

**Not Just What You Do But *Why* You Do It:
The Influence of Self-Determination and Passion on the Relationship between Physical
Activity and Well-Being in Active Women with Multiple Roles**

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ABSTRACT

Although there is a well-known relationship between physical activity and well-being, particularly among women, this association is complex. There is a call for more research regarding key moderating processes that will help to explain the circumstances under which physical activity can lead to optimal well-being. The overall purpose of this dissertation was to examine the influence of situational motivation (Self-Determination Theory; Deci & Ryan, 1985) and passion (Dualistic Model of Passion; Vallerand et al., 2003) as predictors of the relationship between physical activity and indicators of well-being, namely affect and vitality, in active women with multiple life roles. The influence of perceived intensity (RPE) was also investigated. Study 1 followed a within-subject experimental design (N = 40). *Article 1* revealed a significant interaction effect between RPE and introjected regulation whereby at low levels of introjection, RPE was positively associated with changes in positive affect with a running task. In *Article 2*, identified and introjected regulations were positively associated with pre- to post-running increases in positive affect. Moreover, participants with high introjection reported a greater increase in positive affect with a running task but also a greater decline in affect after a non-physical control task. Study 2 employed the Experience Sampling Method over a 14-day period (N = 66). *Article 3* revealed a novel motivational sequence whereby introjected regulation was associated with higher RPE, intrinsic motivation (as well as RPE), was positively related to post-physical activity positive affect and the positive influence of identified regulation on affect appeared 3-hours post-activity. Lastly, *Article 4* revealed that women's daily affect was related to engaging in their passionate activity (i.e., physical activity) and that higher harmonious passion and lower obsessive passion led to more stable positive affect across days. Vitality, as measured at endpoint, was negatively predicted by obsessive passion and positively by harmonious passion.

The findings are discussed in relation to theoretical tenets and previous studies. The unique results give rise to interesting avenues of future enquiry, such as exploring motivational profiles. It is recommended that wellness interventions should emphasize women's internalization of physical activity in hopes of achieving balanced, sensible physical activity.

CHAPTER I
INTRODUCTION

CHAPTER 1: INTRODUCTION

There is a well-documented connection between regular physical activity and physical as well as psychological health (Biddle, Fox, & Boutcher, 2000; Bouchard, Blair, & Haskell, 2012).¹ Specifically, there is ample supporting evidence linking both acute and habitual physical activity with indicators of well-being. However, the relationships are variable and complex and therefore it is critical to understand the mechanisms and/or the circumstances underlying these associations (Biddle & Ekkekakis, 2005). The global objective of this dissertation was to acquire a greater understanding of the influence of motivation as well as passion on the relationship between physical activity and indicators of well-being in active women with multiple life roles. The role of the perceived intensity of physical activity (i.e., RPE) was also of interest. In the sections that follow, literature on physical activity and well-being is reviewed in depth, along with an explanation of the guiding theoretical principles of this dissertation. The purposes and hypotheses are presented in the latter segment of this chapter.

Physical Activity and Health

Physical activity can lead to a multitude of physical health benefits including improvements in musculoskeletal fitness (Garber et al., 2011) and reductions in the risk of chronic ailments such as heart disease, type 2 diabetes, and certain cancers (Bryan & Katzmarzyk, 2011; Centers for Disease Control [CDC], 2010; Warburton, Nicol, & Bredin, 2006). Women, in particular, can experience an array of unique physical health benefits from physical activity, including protection from osteoporosis, a decline in the risk of cervical and breast cancers, and a reduction in premenstrual syndrome (Charlinton, 2008; Monninkhof et al., 2007; Schmitt, Schmitt, & Dören, 2009). There have been fewer investigations regarding the effects of physical activity on the health and fitness of women specifically (ACSM, 1998;

Canadian Institute for Health Information, 2003; Nies, Vollman, & Cook, 1998). Although advancements have been made in this research in the last decade, studying women's physical activity remains a key public health priority (Sabiston et al., 2010).

Among women and men, physical activity can also lead to improvements in mental or psychological health (Asztalos et al., 2009; Biddle et al., 2000; Penedo & Dahn, 2005).² A major line of research has centered around examining the influence of physical activity on clinical anxiety, stress, and depression. Systematic reviews offer empirical support that regular exercise training offers a minimal risk intervention that can reduce symptoms of anxiety and moderately improve depressive symptoms (Herring, O'Connor, & Dishman, 2010; Mead et al., 2009). This positive influence may be particularly pronounced in women (Kull, Ainsaar, Kiive, & Raudsepp, 2012; Teychenne, Ball, & Salmon, 2008). Recent evidence even suggests that exercise is gaining popularity over pharmacological treatments as an effective agent in reducing symptoms of psychiatric health disorders, most notably clinical depression (Melville, 2012; Taylor, 2010).

Although a fair amount of physical activity research has focused on addressing mental illness (Saxena, Van Ommeren, Tang, & Armstrong, 2005; Stathopoulou, Powers, Berry, Smits, & Otto, 2006) a social sciences movement towards the study of *positive* mental health has been mirrored by physical activity researchers (Christopher, 1999; Rejeski & Thompson, 2007; Ryff, 1995). Specifically, engaging in physical activity has been linked to improved sleep quality (Youngstedt, 2005), superior cognitive performance (Weuve et al., 2004), and better physical self-perceptions (Elavsky, 2010). Most notably, there is a growing literature indicating that engaging in physical activity is associated with well-being (Biddle & Mutrie, 2008; Lotan, Merrick, & Carmeli, 2005). Studying individual well-being is a fruitful avenue of enquiry given that it may positively influence future behavioural self-regulation (Aspinwall, 1998) and that it

has been associated with reduced mortality and morbidity in healthy and diseased populations (Diener & Chan, 2011; Xu & Roberts, 2010).

Physical Activity and Well-Being: Summary

A well-accepted definition of well-being is that of Diener (1984, 2006) who described ‘subjective well-being’ as being made up of (a) life satisfaction, and the balance between (b) positive affect and (c) negative affect. In this popular tripartite model, the three components are separable and can be examined individually (Lucas, Diener, & Suh, 1996). Diener (2006) refined his definition to also reflect a broader term that encompasses how individuals evaluate their lives in general. Ryan and Deci (2001) aligned ‘subjective well-being’ within hedonism, a perspective focused on happiness and positive affect. This can be contrasted with ‘psychological well-being’ which arose within the eudaimonism tradition that is centered on self-realization and which boasts constructs such as vitality (Ryff & Keyes, 1995). ‘Psychological well-being’ is multi-dimensional and is heavily focused on what constitutes well-being and not merely the factors that foster it (Ryan & Deci, 2001). In this thesis, ‘well-being’ will be used as an overarching term to reflect a broader conceptualization of general well-being as it is often employed in the SDT literature, thus combining hedonic and eudaimonic elements (Ryan & Deci, 2001).

It is commonly accepted that we can infer the quality or level of an individual’s well-being through direct assessment of state-specific markers such as affect (positive and negative) or of seemingly related constructs such as vitality; these are referred to as indicators of well-being (Edmunds, Ntoumanis, & Duda, 2007; Wilson & Rodgers, 2007). As remarked in a recent conceptual review, considerable links have been made between physical activity and indicators of well-being (Guérin, 2012). For instance, regular physical activity has been linked to indices such as self-esteem and satisfaction with life (Elavsky & McAuley, 2005; McAuley et al., 2005).

Thøgersen-Ntoumani, Fox, and Ntoumanis (2005) found that physical activity among corporate employees predicted a model of well-being in various facets of life (e.g. physical self-worth, enthusiasm at work, work-related well-being etc.). One specific indicator of well-being that has received increasing attention in the physical activity domain is vitality. Falling under the umbrella of well-being and also of quality of life, but distinguishable by its enduring, phenomenological and eudaimonic qualities (i.e., focused on self-actualization; Guérin, 2012), vitality refers to a meaningful sense of aliveness or energy and a zest for life (Nix, Ryan, Manly, & Deci, 1999; Ryan & Frederick, 1997). Cross-sectional and longitudinal studies have revealed that engaging in recommended levels of physical activity is associated with greater feelings of vitality (Perras et al., 2009; Vuillemin et al., 2005; Wendel-Vos, Schuit, Tijhuis, & Kromhout, 2004).

Affective states are another markedly popular outcome in this line of research (Pasco et al., 2011; Williams, 2008). Affect, sometimes used interchangeably with mood, is a term that refers to the overall valence of an experience (positive, negative), thus reflecting the *quality* of a subjective feeling state (Batson, Shaw, & Oleson, 1992; Reed, 2005). According to the Circumplex Model, coupled with its valence component, affect can be further characterized on the basis of a second bipolar and orthogonal dimension: activation (Ekkekakis, & Petruzzello, 1999). *Low* activation refers to a calm or depressed state while the more widely studied *high* activation implies an energetic and excited state. These dimensions have shown relevance in exercise contexts (Blanchard, Rodgers, & Gauvin, 2004; Ekkekakis & Petruzzello, 2002). There is considerable evidence regarding the influence of physical activity on affect and mood (Berger & Motl, 2000; Biddle, 2000; Biddle & Mutrie, 2008). In a meta-analysis of 158 studies, Reed and Ones (2006) found a consistent positive influence of acute exercise on high activation positive

affect, which is identified as a hallmark quality of well-being (Russell, 2003). Decreases in negative mood states post- aerobic exercise have also been noted (Cox, Thomas, Hinton & Donahue, 2004; Steinberg et al., 1998). Still, there is more ambiguity pertaining to negative affect, for which the influence seems less robust (Hansen, Stevens, & Coast, 2001; Pasco et al., 2011). In this thesis, the influence of physical activity was evaluated across valence (positive, negative) and activation (high, low) dimensions of affect for a more complete assessment.

Moreover, to our knowledge the majority of studies on acute affective states has focused on the period immediately post- or minutes post-activity. However, in regards to the time-frame of assessment for the influence of physical activity, Kesaniemi et al. (2001) defined *acute* effects as changes that occur during and in the hours after physical activity (with no additional activity in-between). Moreover, Rudolph and Butki (1998) argued “...it is reasonable to speculate that the maximum psychological benefits that can be realized as a function of acute exercise do not occur until individuals have recovered from the immediate effects of physical exertion” (p. 278). Other researchers have also remarked that the acute effects on mood, especially in active individuals, may last from minutes to several hours (mostly two to four; Daley & Welch, 2004; Focht & Koltyn, 1999; Wichers et al., 2012). However, there seems to be variability in these findings as some specific studies, such as Cox, Thomas, Hinton, and Donahue (2006), have found no effect of time following exercise (see also Reed & Ones, 2006 for review). Hence, one sub-goal in this dissertation was to extend the ‘post-physical activity’ period by also considering changes in affect hours after physical activity, specifically, three hours after.

Researchers contend that repeated satisfying exposure to short-term positive states (we argue, post-, and also 3-hours post-) can lead to increased well-being over time (Fredrickson, 2001; Lyubomirsky, King, & Diener, 2005; Rousseau & Vallerand, 2008). Conceivably then, the

build-up of acute affective benefits from habitual physical activity engagement could contribute to one's global sense of wellness. Indeed, Reed and Buck (2009) revealed that *regular* aerobic exercise resulted in moderate increases in individuals' general positive affect. Interestingly, acute affective responses to physical activity (i.e., more positive, less negative) can also predict long-term participation (Kwan & Bryan, 2010a; Williams et al. 2008), perhaps initiating a cycle of stable and sufficient physical activity as well as greater well-being. Overall, in this thesis we sought to examine the associations between physical activity and changes in acute and daily affect as well as levels of a more general and eudaimonic indicator of well-being (i.e., vitality).

Selected research has focused on individuals who regularly participate in physical activity. Among earlier investigations, one particular study found increases in positive affect in trained participants after treadmill running that were matched by *decreases* in untrained individuals (Hsiao & Thayer, 1998). Regular exercisers have also exhibited heightened mood that has exceeded those of non-exercisers after a bout of exercise at the recommended intensity/duration for cardiorespiratory fitness (Hoffman & Hoffman, 2008). O'Halloran, Murphy, and Webster (2004) discovered that regular runners experienced post-running elevations in mood as reflected through composure and mental clarity that were not seen during a reading task. Others have mirrored such conclusions vis-à-vis distinct affective outcomes across different activity/fitness levels, mostly favouring active individuals (Berger & Owen, 1998; Markowitz & Arent, 2010). Thus, to optimize our understanding of affective changes associated with physical activity, the studies in this dissertation were conducted with an active population.

With gender, a parallel contention of the affective benefits of physical activity has been raised. Notably, the effects of physical activity on positive mood states seem to be particularly evident in women (Hansen, Moses, & Gardner, 1997, Penedo & Dahn, 2005). Studies with

women have demonstrated that physical activity has a favourable emotional effect immediately following the activity (Cramp & Bray, 2010; Gauvin, Rejeski, & Norris, 1996; Gauvin, Rejeski, & Reboussin, 2000) and on general positive affect (Kelsey et al., 2006). With respect to more global well-being, researchers discovered that active women fare better than those that are inactive (Galper, Trivedi, Barlow, Dunn, & Kampert, 2006; Kull, 2002; Kull et al., 2012).

Studies have also revealed positive associations between physical activity and reduced symptoms of depression in women (Craft, Freund, Culpepper, & Perna, 2007; Gutierrez et al., 2012), which is a dominant source of disability in this gender (Noble, 2005). Moreover, a large-scale longitudinal study revealed that greater physical activity was associated with larger increases in vitality and the mental component of health-related quality of life among women compared to men (Tessier et al., 2007). Other studies have also linked physical activity with higher levels of vitality in women (Brown, Mishra, Lee, & Bauman, 2000; Wendel-Vos et al., 2004). As an important outcome in itself, vitality has received insufficient empirical attention in its relationship with physical activity among healthy, non-clinical women (Heesch et al., 2012). Given that women's mental health is generally poorer than that of their male counterparts (Denton, Prus, & Walters, 2004; Seedat et al., 2009; Statistics Canada, 2011), a better understanding of the physical activity-well-being relationship among women is needed (Sabiston et al., 2010). The present thesis addressed a call for more women-directed research aimed at gaining a better understanding of women's affective experience with respect to physical activity as well as their vitality (Ainsworth, 2000).

Physical Activity and Well-Being: Mechanisms

Although many studies document a positive association between physical activity and well-being, the relationship appears to be far from simplistic (Biddle & Ekkekakis, 2005).

Indeed, there is evidence of variability in research findings indicating that not all individuals who participate in physical activity achieve greater well-being (O'Connor & Puetz, 2005; Scully et al., 1998). For example, one study found that only half of participants engaging in a 30-minute cycling task at moderate-to-high intensity felt progressively better (Van Landuyt, Ekkekakis, Hall, & Petruzzello, 2000). In addition, Brown and colleagues (2004) demonstrated in a large national sample that moderate to vigorous physical activity for extended periods or *every* day of the week led to lower health-related quality of life, a broad term that includes perceptions of well-being. Similarly, high levels of physical activity have been associated with important dimensions of 'exercise dependence', such as interference with one's social life, which carries implications for active individuals' well-being (Kjelsas, Augestad, & Gotestam, 2003).

Indeed, evidence from the exercise addiction literature is particularly insightful. Notably, when exercise-dependent persons are deprived of their activity, they experience significant declines in well-being through increased stress, depression, and irritability (Aidman & Woollard, 2003; Hausenblas & Symons Downs, 2002; Kjelsas et al., 2003). Likewise, an 'overtraining' phenomenon in athletes has been accompanied by increments in negative affect and mental exhaustion (Berger et al., 1999; Hooper & MacKinnon, 1995). These results are perplexing and they suggest that merely engaging in physical activity (i.e., amount) is insufficient to accrue benefits in well-being. Yet, to date, sophisticated explanations of the findings seem to be lacking. According to experts, it is pivotal to establish the mechanisms and/or the circumstances under which physical activity may, or may not, benefit well-being, including affective states and vitality (Berger & Motl, 2000; Biddle & Ekkekakis, 2005; Lehnert, Sudeck, & Conzelmann, 2012). This understanding is important on several grounds, from advancements in wellness

interventions to developments in relevant and applicable theory (Biddle & Ekkekakis; Gauvin & Rejeski, 1993).

Researchers have begun to address gaps in this knowledge by attempting to isolate factors that could explain the link between physical activity and indicators of well-being.

Moderating variables, in particular, require additional research attention to better understand different affective patterns (i.e., well-being) that occur with physical activity engagement (Reed & Ones, 2006). More concretely, moderating variables inform us of the circumstances under which a given association occurs or does not (Wu & Zumbo, 2008), and therefore it follows that the strength/direction of the relationship between physical activity and well-being could be different depending on levels of key moderators, thus elucidating plausible processes.

There is a body of literature showing that exercise characteristics such as type, duration, and intensity, among others, can in fact modify its relationship with well-being, notably affect (Coon et al., 2011; Rocheleau, Webster, Bryan, & Frazier, 2004). For instance, across several studies reviewed by Reed and Buck (2009) that looked at regular physical activity, doses of 3-5 days per week provided stronger effect sizes in terms of affective benefits. Moreover, the effects of regular and acute aerobic physical activity on positive-activated affect were stronger for activity of 30-35 minutes in duration (Reed & Buck, 2009; Reed & Ones, 2006). From the pool of possible exercise-based moderating factors, intensity has received considerable research attention. As it will become evident in the following section, significant between-person variability with respect to how the intensity of physical activity influences indicators of well-being warrants continued inquiry of this influential factor (Ekkekakis, Parfitt, & Petruzzello, 2011). Therefore, this dissertation examined women's rating of their perceived exertion of

physical activity (i.e., intensity) as one moderator of the relationship between physical activity and well-being.

Intensity of Physical Activity

In studying affective states in particular, researchers have examined the intensity of physical activity based on the premise that the extent to which individuals exert themselves should influence how they feel during- and post-activity. Physical activity intensity refers to the amount of energy an individual expends to engage in the activity and it can be assessed either objectively (e.g., heart rate), or subjectively, or any combination of the two (Kenney, Wilmore, & Costill, 2011). In terms of widely employed subjective evaluations, ‘perceived exertion’ is a common term that is used to describe individuals’ interpretations of their bodily sensations during physical activity, and this reflects how much work is being carried out (Noble & Robertson, 1996). In particular, the Ratings of Perceive Exertion scale (RPE; Borg, 1982) has become a well-established and reliable measure (Noble & Noble, 1998; Tenenbaum & Hutchinson, 2007). The RPE is a self-reported indicator that combines perceptual, performance, and physiological elements and that correlates well with objective measures (Borg, 1998). In this dissertation, the RPE was employed to gauge the intensity of physical activity, although relevant studies are presented here that use either/both objective or subjective measures.

While there has been substantial progress in identifying the nature of the influence of intensity on affective states, particularly positive affect, the variability in these results is notable (Reed & Ones, 2006). For instance, a few studies have found that affective states after acute exercise were not associated with participants’ RPE of the activity (Raedeke, 2007; Rendi, Szabo, Szabó, Velenczei, & Kovács, 2008). However, many studies reveal the opposite, namely that intensity does have a significant influence on improving mood, at least immediately post-

exercise (e.g., Cox et al., 2006; Rocheleau et al., 2004). Hence, researchers have also sought to achieve greater precision regarding the specific intensity levels at which affective changes ensue. Some believe that individuals need to achieve an intensity ‘threshold’ during exercise in order for affective changes (and benefits) to occur, and also that activity beyond a certain intensity point would result in worsening of affect (Ekkekakis & Petruzello, 1999, Yeung, 1996). However, experts maintain that this ‘U-shaped dose-response relationship’, which may be more apparent for negative affective states, has not received sufficient empirical support (Ekkekakis, Hall, & Petruzzello, 2008; Ekkekakis & Petruzello, 1999).

More recently, there is cumulative evidence for high activation positive affect revealing that improvements post-exercise tend to arise with moderate intensity activity (Reed & Buck, 2009; Reed & Ones, 2006). This is consistent with current physical activity guidelines that recommend 150 minutes of *moderate*-intensity physical activity to achieve health benefits (Tremblay et al., 2011). However, when it comes to mental health outcomes, and those relating to well-being and affect especially, is it erroneous to assume that moderate activity is *always* optimal across *all* individuals, of any fitness/activity level?

Indeed there is evidence that a person’s activity level may influence the nature of the relationship between intensity and affective states (Reed & Ones, 2006). For example, in active middle-aged women Cox et al. (2006) found that higher intensity exercise resulted in greater positive changes in affect than moderate intensity. Additional research has corroborated that active individuals have unique affective reactions to higher intensity physical activity and that this may influence future participation, and undoubtedly, overall well-being (Bixby & Lochbaum, 2006; Blanchard, Rodgers, Spence, & Courneya, 2001; Williams, 2008). Such findings complement the evidence that self-selection or preference regarding the intensity of

exercise may be more relevant than imposed intensity in achieving benefits in affect (Parfitt & Hughes, 2009; Rose & Parfitt, 2007). In sum, there is a general consensus that physical activity intensity *can* have an important moderating influence on affective states as an indicator of well-being, despite a lack of consistent support regarding a benchmark intensity needed to acquire such benefits.

In addition, ambiguity seems to arise regarding whether the influence of intensity on affective states is confined to immediately post-activity or whether the effect is longer lasting (i.e., 3-hours post-physical activity). In the acute period following physical activity, a number of studies have detected that the influence of intensity on positive high activation affect tends to steadily decline with the passage of time (Reed & Ones, 2006). Still, there is evidence that the effect of RPE on positive mood may be sustainable up to 90 minutes post-activity (Cox, et al., 2006). Moreover, Cox and colleagues (2004) found that the influence of exercise intensity on reductions in state anxiety only emerged 30-minutes post-exercise. However, they found that these delayed improvements were only true of a high intensity exercise condition (i.e., 80% VO₂ max), thus adding to the complexity. Discrepancies in the findings to date suggest that a more thorough understanding of RPE and affect is required and in specific populations (i.e., active individuals). Therefore, active women's RPE was examined in this dissertation in relation to two aspects: the direction and/or magnitude of its influence on positive and negative affect as well as the length of time that such effects occur or last (i.e., post- and 3-hours post-physical activity).

The emphasis on self-selected intensity (or RPE) coincides with recent interest in individual-level variables that may influence one's chosen intensity and subsequent links with well-being. Still, Tenenbaum and Hutchinson (2007) maintain that such research is in its infancy. Scant research has examined the possible interactions between self-selected physical activity

intensity and psychological aspects (e.g., self-efficacy). Given that motivation acts as a primary driving force of physical activity behavior (Sherwood & Jeffery, 2000), it is surprising that little research has examined its ability to predict, and/or interact with, one's exertion during physical activity. That said, one study supported that certain types of motivation may be more predictive of higher intensity exercise (Duncan, Hall, Wilson, & O, 2010). Another showed that the quality of motivation is an important predictor of affective changes that occur with activity that is of a self-selected intensity (Legrand & Tatcher, 2011). In this dissertation, one of the aims was to understand the relationships between RPE, motivation, and affective states. The specific motivational theory that was used to guide these enquiries (i.e., Self-Determination Theory [SDT]; Deci & Ryan, 1985) will be presented in the next section.

While on the topic of theory, apart from more recent exceptions (e.g., *dual-mode theory*, Ekkekakis, 2003), studies focusing on basic exercise stimulus factors such as intensity have been largely atheoretical. Moreover, this literature does not necessarily or adequately acknowledge individuals as initiators of their own behavior. In explaining the physical activity-affect relationship, Pasco et al. (2011) suggested that we need to examine important psychosocial influences alongside other factors that may be neurobiological (i.e., intensity-related influences). This view is in line with tenants of the *dual-mode theory*, albeit to our knowledge, research within this latter framework has still favored physiological processes (Ekkekakis et al., 2011). Although informative, effect sizes for many physical moderators have generally been weak, leaving a good proportion of variance in the physical activity-well-being relationship unexplained. This is suggestive that other moderators need to be accounted for (Reed & Ones, 2006). Thus, consistent with Pasco et al. (2011) as well as the intensity-motivation linkage introduced above, experts contend that psychological and motivational determinants require

further attention in this line of research (Anderson & Brice, 2011; Berger & Motl, 2000; Ekkekakis & Petruzello, 1999). According to these sources, greater use of theoretical models is also essential to build sound explanations of the physical activity-well-being relationship. This individual-level and theoretical focus was the guiding position in this dissertation.

Some progress has been made vis-à-vis psychological mechanisms that could help explain how or why physical activity leads to well-being (Anderson & Brice, 2011). Giacobbi, Hausenblas, and Frye (2005) found that personality factors (e.g., openness to experience) had a significant moderating effect on the exercise-mood relationship. Specifically, higher openness led to improved mood when participants engaged in more physical activity. However, effect sizes were small. Furthermore, given that personality traits are fairly enduring (Vealy, 2002) it is worthwhile to examine variables that are more amenable to change. In this regard, researchers have also found that factors such as higher self-efficacy (Raedeke, Focht, & Scales, 2009) can modify physical activity's influence on well-being outcomes in a positive direction.

However, there appear to be fewer investigations of *motivational* factors despite the aforementioned contention that motivation is a key determinant of individuals' engagement in behaviours like physical activity as well as their well-being (Pan et al., 2009; Ryan, Huta, & Deci, 2008; Sherwood & Jeffery, 2000). Specifically, the *quality* of motivation, namely one's self-determination (SDT; Deci & Ryan, 1985), may supply a missing and understudied link in explaining well-being-related outcomes of physical activity (Lutz, Lochbaum & Turnbow, 2003; Prichard & Tiggeman, 2008; Wilson & Rodgers, 2007). Therefore, this dissertation used SDT as its leading theoretical framework. A second and complimentary model, the Dualistic Model of Passion (DMP; Vallerand et al., 2003), was also utilized in order to study passion for physical activity. In the next sections, the relevant principles and pertinent research relating to SDT (i.e.,

self-determination) are presented first followed by an introduction to the DMP (i.e., passion), showing its relevance for this thesis and reviewing literature that support its tenants.

Self-Determined Motivation

In SDT (Deci & Ryan, 1985), it is postulated that malleable motivational variables can have an optimizing influence on individuals' behaviour and well-being (Ryan & Deci, 2001; Ryan, Huta, et al., 2008). According to Deci and Ryan (2008), SDT is a promising framework to help explain behavioural and psychological outcomes across contexts (e.g., sport, work, relationships). Self-Determination Theory has received significant research attention in understanding the motivational underpinnings of health behaviours such as physical activity (Fortier, Williams, Sweet, & Patrick, 2009; Teixeira, Carraça, Markland, Silva, & Ryan, 2012). Moreover, SDT has been advocated as a framework to purposely examine *women's* physical activity engagement (Solmon, Munro, Autrey, & Landry, 2002). The theory's multidimensional lens has the potential to offer distinct insight regarding the interaction of factors that contribute to the uniqueness of women's physical activity experiences and well-being (Landry & Solmon, 2002).

Self-Determination Theory (SDT) is an individual-level theory grounded in a humanistic perspective (Deci & Ryan, 1985). Within SDT, humans have a natural tendency to grow and to integrate their experiences into a complete sense of self. Self-Determination Theory is made up of four sub-theories: organismic integration theory (OIT), cognitive evaluation theory, causality orientation theory, and basic needs theory. While descriptions of the latter three are available elsewhere (see Deci & Ryan, 2002), what is paramount to OIT, and to this dissertation, is that the internalization of behaviour can predict motivational consequences (in this case well-being). The distinctiveness of SDT is that this internalization process is viewed within OIT as a continuum rather than a dichotomy (Ryan & Deci, 2002). In essence, the 'self-determination continuum'

presents a distinction between controlled motivation, resulting from factors such as demands and/or pressure, and autonomous or self-determined motivation, arising from elements of volition, choice, and interest (Ryan & Connell, 1989). The continuum is depicted as a taxonomy of three main types of motivation (i.e., amotivation, extrinsic, intrinsic) that can be further delineated by six different behavioural regulations. As the regulations become increasingly more self-determined across the spectrum, they are thought to lead to progressively better behavioural and psychological consequences (e.g., higher engagement, greater well-being; Deci & Ryan, 2002; Ryan & Deci, 2000a, 2000b). It is also postulated in SDT that individuals have a natural tendency to proceed along the continuum unless thwarted by their experiences/surroundings.

The self-determination continuum. Amotivation lies at the left end of the spectrum and it represents lacking the intention to act (Ryan & Deci, 2002). To its right, we find the extrinsic segment that is characterized by four types of motivation that represent increments in self-determination. The most controlled type, external regulation, is defined as being motivated according to external demands such as to obtain a reward or to avoid punishment. A woman who engages in exercise only because her military rank requires it would exemplify this motivational style. The coercive nature of this type of motivation should lead to worse behavioural and psychological outcomes (Deci & Ryan, 2002). Next, introjected regulation involves a slight internalization of a behaviour but with little acceptance as one's own since it arises from sentiments of guilt or shame (Ryan & Deci, 2000a). An example would be a woman who sets out on a daily run in order to impress others and/or avoid feeling shameful about her body.

Consistent with evidence that women tend to differ from men on key psychological variables associated with physical activity engagement (Kjelsas & Augestad, 2003; Marcus & Forsyth, 1998; Segar, Jayaratne, Hanlon, & Richardson, 2002), elaboration of this latter

regulation is warranted. Notably, researchers concur that concerns of self-presentation, such as weight concerns, body shape and tone, as well as general appearance, are more commonly reported motives for women (LaChausse, 2006; Lowery et al., 2005; Prichard & Tiggeman, 2008). Such reasons are experienced as controlling and have been positively associated with higher levels of introjected regulation (Markland & Ingledew 2007). In parallel, studies have indicated that women endorse introjected regulation to a greater degree than men and that it can have a stronger influence on their physical activity participation (Duncan et al., 2010; Wilson, Rodgers, Fraser, & Murray, 2004). Indeed, Stephan, Boiché, and Le Scanff (2010) found higher introjection in persistent female exercisers. Moreover, in a study referred to earlier, only among women was introjection associated with physical activity intensity (Duncan et al., 2010).

In addition, many women may also engage in physical activity out of additional self-imposed demands and guilt (Lloyd & Little, 2010). To explicate, it is commonplace for Canadian women to spend 30 or more hours per week in paid work (Marshall, 2009). Many women feel a need to incorporate a healthy lifestyle (e.g., exercise) while juggling multiple life roles, such as working professional, wife, and mother (Johnston & Swanson, 2006; Segar, Eccles, Peck, & Richardson, 2007). It is conceivable then that some women can experience self-imposed pressure to fulfill these demands and thus view physical activity as yet another task to accomplish that may result in feelings of guilt if *not* completed (Nies, Vollman, & Cook, 1999; Vancour, 2009). Therefore, particular attention was paid to introjection in this dissertation. The above arguments also reveal the importance of studying multiple-role women.

Ensuing on the continuum is identified regulation; it is the first of the more self-determined motivational types as it arises when an individual values the behaviour in question and assigns it personal importance (Ryan & Deci, 2002, 2003). An example of this would be a

woman who attends a yoga class in order to maintain a good health and relieve stress. Identified regulation may be important in motivating behaviours that are valued but that may not be inherently interesting, such as physical activity, and researchers have found this regulation to be strongly associated with motivational/behavioural consequences in men and women (Teixeira et al., 2012; Wilson et al., 2004).

Next is the most self-determined of the extrinsic motivations: integrated regulation. It involves an integration of the behaviour into one's sense-of self, to the extent that the behaviour is consistent with personal goals and values. An active woman who exercises because it is congruent with her identity (e.g., "I am a swimmer") and with her core beliefs would typify this regulation. Both identified and integrated regulations have been associated with exercise frequency in women (Duncan et al., 2010). Lastly, to the extreme right of the continuum is intrinsic motivation. It is characterized by inherent satisfaction in an activity (Ryan & Deci, 2002). Engaging in the activity for its own sake is enjoyable and rewarding. For instance, a woman who is intrinsically motivated for dancing would do so because she enjoys the physical stimulation it provides her. Persistent female exercisers tend to display higher levels of intrinsic motivation (Stephan et al., 2010).

Self-determination and well-being. The literature pertaining to indicators of well-being in relation to self-determined motivation toward physical activity specifically is expanding. The findings to date are promising and worthy of continued investigation. In particular, there is evidence that individuals who are more self-determined for physical activity report more enjoyment (Guérin & Fortier, 2012; Raedeke, 2007), greater vitality (Perras et al., 2009), and elevated *general* positive affect (Puente & Anshel, 2010). Lower levels of negative affect have also been found, although this effect has not been as strong (Gagné, Ryan, & Bargman, 2003;

McDonough & Crocker, 2007). Moreover, self-determined physical activity motivation can predict greater self-esteem (Thøgersen-Ntoumani & Fox, 2007) and better self-evaluation patterns (Brunet & Sabiston, 2009; Thøgersen-Ntoumani & Ntoumanis, 2006), which have been linked to positive affect and general well-being (Fox, 1997; Netz, Wu, Becker, & Tenenbaum, 2005; Van de Vliet et al., 2002). In addition, intrinsic exercise motives specifically have been associated with several indicators of well-being in long-term exercisers, for example lower stress (Maltby & Day, 2001). Contrarily, external regulation has often been associated with lower well-being (Ryan & Deci, 2006). To our knowledge, no study to date has examined self-determined motivation toward physical activity as a moderator of well-being in *active women*. Moreover, many studies in this area have analyzed a global index of self-determined motivation rather than the predictive influence of distinct regulations. The current dissertation addressed these gaps.

Still, those studies that have prioritized the regulations have offered particular insights regarding introjected regulation and its problematic influence on psychological outcomes. For instance, in university employees Thøgersen-Ntoumani and Fox (2007) revealed that while life satisfaction and physical well-being were *positively* predicted by identified regulation, they were *negatively* influenced by introjection. This controlling and pressured form of motivation has been linked to social physique anxiety and eating disorder symptomology (Thøgersen-Ntoumani, & Ntoumanis, 2007) as well as excessive exercise (Fortier & Farrell, 2009; Gonzalez-Cutre & Sicilia, 2012). In addition, exercising for internally controlling reasons can negatively impact one's vitality (Edmunds et al. 2007) and overall well-being (Markland & Ingledew, 2007). In facilitating physical activity behaviour, there are claims that introjection is predictive of short-term engagement but less of long-term persistence (Ryan, Patrick, Deci & Williams, 2008) and this dynamic effect for introjection has received empirical support (e.g., Pelletier, Fortier,

Vallerand, & Briere, 2001). Notwithstanding conflicting evidence for activity maintenance, the research presented just above as well as the conclusions of a recent systematic review (Teixeira et al., 2012) attest that the negative feelings that characterize an introjected regulation may come at a more grave overall cost to active women's well-being. This was considered worthy of attention.

Lastly, it is important to acknowledge the complexity of motivation as it pertains to SDT. Specifically, according to Vallerand (2007a; Vallerand & Ratelle, 2002) the influence of motivation is hierarchically organized. Within the Hierarchical Model of Intrinsic and Extrinsic Motivation (HMIEM), the regulations can exist at three levels of generality: situational, contextual, and global (Vallerand, 2007a). Amongst the model's several principles, Corollary 3.3 specifies that contextual motivation (i.e., one's usual motivation for physical activity) should influence one's situational motivation for a given activity at a specific time (e.g. discrete exercise session). Also, the level of a given motivational *outcome* (e.g. post-activity affect) should correspond to the level of generality of motivation that produced it (e.g., situational motivation pre-activity; Corollary 5.2; Vallerand, 2007a). The HMIEM has been upheld in the contexts of sport and physical activity, yet additional studies are needed (Gagné et al., 2003; Kowal & Fortier, 2000; Ntoumanis & Blaymires, 2003). Thus, it was deemed important in this dissertation to consider the top-down effect of motivation across levels and to use an appropriate level of motivation (i.e., situational) to match momentary affective outcomes.

In addition, it appears that there has been a focus on more *global* or general well-being consequences in the SDT literature, even when looking at affect (i.e., overall positive/negative affect). There is little knowledge of the influence of self-determined motivation (regulations specifically) on immediate physical activity-specific affect, surely a worthy outcome in itself and

a contributor to long-term well-being (Biddle & Mutrie, 2008; Gagné et al., 2003). Indeed, it is argued that the influence of self-determination on affect in the acute phases of physical activity is worthy of further attention (Kanning, Ebner-Priemer, & Brand, 2011; Lutz et al., 2003). In one study, Lutz and colleagues (2003) showed that higher scores on self-determined regulations predicted greater positive affect following an exercise class. However, the authors measured overall (contextual) motivation for physical activity rather than situational motivation for the specific session. In another investigation, Kwan et al. (2011) assessed daily exercise-related affect but only measured contextual regulations at the end of a one-month study (Kwan, Hooper, Magnan, & Bryan). Therefore, the studies in this thesis addressed the influence of situational motivation toward single bouts of physical activity on succeeding (acute) changes in affect.

While situational motivation was considered most relevant in the prediction of momentary affect (as an indicator of well-being), another concept that was deemed pertinent to our enquiries was that of ‘passion’ (Vallerand et al., 2003). Namely, an individual’s passion for a valued activity, as construed within the DMP, can also moderate the extent to which engaging in the activity benefits or thwarts well-being (Vallerand, 2010).

Passion

In keeping with formerly mentioned trends regarding the study of positive mental states, the study of *passion* is concerned with what makes people’s lives worth living. Specifically, passion for an activity can offer a meaning to life and can spur engagement. Ultimately, being passionate can enhance one’s greater well-being, and this is the first basic premise of the DMP (Vallerand et al., 2003). Vallerand and colleagues (2003) proposed a novel, dual approach to passion, wherein passion is defined as “a strong inclination toward an activity that people like, that they find important and in which they invest time and energy” (p. 757). Passion develops

when an individual's representation of a highly valued activity becomes incorporated into his or her identity. The nature of this internalization process establishes a distinction between two types of passion: harmonious passion (HP) and obsessive passion (OP).

When an activity is internalized in an autonomous way, it is not bound by any contingencies and therefore is engaged in with a sense of volition and freedom. This facilitates the development of a HP, whereby the activity is well-balanced both internally within one's identity as well as externally with other aspects of one's life (Vallerand et al., 2003). Harmonious passion can be distinguished from an OP, with which one feels compelled to engage in a valued activity since it has been internalized in a controlled fashion. Individuals can develop an OP for physical activity because they lack control over the excitement that it brings and or because they have attached certain contingencies to it (Vallerand, 2010). Contingencies can arise from intra- or inter-individual pressures and can result in the activity becoming overly prominent in one's identity and life. Despite apparent conceptual similarities, Vallerand et al. (2003; study 2) found that respectively, passion and motivation (from SDT) explained unique variance in affective outcomes. Hence, they were examined independently in this dissertation.

The DMP can be applied across any number of domains (Vallerand, 2010). Research has shown that physical activity and sport are popular types of passionate activities (Rousseau & Vallerand 2008; Vallerand et al. 2003). Although being passionate for sport and physical activity can inherently deliver quite a few wellness outcomes, and though this context may be ideally suited to study the principles of the DMP (Carbonneau, Vallerand, & Massicotte, 2010; Vallerand, 2010), few passion studies have been conducted in the physical activity domain specifically (see Parastatidou et al. 2012). None have uniquely targeted women. Therefore, active women's passion toward physical activity was examined in this dissertation.

In accordance with the first principle of the DMP, there is evidence attesting that being passionate for an activity such as physical activity can lead to greater well-being, for instance by increasing levels of positive affect among other outcomes (Vallerand, 2012). Moreover, exhibiting higher or lower levels of HP and/or OP can predict different psychological consequences and this constitutes a second fundamental principle of the DMP. Specifically, there is support that higher levels of HP and lower OP can lead to long-term indicators of well-being such as greater satisfaction with life and vitality (Forest, Mageau, Sarrazin, & Morin, 2011; Philippe, Vallerand, & Lavigne, 2009; Rousseau & Vallerand, 2008). For instance, Philippe et al. (2009) found that a group of harmoniously passionate individuals, and women in particular, showed a greater increase in vitality one year later compared to an obsessively passionate group.

In addition, HP has been associated with greater positive affect immediately following the activity (Rousseau & Vallerand, 2008), from day to day (Mageau & Vallerand, 2007), and in general (Vallerand et al., 2003; study 2). Conversely, scoring higher on OP has been associated with ruminating thoughts, over-valuing the activity, as well as experiencing conflict with other areas of life (Donahue et al., 2012; Séguin-Lévesque, Laliberté, Pelletier, Blanchard, & Vallerand, 2003). For active women juggling multiple roles, having an OP for physical activity could create significant mental and/or social tension. It is unsurprising that OP passion has been associated with negative affect, especially in the form of shame and anxiety (Rousseau & Vallerand, 2008; Stenseng, Rise, & Kraft, 2011; Vallerand et al., 2003; study 1). What is also interesting is the evidence that OP can predict worse daily affect than HP on days when an individual is unable to or is prevented from engaging in the activity (Mageau & Vallerand, 2007), a predicament that many women with multiple roles may experience with respect to their physical activity. For the purposes of this research, this was characterized as a third main

principle of the DMP. Thus, among active women with a passion for physical activity, it was deemed important to examine the links between passion types and daily affect as well as vitality.

Approaches to Research

Lastly, a brief note regarding the methods utilized in current and past research will set the stage for this dissertation. On the one hand, many SDT studies presented above were cross-sectional and conducted in the context of participants' present location and/or their current physical activity milieu (e.g., classroom, fitness facility). Few of them have allowed for true testing of the moderating effect of motivation. For instance, and although it was a highly pertinent study, Lutz et al. (2003) employed the convenience of an established exercise class rather than an experimental design. The experimental method offers particular advantages in the domain of exercise as it provides better containment of extraneous influences, thus giving researchers an edge in exploring underlying moderating processes. In fact, there has been a call for more experimental work in this area, particularly in the prediction of affective states (Arent, Rogers, Landers, 2002). Yet, to our knowledge few studies have attempted to explore underlying physical activity-well-being mechanism in experimental settings (e.g., Markowitz & Arent, 2010), and none have tested SDT's motivational regulations. Hence, an experimental laboratory study using a within-groups design was conducted as the first study of this dissertation. This also addressed a call for more controlled studies of exercise and well-being in women (Kull, 2002).

On the other hand, researchers, including a few from the SDT and DMP traditions, have demonstrated the value of examining predictors of well-being over time and within people's day-to-day lives (Kwan et al., 2011; Verner-Filion, Lafreniere, & Vallerand, 2012; Ryan, Bernstein, & Brown, 2010). The Experience Sampling Method (*ESM*; Csikszentmihalyi & Larson, 1987), also known as 'ecological momentary assessment' or 'diary studies', provides standardized

descriptions of participants' thoughts, feelings, and behaviours in their daily life, possibly across several situations (Hektner, Schmidt, Csíkszentmihályi, 2007). With the ESM, researchers can define and regulate the format and schedule of participants' momentary self-observations (Reis & Gable, 2000). With advances in digital technology, computerized ESM and the use of handheld devices have made this type of research more reliable and less burdensome on participants (Barrett & Barrett, 2001). Moreover, experience sampling offers several advantages over traditional cross-sectional designs, such as minimizing retrospective self-report bias and/or memory reconstruction errors, examining behaviours in their spontaneous contexts, and capturing intra-individual variability (Reis & Gable; Scollon, Prieto, & Diener, 2003).

Specifically, the ESM is ideally suited to collect data on daily physical activity and affect taking into account participants' naturalistic contexts (Hausenblas, Gauvin, Downs, & Duley, 2008; Lutz et al., 2008). Pioneer studies by Gauvin and colleagues (Gauvin et al., 1996; Gauvin et al., 2000) have spurred recent investigations that have helped to validate the ESM in this line of inquiry (e.g., Hyde, Conroy, Pincus & Ram, 2011; Lepage & Crowther, 2010). However, it has been under-employed in the aforementioned literature for SDT and the DMP. Therefore, to complement the experimental design in Study 1, the ESM was used in the second study of this dissertation. Moreover, this method was well suited to collect real-time data in the busy lives of active, multiple-role women.

Purposes & Hypotheses

The overall purpose of this dissertation was to examine the influence of theory-based motivation and passion predictors of the relationship between physical activity and indicators of well-being, namely affect and general vitality, in active women with multiple life roles. The effect of the perceived intensity of physical activity (RPE) was also of interest. Two studies were

conducted. The first was a within-groups laboratory study that focused on acute motivational components and subsequent affective responses from a self-paced running session versus a neutral, non-physical control activity (see Appendix B). This experimental framework offered significant control over extraneous factors. The second study was a 14-day experience sampling (ESM) examination of the influence of motivation and passion on the relationship between physical activity engagement and well-being outcomes in active, multiple-role women's natural environments. Passion, as a more contextual and encompassing individual concept, was deemed less pertinent to the content of *Study 1* which focused on acute, 'pre-post' relationships during two brief sessions. Study 2 served to complement the first by offering a naturalistic, longitudinal assessment of the variables of interest, thus maximizing the ecological validity of the present research.

Study 1- Laboratory Study

This study has been organized as two papers that explored distinct objectives. *Article 1* focuses solely on the running task and the interaction between motivation and RPE. *Article 2* investigates the full moderating influence of situational motivation with both running and control tasks.

Article 1-Purposes: Motivation, RPE interaction. This article targeted the influence of RPE and motivation on positive affect after a laboratory running task. The purpose was to explore whether there was an interaction between situational motivational regulations to engage in a running activity and a Ratings of Perceived Exertion (RPE) in predicting pre-to post-activity (i.e., running) changes in positive affect. Given previously acknowledged associations between different types of motivation and exercise intensity preferences, three types of motivation were targeted in the analyses, namely intrinsic, identified and introjected regulations.³

Article 2-Purposes: Moderating influence of motivation. The preliminary objective (P1) was to examine the influence of an acute bout of preferred exercise (i.e., running task) versus a non-physical control task on changes in positive affect from pre- to post- task.⁴ The main purpose (P2) of this study was to investigate the moderating influence of situational motivation for running on the relationship between an acute bout of running (versus a control task) and changes in positive affect from pre- to post- task. An additional, exploratory objective (P3) targeted the running task specifically and examined the relative influences of individual motivational regulations on positive affect after running, controlling for levels of affect pre-run.

Article 2- Hypotheses: Moderating influence of motivation. It was expected that participants would show a greater increase in positive affect from pre- to post- task with running versus a control task (H1). For the main purpose, based on SDT and previous studies (Edmunds et al., 2007; Lutz et al., 2003), it was hypothesized that levels of self-determined motivation for running would exert a moderating effect on pre- to post- task changes in positive affect such that: (a) Women with higher levels of intrinsic motivation and identified regulation would show strong increases in positive affect post-running but not post-control task; and (b) Women with higher levels of external and introjected regulations would show a weak or absent changes in positive affect post-running, similar to that achieved post-control task (H2). With respect to the final, exploratory objective it was expected that, after controlling for levels of positive affect pre-running task, self-determined regulations (i.e., intrinsic, identified) would exert positive influences on levels of positive affect post-running. Introjected and external regulations would show weak or slightly negative associations with post-running positive affect (H3).

Study 2- Experience Sampling Study

Article 3-Purposes: Motivation, RPE, and positive affect. The preliminary aim of this paper was to examine the relationships between pre-, post-, and three-hours post physical activity positive affect (P1). Another objective was to test the association between RPE and positive affect post- and 3-hours post- physical activity (P2). The main purpose was to examine the influence of situational motivational regulations on changes in positive affect from pre- to post- to 3-hours- post physical activity (P3). A supplemental purpose was to explore the influence of situational regulations on RPE (P4).

Article 3-Hypotheses: Motivation, RPE, and positive affect. Consistent with Reed and Ones (2006), it was expected that pre-physical activity positive affect would show a significant association with post-physical activity affect which would in turn be positively associated with positive affect three hours after physical activity, albeit to a lesser extent (H1). Significant associations between RPE and positive affect were expected such that there would be a positive association between RPE and positive affect and this relationship would be stronger post- compared to 3-hours post-physical activity (Reed & Ones, 2006; H2). For the main objective, based on SDT and past research (Kwan et al., 2011, Ryan & Deci, 2000) it was hypothesized that: (a) Situational intrinsic motivation and identified regulation would be positively related to positive affect post- and 3-hours post physical activity; and (b) Situational external and introjected regulations would be negatively related to positive affect post- and 3-hours post physical activity (H3). For the final purpose, it was expected that self-determined regulations, namely intrinsic motivation and identified regulation, as well as introjection would show positive associations with RPE (Duncan et al., 2010; H4). External regulation would not be significantly associated with RPE.

Supplemental analyses-Purposes. The original thesis proposal document also contained auxiliary purposes that were not feasible to include within the scope of *Article 3*. Therefore, they are presented in a supplemental section following *Article 3* as they were tested drawing from the same dataset. The supplemental purposes are numbered sequentially from *Article 3*. The first supplemental objective was to test Corollary 3.3 of the HMIEM regarding the top-down relationship between contextual and situational motivation (Vallerand, 2007a). Specifically, we examined the predictive relationship between contextual motivation (i.e., regulations) toward physical activity measured at baseline and situational motivation (i.e., regulations) toward each physical activity session over the 14-day investigation period (P5). In addition, we re-examined the first three objectives from *Article 3* (p. 29) but with negative affect replacing positive affect as the outcome variable (P6-P8).

Supplemental analyses-Hypotheses. As per the HMIEM (Vallerand, 2007a, 2007b) and past studies (Kowal & Fortier, 2000), it was expected that contextual motivational regulations for physical activity would be significantly and positively related with situational motivation regulations. That is, the higher (or lower) the score on self-determined contextual motivational regulations, the higher (or lower) the score on self-determined situational regulations for each physical activity session (and likewise for the non-self-determined regulations; H5).

Consistent with conclusions by Reed and Ones (2006) for positive affect and others for negative affective states (Focht & Koltyn, 1999; Rocheleau et al., 2004), it was expected that pre-physical activity negative affect would show a significant association with post-physical activity negative affect (i.e., reduction) which in turn would be positively associated with negative affect three hours after physical activity, albeit to a lesser extent (H6). Given notable inconsistency regarding the association between RPE and negative affect, both immediately post-

and hours after physical activity (Cox et al., 2006; Ekkekakis et al., 2008), this purpose remained exploratory. Moreover, there is some evidence that intensity tends to hold a complex curvilinear relationship with negative affect (i.e., increased negative affect with very high RPE; Arent, Landers, Matt & Etnier, 2005), thus no directional or time point-related hypotheses for RPE were forwarded (H7). For the main objective, based on SDT and relevant research on overall negative affect (Edmunds et al., 2007; Puente & Anshel, 2010), it was hypothesized that: (a) Situational intrinsic motivation and identified regulation would be negatively related to negative affect post- and 3-hours post physical activity; and that (b) Situational external and introjected regulations would be positively related to negative affect post- and 3-hours post physical activity (H8).

Article 4-Purposes: Passion and well-being. The first objective of the final article was to investigate the influence of engaging in one's passion (i.e., physical activity) on daily high and low activation positive and negative affect (P1). The second goal was to examine the influence of passion types (HP, OP) on daily positive and negative affect when women engaged in physical activity (P2). The third purpose was to examine whether levels of HP and OP would moderate the effect of activity engagement on daily affect (P3). The fourth purpose of this article was to examine, controlling for physical activity levels and using two complementary types of analyses, the relationship between HP as well as OP and levels of vitality measured two weeks later (P4).

Article 4-Hypotheses: Passion and well-being. It was expected that women would report greater positive- and lower negative affect on days when they engaged in their passionate activity versus days when they do not (Mageau & Vallerand 2007; Wichers et al., 2012; H1). On days when participants engaged in physical activity, it was hypothesized that a) levels of HP would be positively associated with positive affect and negatively related to negative affect, while b) reverse or non-significant associations would arise for OP levels (Rousseau &

Vallerand, 2008; Vallerand, 2012; H2). We expected a significant moderation effect such that higher OP would result in lower positive- and greater- negative affect on non-physical activity days compared to activity days (Mageau & Vallerand 2007). The discrepancy in affect across days would diminish with higher HP (Vallerand 2010; H3). Lastly, via group differences, we expected that women in a harmoniously passionate group (versus obsessive group), would show greater levels of vitality. With prospective regression, we hypothesized a positive relationship between HP and vitality, accompanied by a weak or negative association for OP (Philippe et al. 2009; H4).

Organization of the Thesis

The sections that follow are organized chronologically in the order the data was collected. That is, the results of Study 1 are presented first followed by Study 2, as outlined in the Purposes and Hypotheses section. The results pertaining to each article (and Supplemental section) are presented as individual chapters (i.e., Chapters II to VI). Specifically, the results for Study 1 are subdivided into *Article 1* (Chapter II) which is published in *The Journal of Obesity* and *Article 2* (Chapter III) which has been submitted for publication in *Sage Open*. Next, *Article 3* (Chapter IV), which has been accepted for publication in its present form in *Health Psychology Research* is followed by the *Supplemental Analyses* section (Chapter V). The purpose of the supplemental section is to present the results from objectives that were featured in the thesis proposal and that are relevant to *Article 3*. These findings make a valid contribution to the thesis. However, it was not feasible to include them within the scope of the *Article 3* publication due to length and complexity issues in presenting the results together in their entirety. All tables for the *Supplemental Analyses* appear in the final pages of this section. *Article 4* (Chapter VI) closes the results portion of the dissertation and this article has been submitted to *Psychology of Well-*

Being. Referencing and paragraph formatting (spacing) for each article coincide with the final version submitted to the respective journal.

Succeeding the presentation of results is Chapter VII: General Discussion. This section provides an overall summary and integrative discussion of material presented in the preceding chapters. Footnotes appear at the end of the respective section in which they are featured. A complete 'References' list for Chapters I (Introduction) and VII (General Discussion) appears at the end of Chapter VII. A Statement of Contributions section outlining my involvement and that of my article co-authors, as well as all Appendices for Studies 1 and 2 conclude this dissertation.

Footnotes (Introduction)

¹ *Physical activity* is defined as movement of the body that results in energy expenditure; this can be freely chosen and/or integrated into one's routine. *Exercise* is similarly defined but is more restricted in that it refers to movement that is planned, structured and repetitive with the objective of maintaining/improving fitness (Biddle & Mutrie 2008). For the purposes of this dissertation we will employ the more global term of *physical activity* in order to capture a broader spectrum of activities. That said, the term *exercise* will be employed when it applies to the cited literature and when it is most pertinent to our enquiries.

² *Mental health* is a broad term that the World Health Organization (2010) has identified as one component within its definition of health. The WHO describes health not merely as the absence of disease but as a fusion of physical, social, and mental dimensions of a person's existence (WHOQOL group, 1995). Mental health, in short, refers to an assortment of activities that are directly or indirectly related to the "promotion of well-being, the prevention of mental disorders, and the treatment and rehabilitation of people affected by mental disorders" ("Mental Health," para. 1).

³ Given the exploratory nature of the objectives in this article, no specific hypotheses were forwarded.

⁴ The original intent with Study 1 (*Article 1*) was to examine both positive and negative dimensions of affect. Therefore, the negative affect items of the affect measure (i.e., The Positive and Negative Affect Schedule [PANAS]; Watson, Clark, & Tellegen, 1988) were administered to all participants. Although a strong case has been argued in *Article 1* regarding the importance of concentrating on positive affect, other psychometric factors also led to a focus on the positive facet. Most importantly, the negative affect subscale of the PANAS (and high activation items

specifically), demonstrated very low variances in Study 1 thereby contributing to very low internal consistency values (α range: .22 - .75; See Table 1 in Appendix A). The low activation negative affect variable fared slightly better although the alpha value post-run was still very low ($\alpha = .29$).

In addition, and not surprising considering the above information, most of the distributions for negative affect did not satisfy the statistical assumptions for ANOVAs and multiple regressions. Kurtosis and skewness values (Table 1 in Appendix A) as well as outliers posed the greatest problems. As per Tabachnick and Fidell (2007), several outliers were given one value lower than the next lowest in the distribution. Yet, problematic distributions of the variables persisted. Transforming the negative affect variables, such as taking the square root or log function of the original values, did not rectify the distribution issues for all variables. Kwan and Bryan (2010b) reported a similar issue in their study:

Examinations of skew and kurtosis revealed no problematic deviations from normality or homoscedasticity, except for measures of negative affect. A minority of participants reported non-zero values on negative affect items at any point, indicative of floor effects. As such, there were no statistical transformations appropriate for this variable [...] (p. 77)

Other authors have also reported less than adequate properties for negative affect in exercise contexts (e.g., Lutz et al., 2008). Therefore, no purposes/hypotheses were included for either high- or low- activation negative affect in the articles of this particularly study.

CHAPTER II

**SITUATIONAL MOTIVATION AND PERCEIVED INTENSITY: THEIR
INTERACTION IN PREDICTING CHANGES IN POSITIVE AFFECT FROM
PHYSICAL ACTIVITY**

[RUNNING HEAD removed]

Situational Motivation and Perceived Intensity: Their Interaction in Predicting Changes in
Positive Affect from Physical Activity

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Abstract

There is evidence that affective experiences surrounding physical activity can contribute to the proper self-regulation of an active lifestyle. Motivation toward physical activity, as portrayed by Self-Determination Theory, has been linked to positive affect, as has the intensity of physical activity, especially of a preferred nature. The purpose of this experimental study was to examine the interaction between situational motivation and intensity [(i.e., Ratings of Perceived Exertion; (RPE))] in predicting changes in positive affect following an acute bout of preferred physical activity, namely running. Forty-one female runners engaged in a 30-minute self-paced treadmill run in a laboratory context. Situational motivation for running, pre- and post-running positive affect, and RPE were assessed via validated self-report questionnaires. Hierarchical regression analyses revealed a significant interaction effect between RPE and introjection ($p < .05$) but not between RPE and identified regulation or intrinsic motivation. At low levels of introjection, the influence of RPE on the change in positive affect was considerable, with higher RPE ratings being associated with greater increases in positive affect. The implications of the findings in light of SDT principles as well as the potential contingencies between the regulations and RPE in predicting positive affect among women are discussed.

Introduction

Physical activity (PA) has been identified as a hallmark contributor to individuals' quality of life [1], most notably among women [2]. Indeed, several research endeavours have converged on trying to understand the principal determinants of PA, and in particular, those factors that can be associated with individuals' volitional control of this specific behaviour. One factor that has been of mounting interest to behavioural scientists is that of affect and/or mood, which is defined as the *quality* of a subjective feeling state consisting of elements of valence (i.e., good/bad) and activation (i.e., high/low) [3]. Notably, studies have revealed associations between engaging in an acute bout of PA and immediate increases in *positive* affect [4]. In turn, basic affective reactions that are tied to a moderate intensity PA session (i.e., increases in positive affect) have been shown to predict futures bouts of PA six and twelve months later [5]. Indeed, repeated *positive* affective experiences associated with PA may sustain PA motivation over time and this can facilitate long term PA participation [6, 7]. It follows then that studying positive affect in the context of specific PA sessions is an outcome worthy of investigation in its own right, and this within broader attempts to understand how to optimally predict sustainable patterns of PA behaviour for successful weight management and greater well-being.

However, experts have highlighted that not all individuals who participate in PA achieve more positive affective states and ensuing increments in general well-being [8]. Indeed, results have not been entirely consistent as some participants have witnessed no change or a worsening of their affect with exercise [9]. This may have long-term implications in terms of sustaining adequate amounts of PA as well as levels of well-being. This has led to researchers' attempts to isolate the conditions under which the specific affective benefits of exercise might be maximized or conversely, thwarted.

In particular, one line of research has focused on the intensity of PA and its relationship with exercise-related affect. Meta-analytic findings have revealed that the effect of acute PA on positive-activated affect may be stronger at low-to-moderate intensities [4, 10]. In past studies, some researchers have attempted to uncover a “threshold of intensity” for the affective benefits of exercise, yet there is insufficient empirical evidence for an inverted U shape dose-response relationship [11]. From a more person-centered view, several researchers now argue that preferred/self-selected intensity might lead to stronger benefits in positive affect than prescribed PA intensities [12, 13]. Overall, the evidence is inconclusive as there appears to be significant inter-individual variability regarding the benchmark intensity level that is most conducive to increments in positive affect.

Another line of work that has specifically targeted such individual-based differences has also addressed a call for more theoretical research on possible psychological mechanisms underlying the PA-positive affect relationship [14, 15]. In particular, it has been suggested and recently emphasized that individuals’ motivational styles toward PA may supply a missing and understudied link [16]. Self-determination theory (SDT), one recognized and well supported motivational theory, distinguishes between two general types of motivation: self-determined motivation and controlled motivation (or regulation) [17]. Deci and Ryan [17] also classified motivation into several types of behavioural regulations that fall within these two broader categories. Overall, self-determined motivation is rooted in feelings of satisfaction, choice and volition. It is characterized as enjoying an activity for its own sake (i.e., intrinsic motivation) and/or assigning it value and personal importance (i.e., identified regulation). Controlled or non-self-determined motivation can be defined as engaging in an activity, such as exercise, so as to avoid self-inflicted shame or guilt, or to gain a personal reward, namely pride (introjected

regulation) [18]. Controlled motivation can also be characterized by being motivated according to external demands (e.g., to obtain a reward; external regulation) [18]. Self-determination theory also postulates another type of motivation, amotivation, which was deemed less relevant in the present study with active participants as it is defined as lacking the intention to act [17].

Self-determination, namely higher levels of intrinsic and identified styles of motivation, has been associated with healthy intentions to engage in health promoting behaviours such as PA [19]. In women, identified regulation has also stood out as a predictor of the intensity of PA engagement [20]. Higher levels of these self-determined regulations have also been *positively* associated with desirable psychological variables including PA enjoyment [21] and post-PA positive affect [22], as well as a battery of well-being indicators such as greater self-esteem and lower depression and state anxiety levels [23].

On the other hand and under the more controlling classifications, introjected regulation is considered less favourable than self-determined motivational styles [18]. Indeed research has revealed an association between introjected motivation for PA and maladaptive outcomes that include poorer life satisfaction [24] and exercise-dependence symptoms such as strenuous PA [25]. Similarly, higher scores on external motivation have been linked to self-esteem issues and higher levels of negative affect [26].

Although motivation toward PA and the perceived intensity of PA have seemingly been construed as independent influences, it could be that they exert an interaction effect on PA-induced affective changes. Such an interplay would be consistent with the expert-noted complexity of underlying mechanisms of the PA-affect (and well-being) relationship as well as new evidence regarding the relevance of motivational styles in predicting changes in affect following PA at self-selected intensities [15, 16]. Especially with introjected regulation, which

theory proposes should not be directly linked to well-being (and affect), perceived intensity may exert a particular contributing influence [27]. While other research, albeit scant, has underscored the possible interplay between self-selected PA intensity and psychological factors such as personality [28] and self-efficacy [29], to our knowledge no empirical research has properly entertained the interaction with motivation. Indeed, an interplay between perceived intensity (self-selected) and motivation styles in predicting changes in affect with acute PA could reveal a sustainable mechanism for long-term PA and well-being that lies within individuals' volitional regulation and that also capitalizes on the physical properties of exercise.

Therefore, the purpose of this controlled laboratory study was exploratory and was to examine whether there was an interaction between SDT's motivational regulations to engage in a running activity and Ratings of Perceived Exertion (RPE; self-selected intensity) in predicting pre-to post-PA (i.e., running) changes in positive affect. The three types of motivation were targeted given evidence cited above as well as recently revealed associations between motivation types and intensity preferences. Lastly, this study was conducted with *active women* given that the link between PA and affect may be particularly evident in active individuals experienced with PA [30, 31] as well as among women [32, 33]. This would allow for a "model" sample to highlight the above underlying theoretical relationships; in addition, this would contribute to an important need to better understand how to develop successful PA intervention strategies in women [34].

Methods

Participants

Forty-one healthy and active women (i.e., > 20 minutes of moderate to vigorous PA three times per week) with an average age of 40.98 ($SD = 4.93$) participated in this study. The Godin

Leisure Time Exercise Questionnaire [35], a common and validated self-report measure of PA levels, was administered as a screening measure and the mean score for this sample was high at 59.71. The participants also had a low average BMI of 22.47. To minimize confounding influences in the experimental protocol, it was necessary that participants self-report running as their preferred or most frequent exercise modality [36]. In their leisure time, the women reported running at a mean RPE of 13.37 ($SD = 1.22$). They also gave an average of 8.60 km for a usual run and/or 49.37 minutes per run. The women in this sample were well-educated (82.9% with a university degree or higher) and all were employed outside of the home.

Measures

Positive affect. The Positive Affect Negative Affect Schedule (PANAS) [37], comprised of 20 adjective words (10 positive, 10 negative), was used to assess participants' affect. According to the circumplex model, affect can be characterized by the dimensions of valence (positive, negative) as well as activation (low, high) and experts maintain that the PANAS focuses on the high activation component of affect [38]. For each adjective, participants rated their response from (1) not at all to (5) extremely using the stem *Indicate to what extent you feel this way right now, that is, at the present moment*. Examples of adjectives include: excited (positive) and upset (negative). Given the focus on *positive* affect in the present investigation, only these adjectives were summed and analyzed. In the present study, the Cronbach Alpha for the positive subscale pre- and post-running were .88 and .91 respectively.

Motivation. The Situational Motivation Scale (SIMS) [39] was employed to measure situational motivation to run. The SIMS is comprised of 16 items across four subscales that assess the different behavioural regulations (intrinsic motivation, identified, external,

amotivation). Introjected regulation was excluded from the original SIMS in order to have a more succinct instrument for research purposes [39]. In the current study, an enhanced version of the SIMS with four validated items tapping this type of regulation was used [40, 41]. Using a 7-point Likert Scale from (1) corresponds not at all to (7) corresponds exactly, participants respond to stem *why are you currently [about to run]*, for items that included “Because I want to avoid feeling guilty” (introjection) and “Because I am doing it for my own good” (identified). Average score were calculated for intrinsic motivation, introjected regulation, and identified regulation. As expected from a sample of active participants, scores on external regulation and amotivation were low and variance levels were negligible, which contributed to low internal consistency values. No further analyses were conducted on these regulations. The Cronbach alphas of relevant subscales were acceptable to good with values of .65, .85, and .85 for identified regulation, introjected regulation and intrinsic motivation respectively.

Perceived intensity. The Ratings of Perceived Exertion (RPE) Scale [42] was administered in the minutes immediately following the run to assess the perceived intensity/exertion of the running activity. More specifically, and similar to previous studies, we employed what some experts have coined “session RPE”, whereby participants were instructed to rate the overall intensity of the full running session [43, 44]. This was expected to minimize the influence of momentary fluctuations in how participants’ perceived their exertion, which could contaminate the accuracy of the overall evaluation. Numerical values from 6 to 20 make up the [session] RPE scale which is also anchored at every odd integer with a brief descriptor (i.e., 7 = very, very light; 13 = somewhat hard; 19 = very, very hard). The validity and reliability of the RPE are well established given its frequent usage in studies of PA and mood [45].

Procedures

This study was approved by the Ethics Review Board of the University of Ottawa and was part of a larger project. Interested subjects attended an individual session at a university laboratory space. Upon arrival, participants provided written informed consent and promptly responded to the SIMS and the PANAS prior to the running activity. Participants were taken to a private exercise room equipped with a treadmill, a desk, and a chair and were explained the running protocol. In order to mimic a self-paced run and yet easily log the pace of the run to ensure that at least a moderate intensity run was being met, the treadmill control panel was physically detached from the treadmill running belt. This allowed the researcher to easily adjust settings in response to any and all demands from the participant. The participants completed a 2-3 minute warm-up walk at an average speed of 5.17 km/hour. Next, the researcher sped up the belt to the participant's desired pace. The researcher remained in proximity in order to speed up or slow down the belt as frequently as necessary, the details and timing of which were duly noted. By weighting any change in pace by the ratio of elapsed time at that pace, an average running pace was computed. There was minimal conversation and eye contact between participant and researcher and the treadmill was maintained at a grade of zero. Participants ran for a 30-minute duration in order to stay consistent with previous inquiries on acute exercise and affective states (for example, Bartholomew et al., 2005 [46]). Afterwards, the belt was slowed to the initial walking speed for a 2-minute cool-down and participants provided the session RPE for the 30-minute running component. Lastly, participants responded to the PANAS once again.

Analyses

All data were entered into SPSS Version 18.0; sums, means, and standard deviations were calculated. Initial data screening procedures were conducted according to procedures outlined in

Tabachnick and Fidell [47]. Namely, assessments were conducted for data entry errors, missing data, outliers, normality and the basic assumptions of regression analyses. Descriptive statistics and reliability analyses were calculated for affect and motivation variables. A repeated-measures t-test compared pre-run and post-run levels of positive affect as a preliminary examination of whether the run had a significant influence on participants' affect.

A standardized residual change score for positive affect was calculated for each participant in order to adequately account for participants' initial affect scores [48]. Namely, a predictor score was computed by regressing post-run affect on pre-run affect and then subtracting this from the observed scores. The residual change score served as the outcome variable in three separate hierarchical multiple regression models that were employed to test the interaction between RPE and situational motivation for running. Specifically, separate product terms for RPE and the three motivational regulations were created using standardized scores and each term was added as the last step in their respective regression models.

Results

During the experimental running session, participants ran at an average pace of 9.66 km/hour and provided a mean RPE of 12.79. This value reflects a moderate to high intensity that was similar to the usual RPE achieved by the women outside of the laboratory. There were no univariate outliers on any of the variables. All assumptions regarding normality, linearity, and homoscedasticity were met and there was no evidence of collinearity. Positive affect increased significantly from pre- to post- run [$t(40) = 4.83, p < .001$]. See Table 1 for descriptive statistics.

Results of the hierarchical regression analyses showed no significant interaction between intrinsic motivation and RPE on residual change scores in positive affect [$F_{\text{change}}(1,37) = .23, P = .63$] nor between identified regulation and RPE [$F_{\text{change}}(1,37) = 1.82, P = .19$]. However, there

was a significant interaction effect of RPE and introjection [$F_{\text{change}}(1,37) = 4.20, \beta = -.30 P < .05$] which explained an additional 9% of variance in the change in positive affect from the variables alone.

As displayed in Figure 1, when participants reported low introjection, the influence of perceived running intensity on the change in positive affect was considerable, with higher RPE being associated with a greater increase in affect from pre- to post-run. This effect became less pronounced with rising levels of introjection. That is, when participants reported high introjected regulation, the change in positive affect was elevated and fluctuated very little with rising RPE values, and even showed a trend toward diminishing slightly.

Discussion

The results of this experimental study revealed a significant interaction between RPE (i.e., intensity) and introjected regulation but not between RPE and intrinsic or identified styles of motivation in predicting changes in positive affect from pre- to post-running. To our knowledge, this is the first study to have examined this interplay, which builds on previous deliberations by Ekkekakis and Lind [49] regarding a potentially complex causal chain linking intensity, pleasure from exercise and adherence, among other factors. In particular, our investigation offers an important adjunct to a study by Duncan and colleagues [20] that revealed associations between SDT's motivational regulations and PA intensity. Specifically, we considered the interaction *between* these variables in explaining a factor that is being increasingly recognized not only as an important consequence of PA but also as a viable determinant of future participation, namely positive affect [5]. Our results attest to recent suggestion that a person's motivational style for PA should be considered when attempting to maximize the affective gains of aerobic PA, especially at a self-selected intensity [16]. The strengths of this investigation include the self-

paced nature of the running activity, a situational measure of motivation for running, and the use of a well-controlled laboratory environment.

Researchers have observed that up to very high exertion levels, there is a basic positive linear association between exercise intensity and affect [50]. While the basic linear relationship (RPE-positive affect) in this study was in fact positive for low and moderate levels introjection, it deviated markedly for those high in introjection, such that affective changes were fairly stable regardless of perceived intensity. While introjection has been associated with engaging in vigorous exercise [20], our results imply that this relationship may have little bearing on the acute mood changes that are experienced through PA, at least among avid female runners. This interplay may even be worrisome given a downward trend in positive affect as the RPE increased among highly introjected runners. This could suggest that active females that are high in introjection achieve some form of an immediate ‘feel-good’ or ‘relief’ effect from an activity such as running that serves to prevent or relieve feelings of guilt, thereby materializing irrespective of perceived intensity. This was evidenced in our study by greater overall gains in affect for those high in introjection, which may be akin to what Sabiston and colleagues [51] referred to as the *reparative* properties of motivation from guilt.

On the other hand, among runners lower in introjected regulation, changes in positive affect were associated with greater variability in RPE which could indicate a greater appreciation of the sensations and physical properties of PA. Lind et al. [52] remarked that individuals usually choose to exercise at a pace that improves or maintains their mood. Our findings show that this may be more applicable for exercisers with lower introjection and who are less driven by internal pressures to exercise, thereby freeing them to experience the PA session more fully. Therefore, *in-task* affective states and sensation, which were not assessed in our study, could be a source of

discrepancy between persons high and low in introjection. Future studies should consider open-ended probes during acute PA sessions in order to ascertain the pertinent sources of affective changes between individuals that differ in motivational style.

Despite its effect on positive affect in our study, as well its influence on sustaining high intensity PA [20], introjection has been associated with several negative psychological consequences that were not assessed in our acute exercise study (e.g., lower self-worth and life satisfaction) [24]. Thus, cautious interpretation of our results is warranted as immediate improvements in positive affect may not necessarily translate into benefits in general well-being [51]. This could be disconcerting if we consider that individuals with lower levels of well-being are generally less likely to engage in PA [53], thus initiating a questionable cycle of regular PA maintenance and compounding issues related to leading a healthy and active lifestyle.

On a different note, the results showing non-significant interactions between more self-determined motivational styles and RPE may be of theoretical significance. Similar to what was discussed above with respect to runners with lower levels of introjection, our results hint that those with higher levels of intrinsic and/or identified regulation could have less contingencies attached to their exercise engagement. In this regard, Burton and colleagues [54] found that being intrinsically motivated positively predicted well-being independently of the level of performance. Moreover, they found that fostering intrinsic motivation may diminish certain contingencies between one's perceived performance and their well-being. This is consistent with SDT principles and research revealing that despite variability in perceived competence for an activity, self-determined individuals show greater interest, pleasure and confidence which is exhibited through greater well-being [55]. Thus, the relationship between self-determined regulations and well-being is more likely of a direct nature, as indicated in the present study

whereby perceived intensity, which could be viewed as an indicator of their performance, did not significantly shape post-PA changes in positive affect among the women higher on self-determined regulations. Other authors have also noted a direct relationship between identified and intrinsic motivation and post-PA affect as an indicator well-being [22]. In addition, and from a psychometric perspective, ceiling effects could be partly to blame for non-significant findings given the high means and low variances for these variables, especially identified regulation.

With respect to other possible limitations of this study, there are variant opinions in the literature regarding the optimal time point(s) at which to assess RPE. We opted to assess session RPE immediately post-PA which is common practice among researchers [50, 56]. However, some authors such as Singh et al. [57] argue that post-PA RPE can vary significantly in the few minutes following exercise (e.g., between 5-10 minutes) and that evaluations of RPE taken 15-30 minutes after PA are more stable and valid indicators of participants' perceived intensity. Still, other experts gravitate away from session RPE altogether claiming that repetitive RPE measurements at regular intervals during a PA session provide a more representative measure of intensity [58, 59]. In future studies, researchers will need to address concerns over the optimal time point(s) for RPE measurement(s) in studying exercise-related affect and they may wish to supplement such inquiries with alternative and objective measures of intensity. Similarly, researchers might wish to consider the use of research designs that capitalize on longitudinal and in-task effects of motivation and intensity on indicators of well-being.

In addition, future studies will need to make use of larger samples and draw from groups of participants that are more diverse in terms of activity levels as this may alleviate some of the psychometric issues regarding the assessment of certain motivational styles. The use of only active, healthy-weight women could also be considered a drawback of the present study in terms

of generalizability and it would be worthwhile to test the given interactions in overweight or obese individuals who may experience PA differently [60]. Researchers have already shown that autonomous regulations are associated with long-term weight management as well as indicators of well-being in obese populations [23, 61] and it would be worthwhile to examine the interplay with PA intensity in order to develop optimal interventions strategies for these individuals.

Yet it is also interesting to note that some studies have actually shown that affective experiences and pleasure from exercise might not significantly differ between normal weight and overweight women, at least at self-selected intensities [29, 49]. In addition, other experts mention that it is actually fruitful to study an active population as much can be learned regarding the determinants of successful PA engagement and associated consequences and this could then be targeted among the insufficiently active [20]. Moreover the purpose of this study was to explore a theory-based interaction mechanism and therefore it was advantageous to select a sample that could maximize the postulated relationships. In sum, while women *higher* in introjection showed the greatest change in positive affect post-running, further reasoning as to why this increase was not particularly sensitive to the self-selected intensity of the run (RPE), as well as the long-term impact of this relationship on well-being and PA maintenance, is left to future inquiries.

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Table 1. *Means and standard deviations (SD) for situational motivational regulations, positive affect, and rating of perceived exertion (RPE).*

Variable	Mean	SD
Intrinsic motivation for running	5.80	.82
Identified regulation for running	6.35	.47
Introjected regulation for running	3.23	1.44
Pre-run positive affect	33.39	6.36
Post-run positive affect	36.02	6.93
RPE	12.79	1.15

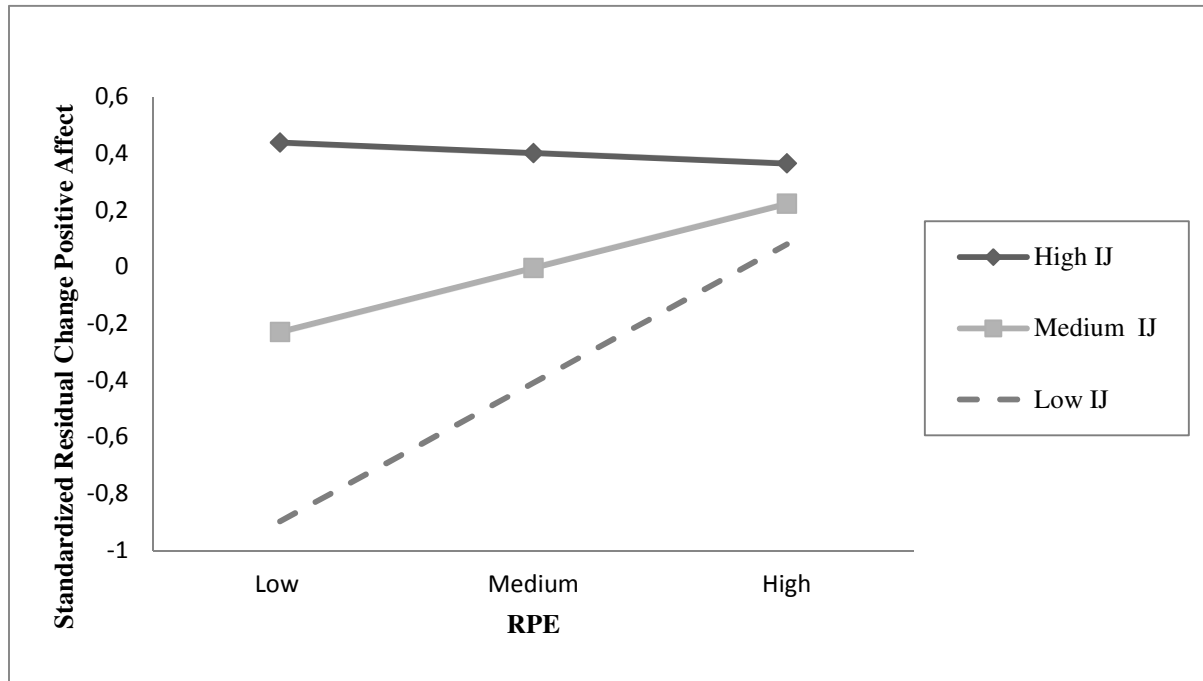


Figure 1. The interaction between introjected motivation for running (IJ) and Ratings of Perceived Exertion (RPE) on residualized change scores in positive affect.

CHAPTER III

THE MODERATING INFLUENCE OF SITUATIONAL MOTIVATION ON THE RELATIONSHIP BETWEEN PREFERRED EXERCISE AND POSITIVE AFFECT: AN EXPERIMENTAL STUDY

[RUNNING HEAD removed]

The Moderating Influence of Situational Motivation on the Relationship Between Preferred
Exercise and Positive Affect: An Experimental Study

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Abstract

Despite convincing evidence supporting the association between exercise and positive affect, this complex relationship requires further theoretical and person-centered explanation. The nature of one's motivation toward exercise, as postulated by Self-Determination Theory (SDT), may supply a missing and understudied link. The primary aim of this experimental study was to examine the moderating influence of situational motivation on the relationship between an acute bout of preferred exercise, namely running (vs. control), and changes in positive affect. Forty-one active women attended two sessions to engage in (a) a 30-minute moderate-intensity self-paced treadmill run and (b) a 30-minute quiet activity (i.e., newspaper reading). Participants with high introjection versus those with low introjection reported a greater increase in positive affect from pre- to post-running and a greater decrease in positive affect from pre- to post-control. Motivational variables accounted for 7% of variance in post- run positive affect.

Keywords: exercise; positive affect; motivation; self-determination theory; women

Introduction

Physical Activity, Affect and Motivation

There is a growing literature demonstrating that exercise is associated with greater well-being (Lotan, Merrick, & Carmeli, 2005; Brown, Gilson, Burton, & Brown, 2011). In particular, there is budding evidence regarding the positive influence of exercise and physical activity at large on several indicators of well-being, including affect (Berger & Motl, 2000; Biddle & Mutrie, 2008). By definition, affect reflects the quality of a subjective feeling state and according to the circumplex model, it can be characterized by two bipolar and orthogonal dimensions, namely valence (positive, negative) and activation [high (HA), low (LA); Ekkekakis & Petruzello, 2002]. While HA affect refers to an energetic state and excitation, LA affect refers to a calm, relaxed and/or depressed state. Greater levels of positive affect have been identified as a hallmark quality of well-being (Russell, 2003). In particular, repeated satisfying exposure to short-term positive affect states, such as those achievable with acute bouts of exercise, can lead to increased well-being (Lyubomirsky, King, & Diener, 2005; Rousseau & Vallerand, 2008).

Indeed there is meta-analytic evidence to indicate that acute exercise has a moderate, consistent effect on levels of positive affect (Reed & Ones, 2006). Although under examined as an influential factor in regular exercise engagement, repeated, positive affective experiences associated with individual (acute) exercise sessions may sustain motivation over time and this can facilitate long term exercise participation (Focht, 2009; Kwan & Bryan, 2010). It is not surprising then that the link between exercise and affect may be particularly evident in active individuals who are experienced with exercise (Hoffman & Hoffman, 2008; Markowitz & Arent, 2010). According to some authors, it can be rather informative to study an active population as much can be learned regarding the determinants of successful exercise engagement and

associated consequences which could then be targeted among the insufficiently active (Duncan, Hall, Wilson, & O, 2010).

Likewise, the relationship between exercise and well-being, especially affect, seems to be quite pronounced in women (Kelsey et al., 2006; Kull, 2002). Studies with women consistently demonstrate the positive influence of exercise on affective states immediately afterwards (Cramp & Bray, 2010; Gauvin, Rejeski, & Reboussin, 2000). More generally, researchers have found that active women experience greater general well-being than those that are inactive (Gill, Williams, Williams, Butki, & Young, 1997; Kull, 2002). Despite the emotional benefits, women engage in lower levels of physical activity than men (Bassett, Wyatt, Thompson, Peters, & Hill, 2010; Colley et al., 2011), which may be related to socio-psychological variables that are uniquely associated with women's engagement in exercise (Segar, Jayaratne, Hanlon, & Richardson, 2002). Moreover, women's mental health is generally poorer than men's and is deserving of research attention in its own right (Denton, Prus, & Walters, 2004).

Although the evidence to date is rather convincing, the relationship between exercise and well-being in both men and women is far from simplistic, particularly when it comes to affective states (Biddle & Ekkekakis, 2005). Indeed, variability across research findings is indicative that not all individuals who participate in exercise achieve greater well-being (O'Connor & Puetz, 2005). For instance, Van Landuyt et al. (2000) found that only half of participants engaging in a 30- minute moderate to high intensity cycling task felt progressively better (Van Landuyt, Ekkekakis, Hall, & Petruzzello). The implication of these and other findings (e.g., Brown et al., 2004) is that merely engaging in exercise, in terms of amount and/or intensity, may be insufficient to accrue benefits in affect and well-being. Indeed, there is a need for more sophisticated knowledge of underlying processes with which exercise may or may not benefit

affective states (Berger & Motl, 2000; Biddle & Ekkekakis, 2005; Ekkekakis, Parfitt, & Petruzzello, 2011). Specifically, experts have called for more research on the *moderators* associated with different patterns of post-exercise affect (Reed & Ones, 2006). Moderating variables inform us of the circumstances under which a given association occurs.

Although exercise characteristics such as type, intensity, and duration can modify its association with affect, the evidence remains inconsistent (Markowitz & Arent, 2010). In addition, a sizeable proportion of earlier research on exercise stimulus factors has been atheoretical, prompting experts to recommend greater use of theoretical models (Berger & Motl, 2000; Reed & Buck, 2009). The use of theory allows us to move beyond description to conjure up explanations of how and why certain phenomena occur (or do not). Despite conceptual progress in the last decade (e.g., ‘dual-mode theory’, Ekkekakis, 2003), there is a persistent tendency to prioritize physiological processes (Ekkekakis et al. 2011), whereas other theory-based variables of a psychological nature ought to be better accounted for (Reed & Ones, 2006; Berger & Motl). Amongst the theoretical, person-centered research that has emerged (e.g., self-efficacy; Raedeke, Focht, & Scales, 2009), to our knowledge there is still a gap with respect to moderating *motivational* variables, as initially highlighted by Berger and Motl. Certainly there is a need for more theory-based enquiries of motivation in this area given the central role of motivational variables in our understanding of exercise behaviour and of indicators of well-being such as positive affect (Biddle & Mutrie, 2008; Sebire, Standage, & Vansteenkiste, 2009).

Specifically, the quality of motivation, namely one’s self-determination (Deci & Ryan, 1985; 2000), may supply a missing link in understanding well-being (affect) -related outcomes of exercise (Thøgersen-Ntoumani & Fox, 2007). Moderation frameworks with self-determined motivation have proven useful in explaining ‘behaviour-well-being’ relationships (Lemyre,

Roberts, & Stray-Gundersen, 2007). According to the founders of Self-Determination Theory (SDT), motivation can be distinguished along a continuum from controlled (extrinsic) motivation, resulting from demands and/or pressure, to more autonomous or self-determined motivation, arising from elements of volition, choice, and interest (Deci & Ryan, 1985). The continuum is delineated as having six behavioural regulations that are increasingly more self-determined (Deci & Ryan, 2002). The influence of motivation is also thought to be hierarchically organized, whereby the regulations operate at three levels of generality: situational, contextual, and global (Vallerand, 2007). Within this hierarchy, the level of a given outcome (e.g., post-exercise affect) should correspond to the motivation level that produced it (e.g., pre-, situational).

Amotivation lies at one end of the continuum and represents lacking the intention to act (Deci & Ryan, 2002) and adjacent to it, external regulation is defined as being motivated according to external demands (e.g., to obtain a reward). Next, introjection involves a slight internalization of the behaviour, a processes whereby regulation of a behaviour is taken in and integrated with one's sense of who they are (Deci & Ryan, 2002), but with little acceptance as one's own since it arises from sentiments of guilt or shame. Often, one feels pressure to engage in the activity to gain a sense of self-worth. Ensuing on the spectrum is identified regulation; this is the first of the more self-determined motivation types as it arises when an individual values the behaviour (i.e., exercise) and assigns it personal importance. It is followed by integrated regulation which involves engaging in an activity because it is well assimilated into one's identity and core values. Lastly, at the other extremity of the continuum lies intrinsic motivation, as characterized by enjoyment and by inherent satisfaction in an activity, whereby an individual engages in the activity for its own sake (Deci & Ryan, 2002).

In SDT, it is posited that controlling forms of motivation generally lead to less adaptive consequences than more autonomous motivation. For instance in the exercise context, external regulation among women has been associated with unstable self-esteem and greater negative affect (Gagné, Ryan, & Bargmann, 2003). Moreover, introjected regulation for exercise has been linked to lower vitality and poorer life satisfaction (Edmunds, Ntoumanis, & Duda, 2007; Thøgersen-Ntoumani & Fox, 2007). However, results are somewhat equivocal with introjection as this type of motivation has also been correlated with behavioural persistence (Stephan, Boiché, & Le Scanff, 2010; Sabiston et al., 2010). There is evidence that, for women, higher amounts of introjection can have a positive influence on intentions and exercise behaviour itself (Markland, 2009; Thøgersen-Ntoumani & Ntoumanis, 2006). This controlling regulation has also been associated with the intensity with which women exert themselves during exercise, which can impact their affect post-exercise (Duncan et al., 2010; Guérin & Fortier, 2012). Indeed, women have been found to endorse greater levels of introjection than men (Wilson, Rodgers, Fraser, & Murray, 2004). In sum, the influence of introjection appears to be ambiguous. While introjection can positively predict behavioural engagement (i.e., exercise), it may simultaneously compromise one's greater well-being (i.e., affect), as purported by SDT (Teixeira et al., 2012).

Conversely, studies have consistently shown that individuals who are more self-determined for exercise tend to not only engage in higher levels of physical activity (Sebire, Standage, & Vansteenkiste, 2011); they also report greater emotional benefits such as elevated general positive affect (Puente & Anshel, 2010). Self-determined motivation, namely intrinsic motivation and identified regulation, can also predict better self-evaluation patterns, which have been linked to positive affect and well-being (Brunet & Sabiston, 2009; Thøgersen-Ntoumani &

Ntoumanis, 2006). Among regular exercisers, intrinsic exercise motives have been tied to lower stress levels and better scores on global indicators of well-being (Maltby & Day, 2001).

There are only a few studies that have examined the influence of self-determination on positive affect in the acute phase of exercise. Among them, Lutz, Lochbaum, and Turnbow (2003) found that higher self-determined contextual motivation toward exercise predicted greater positive affect after an exercise class. However, their research design did not allow for testing the specific moderating effect of self-determined motivation, including the motivational regulations as distinct predictors/moderators, and the authors focused on contextual motivation. Moreover, Lutz et al. employed the convenience of an exercise class rather than an experimental design. Despite the advantage of naturalistic research for improved ecological validity, it offers less containment of confounding influences (e.g., social variables, distractions, etc.).

Also, there is evidence to support that affective states produced or modified in controlled environments are not all that different from those produced in non-laboratory settings (Blanchard, Rodgers, & Gauvin, 2004). Experimental studies of exercise allocate good control over extraneous influences, allowing for explorations of potential mechanisms as well as moderating processes/conditions. Therefore, the focus of the present investigation was on the moderating effect of motivation on the acute exercise-positive affect link in the context of an in-laboratory, running-based experiment. To our knowledge, this is the first study to pursue this. In keeping with expert advice that laboratory researchers should adequately match an exerciser's usual exercise modality (Kerr & Kuk, 2001), we targeted self-reported runners. This was also prudent given evidence that exercise preference and familiarity can influence exercise-related mood changes (Lane, Jackson, & Terry, 2005). Likewise, a self-paced running task was deemed favourable as this is in line with SDT principles of optimizing choice as well as evidence

showing greater positive affective responses from self-paced exercise (Vazou-Ekkekakakis & Ekkekakis, 2009).

Aims & Hypotheses

The purpose of this within-subject experiment was to examine the moderating influence of situational motivation (for running) on the relationship between an acute bout of preferred exercise (i.e., running; vs. control) and pre-post changes in positive affect. This study was part of a larger project. The results of a preliminary paper focusing solely on the running activity showed that introjected regulation interacted with the perceived intensity of the run (RPE) to predict positive affect, such that women with lower introjection saw improvements in positive affect as their RPE for the run increased (Guérin & Fortier, 2012). By comparing a running activity with a control task, the present enquiry expands on the previous article by testing the full moderating effect of motivational regulations individually. Several premises were tested.

First, a preliminary hypothesis was that participants would show a greater pre-to-post increase in positive affect when engaging in a running task compared to a control task (Blanchard, et al., 2004; Reed & Ones, 2006). Second, based on SDT and past research, it was expected that self-determined motivation for running would moderate the effect of exercise (run) on pre-to-post changes in affect. That is, women with higher levels of intrinsic motivation and identified regulation would show strong increases in positive affect post-running (not post-control). In contrast, women with higher levels of external and introjected regulations would show a weak or no change in positive affect post-running, similar to that achieved post-control.

Given these speculations, a third and exploratory line of enquiry targeted the relative effects of motivational regulations on positive affect following the running task specifically. Based on SDT and previous findings (Lutz et al., 2003; Edmunds et al., 2007), it was expected

that intrinsic and identified regulations would exert positive influences on post-run positive affect after controlling for pre-run (baseline) levels of affect. These regulations would explain a greater amount of variance in post-run positive affect than introjected or external regulations, as these latter associations with post-run affect were expected to be weak or even slightly negative.

Methods

Participants

Women between the ages of 25 and 55 were recruited from local universities, chiropractic clinics, and sport/children stores via posters and word of mouth as well as through running/athletics websites. Eligible participants reported no underlying medical condition, were not currently pregnant, and satisfied a health screening test for exercise. All participants were active, that is, they reported a minimum of 20 minutes of moderate to vigorous exercise at least three times per week for at least six months. It was also required that participants perceive running as their preferred or most frequent exercise modality. These criteria were confirmed via self-report during each participant's initial contact to partake in this study.¹ The final sample size was 41 and this was deemed satisfactory to detect a medium-sized effect using repeated measures ANOVAs (GPower 3.1.2) and as established from previous studies (Reed & Ones, 2006). Although small for multiple regressions, these adjunct analyses served an exploratory purpose and no a-priori power analysis was conducted. That said, similar sample sizes have been used in other repeated-measures investigations in this area as well other studies applying hierarchical regression with a similar number of variables (e.g., Berlin, Kop, & Deuster, 2006).

Measures

Demographic/background measures. A demographic form consisted of open- and closed-ended questions requesting information that was both general (e.g., occupation, height,

weight) and running specific (e.g., *I have been running at my current intensity/frequency for: [blank] months*). Body Mass Index (BMI) was calculated as *weight* (in pounds) multiplied by 703 then divided by *height* (in inches) squared. The Godin Leisure Time Exercise Questionnaire (LTEQ; Godin & Shephard, 1985) was used to describe the current exercise levels of participants in this study. Participants evaluated the number of days in a typical week they had engaged in light, moderate, and strenuous exercise. The frequency values were multiplied by their corresponding intensity value, namely three, five, and nine, then summed to provide a total weekly activity score. All 41 women met a cut-off score of 24 in order to be included in the analyses. This value is consistent with recommendations for health benefits and is the equivalent of just over two vigorous and one moderate session per week (Godin, 2011).

Main measures: Affect. The Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988) was administered to measure pre- and post-task affect. The PANAS has been a popular instrument to assess affect in SDT research and in exercise studies (Reed & Ones, 2006). The PANAS is an appropriate measure across exercise and non-exercise situations (i.e., laboratory studies), albeit it is a measure of HA affect only (Ekkekakis & Petruzzello, 2001). However, some researchers have substantiated that exercise can induce positive feelings of calmness and relaxation, typical of LA affect, and argue that these affective properties should not be ignored (Blanchard et al., 2004; Gauvin & Rejeski, 2001). Given that LA items have been integrated into the PANAS in other domains (e.g., Abercrombie, Kalin, & Davidson, 2005), doing so in the exercise context would make a welcomed contribution. In the present study, 11 items (5 positive) established by Feldman Barrett and Russell (1998) assessing LA affect were added to supplement the PANAS which is originally comprised of 20 adjective words, 10 positive and 10 negative (also see Abercrombie et al.).²

For each of the 31 adjectives, responses to the stem *Indicate to what extent you feel this way right now, that is, at the present moment* were rated from (1) not at all to (5) extremely. Examples of adjectives include “excited” (positive, HA) and “serene” (positive, LA). Given the focus on *positive* affect in this study, only these items were summed, separately for HA and LA, and analyzed.³ Internal consistency values for all times points in the present study were robust and can be found in Table 1.

Main measures: Situational motivation. The Situational Motivation Scale (SIMS; Guay, Vallerand, & Blanchard, 2000) was employed to measure situational motivation for running. The SIMS consists of 16-items with four subscales that tap the different behavioural regulations (Standage, Treasure, Duda, & Prusak, 2003). Integrated and introjected regulations were excluded from the original SIMS in order to condense the scale (Guay et al., 2000). However, given the relevance of introjection in the present study, an enhanced version of the SIMS was employed which contained four additional items developed by Gillet et al. (in press) to target this regulation (Gillet, Vallerand, Lafrenière, & Bureau).⁴ Responses to the stem *why are you currently [about to run]* are anchored on a 7-point Likert Scale from (1) corresponds not at all to (7) corresponds exactly. A sample item is “because I think this activity is pleasant” (intrinsic motivation).

Average scores were calculated for intrinsic motivation, identified regulation, and introjected regulation. The psychometric properties of the SIMS are documented elsewhere, including significant factor loadings for the modified version with introjection (Gillet et al., in press; Standage et al. 2003). The Cronbach’s alpha values of the given subscales in the present study are displayed in Table 1. As expected from a sample of active participants, scores on external regulation and amotivation were low and variance levels were negligible, which

contributed to low internal consistency values. No further analyses were conducted on these regulations; no hypotheses had been forwarded for amotivation.

Intensity measure. In this study, the Ratings of Perceived Exertion Scale (RPE; Borg, 1982) was employed solely for descriptive purposes regarding the average perceived intensity of the running task and not for the purpose of analysis. Readers can consult Guérin and Fortier (2012) for a detailed investigation. The RPE consists of self-reported numerical values from 6 to 20 that are anchored with descriptors at every odd integer (i.e., 7 = very, very light; 13 = somewhat hard; 19 = very, very hard). The RPE has been popularized in studies of exercise and affect and its validity and reliability are well established (Russell & Newton, 2008).

Design and Procedures

This experimental study followed a 2 (running, control) x 2 (pre, post) repeated-measures design. A traditional pre-post design was employed based on the results of an important meta-analytic review (Reed & Ones, 2006) and given that the focus in our study, similar to others, was on immediate changes in affect following exercise (Miller, Bartholomew, & Springer, 2005; Hallgren, Moss, & Gastin, 2010). Participants attended two individual sessions at a campus laboratory space. Upon arrival, the women provided written consent after being informed of (a) the purpose to examine psychological factors during physical and/or non-physical activities, and (b) the protocol, namely that at the start of each session they would be randomly assigned to one of two tasks (i.e., running, quiet attention-control). In reality, a direct within-person comparison of the two tasks was sought therefore counterbalancing was used to assign half of the women to the running task at session 1 ($n = 21$) and the other half at session 2. Blinding the participants to the task they would receive at each session was expected to minimize carry-over and expectation effects. This study was approved by the University of Ottawa Ethics Review Board.

At the start of session 1, each woman completed the intake assessment and the LTEQ followed by the SIMS and the PANAS promptly before being assigned one of the tasks. Session 2 followed a similar format, although background measures were omitted. Session 2 also concluded with a short debrief to inform participant of all components of this study.

Running task. Each participant was taken to a private exercise room equipped with a treadmill, a desk, and a chair. The treadmill control panel was physically detached from the running belt. This allowed the researcher to easily monitor and adjust settings according to the participant's requests in order to mimic a self-paced, moderate-to-high intensity run. The participants completed a 2-3 minute warm-up at an average speed of 5.17 km/hour. Next, the researcher sped up the belt to the participant's desired pace. The researcher remained in proximity for any requests to alter the speed, the details and timing of which were duly noted. An average running pace was calculated by weighting any change in pace by the ratio of elapsed time spent at that pace. Conversation and eye contact between participant and researcher was kept to a minimal. Participants ran for 30 minutes as this can be considered to be a standard duration for examining acute exercise and affective states (e.g., Van Landuyt et al., 2000). Then, the belt was slowed to the initial walking speed for a 2-minute cool-down. The participant stepped off the treadmill and promptly provided their running RPE and responded to PANAS.

Control task. Each participant was taken individually to a private and quiet room equipped with a chair and a desk on which was laid out the daily newspaper and a small selection of general-topic magazines. The researchers were very discerning in their selection of neutral reading material; suggestions of health and body image were kept to a minimum to avoid inflation/deflation influences on affect. This type of quiet, seated control task is common in exercise studies (e.g., Vocks, Hechler, Rohrig, & Legenbauer, 2009). The participant was

instructed to occupy her attention with the provided material until the designated time had elapsed. The researcher busied herself in the adjacent workspace in order to mimic the procedures/presence of the running task. After roughly 35-37 minutes (running task total time with warm-up/cool-down), the participant promptly responded to PANAS.

Analyses

All data were entered into SPSS Version 18.0. Data screening procedures were conducted according to guidelines set out by Tabachnick and Fidell (2007); this included assessments of data entry errors, missing data, outliers, normality and testing of basic assumptions of analyses of variance and regression analyses. Descriptive statistics and reliability analyses were calculated for affect and motivation variables and appear in Table 1. Bivariate correlations were computed to detect underlying patterns of relationships in the data (not reported).

Using repeated-measures t-tests, scores for the three motivational variables were examined across sessions to justify employing average scores of situational motivation to simplify their inclusion as covariates. To test the preliminary hypotheses, a series of repeated measures analyses of variance (ANOVAs) were conducted. Specifically, the data for HA and LA affect respectively were subjected to 2 (task: running, control) X 2 (time: pre, post) ANOVAs. A series of post-hoc t-tests with bonferroni adjustment ensued to dissect the findings. Next, to test the moderating influences of situational motivational regulations as continuous variables, the ANOVAs were repeated by specifying intrinsic motivation, as well as identified and introjected regulations independently as a covariate in each model (i.e., ANCOVA). The alpha level was adjusted for multiple tests ($p < .02$). In graphing significant interaction(s), high and low values of the moderators (motivation covariates) were specified as one standard deviation above and below the mean (Aiken & West, 1991).

To test hypotheses pertaining to the running task specifically, separate hierarchical multiple regressions were conducted for post-run HA affect and post-run LA affect as dependent variables. Namely, for each of the two regression models, scores on the three motivational regulations were added as predictors in step 2 after controlling for pre-run affect in step 1.

Results

Preliminary Analyses

A mean substitution estimation was employed for missing data points (2.4%) as this amount was less than 5% (Tabachnick & Fidell, 2007). Using standardized scores, no univariate outliers were identified on any of the affect or motivation variables. Normality was confirmed by examining the distributions of the variables (i.e., histograms) and their skewness and kurtosis values. There were no issues with linearity, homoscedasticity or collinearity. Lastly, scores for motivation toward running remained stable from one session to the next ($ps > .05$) and were highly correlated ($ps < .01$), thus average scores across session for the regulations were used as covariates in the ANOVAs.

Sample & Running Task Characteristics

Seventy-six women volunteered for this study. Thirty-four were deemed ineligible either on the basis of aforementioned criteria or due to scheduling/contacting issues. One woman was excluded as she failed to attend both sessions. The women in the final sample ($N = 41$) had an average age of 40.98 ($SD = 4.93$), were well-educated (82.9% reporting university degree or higher) and were primarily Caucasian (90.2%). The average BMI for this sample was healthy at 22.47 and self-reported levels of exercise were generally high, with a mean score of 59.71 on the LTEQ (range: 27-116).⁵ In their leisure time, the women reported an average of 8.60 km per run ($SD = 2.39$) and/or 49.37 minutes per run ($SD = 11.35$), with a mean RPE of 13.37 ($SD = 1.22$).

During the in-lab running task, participants ran at an average pace of 9.66 km/hour and reported a mean RPE of 12.79 (range: 11-16), similar to their regular runs and indicative of moderate to high intensity as desired.

Time and Task Effects

To test the preliminary hypothesis, results of the repeated measures ANOVA for high activation (HA) revealed a significant difference in positive affect between tasks [$F(1,40) = 46.47, p < .001, \eta^2 = .54$] and across time [$F(1,40) = 5.83, p < .05, \eta^2 = .13$], as well as a significant interaction between time and task [$F(1,40) = 40.52, p < .001, \eta^2 = .50$]. As expected, post-hoc analyses of simple effects revealed a significant increase in HA positive affect from pre- to post- running task [$t(40) = 4.83, p < .001, d = .75$] and a significant decrease from pre- to post-control task, [$t(40) = -5.40, p < .001, d = .84$]. For LA positive affect, there was a significant main effect of time [$F(1,40) = 20.65, p < .001, \eta^2 = .34$] but not of task [$F(1,40) = 2.34, p < .13, \eta^2 = .06$]. The interaction between task and time was significant [$F(1,40) = 4.48, p < .05, \eta^2 = .10$]. Follow-up pairwise testing of this interaction revealed that although there was a marginal increase in LA positive affect after the running task [$t(40) = 1.98, p = .054, d = .31$], this increase was actually more pronounced for the control task [$t(40) = 5.38, p < .001, d = .76$]. Lastly, follow-up analyses revealed that for HA positive affect, levels post-run were significantly higher than levels post-control task [$t(40) = 8.35, p < .001, d = 1.30$]. The reverse was found for LA positive affect, whereby levels post-control were significantly higher than levels post-run [$t(40) = -2.23, p < .05, d = .35$].

Moderating Effects

Repeated measures ANCOVAs were well suited to examine the moderating influence of motivational variables on time by task relationships. For HA positive affect, there was a

significant three-way interaction between task, time, and introjection as a continuous covariate [$F(1, 39) = 4.71, p < .05, \eta^2 = .11$]. As shown in Figure 1, for women with higher levels of introjection (i.e., greater than one SD above the covariate mean) both the increase in HA affect from pre- to post-run and, interestingly, the decrease in HA from pre- to post-control were more pronounced than for those with lower levels of introjection. The three-way interaction between the identified regulation covariate, task, and time was not significant [$F(1,39) = .92, p = .34, \eta^2 = .02$], nor was the interaction significant for intrinsic motivation [$F(1,39) = .23, p = .34, \eta^2 = .01$]. For LA positive affect, there were no significant three-way interactions between motivational regulations, task, and time.

Motivation Effects for Running

Hierarchical regressions were conducted separately for HA and LA positive affect in order to explore the influence of motivation during the running task specifically. All results can be found in Table 2. Starting with HA and after controlling for levels of pre-run affect, intrinsic, identified and introjected regulation variables accounted for approximately 7% of the total 79% of variance explained in the model. Identified regulation was a significant and positive predictor of the increase in HA affect from pre- to post-running while introjection was also a positive and marginally significant predictor ($p = .05$). On the other hand, the beta for intrinsic motivation fell below significance levels, remaining so even when the other regulations were removed from the model (not shown). Motivation variables did not predict a significant amount of variance in post-run LA positive affect after controlling for pre-run affect.

Discussion

The objective of this experimental study was to examine the effect of situational motivation (for running) on the relationship between running (exercise) and immediate changes

in positive affect. Examining person-centered and malleable SDT-based variables as modifying agents was unique to this study and provides innovative theory-driven insight regarding motivational circumstances that may inform underlying processes (Biddle & Ekkekakis, 2005). Key methodological features of this study lend strength to our findings, such as the use of a preferred exercise modality and a laboratory setting in which extraneous factors were minimized. This study adds support for the acute benefits of exercise on well-being given that increases in positive affective states surfaced in our sample (Biddle & Mutrie, 2008). As expected, participants experienced an increase in HA and LA positive affect after 30 minutes of running. Moreover, the increase in HA affect was not seen after the control task.

These findings add to the scarcity of experimental research in this area, particularly with women (Kull, 2002). This study supplements literature attesting to the immediate mental health benefits of running for women and supports ongoing efforts to understand how to engage women in sufficient exercise (Butryn & Furts, 2003; Kelsey et al., 2006). From an applied standpoint, the findings warrant greater emphasis on the direct benefits of preferred exercise on indicators of well-being and in the context of lifestyle interventions aimed at women's global health.

The distinctive findings pertaining to motivation in this study, which accounted for a perceptible 7% of the 79% of variance in positive affect after controlling for pre-run affect, help conjure up a number of musings regarding the principles of SDT. When examined as a covariate, introjected regulation was a significant moderator of the relationship between running and affect, with levels of introjection being positively related to levels of post-run HA affect. Although the moderating effects of self-determined regulations were not significant in the ANCOVAs, identified regulation made a unique, positive contribution to the increase in positive affect with running and this offers partial support of SDT (Deci & Ryan, 2002). This is consistent with

Thøgersen-Ntoumani and Fox (2007) who found that identified regulation predicted physical well-being, albeit they did not examine exercise-related affective changes specifically.

However, our non-significant results for intrinsic motivation and the small (yet significant) effect for identified regulation do not fully align with SDT and past studies reporting significant and stronger associations between self-determination and exercise-induced changes in affect and well-being (Lutz et al., 2003; Standage et al., 2003; Thøgersen-Ntoumani & Ntoumanis, 2006). The positive finding for identified regulation in predicting an increase in positive affect post-running is consistent with the assertion that when individuals engage in exercise because they value the behaviour and its benefits, they are more likely to feel better about themselves and overall (Ryan & Deci, 2000; Thøgersen & Fox, 2007). Our findings for intrinsic motivation on the other hand tend to resonate with those of Gagné et al. (2003) who saw that incoming self-determined motivation did not significantly predict gymnasts' change in well-being from pre-to post-practice. Although the results for intrinsic motivation appear counterintuitive given the strong enjoyment factor that defines this regulation, some authors have shown that identified motivation may be more influential in predicting persistence in health behaviours, such as exercise (Wilson et al., 2004). It should be reiterated that our regression analyses were underpowered and that the means for the self-determined regulations were high and the variances low. This is not surprising given an active sample, but this could have led to restricted ranges and ceiling effects that weakened the explanatory power of these variables, an issue that was compounded by the large proportion of variance explained by pre-run affect.

The results of this study also showed that scoring high on introjection was associated with experiencing higher levels of HA positive affect after running. From a conceptual standpoint, it could be that the source of introjection in the laboratory may be different from that

of everyday running. Specifically, the level of introjection and its relationship with affect could be related to feelings of obligation to the study and a desire to please the researcher (experimental introject) rather than a desire to not let oneself down, which would arise with regular day-to-day running (personal introject). Self-determined regulations may be more stable and less vulnerable to situational fluctuations in sources of motivation (e.g., “I always value running”), thus exerting a lesser influence on positive affect in the laboratory, as reflected by our findings. Plausible variations in the reference context of different motivations could also be related to the possibility that individuals with greater introjection have more contingencies attached to the pleasure they derive from exercise (Guérin & Fortier, 2012). Conversely, the exercise-affect relationship may be more direct among exercisers higher in intrinsic/identified.

Undoubtedly, the findings for introjection in our study are consistent with its characteristic ties to individuals’ self-worth (Deci & Ryan, 2002). According to Sabiston et al. (2010), “guilt may motivate reparative action” and thus for some women, the running session may have improved affect by relieving negative feelings from not having yet exercised (p. 419). Similarly, positive affect can ensue following an activity for which one has an ego-involved goal orientation (a form of introjection), perhaps due to a relief from stress that arises from not having completed the activity/goal (Nix, Ryan, Manly, & Deci, 1999). Still, experts contend that such peaks in positive affect may be short-lived and probably not mentally restorative or conducive to better mental health (Nix, et al.). Thus, introjected runners may not benefit fully from the revitalization qualities of exercise. It may be worthwhile to assess feelings of vitality in similar studies in the future.

The above remarks necessitate certain reservations regarding the moderating effects of introjection on changes in affect over the long term. Although repeated positive affective

experiences with exercise can sustain this type of behaviour (Kwan & Bryan, 2010), behavioural persistence can also escalate into rigid persistence, such as an exercise dependence. Therefore, short-term post-exercise peaks in positive affect among exercisers displaying high introjection may not translate into greater general well being, despite engaging in a physically active lifestyle. Stephan et al. (2010) saw high levels of self-determination as well as introjection in women who persisted with exercise, hinting that perhaps introjection must be coupled with more autonomous motivational forces. However, Stephan and colleagues did not assess emotional outcomes. Altogether, more attention is needed on the long-term effects of introjection on affective states, as echoed by Thøgersen-Ntoumani and Ntoumanis (2006).

Pulling from the experimental design, findings for the control task also provided worthwhile insights. Indeed, compared to women low in introjection, those with higher levels experienced a greater drop in positive affect after completing the non-exercise quiet control task. This adds evidence to our supposition that, for these women, being unable to run or exercise may sustain feelings of guilt and thwart positive affective states. These findings are consistent with literature on exercise dependency cited above as well as with, we speculate, research on the influence of passion (Vallerand et al., 2003). Namely, when obsessively passionate individuals, as characterized by feeling compelled to engage in a valued activity, are deprived of the activity, they experience anxiety and worsening of affect (Vallerand et al., 2003). That some active women might experience more negative emotional consequences from a short relaxing activity is a cause for concern and hints at the overall complexity of the exercise-affect relationship.

As can be appreciated from these deliberations, it is likely that other motivation-related variables within SDT or that align well with SDT, such as passion, may also underlie the exercise-positive affect link. SDT provided a strong theoretical foundation for this study; within

its hierarchical structure, we spotlighted the unique, yet perhaps conflicting, effect of situational motivation. While this type of focus contributes to the literature on exercise and affect, other authors have revealed that satisfying SDT's three psychological needs (i.e., autonomy, competence, relatedness) within women's exercise contexts can also directly influence indicators of well-being (Wilson, Longley, Muon, Rodgers, & Murray, 2006). Indeed, there may be a complex interrelationship between the needs, the regulations, and exercise outcomes such as affect that is worthy of further investigation (McDonough & Crocker, 2007; Sebire et al., 2009).

Certain elements of the protocol in the current study did highlight SDT principles pertaining to the needs thereby reducing confounding effects. Namely, only females who were familiar with running and who, presumably, felt competent with running, were selected to participate. In addition, the self-paced running task promoted participants' autonomy and was expected to mimic a day-to-day run. On the other hand, the control task consisted of sitting in a quiet room reading the newspaper, which could have been a welcomed activity for participants with busy families and hectic schedules. Indeed, participants experienced a greater increase in LA positive affect (e.g., relaxed) with the control task compared to the running task. The lack of significant findings for LA for the running task do resonate with a study by Bartholomew et al. (2001) that failed to witness an exercise-related increase in the analogous state of tranquility (Bartholomew, Moore, Todd, Todd & Elrod). These differences for LA affect between tasks are not surprising. Borrowing from dual-mode theory research, there is evidence that interoceptive cues arising from the physiological stimuli of an exercise task can increase levels of activation and alter affective valence (Ekkekakis 2003; Bryan, Hutchison, Seals, & Allen, 2007).

Lastly, the findings of this study should be interpreted within the context of certain limitations. Given the small sample size, regression results must be taken as exploratory and

indicative of trends between variables that will need to be examined in larger samples. Moreover, additional caution is required in interpreting the results for identified regulation given that this subscale revealed a low alpha in our sample, which is similar to that of other studies (e.g., Ntoumanis & Blaymires, 2003). In fact, the possibly worrisome internal consistency of the SIMS in this study warrants further testing of its psychometric properties in the exercise context. It may be a more psychometrically sound indicator of situational regulations in other domains and/or under manipulations of a participants' autonomy (Guay et al., 2000; Muraven et al., 2007).

In addition, although the pre-post design has been a popular choice for this type of study, several researchers have taken to assessing affect repetitively during exercise as this may be more sensitive to exercise intensity and resistant to dissipation effects (Backhouse et al., 2007; Ekkekakis et al., 2011). Moreover, the generalizability of the current findings to natural day-to-day contexts may be limited as the laboratory could have been experienced as cold and/or boring (e.g., no music, other runners, scenery), thus influencing responses. Although we attempted to minimize threats to internal validity as well as expectancy effects (e.g., via counterbalancing, "blinding" participants), it would be advantageous in future studies to consider a more extensive variety of compromising factors inherent in experimental designs, as outlined elsewhere in the literature (Reed & Ones, 2006; Thomas & Neilson 2001). Finally, more studies are also needed that draw on daily experience sampling whereby women's motivational patterns and affective changes, as well as reciprocal influences, can be modeled over time in natural exercise environments (Kwan, Hooper, Magnan, & Bryan, 2011, Guérin, Fortier, & Sweet, accepted).

In sum, situational motivation can influence changes in positive affect acquired during an acute exercise session albeit more work is needed on the long-term effects of a regulation guided by guilt and obligation. Moreover, given the large amount of variance it explained, it would be

worthwhile to also consider ways to maximize pre-exercise affect, in conjunction with motivation, in order to optimize post-exercise benefits.

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Footnotes

- ¹ As this study was part of a larger project examining psychological variables, physical activity and well-being in active women with multiple life roles, additional criteria that are not elaborated on in this paper were also imposed at the time of recruitment. That is, women also had to be mothers with least one child under the age of 18 living in the home, and had to be employed a minimum of 30-hours/week (full time).
- ² Items added to the PANAS to assess LA affect (Feldman Barrett & Russell, 1998): relaxed, at rest, serene, calm, at ease (+); tired, sluggish, droopy, dull, bored, drowsy (-).
- ³ Although the full PANAS was administered, no analyses could be conducted on negative affect since this subscale (with and without LA items) demonstrated low internal consistency (Cronbach's alpha) in the present study. Other authors have also reported measurement issues with negative affect in the exercise context and this issue may play a role in the proper interpretation of results (Kwan & Bryan, 2010; Lutz et al., 2008).
- ⁴ Items measuring introjection in the enhanced Situational Motivation Scale (SIMS; Gillet et al., 2011): (1) Because I would feel bad not doing it; (2) Because I would feel guilty not to do it; (3) Because I want to avoid feeling guilty; (4) Because I would regret not doing it.
- ⁵ The LTEQ score of 116 was an outlier on this variable. This score belonged to a participant heavily involved in triathlon training.

Table 1.

Descriptive statistics and Cronbach's alpha (α) values for situational motivational regulations for running, positive affect, and Ratings of Perceived Exertion (RPE).

Variable	Running Task (R)			Control Task (C)		
	M	SD	α	M	SD	α
Intrinsic motivation running	5.80	.82	.85	5.69	1.00	.85
Identified regulation running	6.35	.47	.65	6.38	.48	.66
Introjected regulation running	3.23	1.44	.85	3.26	1.27	.85
Pre-task high activation	33.39	6.36	.88	32.30	6.83	.90
Post-task high activation	36.20	6.93	.91	27.17	7.36	.92
Pre-task low activation	16.83	3.70	.81	16.73	4.22	.91
Post-task low activation	17.95	3.83	.85	19.41	3.73	.89
RPE	12.79	1.15	NA	NA	NA	NA

Note. Motivation variables averaged across tasks (used as covariates): intrinsic motivation ($M = 5.75$, $SD = .88$), identified regulation ($M = 6.37$, $SD = .43$), and introjected regulation ($M = 3.24$, $SD = 1.27$).

Table 2.

Running task hierarchical regressions predicting post-run positive affect.

Variable	High Activation (HA) affect					Low Activation (LA) affect				
	B	B(SE)	β	R^2	ΔR^2	B	B(SE)	β	R^2	ΔR^2
Constant	-12.61					3.70				
Step 1 – Control variable(s)				.72					.31	
Pre-run high activation affect	.89**	.11	.82			.43	.19	.42*		
Pre-run low activation affect	-.21	.19	-.11			.08	.11	.14		
Step 2 – Motivation variables				.79	.07*				.32	.01
Intrinsic motivation	.17	.93	.02			-.10	.93	-.02		
Identified regulation	3.02	1.38	.21*			.88	1.38	.11		
Introjected regulation	.79	.39	.16 [†]			-.22	.39	-.08		

Note. [†] $p = .052$, * $p < .05$, ** $p < .001$

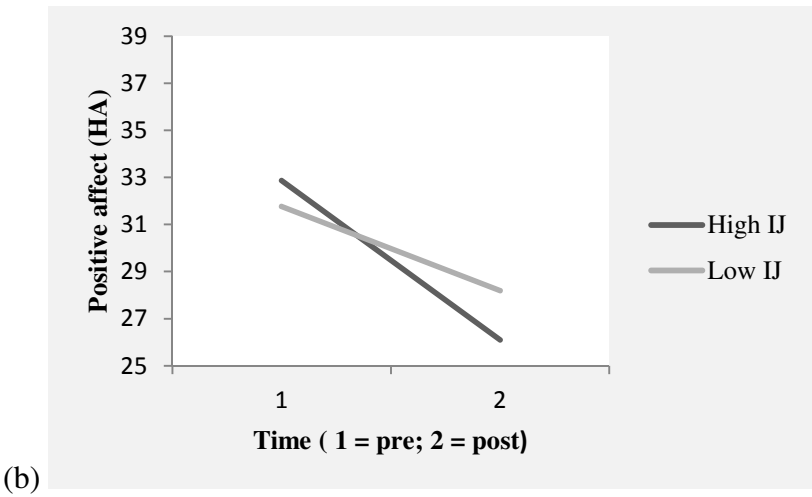
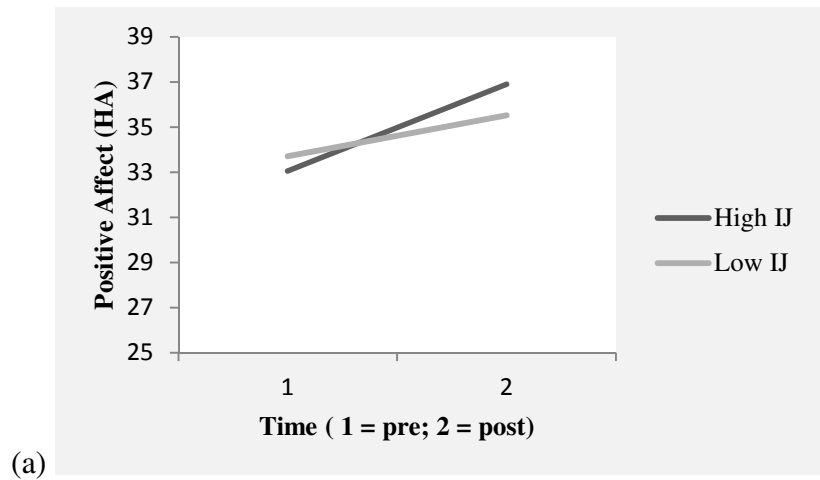


Figure 1. High activation (HA) positive affect scores by level of introjection for (a) pre-post running task and (b) and pre-post control task.

CHAPTER IV

AN EXPERIENCE SAMPLING STUDY OF PHYSICAL ACTIVITY AND POSITIVE AFFECT: INVESTIGATING THE ROLE OF SITUATIONAL MOTIVATION AND PERCEIVED INTENSITY ACROSS TIME

[RUNNING HEAD removed]

An experience sampling study of physical activity and positive affect: Investigating the role of
situational motivation and perceived intensity across time

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Authors' Contributions

EG and MF were involved in the conceptualization and planning of the study. EG oversaw the study protocol and coordinated the data collection while MF supervised all facets of the project. EG and SW assumed responsibility for the analyses and statistical interpretation of the data. EG wrote the manuscript with significant input and revisions from MF and SW. All authors approved the final manuscript.

Conflict of interest

The authors cannot identify any conflicts of interest.

Abstract

Background: The nature of the association between physical activity and positive affect is complex, prompting experts to recommend continued examination of moderating variables. The main purpose of this 2-week field study was to examine the influence of situational motivational regulations from self-determination theory (SDT) on changes in positive affect from pre- to post- to 3-hours post-physical activity. Another purpose was to clarify the relationship between physical activity intensity [i.e., Ratings of Perceived Exertion (RPE)] and positive affect at the stated time points.

Design and Methods: This study employed an experience sampling design using electronic questionnaires. Sixty-six healthy and active, multiple-role women provided recurrent assessments of their physical activity, situational motivation, and positive affect in their everyday lives over a 14-day period. Specifically, measures were obtained at the three time points of interest (i.e., pre-, post-, 3-hours post-physical activity). The data were analyzed using multilevel modeling.

Results: Results showed that intrinsic motivation was related to post-physical activity positive affect while the influence of identified regulation appeared 3-hours post-physical activity. In addition, RPE, which was significantly predicted by levels of introjection, was more strongly associated with an increase in positive affect post-physical activity than three hours later.

Conclusions: The theoretical implications of these findings vis-à-vis SDT, namely in regards to a viable motivational sequence predicting the influence of physical activity on affective states, are discussed. The findings regarding the differential influences of RPE and motivational regulations carries applications for facilitating women's well-being.

Introduction

Physical activity has been identified as a key contributor to people's quality of life. (1)¹ More specifically, physical activity can benefit individuals by improving their mental health and well-being. (2),(3) Affective states are a defining attribute of well-being; and higher positive affect levels accumulated over time have been linked to physical and psychological health. (4) Much research has revealed a significant association between physical activity and affect, particularly in active individuals. (5),(6) Women have also been found to accrue unique benefits from physical activity in terms of reducing the negative affect symptoms of anxiety and depression and improving levels of positive affect. (7),(8)

In this literature, experimental designs and cross sectional approaches have been prevalent. (9) For instance, in a repeated-measures laboratory study with female runners, Guérin and Fortier (10) found an increase in positive affect after 30-minutes of running versus a control task. However, it is difficult to examine physical activity and affect fluctuations over time when participants are confined to a laboratory and/or have to recall their affective states over several hours, days, or weeks. The *Experience Sampling Method* [ESM; (11)], or *Ecological Momentary Assessment*, can alleviate these methodological difficulties. (12),(13) In short, the ESM allows for standardized examination of participants' thoughts, feelings and behaviours in their daily lives. In particular, ESM is ideally suited to collect data on daily physical activity and affect taking into account participants' naturalistic contexts. (14,15,16)

Physical Activity and Positive Affect: Overview

Researchers have identified a relationship between physical activity and positive affect in the acute period surrounding a physical activity session (17,18) as well as more generally in terms of overall positive affect. (19,20) With respect to short-term associations specifically,

¹ *Physical activity* is defined as movement of the body that results in energy expenditure; this can be freely chosen and/or integrated into one's routine. *Exercise* is similarly defined but is more restrictive in that it refers to movement that is planned, structured and repetitive with an objective of maintaining/improving fitness. (94) Although many studies in the domain of interest have been carried out referring to structured exercise, we will employ the more global physical activity term for our purposes and data in order to capture a broader spectrum of physical activities.

several studies have revealed significant increases in positive affect post-physical activity. (21),(22) However, opposite findings have also been shown, revealing some inconsistency in this relationship. (23) To our knowledge, less is known regarding the lasting effects on affective states in the hours after physical activity. Some studies have observed reductions in anxiety 30 to 90 minute post- and up to three hours post- exercise. (24),(25) In terms of positive affect, Cox et al (26) found no effect of time following exercise in a female sample, while another study found an increase that was maintained three hours later. (27) Reed and Ones (18) remarked that improvements in positive affect post-exercise can vary from one to several hours later, but they also conclude that more research is needed as the findings are less than conclusive. Therefore, the preliminary purpose of this study will be to examine the change in positive affect from pre- to post- to 3-hours post-physical activity using experience sampling data over a 2-week period.

Physical Activity and Positive Affect: Moderators

It is apparent from the literature that several factors can dictate how strongly the effects of physical activity may occur initially and how long they might last. (18) Indeed experts stress that the associations between physical activity and affect are complex and they continue to call for more research examining the underlying mechanisms. (28),(29) The intensity of physical activity is one moderator that has received considerable attention in this area.

Intensity and perceived exertion. Studies have revealed that moderately intense physical activity may provide significant benefits in positive affect. (18,19) However, there is notable variability in this literature. For instance, Rendi and colleagues (30) found that affective states following acute exercise were not associated with Ratings of Perceived Exertion (RPE), a subjective indicator of intensity that correlates well with objective measures. (31) Conversely, Cox et al (26) found that in middle-aged women, higher intensity exercise resulted in greater positive affective changes with sustained effects up to 90 minutes post-exercise. Other experts argue less for a specific threshold but rather that the intensity be preferred/self-selected. (32) Even with an emphasis on self-paced activity, evidence of complicated mechanisms underlying the influence of physical activity intensity warrants that this predictor not be ignored, particularly

in the immediate post-physical activity period. Thus, another objective of this study, and one of the first ESM studies to do so, will be to examine and clarify the association between RPE and levels of positive affect post-physical activity as well those sustained 3-hours post-physical activity using measures from multiple physical activity sessions over time.

Recently, experts have also called for more research examining psychosocial factors, in addition to neurobiological factors (i.e., indirectly via intensity-related influences), in explaining the physical activity-affect relationship. (5) Indeed, more knowledge is needed regarding psychological, theory-based variables that may influence this association. (18,33) Self-determined motivation is one construct that deserves greater attention having shown promise in studies of physical activity behaviour and well-being. (34),(35)

Self-determined motivation. Self-Determination Theory (SDT) is a well-supported theory for understanding motivation-related constructs in the context of physical activity as well as for predicting people's well-being. (36) It is assumed within SDT that growth and integration are two innate tendencies that are shared by all individuals, and that when properly nurtured, can facilitate functional, healthy behaviors and wellness. Central to SDT is the process of internalization, whereby motives to engage in a behaviour become increasingly integrated into one's sense of self. (37) This process is explained by the founders of SDT as a continuum of motivational regulations that become increasingly more self-determined (i.e., characterized by volition, choice and autonomy), leading to progressively more adaptive behavioural and psychological consequences. (36,38,39)

The spectrum of motivation runs from amotivation, representing the absence of any intention to engage in the behaviour, to intrinsic motivation (IM) characterized by inherent satisfaction, fun, and enjoyment of the activity for its own sake. (37) In between lies: external regulation (EX), arising from a desire to achieve an external reward or to avoid punishment, followed by introjected regulation (IJ), whereby one is motivated by personal feelings of shame, guilt, or a conditional sense of self-worth. With increased internalization, one considers the activity as important and assigns it personal importance [identified regulation; (ID)] and lastly on

the continuum is integrated regulation. (37) Theoretically, IM and ID are assumed to have positive relationships with indicators of well-being (i.e., positive affect) while IJ and EX should be tied to lower enjoyment (i.e., IM) and thus more negative consequences. (39)

Research has supported that greater self-determined motivation for physical activity is associated with more vitality, higher levels general positive affect, and elevated positive affect following structured exercise. (20,21,40) Both IM and ID regulations have shown positive correlations with daily measures of exercise-related affect. (41) In a similar study, Lepage and Crowther (42) found that health and fitness motivation, which can be theoretically linked with ID regulation, had a significant effect on positive affect following physical activity. These findings complement empirical findings regarding the importance of ID regulation in explaining persistence in strenuous physical activity, a behaviour that may not always be inherently enjoyable. (43-45)

Interestingly, IJ regulation, which tends to be higher in women, has also been associated with engaging in physical activity. (43),(46) However, Pelletier and colleagues (47) found that IJ predicted short-term participation in physical activity but not persistence over time. Moreover, as stated in a recent empirical review in the exercise domain, high levels of IJ might also come at a cost to one's psychological health. (34) Some studies, such as Kwan et al, (48) have found no links between IJ and exercise-related affect. However, several studies have linked IJ regulation for physical activity with lower scores on indicators of well-being like vitality and life satisfaction. (35,49) Indeed researchers hold particular reservations about the influence of IJ on well-being over time. (50),(51) Lastly, associations between EX regulation and indicators of well-being (e.g., affect) have been non-existent or negative. (52,53)

To our knowledge, little work has been done to examine the influence of the motivational regulations from SDT on positive affect in the time frame surrounding physical activity. (10,50) Moreover, aligned studies have assessed contextual-level motivation for physical activity [e.g., (21,48)], which can be contrasted from situational motivation which immediately precedes engaging in a physical activity as well as the proximal consequences that ensue. (54) Arguably,

situational regulations would be more sensitive to momentary and daily fluctuations that can be captured using the ESM. Therefore, we extend past research with the third and main purpose of this study to examine associations between situational motivational regulations and levels of positive affect. As a final investigation point, researchers have presented evidence that SDT's regulations may have interesting associations with physical activity intensity. (50,55,56) For instance, Duncan et al (55) found that IM, IJ and ID were all positively associated with physical activity intensity in women. Therefore, the links between the regulations and RPE will also be explored across time in the present study.

Purpose and Hypotheses

The preliminary objective of this 14-day experience sampling investigation was to examine the relationship of pre-physical activity positive affect with levels of affect post- and 3-hours post-physical activity. Consistent with Reed and Ones, (18) it was expected that positive affect pre-physical activity would show a significant positive association with post-physical activity positive affect and that this latter variable would in turn be positively associated with affect three hours later, albeit to a lesser extent. Another aim of this study was to test the association between RPE and positive affect, which was expected to be significant and positive immediately after physical activity and weaker but still positive three hours after. (18,26) The main purpose of this investigation was to examine the influence of situational motivation on changes in positive affect from pre- to post- to 3-hours post-physical activity. Based on SDT and aforementioned research, it was hypothesized that IM and ID regulation would be positively related to positive affect post-physical activity as well as 3-hours post-physical activity while IJ and EX regulation would be unrelated or negatively related at either time point. The influence of the regulations on RPE was explored in a final, supplemental purpose. The self-determined regulations (i.e., IM, ID) as well as IJ were expected to be positively associated with RPE while EX regulation would show no relation. (55)

Design and Methods

Context

This study was part of a larger project examining the complex relationships between psychosocial variables, patterns of physical activity and non-physically active leisure, as well as indicators of well-being in active adult women with multiple life roles. (57) Therefore, any participant selected for this larger investigation conformed with the following inclusion criteria: a) female and mother with one child still living in the home b) between the ages of 25 and 55, c) active [i.e., meeting the Canadian Guidelines of a minimum of 150 minutes of moderate to vigorous physical activity per week (58)]; d) employed full time (quantified as a minimum of 30 hours/week); e) reporting no underlying medical condition at the time of recruitment that would influence physical activity levels or impair mood.

Participants

Participants were recruited by means of posters on bulletin boards across several athletic centers and sport and children's stores as well as through professional and athletic electronic newsletters. Word-of-mouth recruitment and snowball sampling were also employed. Interested participants contacted the researchers via telephone or email to obtain information and to confirm that they met the inclusion criteria. Although 97 women were recruited, the final sample consisted of 66 active women as 31 women did not meet one or more of the criteria, were unable to commit to the time requirements of the study, or could not be reached for scheduling. The final sample of women had a mean age of 42.56 years ($SD = 5.61$). The participants were mostly Caucasian (89%), well-educated (83% with bachelor's degree or higher) and had an average of two children ($SD = .93$) with a mean age of 10.42 years ($SD = 4.97$). The women were also very active overall, with a mean score of 59.62 ($SD = 21.58$) on the Godin Leisure Time Exercise Questionnaire [LTEQ; (59)], and they had a healthy BMI of 22.59 on average ($SD = 2.68$).

Procedures

Baseline session. Eligible participants began the study by attending an individual research session at a campus laboratory space. After being informed of the study purpose and

protocol, written consent was obtained and participants completed the baseline measures. The researchers downloaded and programmed a questionnaire application to either the participant's own device or to an iPod Touch© that was supplied by the researchers for the 2-week experience sampling portion of the study. Two weeks is considered adequate to represent an individual's daily life. (60) The Apple© application in question was developed for iPod Touches and iPhones© in order to administer the questionnaires in such a way that would maximize procedural ease and consistency across participants. A short information period was given regarding how to use the device and the application. For those borrowing an iPod, more detailed instructions and practice were offered until participants felt comfortable with the device. Participants were also given specific instructions regarding electronic questionnaire requirements for the three time points of interest (i.e., pre-, post-, 3-hour post-physical activity).

Experience sampling. Participants were instructed to begin the next day and to model their habitual behaviour over the 2-week period, including any lapses or surges in physical activity. Using an event-contingent experience sampling schedule, (12) participants responded to sets of questionnaires at three uniform time points, namely pre-, post-, and 3-hours post-physical activity, for each moderate-to-vigorous physical activity session they engaged in over the 14-day period. The first screen of the above-mentioned application was comprised of a questionnaire menu with an option for each of the three time points. The 'Pre-Physical Activity' questionnaire consisted of assessments of motivation and positive affect while the 'Post-Physical Activity' questionnaire consisted of three physical activity description questions followed by a measure of positive affect. Selecting the '3-hour Post-Physical Activity' questionnaire option asked participants to rate their positive affect once again. A 'submit questionnaire' option appeared at the end of each question set, after which participants could no longer view or modify their responses. Questionnaires were timed out after 30 minutes.

Participants received an automatic reminder signal on their device three hours after filling out a post-physical activity questionnaire. To maximize responding, participants were advised that the 3-hour post-physical activity questionnaire could also be completed from the menu prior

to- or after the reminder prompt, should it be within a 2.5-3.5 hour window. However, several participants engaged in physical activity in the evenings before bed, and as such, many 3-hour post-physical activity questionnaires were not completed. All responses for each time point were submitted through a safe and password protected server and were time- and date- stamped upon 'entry'. The researchers downloaded individual datasets as Excel files. All procedures were approved by the University of Ottawa Institutional Review Board.

Endpoint session. Participants returned to the laboratory after the two weeks in order to return the device (if necessary) and so that the researchers could ensure that all data was properly transferred through the server and deleted from the device. Participants were offered a 15\$ gift card for their involvement in the study and they were debriefed and invited to pose questions and raise any issues they had experienced with the application.

Measures

Baseline descriptives. A demographic questionnaire was employed in order to obtain a general description of the sample of women. In addition to questions pertaining to employment, ethnicity, children, etc., the LTEQ was administered in order to quantify activity levels of the participants for descriptive purposes. (59) The LTEQ is a valid and reliable measure of physical activity across different populations. (61) Participants were to indicate the number of times in the last six months they had engaged in strenuous, moderate, and light activity. Definitions of each type were provided. To create a summary score, each number was multiplied by its corresponding MET value of nine, five, and three for vigorous, moderate and light respectively.

Experience sampling: Situational motivation. Three subscales from the original Situational Motivation Scale [SIMS; (62)] were administered to assess the motivational regulations of interest prior to each self-reported physical activity session over the 2-week period. Specifically, 12 original items from the SIMS were used to evaluate levels of IM, EX, and ID regulations. (63) Although IJ regulation was excluded from the original SIMS for brevity, (62) Gillet and colleagues (64) have developed a four-item subscale for IJ that can be integrated into the SIMS. The items in this subscale have demonstrated adequate factor loading and good

internal consistency values [e.g., $\alpha = .85$; (50,64)]. Given the interest in this regulation in the present study, this subscale was also employed.

Each item was answered on a 7-point Likert Scale from [1] corresponds not at all to [7] corresponds exactly using the stem *why are you currently about to engage in exercise*.

For example, one item assessing IJ regulation is “...Because I would regret not doing it.” Mean scores for IM as well as ID, IJ, and EX regulations were calculated for each recorded physical activity session. The SIMS has demonstrated adequate psychometric properties in previous studies. (62,63,65) The Cronbach’s alpha values in the present study for each subscale across participants and exercise sessions ranged from .73 to .91.

Experience sampling: Positive affect. The positive affect subscale of the Positive and Negative Affect Schedule [PANAS; (66)] was employed to assess positive affect at all time points over the two weeks (i.e., Pre-, Post-, 3-hours Post-exercise).² The PANAS is a measure of high activation affect that has been frequently employed as a valid and reliable measure of affective states in studies of exercise behaviour as well as in the SDT literature. (18,67) High activation affect refers to an energetic state (or excitation) which is quite relevant in the context of acute physical activity, in contrast to low activation affect which refers to a calm, relaxed and/or depressed state. (68) For each of ten adjectives that represent positive affect, responses to the stem *Indicate to what extent you feel this way right now* were rated from [1] not at all to [5] extremely. The sum of the ten items, for example “excited” and “interested”, was computed for each questionnaire time point. High internal consistency values for the positive affect subscale pre- ($\alpha = .93$), post- ($\alpha = .91$) and 3-hours post-exercise ($\alpha = .93$) were demonstrated.

Experience sampling: Activity description. Participants were asked to provide the following information after each physical activity session that was logged: The amount of time (in minutes) they had engaged in the activity, a basic description of the type of physical activity

² The full PANAS including the negative affect subscale was administered. Although the alpha level of the negative affect subscale was adequate across time points, the distributions of the data showed significant positive skew (i.e., half of participants scored the minimum value or very low). Since issues with negative affect have been reported in other physical activity studies [e.g., (41,95)] and given the importance of positive affect in this context, analyses of negative affect were not conducted for the present paper.

that was completed (30 characters maximum), and an indication of the intensity of the physical activity. The latter was assessed using a session Rating of Perceived Exertion [RPE; (69)] which is a reliable measure of intensity in exercise-based studies of affective states. (70) The RPE is a self-report instrument made up of descriptors at every odd integer on a 6-20 scale (i.e., 7 = very, very light; 13 = somewhat hard; 19 = very, very hard).

Analyses

Preliminary. Baseline descriptive data were entered directly into SPSS Statistics 20 and summary statistics were computed. The experience sampling data had to be exported from Excel to SPSS. Afterwards, the sums and means of these questionnaires were computed for each of the respective time points and subscales. Averages across time points were also calculated for descriptive purposes (e.g., pre-physical activity positive affect, IM, ID, etc.). The following questionnaire entries were deleted: any pre-physical activity or post-physical activity entries that did not occur within a plausible time frame specified in a participant's post-physical activity description as well as 3-hour post-physical activity entries that occurred within two hours of the post-physical activity recording or later than four hours post-physical activity. Responses to the 3-hour post-physical activity questionnaires were also eliminated if a new pre-questionnaire (i.e., a new session) was answered between the post- and the 3-hour post-questionnaires.

Hierarchical Linear Modeling [HLM; (71)] The ESM produces data with a hierarchical structure therefore the data was restructured to be analyzed in HLM 6.0 statistical software. (72) Each participant could log a unique number of physical activity sessions and therefore it was not possible to have physical activity sessions at level 2 with time (pre-, post-, 3-hour) as a within-person level 1 variable. Therefore, level 1 consisted of the dependent variable (positive affect), the predictor variables for each session, namely pre-physical activity positive affect (and post- for 3-hour analyses), motivational regulations, as well as RPE values. These were grouped by the level-2 variable: participant. In several ways, HLM is ideally suited for this dataset. First, the level 1 observations of each individual are not independent which would violate a major assumption of traditional ordinal least-squares (OLS) regression techniques. (73) Second,

multilevel models can account for uneven time intervals between responses as well as different number of responses from participants. (12,74) Third, HLM can handle large amounts of missing data, and even with small samples, it can provide reliable estimates of within-subject relationships. (9) There is ongoing debate regarding complex power calculations for HLM (75). That said, sample size the current study was consistent with that of past research (15)(76) and with expert recommendations (77,78)

As suggested by Raudenbush et al (71,72) and other researchers, (76) we used a step-up procedure where the first model that was tested did not include predictor variables (i.e., unrestricted model). Then, various restricted models with combinations of variables were tested to address study hypotheses. All level 1 predictors were group-mean centered, with group referring to participant (Level 2). The sample of equations below illustrates the analyses. Level 1 represents participants' rating (subscript i) of post-physical activity positive affect (Y_{pi}) at any given physical activity session (subscript p).³ The person-specific intercepts and slopes are then modeled at Level 2.

Level 1:

$$\text{Post-physical activity positive affect}(Y_{pi}) = \beta_{0i} + \beta_{1i}(\text{Pre-physical activity affect}_{pi}) + \beta_{2i}(\text{RPE}_{pi}) + e_{pi} \quad 1(a)$$

Level 2:

$$\beta_{0i} = \gamma_{00} + u_{0i} \quad 1(b)$$

$$\beta_{1i} = \gamma_{10} + u_{1i} \quad 1(c)$$

$$\beta_{2i} = \gamma_{20} + u_{2i} \quad 1(d)$$

Similar equations were used for the motivational regulations and post-physical activity affect.

³ Additional symbols in the sample equations can be interpreted as: β_{0i} = intercept of post-physical activity (PA) affect in participant i ; β_{1i} and β_{2i} = slope of relationship between level-1 predictor variable and post-PA affect in participant i ; e = random error; γ_{00} = overall intercept expected for post-PA positive affect at the mean of pre-PA affect across participants; γ_{10} = overall slope of relationship between pre-PA positive affect and post-PA affect across participants (γ_{20} = same for RPE); u_0 and u_1 = residual variances.

Level 1:

$$\text{Post-physical activity affect}(Y_{pi}) = \beta_{0i} + \beta_{1i}(\text{Intrinsic}_{pi}) + \beta_{2i}(\text{Identified}_{pi}) + \beta_{3i}(\text{Introjected}_{pi}) + \beta_{4i}(\text{external}_{pi}) + e_{pi} \quad 2(a)$$

Level 2:

$$\beta_{0i} = \gamma_{00} + u_{0i} \quad 2(b)$$

$$\beta_{1i} = \gamma_{10} + u_{1i} \quad 2(c)$$

$$\beta_{2i} = \gamma_{20} + u_{2i} \quad 2(d)$$

$$\beta_{3i} = \gamma_{30} + u_{3i} \quad 2(e)$$

$$\beta_{4i} = \gamma_{40} + u_{4i} \quad 2(f)$$

For equation set 2, any situational regulation found to be significantly associated with post-physical activity affect was then modeled individually while also accounting for pre-physical activity affect and RPE. Similar equations were treated in examining the influence of the regulations on RPE (with and without pre-physical activity affect) as well as for all analyses of 3-hour post-physical activity positive affect as the dependent variable. As shown in equation sets 1 and 2, intercepts and slopes were set as randomly varying in all initial analyses. Parameters were then revised to be fixed if their coefficients were estimated with low reliability or if random errors terms were not significantly different between participants.

Hypotheses were tested using t-ratios that indicate the significance of the respective coefficients in the different models. In addition, HLM includes a log-likelihood test of the fit improvement of variance-covariance structures with previous models (using χ^2). This was employed to examine which models were superior with the inclusion of additional variables or variances. (72,75) The full-maximum likelihood estimation was used as it is deemed suitable for model comparison. (79) To help with interpretation, pseudo- R^2 was calculated as a measure of effect size. Specifically, the unexplained variance from a restricted model is subtracted from that of an unrestricted model and then divided by the unexplained variance in the unrestricted model. (71,78)

Results

Data Cleaning & Summary

Due to recording and data transfer error, the experience sampling data from three participants had to be eliminated.⁴ Aggregate scores across participants for the motivational variables, RPE, and positive affect at the three time points as well as the number of data points for each are reported in Table 1. Discrepancies in the number of data points across variables are either: a) a reflection of skipped recordings by participants at one or more of the possible time points or b) the result of data-cleaning by the researchers. Specifically, any problematic pre-physical activity questionnaires, post-physical activity PANAS entries, and 3-hour post-physical activity questionnaires were eliminated based on aforementioned criteria (see Note in Table 1).

The distributions of the variables were examined in terms of skewness and kurtosis. Mahalanobis distances, multicollinearity and any remaining customary assumptions of univariate and multivariate regression analyses were also tested. (80) One outlying value for RPE was identified and given one point less than the next lowest value in the distribution. Afterwards, a log transformation was applied to the RPE variable as its distribution remained positively skewed. Lastly, graphing residual variances of the 3-hour data revealed one multivariate outlier. This participant's data were removed from further analyses involving the 3-hour time point. No other deviations from normality were observed. Robust standard errors were evaluated in all HLM analyses. The unstandardized coefficients of noteworthy models are presented in Tables 2 and 3. To ease the presentation of complex analyses and models, the results below are organized longitudinally by time point rather than conceptually as they appeared in the Purpose section. All results for RPE pertain to the transformed variable unless otherwise stated.

Post-Physical Activity Positive affect

To put the women's physical activity into context, they logged an average of 10.62 sessions each over the 2-week period (range: 5-20), with some reporting 2+ physical activity

⁴ The remaining 63 women who contributed ESM data were not significantly different from the original sample of $N = 66$ [Age = 42.60 years ($SD = 5.59$), BMI = 22.70 ($SD = 2.81$), LTEQ = 59.86 ($SD = 21.36$, range: 14-130)].

sessions per day. Participants recorded an average of 60 minutes per session ($SD = 38.44$; range: 20-180) and an average RPE of 14.53. A wide variety of physical activity descriptions/types were reported, such as running, swimming, spinning, hiking, and skiing.

Preliminary purpose & RPE. The unrestricted model for post-physical activity positive affect revealed that the average on this outcome variable was high ($M = 34.62$). In the first restricted models that were tested, there was a significant, positive association between pre-physical activity and post-physical activity affect, $t(61) = 7.86, p < .001$, which varied between participants. There was also a significant positive relationship between session RPE and post-physical activity positive affect, $t(605) = 5.85, p < .001$, and this fixed effect remained significant even after accounting for levels of pre-physical activity affect. Pre-physical activity positive affect explained a greater proportion of variance (27.3%) compared to RPE (7.1%). The model with both variables, labeled Model 1 in Table 2, was a better fit compared to pre-physical activity affect as the sole predictor, $\chi^2(1) = 96.38, p < .001$, and this model explained a total of 33.8% of the variance in post-physical activity affect (i.e., pseudo R^2).

Main purpose: Motivation. Next, models were tested to predict post-physical activity positive affect using the situational motivational regulations (fixed). Although EX, IJ, and ID regulations did not show significant associations with the outcome variable, $ts: -1.27$ to $0.33; p > .05$, the slope for IM was significant, $t(603) = 3.14, p < .01$. In this case, for every one unit increase in IM, there was a 1.26 point increase in positive affect. The model with the regulations explained 5.8% percent of the within-person variance in post-physical activity affect. When a model was tested with IM only (accounting for the influence of positive affect pre-physical activity and RPE), the influence of IM remained significant, $t(543) = 2.09, p < .05$. The comprehensive model (Model 2-B in Table 2) explained 34.7% of the variance in post-physical activity positive affect and provided a superior fit than either IM alone, or pre-physical activity affect and RPE excluding IM, $\chi^2s > 5.0, p < .05$.

Next, the associations between the motivational regulations and RPE were examined. First, a test of the basic model with just the regulations showed that only IJ regulation was

significantly and positively associated with RPE, $t(603) = 3.38, p < .001$. T-ratios and significance values were almost identical with the untransformed RPE variable, which offers more meaningful interpretation. In this case, the slope coefficient reflects a resultant 0.28 point increase in RPE (untransformed) with every one-unit increase in IJ. As can be seen from Models 3-A and -B in Table 2, this effect remained significant, $t(544) = 4.28, p < .001$, even after accounting for the effect of incoming positive affect. The model with pre-PA affect and IJ regulation together provided the superior fit and it explained 6% of residual variance in RPE.

Three-hours Post-Physical Activity Affect

Preliminary purpose & RPE. The unrestricted model for 3-hours post-physical activity positive affect revealed that the average on this variable was high ($M = 30.18$), albeit it represents a drop from immediately post-physical activity [aggregate scores: $t(60) = 8.11, p < .001$]. In the first restricted model (not shown in Table 3) there was a significant association between post-physical activity and 3-hours post-physical activity positive affect, $t(588) = 2.43, p < .05$; this slope was set to fixed as it was not found to vary significantly between participants, $\chi^2(52) = 67.52, p = .07$. As shown in Model 1 (Table 3), this effect remained significant after accounting for the fixed effect of positive affect levels prior to engaging in PA, $t(589) = 2.15, p < .05$. The model with both pre- and post-physical activity positive affect provided a better fit than post-physical activity affect alone, $\chi^2(1) = 121.37, p < .001$, and this explained just over 3% of the variance in affect three hours after exercise. There was also a significant positive relationship between session RPE and 3-hours post-physical activity positive affect, $t(588) = 1.91, p < .05$, however, this fixed effect became non-significant after accounting for levels of pre- and post-physical activity affect, $t(588) = 1.10, p = .27$. Still, the model with all three predictor variables provided the best model fit ($p < .001$ for all χ^2 comparison tests) and it explained 4% of variance in 3-hour post physical activity affect (Model 2 in Table 3).

Main purpose: Motivation. Lastly, we examined the predictive ability of the motivational regulations (fixed) with respect to 3-hours post-physical activity positive affect. While neither IM, EX nor IJ regulations were significantly associated with the outcome variable,

$t_s < .05$, $p > .05$, the slope for situational ID regulation ($\beta = 1.25$, $SE = 0.60$) was significant, $t(590) = 2.08$, $p = .038$, but only when the other regulations were excluded (not shown in Table 3). When we tested a model with ID as the only regulation, again controlling for the influence of positive affect levels immediately pre- and post-physical activity as well as RPE, the positive influence of ID remained significant, $t(587) = 1.91$, $p = .05$. This comprehensive model (Model 3-B, Table 3) explained 5.0% of the variance in 3-hours post-physical activity positive affect and provided a superior fit than ID regulation alone, $\chi^2(3) = 251.73$, $p < .001$ and a slightly better fit than the pre-post affect and RPE model not including ID, $\chi^2(1) = 3.42$, $p = .06$.

In sum, intrinsic motivation, positive affect before physical activity, and RPE were positively associated with positive affect immediately after physical activity. Only IJ regulation was associated with RPE. Positive affect three hours-post physical activity was positively predicted by affect pre- and post- and slightly by RPE. Only identified regulation was associated with positive affect three-hours after physical activity.

Discussion

The main purpose of this 14-day experience sampling study was to examine, among active women who were also working mothers, the influence of situational motivation on changes in positive affect from pre- to post- to 3-hour post-physical activity. A secondary objective was to investigate the association between the perceived intensity of physical activity (i.e., RPE) and positive affect at the given time points. A strong feature of this study was the use of the ESM and thus the capacity to capture natural patterns of physical activity engagement and positive affect in the lives of busy, active women. Compared to cross-sectional and laboratory studies, experience sampling offers advantages in terms of reducing retrospective self-report bias and memory reconstruction errors as well as enhancing external validity. Although other studies in this area have been carried out using ESM protocols [e.g., (27,42)] ours offers several unique components. Specifically, we (a) used a sound theoretical framework of motivation (i.e., SDT) to ground our enquiries and we also focused on the proximal effects of situational motivation for each physical activity session. The latter is consistent with Vallerand's (54) hierarchical model of

motivation, namely that a given outcome (i.e., physical activity affect) should correspond to the level of motivation that produced it. We also (b) capitalized on the longitudinal aspects of the ESM by repeatedly measuring affect at three activity-related time points (pre-, post-, 3-hours post-), which to our knowledge has never been done. Finally, we (c) recruited active, multiple-role women rather than using a student-based convenience sample given that the former group remains understudied despite accruing unique emotional benefits from physical activity. (8)

With respect to the preliminary objective of this study, there was a positive relationship between positive affect pre- and post-physical activity, with higher levels reported post. This moderate effect was similar to other studies employing the PANAS in all-women samples. (10,81) This lends added support for the importance of considering individuals' baseline affective states when examining the influence of physical activity, either in research or in interventions. (21,82) Our results also showed a positive association between post-physical activity positive affect scores and those 3-hours post. In other words, the better the women felt immediately after physical activity, the better they felt hours later. However, participants did present lower scores on positive affect 3-hours post-physical activity compared to directly post-physical activity. This drop is not unlike the results obtained by Cox et al (26) for moderate-intensity physical activity. Still, other studies [e.g., (26)] and older experimental research (81) have found that exercise-enhanced affective states (i.e., above baseline levels) do generally persist for three to four hours. (83) Our naturalistic data suggests that this might not necessarily be the case, or rather, that it may be relative to positive affect levels achieved post-activity. Our findings and those of others, for example (81), seem to support propositions that the effect of physical activity can last, but that it is relative, variable, and diminishes over time. (18)

Another aim of this investigation was to clarify the relationship between the perceived intensity of physical activity and positive affect, doing so in natural physical activity environments over a 2-week period. We found that RPE was associated with greater levels of post-physical activity positive affect and thus we conclude that the more intensely the participants perceived they were engaging in their activity, the better they felt psychologically

afterwards. These results add support for similar conclusions with active individuals. (50,84) We also found that the effect of RPE diminished 3-hours post-physical activity. Using an objective measure (VO_2 max), one study saw that at high compared to moderate intensity, positive affect was more sustainable 90-minutes post-physical activity and was higher than baseline. (26) However, this environment was very controlled. Clearly, more studies need to be conducted for further elucidation. Thus far, the results of this investigation confirm the beneficial influence of physical activity on an important indicator of mental health (i.e., affect) and suggest that having women engage in higher intensity physical activity may be particularly beneficial emotionally.

The main purpose of this study was to investigate the role of situational motivational regulations from SDT on the relationship between physical activity and positive affect at three activity-related time points. This was the first ESM study to do so. Overall, the results reveal a viable sequence of influence whereby different types of motivational regulations lead to distinct outcomes that are experienced over time. To explicate, IJ seems to arise as a short-term factor *during* physical activity with its impact on RPE. Next, IM and RPE (i.e., higher intensity physical activity) provide immediate bursts of positive affect post-physical activity and lastly ID regulation appears to foster delayed or long-term effects on positive affect. In the paragraphs that follow, we discuss each link of the sequence in turn.

As expected, IM was significantly associated with an increase in positive affect from pre- to post-physical activity, even after controlling for RPE, which supports that when women engage in their day-to-day physical activity out of enjoyment, they reap immediate emotional benefits. (48) This complements findings from a study with female gymnasts that revealed that IM was related to pre- and post-practice affect as well as vitality. (53) The given link is coherent with SDT in that IM's characteristic properties foster an orientation that predicts positive outcomes. (39) Conversely, our results revealed a non-significant association between EX and positive affect, despite it being in the expected negative direction. This is in line with SDT as well as with conclusions arising from other studies that suggest that the impact of this regulation may be negligible in an active sample. (34,37,55)

Still within the focal objective of this study, IJ regulation was not directly associated with positive affect, either immediately post-physical activity or three hours later. This runs contrary to Guérin and Fortier (10) who in a laboratory setting found that IJ predicted an increase in positive affect, possibly due to an experimentally induced sense of obligation. However, the finding *is* similar to Kwan and colleagues (48) who in a naturalistic study saw no correlation between IJ and positive affective states with exercise. The absence of an association is also consistent with the theoretical tenets of SDT, namely that internally controlled behaviours should not predict organismic wellness. (39)

Unlike introjection, ID regulation is argued to be important for persisting in behaviours that are valued but that are not always inherently pleasurable, such as exercise. (43,85) Most importantly for the present study, previous literature has shown ID regulation for physical activity to be related to enduring indicators of well-being such as physical self-worth and life satisfaction. (35,86) In our sample of women, situational ID regulation was not significantly related to post-activity positive affect. However, and most interestingly, ID regulation held a notable influence on positive affect 3-hours post-physical activity. That is, the more the women identified and valued physical activity when engaging in it, for health benefits for instance, the better they felt hours afterwards. Still, this finding resonates with SDT's contention that the more an individual internalizes an activity, the more she can reap its psychological benefits. (87) In our study, affective benefits of ID appeared hours after partaking in physical activity. To our knowledge, this is the first study to reveal such a finding as little research has directly linked SDT constructs with affective indicators of well-being, either situationally or over time. (88)

Finally, with respect to our supplemental purpose to explore the links between motivation and physical activity intensity, IJ regulation was significantly related to RPE, as predicted. In short, the more the women in our sample engaged in physical activity to avoid feeling guilty or shameful the more intensely they exerted themselves. A similar association between introjected motives and physical activity intensity was noted by Duncan et al (55) as they discussed evidence that women often feel a need to exercise more intensely. If we consider that in our

study RPE was associated with better post-physical activity affect, this pattern is not necessarily maladaptive. However, research suggests that the short-term influence of an IJ style could degenerate in one of two ways. Either persistence in physical activity could wane over time, as per Pelletier and colleagues, (47) thus resulting in fewer post-physical activity affective benefits, or a regimented and addictive pattern of exercise may develop, with unique dangers in terms of overall well-being. (89) Given the physical activity status of our sample, the latter may be more likely and thus careful future enquiry of the longitudinal relationship of IJ, as well as RPE, with indicators of well-being is required.

The sequence interpreted above is of distinct theoretical importance. It will be important in future studies to test these sequential postulates using complex path analyses. Perhaps mediational and moderational frameworks would help dissect these links, particularly the IJ-RPE-affect sequence. In addition, experts argue that the regulations are not mutually exclusive and that unique motivation combinations may best explain physical activity. (54,90) Building from previous motivational profile studies [e.g., (91,92)], examining the combined effect of the regulations and RPE on activity-related affect would be a fruitful avenue of future enquiry.

The practical implications of the results could depend on the aims of an intervention. For women seeking the benefits of frequent bursts of positive affect, including those suffering from fatigue or acute depressive episodes, promoting enjoyable physical activity and pleasurable sensations from exercise (i.e., IM) may be ideal. Moreover, educating and encouraging women to achieve high-intensity physical activity could facilitate rushes of positive affect, in addition to nurturing well-known physical benefits. In terms of stretching the affective benefits of physical activity over longer periods of time for added energy, wellness, and functionality in women's lives, promoting an ID style of motivation should be on the agenda. This may be achieved by marketing the health-benefits of physical activity and encouraging women to internalize its value. Alternatively, a combined approach targeting each of the regulations may be safer and best suited for general well-being promotion.

This study is not without its weaknesses. While the ESM certainly improved the relevance and external validity of the findings, timing and practicality issues led to some erroneous and/or missed entries and fewer assessments at the 3-hour time point specifically. This warrants that the results be interpreted (and generalized) with caution. Moreover, whether and when participants had truly engaged in physical activity as well as how long it lasted was not objectively corroborated. Tapping into the GPS function of the electronic devices and/or fastening the women with accelerometers for the duration of the study would have allowed for a) validation of physical activity reports; and b) teasing out the more physiological aspects of physical activity intensity in addition to subjective RPE. Similarly, no specific analyses were conducted on type of activity. It could be that cycling to work in heavy traffic as one's physical activity for a given day has different and more (or less) enduring effects on positive affect than an hour of intense skiing with one's partner or child. Finally, while the objective was to investigate the given motivational process in active women, future studies using mixed samples with diverse physical activity levels and mental health statuses should be undertaken to corroborate the transferability of the findings.

Notwithstanding these limitations, the results of this study support that physical activity is emotionally beneficial and that higher intensities can stimulate greater improvements. The findings are also suggestive of a novel motivational sequence that carries important theoretical and practical implications. This investigation brings us one step further towards uncovering the intricate relationship between physical activity and well-being.

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Table 1. Descriptive statistics of experience sampling variables: Motivational regulations (pre-exercise) and positive affect.

	N	Mean	SD	ICC
Situational Intrinsic Motivation	635	5.32	1.25	.55
Situational Identified Regulation	635	5.98	0.83	.63
Situational Introjected Regulation	635	4.11	1.79	.77
Situational External Regulation	635	3.13	1.64	.76
Rating of Perceived Exertion Regulation (log transformation)	599	14.53 (1.16)	2.08 (0.06)	.30 (.28)
Pre-exercise affect	626	30.75	8.03	.55
Post-exercise affect	588	34.82	7.26	.54
3-hours post-exercise affect	390	30.23	8.40	.50

Note. SD = Standard Deviation, ICC = Intra-class correlation. Excluded questionnaires based on criteria outlined in main text: six ‘Pre-Exercise’ questionnaires, 14 ‘Post-Exercise’ PANAS entries, and 83 ‘3-hour’ post-exercise questionnaires. A total of 22 recorded physical activity sessions also removed due to RPE values that fell below a moderate intensity cut-off, as suggested by experts. (84,93)

Table 2. Models predicting levels of post-physical activity positive affect.

Model	Coefficient	SE	Model	Estimate	SE
1. RPE and Pre- with Post- Affect					
Fixed effects					
Intercept, β_{00}	34.87**	0.74			
Pre- affect, β_{10}	0.35**	0.05			
RPE β_{20}	22.28**	3.63			
Random effects ^a					
Intercept, σ^2_{u0}	31.28**	5.59			
Pre- affect, σ^2_{u1}	0.06**	0.25			
Residual variance, e	16.71	4.09			
2. A) Regulations with Post- Affect			2. B) Intrinsic motivation with Post-Affect		
Fixed Effects			Fixed Effects		
Intercept, β_{00}	34.82**	0.73	Intercept, β_{00}	34.87**	0.74
Intrinsic motivation, β_{10}	1.26*	0.40	Pre- Positive Affect, β_{10}	0.32**	0.05
Identified regulation, β_{20}	0.17	0.52	Intrinsic motivation, β_{20}	0.59 [†]	0.28
Introjected regulation, β_{30}	0.12	0.39	RPE, β_{30}	22.86**	3.45
External regulation, β_{40}	-0.40	0.31	Random Effects ^a		
Random Effects ^a			Intercept, σ^2_{u0}	31.33**	5.60
Intercept, σ^2_{u0}	29.90**	5.47	Pre- Positive Affect, σ^2_{u1}	.07*	0.26
Residual variance, e	23.79	4.88	Residual variance e	16.45	4.06
3. A) Motivation with RPE^b			3. B) Introjected regulation with RPE^b		
Fixed Effects			Fixed Effects		
Intercept, β_{00}	1.157	0.005	Intercept, β_{00}	1.157**	0.005
Intrinsic motivation, β_{10}	-0.000	0.003	Pre- Positive Affect, β_{10}	0.002**	0.000
Identified regulation, β_{20}	0.005	0.005	Introjected regulation, β_{20}	0.010**	0.002
Introjected regulation, β_{30}	0.009**	0.003	Random Effects ^a		
External regulation, β_{40}	-0.002	0.003	Intercept, σ^2_{u0}	0.001	0.033
Random Effects ^a			Pre- Positive Affect, σ^2_{u1}	0.000	0.001
Intercept, σ^2_{u0}	0.001**	0.03	Residual variance, e	0.003	0.050
Residual variance, e	0.002	0.05			

Note. Coefficient = Unstandardized Estimates; SE = Standard Error; RPE = Ratings of Perceived Exertion. All RPE values based on the log transformed variable; Models 3-A and 3-B are reported to three decimal places given low coefficient values with the RPE as the transformed dependent variable.

^a Variance component estimates and standard deviations are provided for Random Effects.

^b Coefficients with untransformed RPE [Model 3-A]: $\beta_{00} = 14.50$ ($SE = 0.17$); $\beta_{10} = 0.00$ ($SE = 0.11$); $\beta_{20} = 0.16$ ($SE = 0.18$); $\beta_{30} = 0.28$ ($SE = 0.09$); $\beta_{40} = -0.04$ ($SE = 0.11$). [Model 3-B]: $\beta_{00} = 14.49$ ($SE = 0.16$); $\beta_{10} = 0.06$ ($SE = 0.01$); $\beta_{20} = 0.32$ ($SE = 0.07$).

** = $p < .001$, * = $p < .01$, [†] $p < .05$

Table 3. Models predicting levels of 3-hour post-physical activity positive affect.

Model	Coefficient	SE	Model	Estimate	SE
1. Pre- and Post- with -3-hours Post Affect			2. RPE with 3-hours Post Affect		
Fixed effects			Fixed effects		
Intercept, β_{00}	30.25**	0.86	Intercept, β_{00}	30.31**	0.87
Pre- affect, β_{10}	0.07	0.07	Pre- affect, β_{10}	0.07	0.08
Post- affect, β_{20}	0.22 [†]	0.10	Post- affect, β_{20}	0.18	0.10
Random effects			Random effects		
Intercept, σ^2_{u0}	36.08**	6.01	RPE, β_{30}	6.39	6.91
Residual variance, e	32.30	5.68	Intercept, σ^2_{u0}	36.68**	6.06
			Residual variance, e	32.20	5.67
3. A) Motivation with 3-hours Post-Affect			3. B) Identified regulation with 3-hours post-Affect		
Fixed Effects			Fixed Effects		
Intercept, β_{00}	30.23**	0.87	Intercept, β_{00}	30.31**	0.87
Intrinsic motivation, β_{10}	.39	0.51	Pre- Positive Affect, β_{10}	0.05	0.07
Identified regulation, β_{20}	1.02	0.65	Post-positive Affect, β_{20}	0.18	0.10
Introjected regulation, β_{30}	0.38	0.46	RPE, β_{30}	6.22	6.94
External regulation, β_{40}	0.11	0.49	Identified regulation, β_{40}	1.32 [†]	0.69
Random Effects			Random Effects		
Intercept, σ^2_{u0}	37.55**	6.13	Intercept, σ^2_{u0}	36.78	6.06
Residual variance, e	33.01	5.75	Residual variance, e	31.78	5.64

Note. Coefficient = Unstandardized Estimates; SE = Standard Error; RPE = Ratings of Perceived Exertion. All RPE values based on the log transformed variable.

^a Variance component estimates and standard deviations are provided for Random Effects.

** = $p < .001$, * = $p < .01$, [†] $p < .05$

CHAPTER V
SUPPLEMENTAL ANALYSES

SUPPLEMENTAL ANALYSES

As previously mentioned, all supplemental analyses pertain to Study 2. More specifically, they were carried out as an adjunct of the data presented in *Article 3*.

Corollary 3.3 of the HMIEM (P5)

The objective was to test the top-down relationship from contextual motivation (overall motivation for physical activity) to situational (session-specific) motivational regulations.

Measure & Data Cleaning

Contextual motivation towards physical activity was assessed using the Behavioural Regulations in Exercise Questionnaire-2 (BREQ-2; Markland & Tobin, 2004). Specifically, the BREQ-2 was administered to all Study 2 participants within a battery of measures during the first research session (baseline). The BREQ-2 is comprised of 19 items divided into five subscales that assess the different regulations (amotivation, external, identified, introjected, external and intrinsic). Sample items for the stem *Why do you engage in physical activity* are “I feel guilty when I don’t engage in physical activity” (introjected) and “I get pleasure/satisfaction from engaging in physical activity” (intrinsic). Several researchers (e.g., Duncan, Hall, Wilson, & O, 2010; Barbeau, Sweet, & Fortier, 2009) have supplemented the BREQ-2 with four validated items to assess integrated regulation, for example “I consider physical activity to be part of my identity” (Wilson, Rodgers, Loitz, & Scime, 2006). These items were also included in the present study. The BREQ-2 has demonstrated good psychometric properties; it has shown adequate internal consistency in studies with active and sedentary participants (Hall, Rodgers, Wilson, & Norman, 2010) and with all-female samples (Markland, 2009). Items were averaged by subscale to create scores for each contextual motivational regulation.

Descriptives and Cronbach’s alpha (range: .41-.85) for contextual-level motivation variables appear in Table 1 (p. 151 of Chapter V). The contextual amotivation subscale

demonstrated a very low mean and standard deviation which undoubtedly contributed to the high skewness and kurtosis. This is not surprising given the high activity levels of participants in this study and no further analyses were performed on this variable. There were no outlying values on any of the other regulations. The low Cronbach's alpha value for the BREQ-2 identified regulation subscale ($\alpha = .41$) warrants that subsequent analyses/results for this variable be interpreted with caution. Transformations were performed on the external and integrated subscales to correct for minor distributional issues as shown in Table 1. For ease of presentation, all results pertain to the transformed variables, thus resulting in certain mis-scaled coefficient values.

Analyses & Results

We used two statistical approaches to test the relationships between contextual-level regulations towards physical activity measured at baseline (BREQ-2) and situational regulation reported immediately prior to each physical activity session (SIMS). First, we used participants' average situational scores for each subscale across the 14 days. Bivariate correlations between contextual and situational regulations were computed and they are displayed in Table 2 (notable correlations for Corollary 3.3 have been given a distinct subscript). In short, intrinsic motivation at both levels of generality were highly, positively correlated, as were introjected regulations. The correlation between contextual and situational external regulations was smaller than the previous two regulations yet still significant and positive. Contextual introjection was also highly, positively correlated with situational external regulation. Contextual intrinsic motivation was negatively related to situational introjected and external regulations while contextual external was negatively related to situational intrinsic motivation and identified regulation.

Second, to capitalize on within-person variability in situational motivation over the 14-day period, we entered each situational regulation as an outcome variable in HLM (with restricted maximum likelihood). Then, we tested models by entering contextual regulations as level-2 predictors of the intercept (intercept as outcome). For ease of presentation and interpretation of these results, we ran two models for each *situational* regulation: one with self-determined BREQ-2 contextual regulations as predictors [i.e., intrinsic, integrated] and one with the non-self-determined BREQ-2 contextual regulations [i.e., introjection, external]. We ran preliminary tests of the models also accounting for contextual identified regulation among the self-determined regulations; however, we found that it did not significantly influence the models. Given its poor psychometric properties, it was therefore omitted from all models.

The findings (see Table 3) are consistent with the above aggregate score bivariate correlations. The main HLM results can be summarized as follows: a one unit increase in contextual intrinsic motivation predicted a 1.34 unit increase at the situational level ($SE = 0.20$), a one unit increase in contextual introjection predicted a 0.93 unit increase in situational introjection ($SE = 0.13$), a one unit increase in contextual external regulation predicted a 0.56 unit increase in situational-external regulation ($SE = 0.38$). In addition, contextual intrinsic motivation was negatively related to situational introjected and external regulations. Moreover, a one-unit increase in contextual integrated regulation was associated with a 1.18 unit increase (non-significant) in situational-intrinsic motivation ($SE = 0.82$) and a 3.68 unit decrease in situational introjection ($SE = 1.54$). However, transformations performed on contextual integrated and external variables renders literal interpretation of these “unit” values more difficult as they refer to unstandardized coefficients. The only significant relationship for

situational identified regulation was with contextual external regulation, which was in the expected negative direction.

Apart from identified regulation, all associations displayed in Table 3 support Corollary 3.3. Namely, one's motivation towards a given activity at a particular point in time results from a top-down effect from the next highest motivational level in the hierarchy, in this case one's usual motivational orientation for physical activity (contextual; Vallerand, 2007). This was supported with the data given positive relationships between corresponding regulations at both levels (e.g., intrinsic-intrinsic), positive associations between regulations across levels that lie adjacent to one another along the spectrum (e.g., integrated, intrinsic), and negative associations between regulations across levels that are at discrepant ends of the spectrum (e.g., intrinsic, external).

Negative Affect (P6-P8)

In this series of analyses, the first three objectives from *Article 3* (p. 29) for positive affect were re-examined with negative affect as the outcome variable. The purposes are explained in turn.

Measure & Data Cleaning

The negative affect subscale of the PANAS (Watson, Clark, & Tellegen, 1988) was also administered to participants at pre-, post- and 3-hours post-physical activity time point. However, the items were not analyzed within *Article 3* due to psychometric issues as explained in the article's second Footnote. Descriptive information for negative affect variables can be found in Table 4. The negative affect subscale pre- ($\alpha = .87$), post- ($\alpha = .79$) and 3-hours post-physical activity ($\alpha = .84$) demonstrated moderate to high internal consistencies. However, the negative affect variables showed skewed distributions with high kurtosis across time points which could not be corrected with standard data cleaning steps such as transformations (Hair, Anderson, Tatham, & Black, 1998; Tabachnick & Fidel, 2007). Specifically, as can be

ascertained by the frequency values that are presented in Table 5, most participants scored very low on negative affect across time points. Since HLM cannot handle non-normal dependent variables, we addressed the issue by dichotomizing the negative affect variables as “high” and “low”. The partition for each time point was based on the value that split the observations into pairs of relatively evenly sized categories. Specifically a) for pre-physical activity negative affect, scores equal to 12 or greater were considered “high” and coded as “1” (< 12 as “0”); b) for post-physical activity and 3-hours post-physical activity negative affect, scores equal to 11 or greater were considered “high” and coded as “1” (< 11 as “0”). Table 5 also contains the specific frequency breakdown for those coded as “high” and those coded as “low”. Given binary negative affect variables, HGLM had to be used to test models using a log-link function with a Bernoulli distribution (Raudenbush, Bryk, Cheong, Congdon, & du Toit, 2004). Specifically we examined the unit-specific models (correcting for overdispersion) with robust standard errors to determine the odds of scoring high on negative affect (Raudenbush et al., 2004).

The results for negative affect pertain to the high activation component of affect, as per *Article 3*, and are presented below using the same structure (and subtitles) as this article, that is, longitudinally by time point. Coefficients and Odds Ratios can be found in Tables 6 -7. All results for RPE pertain to the transformed variable.

Post-Physical Activity Results

Preliminary purpose & RPE (P6-P7). These objectives were: to examine the relationship between pre- and post- physical activity negative affect (P6) and to test the association between RPE and negative affect pre- and post- physical activity (P7). An unconditional Bernoulli model revealed that the probability of scoring high on negative affect was 39.40% before physical activity and 24.78% after physical activity. In the first restricted

model that was tested, scoring high on negative affect pre-physical activity predicted greater odds of scoring high post-physical activity, $t(607) = 2.12, p < .05$. This can also be interpreted as an 81% probability of being low on negative affect post-physical activity when negative affect is also low pre-physical activity. The slope was revised to fixed as it did not vary between participants, $\chi^2(44) = 52.73, p = .17$. The odds of scoring higher on negative affect were also positively associated with RPE, $t(606) = 2.01, p < .05$, a relationship that was set as fixed. In a model with both variables predicting post-physical activity negative affect, the fixed effect of pre-physical activity negative affect remained significant, $t(606) = 2.04, p < .05$, while the effect of RPE was no longer significant ($p = .08$). The amount of variance explained in this model was less than 1%. See Models 1 and 2 in Table 6.

Motivation (P8). Next, models were tested to probe the influence of situational motivational regulations on changes in negative affect from pre- to post- physical activity (fixed). Although intrinsic, identified and introjected regulations did not show significant associations with the outcome variable (negative affect post-activity), $ts: -0.23$ to $0.93; p > .05$, the slope for external regulation was significant, $t(604) = -1.97, p = .05$. The negative coefficient (and the odds ratio lower than 1) can be interpreted that for every one point increase in situational external regulation, a participant was 25% less likely to score high on negative affect. When a model was tested with external regulation only (accounting for the influence of negative affect pre-physical activity; Model 4 Table 6), its influence was reduced to a trend, $t(606) = -1.86, p < .06$. The amount of variance explained was less than 1%.

Three-hours Post Physical Activity Results

We repeated the analyses for 3-hours post-physical activity data. Once again we examined the unit-specific models (correcting for overdispersion) with robust standard errors to

determine the odds of reporting greater negative affect 3-hours after physical activity (Raudenbush et al., 2004).

Preliminary purpose & RPE (P6-P7). The goals were: to examine the relationships between post- and 3-hours post physical activity negative affect (P6) and to test the association between RPE and negative affect 3-hours post- physical activity (P7). An unconditional Bernoulli model revealed that the probability of reporting high levels of negative affect 3-hours post-physical activity was 32.70%. This represents an increase in negative affect from immediately post- activity, when the probability was 24.78%, but lower negative affect compared to before engaging in the activity (39.40%). In the first restricted model that was tested, scoring high on negative affect post-physical activity predicted greater odds of scoring high three hours later, $t(607) = 3.08, p < .01$. Stated otherwise, there was a 71% probability of scoring high on negative affect 3-hours post-physical activity when one scored high immediately post-physical activity (note: the opposite would also apply, namely scoring lower post- would predict scoring lower 3-hours post-). The slope had to be set as fixed since it did not vary significantly between participants, $\chi^2(34) = 34.36, p = .45$. As shown in Model 1 (Table 7), the post- to 3-hours post association remained significant after accounting for the fixed effect of negative affect prior to engaging in physical activity [pre-activity: $t(608) = 2.69, p < .01$]. The odds of scoring higher on negative affect 3-hours after the activity were unrelated to RPE, $t(607) = -0.50, p = .62$, even after accounting for pre- and post- activity negative affect (Model 2). The amount of variance explained in the 3-hours post negative affect model was less than 1%.

Motivation (P8). Lastly, we examined the predictive ability of the motivational regulations (fixed) with respect to 3-hours post-physical activity negative affect. None of the situational regulations were significantly associated with the probability of scoring high on

negative affect three hours after physical activity, $ts = -1.01$ to 1.36 , $p > .10$. Even when testing individual models for each of the regulations, and when accounting for negative affect pre- and post- physical activity, the coefficients remained non-significant. Coefficient values and Odds Ratios for Model 3 are displayed in Table 7.

Altogether, these results indicate that the odds of scoring high on negative affect are dependent across time points. The influence of RPE on negative affect was limited. External regulation showed a curious influence in terms of reducing the odds of high negative affect post-physical activity. The findings are discussed in further detail in Chapter VII: General Discussion.

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Table 1. *Study 2 descriptive statistics for contextual motivation toward physical activity (BREQ-2) assessed at baseline (N = 63).*

Variable	Mean	SD (variance)	Alpha	Skewness	Kurtosis
Baseline Contextual Motivation (BREQ-2)					
Intrinsic motivation	3.55	0.51 (0.26)	.85	-0.86	-0.41
Integrated regulation ^a	3.58	0.58 (0.34)	.80	-1.63	2.10
Identified regulation	3.65	0.37 (0.14)	.41	-0.89	-0.18
Introjected regulation	1.69	1.13 (1.27)	.86	0.37	-0.97
External regulation ^b	0.38	0.53 (0.28)	.83	1.23	0.05
Amotivation	0.03	0.12 (0.02)	.82	3.67	11.85

Note: BREQ-2 = Behavioral Regulations in Exercise Questionnaire-2; SD = Standard Deviation.

^a Transformed integrated regulation variable (log): $M = 0.12$, $SD = 0.15$, $variance = 0.02$, $skewness = 1.00$, $kurtosis = 0.15$.

^b Transformed external regulation variable (sqrt): $M = .40$, $SD = 0.47$, $variance = 0.22$, $skewness = 0.62$, $kurtosis = -1.10$.

Table 2. *Study 2 partial correlation matrix for contextual (BREQ-2) and situational (SIMS) motivational regulations towards physical activity.*

	Situ-intrinsic	Situ-identified	Situ-introjected	Situ-external
Cont-intrinsic	.58** ^a	.20	-.35**	-.37**
Cont-integrated	.26*	.21	-.04	-.09
Cont-integrated (transformed)	.26* ^a	.24 ^a	-.02	-.07
Cont-identified	.37**	.12 ^a	-.06	-.10
Cont- introjected	-.21	.06	.67*** ^a	.58**
Cont-external	-.37**	-.29*	.31*	.36*** ^a
Cont-external (transformed)	-.35**	-.28*	.27*	.34*** ^a

Note: BREQ-2 = Behavioral Regulations in Exercise Questionnaire-2; SIMS = Situational Motivation Scale; Situ = Situational regulations; Cont = Contextual regulations. The signs for Cont-integrated (transformed) have been reversed as this variable was reflected; Situational variables based on averages across 14 days: Intrinsic ($M = 5.32$, $SD = 1.0$), identified ($M = 5.94$, $SD = .72$), introjected ($M = 4.07$, $SD = 1.61$), external ($M = 3.07$, $SD = 1.48$).

^a Correlations testing HMIEM.

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

Table 3. *Study 2 relationships between contextual (BREQ-2) and situational (SIMS) motivational regulations for physical activity (HLM results).*

	Situ-intrinsic		Situ-identified		Situ-introjected		Situ-external	
	Coefficient	<i>p</i>	Coefficient	<i>p</i>	Coefficient	<i>p</i>	Coefficient	<i>p</i>
Self-determined regulations								
Cont-intrinsic	1.34	<.001	.11	.49	-1.78	<.001	-1.56	<.001
Cont-Integrated (transformed)	1.18	.16	-.90	.20	-3.68	.02	-2.69	.06
Controlled regulations								
Cont-introjected	-.10	.28	.10	.20	.93	<.001	.69	<.001
Cont-external (transformed)	-.66	.02	-.49	.02	.26	.43	.56	.15

Note: BREQ-2 = Behavioral Regulations in Exercise Questionnaire-2; SIMS = Situational Motivation Scale; HLM = Hierarchical Linear Modeling; Situ = Situational regulations; Cont = Contextual regulations. The signs for Cont-integrated (transformed) have been reversed as this variable was reflected. Contextual identified regulation was excluded due to poor internal consistency.

Table 4. *Study 2 descriptive statistics for high activation positive and negative affect variables across experience sampling time points (physical activity-related).*

	N	Mean	SD	ICC
Pre-PA positive affect	626	30.75	8.03	.55
Pre-PA negative affect	626	12.74	4.78	NA
Post-PA positive affect	588	34.82	7.26	.54
Post-PA negative affect	588	10.88	2.19	NA
3-hours post-PA positive affect	390	30.23	8.40	.50
3-hours post-PA negative affect	390	11.47	3.20	NA

Note: SD = Standard Deviation; ICC = Intra-Class Correlation (only applicable for continuous variables); PA = Physical Activity.

Table 5. *Study 2 frequency counts (n) for high activation negative affect scores (variables) by time point and across participants.*

Value	Pre-physical activity	Post-physical activity	3-hours post-physical activity
10	293	418	245
11	75	76	50
12	62	32	28
13	43	17	10
14	33	13	16
15	22	7	11
16	14	3	4
17	14	6	4
18	9	5	4
19	10	1	3
20	5	2	1
21	8	3	2
22	7	1	7
23	8	1	1
24	3	0	0
25	4	0	1
26-30	6	3	1
31-35	4	0	1
36-40	4	0	1
41-45	1	0	0
46-50	1	0	0
“High”	258 ^a	170 ^b	146 ^c
“Low”	368	418	245
Total	626	588	390

Note: ^a Pre-physical activity “high” scores ≥ 12 ; ^b post-physical activity “high” scores ≥ 11 ;

^c 3-hours post physical activity “high” scores ≥ 11 .

Table 6. Study 2 models predicting levels of post-physical activity negative affect.

Model	Coefficient (log odds)	SE	Odds Ratio	Model	Coefficient (log odds)	SE	Odds Ratio
1. Pre- with post- negative affect				2. RPE and Pre- with post- negative affect			
Fixed effects				Fixed effects			
Intercept, β_{00}	-1.36***	0.23	0.26	Intercept, β_{00}	-1.34***	0.23	0.26
Pre-affect, β_{10}	0.56*	0.26	1.76	Pre-affect, β_{10}	0.54*	0.26	1.72
Random effects ^a				RPE (log), β_{20}	4.06	2.34	58.14
Intercept, σ^2_{u0}	1.50***	1.22		Random effects ^a			
Residual variance, e	0.81	0.90		Intercept, σ^2_{u0}	1.62***	1.27	
				Residual variance, e	0.80	0.90	
3. Regulations with post- negative affect				4. External with post- negative affect			
Fixed effects				Fixed effects			
Intercept, β_{00}	-1.13	0.21	0.32	Intercept, β_{00}	-1.38***	0.23	0.25
Intrinsic motivation, β_{10}	-0.03	0.13	0.97	Pre-affect, β_{10}	0.59*	0.27	1.80
Identified regulation, β_{20}	0.22	0.20	1.24	External regulation, β_{20}	-0.22	0.12	0.80
Introjected regulation, β_{30}	0.11	0.13	1.12	Random effects ^a			
External regulation, β_{40}	-0.28*	0.14	0.75	Intercept, σ^2_{u0}	1.50***	1.23	
Random effects ^a				Residual variance, e	0.81	0.90	
Intercept, σ^2_{u0}	1.92***	1.38					
Residual variance, e	0.79	0.89					

Note. Coefficient = Unstandardized Estimates; SE = Standard Error; RPE = Ratings of Perceived Exertion. All RPE values based on the log transformed variable (i.e., high Odds Ratio).

^a Variance component estimates and standard deviations are provided for Random Effects.

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

Table 7. Study 2 models predicting levels of 3-hours post-physical activity negative affect.

Model	Coefficient (log odds)	SE	Odds Ratio	Model	Coefficient (log odds)	SE	Odds Ratio
1. Pre- and post- with 3-hours post-negative affect							
Fixed effects				2. RPE with 3-hours post-negative affect			
Intercept, β_{00}	-1.22***	0.24	0.29	Fixed effects			
Pre-affect, β_{10}	0.79**	0.29	2.20	Intercept, β_{00}	-1.26***	0.23	0.28
Post-affect, β_{20}	0.82**	0.28	2.26	Pre-affect, β_{10}	0.88**	0.29	2.41
Random effects ^a				Post-affect, β_{20}	0.83**	0.27	2.89
Intercept, σ^2_{u0}	1.17***	1.08		RPE, β_{30}	-3.39	2.39	0.03
Residual variance, e	0.81	0.90		Random effects ^a			
				Intercept, σ^2_{u0}	1.09***	1.04	
				Residual variance, e	0.81	0.90	
3. Regulations with 3-hours post-negative affect							
Fixed effects							
Intercept, β_{00}	-0.75	0.24	0.47				
Intrinsic motivation, β_{10}	0.22	0.16	1.24				
Identified regulation, β_{20}	-0.29	0.29	0.75				
Introjected regulation, β_{30}	0.19	0.19	1.22				
External regulation, β_{40}	0.08	0.09	1.08				
Random effects ^a							
Intercept, σ^2_{u0}	2.42***	1.55					
Residual variance, e	0.87	0.76					

Note. Coefficient = Unstandardized Estimates; SE = Standard Error; RPE = Ratings of Perceived Exertion. All RPE values based on the log transformed variable.

^a Variance component estimates and standard deviations are provided for Random Effects.

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

CHAPTER VI

**“I JUST NEED TO MOVE...” : EXAMINING WOMEN’S PASSION FOR PHYSICAL
ACTIVITY AND ITS RELATIONSHIP WITH DAILY AFFECT AND VITALITY**

[RUNNING HEAD removed]

“I just NEED to move...”: Examining women’s passion for physical activity and its
relationship with daily affect and vitality

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Abstract

Background: Physical activity has been linked to well-being among women. One psychological perspective that can offer insights regarding this relationship is the Dualistic Model of Passion. The model posits that individuals can internalize a valued activity in an autonomous fashion, facilitating a harmonious passion, or in a controlled way, resulting in an obsessive passion. The overall purpose of this experience sampling study with active, multiple role women was to examine the influence of passion towards physical activity on daily positive and negative affect as well as more generally in terms of vitality.

Method: Sixty-three healthy and active middle-aged women participated in this study. The women attended a baseline session to complete a series of self-report questionnaires including The Passion Scale. Then, using the experience sampling method, the women responded to electronic questionnaires pertaining to their daily affect and physical activity engagement over a 14-day period. Subsequently they attended a second session during which levels of vitality were assessed. The data were analyzed using Hierarchical Linear Modeling and Analyses of Covariance.

Results: Sixty of the participants (95%) were passionate towards physical activity. Daily positive affect was higher and negative affect lower on days when the women engaged in their passion (i.e., physical activity). On these active days, associations between overall positive and negative affect and levels of harmonious or obsessive passion were in the expected directions, albeit not significant. Levels of harmonious and obsessive passion moderated the relationship between activity engagement and positive affect such that obsessively passionate women felt significantly worse on days when they were not active. Vitality was negatively associated with obsessive passion and positively with harmonious passion.

Conclusions: The findings were consistent with the Dualistic Model of Passion and they suggest avenues of future enquiry. In considering physical activity as a strategy to optimize women's well-being, the internalization process of this activity (autonomous versus controlled) should be considered. Potential application of these results should involve facilitating more harmonious passions towards physical activity by emphasizing flexible and volitional participation that is well balanced among other activities.

Keywords: physical activity; passion; daily affect; vitality; women; experience sampling method; hierarchical linear modeling

Background

Women, Well-Being, and Physical Activity

It was recently revealed that mental illness, including depression, poses a burden 1.5 times greater than that of all cancers (Ratnasingham et al. 2012). Among women, depression is the leading cause of disease-related disability (Noble 2005). Furthermore, there is evidence that levels of psychological health, in general, tend to be lower in women compared to men (Denton et al. 2004; Hopkins Fishel 2008). From a psycho-social perspective, there may be several compromising influences on women's mental health in today's society, for instances feelings of role overload which can arise from marked pressure on women to assume a multitude of roles (e.g., mother, professional, etc.; Lasswell 2002; Pearson 2008). Conversely, there are also protective factors capable of having a beneficial impact on women's mental health and well-being, most notably, engaging in regular physical activity (Kull 2002). Indeed physical activity¹ has been associated with greater wellness and lower symptoms of depression, especially among women (Galper et al. 2006; Penedo and Dahn 2005).

Women's regular engagement in physical activity has also been linked with several specific indices of well-being including positive affect (Elavsky and McAuley 2005; Gauvin et al. 2000; Kull 2002). Affect is defined as the subjective characteristic of an individual's feeling state and it is often described along two dimensions: valence (positive, negative) and activation (high, low; Ekkekakis and Petruzzello 2002). Researchers have demonstrated the beneficial influence of physical activity on women's affective states immediately after the activity (Cramp and Bray 2010; Guérin and Fortier 2012) and in terms of their general affectivity (i.e., Kelsey et al. 2006). Another subjective indicator of well-being that has received increased attention in the context of exercise and that is more eudaimonic (i.e., focused on self-realization and growth) and enduring in nature is vitality. Vitality refers to meaningful feelings of positive energy and enthusiasm (Ryan and Frederick 1997). Vitality is an individual's dynamic and subjective experience of aliveness, and although it is informed by one's physical state, it is of a more psychological quality (Nix et al. 1999). Not surprisingly, experiencing greater levels of vitality is

another beneficial outcome of regular physical activity engagement, particularly among women (Brown et al. 2000; Wendel-Vos et al. 2004).

However, does engaging in physical activity *always* or *necessarily* lead to greater well-being, be it vitality, positive affect, or other indices? Existing literature has led experts to raise such enquiries (Biddle and Ekkekakis 2005). Vancour (2009) remarked that many professional women, for instance, feel a pressure to create a balance between heavy work demands and multiple roles while also incorporating practices of a healthy lifestyle (i.e., exercise). This could result in a controlled orientation, or sense of obligation toward engaging in physical activity, which might not be optimal for one's greater well-being. Indeed, feelings of guilt and pressure towards physical activity have been linked with excessive or rigid engagement in this behaviour, and this can have dire consequences in terms of well-being (Hameret al. 2002; Hausenblas and Downs 2002). Thus, there is reason to believe that we need a more sophisticated understanding of the circumstances under which physical activity leads to greater well-being. Psychological theory can help direct exploration in this regard; in fact, theory has been highly recommended to determine how physical activity contributes to individuals' wellness (Berger and Motl 2000; Reed and Buck 2009). One theoretical perspective that offers strong, well-supported tenets that link activities, such as physical activity, with important indicators of well-being is the Dualistic Model of Passion (Vallerand et al. 2003).

Dualistic Model of Passion (DMP)

Description. Vallerand and colleagues (2003) proposed a novel approach to the study of passion wherein passion is characterized by an investment of time and energy in an activity that one likes, values, and assimilates into one's identity, and which has the potential to lead to positive outcomes. Researchers have shown that sport/physical activity is a top rated passion category and that many active people are passionate about this activity in their life (Vallerand et al. 2003; Rousseau and Vallerand 2008). Therefore, this context is ideally suited to study passion, adding to the fact that passion for physical activity or sport can inherently give rise to several worthy outcomes, such as fitness and health (Vallerand 2010). However, few passion

studies have been conducted in the physical activity domain specifically (Parastatidou et al. 2012) and none have uniquely targeted women.

In addition, because passionate people are engaging in an activity that is highly valued, there is a close link between passion and increased affective experiences (Vallerand 2010; Vallerand 2012). Given that a great deal of time is spent partaking in the passionate activity (Vallerand et al., 2003, study 1; 2008 study 1) and considering aforementioned affective benefits of physical activity among women, it would be interesting to consolidate these streams of research. Thus a first purpose of this study was to examine, among active women who are passionate for physical activity, whether they experience improved affect on days when they engage in their passion (i.e., physical activity) versus days when they do not.

The unique and defining element of the DPM is its representation of passion's inherent dualism (Vallerand 2010). In essence, the consequences of engaging in a passionate activity may depend on the way this activity is internalized and incorporated into one's identity (Vallerand et al. 2003; 2007). According to the stated model, distinct internalization processes can lead to the development of two types of passion: harmonious passion (HP) and obsessive passion (OP). When physical activity is engaged in with a sense of volition and choice, it becomes internalized in an autonomous fashion, thus leading to a harmonious form of passion (Vallerand et al. 2003). With a HP, the activity is well-balanced in one's identity and it is 'in harmony' with other aspects of one's life. Conversely, an OP for physical activity arises from a controlled internalization whereby one likes the activity but feels a compelling and overwhelming urge to engage in it, as described earlier. In this case, contingencies become attached to the activity as a result of intra- and inter-individual pressures to pursue it. The differential psychological consequences of HP and OP have been studied across several life domains (Vallerand 2008).

Type of passion and affect. According to the DMP, experiencing positive affect to its fullest can be thwarted by the rigid and controlling nature of an OP (Vallerand 2010). Studies have supported that OP for an activity is associated with lower levels of positive affect as well as more reports of negative affect, particularly in the form of shame and anxiety (Rousseau and

Vallerand, 2008; Vallerand et al. 2003; study 1; Vallerand 2008). Conversely, the freedom and flexibility of a HP allows individuals to fully engage in an activity thus maximizing positive affect experiences, and over time, allowing for greater well-being (Vallerand 2012). Not surprisingly, HP has been associated with higher positive affect following the activity (Mageau et al. 2005), from day to day (Mageau and Vallerand 2007), and in general across time (Vallerand et al. 2003; study 2).

Although these associations have seldom been tested with respect to physical activity, in a sample of active older adults Rousseau and Vallerand (2008) found that HP predicted greater subjective well-being over time by increasing positive affect during physical activity. Parastatidou and colleagues (2012) showed that HP had a stronger positive association with exercise enjoyment than OP, although they did not assess positive affect directly nor any more generalized effects over time. To our knowledge, no study has been conducted with active women to specifically look at the influence of passion (i.e., HP and OP) on their daily positive and negative affect when they do engage in physical activity in their busy day-to-day lives. This was the second objective of the present study. Moreover, this was accomplished using repeated, overall daily measures over a 14-day period, whereas the above studies employed cross-sectional designs or drew from a few select time points.

Passion types can be further distinguished relative to how an individual is impacted by being unable to engage in the activity (Vallerand et al. 2003). Because OP is characterized by overvaluation and an uncontrollable desire to partake in the activity, it follows that not engaging in the activity would lead to declines in positive affect and increments in negative affect. Conversely, the volitional and balanced qualities of HP would protect against such deleterious effects. Research supports these associations for the high activation components of affect (Ratelle et al. 2004; Vallerand 2010). For instance, in a college sample with a diversity of passions, Mageau and Vallerand (2007) found that OP moderated the effect of activity engagement on positive high activation affect at the end of the day. It is reasonable to assume that multiple-role women would exhibit a unique and at times uncontrollable balancing act with

respect to a passion for physical activity among several other responsibilities. Therefore, it was deemed theoretically and practically pertinent to examine, as another purpose, whether the differential effect of engaging in one's passion (physical activity) on a given day, versus not, on overall daily affect is moderated by passion types in this population. This would be the first study to explore this proposition across four dimensions of affect (high, low, positive negative).

Type of passion and vitality. While optimal affective states are worthy outcomes in themselves, passion researchers have also assessed more global and longstanding indicators of well-being such as satisfaction with life and vitality (Rousseau and Vallerand, 2008; Philippe et al. 2009; Vallerand and Houliort, 2003). Consistent with the dual conceptualization, research has shown that HP holds a positive, prospective association with vitality. Philippe and colleagues (2009) assessed vitality as an indicator of eudaimonic well-being and saw that a group of harmoniously passionate participants, compared to an obsessively passionate group, experienced an increase in vitality one year later. Vitality levels were also higher among women. Little research in the passion tradition has used measures of both cumulative short-term/daily indicators of well-being as well as those that reflect more enduring, eudaimonic facets of well-being in the context of the same study (Rousseau and Vallerand, 2008). Moreover, given the evidence that physical activity may be particularly beneficial for women's vitality, understanding the influence of passion would provide a psychological link that extends above and beyond simply engaging in the activity. This was examined in the final purpose of this study.

Experience sampling and passion. Lastly, some passion researchers have taken to conducting diary studies (also known as the experience sampling method) to investigate daily fluctuations in activity engagement and affect (Mageau and Vallerand 2007; Verner-Filion et al. 2012). The experience sampling method refers to the real-time acquisition of participants' self-reported thoughts feelings and/or behaviours in their natural everyday environments and it has been praised for providing externally valid results (Hektner et al. 2007; Scollon et al. 2003). This approach is also ideally suited for examining day-to-day physical activity patterns specifically

(e.g., Hyde et al. 2011). Therefore, data for the present study was acquired using the experience sampling method in the context of active, multiple-role women's daily lives.

Purposes

The first aim of this experience sampling study with active, multiple-role women was to investigate the influence of engaging in one's passion (i.e., physical activity) on daily positive and negative affect (high and low activation). It was expected that women would report greater positive- and lower negative affect on days when they engaged in their passionate activity versus days when they do not (Mageau and Vallerand 2007; Wichers et al. 2012). The second purpose was to look at the influence of passion types on daily positive and negative affect on days when women engaged in physical activity. It was hypothesized that a) levels of HP would be positively associated with positive affect and negatively related to negative affect, while b) reverse or non-significant associations would arise for OP levels (Rousseau and Vallerand, 2008; Vallerand 2012). The third objective was to examine whether levels of HP and OP would moderate the effect of activity engagement on daily affect. It was presumed that higher OP would result in lower positive- and greater- negative affect on non-physical activity days compared to activity days (Mageau and Vallerand 2007). The discrepancy in affect across days would diminish with higher HP (Vallerand 2010). These relationships were dissected by comparing participants classified as more harmoniously passionate and those more obsessively passionate (i.e., groups).

The fourth purpose of this study was to examine, controlling for physical activity levels and using two complementary types of analyses, the relationship between HP as well as OP and levels of vitality measured two weeks later. Via group differences, we expected women in a harmoniously passionate group, versus an obsessive group, to show greater levels of vitality. With prospective regression, we hypothesized a positive relationship between HP and vitality, accompanied by a weak or negative association for OP (Philippe et al. 2009).

Method

Context

This study was embedded within a larger research program on active women and their various social roles (xxxxxx et al. 2012). As such, the following inclusion criteria were employed to screen all participants for eligibility: a) female aged between 25 and 55, b) mother with one child aged 18 or younger still living in the home, c) physically active (i.e., meeting the Canadian physical activity Guidelines of a minimum of 150 minutes of moderate to vigorous physical activity per week (Tremblay et al. 2010); d) working full-time outside of the home (minimum of 30 hours/week); e) currently free from any underlying medical condition that would influence physical activity levels or impair mood.

Participants

The participants were recruited by several means, including snowball sampling and word of mouth promotion of this study. Moreover, a recruitment text appeared in several professional and athletic e-newsletters and information posters were positioned in athletic centers and sport/children's stores in a large city. Interested participants emailed or telephoned the research team in order to receive details about the study. The researchers reviewed the inclusion criteria with each participant to ensure that she was eligible to partake. Failure to satisfy one or more of the criteria, being unable to commit to the study's time requirements, or being unreachable for scheduling resulted in thirty-one women being eliminated. Another three women were excluded after the study as a result of errors during the recording or transferring of data.

The final sample consisted of 63 very active, healthy women [i.e., mean endpoint Godin Leisure Time Exercise Questionnaire (LTEQ) score of 51.73, $SD = 18.55$; Godin and Shephard, 1985]. They had a mean age of 42.60 years ($SD = 5.59$). Calculations using self-reported height and weight showed that they had a healthy BMI of 22.70 on average ($SD = 2.81$). These mostly Caucasian (89%) women were well-educated (83% with bachelor's degree or higher) and reported a variety of professions such as nurse, professor, assistant director, etc. More than half were legally married at the time of the study (70%), 11 participants were separated or divorced

and seven were living with a partner. The women had an average of two children ($SD = .92$) with a mean age of 10.42 years ($SD = 5.02$). Forty-five percent of the participants reported spending five or more hours per weekday in unpaid childcare-related activities.

Procedures & Measures

This study was approved by the University of ~~xxxxxx~~ Research Ethics Board. The protocol is described in the sections that follow, interposed with descriptions of the measures that were employed at two in-person sessions (two weeks apart) as well as those administered via the Experience Sampling Method (ESM; Csikszentmihalyi and Larson 1987).

Baseline session. At the first of two individual sessions, participants provided their written consent after being informed of the general purpose and requirements of this study. A brief instructional session was delivered to explain an electronic questionnaire application that was developed for this study and that was loaded onto participants' personal electronic devices. For any woman that borrowed a device supplied by the research team, more thorough directions were offered until she felt comfortable with the tool. The timing requirements of the questionnaires, that is, immediately after physical activity and at night before bed, were duly explained. Participants also completed the following set of baseline measures.

Demographics. A basic demographic questionnaire was administered in order to describe the women in this sample. There were questions pertaining to ethnicity, education level, income, marital status, number- and age of children and ages, general health status, and so on. The women were also asked about the number of hours they spend per day in different roles, including childcare-related activities.

Passion. The Passion Scale was used to evaluate passion towards physical activity (Vallerand et al. 2003; Parastatidou et al. 2012). Participants were asked to think about this activity when responding to the two components of the scale. All descriptive items were scored on a 7-point Likert scale from (1) do not agree at all, to (7) very strongly agree. The four items that make up the first component of the scale assess the extent to which one is passionate about the activity (e.g., devote time and energy to it). Being 'passionate' is defined as having a mean

score above the mid-point (i.e., four) across these items. The second component evaluates the two types of passion (HP, OP) and is comprised of 12 descriptive items, six per passion type. Examples of items include “This activity reflects the qualities I like about myself” (HP) and “I am emotionally dependent on this activity” (OP). Several studies have shown high reliability and theoretical validity for the scale (Mageau and Vallerand 2007; Rousseau and Vallerand 2008). Scores for HP and OP are computed by taking the mean of the items in each subscale. The Cronbach’s alpha values for HP and OP were .77 and .88 respectively, which were similar to those of others such as Donahue et al. (2009) in the sport context.

Experience sampling. Participants were directed to begin the experience sampling component of the study the day after the baseline session and for 14 continuous days thereafter. They were encouraged to engage in their normal, daily activities, which could include any brief lapses or surges in physical activity. The present study made use of *interval-contingent sampling* (i.e., end of the day) as well as *event-contingent sampling* (i.e., physical activity session; for details, see Hektner, et al. 2007). Via electronic questionnaires, participants provided a description of their activity after each moderate-to-vigorous session (event) and they rated their overall daily affect every night before going to sleep (interval). An assessment at the end of the day offers a good evaluative judgment of average mood over the course of one day (Giacobbi et al. 2005) and it has been employed in previous passion studies (Mageau and Vallerand 2007).

The questionnaires were administered using an Apple© application that was developed for iPod Touches and iPhones© for the purposes of the larger project. After selecting the appropriate questionnaire from a menu page, participants scrolled down the screen and responded to each item individually. All responses were time- and date- stamped and were submitted through a safe and password protected server. Additional features of the application included an ‘End-of-Day’ questionnaire reminder, where participants could opt to receive a subtle alert on the device at a designated time. In addition, every questionnaire timed out automatically after 30 minutes to prevent erroneous or time-lagged recordings.

Activity description (post-physical activity). After each physical activity session over the 2-week period, the women recorded three pieces of information for descriptive purposes: a) the type of activity they performed (e.g., running); b) the amount of time engaged, and c) a subjective rating of the intensity of the activity. The latter was assessed using the Rating of Perceived Exertion (RPE; Borg 1982), a reliable self-report measure of intensity that is commonly employed in exercise-based studies examining affect (Russell and Newton 2008). Respondents selected their intensity value (RPE) from a series of descriptors at every odd integer on a 6-20 scale (i.e., 7 = very, very light; 13 = somewhat hard; 19 = very, very hard).

Daily affect. Participants' overall daily positive and negative affect were assessed at the end of each day using the Positive and Negative Affect Schedule (PANAS; Watson et al. 1988). This measure is commonly employed by physical activity researchers as well as by others assessing the links between passion and affective states (e.g., Reed and Buck 2009; Rousseau and Vallerand, 2008). Participants were instructed to indicate the extent to which they had *felt this way today* for each of 20 adjectives (10 positive), for example "interested" and "upset", using a 5-point Likert-type scale ranging from (1) not at all to (5) extremely.

Ekkekakis and Petruzzello (2001) contend that the PANAS is a measure of high activation affect only (i.e., excited/energetic state). Hence, other researchers have supplemented the PANAS with 11 items assessing low activation affect (i.e., calm/relaxed state) and these were also integrated into the present study (Abercrombie et al. 2005).² This approach is warranted in order to address the complexity of affect, particularly as exercise-based arousal levels may wane over the course of a day (Barrett and Russell 1998; Kwan and Bryan 2010). Values for positive and negative affect were summed separately by activation to provide daily affect score with possible ranges of 10-50 and 5-25 for high and low activation respectively. In the present study, we obtained high internal consistency values across time and participants for all four affect types (α range = .78 - .94).

Activity engagement (daily). The participants were also asked to provide a dichotomous yes/no rating of physical activity engagement at the end of each day. This served two goals.

First, it helped to address the possibility that participants may forget or be unable to log each post-activity description over the 14 days. Second, it served as partial validation of the post-physical activity description.

Endpoint session. Participants attended a second session approximately two weeks after the first in order to return the device (if applicable) and ensure that all data was properly transferred and deleted from the device. They also responded to one final set of questionnaires. The women were debriefed and presented with a gift card for their involvement in the study.

Physical activity levels. Given the focus of the present study, a global retrospective account of participants' physical activity levels in the last two weeks was obtained for descriptive purposes and to control for this variable in regression analyses. Activity levels were quantified using the Godin LTEQ (Godin and Shephard 1985). The LTEQ is a valid and reliable measure of physical activity across different populations, including active individuals (e.g., Duncan et al. 2010; Jacobs et al. 1993). Participants were asked to consider the last two weeks in evaluating the number of times per week they engaged in light, moderate, and strenuous intensity physical activity (examples provided). To create a weekly activity score, the frequency values are multiplied by their respective MET intensity value, namely three, five, and nine. Scores above 14 are considered moderately active and scores above 24 are active (Godin 2011).

Vitality. The vitality subscale of the Short-Form (SF-36) Health Survey of the Medical Outcomes Study was used to assess vitality (Ware and Sherbourne 1992). Respondents indicated how much of the time over the past month they had been feeling in regards to four items assessing feelings of energy and aliveness (e.g., "Have you felt calm and peaceful?"). Responses were scored on a scale from (0%) none of the time to (100%) all of the time. The subscale has been described as a valid and reliable indicator of eudaimonic well-being (Vuillemin et al. 2005; Ware 2000). In this study, the measure demonstrated adequate internal consistency ($\alpha = .83$)

Analyses

Preliminary. Baseline and endpoint data were entered directly into SPSS Statistics 20 and summary statistics were computed. Passion groups were created by identifying participants'

highest standardized scores on the two passion subscales (Philippe et al. 2009; Mageau et al. 2009). This practice is informative given that when individuals are passionate for an activity, they tend to strongly endorse items from both subscales, resulting in blurred distinction between “purely” passionate people of either type and those that are mixed. Therefore, by drawing on standardized scores, two similarly sized groups of relatively more harmonious and relatively more obsessive participants are created.

As for the experience sampling data, individual datasets were downloaded from the server as Excel files before being exported into SPSS. Then, the sums and means of the post-physical activity and end-of-day affect variables were computed by aggregating scores across the 14 days. If participants had reported a post-activity description on a given day but had not logged the end-of-day measures, a “yes” was imputed as the value for having engaged in activity that day (PANAS items were not imputed). For all data (baseline, daily, endpoint), the distributions of the variables were examined in terms of outlying values, skewness, and kurtosis. In short, all standard assumptions of univariate and multivariate regression analyses were examined, for instance, Mahalanobis distances, multicollinearity and so forth (Tabachnick and Fidell 2007).

Daily affect. The hierarchical structure of the data acquired in this study, namely the daily assessments of positive and negative affect (level 1) nested within stable individual-level passion variables (level 2), warranted the use of hierarchical linear modeling (HLM; Raudenbush and Bryk 2002; Nezlek 2008). The data was restructured to be treated using HLM 6.0 statistical software (Raudenbush et al. 2004). Some advantages of HLM versus analyses of aggregate scores include its ability to reliably estimate relationships within-participants as well as its capacity to manage missing data (Giacobbi et al. 2005; Nezlek 2008).

With HLM analyses, the intercept of an equation indicates the between-person variability of means on the outcome variable when any level 1 predictor in the equation is equal to 0. The type of centering that is applied to the level 1 predictor (or no centering) will influence how the intercept is understood. The same principles govern the interpretation of the grand-mean of participants when level 2 predictors are included. In the present study, the level 1 predictor

consisted of the dichotomous physical activity engagement variable, with “yes” dummy coded as “0” and “no” coded as “1”. This variable was left uncentered, and thus the intercept corresponded to participants’ means on the outcome variable for the category coded as “0”, in this instance, having engaged in physical activity that day. The level 2 predictors in this study were the two passion types (HP, OP) and these were grand- or sample- mean centered. In this case, the intercept represents the mean on the outcome variable *across* all participants. To illustrate the equations that were tested, readers are invited to consult Table 2 and Mageau and Vallerand (2007) for a more detailed description. In initial analyses, intercepts and slopes were set as randomly varying. They were revised to be fixed if coefficients were estimated with low reliability or if errors terms were not significantly variable between participants. Separate equations were tested for the four types of affect (i.e., positive, negative, high- low- activation).

The full-maximum likelihood estimation was used and the hypotheses for purposes one to three were evaluated via t-tests of model coefficients (McCoach and Black 2008). Robust standard errors were evaluated in order to circumvent issues arising with violations of homogeneity of variance. A log likelihood test of fit improvement in HLM (using χ^2) was used to test the superiority of models with the inclusion of additional variables (Hox 2010; Raudenbush et al. 2004). To help with interpretation, pseudo- R^2 was calculated as a measure of effect size by subtracting the unexplained variance from a restricted model (with predictors) from the unexplained variance of an unrestricted model (no predictors) and dividing by the unexplained variance in the unrestricted model (Kreft and De Leeuw 1998; Raudenbush and Bryk 2002).

Vitality. To examine the influence of passion on endpoint vitality, two complementary types of analyses were conducted. First, harmoniously passionate and obsessively passionate women were compared with respect to vitality using an ANCOVA controlling for LTEQ scores (i.e., endpoint physical activity). Second, all passionate participants were included together in hierarchical regression analyses to examine the relative influence of HP and OP levels on vitality. Scores on the LTEQ as well as any other relevant demographic variables such as age were controlled for.

Results

Data Cleaning and Preparation

Out of the 63 women in the final sample, three scored below the midpoint on passion criteria items of the Passion Scale (i.e., non-passionate) and were excluded from the main analyses, as per Donahue et al. (2009). All analyses were conducted on the 60 participants who were passionate for physical activity.³ The distributions of all variables (i.e., baseline, daily, endpoint) were closely examined to verify assumptions. The obsessive passion variable demonstrated a skewed distribution therefore a log transformation of this variable was employed in all statistical tests (Hair et al. 1998).

Moreover, the negative affect variables (high, low activation) showed very skewed distributions that could not be corrected with standard data cleaning actions such as transformations (Hair et al. 1998; Tabachnick and Fidel 2007). Specifically, most participants scored very low on daily negative affect. To address the issue, each negative affect variable was dichotomized as “high” and “low” based on the values that partitioned the observations into pairs of relatively evenly sized categories. Specifically a) for high activation negative affect, scores equal to 12 or greater were considered “high” and coded as “1” (< 12 as “0”) and b) for low activation negative affect, scores equal to 11 or greater were considered “high” and coded as “1” (< 11 as “0”). Given binary variables, HGLM was used to test negative affect models using a log-link function with a Bernoulli distribution (Raudenbush et al 2004). Specifically, unit-specific models (correcting for overdispersion) with robust standard errors were examined to determine the odds of scoring high on negative affect.

There were no other deviations from normality on the main variables. The unstandardized coefficients of noteworthy models are presented in Tables 2-4. The division of participants into passion groups resulted in a harmoniously passionate group consisting of 33 women who displayed higher HP and lower OP levels than the obsessively passionate group ($n = 27$). The groups were significantly different in terms of HP, $t(58) = -5.26, p < .001$, and OP levels, $t(58) = 4.90, p < .001$.

Physical Activity Summary

Table 1 presents descriptive statistics and the number of data points for baseline and endpoint variables as well as for the experience sampling data post-physical activity and at the end of each day. The average RPE rating for the intensity of physical activity sessions across all participants was 14.61 ($SD = 2.17$), which can be labeled as “hard” and of moderate-to-vigorous intensity (Borg, 1982).⁴ The women described a wide variety of physical activities, including, but not limited to: running, swimming, spinning, hiking, and skiing. In terms of the overall frequency of physical activity engagement as reported in the end-of-day questionnaires, participants answered ‘yes’ to having engaged in physical activity on 9.93 days or 71% of days (range: 4-14). They reported “no” on an average of 2.92 days out of the 14.

Purpose 1: Physical Activity and Daily Affect

Positive affect. In the unconditional model for daily high activation positive affect, the average across days was moderate at 28.85 ($SE = .92$). In the first conditional model (Table 2), there was a significant association between engaging in the passionate activity on a given day and levels of positive affect, $t(59) = -4.92, p < .001$, and this relationship varied between participants. Because engaging in physical activity was coded as 0, the negative coefficient indicates that high activation positive affect was significantly higher (by 3.38 points) on days when the women were active (versus not). This model explained 12% of within-person variance.

For low activation positive affect, an unconditional model revealed that the average across all days was relatively high ($M = 16.11, SE = .38$). This model revealed a significant association between engaging in physical activity on a given day (versus not) and levels of daily low-activation positive affect, $t(59) = -6.35, p < .001$, and this varied between participants (Model 3 in Table 3). More specifically, low-activation positive affect was also higher on days when the women engaged in physical activity. Notably, there was a 2.10 point increase from days when the women were not active to days they were. This model explained a similar 12% of within-person variance in low activation positive affect.

Negative affect. Engaging in physical activity on a given day was significantly associated with high activation negative affect such that “high” values were more likely on days when participants were not active, $t(713) = 5.43, p < .001$. An unconditional Bernoulli model revealed that the probability of an elevated score on high activation negative affect (i.e., above 12) across all days was 41.8%, but this dropped to 34.71% on days when the women did engage in physical activity (see Table 4 for odds ratios).

Results from a similar conditional model for low activation showed that reporting greater scores on negative affect was significantly more likely on days when participants did not engage in physical activity, $t(59) = 2.97, p < .01$, an association that varied between participants, $\chi^2(50) = 80.55, p < .01$. The findings revealed that across all days, there was a 46.1% probability of showing elevated levels of low activation negative affect. On days when the women were active, this probability dropped by 5%.

Purposes 2 and 3: Passion Types, Physical Activity, and Daily Affect

Positive affect. The first conditional model tested was an analysis of slopes and means as outcomes in order to examine the direct and moderating influence of passion variables (HP and OP) on daily high activation positive affect. This model provided a better fit than the more basic model (Model 1 in Table 2) consisting of physical activity engagement only, $\chi^2(4) = 9.26, p = .05$. Although the coefficients were in the expected directions, neither HP levels, $t(57) = 0.15, p = .88$, nor OP levels, $t(57) = -0.49, p = .63$, were significantly associated with high activation positive affect on days when participants were active (i.e., the intercept).⁵ However, coefficient values depicted in Model 2-A in Table 2 revealed a trend (i.e., higher estimates, lower p values) that favoured the influence of the passion variables with respect to the *slope* of activity engagement (vs. not engaging) and positive affect.

To underscore these latter associations for purpose three, a simpler model of slope variability only was tested, with passion types as random level-2 predictors of the level-1 activity engagement slope (Model 2-B Table 2). Results showed that HP levels moderated the relation between activity engagement and high activation positive affect, $t(57) = 2.89, p < .01$. Moreover,

OP levels also moderated this relationship but in the opposite direction, $t(57) = -2.23, p < .05$. Partitioning participants into passion groups helped to interpret these interactions. From Figure 1, the more harmoniously passionate women experienced greater high activation positive affect overall and this remained fairly stable across days when they did and did not engage in physical activity. Conversely, obsessively passionate women showed a noticeable drop in positive affect when they did not engage in physical activity ($M = 22.74$) compared to days when they did engage ($M = 28.98$).

A model with analyses of slopes and means as outcome was also tested for low activation positive affect. The conditional model with passion variables was not a superior fit to the simpler model with activity engagement only, $\chi^2(4) = 5.93, p = .20$. On days when participants were active, neither passion types were significantly associated with low activation positive affect (Model 4 in Table 3), albeit the associations were in the expected directions [HP: $t(57) = 1.38, p = 0.17$; OP: $t(57) = -1.24, p = .22$]. In regards to purpose three, neither type of passion moderated the relationship between activity engagement and daily low activation positive affect ($ps > .05$).

Negative affect. Next, a Bernoulli regression model of means as outcomes was tested in order to examine the direct influence of HP and OP on high activation negative affect. Given that there was no significant variability between participants in the association for activity engagement, it was not statistically warranted to add level-2 predictors of a fixed slope. Echoing results for positive affect, neither HP levels, $t(57) = -1.88, p = .07$, nor OP levels, $t(57) = -0.90, p = .929$ were significantly related to greater scores on negative high activation affect. The marginally significant effect of HP can be interpreted such that each increase of one point in HP resulted in 33% lower odds of scoring high on negative affect, factoring in the effect of engaging in physical activity. All odds ratios and coefficients can be found in Table 4. Despite non-significant random variability in a level 1 parameter (e.g., slope), level 2 predictors may be added to a model and interpreted with caution provided there be theoretical justification for their inclusion (Luke, 2004). Still, a Bernoulli model with analyses of means and slopes showed that

neither type of passion moderated the relationship between engaging in physical activity and high activation negative affect ($ps > .05$; not shown in Table 4).

Analyses of Bernoulli models (random slope) were repeated for daily low activation negative affect. Similar to the above findings, there were no direct or moderating effects of HP or OP on the probability of scoring higher on low activation negative affect.

Purpose 4: Passion and Vitality

Finally, we examined the relationship between passion (baseline) and levels of vitality measured at endpoint, that is, after the 14-day experience sampling component. First, and after covarying out the effect of physical activity levels, results showed that women in the harmoniously passionate group scored higher on endpoint vitality than women in the obsessively passionate group, $F(1, 57) = 13.57, p < .01, \eta^2 = .19$. Next, hierarchical regression analyses with all participants (non-grouped) helped dissect the relative, prospective influence of each type of passion. Preliminary bivariate correlations showed that older and more active participants had significantly greater vitality ($rs = .28, p < .05$). After controlling for both variables in step 1 of the regression (i.e., age, LTEQ), passion variables explained a significant portion of variance in endpoint vitality, $F(4, 59) = 5.24, p < .01, R^2 = .28, R^2\text{change} = .15$. Specifically, HP was positively related to vitality ($\beta = .33, p < .01$) while OP was negatively related ($\beta = -.28, p < .05$).

Discussion

The global objective of this experience sampling study with active, multiple role women was to examine the influence of passion towards physical activity on daily positive and negative affect as well as more generally in terms of vitality. Overall, the results lend support for the tenets of the DMP and they generate new paths of enquiry. This study has several strong points. Firstly, the focus of this study was on passion for physical activity which has seldom been studied independently as a passion despite the fact it lends itself remarkably well to the DMP and that it has important ties to mental health (Parastatidou et al. 2012; Melville 2012). Secondly, this research was conducted with active, multiple-role women. They represent a unique population given the juggling that is required to incorporate a passion for physical activity into their busy

daily lives. Moreover, women tend to have lower mental health than men and this must be better addressed (Hopkins Fishel 2008). Thirdly, we evaluated four components of affect across valence (positive, negative) and activation (high, low) dimensions which provided a more representative indicator of day-to-day well-being. Lastly, we capitalized on the experience sampling method, whereby we collected longitudinal, naturalistic self-report data in real-time.

All but three of the women that participated in this study were passionate toward physical activity, which they reported engaging in on close to 10 days (out of 14). On these activity days, the women reported higher overall levels of positive affect as well as lower negative affect compared to days when they did not engage, and this supported our hypotheses for purpose one. This is in-line with the DMP and similar conclusions in the domains of sport (Vallerand et al. 2008) and work (Vallerand and Houliort, 2003) among others, as well as investigations that attest to the cross-domain applicability of the model (Vallerand et al. 2003; Mageau and Vallerand 2007). We conclude that engaging in physical activity specifically as one's passion can lead to regular affective benefits.

This finding may relate to certain qualities inherent to this health behaviour. Carboneau et al. (2010) followed the same line of reasoning to study the emotional outcomes of a passion for yoga, citing well-documented mind-body benefits that accompany a regular yoga practice. Our study expands on theirs by examining a breadth of physical activities and by gathering repeated assessments of daily affect rather than one-time retrospective reports of positive and negative emotions experienced during the activity (i.e., during yoga). Because of this, it was deemed relevant to assess both high and low activation affective states as both are likely to transpire over the course of a day. Incidentally, and unique to this study, we observed that engaging in one's passion for physical activity explained a similar proportion of variance in both high and low activation positive affect. Therefore, it is likely that the rush and excitement of engaging in one's passion can be accompanied by feelings of calmness and serenity over the course of a day. Other researchers have also reported that women experience fluctuations in both

high and low activation states throughout the day, such as feelings of tranquility and exhaustion, and that these are sensitive to physical activity engagement (e.g., Focht et al. 2004).

In the objectives that followed, we queried the dual conceptualization of passion within the Vallerand et al. (2003) model for a more thorough understanding of the above effects. Individual hypotheses for our second purpose, regarding the respective influences of HP and OP on women's daily affect, and on physical activity days specifically, were not supported statistically. Firstly, the autonomous internalization that typifies HP was not significantly more beneficial emotionally over a day's course than having engaged in the passionate activity itself, though this association was positive. Albeit this study was novel in analyzing an overall rating of daily affect, ours is not the first to have found non-significance for HP in relation to positive emotions (Ratelle et al., 2004), nor with respect to negative affectivity (Mageau et al. 2005). Still, the findings are not fully in line with the DMP nor with Mageau and Vallerand (2007) who found that HP had a positive impact on positive affect assessed at the end of the day.

Secondly, higher levels of OP, stemming from a rigid and uncontrollable urge to engage in physical activity, did not appear to be emotionally injurious on days when the women engaged in the activity. As per Ratelle et al. (2004), our relationship between OP and daily positive daily affect was negative, though it was non-significant and this is consistent with Mageau and Vallerand (2007). Still, true to the DMP, engaging in physical activity out of an OP should be associated with poorer emotional states given one's rigid and defensive orientation. A few factors could account for why our findings disagree with others that support this theoretical association. First, links have largely been documented during or shortly after activity engagement (Stenseng et al. 2011; Mageau et al. 2005), whereas we found that an overall *daily* rating of negative affect was unrelated to OP on days when the women engaged in their passion. Second, borrowing from recent motivational theory-based studies (e.g., Guerin and Fortier 2012) it stands to reason that more agreeable affect for women with higher OP could be tied to a catharsis type of effect on days when they engage in physical activity. Namely, they may experience relief from feelings of guilt and anxiety attached to the activity and/or, in this

population specifically, possibly also a feeling of gratification from having “fit it in”. Future qualitative work would be ideally suited to expose such possible origins of these results.

Moreover, it is important to acknowledge the likelihood of measurement issues in explaining the absence of certain associations. For instance, potential ceiling effects for positive affect may have reduced the variance left to be explained by passion variables. In addition, participants consistently reported minimal scores for high and low activation negative affect (i.e., floor effects). Although dichotomizing the variables permitted analysing the data, raw score specificity was lost. Moreover, the possibility of biased responding cannot be ignored as a limitation, in that the women in this sample may have avoided full disclosure of their negative affect (Fujita et al. 1991). Whether such social desirability effects are unique to our population of women or not, they may need to be controlled for in future studies.

With some caution, results of this study so far support that women who are passionate about physical activity can reap its well-established emotional benefits and that the orientation of this passion, be it more harmonious and/or obsessive, tends to have a neutral effect on daily affective states, at least on days when women are active. But as per the DMP, the act of engaging in the passionate activity presents only one side of the passion equation with respect to well-being. Indeed, the third purpose of this study was to examine the moderating effect of passion types on the relationship between participating in physical activity (versus not) and daily affect.

Consistent with Mageau and Vallerand (2007) and our hypothesis, we found that OP exerted a significant moderating influence on positive affect (high activation), such that greater OP levels resulted in lower positive affect on days when participants were not active. This lends added support for the DMP, namely that OP is tied to a dependence on the passionate activity, which leads to substantial frustration when one cannot partake in it (Vallerand 2010). The moderating influence of HP was a unique finding of this study since Mageau and Vallerand (2007) did not see a significant effect. Group-based values can be interpreted such that being more harmoniously passionate fosters more stable positive affectivity that is less conditional on engaging in the passionate activity. According to Vallerand (2010) this reflects an ability to

adapt and focus energy elsewhere, which would be highly advantageous for women juggling many roles and responsibilities. Contrary to our hypotheses and tenants of the model, there were no moderating effects of HP nor OP for negative affect. Aforementioned measurement issues at a surface level may have played a role. On more theoretical grounds however, claims within the DMP pertain to being *prevented* from engaging in the activity. As a weakness of the current study, we did not inquire as to whether participants freely chose not to engage in physical activity or whether internal (i.e., injury) or external (e.g., daycare cancelation) circumstances prevented them from doing so. Such nuances in activity non-engagement may be particularly relevant in this population, and should be assessed in forthcoming investigations.

Being prevented from engaging in physical activity could lead obsessively passionate women to ruminate about the activity when not engaging in it (Donahue et al. 2012; Vallerand 2008). Maladaptive ruminations are one of the mechanisms that have been suggested to explain the influence of passion types on well-being. Other mechanistic influences that have received support include flow as well as enjoyment when engaged in the activity (Carpentier et al. 2012; Parastatidou et al. 2012). Specifically, individuals with greater HP tend to experience higher amounts of flow while partaking not only in the passionate activity but in other endeavours as well, and this can improve well-being. In future studies, dissecting the cognitions and feelings that also arise when partaking in competing, non-passionate activities and linking them to daily affective states would be informative, particularly among people who identify with the pursuit of many roles and responsibilities. These propositions tie in well with a more general assumption in this literature, namely that passion facilitates greater overall well-being through an accumulation of positive emotional experiences (Vallerand et al. 2007). Thus, it seems relevant to also examine enduring indicators of well-being (i.e., vitality) that can accrue over time in order to understand the progressive influence of one's internalization of the passionate activity.

Thus, in a final purpose we examined passion types in association with levels of vitality assessed at the end of the 14-day study. As expected, and after controlling for age and physical activity levels, we found that vitality was negatively predicted by OP but positively by HP. This

is in accordance with the DMP as well as previous research (e.g., Philippe et al., 2009). We found this to be true not only for absolute levels of each type of passion but also when the women were divided based on their most salient passion type. Others have confirmed similar relationships cross-sectionally, as well as with vitality (and also life satisfaction) assessments after three and 12 months (Rousseau and Vallerand 2008; Philippe et al. 2009; Vallerand et al. 2007). Our results imply that researchers need to be cautious in generalizing the findings regarding vitality from the physical activity literature to all women – clearly, women's internalization processes of physical activity need to be considered to promote a healthy participation. More specifically, our results suggest that while harmoniously passionate women are more likely to reap long-term, eudaimonic and energizing benefits from physical activity, higher OP can result in degradation on the vitality spectrum toward exhaustion. In our study, daily low activation negative affect² was unrelated to passion types which also suggests that the effect might only transpire gradually.

The findings from this study carry practical implications for well-being which complement our theoretical deliberations. Although eradicating a passionate activity altogether is one possible solution when an OP leads to deleterious effects (Vallerand 2010), this seems more applicable to acts such as gambling than physical activity, which is an essential component of a healthy lifestyle. Our results highlight the need to intervene with respect to women's internalization of physical activity into their sense of self, which would mean progressing towards a more harmonious passion and away from an obsessive passion. An autonomous orientation may be sufficient for active, busy women to stay balanced while reaping the emotional benefits of this type of activity (Forest et al. 2012). Either way, several specific tactics may be useful: a) attending to the reasons why one began partaking in the activity while focusing on enjoyment b) group-based exercise sessions without any contingencies attached to activity; c) self-regulation strategies focused on investing energy in alternative activities and setting moderate physical activity goals, thus reducing anxiety. Testing the relevance and efficacy of these applications should be considered in future intervention research. Moreover, forthcoming

studies should seek to further explore interesting underlying mechanisms as previously suggested while also addressing the limitations that have been acknowledged throughout this discussion.

Conclusions

This study offers added support for the applicability and theoretical relevance of the DMP in the physical activity context and among active women with multiple roles. Results showed that engaging in physical activity for which one is passionate leads to benefits in daily affect. However, being more obsessively passionate was associated with worse affect on non-physical activity days and with lower vitality over a two-week period. Harmonious passion led to more stable positive affect and greater vitality over time.

List of abbreviations

DMP: Dualistic Model of Passion; HP: Harmonious Passion; OP: Obsessive Passion; LTEQ: Leisure Time Exercise Questionnaire; SD: Standard Deviation; SE: Standard Error; RPE: Rating of Perceived Exertion; PANAS: Positive and Negative Affect Schedule; SF-36: Short Form-36; SPSS: Statistical Package for the Social Sciences; HLM: Hierarchical Linear Modeling

Competing interests

There are no competing interests.

Authors' contributions

EG and MF were involved in the conceptualization and planning of the study. EG oversaw the study protocol and EG and TW coordinated the data collection. MF supervised all facets of the project. EG and TW assumed responsibility for the cleaning and organization of the data while EG took charge of analyses and statistical interpretation of the data. EG wrote the manuscript with significant input and revisions from MF and TW. All authors approved the final manuscript.

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Endnotes

¹ *Physical activity* is defined as movement of the body that results in energy expenditure; this can be freely chosen and/or integrated into one's routine. *Exercise* is similarly defined but is more restrictive in that it refers to movement that is planned, structured and repetitive with an objective of maintaining/improving fitness (Biddle and Mutrie 2008). For the purposes of this paper we will employ the more global term of *physical activity* in order to capture a broader spectrum of activities. That said, we continue to use the term *exercise* when it applies to the cited literature. ² Items added to the PANAS to assess low activation affect: relaxed, at rest, serene, calm, at ease (positive); tired, sluggish, droopy, dull, bored, drowsy (negative; Barrett and Russell 1998). ³ The 60 passionate women were not significantly different from the full sample ($N = 63$) with respect to basic demographic and physical activity variables [Age = 42.75 years ($SD = 5.56$), BMI = 22.46 ($SD = 2.54$), LTEQ = 52.65 ($SD = 18.55$, range: 9-102)]. ⁴ Given the results of previous studies (e.g., Guerin and Fortier accepted) models of affect were all tested for the influence of RPE (square root transformed). The fixed effect of RPE on daily high activation positive affect was significant, $t(713) = 3.53$, $p < .001$. Testing of high activation models appearing in subsequent sections was repeated controlling for the each participant's average RPE value at level 2. There were no significant changes in model fit with the inclusion of average RPE and the coefficient remained largely unaffected. Not surprisingly, RPE was not related to low activation positive affect ($p = .84$). Therefore, no analyses with RPE are presented in this paper. ⁵ All mentions of OP refer to the log transformed variable.

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Table 1. *Descriptive statistics for baseline, daily experience sampling and endpoint variables.*

	Full sample			Harmoniously passionate			Obsessively passionate		
	N	Mean	SD	N	Mean	SD	N	Mean	SD
Baseline characteristics									
Age	60	42.75	5.56	33	43.45	6.27	27	41.89	4.51
Passion criteria/strength	60	5.84	.73	33	6.01	.66	27	5.62	.76
Harmonious passion	60	5.28	.96	33	5.77	.60	27	4.67	.99
Obsessive passion (log)	60	1.97 (.24)	1.11 (0.21)	33	1.43 (0.13)	.49 (0.14)	27	2.62 (0.34)	1.31 (0.22)
Experience sampling									
Physical activity days									
Intensity - RPE ^a	455	14.61	2.17	248	14.22	1.99	207	15.08	2.29
Time (minutes)	520	70.70	40.53	282	69.52	42.38	238	70.10	38.30
HA Positive affect ^b	560	29.81	8.99	304	30.51	9.00	256	28.98	8.93
LA Positive affect ^c	560	16.53	3.87	304	17.34	3.98	256	15.58	3.51
HA Negative affect (freq)	560	12.29 (207)	3.98	304	12.47 (110)	4.36	256	12.07 (97)	3.46
LA Negative affect (freq)	560	11.14 (232)	4.64	304	10.69 (106)	4.73	256	11.65 (126)	4.48
Non-physical activity Days									
HA Positive affect	175	25.59	7.83	96	28.00	8.00	79	22.67	6.57
LA Positive affect	175	14.10	4.09	96	14.94	4.22	79	13.09	3.71
HA Negative affect (freq)	175	15.34 (118)	7.16	96	15.93 (64)	8.42	79	14.63 (54)	5.18
LA Negative affect (freq)	175	12.60 (105)	5.11	96	12.63 (56)	5.47	79	12.57 (49)	4.67
Across Days									
HA Positive affect across days ^b	735	28.81	8.91	400	29.91	8.83	335	27.49	8.84
LA Positive affect across days ^c	735	15.96	4.06	400	16.76	4.16	335	14.99	3.71
HA Negative affect across days	735	13.02 (325)	5.09	400	13.30 (174)	5.79	335	12.68 (151)	4.08
LA Negative affect across days	735	11.49 (337)	4.80	400	11.16 (162)	4.98	335	11.87 (175)	4.54
Endpoint LTEQ	60	52.65	18.55	33	49.71	13.91	27	56.33	22.74
Endpoint Vitality	60	71.08	11.90	33	74.96	11.95	27	66.34	10.15

Note. SD = Standard Deviation; LTEQ= Godin Leisure Time Exercise Questionnaire; RPE = Rating of Perceived Exertion; HA = High Activation; LA = Low Activation; freq = Frequency of values in the “high” category (i.e., number of observations labeled as “high”, for instance for HA negative affect, 207 out of 560 responses were coded as high or “1”).

^a Both RPE and Time showed skewed distributions even after accounting for the influence of outliers. The variables were left untransformed since no subsequent analyses for these variables are presented in this paper.

^b ICC (Intra-class correlation) of experience sampling HA positive affect: .66(PA days), .61 (across all days).

^c ICC (Intra-class correlation) of experience sampling LA positive affect: .51 (PA days), .48 (across all days).

Table 2. *Models predicting daily high activation (HA) positive affect.*

Model	Estimate	SE	Model	Estimate	SE
1. PA (vs. no-PA) with high activation affect					
Fixed effects					
Intercept, β_{00}	29.64***	0.97			
PA, β_{10}	-3.38***	0.69			
Random effects ^a					
Intercept, σ^2_{u0}	52.77***	7.26			
PA, σ^2_{u1}	11.92***	3.45			
Residual variance, e	27.76	5.27			
2. A) PA (vs. no-PA) and passion with high activation affect			2. B) PA (vs. no-PA) and passion with high activation affect; slope only		
Fixed effects			Fixed effects		
Intercept, β_{00}	29.64***	0.96	Intercept, β_{00}	29.64***	0.96
Harmonious passion, β_{01}	0.16	1.02	PA, β_{10}	-3.34***	0.64
Obsessive passion ^b , β_{02}	-2.30	4.58	Harmonious passion, β_{11}	1.67**	0.62
PA, β_{10}	-3.34***	0.65	Obsessive passion ^b , β_{12}	-5.89*	2.64
Harmonious passion, β_{11}	1.62*	0.62	Random effects ^a		
Obsessive passion ^b , β_{12}	-5.09 [†]	3.19	Intercept, σ^2_{u0}	52.60***	7.25
Random effects ^a			PA, σ^2_{u1}	10.03***	3.17
Intercept, σ^2_{u0}	52.37***	7.24	Residual variance, e	27.72	5.26
PA, σ^2_{u1}	10.01***	3.16			
Residual variance, e	27.72	5.26			

Note. Unstandardized Estimates; SE = Standard Error; PA = Physical Activity. Level 1: Daily positive affect(Y_{pi}) = $\beta_{0i} + \beta_{1i}(\text{PA engagement}_{pi}) + r_{pi}$. Level 2: $\beta_{0i} = \gamma_{00} + \gamma_{01}(\text{Harmonious Passion}) + \gamma_{02}(\text{Obsessive Passion}) + u_{0i}$; $\beta_{1i} = \gamma_{10} + \gamma_{11}(\text{Harmonious Passion}) + \gamma_{12}(\text{Obsessive Passion}) + u_{1i}$

^aVariance component estimates and standard deviations are provided for Random Effects.

^bLog transformed Obsessive passion variable.

[†] $p = .10$. * $p < .05$. ** $p < .01$. *** $p < .001$.

Table 3. *Models predicting daily low activation (LA) positive affect.*

Model	Estimate	SE
3. PA (vs. no-PA) with low activation affect		
Fixed effects		
Intercept, β_{00}	16.61***	0.39
PA, β_{10}	-2.10***	0.33
Random effects ^a		
Intercept, σ^2_{u0}	8.03***	2.83
PA, σ^2_{u1}	2.09*	1.45
Residual variance, e	7.58	2.75
4. PA (vs. no-PA) with low activation affect		
Fixed effects		
Intercept, β_{00}	16.61***	0.38
Harmonious passion, β_{01}	0.58	0.42
Obsessive passion ^b , β_{02}	-2.39	1.94
PA, β_{10}	-2.09***	0.33
Harmonious passion, β_{11}	0.34	0.38
Obsessive passion ^b , β_{12}	-1.04	1.86
Random effects ^a		
Intercept, σ^2_{u0}	7.54***	7.54
PA, σ^2_{u1}	1.88*	1.37
Residual variance, e	7.89	2.75

Note. Unstandardized Estimates; SE = Standard Error; PA = Physical Activity. See Equations Table 2.

^aVariance component estimates and standard deviations are provided for Random Effects.

^bLog transformed Obsessive passion variable.

[†] $p = .10$. * $p < .05$. ** $p < .01$. *** $p < .001$.

Table 4. Models predicting daily negative affect (high and low activation; HA, LA).

Model	Coefficient (log odds)	SE	Odds Ratio	Model	Coefficient (log odds)	SE	Odds Ratio
High Activation Negative Affect							
5. PA (vs. no-PA) with high activation affect				6. PA (vs no-PA) and passion with high activation affect			
Fixed effects				Fixed effects			
Intercept, β_{00}	-0.64**	0.23	0.53	Intercept, β_{00}	-0.64**	0.23	0.53
PA, β_{10}	1.31***	0.24	3.71	Harmonious passion, β_{01}	-0.34	0.18	0.71
Random effects ^a				Obsessive passion ^b , β_{02}	-0.10	1.06	0.91
Intercept, σ^2_{u0}	2.51***	1.58		PA day, β_{10}	1.31***	0.24	3.71
Residual variance, e	0.81	0.90		Random effects ^a			
				Intercept, σ^2_{u0}	2.41***	1.55	
				Residual variance, e	0.81	0.90	
Low Activation Negative Affect							
7. PA (vs. no-PA) with low activation affect				8. PA (vs no-PA) and passion with low activation affect			
Fixed effects				Fixed effects			
Intercept, β_{00}	-0.36	0.30	0.70	Intercept, β_{00}	-0.37	0.30	0.53
PA, β_{10}	0.77**	0.26	2.17	Harmonious passion, β_{01}	-0.403	0.35	0.77
Random effects ^a				Obsessive passion, β_{02}	1.43	1.28	1.03
Intercept, σ^2_{u0}	4.70***	2.17		PA, β_{10}	0.76	0.25	3.60
PA, σ^2_{u1}	1.53**	1.24		Harmonious passion, β_{11}	-0.10	0.22	0.68
Residual variance, e	0.73	0.85		Obsessive passion ^b , β_{12}	-1.85	1.09	0.66
				Random effects ^a			
				Intercept, σ^2_{u0}	4.62***	2.15	
				PA, σ^2_{u1}	1.27 [†]	1.13	
				Residual variance, e	0.73	0.85	

Note. Unstandardized Estimates; SE = Standard Error; PA = Physical Activity.

^aVariance component estimates and standard deviations are provided for Random Effects.

^bLog transformed Obsessive passion variable.

[†] $p = .10$. * $p < .05$. ** $p < .01$. *** $p < .001$.

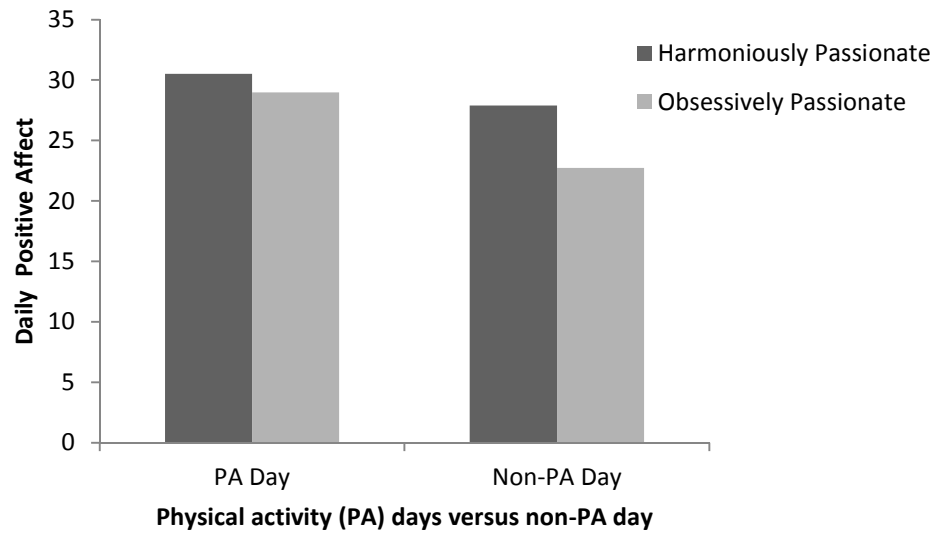


Figure 1. Daily high activation (HA) positive affect on days with and without physical activity by passion group.

CHAPTER VII
GENERAL DISCUSSION

DISCUSSION

The overall goal of this research was to gain a better understanding of the influence of self-determined motivation and passion on the relationship between physical activity and indicators of well-being in active women with multiple life roles. The role of the perceived intensity of physical activity (RPE) was also of interest. Self-Determination Theory (SDT) and the Dualistic Model of Passion (DMP) provided the theoretical foundation. In this dissertation, several objectives were examined using a two-study approach. Study 1 (S1) used an experimental design and was focused primarily on SDT's situational motivational regulations and RPE as predictors of short-term affective outcomes of running (as a preferred form of physical activity). Study 2 (S2) was a naturalistic investigation that employed the Experience Sampling Method (ESM). This multi-purpose study sought to predict changes in affective states with physical activity from pre- to post- to 3-hours post-activity using situational motivation and RPE variables. Moreover, Study 2 investigated the influence of women's passion for physical activity on their daily affect and general vitality as two important indicators of well-being.

Summary of Findings

Study 1. This study was conducted in a sample of 40 active middle-aged women who held multiple life roles and who had a preference for running. The outcome of interest in *Article 1* was the change in positive affect as an indicator of well-being from before to after a self-paced, in-laboratory running activity (30-minutes). An increase in high activation positive affect from pre- to post-running was related to the interplay between situational introjected regulation, as defined by running due to feelings of guilt and shame, and the intensity at which the women felt they were running during the task (i.e., RPE). Among women reporting high levels of introjection, positive affect was high and showed very little change with rising RPE values.

Women with low introjection saw a clear positive association between RPE and positive affect with running, which is more typical of an active population (Reed & Ones, 2006).

In the same sample, *Article 2* (S1) focused on the unique moderating effects of each of the situational motivations through comparison of the laboratory-based running session to a non-physical control task. First and as expected, results of the preliminary purpose showed that the increase in high activation positive affect with running was accompanied by a decrease in this outcome with the control task. For the main objective, and again highlighting the role of introjected regulation, only this situational motivation was a significant moderator of the relationship between the activity (running versus control) and changes in high activation positive affect. In this case, women with greater introjection reported a larger increase in high activation positive affect after running but also a greater decrease following the control task. We concluded that this may be attributed to a sense of relief occurring only when exercise is completed. For the running task specifically, situational identified and introjected regulations were positively related to post-running high-activation positive affect after controlling for pre-task levels of affect ($ps < .05$). Poor psychometric properties precluded the analysis of negative affect.

Study 2. Results of this study with 63 active, middle aged women with multiple roles were based on repeated-measures questionnaire data collected using electronic devices over a 14-day period. The results from HLM analyses of pre-, post-, and 3-hours post physical activity data pertaining to all purposes from *Article 3* can be adequately summarized in a motivational sequence to predict levels of high activation positive affect. In the short-term, situational introjection was positively associated with participants' RPE of the activity. Both RPE and situational intrinsic motivation were positively associated with positive affect immediately following physical activity. Positive affect levels 3-hours post-physical activity were relative to

those post-activity but they also increased when the women displayed higher identified regulation before engaging in the activity. The positive association between session RPE and 3-hours post-physical activity positive affect became non-significant after accounting for pre- and post- activity affect.

In the *Supplemental Analyses*, one purpose was to test Corollary 3.3 of the HMIEM using the Study 2 dataset. Results supported that situational regulations toward physical activity sessions are subject to the top down influence of contextual (typical) motivation for physical activity. To test the next series of objectives, negative affect variables from Study 2 were dichotomized as high and low for HLM analyses. Similar to positive affect, levels of negative affect showed dependency across time points (e.g., pre- predicting post-). There was also a decrease in the probability of scoring high on negative affect after physical activity. Unlike *Article 3 (S2)*, in which there were no significant associations for external regulation, this non-self-determined type of motivation was unexpectedly related to less negative affect post-physical activity. The influences of other situational SDT regulations and of RPE on negative affect (and over time) were non-significant.

The results of *Article 4* were based on the sample data for 60 women from Study 2 who were passionate for physical activity; the remaining three women did not meet the passion criteria. As predicted, there was a significant association between engaging in this passionate activity and daily high- as well as low- activation positive affect, with greater levels reported on days when the women were active. Similarly, the probability of scoring high on daily negative affect (high, low activation) was significantly related to whether the women had engaged in their passionate activity, such that negative affect was lower on days when the women had been active. Although neither HP nor OP for physical activity was significantly related to daily

positive affect on days when the women engaged in their passion, both types exerted a moderating effect for high activation positive affect. Namely, HP was related to higher and more stable positive affect across days while higher OP was associated with lower positive affect on days when the activity did not occur. Finally, passion group differences and hierarchical regressions revealed that HP was positively predictive- and OP negatively predictive of endpoint vitality (post-14 days).

Supplemental Analyses (Chapter IV): Interpretations

The first set of results presented in Chapter IV supported Corollary 3.3 of the HMIEM which specifies that one's usual contextual motivation for physical activity should positively predict situational motivation for specific activity sessions (Vallerand, 2007a). For example, we saw that contextual introjection was highly correlated with situational introjection and also with situation external regulation, which lies adjacent to it along the SDT continuum. This is consistent with previous studies like Ntoumanis and Blaymires (2003).

The supplemental results for negative affect supported that levels were lower immediately after physical activity but that post-physical activity levels were relative to those reported pre- activity (Rocheleau et al., 2004). Moreover, negative affect 3-hours post physical activity was also lower than before engaging in the activity, but also dependent on levels immediately post-, findings that are in-line with those of Daley and Welch (2004). There was no effect of RPE on negative affect hours after engaging in physical activity while the effect immediately post- was negligible. These findings support some previous research showing a lack of association between intensity and changes in negative affect after exercise (Cox et al., 2006; Rocheleau et al., 2004). We did not see a detrimental impact of high RPE on negative affect immediately after the activity which may be a reflection of the high fitness capacity of these

women (Blanchard et al., 2001; Cox et al., 2006). Moreover, given that this was a naturalist study, the results may be related to participants choosing not to surpass their own threshold that would lead to negative emotionality (Rocheleau et al., 2004; Vazo-Ekkekakis & Ekkekakis, 2009; Ekkekakis, et al. 2011). Moreover, we did not test cubic or quadratic functions in our data which could have delineated curvilinear trends for negative affect that can arise with more extreme RPE values, as identified by some experts (Arent et al., 2005; Yeung, 1996).

Regarding motivation, results were not entirely consistent with our predictions in that intrinsic and identified forms of motivation were not significantly associated with lower negative affect post- or 3-hours post-physical activity. This runs contrary to SDT which maintains that a more autonomous internalization of physical activity should manifest itself by reduced states of ill-being (Ryan & Deci, 2000b). Other studies have reported findings for general negative affect that are more in-line with SDT, namely that it holds a negative association with self-determined motivation (e.g., McDonough & Crocker, 2007; Puente & Anshel, 2010). Our results are more aligned with research by Gagné et al. (2003) that did not see a significant influence of self-determined motivation towards physical activity on negative affect post-activity specifically.

Lastly, the positive association between situational external regulation and reduced negative affect was surprising given that theoretically, the controlling nature of this type of motivation should have lead the women to feel worse post-physical activity (Deci & Ryan, 2002). It is possible that in instances when external regulation was higher, other social/ environmental variables acted as confounding influences that improved negative affect (e.g., the presence of a partner). That said, all findings for negative affect must be interpreted with extreme caution given the skewed nature of the original data and patent floor effects.

Strengths

This dissertation is of high importance on theoretical, practical, and methodological grounds. First and foremost, this research makes important contributions to our understanding of the mechanisms influencing the complex link between physical activity and well-being. Experts agree that more sophisticated knowledge is needed regarding underlying processes or circumstances under which physical activity may, or may not, benefit well-being (Berger & Motl, 2000; Lehnert et al., 2012). Advancing such research is particularly warranted in certain populations, notably among active women with multiple life roles (Gutierrez et al., 2012; Kull et al., 2012). Furthermore, and as argued by Biddle and Ekkekakis (2005), it is *theoretical* progress in particular that will move the physical activity-well-being relationship beyond mere association into a better understood sequence. Thus, an additional and significant strength of this dissertation is that it was grounded in two strong and relevant psychological frameworks.

Respectively, SDT and the DMP present tenable postulates regarding the psychological circumstances under which individuals can achieve improvements in well-being by engaging in physical activity. Therefore, they were ideal and complimentary perspectives to help direct this research. With SDT on one hand, less was known regarding the influence of situational physical activity motivation on ensuing affective states from acute activity engagement (Lutz et al., 2003), and thus both studies contribute novel insights. On the other hand, the dual conceptualization of passion within the DMP has seldom been tested in the physical activity context independently, much less in the daily lives of busy women, and this provided an ideal platform to showcase the model's predictive capacity. Other assets of this dissertation that pertain to theory will be highlighted in the 'Theoretical Implications' sections.

This project also addressed a need for more research regarding physical activity and indicators of well-being in active women's busy lives (Sabiston et al., 2010). Given that women's mental health may be more fragile than men's (Denton et al., 2004; Hopkins Fishel, 2008), the findings of this dissertation help to clarify how physical activity may serve as a potential avenue to improve women's psychological wellness, and in particular, under which motivational circumstances this may be optimized. Results of the two studies contribute applied knowledge regarding malleable psychological variables that may be targeted in interventions that seek to maximize adult women's well-being through adaptive, healthy physical activity.

Certainly, use of the ESM in Study 2, consisting of continuous self-assessments in the context of women's naturally occurring physical activity and day-to-day endeavours, renders the above conclusions and any future applications all the more transferable (Scollon et al., 2003). The ecological validity of Study 2 was well balanced by the rigours of an experimental design in Study 1, which contributed a well-contained examination of theoretical concepts at an acute situational level. Study 1 also addressed a shortage of experimental research on theoretical moderators in this domain, especially among women (Arent, et al., 2002; Kull, 2002). The use of distinct but complementary means of data collection strengthens our conclusions regarding theory-based moderators of the physical activity-well-being relationship. As another methodological but also a conceptual strength, we evaluated participants' affect across valence (positive, negative) and activation (high, low) dimensions for a total of four affective components. This provided a more complete assessment of changes and nuances in affect over time (pre-, post, 3-hours post-physical activity) and over a full day's course, which together with a measure of overall vitality in Study 2, provided a comprehensive evaluation of well-being. This echoes recommendations by Lutz and colleagues (2008). Lastly, the results of this thesis were attained

through complex analyses, notably by HLM which can account for the intricacies of ESM data (e.g., missing data, time intervals). Accordingly, a thorough display of the findings in Chapters II-VI offers a wealth of novel conclusions that will stimulate research in this area.

Theoretical Implications

This dissertation tested the tenants of two theories, namely SDT and the DMP. Since enquiries pertaining to women's perceptions of the intensity of their physical activity (RPE) were also conducted in conjunction with the SDT framework, the findings are also discussed here.

Self-Determination Theory (SDT). Self-determination theory is comprised of several mini-theories. The postulates tested in this dissertation pertained specifically to Organismic Integration Theory (OIT; Deci & Ryan, 1985; Ryan & Connell, 1989), which describes an internalization process by which values and regulations for behaviours such as physical activity become increasingly more self-determined along a continuum, leading to progressively more positive consequences. Given SDT's humanistic penchant on development and growth, motivational regulations are not only thought to predict physical activity participation but to also predict outcomes in well-being. Several findings, as elaborated below, supported the SDT principle that more self-determined motivation leads to improvements in affect (Deci & Ryan 2012; Teixeira et al., 2012). What is unique about this dissertation in regards to SDT is that it focused on affect immediately pre- and post-physical activity as well as 3-hours after, and this carries implications in terms of delayed, sequential, and/or enduring motivational influences on well-being. As another strong point, Corollary 5.2 of the HMIEM specifies that the level of generality of a psychological outcome should match the level of motivation producing it (Vallerand, 2007a, 2007b). Even in the prediction of acute pre-post affect, previous studies have focused on contextual motivation toward physical activity. An emphasis on proximal, matching-

level relationships was a unique element of this thesis. Results pertaining to situational regulations in *Articles 1-3*, as well as support for Corollary 3.3 (*Supplemental Analyses*), attest to the merit of attending to proximal motivational forces for theoretically sound predictions (Blanchard, Mask, Vallerand, de la Sablonnière, Provencher, 2007; Guay, Vallerand, & Blanchard, 2000; Standage, Treasure, Duda, & Prusak, 2003). The findings for the respective regulation are discussed sequentially in the paragraphs that follow.

The results of *Article 3* (S2) supported the SDT premise that intrinsic motivation toward physical activity would lead to improvements in positive affect, and in this case, post-activity specifically. This relationship has been found in previous studies (Lutz et al., 2003; Tripathi & Samantaray, 2011). In *Article 2* (S1), and similar to Gagné et al., (2003), this association was not supported, although measurement issues (ceiling effects) and the artificial (laboratory) context may have been to blame. Although much SDT research has examined the role of intrinsic motivation in behavioral engagement, less is known regarding its influence on exercise-related positive emotions, be it immediately post- or a short lapse of time later. In *Article 3* (S2) we showed that engaging in physical activity for inherent pleasure and enjoyment was not predictive of positive affect 3-hours post-activity as it was immediate post-. Given abundant support for the link between intrinsically motivated physical activity and global well-being (Deci & Ryan, 2000b; Deci & Ryan, 2008), it is conceivable that short bursts in positive affect from intrinsically motivated exercise may accumulate across sessions, bestowing overall benefits in well-being.

Next, identified regulation was associated with improvements in positive affect after a short bout of running (*Article 2- S1*), which is consistent with SDT as well as with findings by Lutz et al. (2003) immediately after exercise. In *Article 3* (S2) however, identified regulation was not associated with positive affect post-physical activity (nor with RPE). However, it was

significantly related to positive affect three hours later. These results are not inconsistent with research linking identified regulation for physical activity with general indices such as life satisfaction and physical self-esteem (Thøgersen-Ntoumani & Fox, 2007; Wilson & Rodgers, 2002). The results add further support for the SDT continuum and its relevance to well-being.

Moreover, to our knowledge, that the more one engages in physical activity by choice and for its valued health benefits (i.e., identified regulation), the better one will feel up to three hours afterwards is a novel and significant finding. What this means for OIT is that identified regulation is not only germane for continued engagement in a behaviour that is not always inherently enjoyable (i.e., exercise), but this degree of internalization can also sustain beneficial emotional states over time. This may prompt a motivational maintenance loop whereby delayed and potentially longer lasting affective benefits also propel future bouts of exercise (Kwan & Bryan 2010a; Williams et al., 2008). What this also implies for the theory is that intrinsic and identified regulation may have distinct but complementary influences on positive affect which should be collectively facilitated. Other researchers have made similar remarks regarding the pooled effects of the regulation for exercise behavior specifically and this will be discussed in our suggestions for future research (Teixeira et al., 2012; Vlachopoulos & Karageorghis, 2005).

Although the findings for introjected regulation were slightly conflicting between studies, they offer relevant insights as to the internalization continuum. Specifically, higher levels of introjected regulation predicted an increase in positive affect after running in the laboratory (Study 1) but not immediately after physical activity in women's day-to-day environments nor three hours later as per *Article 3* (S2). The latter findings are more in-line with the SDT premise that physical activity spurred by internal pressures of shame and guilt should not bring about organismic well-being (Ryan & Deci, 2000b). Past research has either shown introjection to have

no relationship with positive affect (e.g., Kwan et al., 2011) or a negative impact on indicators of well-being and overall health (Frederick-Recascino, 2002; McDonough & Crocker, 2007).

In *Article 1* (S1), an interaction effect between introjection and RPE was interpreted such that exhibiting lower introjection may allow for a greater appreciation of the sensations and vigor of the activity, thus dictating improvements in affect. With high introjection however, it seemed that merely knowing the activity had been performed was enough to improve mood. From a different angle, in *Article 3* (S2) we tested whether situational regulations would directly predict perceived activity intensity. Of note, greater introjection predicted higher RPE, a finding that is difficult to affiliate with SDT as it is ambiguous whether high RPE can be *necessarily* dichotomized as a ‘good’ or a ‘bad’ outcome. Still, the results resonate with SDT- based studies showing a link between introjection and high intensity activity in women and among exercise dependent females (Duncan et al., 2010; Edmunds, Ntoumanis & Duda, 2006). Thus, it is tenable that high intensity exercise in some women may be partly driven by a sense of obligation.

Furthermore, introjection was the only type of motivation in *Article 2* (S1), to significantly moderate the influence of physical activity on positive affect. Specifically, high introjection was tied to improved affect with running but worse affect with a non-physical control task. That the self-determined regulations were not significant moderators may indicate that they have a more firm influence on affect and well-being across the context/type or degree of activity (Burton et al., 2006). For instance, Burton et al. (2006) found a constant association between intrinsic motivation and well-being that was not contingent on performance factors (i.e., intensity). As alluded to above, the specific results for introjection imply that with higher levels, affective gains may be particularly contingent on merely being able to engage in physical activity. For some women, and consistent with similar reasoning (Sabiston, 2010; Nix et al.,

1999), a running session (of any intensity) may have improved affect by relieving stress or guilt from not having yet engaged in exercise. We need to acknowledge that introjection's effect in the laboratory may have been inflated by a sense of obligation to the study rather than a desire to not let oneself down (see *Article 2*) as introjection was not related to enhanced affect in Study 2.

Nonetheless, consistent with SDT and past research, high introjection resulting in a) activity-contingent positive affect, and/or b) feeling an obligation to exercise at a high intensity, carries the possibility of negative psychological (and physical) repercussions over time (Deci & Ryan, 2012; Edmunds et al., 2006; Hamer, Karageorghis, Vlachopoulos, 2002). That in *Article 3* (S2) introjection was not associated with positive affect 3-hours after the activity (nor post-activity) may partly attest to this.

The non-significant influence of external regulation was nearly ubiquitous across the studies presented, at least for positive affect. According to SDT, being driven to engage in physical activity because of an external pressure or reward should result in poorer psychological consequences (Deci & Ryan, 2012). Our findings are not necessary contrary to SDT but may simply reflect that active women display low and less variable levels of external regulation and that, consistent with other research, its influence tends to be negligible in individuals who are already regularly active (Teixeira et al., 2012; Duncan et al., 2010). As previously discussed, and deviating from SDT, we did see a paradoxical association between situational external regulation and diminished negative affect (*Supplemental Analyses-S2*). However, there were persistent measurement issues for negative affect across both samples of active women. Thus, it is ambiguous (but possible) as to whether theory-based motivation variables may be more pertinent in our understanding of how to maximize *positive* affective states with physical activity rather than reduce *negative* ones (Kwan et al., 2011).

There is ongoing discourse in the SDT literature as to which type(s) of motivation is/are more critical in explaining and promoting physical activity. In *Articles 1 to 3* we make a valid contribution to this debate, namely by focusing uniquely on outcomes of well-being. Our results are relevant to those of a recent systematic review (Teixeira et al., 2012) that timing in the behavioural process (initiation or maintenance) may be an essential consideration, to which we would add the type of outcome as well (exercise engagement versus exercise-induced well-being). There seems to be a particular paradox vis-à-vis the influence of introjected regulation. Specifically, while introjection may facilitate exercise participation and at a higher intensity, it is possible that persistence may either a) wane over time (Pelletier, et al., 2001) or b) become rigid (i.e., exercise dependency), accompanied by repercussions to the self and to mental as well as physical health (e.g., lower well-being, injury; Ackard, Brehm, & Steffen, 2002; Hamer et al., 2002). Conversely, as dictated by Teixeira et al. (2012), intrinsic and identified regulations may be simultaneously operative for optimal activity engagement. Our results extend this assertion, revealing that the latter may also have added value in the form of durable emotional benefits.

Passion. The findings of *Article 4* (S2) substantiate premises of the DMP in their capacity to link one's engagement in a favored activity (i.e., physical activity) with well-being (Vallerand et al., 2003). Sixty (95%) of the female participants in Study 2 were passionate for physical activity. They reported engaging in physical activity on close to 75% of days over a two-week period, reflecting that passionate individuals engage in their activity at a high frequency. This, according to the DMP's first premise, may result in cumulative benefits in affect and well-being (Vallerand et al., 2003; Vallerand, 2008). That these 60 women showed clear improvements in affect on days when they engaged in their passion for physical activity supports this principle and is in line with previous studies (Rousseau & Vallerand, 2008; Mageau

& Vallerand, 2007). Moreover, the results also suggest that when assessing affective states as the primary outcome for testing the DMP, different dimensions need to be considered. Specifically, participants showed comparable increases in high and low activation *positive* affect on activity days that were matched by decrements in high and low activation *negative* affect on non-activity days. What this represents for the theory is that having a passion for an activity, notably physical activity, has the potential to influence well-being on a daily basis via several avenues, including feelings of calmness and reductions in emotions such as anger. Although some studies have supported DMP postulates for positive and negative affect (e.g., Vallerand et al., 2006), many passion studies have focused heavily on positive affective states (e.g., Mageau & Vallerand, 2007), and to our knowledge, none had yet dissected the activation dimension of affect.

As a second basic premise of the Vallerand et al. (2003) model, the type of passion that drives an activity, be it obsessive (contingencies, controlling) or harmonious (volitional, flexible), should lead to different psychological consequences, namely positive, healthy outcomes for HP and less so for OP. Our finding that neither HP nor OP levels were significantly associated with daily affect on days when the women did engage in the activity was not directly in-line with the principle. Still, according to the model, the emotional consequences from activity non-engagement should be particularly sensitive to passion types and this was supported by our data for positive affect from *Article 4*. Indeed, significant moderation effects uniquely showed that: a) OP can have an injurious effect on positive affect when individuals do not engage in their passionate activity and b) HP can offer a protective effect by facilitating greater positive affect across days with a less critical dependency on engaging in physical activity or not. To our knowledge this is the first study to show this effect for HP as only the moderating role of OP had received empirical support (Mageau & Vallerand, 2007). Given that an overall daily measure of

affect was employed in *Article 4*, the findings also reflect more generalized affect that transpires over a day's course rather than acute states during or immediately after an activity, as it has often been assessed in the passion literature (Vallerand, 2012). This suggests that DMP postulates linking passion types with affective outcomes may be particularly sensitive to the time frame of assessment, be it during the activity itself versus day to day or more globally.

The results for vitality on the other hand, which was construed in this dissertation as a more global indicator of well-being, were very much in-line with the DMP. Namely, greater OP, as characterized by being unable to control one's urge to engage in physical activity, was associated with lower vitality at endpoint. Conversely, being harmoniously passionate was positively associated with general feelings of rejuvenation and energy (i.e., vitality). Such enduring benefits in well-being may be related to the accumulation of pleasant affect on a daily basis (Rousseau & Vallerand, 2008). The buildup of positive states is one mechanism among others, such as ruminative cognitions and self-esteem, which have been proposed to mediate the relationship between passion types and well-being (Carpentier, Mageau, & Vallerand, 2012).

Lastly, the results presented in *Article 4* (S2) demonstrate that the DMP is theoretically robust in the physical activity domain specifically, a context which has been seldom studied individually. This is coherent with claims, as well as supporting research, that the model is malleable across domains (see Vallerand, 2010 for review).

Limitations

It is important to acknowledge shortcomings of research to ensure sound progress in the area. This dissertation had certain limitations of its own. First, this research was conducted with a restricted sample, that is, active, full-time employed, middle-aged mothers. This specificity was intentional for the goals of this project although it limits the generalizability to different groups

of women (i.e., younger/older, non-mothers, inactive) and to men. Next, since questionnaire data was collected and analyzed, all results were based on self-report which is subject to a number of cognitive and/or response biases. Given the length of some questionnaires as well as the multiple repeated assessments of the ESM, it is possible that participants may have felt burdened, thus leading to erroneous responding (Reis & Gable, 2000). It is also possible that participants were aware of the nature of the hypotheses in this research, and therefore responded in ways the researcher would expect (e.g., “I *should* feel better after exercise”). This may be particularly true in this line of research, wherein expectations may influence participants’ mood above biasing their responses: “...expectations regarding the benefits of exercise are crucial for maximizing perceived mood enhancements” (Anderson & Brice, 2011, p .79).

Social desirability may have also swayed participants to under- or over report certain motivation or emotion items in order to appear a certain way to the researchers (Grimm, 2010). In particular, there may be a reluctance to report feeling sad when the cultural norm dictates that negative emotions are undesirable (Barrett & Barrett, 2001). We did see especially low means and low variability for negative affect across time points and in both studies. Although others have also shown this for negative affect (e.g., Kwan & Bryan, 2010b), another study in particular saw notable changes in negative affect with physical activity among inactive female smokers (Bock, Marcus, King, Borrelli, & Roberts, 1999). Notwithstanding possible biases, it is also conceivable that most of the women in this sample were genuinely happy, which is possibly a reflection of the population that was studied (i.e., active, employed, healthy individuals). It will be important in future studies to consider controlling for response factors.

Overall, the results for negative affect must be interpreted with caution as they are based on dichotomous variables created from continuous scores (i.e., PANAS). This questionnaire was

not alone to raise problems. In Study 1, the low alpha for the identified regulation subscale of the SIMS was a cause for concern. Given a similar observation by Ntoumanis and Blaymires (2003), it would be worthwhile to conduct further testing of the validity of this subscale in physical activity situations. In Chapter V, issues with subscales of the BREQ-2 (Markland & Tobin, 2004) assessing contextual motivation warrant that the results be replicated in future studies, especially with active samples. There may be nuances in some of the items which are perceived differently and as more or less relevant by highly active people. Lastly, the OP subscale of The Passion Scale (Vallerand et al., 2003) had to be transformed for analyses. To our knowledge, this type of skewness issue is not typical of other passion studies and thus it may have been an artifact of the current sample. Although it was argued that multiple-role active women were well-suited to study the influence of passion, it might have been less likely for an OP to co-exist with more important responsibilities, for example career and family.

In addition to research design limitations discussed in Chapters II-VI, the following is a list of relevant factors that, had they been included as potential confounders, may have strengthened the results of this dissertation: a) In Study 1, participants' perceptions of the indoor, laboratory setting in relation their normal running environment (i.e, same, good, poor); b) In Study 2 (*Article 3*), participants' activity/circumstances when responding to the 3-hours post-physical activity questionnaire.¹ It should also be noted that there were fewer data points at 3-hours post-, which may have been related to the timing of physical activity sessions or to a non-response bias; c) In Study 2 (*Article 4*), participants' intentions to engage in physical activity each day with the prospect of capturing whether, on non-activity days, the women had been prevented from engaging in their passion (or freely chose not to).

As additional aspects that could have been accounted for in both studies: d) Participants' positive and negative affect *during* physical activity (elaborated on pp. 49-50); and e) Social factors pertinent to participants' physical activity engagement. Mostly for Study 2, familial demographic variables (e.g., marital status, number/age children) as well as social support, both in general and for physical activity, may have influenced the women's motivation and passion, physical activity patterns, and daily affective states, as expanded in Future Research below.

Future Research

There are also several avenues for future exploration and these build on themes that have been prefaced above. First, in regards to SDT, the influence of the regulations (i.e., OIT) is but one facet of this complex theory's predictive power. For instance, Wilson and colleagues (2006) found that greater satisfaction of perceived autonomy and competence (psychological needs) in exercise was associated with greater well-being (Wilson, Longley, Muon, Rodgers, & Murray). Therefore, forthcoming studies should consider the basic needs along with the regulations given that postulates of this mini-theory may be relevant when it comes to explaining women's well-being from physical activity (McDonough & Crocker, 2007; Vallerand, 2007b).

In addition, SDT has been a favoured theory for its emphasis on the social context within which physical activity occurs (Deci & Ryan 2008; Gagné et al., 2003). Women's perceptions of their social surroundings, be it with whom they exercise or how supported they feel in their family environment, may hold relevance in this line of enquiry. For instance, it would be insightful to examine how the social context may change the way active, passionate women feel when they are unable to engage in the activity (e.g., feeling related to others in an alternative activity). Among women, social support to pursue physical activity may indeed interact with different motives to predict regular participation (Segar, Eccles, Richardson, 2008). Interestingly,

Titze, Stronegger, and Owen (2005) found that high enjoyment was unlikely to co-exist with high social support among women who adopted a regular running practice. In future experience sampling studies especially, social factors pertaining to *each* physical activity session, such as relatedness with others and feeling encouraged, may supply additional explanatory power.

Second, there is a complementarity between the SDT and the passion model that is worthy of future study (Vallerand, 2010). For instance, engaging in physical activity to avoid feeling shameful or guilty constitutes a controlling form of internalization (i.e., introjection) which can invoke an obsessive need to engage in it. In *Article 2* (S1) and *Article 4* (S2) of this dissertation, we examined activity ‘non-engagement’ and the role of theoretical constructs in explaining resultant effects on well-being. The findings were compatible: a) women with higher levels of introjection displayed a pronounced drop in positive affect during a non-physical control task; meanwhile in a second sample, b) women with greater OP had lower positive affect on days when they were not active. Moreover, there may be a link between a) situational identified regulation and higher positive affect 3-hours after physical activity (*Article 3*), and b) higher HP levels leading to greater general vitality (*Article 4*). Namely, an appreciation of the health benefits of physical activity may prolong its emotional gains, fostering a more balanced and volitional pattern of engagement that is altogether revitalizing over time. Such discernible conceptual ties should be tested in the same article or statistical model in future research.

As a third and related suggestion, forthcoming studies should also explore the cluster analysis approach in creating profiles of psychological variables pertinent to women’s physical activity engagement (Aldenderfer & Blashfield, 1984). Exhibiting high and low levels of notable constructs simultaneously may lead to more accurate prediction of indicators of well-being than isolating each variable’s respective effect. The person-centered profiling approach emphasizes

that not all individuals fit the same motivational mold when it comes to activity engagement and researchers have attested to the validity of this technique with SDT (Guérin & Fortier, 2012; Ratelle, Guay, Vallerand, Larose, & Senécal, 2007; Vansteenkiste et al., 2009). Although some classification studies have been specific to women's behaviour (Stephan, et al., 2010), new studies should test the utility of this approach to optimally predict *well-being* as the primary outcome. In this regard, combining constructs from SDT and the DMP would be novel and worthwhile in order to examine, for instance, whether scoring low on OP and consistently high on intrinsic and identified regulations is an optimal profile to maximize a woman's well-being.

Fourth, considering the complexity of the physical activity-well-being relationship (Biddle & Ekkekakis, 2005) and given that a fair amount of variance remained unexplained in the analyses of this dissertation, it is likely that other theories could provide worthy insights. Some of these viewpoints may even assimilate certain elements of SDT and/or the DMP. For example, individuals' *self-compassion* (Neff, 2003) is one perspective that has been gaining momentum in this area of research and among women (Magnus, Kowalski, & McHugh, 2010; Mosewich et al., 2011). Notably, Magnus et al. (2010) found that self-compassion, characterized by kindness for- and appreciation of the self, was negatively related to introjected regulation and to obligatory exercise. In addition, constructs pertaining to the self-presentation framework (or *impression management*), have been tied to SDT and may be particularly relevant in predicting aspects of well-being in the context of women's physical activity (Gammage, Hall, & Martin-Ginis, 2004; Lewis & Neighbors, 2005).

Therefore, testing sophisticated models involving mediational chains of predictors across theories would be interesting for prospective studies. Results from Study 2 of this dissertation attest to the relevance of longitudinal designs in this regard since relationships between

constructs and outcomes may be delayed or cumulative. The sequence presented *Article 3* linking motivational regulations, RPE, and positive affect is a step in this direction. This also reflects that in predicting affective states in particular, integrating concepts may extend beyond the psychological realm to the bodily level, as per the Dual-Mode Theory (Ekkekakis, 2003).

Lastly, accounting for limitations in the depth of possible responses to psychological questionnaires and given the wealth of external factors influencing women's physical activity and their ensuing mental health (Kowal & Fortier, 2007; Segar et al., 2007), it would be valuable in future work to conduct individual interviews and focus groups. Others have documented women's willingness to explore how and why physical activity is a part of their life and the impact this carries (Guérin, Fortier, O'Sullivan, & Neilson, 2012; Whipple, Combs, Dowd, & Elliot, 2011). This would certainly allow, among other advantages, to tackle motivational and passion roots that may be psychological (e.g., body image insecurity leading to excessive exertion) or more social (e.g., running group as positive time spent with friends).

Practical Implications

The results of this dissertation lend themselves to a number of practical applications. Without relegating the plethora of factors weighing on the statistic that women are nearly 1.5 times more likely than men to meet the criteria for mood or anxiety disorders (Statistics Canada, 2011), our findings offer a small window of understanding that can be harnessed from a prevention standpoint. In a pair of studies, we showed that women's engagement in physical activity can lead to improvements on indicators of well-being, namely positive/negative affect and vitality, and that certain motivational qualities can maximize such effects. We agree with others (Kwan & Bryan, 2010a; Williams, 2008) that targeting an adaptive, autonomous motivational orientation is vital in sustaining healthy activity levels and ensuing well-being.

Our results showed that promoting the development of a passion for physical activity among women can be advantageous in terms of maximizing well-being via steady long-term engagement and an accumulation of positive experiences. However, caution must be exerted to facilitate a more autonomous internalization of the activity because the opposite can lead to daily affective states that are very much contingent on being able to engage in the activity. Above and beyond the influence on mood throughout the day, Mageau, Carpentier, and Vallerand (2011) showed that with a more obsessive passion, individuals' self-esteem is also more contingent on the activity, tending to fluctuate with how well/much they perform the activity. Thus, media campaigns or health promotion programs that advocate physical activity to enhance women's wellness should emphasize the value of healthy, sensible, revitalizing and enjoyable engagement.

The idea of *sensible* engagement in physical activity seems to be particularly salient for well-being promotion. This is coherent with evidence that physical activity on 3-5 days per week may be optimal for affective benefits (Reed & Buck, 2009) and that exercising every day of the week can diminish one's quality of life (Brown et al., 2004). It was shown in this dissertation that uncontrollable urges to engage in physical activity can lead to lower vitality, and possibly, physical and emotional exhaustion. Indeed, obsessive passion has recently been linked to exercise dependence (Paradis, Cook, Martin, & Hall, in press), with its host of harmful repercussions, as well as to burnout over time, particularly when the passion comes into conflict with other salient life spheres (Vallerand, Paquet, Philippe, & Charest, 2010). Among women who juggle family and work responsibilities, the risk for conflict may be high and the consequences of burnout dire. Fortunately, the overall results of this dissertation are suggestive of psychological processes that can be targeted in women's wellness programs in order to ensure sensible participation in physical activity that fits within women's many responsibilities.

The novel motivational sequence presented in *Article 3* (S2) lends itself to several applied strategies. Moreover, it may be reasonable to incorporate the noted motivational and physical activity elements in this time-based sequence, as well as other suggestions in the SDT literature, into one comprehensive step-based approach: 1) Identify and promote what constitutes enjoyable physical activity for individual women in order to increase positive affect, 2) Then, encourage short and intense bursts of this or similar activities (i.e., high RPE) to quickly boost affect. Given that many women feel time-pressed on a daily basis (Nomaguchi, Milkie, & Bianchi, 2005; Statistics Canada, 2010), this option may be particularly well-received. Although in *Article 3* (S2) we found that introjection predicted higher RPE, we need to be mindful of adverse short- and long-term risks of introjected motives on women's body image and well-being. When encouraging high-intensity activity, it may be more prudent to target desirable sensations and elements of SDT such as competence, perhaps through a graded-intensity approach.

Finally, in order to promote flexible participation as well as lasting emotional benefits for several hours and more generally, Step 3 boasts several strategies that target a more autonomous internalization. For example, a) setting moderate, realistic exercise goals to avoid excessive participation, b) reframing physical activity so that it is not perceived as another performance area for high-achieving women, c) keeping a daily (and/or pre-post physical activity) diary of notable physical and mental health improvements and barriers, d) the values interview, whereby a consultant can explore a woman's core goals and values to bring her physical activity in line with them. Building on the latter strategy, e) identifying valued areas of life and integrating them with physical activity (e.g., family bike ride, yoga for highly-regarded relaxation).

In closing, the findings of this dissertation are optimistic in that despite the pressures on women to give themselves fully to a multitude of roles (Pearson, 2008), it is surely feasible for

them to engage in levels of physical activity that meet current physical activity guidelines. Others have also recently supported this (Krouse, Ransdell, Lucas, & Prichard, 2011; Whipple et al., 2011). Moreover, by helping women through an autonomous internalization process of physical activity, we can use the benefits of an active lifestyle to not only improve mental health when it goes astray, but also as a preventative measure to maximize women's well-being.

Conclusion

The overall purpose of this dissertation was to contribute a better understanding of the psychological circumstances under which physical activity can lead to greater well-being among active women with multiple roles. The findings exposed the utility of using psychological, theoretical constructs drawn from SDT and the DMP, as well as the influence of perceptions of activity intensity (i.e., RPE), in this regard. Specifically, in Study 1 and/or Study 2, higher RPE as well as intrinsic, introjected and identified types of situational motivation for physical activity exerted beneficial influences on acute affective states, the latter being especially influential three hours after the activity. Although introjection may help predict higher intensity activity, theory dictates that this regulation's influence on well-being may be questionable over time. Indeed, obsessive passion, with its conceptual ties to introjection, was shown to lead to less stable daily positive and negative affect and lower vitality over time. The opposite findings for harmonious passion are in-line with those of the self-determined motivational regulations and warrants that sensible, balanced physical activity be promoted in women's wellness programs. Future research should seek to improve the complexity of predictive models by combining constructs from SDT and the DMP and by integrating other theoretical perspectives to discover the most adaptive psychological profiles for achieving greater well-being from physical activity.

Footnote (discussion)

¹ Although initial design of the software application included the following multiple choice question at the 3-hour post physical activity time point, technical issues during the collection and transfer of this data rendered it unusable:

1. Currently, you are (select best match): _____
 - a) working
 - b) running errands
 - c) housework or household task
 - d) leisure – alone or with partner/friend(s)
 - e) caring for kid(s)
 - f) exercising
 - g) dressing, showering, and/or preparing for bed
 - h) sleeping/resting
 - i) other

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STATEMENT OF CONTRIBUTIONS

This thesis was conducted within the scope of a larger project looking at active women with multiple life roles wherein factors such as non-physically active leisure and sleep were also examined. As the candidate's supervisor, and given her expertise with Self-Determination Theory as well as her personal interest in multiple-role-women and wellness, Dr. Michelle Fortier directed this project. Dr. Shaelyn Strachan was a collaborator. Dr. Strachan provided conceptual input to the larger project through the inclusion of variables from Identity Theory, albeit these were not analyzed within the purposes of the current dissertation. Moreover, she made financial contribution to the purchasing of iPod Touches for Study 2. The committee members played a guiding role at the thesis proposal, notably in terms of refining the research design of Study 1. They also approved the integration of physical activity intensity (RPE) as a component of this thesis.

This project was jointly conceptualized by Dr. Fortier and the doctoral candidate, Mrs. Eva Guérin. Mrs. Guérin was implicated in all stages of the project. Her involvement consisted of the following, but was not limited to: Co-conceptualization and measures selection, procurement of ethics certificates (including amendments and renewals), collaborating with a software developer to create a questionnaire application, recruiting- as well as communicating with and scheduling participants, collecting data during two individual sessions for Study 1 and for Study 2, data entry and cleaning, auditing an HLM course and analyzing all data presented in Chapters II-VI, writing and revising the articles.

Mrs. Guérin received assistance from fellow students during the recruitment and data collection phases. Notably, Tamara Williams, a master's student under Dr. Fortier's supervision, is also completing her thesis within this larger project. She aided in recruiting participants and

conducted several of the individual research sessions for Studies 1 and 2. She was also involved in data cleaning for Study 2. Two other research assistants aided in various steps of the processes, notably in co-running participant sessions and in data entry.

As for the contributions to the individual articles: For *Article 3*, Dr. Guérin benefited from statistical consultation with Dr. Shane Sweet, a previous doctoral student of Dr. Fortier's. Given his input in the HLM analyses as well as the interpretation of the results and in revising the final draft of the manuscript, he was included as a third author. *Article 4* was in-line with Tamara William's master's thesis work looking at conflict between physically active and non-physically active leisure. Given her familiarity with baseline and endpoint data for Study 2 (collecting, cleaning) and her knowledge of the literature, Mrs. Williams provided input on the final draft of the manuscript and was included as a co-author.

In sum, Mrs. Guérin was responsible for all work presented in these articles, and Dr. Fortier was responsible for overseeing all aspects of this project, including significant editing of all sections of this thesis.

APPENDIX A

Study 1 Descriptives for Negative Affect (Table 1)

Appendix A. Table 1

Table 1. Study 1 descriptive statistics and Cronbach's alpha (a) values for negative affect across tasks and time points.

Variable	Running					Control				
	Mean	SD (Variance)	Alpha	Skewness	Kurtosis	Mean	SD (Variance)	Alpha	Skewness	Kurtosis
High Activation										
Pre-task	11.02	1.37 (1.87)	.463	1.43	1.24	11.08	1.68 (2.82)	.751 ^a	1.77	2.46
Post-task	10.20	0.71 (0.51)	.220	3.58	11.72	10.76	1.41 (2.00)	.552	1.98	2.98
Low Activation										
Pre-task	8.39	2.43 (5.89)	.735 ^a	1.35	1.89	9.45	3.30 (10.90)	.826 ^a	.85 ^a	-.19 ^a
Post-task	6.90	0.97 (0.94)	.285	1.24	1.65	10.10	3.69 (13.59)	.857 ^a	.91 ^a	.24 ^a

Note. Note: ^a Values found to be unproblematic.
Number (n) of outlying values given one value lower than next lowest in distribution (Tabachnick & Fidell, 2007): Post-running High Activation (2), pre-control high activation (2), pre-running low activation (1), post-running low activation (1).

APPENDIX B

Research Design Study 1 (Figure 1)

Appendix B. Figure 1

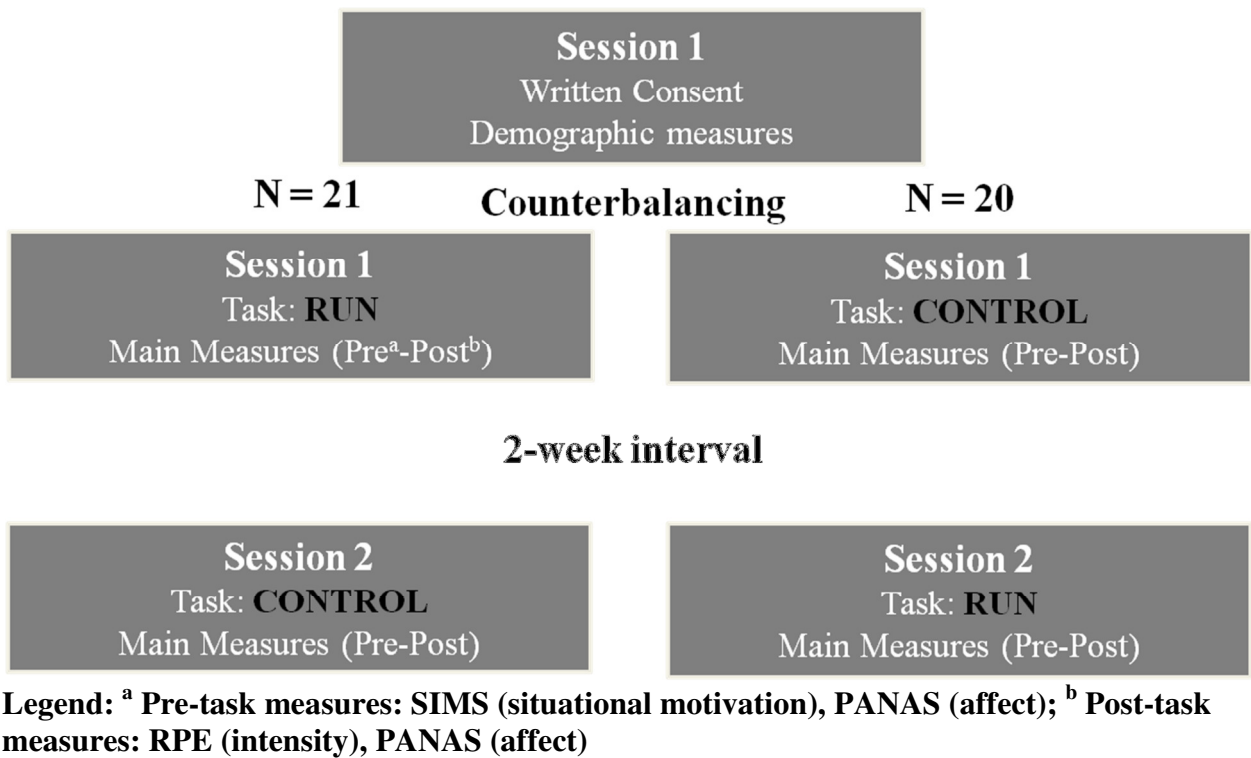


Figure 1. Research design Study 1

APPENDIX C

Measures

Appendix C. Measures

The measures appearing in this section have been divided into Study 1 and Study 2. However, several instruments were employed across both studies: a) Godin LTEQ (Appendix B-2); b) SIMS (Appendix B-3); c) PANAS (Appendix B-4); d) RPE (Appendix B-5). To avoid redundancy, they are only feature once (i.e., under Study 1) although specific footnotes have been inserted in the respective appendices to indicate changes in the instruction/response stems that were made for Study 2.

Study 1 – Experimental Study

Appendix C-1 [EN]

Demographics Form Study 1

Contact person (in case of emergency):

Name: _____ Number: _____

Your occupation: _____

Education level (select highest achieved):

- ☐ No diploma or certificate
- ☐ High School degree
- ☐ Apprenticeship or trades certificate
- ☐ College or CEGEP degree (≤ 1 year)
- ☐ College or CEGEP degree (≥ 1 year)
- ☐ Some university studies (minimum of 1 year)
- ☐ Bachelor's degree
- ☐ Master's degree
- ☐ Degree in medicine, dentistry, veterinary medicine, or optometry
- ☐ Doctorate degree

Household Income (select one):

- ☐ < \$20, 000 ☐ \$20, 000 - 29, 999 ☐ \$30, 000- 39, 000 ☐ \$40, 000- 59, 999
- ☐ \$60, 000 - \$79, 999 ☐ \$80, 000 – 99, 999 ☐ > \$100, 000

Hours of paid work/week: _____

Ethnicity:

- ☐ White ☐ Black ☐ East-Southeast Asian ☐ West Asian/Arab ☐ South Asian

€Latin American €NA aboriginal €Other

Marital status:

€Single €Married €Separated €Divorced €Widowed €Cohabiting

Number of children: _____ (**living in the home, under the age of 18)

Age of children (list): _____

The following questions pertain to your general health:

Weight: _____ lbs

Height: _____ ft _____ in

1. Do you have any underlying medical condition(s) that the researchers should be aware of:

Yes No

If Yes, Please specify: _____

2. Do you have a history of respiratory, cardiovascular, or metabolic disease?

Yes No

3. Do you have any acute or chronic injury that currently causes you undue pain or increases your risk of further injury?

Yes No

QUESTIONS PERTAINING TO RUNNING BEHAVIOURS

Running is one of my preferred forms of physical activity:

- (a) Agree
- (b) Disagree

Running is one of my most frequent forms of physical activity:

- (a) Agree
- (b) Disagree

I have been running at my current intensity/frequency for:

_____ months (OR _____ years)

I prefer to run:

- (a) On a treadmill
- (b) Outdoors
- (c) Either
- (d) It depends

If you answered (d), explain if desired: _____

I prefer to run:

- (a) Alone
- (b) With a partner or group
- (c) Either
- (d) It depends

If you answered (d), explain if desired: _____

I prefer to run with music:

- (a) Always
- (b) Sometimes
- (c) Rarely
- (d) Never

I usually run (I prefer):

- (a) In the morning
- (b) In the early afternoon/lunch
- (c) In the late afternoon
- (d) In the evening
- (e) All/any of the above

If you answered (d), explain if desired: _____

The average length (time) of my runs is: ____ minutes (excluding warm up/cool down walking)

and/or

The average mileage of my runs is: ____ km (excluding warm up/cool down walking)

The average intensity of my runs is: ____ (**please select a value from the list below)

- 6 No exertion at all
 - 7 Extremely light
 - 8
 - 9 Very light - (the equivalent of easy walking slowly at a comfortable pace)
 - 10
 - 11 Light
 - 12
 - 13 Somewhat hard (It is quite an effort; you feel tired but can continue)
 - 14
 - 15 Hard (heavy)
 - 16
 - 17 Very hard (very strenuous, and you are very fatigued)
 - 18
 - 19 Extremely hard (You can not continue for long at this pace)
 - 20 Maximal exertion
-

*Appendix C-1 [FR]***Personne ressource (en cas d'urgence):**

Nom: _____ Téléphone: _____

Numéro de participant: _____ (fourni par l'équipe de recherche)**Age:** _____**Votre profession:** _____**Niveau d'éducation (sélectionner le plus élevé que vous avez reçu) :**☐ Aucun diplôme ou certificat☐ Diplôme d'études secondaires☐ Certificat d'apprenti ou d'une école de métiers☐ Diplôme/certificat d'un collège ou d'un CEGEP (programme d'un an ou moins)☐ Diplôme/certificat d'un collège ou d'un CEGEP (programme de plus d'un an)☐ Études universitaires partielles (minimum 1 an)☐ Un baccalauréat☐ Une maîtrise☐ Un diplôme en médecine, en art dentaire, médecine vétérinaire, ou en optométrie☐ Un doctorat**Revenu (sélectionner un choix):**☐ < \$20, 000 ☐ \$20, 000 - 29, 999 ☐ \$30, 000- 39, 000 ☐ \$40, 000- 59, 999☐ \$60, 000 - \$79, 999 ☐ \$80, 000 – 99, 999 ☐ > \$100, 000**Ethnicité:**☐ Blanc ☐ Noir ☐ Asiatique de l'est/sud-est ☐ Asiatique de l'ouest/Arabe ☐ Sud-asiatique☐ Origine de l'Amérique latine ☐ Nord-Amérindienne ☐ Autre**Nombre d'heures de travail payées par semaine:** _____**Situation de famille:**☐ Célibataire ☐ Mariée ☐ Séparée ☐ Divorcée ☐ Veuve**Nombre d'enfants:** _____ (**en bas de 16 ans qui habite à la maison)**Âge des enfants (lister):** _____**Les questions suivantes portent sur votre état de santé général.****Poids:** _____ lbs**Taille:** _____pieds_____pouces

1. Souffrez-vous de une/des condition(s) médicale(s) sous-jacente d'ont l'équipe de recherche devrait être au courant?

Oui Non

Si oui, veuillez spécifier : _____

2. Est-ce que votre dossier médical comprend une/des maladie(s) respiratoire(s), cardiovasculaire(s), et/ou métabolique(s)?

Oui Non

3. Souffrez-vous en ce moment d'une blessure aiguë et/ou chronique qui vous donne des douleurs ou qui augmente le risque que vous vous blessiez à nouveau?

Oui Non

QUESTIONS SUR VOS COMPORTEMENTS RELIÉS À LA COURSE:

La course est une de mes activités physiques préférées:

- (a) En accord
- (b) Pas en accord

La course est une de mes activités physiques les plus fréquentes:

- (a) En accord
- (b) Pas en accord

Je cours à ma présente fréquence (par semaine) et intensité depuis:

____ mois (OU ____ années)

Je préfère courir:

- (a) À l'aide d'un tapis roulant
- (b) Dehors
- (c) Un ou l'autre
- (d) Ça dépend

Si vous avez répondu (d), élaborer si désiré : _____

Je préfère courir:

- (a) Seule
- (b) Avec un/une partenaire ou en groupe
- (c) Un ou l'autre
- (d) Ça dépend

Si vous avez répondu (d), élaborer si désiré: _____

Je préfère courir avec de la musique :

- (a) Toujours
- (b) Parfois
- (c) Rarement
- (d) Jamais

Normalement je cours (je préfère):

- (a) Le matin
- (b) En début d'après midi/ heure du diner
- (c) En fin d'après-midi
- (d) En soirée
- (e) Tous/ n'importe temps ici-haut

Si vous avez répondu (e), élaborer si désiré: _____

En moyenne, la durée de chacune de mes courses est de : ____ minutes (non compris l'échauffement et la période de récupération après la course).

et/ou

En moyenne, la distance parcourue à chaque course est de: ____kilomètres (non compris l'échauffement et la période de récupération après la course).

En moyenne, l'intensité (difficulté) de ma course est de: ____ (sélectionner de la liste sous-bas).**

- 6 Aucun effort
- 7 Extrêmement facile
- 8
- 9 Très facile (l'équivalent d'une marche lente à un pas confortable)
- 10
- 11 Facile
- 12
- 13 Un peu difficile (C'est un effort; vous êtes fatigué mais vous continuez)
- 14
- 15 Difficile (haute intensité)
- 16
- 17 Très difficile (très exténuante et vous êtes très épuisé)
- 18
- 19 Extrêmement difficile (Vous ne pouvez continuer longtemps a ce pas)
- 20 Effort maximal

Appendix C-2 [EN]

Godin Leisure-time Exercise Questionnaire (LTEQ; Godin and Shephard, 1985)

1. Considering **A TYPICAL WEEK [in the past 6 months]**,^a how many times on average do you do the following kinds of exercise for more than 20 minutes during your free time (**write the appropriate number of times per week on the line**).

A) STRENUOUS/VIGOROUS PHYSICAL ACTIVITY (HEART BEATS RAPIDLY)

(e.g., running, jogging, hockey, football, soccer, squash, basketball, cross country skiing, judo, roller skating, vigorous swimming, vigorous long distance bicycling)

_____ Times per Week

B) MODERATE PHYSICAL ACTIVITY (NOT EXHAUSTING)

(e.g., fast walking, baseball, tennis, easy bicycling, volleyball, badminton, easy swimming, alpine skiing, popular and folk dancing)

_____ Times per Week

C) MILD PHYSICAL ACTIVITY (NOT EXHAUSTING)

(e.g., yoga, archery, fishing from a river bank, bowling, horseshoes, golf, show-mobiling, easy walking)

_____ Times per Week

2. Considering a **TYPICAL WEEK [in the past 6 months]**,^a during your leisure-time, how often do you engage in any regular activity long enough to work up a sweat (heart beats rapidly)?^b (**select one box**)

☐

Often

☐

Sometimes

☐

Never/Rarely

Note.

^a For the endpoint of Study 2, the time frame was altered to *in the last 2 weeks*

^b This item was not analyzed for the purposes of this dissertation.

Appendix C-2 [FR]

1. Considérez une période **d'UNE SEMAINE TYPIQUE durant les 6 derniers mois**, combien de fois, en moyenne, vous adonnez-vous aux types d'activités physiques suivantes pendant **plus de 20 minutes** durant vos temps libres ? (**Inscrivez le nombre approprié sur chaque ligne**).

A) ACTIVITÉ PHYSIQUE D'INTENSITÉ ÉLEVÉE (FRÉQUENCE CARDIAQUE ÉLEVÉE)

(ex: jogging ou course à pied, ski de fond, nage intensive, bicycle intensif sur une longue distance, ...)

_____ Nombre de fois par semaine

B) ACTIVITÉ PHYSIQUE MODÉRÉE (SANS ÊTRE EXTÉNUANTE)

(ex: marche rapide, tennis, badminton, golf, motoneige, danse, volley-ball, bicycle de promenade, ...)

_____ Nombre de fois par semaine

C) ACTIVITÉ PHYSIQUE D'INTENSITÉ FAIBLE (EFFORT MINIMAL)

(ex: marche lente, quilles, golf, curling, ...)

_____ Nombre de fois par semaine

2. Considérez une période **d'UNE SEMAINE TYPIQUE [pendant les 6 derniers mois]**.^a Durant vos temps libres, à quelle fréquence pratiquez-vous une activité physique régulière suffisamment soutenue pour provoquer une transpiration (le cœur bat rapidement)? **(Choisissez une boîte)**

☐

Souvent

☐

Parfois

☐

Jamais/rarement

Note.

^a In Study 2, the time frame was altered to *durant les dernières 2 semaines*

^b This item was not analyzed for the purposes of this dissertation.

Appendix C-3 [EN]

The Situational Motivation Scale (SIMS: Guay et al., 2000)

Directions: Read each item carefully [while thinking as though you are about to engage in a normal running session].^a Using the scale below, please indicate on the line preceding each item the number that best describes [INSERT APPROPRIATE INSTRUCTION^b]. Answer each item according to the following scale:

1	2	3	4	5	6	7
corresponds not at all	corresponds very little	corresponds a little	corresponds moderately	corresponds enough	corresponds a lot	corresponds exactly

_____ 1. Because I think that this activity is interesting.

_____ 2. Because I am doing it for my own good.

_____ 3. Because I am supposed to do it.

_____ 4. Because I would feel bad not doing it.*

_____ 5. There may be good reasons to do this activity, but personally I don't see any.

_____ 6. Because I think that this activity is pleasant.

- ___ 7. Because I think that this activity is good for me.
- ___ 8. Because I would feel guilty not to do it.*
- ___ 9. Because it is something that I have to do.
- ___ 10. I do this activity but I am not sure if it is worth it.
- ___ 11. Because this activity is fun.
- ___ 12. By personal decision.
- ___ 13. Because I don't have any choice.
- ___ 14. I don't know; I don't see what this activity brings me.
- ___ 15. Because I feel good when doing this activity.
- ___ 16. Because I want to avoid feeling guilty.*
- ___ 17. Because I believe that this activity is important for me.
- ___ 18. Because I feel that I have to do it.
- ___ 19. I do this activity, but I am not sure it is a good thing to pursue it.
- ___ 20. Because I would regret not doing it.*

Note.

^a In square brackets: Study 1 only.

^b Options: *your current reason for why you want to run (i.e., in this moment)*. Note, this activity refers to running (Study 1); *why you are going to engage in this physical activity session* (Study 2- pre-physical activity).

*Supplementary items for introjection (Gillet et al., in press; N. Gillet personal communication, April 1, 2010).

Appendix C-3 [FR]

Directives: Lisez chaque affirmation avec attention [en vous situant sur le point de vous engager à une séance de course normale.^a Puis, en utilisant l'échelle suivante, veuillez indiquer sur la ligne devant chaque énoncé à quel point vous êtes en accord avec chaque affirmation pour décrire en ce moment pourquoi courez vous. **Veuillez noter: cette activité désigne la course.** Veuillez répondre à chaque item à l'aide de l'échelle suivante :

1	2	3	4	5	6	7
ne me correspond pas du tout	correspond très peu	correspond un peu	correspond modérément	correspond assez	correspond beaucoup	correspond exactement

- ___ 1. Je trouve que cette activité est intéressante. (p ex : Je trouve que *la course* est intéressante)
- ___ 2. Je fais cette activité pour mon bien.
- ___ 3. Je fais cette activité parce que je suis supposé de le faire.
- ___ 4. Parce que je me sentirais mal si je ne faisais pas cette activité.*

- ___ 5. Il doit y avoir une bonne raison pour que je fasse cette activité mais je ne la vois pas.
- ___ 6. Je trouve cette activité plaisante.
- ___ 7. Je pense que cette activité est une bonne chose pour moi.
- ___ 8. Parce que je me sentirais coupable si je ne faisais pas cette activité.*
- ___ 9. Je fais cette activité parce que c'est quelque chose que je dois faire.
- ___ 10. Je fais cette activité mais je ne suis pas sûr que ça vaille la peine.
- ___ 11. Je trouve que cette activité est fun/cool.
- ___ 12. C'est ma décision personnelle de faire cette activité.
- ___ 13. Je fais cette activité parce que je n'ai pas le choix.
- ___ 14. Je ne sais pas. Je ne vois pas ce que cette activité m'apporte.
- ___ 15. Je me sens bien quand je fais cette activité.
- ___ 16. Parce-que je veux éviter de me sentir coupable.*
- ___ 17. Je fais cette activité parce que je pense que cette activité est importante pour moi.
- ___ 18. Je fais cette activité parce que j'ai le sentiment que je dois le faire.
- ___ 19. Je fais cette activité mais je ne suis pas sûr que ce soit une bonne chose de la continuer.
- ___ 20. Parce que je le regretterais si je ne le faisais pas.*

Note.

^a In Study 2, the questionnaire application for iPods was developed in English only. The SIMS was not given in French.

*Supplementary items for introjection (Gillet et al., in press; N. Gillet personal communication, April 1, 2010).

Appendix C-4 [EN]

Positive and Negative Affect Schedule (PANAS; Watson et al. 1988)

Directions: This scale consists of a number of words that describe different feelings and emotions. Read each item and then mark the appropriate answer in the space next to that word. Indicate to what extent [INSERT APPROPRIATE TIME INSTRUCTION^a]. Use the following scale to record your answer:

1	2	3	4	5
not at all	a little	moderately	quite a bit	Extremely

___ interested	___ hostile	___ calm*
___ relaxed*	___ enthusiastic	___ determined
___ distressed	___ serene*	___ drowsy*
___ excited	___ proud	___ attentive
___ upset	___ irritable	___ jittery
___ at rest*	___ droopy*	___ at ease*
___ strong	___ alert	___ active
___ tired*	___ ashamed	___ afraid
___ guilty	___ dull*	___ bored*
___ scared	___ inspired	
___ sluggish*	___ nervous	

Note:

^a Instruction options: *you feel this way right now, that is, at the present moment* (Study 1 and Study 2 pre-, post-, and 3-hours post-physical activity); *you have felt this way today* (Study 2-end of day).

*Additional items for low activation (Feldman Barrett & Russell, 1998)

Appendix C-4 [FR]

Directives: Ce questionnaire contient des adjectifs qui décrivent des sentiments et des émotions. Lisez chacun de ces adjectifs. Pour chacun des adjectifs, vous devez indiquer sur la ligne devant à quel point il décrit comment vous vous sentez présentement. Pour ce faire, veuillez utiliser le choix de réponses suivant:

1	2	3	4	5
Très peu ou pas du tout	Peu	Modérément	Beaucoup	Énormément

___ intéressée	___ hostile	___ calme*
___ détendue*	___ enthousiaste	___ déterminée
___ angoissée	___ sereine*	___ endormie*
___ excitée	___ fière	___ attentive
___ fâchée	___ irritée	___ agitée
___ au repos*	___ affligée*	___ à l'aise*
___ forte	___ alerte	___ active
___ fatiguée*	___ honteuse	___ effrayée
___ coupable	___ plate*	___ ennuyée*
___ craintive	___ inspirée	
___ léthargique*	___ nerveuse	

Note. ^a In Study 2, the questionnaire application for iPods was developed in English only. The PANAS was not given in French.

*Additional items for low activation (Feldman Barrett & Russell, 1998)

*Appendix C-5 [EN]**Rating of Perceived Exertion (RPE; Borg, 1982)*

Select the value that best reflects how you perceived the average intensity of this [activity]^a to be: ____

- 6 No exertion at all
- 7 Extremely light
- 8
- 9 Very light - (easy walking slowly at a comfortable pace)
- 10
- 11 Light
- 12
- 13 Somewhat hard (It is quite an effort; you feel tired but can continue)
- 14
- 15 Hard (heavy)
- 16
- 17 Very hard (very strenuous, and you are very fatigued)
- 18
- 19 Extremely hard (You can not continue for long at this pace)
- 20 Maximal exertion

Note:

^a For Study 1 (post-task), the instructions were worded to reflect the task that was engaged in (i.e., running, control); For study 2, the wording reflect the physical activity session just engaged in.

Appendix C-5 [FR]

Choisissez le chiffre qui correspond le mieux à votre perception de l'intensité (difficulté) de cette activité en moyenne : ____

- 6 Aucun effort
- 7 Extrêmement facile
- 8
- 9 Très facile (l'équivalent d'une marche lente à un pas confortable)
- 10
- 11 Facile
- 12
- 13 Un peu difficile (C'est un effort; vous êtes fatigué mais vous continuez)
- 14
- 15 Difficile (haute intensité)
- 16
- 17 Très difficile (très exténuante et vous êtes très épuisé)
- 18
- 19 Extrêmement difficile (Vous ne pouvez continuer longtemps à ce pas)
- 20 Effort maximale

Note.

In Study 2, the questionnaire application for iPods was developed in English only. The RPE was not given in French.

Study 2 – Experience Sampling Study**Baseline Session Measures***Appendix C-6 [EN]**Demographics Form Study 2*

Reminder: Please be as honest as possible. There are no right or wrong answers and the research team does not make any links between your name, your ID number/your responses. We are simply seeking to better understand this research area by creating averages of all participants' responses.

Participant Number: _____ (provided by research team)

1. Age: _____

2. Your occupation: _____

3. Education level (select highest achieved):

- ☐ No diploma or certificate
- ☐ High School degree
- ☐ Apprenticeship or trades certificate
- ☐ College or CEGEP degree (≤ 1 year)
- ☐ College or CEGEP degree (≥ 1 year)
- ☐ Some university studies (minimum of 1 year)
- ☐ Bachelor's degree
- ☐ Master's degree
- ☐ Degree in medicine, dentistry, veterinary medicine, or optometry
- ☐ Doctorate degree

4. Total Household Income (select one):

- ☐ < \$20,000 ☐ \$20,000 - 29,999 ☐ \$30,000 - 39,999 ☐ \$40,000 - 59,999
- ☐ \$60,000 - 79,999 ☐ \$80,000 - 89,999 ☐ \$90,000 - 99,999 ☐ \$100,000 - 124,999
- ☐ \$125,000 - 149,999 ☐ > \$150,000

5. Hours of paid work/week: _____

6. a) Indicate approximately how many hours you spend per day (typical weekday) on unpaid household work (cooking/washing up, housekeeping, maintenance and repair, shopping):

- ☐ 1 hour or less ☐ 2 hours ☐ 3 hours ☐ 4 hours ☐ 5 hours ☐ 6 hours or more

b) Indicate approximately how many hours you spend per day (typical weekday) on unpaid child care (select one):

- ☐ 1 hour or less ☐ 2 hours ☐ 3 hours ☐ 4 hours ☐ 5 hours ☐ 6 hours or more

7. Ethnicity (select all that apply):

☐ First Nations (North American Indian), Métis or Inuk (Inuit) ☐ White ☐ Black ☐ South Asian
(e.g. East Indian, Pakistani, Sri Lankan, etc.) ☐ Southeast Asian (e.g. Vietnamese, Cambodian,
Malaysian, Laotian, etc.) ☐ West Asian (e.g., Iranian, Afghan, etc.) ☐ Korean ☐ Japanese ☐ Arab
☐ Chinese ☐ Latin American ☐ Filipino ☐ Other – Specify _____

8. Marital status:

☐ Single ☐ Never legally married ☐ Legally married (and not separated) ☐ Separated, but still
legally married ☐ Divorced ☐ Widowed ☐ Common-law (**refers to two people who live
together as a couple but who are not legally married to each other**)

9. Number of children: _____ (**living in the home, under the age of 18)

10. Age of children (list): _____

**11. Do you have family members living in your home that require additional care due to physical,
mental or cognitive health limitations (e.g., child, parent, etc.)?**

Yes No

If Yes, Please specify: _____

The following questions pertain to your general health:

Weight: _____ lbs

Height: _____ ft _____ in

4. Do you have any underlying medical condition(s) that the researchers should be aware of:

Yes No

If Yes, please specify: _____

5. Do you *currently* suffer from a diagnosed mood disorder (e.g., depression, bipolarity etc.)?

Yes No

If Yes, please specify (*please include treatment, if any): _____

6. Do you *currently* suffer from a diagnosed pain disorder (e.g., fibromyalgia)?

Yes No

If Yes, please specify (*please include treatment, if any): _____

16. Are you currently taking any prescription or non-prescription medicine that could influence your mood?

Yes No

If Yes, please specify: _____

17. Do you have a history of respiratory, cardiovascular, or metabolic disease?

Yes No

18. Do you have any acute or chronic injury that currently causes you undue pain or increases your risk of further injury?

Yes No

Appendix C-6 [FR]

Rappel: SVP être le plus honnête que possible. Il n'y a pas de bonne ni de mauvaise réponse. De plus l'équipe de recherche ne fera aucun lien entre votre nom et votre numéro d'identification. Nous calculerons des moyennes pour les réponses de nos participantes et ces moyennes nous dirigerons vers une compréhension approfondis de ce domaine de recherche.

Numéro de participant: _____ (fourni par l'équipe de recherche)

1. Age: _____

2. Votre profession: _____

3. Niveau d'éducation (sélectionner le plus élevé que vous avez reçu) :

€Aucun diplôme ou certificat

€Diplôme d'études secondaires

€Certificat d'apprenti ou d'une école de métiers

€Diplôme/certificat d'un collège ou d'un CEGEP (programme d'un an ou moins)

€Diplôme/certificat d'un collège ou d'un CEGEP (programme de plus d'un an)

€Études universitaires partielles (minimum 1 an)

€Un baccalauréat

€Une maîtrise

€Un diplôme en médecine, en art dentaire, médecine vétérinaire, ou en optométrie

€Un doctorat

4. Revenu du ménage (sélectionner un choix):

☐ < \$20, 000 ☐ \$20, 000 - 29, 999 ☐ \$30, 000- 39, 000 ☐ \$40, 000- 59, 999
☐ \$60, 000 - \$79, 999 ☐ \$80, 000 – 89, 999 ☐ \$90, 000 – 99, 999 ☐ \$100, 000 – 124, 999
☐ \$125, 000 – 149, 999 ☐ > \$150, 000

5. Nombre d'heures de travail payées par semaine: _____**6. Veuillez indiquer approximativement combien d'heures par semaine que vous passez à faire du travail ménagé non payé (cuisine/nettoyer, ménage, maintenance et réparation, courses) :**

☐ 1 heure ou moins ☐ 2 heures ☐ 3 heures ☐ 4 heures ☐ 5 heures ☐ 6 heures ou plus

6. Veuillez indiquer approximativement combien d'heures par semaine que vous passez à faire de la garde d'enfants non payé (choisissez une option):

☐ 1 heure ou moins ☐ 2 heures ☐ 3 heures ☐ 4 heures ☐ 5 heures ☐ 6 heures

7. Ethnicité:

☐ Premières Nations (Nord-Amérindienne), Métis ou Inuk (Inuit) ☐ Blanche ☐ Noire ☐ Sud-Asiatique (p. ex., Indien de l'Inde, Pakistanais, Sri-Lankais, etc.) ☐ Asiatique du Sud-Est (p. ex., Vietnamien, Cambodgien, Malaisien, Laotien, etc.) ☐ Asiatique occidentale (p. ex., Iranien, Afghan, etc.)
☐ Coréenne ☐ Japonaise ☐ Arabe ☐ Chinoise ☐ Latino-Américaine ☐ Philippine ☐ Autre –
 Spécifiez : _____

8. Situation de famille:

☐ Célibataire ☐ Jamais légalement marié ☐ Légalement marié (et non séparé) ☐ Séparé, mais toujours légalement marié ☐ Divorcé ☐ Veuve ☐ Union libre (deux personnes qui vivent ensemble en tant que couple sans être légalement mariées l'une à l'autre)

9. Nombre d'enfants: _____ (en bas de 18 ans qui habite à la maison)****10. Âge des enfants (lister): _____****11. Est qu'il y a un membre de votre famille habitant votre maison qui demande des soins supplémentaires causé par un déficit de santé physique, mental ou cognitive (e.g., enfant, parent, etc.)**

Oui Non

Si Oui, Veuillez spécifier: _____

Les questions suivantes portent sur votre état de santé général.

Poids: _____ lbs

Taille: _____ pieds _____ pouces

13. Souffrez-vous de une/des condition(s) médicale(s) sous-jacente d'ont l'équipe de recherche devrait être au courant?

Oui Non

Si oui, veuillez spécifier : _____

7. Souffrez-vous présentement d'un/des trouble(s) d'humeur diagnostiqué (p.ex. dépression, bipolarité, etc.)?

Oui Non

Si oui, veuillez spécifier (si applicable, svp inclure votre traitement) : _____

8. Souffrez-vous présentement d'un/des trouble(s) de douleur somatoforme diagnostiqué (p.ex. fibromyalgie)

Oui Non

Si oui, veuillez spécifier (si applicable, svp inclure votre traitement) : _____

16. Est-ce que vous prenez en ce moment des médicaments d'ordonnance ou en vente libre qui pourraient avoir une influence sur votre humeur?

Oui Non

Si oui, veuillez spécifier : _____

17. Est-ce que votre dossier médical comprend une/des maladie(s) respiratoire(s), cardiovasculaire(s), et/ou métabolique(s)?

Oui Non

18. Souffrez-vous en ce moment d'une blessure aiguë et/ou chronique qui vous donne des douleurs ou qui augmente le risque que vous vous blessiez à nouveau?

Oui Non

*Appendix C-7 [EN]**Contextual Motivation: Behavioural Regulations in Exercise Questionnaire-2 (BREQ-2; Markland & Tobin, 2004)*

Directions: We are interested in the reasons underlying peoples' decisions to engage, or not engage in physical activity. Using the scale below, please indicate to what extent each of the following items is true for you. Please note that there are no right or wrong answers and no trick questions. We simply want to know how you personally feel about physical activity.

Not true for me		Sometimes true for me		Very True for me
0	1	2	3	4

WHY DO YOU ENGAGE IN PHYSICAL ACTIVITY?

- ___ 1. I consider physical activity a fundamental part of who I am.*
- ___ 2. I can't see why I should bother engaging in physical activity.
- ___ 3. I get pleasure/satisfaction from engaging in physical activity.
- ___ 4. I engage in physical activity because it's fun.
- ___ 5. I feel under pressure from others to engage in physical activity.
- ___ 6. I consider physical activity to be part of my identity.*
- ___ 7. I feel ashamed when I miss my physical activity.
- ___ 8. I don't see the point in engaging in physical activity.
- ___ 9. It's important to make the effort to engage in physical activity.
- ___ 10. I value the benefits of physical activity.
- ___ 11. It's important to me to engage in physical activity regularly.
- ___ 12. I engage in physical activity because my friends/family/partner say I should.
- ___ 13. I think that engaging in physical activity is a waste of time.
- ___ 14. I get restless if I don't engage in physical activity regularly.
- ___ 15. I enjoy my physical activity sessions.
- ___ 16. I feel guilty when I don't engage in physical activity.
- ___ 17. I engage in physical activity because other people say I should.
- ___ 18. I consider physical activity to be consistent with my values.*
- ___ 19. I engage in physical activity because others will not be pleased with me if I don't.
- ___ 20. I engage in physical activity because it is consistent with life goals.*
- ___ 21. I find physical activity a pleasurable activity.
- ___ 22. I feel like a failure when I haven't engaged in physical activity.
- ___ 23. I don't see why I should have to engage in physical activity.

Note:

*Supplementary items for integrated regulation (Wilson et al., 2006).

Appendix C-7 [FR]

Directives: Nous aimerions connaître les raisons qui incitent les gens à pratiquer ou à ne pas pratiquer de l'activité physique. En vous servant de l'échelle ci-dessous, veuillez indiquer jusqu'à quel point chacun des énoncés suivants est vrai pour vous. Il n'y a pas de bonne ou mauvaise réponse ni de question pièges. Nous voulons simplement savoir comment vous vous sentez face à l'activité physique.

Absolument pas vrai pour moi		Parfois vrai pour moi		Très vrai pour moi
0	1	2	3	4

POURQUOI PARTICIPEZ-VOUS À L'ACTIVITÉ PHYSIQUE?

- ___ 1. Je considère l'activité physique comme étant une partie fondamentale de ma personne.*
- ___ 2. Je ne vois pas pourquoi je devrais prendre la peine de faire de l'activité physique.
- ___ 3. L'activité physique m'apporte du plaisir et de la satisfaction.
- ___ 4. Je fais de l'activité physique parce que j'aime ça.
- ___ 5. Je trouve que les autres font pression sur moi pour que je fasse de l'activité physique.
- ___ 6. Je considère que l'activité physique fait partie de moi.*
- ___ 7. J'ai honte quand je rate une session d'activité physique.
- ___ 8. Je ne vois pas l'utilité de l'activité physique.
- ___ 9. J'estime qu'il est important de faire un effort pour pratiquer l'activité physique.
- ___ 10. J'apprécie les avantages que m'apporte l'activité physique.
- ___ 11. J'estime qu'il est important pratiquer de l'activité physique régulièrement.
- ___ 12. Je fais de l'activité physique parce que mes amis/ma famille/mon partenaire estime(nt) que je dois le faire.
- ___ 13. Je trouve que l'activité physique est une perte de temps.
- ___ 14. Je ne sens nerveuse/agitée si je ne fais pas de l'activité physique régulièrement.
- ___ 15. J'apprécie mes séances d'activité physique.
- ___ 16. Je me sens coupable si je ne fais pas de l'activité physique.
- ___ 17. Je pratique l'activité physique parce que les autres estiment que je dois en faire.
- ___ 18. Je crois que l'activité physique fait partie de mes valeurs.*
- ___ 19. Je pratique l'activité physique parce que les autres n'apprécieront pas si je ne le fasse pas.
- ___ 20. Je fais de l'activité physique parce que c'est en accord avec mes objectifs de vie.*
- ___ 21. Je trouve que la l'activité physique est une activité agréable.
- ___ 22. Je me sens minable (perdante) quand je ne fais pas de l'activité physique.
- ___ 23. Je ne vois pas pourquoi je devrais faire de l'activité physique.

Note:

*Supplementary items for integrated regulation (Wilson et al., 2006).

*Appendix C-8 [EN]**Passion for Physical Activity: The Passion Scale (Vallerand et al., 2003)*

Directions: While thinking of PHYSICAL ACTIVITY and using the following scale, please indicate your level of agreement with each item by placing the appropriate number on the line preceding that item. Please be as honest as possible.

1	2	3	4	5	6	7
Do <u>not</u> Agree at All	Very Slightly Agree	Slightly Agree	Moderately Agree	Mostly Agree	Strongly Agree	Very Strongly Agree

- ____ 1. I spend a lot of time doing physical activity.*
- ____ 2. I like physical activity.*
- ____ 3. Physical activity is important for me.*
- ____ 4. Physical activity is a passion for me.*
- ____ 5. My physical activity is in harmony with the other activities in my life.
- ____ 6. I have difficulties controlling my urge to do physical activity.
- ____ 7. The new things that I discover with physical activity allow me to appreciate it even more.
- ____ 8. I have almost an obsessive feeling for physical activity.
- ____ 9. Physical activity reflects the qualities I like about myself.
- ____ 10. Physical activity allows me to live a variety of experiences.
- ____ 11. Physical activity is the only thing that really turns me on.
- ____ 12. My physical activity is well integrated in my life.
- ____ 13. If I could, I would only concentrate on my physical activity.
- ____ 14. My physical activity is in harmony with other things that are part of me.
- ____ 15. My physical activity is so exciting to me that I sometimes lose control over it.
- ____ 16. I have the impression that my physical activity controls me.

Note:

* Component one items - used to identify if passion is present in the individual (passion criteria).

Appendix C-8 [FR]

Directives: En pensant à **L'ACTIVITÉ PHYSIQUE** et en utilisant l'échelle qui suit, indiquez avec le chiffre approprié sur chaque ligne à quel point vous êtes en accord avec chaque énoncé. Veuillez répondre le plus honnêtement que possible.

1	2	3	4	5	6	7
Pas du tout en accord	Très peu en accord	Un peu en accord	Moyennement en accord	Assez en accord	Fortement en accord	Très fortement en accord

- ___ 1. Je consacre beaucoup de temps à faire de l'activité physique.
- ___ 2. J'aime l'activité physique.
- ___ 3. L'activité physique est importante pour moi.
- ___ 4. L'activité physique représente une passion pour moi.
- ___ 5. Mon activité physique est en harmonie avec les autres choses qui font partie de moi.
- ___ 6. J'éprouve de la difficulté à contrôler mon besoin de faire de l'activité physique.
- ___ 7. Les choses nouvelles que je découvre dans le cadre de l'activité physique me permettent de l'apprécier davantage.
- ___ 8. J'ai un sentiment qui est presque obsessionnel pour l'activité physique.
- ___ 9. L'activité physique reflète les qualités que j'aime de ma personne.
- ___ 10. L'activité physique me permet de vivre des expériences variées.
- ___ 11. L'activité physique est la seule chose qui me fasse vraiment "tripper".
- ___ 12. Mon activité physique s'intègre bien dans ma vie.
- ___ 13. Si je le pouvais je ferais seulement mon activité physique.
- ___ 14. Mon activité physique s'harmonise bien avec les autres activités dans ma vie.
- ___ 15. Mon activité physique est tellement excitante que parfois j'en perds le contrôle.
- ___ 16. J'ai l'impression que mon activité physique me contrôle.
-

Experience Sampling Measures

Appendix C-9(a)

Pre-physical activity questionnaires

Note. See Appendix C-3 for the SIMS and Appendix C-4 for the PANAS.

Appendix C-9(b)

Post-physical activity description/questionnaires

Please provide the following information on the physical activity you just completed:

1. Type (describe): _____
(E.g., running, walking, skiing, yoga, etc.)

2. For how long did you engage in this physical activity (excluding warm-up/cool-down):
_____ mins

Note. The RPE (Appendix C-5) was administered as Question 3. The PANAS (Appendix C-4) was also administered at this time point.

Appendix C-9(c)

3-Hours post-physical activity

1. Currently, you are (select best match): _____
- a) working
 - b) running errands
 - c) housework or household task
 - d) leisure – alone or with partner/friend(s)
 - e) caring for kid(s)
 - f) exercising
 - g) dressing, showering, and/or preparing for bed
 - h) sleeping/resting
 - i) other

Note. The PANAS (Appendix C-4) was also administered at this time point.

Appendix C-9(d)

End-of-Day Questionnaire

These questions pertain to TODAY:

1. Did you **intend** to engage in physical activity today?
___ Yes ___ No

1. Did you **engage** in physical activity today?

___ Yes ___ No

Note. The PANAS (Appendix C-4) was also administered at this time point.

Endpoint Session Measure

Appendix C-10 [EN]

Vitality Subscale of the SF-36 (Ware & Sherbourne, 1992).

Directions: These questions are about how you feel and how things have been with you during the past 4 weeks. For each question, please give the one answer that comes closest to the way you have been feeling, using the scale:

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
None of the time	A little of the time		Some of the time		A good bit of the time		Most of the time		All of the time	

HOW MUCH OF THE TIME DURING THE PAST 4 WEEKS:

___ 1. Did you feel full of pep?

___ 2. Did you have a lot of energy?

___ 3. Did you feel worn out?

___ 4. Did you feel tired?

Appendix C-10 [FR]

Directives: Ces questions portent sur comment vous vous sentez et comment les choses ont été avec vous pendant les dernières 4 semaines. Pour chaque question, veuillez indiquer, à l'aide de l'échelle qui suit, la réponse qui correspond le mieux avec la manière dont vous vous êtes sentis :

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Jamais	Rarement		Quelquefois		Souvent		Très souvent		En permanence	

AU COURS DE CES 4 DERNIÈRES SEMAINES, Y A-T-IL EU DES MOMENTS OÙ:

___ 1. Vous vous êtes senti(e) dynamique?

___ 2. Vous vous êtes senti(e) débordant(e) d'énergie?

___ 3. Vous vous êtes senti(e) épuisé(e)?

___ 4. Vous vous êtes senti(e) fatigué(e)?

Appendix C. Measures - Table 2

Table 2. *Experience sampling protocol and measures for Study 2.*

Measures/Procedure	Event-contingent sampling (day 1 to day 14)		Interval-contingent sampling (day 1 to day 14)		Endpoint* (Day 15)
	Baseline* (Day 1)	Pre-PA	Post-PA	3-hours post PA (signal)	
Administer device	X				
Preliminary					
Demographics	X				
Passion					
The Passion Scale	X				
Motivation					
Contrastual (BREQ-2)	X				
Situational (SIMS)		X			
Affect					
PANAS	X	X	X	X	X
Physical activity description			X		Y/N
Rating of Perceived Exertion					
RPE			X		
Physical Activity					
LTBQ	X				X
Vitality					
Vitality					X
Subscale SF-36					
Retrieve device					X

Note. *Research sessions (paper questionnaires). All other measures were administered electronically

APPENDIX D

Consent Forms

Appendix D. Consent Form Study 1 [EN]

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Faculté des sciences de la santé
École des sciences de l'activité physique

Faculty of Health Sciences
School of Human Kinetics

CONSENT FORM

Title of the Study: A laboratory study examining psychological factors and running in active women with multiple roles.

Primary researcher: Eva Guérin, Doctoral candidate, School of Human Kinetics, Faculty of Health Sciences at the University of Ottawa. Tel: (613) [redacted] Ext. [redacted] Email: [redacted]

Supervisor: Michelle Fortier, PhD, School of Human Kinetics, Faculty of Health Sciences at the University of Ottawa. Tel: (613) [redacted] Ext. [redacted] Email: [redacted]

Purpose of the study: Psychological variables have been studied in helping women maintain an active lifestyle. Specifically, different psychological factors are found to be related to regular engagement in physical activity, including running. The goal of this study is to better understand psychological and motivational variables in active women that have multiple roles and, more specifically, those women who self-report running as their preferred mode of physical activity. In particular, the researchers of this study are interested in studying the short-term relationships between motivational and other psychological factors in both running and mundane, non-running activities. Overall, this study will seek to gain a better understanding of the stated psychological factors in women who juggle their physical activity (i.e., running), among several life roles (e.g., mother, working professional, athlete, etc).

Participation: My participation will consist of attending two (2) laboratory sessions that will last approximately 1.5 hours (90 minutes) each or less. The second session will take place at or around the same time of day as the first and approximately seven (7) days later. During *each* session, I will be asked to complete a series of written questionnaires and to engage in one of two activities: (a) one 40-minute quiet, day-to-day attention-control task (video and newspaper) or (b) one 30-minute moderate-to-high intensity treadmill run (with 5-minute warm-up/graded running and 5-minute cool-down). Given the researcher's interest in the stated variables during both tasks, I will be assigned (randomly) to one of four (4) possible testing scenarios (i.e., order of the tasks by session), the details of which have been explained to me by the researcher.

Risks: My participation in this study could entail that I run on a treadmill at a moderate-to-high intensity (i.e., running task) and this may cause me to feel mild fatigue and/or muscle weakness. However, by volunteering to participate in this study I am acknowledging that I am active and a regular runner and I therefore understand and expect the level of exertion involved. I have been informed that the room for the running task will be well ventilated and that water will be available in order to minimize discomfort. I have received assurance from the researcher that all equipment (e.g., treadmill and heart rate monitor) meet the necessary safety standards. I have been made aware of and understand the physical injury risks of standard treadmill usage.

Benefits: My participation in this study will allow the researchers to gather important knowledge on the underlying psychological components of regular physical activity (i.e., running) in an understudied population, that is, female runners who have multiple life roles. This study will help provide a basis for future studies, both intervention-based and experimental, to help facilitate different psychological components in women who are seeking to commence or maintain a regular running regimen while also engaging in other important life spheres.

Confidentiality and anonymity: I have received assurance from the researcher that the information I will share will remain strictly confidential. I understand that the data I provide will be used only for the purposes of the main researcher's doctoral dissertation and that my confidentiality will be protected as the only persons to have access to the data will be: the main researcher (Eva Guérin), her supervisor, one master's student, and one research



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assistant. **Anonymity** will be protected in the following manner: A participant code number will be assigned to me and that number will be used to protect my privacy. Moreover, data from all participants will be averaged and therefore the information I provide will never be singled out in the presentation of results. My name or any other identifying information will not appear in published articles or any conference presentation of the results of this study.

Conservation of data: The data collected, that is, my written responses to all questionnaires (including intake demographic information), will be kept in a secure manner. Specifically, all paper questionnaires will be stored in a locked filing cabinet for 10 years in the main researcher's private work space at the University of Ottawa. Only those individuals stated in the confidentiality section will know the lock combination for the cabinet. After 10 years, all copies of paper questionnaires will be shredded and properly disposed of.

Compensation: By consenting to participate in this study, my name will enter a draw among the other participants of this study for a chance to win a one-day all-inclusive pass at *Le Nordik Spa* in Chelsea, Quebec.

Voluntary participation: I am under no obligation to participate and if I choose to participate, I can withdraw from the study at any time and/or refuse to answer any questions, without suffering any negative consequences. If I choose to withdraw, I consent that the data gathered until the time of withdrawal will:

- ☐ be used by the research team ☐ NOT be used by the research team

I, _____ agree to participate in the above research study conducted by Eva Guérin of the School of Human Kinetics in the Faculty of Health Sciences at the University of Ottawa, whose research is under the supervision of Dr. Michelle Fortier.

- I would like to receive a copy of the results once the project is completed. If yes, please indicate your address: ☐ Yes ☐ No Address: _____

This research team is also looking for participants in a second study on motivation and physical activity in daily life (2-weeks) using i-Pod Touches. Please check the box below and provide us with your telephone number if you are interested in being contacted to participate in this study.

- I agree to be contacted for this second study but I understand that my selection is not guaranteed for this study. ☐ Yes ☐ No Tel. Number: _____

If I have any questions about the study, I may contact the researcher or her supervisor.

If I have any questions regarding the ethical conduct of this study, I may contact the Protocol Officer for Ethics in Research, University of Ottawa, Tabaret Hall, 550 Cumberland Street, Room 159, Ottawa, ON K1N 6N5
Tel.: (613) 562-5841. Email: ethics@uottawa.ca

There are two copies of the consent form, one of which is mine to keep.

Participant's signature: _____ Date: _____

Researcher's signature: _____ Date: _____

Appendix D. Consent Form Study 1 [FR]

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Université d'Ottawa • University of Ottawa

Faculté des sciences de la santé
École des sciences de l'activité physique

Faculty of Health Sciences
School of Human Kinetics

FORMULAIRE DE CONSENTEMENT

Titre du projet: Des facteurs psychologiques reliés à la course chez les femmes actives à rôles multiples : Une étude en laboratoire.

Nom de la chercheuse principale: Eva Guérin, candidate doctorale à l'École des sciences de l'activité physique à la Faculté des sciences de la santé de l'Université d'Ottawa. Tél: [redacted] Poste [redacted]
Courriel: [redacted]

Superviseure: Michelle Fortier, PhD, École des sciences de l'activité physique à la Faculté des sciences de la santé de l'Université d'Ottawa. Tél: [redacted] Poste [redacted] Courriel: [redacted]

But de l'étude: De nombreuses études ont été faites concernant les variables psychologiques qui pourraient aider les femmes à maintenir un style de vie actif. En effet, de nombreux facteurs psychologiques ont été liés à une participation assidue à l'activité physique, y compris la course. Le but de cette étude est de mieux comprendre ces variables psychologiques et motivationnelles chez les femmes qui ont des rôles de vie multiples et avec celles qui évaluent la course comme étant leur genre d'activité physique préférée et/ou la plus fréquente. Plus précisément, les chercheuses de ce projet s'intéressent à la relation à court-terme entre les facteurs psychologiques et motivationnelles lors de la course au tapis roulant ainsi que lors des activités quotidiennes non-physiques. En gros, cette étude tentera de fournir une compréhension approfondie des facteurs psychologiques susnommés chez les femmes qui jonglent leurs activités physiques (ex, leur course) avec leurs nombreux rôles de vie (ex. mère, employée professionnelle, athlète, etc.).

Participation: Ma participation consistera à me présenter à deux (2) sessions en laboratoire d'une durée d'environ 1.5 heures ou moins (75 minutes) chacune. La deuxième session aura lieu environ sept (7) jours après la première et approximativement à la même heure. À *chaque* session, je serai appelée à répondre à des questionnaires écrits et de participer à une de deux activités : (a) une tâche quotidienne pour occuper l'attention (tel qu'un vidéo et lire le journal) ou (b) une course de 30 minutes d'une intensité modérée-à-élevée sur un tapis roulant (avec 5 minutes d'échauffement et 5 minutes de marche après). Étant donné l'intérêt des chercheurs pour les variables susmentionnées, je serai assignée de façon aléatoire à une de quatre (4) possibilités pour le déroulement des tâches (*ordre* des tâches par session). Les détails de ceci m'ont été expliqués par l'assistant de recherche.

Risque(s): Ma participation dans cette étude pourrait nécessiter que je coure sur un tapis roulant à une fréquence modérée-à-élevée et ceci pourrait me causer de la fatigue légère et de la faiblesse musculaire. Cependant, en me portant volontaire pour participer à cette étude, je concède que je suis active et que je cours régulièrement. Donc je comprends et je m'attends au niveau d'effort impliqué. Aussi, on m'a bien informé que pour minimiser l'inconfort, la salle où la course aura lieu sera bien aérée et qu'il y aura de l'eau à ma disposition. La chercheuse m'a assurée que l'équipement (tel que le tapis roulant et le moniteur de rythme cardiaque) sont conformes aux critères de sécurité requis. J'ai été suffisamment informé des risques de blessures physiques à l'emploi conforme d'un tapis roulant et je comprends cette information.

Bienfaits: Ma participation à cette recherche aura comme conséquence d'aider les chercheurs à amasser des connaissances importantes au sujet des composantes psychologiques qui expliquent l'engagement à l'activité physique dans une population sous-étudiée, c'est-à-dire des femmes coureuses à rôle de vie multiples. Cette étude offrira une base afin que de futures études, sois expérimentales ou à l'aide d'intervention, puissent apprendre

comment favoriser les différentes composantes psychologiques avec des femmes qui cherchent à commencer ou à maintenir un régime de course régulier tout en s'engageant dans plusieurs domaines de vie importants.

Confidentialité et anonymat: J'ai l'assurance de la chercheuse que l'information que je partagerai restera strictement confidentielle. Je m'attends à ce que le contenu ne soit utilisé que pour la thèse de doctorat de la chercheuse principale et que ma confidentialité sera protégée car les seules individus qui auront accès aux données seront les membres de l'équipe de recherche : la chercheuse principale (Eva Guérin), sa superviseuse, une étudiante à la maîtrise, et un/une assistant(e) de recherche. L'anonymat est garanti de la façon suivante: Un numéro de participante (code) me sera attribué et il sera utilisé pour protéger mon identité. De plus, des moyennes de toutes les données seront calculé donc l'information que je fournirai ne sera jamais remarquée parmi d'autres lorsque les résultats seront présentés. Mon nom et toute autre information qui pourrais m'identifier n'apparaîtra jamais dans les publications ni lors de la présentation des résultats de cette étude à des conférences.

Conservation des données: Les données recueillies, c'est-à-dire mes réponses à tous les questionnaires (y compris l'information démographique initiale) seront conservées de façon sécuritaire. Précisément, tous les questionnaires papiers seront conservés pendant 10 ans dans un classeur barré dans l'espace de travail privé de la chercheuse principale à l'université d'Ottawa. Seuls les individus nommés dans la section de confidentialité ci-dessus connaîtront la combinaison du cadenas pour le classeur. Après 10 ans, toute copie papier des questionnaires seront déchetés et disposés de façon convenable.

Compensation: En accordant mon consentement pour participer à cette étude, mon nom sera mis dans un tirage pour la chance de gagner un laissez-passer d'une journée au *Nordik Spa* à Chelsea, Québec.

Participation volontaire: Ma participation à la recherche est volontaire et je suis libre de me retirer en tout temps, et/ou refuser de répondre à certaines questions, sans subir de conséquences négatives. Si je décide de me retirer, j'autorise que l'information que j'aurai fournie jusqu'à mon retrait :

- ☐ soit utilisé par l'équipe de recherche ☐ ne soit PAS utilisé par l'équipe de recherche

Je, _____ accepte de participer à cette recherche menée par Eva Guérin de l'École des sciences de l'activité physique à la Faculté des sciences de la santé de l'Université d'Ottawa, laquelle recherche est supervisée par Dr. Michelle Fortier.

- J'aimerais recevoir les données finales lorsque ce projet sera terminé. Si oui, svp indiquer votre adresse :
☐ oui ☐ non Adresse: _____

De plus, l'équipe de ce projet est à la recherche de participantes pour une deuxième étude laquelle, à l'aide de i-Pod Touches, tentera d'examiner la motivation et l'activité physique dans la vie quotidienne (2 semaines). Veuillez cocher la boîte ici-bas et veuillez indiquer votre numéro de téléphone si vous désirez être contactée pour participer à cette étude.

- J'accepte d'être contactée pour la deuxième étude et je comprends que cette autorisation n'assure pas ma sélection à cette étude.
☐ oui ☐ non Téléphone: _____

Pour tout renseignement additionnel concernant cette étude, je peux communiquer avec la chercheuse ou sa superviseuse.

Pour tout renseignement sur les aspects éthiques de cette recherche, je peux m'adresser au Responsable de l'éthique en recherche, Université d'Ottawa, Pavillon Tabaret, 550, rue Cumberland, salle 159, Ottawa, ON K1N 6N5. Tél.: (613) 562-5841 Courriel : ethics@uottawa.ca

Il y a deux copies du formulaire de consentement, dont une copie que je peux garder.

Signature de la participante: _____ Date: _____

Signature de la chercheuse: _____ Date: _____

Appendix D. Consent Form Study 2 [EN]



CONSENT FORM

Title of the Study: A self-monitoring field study examining emotions and motivation for physical activity in active women with multiple roles.

Primary researcher: Eva Guérin, Doctoral candidate, School of Human Kinetics, Faculty of Health Sciences at the University of Ottawa.

Tel: [redacted] Ext. [redacted] Email: [redacted]

Supervisor: Michelle Fortier, PhD, School of Human Kinetics, Faculty of Health Sciences at the University of Ottawa.

Co-Investigator: Shaelyn Strachan, PhD, School of Human Kinetics, Faculty of Health Sciences at the University of Ottawa.

Purpose of the study: Different psychological variables have been studied in helping women maintain an active lifestyle and in predicting engagement in leisure activities. Specifically, motivation, identity, and emotions are found to be related to regular engagement in physical activity. The goal of this study is to better understand emotion- and motivation-based variables related to active and inactive leisure in active women who juggle their physical activity (e.g., running, aerobics, soccer, etc.) among several life roles (e.g., mother, working professional, athlete, wife, etc.). We will also briefly inquire about sleep patterns and a selection of other lifestyle factors. In particular, the researchers of this study are interested in studying the relationships between motivational and emotional factors as well as identity with respect to regular exercise sessions and at the end of each day for a two-week period. Links with other behaviours such as sleep and inactive leisure are also of interest. Overall, this study will seek to gain a better understanding of the stated psychological factors related to physical activity and leisure over a set period of time in active, working mothers and in their natural everyday environments.

Participation: My participation will consist of attending two (2) short sessions and answering electronic questionnaires over a two-week period using an i-Pod Touch that will be administered to me for the duration of the study.¹ The first session will last approximately 90 minutes or less during which I will be administered an i-Pod touch, and given detailed verbal instructions on how to use it to answer the questionnaires for this study. At this time I will also be asked to complete a series of *written* questionnaires. Starting the next day and for the following 2-weeks, I will respond to two (2) questionnaires electronically on the device before all of my regular physical activity sessions and to one questionnaire immediately afterwards. I will be beeped 3-hours later to answer this brief questionnaire once more. At the end of each day, I will be requested to provide responses to the questionnaire once again. On random nights I will also receive a few additional short questions. At the end of two weeks, I will attend a final session (< 30 minutes) to return the device and to answer a final set of questionnaires.

Benefits: My participation in this study will allow the researchers to gather important knowledge on the underlying psychological components of regular physical activity and other leisure over time in an understudied population, that is, active female who have multiple life roles. This study will help provide a basis for future studies, both intervention-based and experimental, to help facilitate different motivational and emotional components in women who are seeking to commence or maintain a regular physical activity regimen while also engaging in other important life spheres.

Confidentiality and anonymity: I have received assurance from the researcher that the information I will share will remain strictly confidential. I understand that the contents will be used only for the purposes of the main researcher's doctoral dissertation and that my confidentiality will be protected as the only persons to have access to the data will be: the main researcher (Eva Guérin), her supervisor and the co-investigator, one master's student and one research assistant. Anonymity will be protected in the following manner: A participant code number will be assigned to me and that number will be used to protect my privacy. Moreover, data from all participants will

¹Participants with their own iPod (3rd or 4th generation) or iPhone may chose to download the application and use their own device.



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be averaged and therefore the information I provide will never be singled out in the presentation of results. My name or any other identifying information will not appear in published articles or any conference presentation of the results of this study.

Conservation of data: The data collected, that is, my responses to all questionnaires (including intake demographic information), will be kept in a secure manner. Specifically, all paper questionnaires will be stored in a locked filing cabinet for 10 years in the primary researcher's private work space at the University of Ottawa. Only those individuals stated in the confidentiality section will know the lock combination for the cabinet. After 10 years, all copies of paper questionnaires will be shredded and properly disposed of. All electronic responses will be sent automatically via a secure online server and saved on the primary researcher's password protected computer. No data will ever be saved on the devices and, after 10 years, all electronic data will be safely deleted from this computer.

Compensation: By consenting to participate in this study, my name will enter a draw among the other study participants for a chance to win a one-day in all-inclusive pass at *Le Nordique Spa* in Chelsea, Quebec.

Voluntary participation: I am under no obligation to participate and if I choose to participate, I can withdraw from the study at any time and/or refuse to answer any questions, without suffering any negative consequences. If I choose to withdraw, I consent that the data gathered until the time of withdrawal will be:

☐ be used by the research team ☐ NOT be used by the research team

I, _____ agree to participate in the above research study conducted by Eva Guérin of the School of Human Kinetics in the Faculty of Health Sciences at the University of Ottawa, whose research is under the supervision of Dr. Michelle Fortier.

- I would like to receive a copy of the results once the project is completed. If yes, please indicate your address: ☐ Yes ☐ No Address: _____

This research team is also looking for women to participate in a supplemental short study on physical activity, motivation and their experiences surrounding multiple roles. This study would involve one qualitative interview (60 minutes). Please checkmark the box below and provide us with your telephone number if you are interested in being contacted to participate in this study.

- I agree to be contacted for this other study but I understand that my selection is not guaranteed for this study. ☐ Yes ☐ No Tel. Number: _____

If I have any questions about the study, I may contact the researcher or her supervisor.

If I have any questions regarding the ethical conduct of this study, I may contact the Protocol Officer for Ethics in Research, University of Ottawa, Tabaret Hall, 550 Cumberland Street, Room 159, Ottawa, ON K1N 6N5.
Tel.: (613) 562-5841 Email: ethics@uottawa.ca

There are two copies of the consent form, one of which is mine to keep.

Participant's signature: _____ Date: _____

Researcher's signature: _____ Date: _____

Appendix D. Consent Form Study 2 [FR]



Université d'Ottawa - University of Ottawa

Faculté des sciences de la santé
École des sciences de l'activité physique

Faculty of Health Sciences
School of Human Kinetics

FORMULAIRE DE CONSENTEMENT

Titre du projet: Une étude en terrain utilisant le monitoring de soi pour examiner les émotions et la motivation envers l'activité physique chez les femmes actives à rôle multiple.

Nom de la chercheuse principale: Eva Guérin, candidate doctorale à l'École des sciences de l'activité physique à la Faculté des sciences de la santé de l'Université d'Ottawa.

Tel: [redacted] Ext. [redacted] Email: [redacted]

Superviseure: Michelle Fortier, PhD, École des sciences de l'activité physique à la Faculté des sciences de la santé de l'Université d'Ottawa.

Co-investigatrice: Shaelyn Strachan, PhD, École des sciences de l'activité physique à la Faculté des sciences de la santé de l'Université d'Ottawa.

But de l'étude: De nombreuses études ont été fait concernant les variables psychologiques qui pourraient aider les femmes à maintenir un style de vie actif. Les variables impliquées dans les activités de loisirs ont aussi été sujet d'étude. En effet, de nombreux facteurs émotionnels, ainsi que la motivation et l'identité particulièrement, ont été lié à une participation assidue à l'activité physique. Le but de cette étude est de mieux comprendre les variables émotionnelles et motivationnelles liés aux activités de loisirs physiques et non physiques chez les femmes actives qui jonglent leurs activité physique (e.g. course, aérobie, soccer, etc.) parmi leurs nombreux rôle de vie (e.g. mère, employé professionnel, athlète, etc.). Nous enquerrons aussi brièvement au sujet du sommeil et d'autres comportements de vie. En particulier, les chercheuses de cette étude s'intéressent à regarder les liens entres les facteurs motivationnelles et émotionnelles ainsi qu'à l'identité lors de sessions d'activité physique régulières ainsi qu'à la fin de la journée pendant une période de deux semaines. Ces facteurs seront aussi étudiés en lien avec le sommeil et les activités de loisirs. En gros, cette étude tentera de contribuer une compréhension approfondie des facteurs psychologiques susnommés reliés à l'activité physique (et aux activités de loisirs) pendant une période de temps fixe et dans l'environnement quotidien de mères actives.

Participation: Ma participation comprendra de me présenter à deux (2) courtes sessions et de répondre pendant une période de deux semaines à des questionnaires électroniques à l'aide d'un i-Pod Touch qui me sera fournis pour la période de cette étude. À la première session d'une durée d'environ 90 minutes, je recevrai le i-Pod Touch ainsi que des consignes détaillés pour comment m'en servir afin répondre aux questionnaires. À ce moment là je serai aussi demander de compléter une série de questionnaires écrit. En commençant le lendemain et pour les deux semaine par la suite, je vais devoir répondre sur l'appareil même à deux (2) questionnaire électronique avant chaque session d'activité physique normale et un questionnaire immédiatement après. Je recevrai un signal sonore trois heures plus tard pour répondre a ce dernier questionnaire à nouveau. A la fin de chaque journée, je vais devoir répondre au questionnaire une autre fois. Quelques courtes questions de plus me seront posées au hasard certains soirs. Après deux semaines, je me présenterai à une deuxième session (moins de 30 minutes) pour rapporter l'appareil et pour répondre aux derniers questionnaires.

Bienfaits: Ma participation à cette recherche aura pour effet d'aider les chercheurs à amasser des connaissances importantes au sujet des composantes psychologique qui explique l'engagement à l'activité physique dans une population sous-étudié, c'est-à-dire des femmes actives à rôle de vie multiple. Cette étude offrira une base afin que de futures études, sois expérimental ou à l'aide d'intervention, puissent apprendre comment favoriser les différentes composantes psychologiques et motivationnelles avec des femmes qui cherche à commencer ou à maintenir un régime d'activité physique régulier tout en s'engageant dans plusieurs domaines de vie important

¹Une participante avec son propre iPod (3rd or 4th generation) or iPhone à l'option de télécharger l'application et de se servir de son appareil pour l'étude.

Confidentialité et anonymat: J'ai l'assurance des chercheurs que l'information que je partagerai avec eux restera strictement confidentielle. Je m'attends à ce que le contenu ne soit utilisé que pour la thèse de doctorat et que ma confidentialité sera protégée car les seules individus qui auront accès aux données seront les membres de l'équipe de recherche : la chercheuse principale (Eva Guérin), sa superviseure et une co-investigatrice, une étudiante à la maîtrise, et un/une assistant(e) de recherche. L'anonymat est garanti de la façon suivante: Un numéro de participant (code) me sera attribuer et il sera utilisé pour protéger mon identité. De plus, des moyennes de tout les données seront calculé donc l'information que je fournirai ne sera jamais remarqué parmi d'autres lorsque les résultats seront présentés. Mon nom et tout autre information qui pourrait m'identifier n'apparaîtra jamais dans les publications ni lors de présentation des résultats de cette étude à des conférences.

Conservation des données: Les données recueillies, c'est-à-dire mes réponses à tous les questionnaires (y compris l'information démographique initiale) seront conservées de façon sécuritaire. Précisément, tous les questionnaires papiers seront conservés pendant 10 ans dans un classeur barré dans l'espace de travail privé de la chercheuse principale à l'université d'Ottawa. Seuls les individus nommés dans la section de confidentialité ci-dessus connaîtront la combinaison du cadenas pour le classeur. Après 10 ans, toutes copies papiers des questionnaires seront déchiquetés et disposer de façon convenable. Tous les réponses électroniques seront transmises à travers un serveur sécuritaire en ligne et sauvegardé sur l'ordinateur protégé par mot de passe de la chercheuse principale. Aucune donnée sera sauvegardé sur l'appareil directement et après 10 ans tous les données seront supprimés de l'ordinateur de la chercheuse de façon sécuritaire.

Compensation: En accordant mon consentement pour participer à cette étude, mon nom sera mis dans un tirage pour la chance de gagné un laissez-passé d'une journée au Nordik Spa à Chelsea, Québec.

Participation volontaire: Ma participation à la recherche est volontaire et je suis libre de me retirer en tout temps, et/ou refuser de répondre à certaines questions, sans subir de conséquences négatives. Si je décide de me retirer, j'autorise que l'information que j'aurai fournie jusqu'à mon retrait :

- ☐ soit utiliser par l'équipe de recherche ☐ ne soit PAS utiliser par l'équipe de recherche

Je, _____ accepte de participer à cette recherche menée par Eva Guérin de l'École des sciences de l'activité physique à la Faculté des sciences de la santé de l'Université d'Ottawa, laquelle recherche est supervisée par Dr. Michelle Fortier.

- J'aimerais recevoir les données finales lorsque ce projet sera terminé. Si oui, svp indiquer votre adresse :
☐ oui ☐ non Adresse: _____

De plus, l'équipe de ce projet est à la recherche de femmes pour participer à une étude supplémentaire au sujet de l'activité physique, la motivation, et les expériences concernant les rôles de vie multiples. Cette étude nécessitera seulement qu'un court entretiens qualitatif (60 minutes). Veuillez cocher la boîte ici-bas et veuillez indiquer votre numéro de téléphone si vous désirez être contactée pour participer à cette étude.

- J'accepte d'être contactée pour la deuxième étude et je comprends que cette autorisation n'assure pas ma sélection à cette étude.
☐ oui ☐ non Téléphone: _____

Pour tout renseignement additionnel concernant cette étude, je peux communiquer avec le chercheur ou son superviseur. Pour tout renseignement sur les aspects éthiques de cette recherche, je peux m'adresser au Responsable de l'éthique en recherche, Université d'Ottawa, Pavillon Tabaret, 550, rue Cumberland, salle 159, Ottawa, ON K1N 6N5. Tél.: (613) 562-5841 Courriel : ethics@uottawa.ca

Il y a deux copies du formulaire de consentement, dont une copie que je peux garder.

Participant's signature: _____ Date: _____

Researcher's signature: _____ Date: _____

APPENDIX E

Ethics Certificates

File Number: h08-10-09

Date (mm/dd/yyyy): 09/24/2010



Université d'Ottawa
Bureau d'éthique et d'intégrité de la recherche

University of Ottawa
Office of Research Ethics and Integrity

Ethics Approval Notice

Health Sciences and Science REB

Principal Investigator / Supervisor / Co-investigator(s) / Student(s)

<u>First Name</u>	<u>Last Name</u>	<u>Affiliation</u>	<u>Role</u>
Michelle	Fortier	Health Sciences / Human Kinetics	Supervisor
Eva	Guérin	Health Sciences / Human Kinetics	Student Researcher

File Number: h08-10-09

Type of Project: PhD Thesis

Title: The Influence of Motivation and Passion on the Relationship Between Physical Activity and Well-Being

Approval Date (mm/dd/yyyy)	Expiry Date (mm/dd/yyyy)	Approval Type
09/24/2010	09/23/2011	Ia

(Ia: Approval, Ib: Approval for initial stage only)

Special Conditions / Comments:
N/A

File Number: h08-10-09

Date (mm/dd/yyyy): 09/24/2010

**Université d'Ottawa**

Bureau d'éthique et d'intégrité de la recherche

University of Ottawa

Office of Research Ethics and Integrity

This is to confirm that the University of Ottawa Research Ethics Board identified above, which operates in accordance with the Tri-Council Policy Statement and other applicable laws and regulations in Ontario, has examined and approved the application for ethical approval for the above named research project as of the Ethics Approval Date indicated for the period above and subject to the conditions listed the section above entitled "Special Conditions / Comments".

During the course of the study the protocol may not be modified without prior written approval from the REB except when necessary to remove subjects from immediate endangerment or when the modification(s) pertain to only administrative or logistical components of the study (e.g. change of telephone number). Investigators must also promptly alert the REB of any changes which increase the risk to participant(s), any changes which considerably affect the conduct of the project, all unanticipated and harmful events that occur, and new information that may negatively affect the conduct of the project and safety of the participant(s). Modifications to the project, information/consent documentation, and/or recruitment documentation, should be submitted to this office for approval using the "Modification to research project" form available at: http://www.rges.uottawa.ca/ethics/application_dwn.asp

Please submit an annual status report to the Protocol Officer 4 weeks before the above-referenced expiry date to either close the file or request a renewal of ethics approval. This document can be found at: http://www.rges.uottawa.ca/ethics/application_dwn.asp

If you have any questions, please do not hesitate to contact the Ethics Office at extension 5841 or by e-mail at: ethics@uOttawa.ca.

Signature:

Leslie-Anne Barber
Protocol Officer for Ethics in Research
For Daniel Lagarec, Chair of the Health Sciences and Sciences REB

File Number: H08-10-09

Date (mm/dd/yyyy): 09/29/2011



Université d'Ottawa
Bureau d'éthique et d'intégrité de la recherche

University of Ottawa
Office of Research Ethics and Integrity

Ethics Approval Notice

Health Sciences and Science REB

Principal Investigator / Supervisor / Co-investigator(s) / Student(s)

<u>First Name</u>	<u>Last Name</u>	<u>Affiliation</u>	<u>Role</u>
Michelle	Fortier	Health Sciences / Human Kinetics	Supervisor
Shaelyn	Strachan	Health Sciences / Human Kinetics	Co-investigator
Eva	Guérin	Health Sciences / Human Kinetics	Student Researcher

File Number: H08-10-09

Type of Project: PhD Thesis

Title: The Influence of Motivation and Passion on the Relationship Between Physical Activity and Well-Being

<u>Renewal Date (mm/dd/yyyy)</u>	<u>Expiry Date (mm/dd/yyyy)</u>	<u>Approval Type</u>
09/24/2011	09/23/2012	1A

(1a: Approval, 1b: Approval for initial stage only)

Special Conditions / Comments:
N/A

File Number: h08-10-09

Date (mm/dd/yyyy): 09/29/2011



Université d'Ottawa
Bureau d'éthique et d'intégrité de la recherche

University of Ottawa
Office of Research Ethics and Integrity

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http://www.rges.uottawa.ca/ethics/application_dwn.asp

If you have any questions, please do not hesitate to contact the Ethics Office at extension 5841 or by e-mail at: ethics@uOttawa.ca.

Signature:

Kim Thompson
Protocol Officer for Ethics in Research
For Daniel Lagarec, Chair of the Sciences and Health Sciences REB