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On the nature and function of scoring protocols used in exercise motivation research: An empirical study of the behavioral regulation in exercise questionnaire

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ABSTRACT

Objectives: The purpose of this study was to examine the effects of different scoring protocols used with instruments designed to assess motivation in line with Organismic Integration Theory (OIT; Deci & Ryan, 2002).
Design: This study used non-probability based sampling within a cross-sectional (survey) design.
Methods: Participants across four samples (N's ranged from 236 to 1200) completed either (a) the Behavioral Regulation in Exercise Questionnaire (BREQ), (b) the BREQ-2, or (c) the BREQ-2R in conjunction with a self-report assessment of physical activity behavior.
Results: Participants endorsed more self-determined than controlled motives for physical activity. Identified regulation was the dominant correlate of more frequent physical activity behavior. The link between external regulation and physical activity was consistently weak. Multiple regression analyses revealed identified regulation was the strongest predictor of physical activity compared with other motives. Regression models using omnibus scoring protocols accounted for less variance in physical activity behavior in contrast to an item-aggregation scoring protocol.
Conclusions: Identified regulation may be a key source of physical activity motivation in adults. The scoring protocol used with OIT-based instruments represents an important consideration for advancing physical activity research.

Understanding why people choose to sustain participation in physical activity (or terminate their involvement) has become a focal point of research in exercise psychology (Wilson, 2012). This is not surprising given that population health studies consistently link lower levels of physical activity with biomedical (e.g., hypertension) and psychological (e.g., depression) health problems that reduce the quality and longevity of life (Bouchard, Blair, & Haskell, 2007). Despite these health threats, substantial portions of the population in many countries remain insufficiently active (Bouchard et al.) while an estimated 50 percent of adults starting an exercise program will discontinue participation within six months (Buckworth & Dishman, 2002). Considering these participation trends, it is important to know why some people engage in physical activity whilst others remain less active. This 'participation paradox' is a complex yet important motivational question that has the potential to be understood by applying relevant theory (Markland & Ingledew, 2007). Organismic Integration Theory (OIT; Deci & Ryan, 2002) is one theory that could be useful for understanding the motivational basis of physical activity.

OIT is focused on the nature of extrinsic and intrinsic motivation in conjunction with the socio-contextual processes that can facilitate (or derail) behavioral regulation (Ryan & Deci, 2007). A central assumption embedded within OIT is that motivation varies along a continuum of perceived self-determination ranging from non-self-determined (or controlled) to self-determined (or autonomous) forms of behavioral regulation (Ryan & Deci). The relative positioning along this motivational continuum reflects the extent to which different reasons motivating action have been internalized by the person and ultimately integrated with, or fragmented within, the person's sense of self (Ryan & Deci). The six constructs aligning the OIT continuum include: Amotivation, external regulation, introjected regulation, identified regulation, integrated regulation, and intrinsic regulation (Ryan & Deci).

Amotivation is concerned with "lacking the intention to act" (Deci & Ryan, 2002, p.17) or a state whereby insufficient motivation

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exists to move a person to action (Vallerand, 2007). External regulation involves engaging in a behavior to obtain incentives (e.g., rewards) or avoid unwanted sanctions (e.g., punishment; Deci & Ryan). Introjected regulation concerns sanctions that motivate behavior via self-imposed pressure to avoid negative emotions (e.g., shame) or maintain conditional self-worth (Deci & Ryan). Identified regulation is the "lower boundary of autonomous regulation" (Wilson, Rodgers, Fraser, & Murray, 2004, p.82) that motivates action due to the personal importance (or value) affixed to outcomes stemming from participation (Deci & Ryan). Integrated regulation concerns the incorporation of identified regulations with the self insofar as pursuing the target behavior is aligned with core values and personal beliefs (Deci & Ryan). Finally, intrinsic regulation refers to "doing an activity for its own sake" (Ryan & Deci, 2007, p.2) such that behavior is motivated by enjoyment, fun, interest, or inherent satisfaction of the activity itself (Deci & Ryan).

Early physical activity research using OIT as a guiding framework focused on developing instruments to assess motivation. Markland and colleagues spearheaded this line of research with the Behavioral Regulation in Exercise Questionnaire (BREQ; Mullan, Markland, & Ingeldew, 1997) and the BREQ-2 (Markland & Tobin, 2004). Mullan et al. developed the BREQ using confirmatory factor analysis to reduce an initial pool of 30 items modified from the Academic Motivation Scale (Vallerand et al., 1992) and the Self-Regulation Questionnaire (Ryan & Connell, 1989) to a total of 15-items assessing external, introjected, identified, and intrinsic regulations for exercise. A subsequent investigation by Markland and Tobin used a similar approach to develop the BREQ-2 that includes a subscale to measure amotivation toward exercise. Consistent with other OIT-based instruments (e.g., Sport Motivation Scale; Pelletier, Fortier, Vallerand, Tuson, & Briére, 1995), neither the BREQ nor the BREQ-2 assess integrated regulation. Subsequently, the BREQ-2R (Wilson, Rodgers, Loitz, & Scime, 2006) was developed to include a subscale measuring integrated regulation for exercise that can be used in conjunction with either the BREQ or BREQ-2.

The development of these instruments has stimulated several lines of research attesting to the construct validity of score interpretations. Construct validation is central to instrument development processes geared toward understanding physical activity motivation (Wilson, 2012; Wilson, Mack, & Grattan, 2008). Based on existing research, the construct validity of scores derived from the BREQ (and to a lesser degree the BREQ-2 and BREQ-2R) is impressive in terms of scope and quality (see Wilson, 2012, for a review). Nevertheless, Messick (1995) contends that construct validation is an ongoing process requiring the constellation of evidence from multiple sources to imbue test score interpretations with clarity and meaning. To date, research efforts have afforded limited attention to the 'optimal' method of representing scores derived from each instrument. Scoring is a fundamental component of test use and interpretation and construct validation (Messick, 1995) that is worthy of scrutiny with reference to the BREQ, BREQ-2, and BREQ-2R instruments to further inform and develop the OIT literature (Wilson, 2012).

Scoring protocols and OIT instrumentation

A number of different scoring protocols have been proposed (or implied) for use with OIT-based instruments. The first scoring protocol noted in the exercise psychology literature was presented by Mullan et al. (1997). In their initial development and validation work, Mullan et al. advocated summarizing participant responses by averaging the items comprising each individual BREQ subscale into four unique scores that represent distinct OIT-based motives. This is referred to as the 'item-aggregation approach' in this paper (see Method A in Table 1).

Another scoring protocol initially termed the 'Relative Autonomy Index' (RAI; Ryan & Connell, 1989; also known as the Self-Determination Index [SDI]; Vallerand, 2007) has also been commonplace in physical activity research using OIT. The RAI approach is predicated on the assumption of a "quasi-simplex pattern" (Deci & Ryan, 2002, p.18) of associations displayed between motives spanning OIT's continuum. In simple terms, Deci and Ryan (2002) assert that one form of evidence favoring the conceptualization of motivation as an underlying continuum of internalizations varying in perceived self-determination is apparent when adjacent regulations on the continuum (e.g., $r_{external\text{-}introjected\ regulations}$) display more positive associations with one another compared to distal regulations (e.g., $r_{external\text{-}intrinsic\ regulations}$). In the RAI approach, the scores from each BREQ subscale are weighted then aggregated to form a solitary numerical index representing the extent to which a person's exercise behavior "is more or less self-determined" (Mullan & Markland, 1997, p.356). The most prominent RAI formula evident in the exercise psychology literature using the BREQ is based on Ryan and Connell's (1989) work (see Method B in Table 1).

The inclusion of an amotivation subscale within the BREQ-2 (Markland & Tobin, 2004) and BREQ-2R (Wilson et al., 2006) that also assesses integrated regulation warrants alternative RAI formulas to accommodate these additional constructs. Markland (March 3rd, 2011) suggested one approach to calculating an RAI based on using scores from all five BREQ-2 subscales (see Method C in Table 1). Vallerand and colleagues proposed a third formula for

Table 1
Overview of scoring protocols for the BREQ, BREQ-2, and BREQ-2R.

Scoring protocol	Formula	Source reference
Method A		
Item-aggregation	$\Sigma[\text{item}_1, \text{item}_2, \text{item}_3, \text{item}_4]/n_{ij}$ items	Ryan and Connell (1989)
Method B		
RAI_{BREQ}	$\Sigma([\text{External} \times -2] + [\text{Introjected} \times -1] + [\text{Identified} \times 1] + [\text{Intrinsic} \times 2])$	Ryan and Connell (1989)
Method C		
$\text{RAI}_{\text{BREQ-2}}$	$\text{RAI}_{\text{BREQ-2}} = \Sigma([\text{Amotivation} \times -3] + [\text{External} \times -2] + [\text{Introjected} \times -1] + [\text{Identified} \times 2] + [\text{Intrinsic} \times 3])$.	Markland (2011)
Method D		
$\text{RAI}_{\text{BREQ-2R}}$	$\text{RAI}_{\text{BREQ-2R}} = \Sigma([\text{Amotivation} \times -3] + [\text{External} \times -2] + [\text{Introjected} \times -1] + [\text{Identified} \times 1] + [\text{Integrated} \times 2] + [\text{Intrinsic} \times 3])$.	Vallerand et al. (2008)
Method E		
Autonomous motives	$\text{BREQ}_{\text{autonomous motives}} = \Sigma([\text{Intrinsic}) + (\text{Identified})/2)$	Sebire et al. (2008)
Controlled motives	$\text{BREQ}_{\text{controlled motives}} = \Sigma([\text{External}) + (\text{Introjected})/2$	

Note: BREQ = Behavioral Regulation in Exercise Questionnaire (Mullan et al., 1997). BREQ-2 = Behavioral Regulation in Exercise Questionnaire-2 (Markland & Tobin, 2004). BREQ-2R = Behavioral Regulation in Exercise Questionnaire-2 Revised (Wilson et al., 2006). Where n_{ij} = number of test items on the jth construct.