regulation and, second, controlled motivation was defined by introjected and external regulations. The hypothesized model was tested through a path analysis in the exact same way as in Studies 1 and 2, except that a dummy variable reflecting the experimental conditions (autonomous motivation +1 vs. control −1) was included in the model as a predictor of autonomous motivation and amotivation. Given that there was no difference on controlled motivation between experimental conditions, no path was specified between the dummy variable and controlled motivation. Furthermore, covariance paths among motivation types and between positive and negative affect were estimated. The model had an acceptable fit to the data, χ^2 (18, N = 77) = 23.21, $p > .05$, $\chi^2/df = 1.29$, CFI = .98, IFI = .98, RMSEA = .06, and SRMR = .05.

As shown in Fig. 3, all estimated paths were significant with the exception of the path between amotivation and positive affect that was not significant ($t = -1.07$, $p = .29$). Indirect effects were investigated to further test the mediating role of motivation between experimental conditions (the dummy coding) and positive and negative affect and the mediating role of positive and negative affect between motivation and performance (see Table 2) using bootstrapped confidence interval estimates of the indirect effect (Preacher and Hayes 2008). Results confirmed the mediating role of autonomous motivation between experimental conditions and positive affect ($\beta = .21$; CI = .04 to .41) and the mediating role of amotivation between experimental conditions and negative affect ($\beta = -.06$; CI = −.18 to −.02). Results also supported the mediating role of positive affect between autonomous motivation and performance ($\beta = .15$; CI = .01 to .35), the mediating role of negative affect between controlled motivation and performance ($\beta = -.07$; CI = −.28 to −.00), and the mediating role of negative affect between amotivation and performance ($\beta = -.09$; CI = −.18 to −.00). Given that there was no direct path between experimental conditions and affect, and between situational motivation and performance, all mediations can be seen as full.

As in Studies 1 and 2, we next tested two alternative models. The two models were identical to those tested in Study 1 with the only exception that the dummy variable for the experimental conditions was an exogenous variable in the two models. Results revealed that the two models demonstrated a worse fit than the hypothesized model (see Table 7). The hypothesized model was thus judged the most plausible model on both theoretical and empirical grounds.[3]

The results of Study 3 provided support for the hypotheses that experimentally inducing autonomous motivation in participants led them to experience higher levels of autonomous motivation, positive affect (but lower levels of amotivation and negative affect), and ultimately

[3] As in Studies 1 and 2, we have tested other alternative models. Results revealed that these alternative models exhibited a worse fit than the hypothesized model. For sake of brevity these alternative models are not reported here. They can be obtained through the first author.

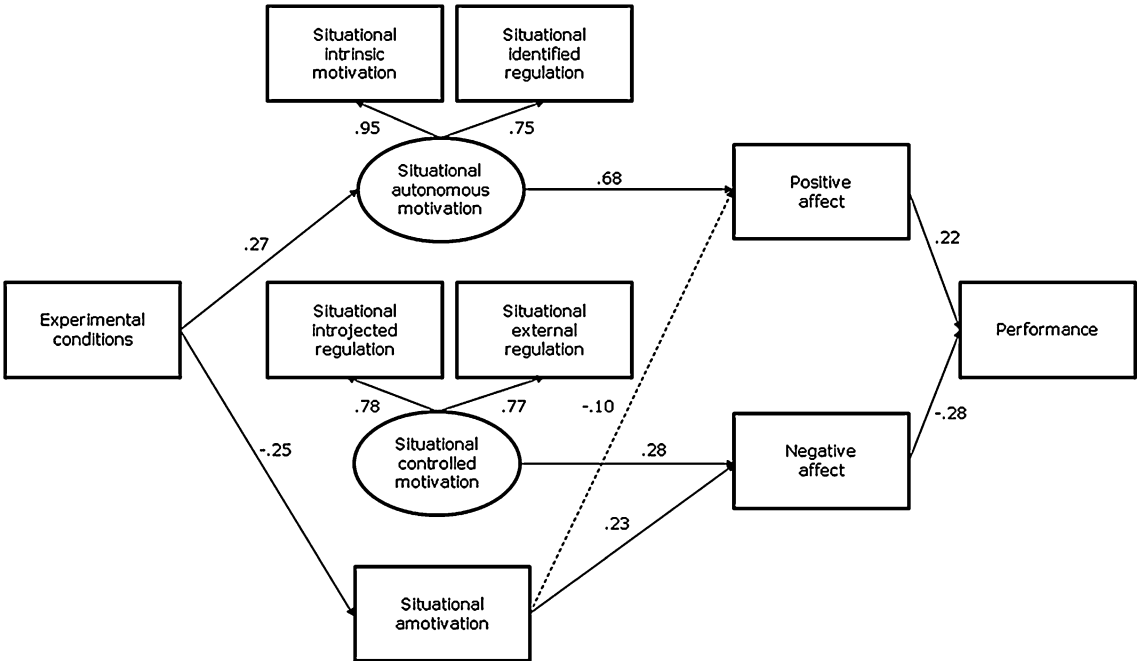

Fig. 3 Results from Study 3. *Notes* All coefficients were standardized. All relationships are significant ($p < .05$) with the exception of that identified by a *dashed line*. For sake of clarity, covariances among error terms and indicators of latent variables are not shown

Table 7 Goodness-of-fit indices of the two alternative models for Study 3

Model	χ^2	*df*	Normed χ^2	CFI	IFI	RMSEA	SRMR	AIC
Hypothesized model	23.21	18	1.29	.98	.98	.06	.05	−12.79
Alternative model 1	44.63	17	2.63	.86	.87	.15	.11	10.62
Alternative model 2	24.54	17	1.44	.96	.96	.08	.07	−9.46

performance. Furthermore, results from the structural equation model did show that the positive effect of the experimental induction on performance did take place through the autonomous motivation-positive affect-performance sequence.

Meta-analysis of Studies 1, 2, and 3

In order to shed light on the few inconsistencies obtained across Studies 1, 2, and 3, a meta-analytic structural equation modeling analysis, including all participants from Studies 1, 2, and 3, was conducted using Cheung and Chan's (2005) two-stage method. First, a multi-group confirmatory factor analysis confirmed the homogeneity of correlation matrices across Studies 1, 2, and 3. Second, a multi-group structural equation modeling analysis was conducted. The model was tested simultaneously across all samples and was composed of one observed (i.e., performance) and nine latent variables. Intrinsic motivation, identified, introjected, and external regulations, amotivation, and positive and negative affect were defined by their corresponding items. Moreover, two second-order variables were created. First, autonomous motivation was defined by intrinsic motivation and identified regulation and, second, controlled motivation was defined by introjected and external regulations. The model tested was the same as the one tested in Study 1. The model had an acceptable fit to the data, χ^2 (1,277, N = 579) = 2,113.87, $p < .05$, $\chi^2/df = 1.66$, CFI = .90, IFI = .90, RMSEA = .04.

As shown in Fig. 4, all estimated paths were significant. Indirect effects were investigated to further test the mediating role of positive and negative affect between motivation and performance. Consequently, bootstrapped confidence interval estimates of the indirect effect (see Preacher and Hayes 2008) were calculated to confirm the significance of mediations. Results confirmed the mediating role of positive affect between autonomous motivation and performance ($\beta = .26$; CI = .19 to .32), the mediating role of negative affect between controlled motivation and performance ($\beta = -.04$; CI = $-.08$ to $-.01$), and the mediating role of positive and negative affect between amotivation and

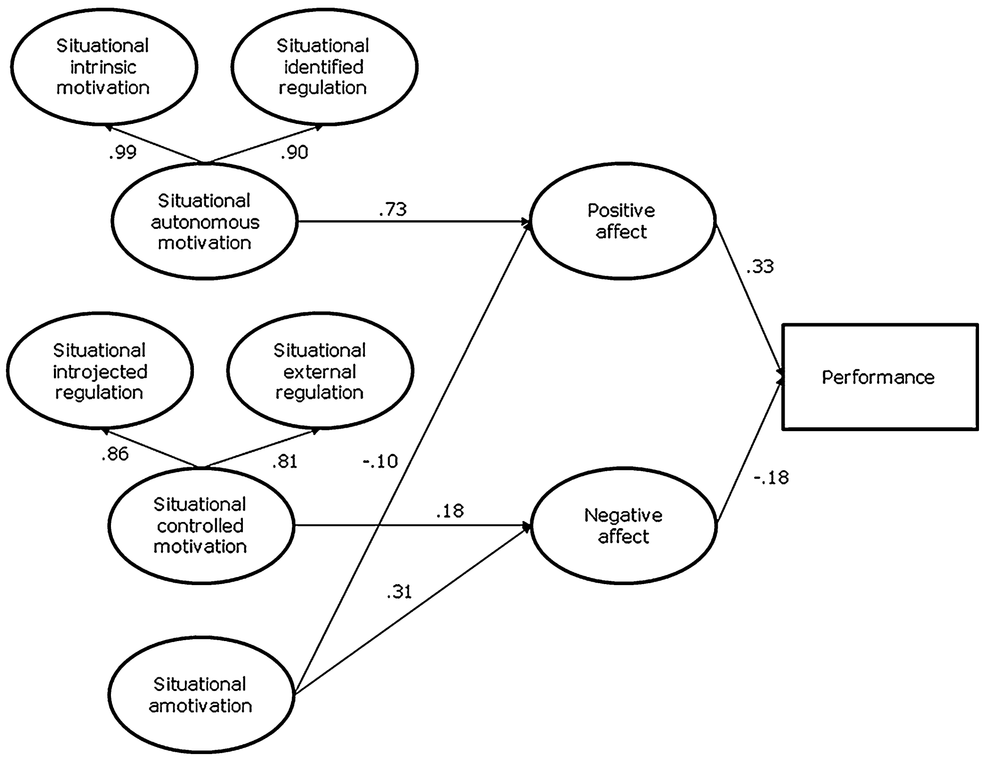

Fig. 4 Meta-analysis of Studies 1, 2, and 3. *Notes* All coefficients were standardized and were significant ($p < .05$). For sake of clarity, covariances and indicators of latent variables are not shown

performance ($\beta = -.08$; CI $= -.12$ to $-.03$). Given that there was no direct path between situational motivation and performance, all mediations can be seen as full.

Furthermore, we tested whether the model was invariant across genders. We tested gender invariance, by constraining all factor loadings, factor correlations/variances, and path coefficients to be equal across genders. When testing invariance, Cheung and Rensvold (2002) suggested comparing the CFI statistics of baseline model with constrained models. Furthermore, a decline in CFI smaller than or equal to $-.01$ indicates that the null hypothesis of invariance should not be rejected (Cheung and Rensvold 2002). The constrained model fitted the data adequately, χ^2 (877, N = 579) = 1,707.26, $p < .05$, $\chi^2/df = 1.95$, CFI = .90, IFI = .90, RMSEA = .04. In addition, comparison of the CFI values between this model and the baseline model yielded a negligible difference, ΔCFI = .006, thus suggesting that the model was invariant across genders.

General discussion

The purpose of the present research was to test an integrative model that seeks to explain the processes through which autonomous and controlled motivation and amotivation influence performance on heuristic tasks. The hypothesized model posits that positive and negative affect mediates the motivation-performance relationship. In other words, motivation and affect are considered as proximal and distal predictors of performance, respectively. Specifically, the model proposes that autonomous motivation predicts positive affect, while controlled motivation and amotivation both lead to negative affect. In addition, amotivation negatively predicts positive affect. In turn, positive and negative affect positively and negatively predicts performance, respectively. The model was confirmed in three studies using correlational (Studies 1 and 2) and experimental designs (Study 3) as well as in the meta-analysis of Studies 1, 2, and 3. In addition, the role of individual differences (Study 2) and situational factors (Study 3) as triggers of the "Motivation-Affect-Performance" sequence was confirmed. Overall, the present findings provide strong support for the hypothesized model and lead to a number of implications.

A first implication is that the present findings provide clarification on the role of three types of motivation as distal predictors of objective performance on a heuristic task. First, the present findings support the fact that autonomous motivation does increase performance. The results of structural equation modeling analyses in three studies supported the role of autonomous motivation in performance. However, more importantly, the results of Study 3 where autonomous motivation was experimentally induced, justify the inference of causality as pertains to the role of autonomous motivation in facilitating performance. These findings are in line with past findings on the positive role of autonomous motivation in performance (e.g., Amabile 1985; Guay and Vallerand 1997; Lepper et al.

1973). Second, amotivation was found to negatively predict performance. Although this finding was expected in light of the literature on the relationship between amotivation and other outcomes, the present research is the first to document the negative relationship of amotivation with objective performance. Third, results of the meta-analysis revealed that controlled motivation does indeed negatively predict performance. Thus, these results obtained in the present research suggest that controlled motivation can undermine performance.

Overall, these results provide strong support for SDT (Deci and Ryan 2000). Indeed, SDT posits that autonomous forms of motivation should facilitate performance as one is fully engaged and focused on the task as engagement reflects a personal decision to partake in the activity. Conversely, SDT posits that the other two motivational constructs should produce less than optimal engagement in the activity and thus lower levels of performance as one feels that he or she is pressured to engage in the activity (controlled motivation) or finds little value in the activity (amotivation).

A second important implication of the present findings is that affect represents one of the psychological processes mediating the motivational effects on performance. Specifically, positive and negative affect experienced while engaging in the activity was found to mediate the positive and negative effects, respectively, of motivation on performance. These findings are in line with past findings on the role of motivation in affect (see Deci and Ryan 1985, 2000; Vallerand 1997) and that of positive affect in performance (see Isen 1987). While past research had not conclusively shown that negative affect undermines performance (see Isen et al. 1987), the present findings revealed that negative affect negatively predicted objective performance, serving as a proximal predictor of performance. Although the effect was not found in Study 2, the link was significant in Studies 1 and 3 as well as in the meta-analysis. The negative effects of negative affect on performance would thus appear to be more important than previously anticipated.

Of additional importance is the fact that the three motivational constructs varied greatly in their relationship with performance. For instance, bootstrap analyses from the meta-analysis of Studies 1, 2, and 3 revealed that the indirect effect of autonomous motivation on performance ($\beta = .26$) was greater than those of controlled motivation ($\beta = -.04$) and amotivation ($\beta = -.08$). In the present research, negative affect is a mediating variable in the relationships between controlled motivation and performance, and between amotivation and performance. Yet, negative affect was less strongly related to performance than positive affect. This can explain why the indirect effect of autonomous motivation on performance (via positive affect) was greater than those of controlled motivation and amotivation. The greater negative relationship of amotivation relative to controlled motivation is due to the fact that the relationship between amotivation and performance is mediated by both positive and negative affect while that of controlled motivation is only mediated by negative affect. The relative strength of these total effects also help explain why past research had consistently found positive effects for autonomous motivation while the effects of controlled motivation were obtained less consistently. Because the effect of autonomous motivation is relatively strong, it is likely to be obtained in a variety of situations and even with low number of participants. Such may not be the case for controlled motivation as its effect on performance is much weaker.

Some limitations need to be considered when interpreting the present results. First, participants in all three studies were university students. Future research is needed to determine if the results generalize to the general population. Second, the same heuristic task (the anagrams) was used in all three studies. The results of the present studies are thus specific to the anagram task used in the present research. Future research is needed to ascertain whether the present findings generalize to other heuristic tasks and perhaps to other algorithm and motor tasks (where performance results mainly from effort and persistence; e.g., long-distance running). Future research is thus needed to assess the role of affect (in addition to effort) as a mediator of the motivation-performance in such tasks. Third, we used short PANAS scales to assess positive and negative affect. Future research should replicate the present findings with the full PANAS scales. Fourth, in the present research, motivation and affect were assessed after performance occurred. Future research with a prospective design and a measure of pre-performance motivation is needed to more firmly test the role of motivation in performance. Finally, although an experimental design was used in Study 3, only autonomous motivation and amotivation were successfully induced. Future research should attempt to experimentally induce controlled motivation in order to more clearly determine its role in performance.

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