On the Hierarchical Structure of Self-Determined Motivation: A Test of Top-Down, Bottom-Up, Reciprocal, and Horizontal Effects

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This article aimed to test some hypotheses about the hierarchical structure of self-determined motivation in two longitudinal studies. First, the authors verified the stability of global self-determined motivation and school self-determined motivation over time. Second, they tested top-down, bottom-up, reciprocal, and horizontal effects between global self-determined motivation and school self-determined motivation. In Study 1, 122 college students were evaluated on two occasions with a 5-year interval on their global and school self-determined motivation. In Study 2, 294 college students were evaluated on the same variables with a 1-year interval. Results from both studies revealed that (a) global self-determined motivation was not more stable than self-determined school motivation over time and (b) a cross-lag model including reciprocal effects between self-determined global and self-determined school motivation offered the best fit indices comparatively to a model involving only horizontal (or stability) effects. Discussion emphasizes the theoretical implications of the results.

Keywords: *self-determination; motivation; hierarchical models*

Throughout the past decades, several hierarchical models have been proposed to better understand the dynamic interplay among psychological constructs. For example, Bretherton (1985) proposed a hierarchical model of attachment representations where maternal attachment security influences the security of all attachment relationships. Similarly, hierarchical models of the self usually propose a general self-concept and self-concepts toward different activities (e.g., academic and physical) (Shavelson, Hubner, & Stanton, 1976) where global and specific elements of the self mutually influence each other. Recently, Vallerand (1997) proposed a hierarchical model of self-determined motivation (i.e., regulation of behaviors by choice and pleasure) where self-determined motivation operates and interacts at various levels, including the global level (or personality level) (Deci & Ryan, 1985), the life domains level (Guay & Vallerand, 1997), and the situational level (i.e., when a target behavior is assessed in a given situation) (Guay, Vallerand, & Blanchard, 2000).

The purpose of the present study was to test some hypotheses about the hierarchical structure of self-determined motivation (Vallerand, 1997). More precisely, two goals underlied the present two studies. First, we verified if global self-determined motivation (i.e., a trait-like concept) is more stable than school self-determined motivation over time. Second, we investigated, in a cross-lag panel model, how global and school self-determined motivation influence each other. Specifically, (a) does one's global self-determined motivation predict how one would regulate his or her behavior in the school context (school self-determined motivation), (b) does how one regulates his or her behaviors in the school context explain more global inferences about one's global self-determined motivation, and (c) is the relation between these motivational levels reciprocal or (d) simply horizontal (i.e., no effect between levels)?

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These questions address the development and the consequences of motivational representations, which are critical issues in motivational research. Although some studies have investigated these questions, important methodological limitations prevented these studies to fully address these issues. The present research was designed to overcome these methodological limitations. In the following sections, we present the operationalization of self-determined motivation, an overview of the hierarchical model of self-determined motivation (Vallerand, 1997), methodological guidelines, and a literature review.

SELF-DETERMINED MOTIVATION

Deci and Ryan (1985) proposed that there are different types of motivation, reflecting different levels of self-determination. Intrinsic motivation reflects the highest degree of self-determination. It refers to engaging in an activity for its own sake and the experience of pleasure and satisfaction derived from participation (e.g., Deci, 1975; Lepper, Greene, & Nisbett, 1973).

Extrinsic motivation refers to engaging in an activity as a means to an end rather than for its intrinsic qualities (Deci, 1975). According to Self-Determination Theory (Deci & Ryan, 1985), different types of extrinsic motivation exist, which differ in their underlying level of self-determination (see Deci & Ryan, 1985; Ryan & Connell, 1989). From low to high levels of self-determination, the different types of extrinsic motivation are external regulation, introjected regulation, and identified regulation. External regulation refers to behaviors that are not self-determined because they are regulated through external means such as rewards and constraints. Introjected regulation refers to behaviors that are in part internalized by the person. For example, individuals can act to rid themselves of their guilt, to lessen their anxiety, or to maintain a positive image of themselves. Identified regulation refers to behaviors that are performed by choice because the individual judges them as important. For example, a student may not like college but may decide to go because he or she feels that a college diploma is important to enter the job market in a field that he or she likes.

A last concept posited by Self-Determination Theory is amotivation. Amotivation pertains to the lack of intentionality and therefore refers to the relative absence of motivation (neither intrinsic nor extrinsic). Amotivated individuals experience feelings of incompetence and expectancies of uncontrollability.

Researchers have used these motivational concepts to compute an index of self-determined motivation by contrasting the relative importance of the different types of motivation (Ryan & Connell, 1989). Specifically, people who have high levels of self-determined motivation are characterized by intrinsic motivation and identified regulation, whereas those who have very low levels of self-determined motivation are regulated by external, introjected regulations and amotivation. Thus, self-determined people do things out of choice and try to act according to their own values. On the contrary, non-self-determined people behave to reduce feelings of guilt, to obtain external rewards (or to avoid punishment), or out of thoughtless habit.

THE HIERARCHICAL MODEL OF SELF-DETERMINED MOTIVATION

Although the Hierarchical Model deals with social factors, motivational mediators, motivational consequences, conflicts, and compensation effects (see Vallerand, 1997; Vallerand & Ratelle, 2002, for more details), we herein present only issues directly relevant to the present study, namely, levels of generality, stability, and top-down/bottom-up effects.

First, the Hierarchical Model proposes that self-determined motivation exists at three levels of generality. The first level of motivation pertains to the motivation experienced by an individual toward a given activity at a specific point in time (i.e., situational motivation). The second level deals with more generalized self-determined motivation toward broad life contexts such as interpersonal relationships, education, work, religion, and others. This contextual level refers to a self-referent system used by individuals to describe their motivations in a particular sphere of activities. Motivation at the last level of generality refers to a global motivational orientation at the personality level. It refers to relatively enduring individual differences with respect to people's motivations. There has been reasonable empirical support for the multiple-level structure of self-determined motivation (see Vallerand, 1997; Vallerand & Ratelle, 2002, for a review).

Second, the Hierarchical Model also posits that the stability of motivations varies according to their level of generality. Specifically, motivation is expected to become less stable as one descends the hierarchy; that is, global motivation is expected to become more stable over time than contextual motivation, and contextual motivation more so than situational motivation. The rationale underlying this hypothesis is that contextual motivation is more easily affected by the environmental context and thus less stable over time comparatively to global self-determined motivation.

Third, the Hierarchical Model proposes a top-down (TD) impact of motivation at higher levels of the hierarchy on motivation at the next lower level. It is proposed that motivation at one level should have a stronger TD impact on motivation at the next lower level than on motivation at a more distant level. For instance, global

motivation should have a greater impact on contextual motivation than on situational motivation, and contextual motivation should have a greater impact on situational motivation than would global motivation. With respect to global motivation, the model proposes that global motivation should have an important TD impact on motivation toward specific life contexts such as education, leisure, work, and interpersonal relationships. For instance, students with a high global self-determined motivational orientation should display higher levels of self-determined motivation in education than students with lower levels of global self-determined motivation. That is, students' global motivational inferences should, in part, affect how they generally regulate their behaviors in a self-relevant context. Finally, the hierarchical model proposes a bottom-up (BU) effect of lower levels in the hierarchy on the next level up. Specifically, students' repeated experiences of being motivated in a self-determined fashion in the school context should facilitate the development of general inferences about their global motivation (see Vallerand, 1997, for more details). In sum, the Hierarchical Model proposes reciprocal effects (both TD and BU effects) between adjacent motivational levels in the hierarchy.

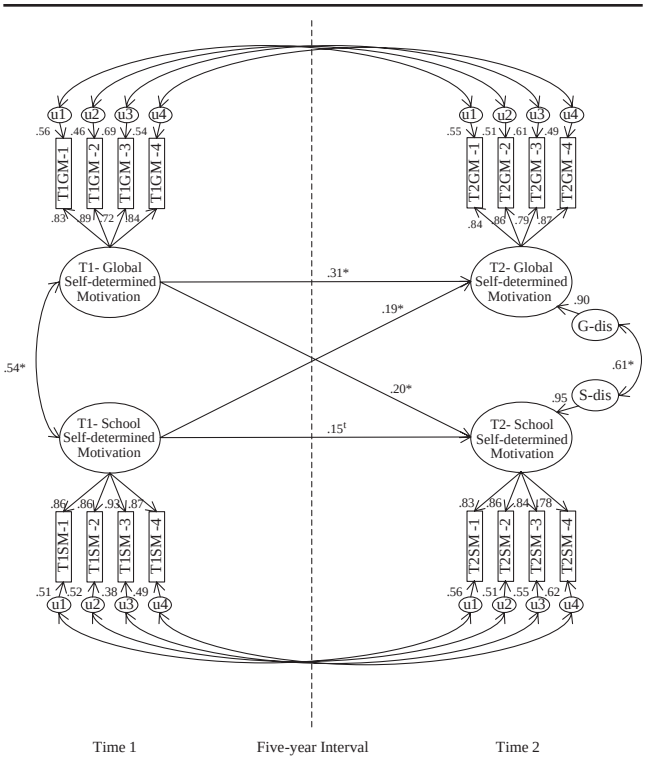

Figure 1 Study 1: Results of the Structural Model Involving Constrained Bottom-Up (BU) and Top-Down (TD) Effects (Model 2).

NOTE: T1GM-1 to T1GM-4 = Time-1 global self-determined motivation indices; T2GM-1 to T2GM-4 = Time-2 global self-determined motivation indices; T1SM-1 to T1SM-4 = Time-1 school self-determined motivation indices; T2SM-1 to T2SM-4 = Time-2 school self-determined motivation indices; U = uniquenesses; Dis = disturbances.
*$p < .05$. $\tau < .08$.

METHODOLOGICAL GUIDELINES AND LITERATURE REVIEW

Marsh and Yeung (1998) proposed methodological guidelines to test BU, TD, and reciprocal effects. These guidelines are based on a general structural equation modeling (SEM) model. First, each latent construct should be inferred on the basis of at least three indicators. Second, it is important to appropriately control for possible method/halo effects associated with measures collected on multiple occasions. Because the failure to control for these effects produces positively biased estimates of stability, tested models should always contain the correlation between the measurement error of the same indicator through time (correlated uniquenesses). Third, constructs should be measured at least twice and the data should span at least 1 year. Fourth, an a priori model that estimates stability coefficients and cross-lag effects among the constructs (see Figure 1) should be tested. In doing so, other alternative models would be nested under this more general model, thereby offering a point of comparison. Fifth, it is important to consider a sufficiently large sample to justify the generality of the findings.

We have identified five relevant studies that tested the TD and BU effects. One study originated from the self-concept research area (Marsh & Yeung, 1998), whereas the other four pertained to the motivational literature (Blanchard, Vallerand, & Provencher, 1995; Vallerand, Chantal, Guay, & Brunel, 2001; Vallerand, Guay, Blanchard, Mageau, & Cadorette, 2001; Williams, Grow, Freedman, Ryan, & Deci, 1996). However, motivational studies were characterized by faulty measurement (i.e., using only one index rather than multiple indicators), cross-sectional designs, and failure to control for method/halo effects when measures were collected on multiple occasions. Therefore, these previous motivational studies do not allow any firm conclusion to be drawn about the causal ordering between global self-determined motivation and domain-specific self-determined motivation.

One study in the self-concept research area that appropriately tested TD, BU, and horizontal effects is that of Marsh and Yeung (1998). These authors provided little evidence for the TD and BU effects between global and specific elements of self-concept. More precisely, they found that the horizontal effects (stability) model

represents more adequately the data than the BU, TD, and reciprocal-effects models. Consequently, Marsh and Yeung cast some doubts on the usefulness of hierarchical representations of self-concept. Unfortunately, this study did not pertain to motivation. Hence, one goal of the present investigation was to evaluate if such results could be generalized to self-determined motivation.

THE PRESENT STUDIES

Two goals underlied the present two studies. First, we verified the stability of global and school self-determined motivation over time. Second, we investigated (a) if global self-determined motivation could predict changes in school self-determined motivation over time (i.e., TD effect), (b) if school self-determined motivation could explain changes in global self-determined motivation (i.e., BU effect), and (c) if the relation between these constructs was reciprocal (i.e., BU and TD effects) or simply horizontal (i.e., without TD or BU effects).

The present longitudinal studies had some strengths that overcame limitations of previous motivational studies on BU and TD effects. Specifically, the present studies met all of the methodological criteria formulated by Marsh and Yeung (1998); that is, these studies were characterized by (a) multiple indicators to assess both latent constructs, (b) a SEM model that estimated stability coefficients and TD and BU effects to determine the causal flow among the constructs, (c) SEM models with correlated uniquenesses, (d) a longitudinal design with two waves of data collected 5 years (Study 1) and 1 year (Study 2) apart, and (e) a sufficiently large sample (Study 2).

STUDY 1

Method

PARTICIPANTS AND PROCEDURE

Data from this study were obtained from a longitudinal project on young adults' academic adjustment and professional integration. This project included one wave of data collection in 1994 with a follow-up data collection in 1999. In March 1994, 1,039 students completed various motivational measures as well as the Global Motivation Scale and the Academic Motivation Scale. Questionnaires were administered in the college[1] classroom by research assistants. Among the 1,039 students, 500 agreed to give us their address and telephone number to eventually participate in a follow-up study. In March 1999, these 500 students were contacted by a research assistant. Of those 500 participants, 360 participants were reached and received a questionnaire by mail. The questionnaire comprised various measures, including the Global Motivation Scale and the Academic Motivation Scale. Of those 360 participants, 202 returned the questionnaire for a response rate of 56%. Among those 202 participants, 125 were still in school, whereas 77 were working. Analyses on the stability and TD/BU effects were based on this last sample of 125 participants because individuals who were not in school at Time 2 did not complete the Academic Motivation Scale.

The final subsample (n = 122, 3 multivariate outliers were deleted) consisted of 84 women and 38 men with a mean age of 18.25 years at Time 1. They had a college grade point average (GPA) of 77% and were completing, on average, their third semester of college. Most participants had a part-time job (58.2%). At Time 2, 14% of participants indicated that their last completed year of schooling was at the college level, 70.5% at the undergraduate level (university), and 14.7% at the graduate level. Most participants were full-time students (77.0%) and 72.9% had a part-time job.

Analyses were conducted to ensure that this final subsample (n = 122) was equivalent and thus representative of other participants at Time 1 (n = 914). First, results of independent t tests indicated that means for all motivational indices at Time 1 were equivalent across samples (smallest p value = .13, average p value = .63).

Second, a MANOVA conducted on demographic variables revealed some differences between the two samples (Wilks's Λ = .96), exact $F(12, 611) = 5.92$, $p < .05$. Univariate F tests showed that although both samples had the same school achievement average (p = .06) and completed the same number of semesters (p = .17), they differed in age, $F(1, 622) = 7.70$, $p < .01$, and in the amount of hours spent at work, $F(1, 622) = 4.33$, $p < .05$. The smaller subsample was younger and worked less than the remaining sample. Furthermore, correlations showed that the smaller sample was composed of a greater percentage of women than the remaining sample ($\phi = -.08$, $p < .05$). It should be noted, however, that these effects were small in magnitude (from 0.5% to 1% of explained variance) (Cohen, 1988).

Third, the measurement model at Time 1 was tested for factorial invariance across the two samples. Results revealed that the smaller subsample was equivalent to the initial larger sample with respect to its factorial structure. More specifically, multiple-group analyses showed that the measurement model of both global and school self-determined motivation at Time 1 was invariant across the two groups in terms of their factor loadings, factor variances, and covariances. Error variances somewhat differed across groups but Bentler (1992) suggested that error invariance is the least important hypothesis to test. Given the small magnitude of the demographic differences and the highly restrictive test

of invariance, we feel relatively confident that results obtained with the smaller sample can be generalized to the initial larger sample.

MEASURES

The Global Motivation Scale. The French version of the Global Motivation Scale (GMS) (Guay, Blais, Vallerand, & Pelletier, 1999) assesses three types of intrinsic motivation (toward knowledge, stimulation, and accomplishment) (see Vallerand, 1997; Vallerand et al., 1992, 1993), three types of extrinsic motivation (i.e., identified, introjected, and external regulation), and amotivation. There are four items per subscale and thus a total of 28 items. Each item represents a possible reason for doing things in general. Items are scored on a 7-point Likert-type scale (1 = *does not correspond at all* to 7 = *correspond completely*). Sample items (in English) of the GMS are presented in Appendix A.

Because no previous published study had yet assessed GMS psychometric properties, we tested the factor structure and the reliability of the scale (Guay et al., 1999). A confirmatory factor analysis was thus performed at Time 1 on the total sample (N= 1,039). Three multivariate outliers were deleted to satisfy univariate and multivariate normality postulates and all variables were centered to prevent multicollinearity problems (Kline, 1998). Results confirmed the seven-factor structure of the GMS. All factor loadings were significant and greater than .56. Furthermore, fit indices confirmed that the model had an excellent fit to the data, $\chi^2(329, N= 1{,}036) = 1088.379$, $p < .001$; Comparative Fit Index (CFI) = .952; Non-Normed Fit Index (NNFI) = .944; root mean square error of approximation (RMSEA) = .047. Factor loadings and uniquenesses are presented in Appendix B, whereas Appendix C presents the factor correlations among the subscales of the GMS. In addition, internal consistency values of the seven subscales were found to be satisfactory (Cronbach's alpha ranging from .75 to .91). The total sample at Time 1 (N= 1,036) was randomly divided in two equivalent subsamples (n = 538 and n = 498) to make a stronger case for the robustness of the GMS psychometric properties. Results of confirmatory factor analysis (CFA) and Cronbach's alphas were similar for each subsample.[2]

The Academic Motivation Scale. The French version of the Academic Motivation Scale (AMS) (Vallerand, Blais, Brière, & Pelletier, 1989) assesses students' contextual motivation toward school activities. The AMS is composed of seven subscales. However, in the present study, the abridged version containing four subscales was used. There are four items per subscale and thus a total of 16 items. Each item represents a possible reason for going to school. One subscale assesses intrinsic motivation (e.g., "Because I experience pleasure and satisfaction when learning new things"). Two subscales assess types of extrinsic motivation: identified regulation (e.g., "Because this will help me make a better choice regarding my career orientation") and external regulation (e.g., "In order to have a better salary later on"). The fourth subscale assesses amotivation (e.g., "I don't know; I can't understand what I am doing in school"). Items are scored on a 7-point Likert-type scale (1 = *not at all in agreement* to 7 = *completely in agreement*). The AMS has evidenced high levels of construct and concurrent validity as well as internal consistency (see Vallerand et al., 1989, 1992, 1993). In the present study, Cronbach's alphas for the four subscales ranged from .76 to .91.

STATISTICAL ANALYSES

Goodness of fit. All SEM analyses were performed on covariance matrices using maximum likelihood estimation procedure (EQS Version 5.1) (Bentler, 1993). To ascertain the model fit, we used the CFI, the NNFI (also known as the Tucker-Lewis Index), the RMSEA, as well as the chi-square test statistic. The NNFI and CFI vary along a 0:1 continuum (although the NNFI could be greater than 1, this is rarely the case in practice), where values greater than .90 are typically taken to reflect an acceptable fit (Schumacker & Lomax, 1996). Browne and Cudeck (1993; also see Jöreskog & Sörbom, 1993) suggest that RMSEAs less than .05 are indicative of a "close fit" and that values up to .08 represent reasonable errors of approximation. Furthermore, model comparison was facilitated by positing a nested ordering of models in which the parameter estimates for a more restrictive model are a proper subset of those in a more general model (for further discussion, see Bentler, 1990).

Self-determined motivational indices. To test the general SEM model presented in Figure 1, we computed four indices of self-determination for each latent construct (i.e., global motivation and school motivation). These indices offer the possibility to integrate scores on each motivation subscale under a single score, thus reducing the number of variables in the tested models. These indices are depicted in Figure 1 under labels T1GM-1 to T1GM-4 and T2GM-1 to T2GM-4 for the global self-determined motivation latent construct and T1SM-1 to T1SM-4 and T2SM-1 to T2SM-4 for the school self-determined motivation latent construct. Following the procedure commonly used in the self-determination theory literature (e.g., Blais, Sabourin, Boucher, & Vallerand, 1990; Fortier, Vallerand, & Guay, 1995; Grolnick & Ryan, 1987; Vallerand, Fortier, & Guay, 1997), subscale items were used to compute the self-determination indices by subtracting non-self-determined motivations from self-determined motivations. These motivational indices thus represent people's relative levels of self-determination, with higher scores indicating higher levels of

intrinsic and identified regulation relative to external regulation, introjected regulation, and amotivation. For school motivation, we used the following formula to compute the self-determination indices: ([2*intrinsic motivation] + [1*identified regulation]) – ([1*external regulation] + [2* amotivation]). We computed the first self-determination school motivation index (i.e., see label SM-1 in Figure 1) by taking the first item of the four AMS subscales. To compute the three remaining school self-determination indices (SM-2, SM-3, and SM-4), we used, respectively, the second, third, and fourth item of each subscale. The same procedure was used for the GMS but using the following formula: [(2*(IM knowledge + IM accomplishment + IM stimulation)/3 + 1*identified regulation)–((1*(external regulation + introjected regulation)/2 + 2*(amotivation))]. There were four items per subscale and thus four self-determined motivational indices were computed for the GMS. For the SEM analyses, all indicators were centered to forego multicollinearity problems (Kline, 1998).

Correlated uniquenesses and correlated disturbances. As suggested by Marsh and Hau (1996), our SEM models contained correlated uniquenesses between the same motivational constructs measured on two occasions (see in Figure 1 the two headed arrows connecting Time 1 U1 and Time 2 U1). In longitudinal studies, when the same items are administered to the same participants on multiple occasions, it is likely that uniquenesses associated with the matching measured variables will be correlated. If there are substantial correlated uniquenesses that are not included in the model, then the estimated correlations between the corresponding latent constructs will be positively biased. In the present study, for example, this would result in a positively biased estimate of the test-retest stability coefficients relating responses to the same latent variables on two occasions and, perhaps, would also negatively bias estimates of the impact of other constructs on those latent variables. In the present investigation, models that included these correlated uniquenesses fit the data significantly better than models without correlated uniquenesses. Based on our preliminary analyses, and to facilitate interpretation of the results, we focus our discussion on a priori models with correlated uniquenesses.

Furthermore, the covariance between disturbance terms at Time 2 was estimated (Jöreskog & Sörbom, 1976; Marsh & Yeung, 1998). As with the uniquenesses, if there is a substantial correlation between disturbance terms that is not included in the model, then it is likely that the estimated reciprocal effects between the corresponding latent constructs will be biased. This covariance was thus modeled to have a more stringent test of the tested models.

TABLE 1: Factor Correlations Between Global and School Self-Determined Motivation at Time 1 and 2 for Studies 1 and 2

	1	*2*	*3*	*4*
Study 1				
1. Global self-determined motivation (T1)	—			
2. Global self-determined motivation (T2)	.38**	—		
3. School self-determined motivation (T1)	.54**	.41**	—	
4. School self-determined motivation (T2)	.22*	.65**	.29**	—
Study 2				
1. Global self-determined motivation (T1)	—			
2. Global self-determined motivation (T2)	.68**	—		
3. School self-determined motivation (T1)	.62**	.49**	—	
4. School self-determined motivation (T2)	.47**	.63**	.68**	—

NOTE: T1 = Time 1, T2 = Time 2.
*$p < .05$. **$p < .01$.

Results

We first conducted CFA analyses to test the stability of global and self-determined school motivation. Second, we tested TD, BU, reciprocal, and horizontal effects between global self-determined motivation and self-determined school motivation.

TEST OF STABILITY

Stability of the motivational concept was assessed via a CFA model instead of a cross-lag model because the stability paths estimated in cross-lag analyses are influenced by the effects of cross-lagged paths. The fit of the measurement model was excellent, $\chi^2(90, n = 122) = 122.499$, $p < .01$; CFI = .98; NNFI = .97; RMSEA = .06. All factor loadings were significant and greater than .72. Correlations between latent constructs are presented in Table 1. Results suggested that global self-determined motivation (i.e., $r = .38$) may be more stable than self-determined school motivation (i.e., $r = .29$). However, the difference between the two coefficients did not reach statistical significance. Indeed, when these two correlations were constrained to equality, the fit of the model was not significantly reduced according to the chi-square test.

TEST OF BU, TD, RECIPROCAL, AND HORIZONTAL EFFECTS

In line with Marsh and Yeung's (1998) methodology, change was assessed using true residualized scores, where true scores at Time 2 are regressed on the true scores on the same variable at Time 1 (Sörbom, 1976).

TABLE 2: Goodness-of-Fit of the Three Models for Studies 1 and 2

Model	χ^2	df	*CFI*	*NNFI*	*RMSEA*
Study 1					
Model 1	122.50	90	.98	.97	.06
Model 2	123.66	91	.98	.97	.06
Model 3	131.73	92	.97	.96	.06
Study 2					
Model 1	173.62	90	.98	.97	.06
Model 2	173.71	91	.98	.97	.06
Model 3	180.52	92	.98	.97	.06

NOTE: CFI = Comparative Fit Index, NNFI = Non-Normed Fit Index, RMSEA = root mean square error of approximation.

These residualized scores represent individual change relative to others in the group from Time 1 to Time 2. Three models were compared to investigate TD, BU, reciprocal, and horizontal effects between global and school self-determined motivation. To facilitate model comparison, the more inclusive model (i.e., the cross-lag model) is presented first followed by nested models. Table 2 presents a summary of the goodness-of-fit for the three models.

In Model 1, a cross-lag model was tested to investigate the TD, BU, reciprocal, and horizontal effects between global and school self-determined motivation. All paths from all latent variables at Time 1 to all latent variables at Time 2 were freely estimated. Results indicated that the cross-lag model had a satisfactory fit to the data (see Table 2). Horizontal effects were small but significant (global motivation, $\beta = .22$; contextual motivation toward education, $\beta = .24$). There was a significant BU effect, where school self-determined motivation predicted global self-determined motivation 5 years later ($\beta = .29$). The hypothesized TD effect did not reach statistical significance but the relationship between global self-determined motivation at Time 1 and school self-determined motivation at Time 2 was in the expected direction ($\beta = .10$).

Given the small sample size, it would be hazardous to discard the possibility of a TD effect on the ground of this statistical test. To investigate this issue further, we tested a second model where TD and BU effects were constrained to equality. Results of Model 2 are presented in Figure 1. The fit of this constrained model was not significantly lower than the unconstrained cross-lag model, $\Delta\chi^2(1) = 1.157$, $p > .05$. Furthermore, in the constrained model, both TD and BU effects were significant (TD, $\beta = .20$; BU, $\beta = .19$), indicating that both TD and BU effects seemed to be present and of equal importance. The stability of school self-determined motivation was somewhat reduced when the cross-lag paths were constrained to equality and thus was marginally significant ($\beta = .15$, $p < .08$). However, the stability effect of the global self-determined motivation was significant ($\beta = .31$, $p < .05$). This second model explained 19% of variance in global self-determined motivation and 9% of variance in self-determined school motivation at Time 2.

To verify if Model 2 was the best fitting model, a horizontal model (i.e., stability paths only; Model 3) was tested and compared to Model 2. Although this third model had an excellent fit to the data (see Table 2), its fit was significantly worse than the one of Model 2, $\Delta\chi^2(1) = 8.08$, $p < .01$. The horizontal model also explained less variance than Model 2. Decreases of 8% in the explained variance of global self-determined motivation and of 6% in the explained variance of school self-determined motivation at Time 2 were observed. Taken as a whole, these results provided good support for the reciprocal effects model involving BU and TD effects.[3]

Discussion

SEM analyses reveal that the BU and TD effect are useful to predict changes in global and school self-determined motivation, respectively, over a 5-year period but that global self-determined motivation (i.e., $r = .38$) is not more stable than self-determined school motivation (i.e., $r = .29$). However, results from these statistical tests do not necessarily indicate a true absence of difference in the stability of global and school self-determined motivation. In fact, the small sample size involved in Study 1 may explain the absence of significant differences.

In addition, it is important to underscore that the sample is restricted to some students who had made slow progress toward their degrees. Indeed, because most students were at least at their second semester of college in 1994 they should have completed their undergraduate studies in the 5-year interval and should have been working or in a graduate program, which was not the case. In fact, 70.5% of the participants were still at the undergraduate level at Time 2. Consequently, they may have experienced some disruptions that would have delayed their completion of the degree, which might have affected their motivation. To alleviate these problems, we sought to replicate the findings of Study 1 with a second larger sample of students who did not experience any disruption in the course of their degrees.

STUDY 2

Participants and Procedure

Data from the second study were obtained from a longitudinal project on young adults' academic adjustment. In fall 2000, 2,300 participants were contacted in their college classroom and were asked to complete a questionnaire at home. The questionnaire was not administered in class because the questionnaire took approxi-

mately 60 min to complete. A research assistant explained that the purpose of the study was to gain knowledge about college students' experiences. The questionnaire was distributed along with a pre-stamped envelope addressed to the university. In addition, participants completed a form in class in which they indicated their names and telephone numbers so that a research assistant could call and remind them that they had to send back their questionnaire. A total of 838 participants sent back their questionnaire yielding a response rate of 36%. This response rate was similar to those of previous studies (e.g., Guay et al., 2000). Among these 838 students, 380 participated at Time-2 in the fall 2001 where the same measures were administrated. Among these 380 participants, 358 were still in school at Time 2. Analyses were performed on the 294 participants who did not have missing data on motivational indices and who did not contribute excessively to multivariate non-normality (5 outliers were deleted).

This final subsample consisted of 222 women and 67 men (5 did not specify their gender) with a mean age of 17.6 years at Time 1. Most participants (87.1%) had a part-time job, worked on average 11.8 hours per week, and had a college GPA of 78% at Time 2.

Analyses were conducted to ensure that the final subsample ($n = 294$) was equivalent and thus representative of other participants who did not participate in the Time 2 data collection or who were no longer in school at Time 2 ($n = 466$). First, independent t tests were performed on global and school motivational indices at Time 1 to ensure that they were comparable across samples. Results showed that the means were equivalent across samples (smallest p value = .13).

Second, a MANOVA conducted on demographic variables revealed no difference between the two samples (Wilks's $\Lambda = .99$), exact $F(6, 450) = .73$, $p = .62$. Both samples had the same mean age, worked as many hours per week, and came from families where parents had similar education and annual income. Furthermore, as in Study 1, correlations showed that the smaller sample was composed of a greater percentage of women than the remaining sample ($\phi = -.09$, $p < .01$). However, no difference was found on the percentage of participants who had a part-time job.

Third, the measurement model at Time 1 was tested for factorial invariance across the two samples. Results indicated some differences for the academic motivation scale. Specifically, multiple-group analyses showed differences on one item's factor loading as well as on another item's error variance. These differences, however, were not reflected in the factor variances and covariances, which were equivalent across samples.

In sum, although the factorial structure was not exactly comparable across samples, very few differences were detected across samples on the demographic variables and on motivational indices. We thus feel relatively confident that the smaller sample is representative of the initial larger sample.

MEASURES

Measures were exactly the same as those presented in Study 1 with the exception that in Study 2 we used the full version of the Academic Motivation Scale. We thus computed our motivational indices using the same formula that was used to compute the global motivational indices in Study 1: [(2*(IM knowledge + IM accomplishment + IM stimulation)/3 + 1*identified regulation) – ((1*(external regulation + introjected regulation)/2 + 2*(amotivation))]. Subscales of the global and academic motivation scales showed satisfactory reliability coefficients. For the global motivation scale, reliabilities ranged from .77 to .88 (average $\alpha = .82$), whereas the reliabilities for the academic motivation scale ranged from .66 to .90 (average $\alpha = .84$).

Results

SEM analyses were conducted according to the procedure described in Study 1. We first conducted CFA analyses to test the stability of global and self-determined school motivation. Second, we tested TD, BU, reciprocal, and horizontal effects between global self-determined motivation and self-determined school motivation.

TEST OF STABILITY

As in Study 1, a CFA analysis was conducted to assess the stability of the motivational concepts. The fit of the measurement model was excellent, $\chi^2(90, n = 294) = 173.620$, $p < .001$; CFI = .98; NNFI = .97; RMSEA = .06. All factor loadings were significant and greater than .79. Correlations between latent constructs are presented in Table 1. Results suggested that global self-determined motivation (i.e., $r = .68$) was as stable as self-determined school motivation (i.e., $r = .68$).

TEST OF BU, TD, RECIPROCAL, AND HORIZONTAL EFFECTS

As in Study 1, three models were compared to investigate TD, BU, reciprocal, and horizontal effects between global and school self-determined motivation. Table 2 presents a summary of the goodness of fit for the three models.

In Model 1, a cross-lag model was tested to investigate the TD, BU, reciprocal, and horizontal effects between global and school self-determined motivation. Results indicated that the cross-lag model had a satisfactory fit to the data (see Table 2). Horizontal effects were large and significant (global motivation, $\beta = .61$; contextual motivation toward education, $\beta = .62$). Although the cross-lag paths were in the expected direction, neither the BU nor

the TD effects reached statistical significance (BU, β = .11; TD, β = .09).

However, in Model 2, when both cross-lag paths were constrained to equality the estimated path errors of the BU and the TD effects were reduced and both paths became significant (TD and BU, β = .10). It should be noted that cross-lag path coefficients obtained were somewhat low (.10). Although these effects may appear to be small, it is important to keep in mind that these effects were significant despite the fact that we made a stringent test of these relations by controlling for the effects of Time 1 global and school self-determined motivation. It might also be worthwhile to note that the major determinants of subsequent measures of motivation are the earlier measures of the same variables. Because these stability coefficients are substantial, relatively small effects of other variables represent substantial effects.

Constraining both paths to equality might have alleviated multicolinearity problems in the estimation process and thereby reduced the error of estimation of the cross-lag paths. Furthermore, the fit of this constrained model was not significantly lower than the unconstrained cross-lag model, $\Delta\chi^2(1) = 0.085$, $p > .05$, indicating that both TD and BU effects were equivalent. This second model explained 47% of variance in global self-determined motivation and 46% of variance in self-determined school motivation at Time 2. Results of Model 2 are presented in Figure 2.

Finally, results showed that BU and TD paths significantly accounted for change in global and academic motivation over a 1-year interval when they were considered simultaneously. Indeed, results showed that when Model 2 was compared to the horizontal model (i.e., Model 3), Model 2 remained the best-fitting model. Although the horizontal model had an excellent fit to the data (see Table 2), its fit was significantly worse than Model 2, $\Delta\chi^2(1) = 6.81$, $p < .01$. The horizontal model also explained less variance than Model 2. Decreases of 3% in the explained variance of global self-determined motivation and of 3% in the explained variance of school self-determined motivation at Time 2 were observed.

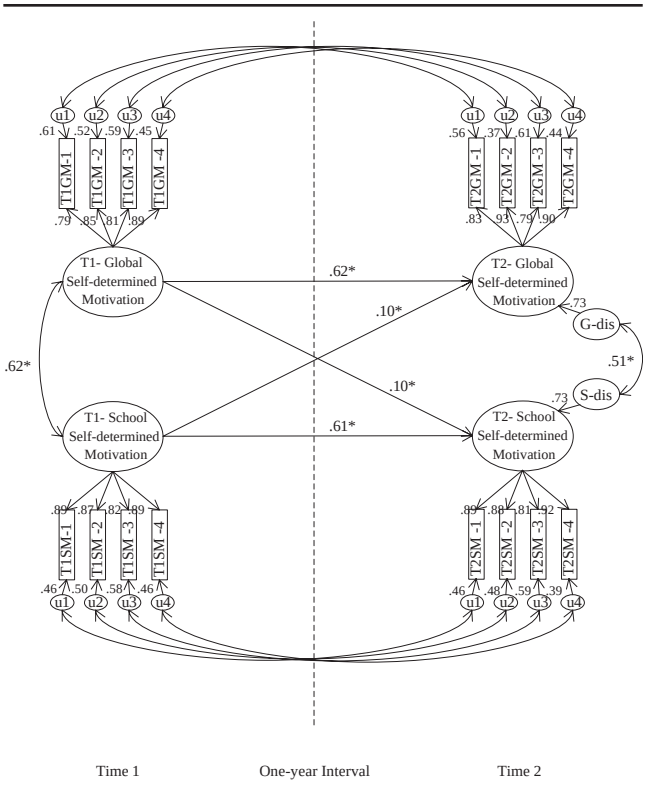

Figure 2 Study 2: Results of the Structural Model Involving Constrained Bottom-Up (BU) and Top-Down (TD) Effects (Model 2).

*$p < .05$.

Discussion

Taken as a whole, results of Study 2 replicated those obtained in Study 1. Again, the stability of global and school self-determined motivation was equivalent and reasonable support was found for the TD and BU effects. Specifically, although taken separately the BU and TD paths did not reach statistical significance, results revealed that when constrained to equality, the cross-lag paths were predictors of change in school and global self-determined motivation at Time 2 over a 1-year interval. As we pointed out, constraining both paths to equality might have alleviated multicolinearity problems in the estimation process and thereby reduced the error of estimation of the cross-lag paths. Furthermore, when considered simultaneously, BU and TD paths significantly improved model fit, suggesting their importance in predicting change in global and school self-determined motivation.

GENERAL DISCUSSION

The main purpose of the present research was to test stability effects and BU, TD, reciprocal, and horizontal effects between global and school self-determined motivation. The present findings have important implications for at least two key issues. First, they suggest how self-determined motivational representations at different levels of generality may influence each other. Second, they inform us about the stability of self-determined motivation over time. These issues are discussed below.

How Motivational Representations Interact

Recently, Marsh and Yeung (1998) concluded from their self-concept study that their results provided some support for the horizontal effects (stability) model but little support for the BU, TD, and reciprocal-effects model. Although the Marsh and Yeung findings have not

yet been replicated in various samples, they nevertheless question the usefulness of hierarchical representations of self-concept. Results of the present study revealed that such a conclusion may not necessarily hold for motivational self-representations. Specifically, results indicated that the best-fitting model in both studies was the one where the TD and BU paths were present, thereby providing reasonable support for the reciprocal effects model. These divergent findings were surprising given the fact that some studies showed that self-concept is positively related to self-determined motivation (i.e., intrinsic motivation) (Guay, Boggiano, & Vallerand, 2001). Future research is needed to investigate why these results should differ.

Although the present findings suggested that a TD effect may take place over time, it might best operate in specific situations and in very short periods of time, such as when one encounters a new situation. It is in these types of situations that social and personality psychologists have observed TD effects (see Snyder & Cantor, 1998). On the other hand, the BU effect might be more likely to occur over time within the context of a developmental framework. In fact, it is in these situations that some developmental research on self-concept has documented the BU effect (see Harter, 1999). In addition, it is possible that the TD and BU effects occur at different points over the lifespan. Thus, it is possible that the BU effect takes place mainly during the formative years (until young adulthood), thereby allowing global self-determined motivation to develop and become more stable. Once crystallized, global self-determined motivation would then affect more specific motivational components (the TD effect). Thus, the TD effect might be more relevant to explain how more global aspects of motivation can influence specific motivational self-representations in a given context, and the BU effect might be more useful to explain the psychological process through which repeated experiences over cumulative contexts lead to changes in global motivation. Future research on these issues appears particularly important for the field of motivation.

On the Stability of Motivation

Hierarchical models (Shavelson et al., 1976; Vallerand, 1997) usually propose that the stability of components varies according to their levels of generality. As one descends the hierarchy, the components become specific and less stable. However, Marsh and Yeung (1998) provided challenging empirical evidence concerning self-concept stability. Specifically, they showed in two studies that global self-concept is less stable than specific self-concept scales. To explain their results, Marsh and Yeung (1998) used an information-processing explanation that posits that participants based their global self-concept answers on their immediate experience or mood instead of pursuing the cognitively demanding task of making global self-inferences.

In contrast to Marsh and Yeung's study, results of the present two studies indicate that global motivation is not less stable than school motivation. However, stability coefficients for global self-determined motivation and school motivation were found to be equivalent in both studies, thereby providing no support for Vallerand's (1997) hypothesis on stability. Nevertheless, it is possible that by using a larger time-lag and more participants one could observe different results. For example, it is possible that having more participants in Study 1 would have led to significant differences between the stability effects of global and school self-determined motivation over this 5-year time frame. In addition, it is possible that global motivation in late adolescence (i.e., 19 years old) is not completely crystallized. We can expect that global motivation might become more stable as individuals grow in age. Future research is thus needed to understand the stability of global motivation across the lifespan.

Limitations and Conclusion

Although the present results provided support for the reciprocal effects model (TD and BU effects), at least five limitations should be taken into consideration when interpreting these findings. First, the present study pertained solely to the education context. Although Blais, Vallerand, Brière, and Gagnon (1990) showed that this life context is very important for college students, it nevertheless remains that other contexts such as leisure and interpersonal relations are also important and could be involved in the BU/TD effects.

Second, participants who took part in the present studies were all college students. It would be important to ascertain the validity of the TD and BU effects with other populations, such as working and elderly populations.

Third, it is possible that TD and BU effects showed in Study 1 are different for people still in the school context at Time 2 and those who were not. That is, it might be reasonable to expect that school motivation has a stronger impact on Time 2 global motivation for a sample of individuals who are still in school than for a group that is no longer in school. Unfortunately, our sample size in Study 1 limited our investigation of such a hypothesis and it was not possible to test this hypothesis in Study 2 because very few participants were no longer in school ($n = 22$).

Fourth, although the data were longitudinal and we used sophisticated analyses, one should be careful about inferring causality. However, as mentioned by Campbell and Kenny (1999), the cross-lag panel correlation analy-

sis still plays an interesting role in the analysis of longitudinal data.

In sum, the study of self-determined motivation has progressed considerably over the past three decades. Specifically, many studies have investigated self-determined processes at three levels of generality, including the personality and the life domains levels. However, few of these studies have verified how these various motivational levels interact together. Although additional research needs to be conducted on this issue, the present research offers reasonable support for a reciprocal relation between global and self-determined school motivation.

APPENDIX A
Sample Items Taken From the Global Motivation Scale (GMS)

In general, I do things . . .

1. . . . in order to feel pleasant emotions.
2. . . . because I do not want to disappoint certain people.
3. . . . in order to help myself become the person I aim to be.
4. . . . because I like making interesting discoveries.
5. . . . because I would beat myself up for not doing them.
6. . . . because of the pleasure I feel as I become more and more skilled.
7. . . . although I do not see the benefit in what I am doing.

4. Intrinsic motivation to know
6. Intrinsic motivation to accomplishment
1. Intrinsic motivation to stimulation
3. Identified regulation
5. Introjected regulation
2. External regulation
7. Amotivation

APPENDIX B
Study 1: Confirmatory Factor Analysis of the GMS: Factors Loadings and Uniquenesses (n = 1,036)

	Factors Loadings	*Uniquenesses*
Subscales		
1. Intrinsic toward knowledge		
Im-k-1	.81	.59
Im-k-2	.83	.56
Im-k-3	.85	.53
Im-k-4	.88	.48
2. Intrinsic toward accomplishment		
Im-a-1	.73	.68
Im-a-2	.78	.62
Im-a-3	.75	.67
Im-a-4	.76	.65
3. Intrinsic toward stimulation		
Im-s-1	.81	.59
Im-s-2	.79	.61
Im-s-3	.88	.47
Im-s-4	.85	.53
4. Identified regulation		
Iden-1	.62	.79
Iden-2	.75	.66
Iden-3	.65	.76
Iden-4	.72	.69
5. Introjected regulation		
Intro-1	.70	.71
Intro-2	.88	.48
Intro-3	.56	.83
Intro-4	.89	.45
6. External regulation		
Ext-1	.66	.76
Ext-2	.85	.53
Ext-3	.78	.62
Ext-4	.67	.74
7. Amotivation		
Amo-1	.57	.82
Amo-2	.65	.76
Amo-3	.66	.76
Amo-4	.74	.67

APPENDIX C
Study 1: Factor Correlations Among the Subscales of the Global Motivation Scale (GMS) (n = 1,036)

	1	*2*	*3*	*4*	*5*	*6*	*7*
1. Intrinsic toward knowledge	—	.72*	.66*	.74*	.02	–.05	–.27*
2. Intrinsic toward accomplishment		—	.79*	.87*	.10*	.18*	–.23*
3. Intrinsic toward stimulation			—	.69*	–.02	.01	–.21*
4. Identified regulation				—	.17*	.18*	–.24*
5. Introjected regulation					—	.57*	.37*
6. External regulation						—	.38*
7. Amotivation							—

*p < .05.

NOTES

1. College in the Quebec educational system refers to a post–high school but pre-university institution, which offers 2-year (for the program leading to university) or 3-year (for the technical terminal program) programs.

2. One may argue that because participants were all in school, they answered questions about their global self-determined motivation having in mind only the school domain. As a result, our measures would not discriminate between global and school self-determined motivation. To verify the validity of the Global Motivation Scale, we performed correlation analyses on all participants (N = 1,039) using school self-determined motivation and two additional indices of self-determination available at Time 1 but not at Time 2, namely, self-determined

motivation toward leisure and interpersonal relationships. Results indicated that global self-determined motivation was correlated with self-determined motivation toward school (r = .50) but also toward interpersonal relationships (r = .38) and leisure (r = .57). In addition, we verified if these correlations varied as a function of the relative importance of these domains for participants. Results indicated that the pattern of relations presented above was similar for all participants no matter which domain they rated as the most important. In light of these analyses, we believe that participants used global self-inferences to evaluate their global self-determined motivation similar to the self-inferences used to complete personality inventory such as the NEO Five Factor Inventory (Costa & McCrae, 1992).

3. One may argue that the fit of our models is uniquely dependent on the correlated uniquenesses. We thus tested a model where all paths between the latent variables were set to zero. This model failed to adequately fit the data, $\chi^2(96) = 229.076$; Comparative Fit Index (CFI) = .905; Non-Normed Fit Index (NNFI) = .88; root mean square error of approximation (RMSEA) = .107, indicating that the relations between the latent variables are important.

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