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**Judgments of Happiness during Trail Running: Pleasure, Engagement, and Meaning**

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**Abstract**

**Objectives:** It has been theorized that happiness is derived from three major, unique sets of life experience: pleasure, engagement, and meaning. The present study examined the mental processes by which individuals combined five information cues (relatedness, autonomy, competence, mental vitality and physical vitality) when judging the degree of happiness felt by a trail runner during a run.

**Design / Method:** The participants (104 adult male athletes;  $M_{age} = 32.70$ ;  $SD = 10.86$ ) rated pleasure, engagement, and meaning in 32 scenarios built from combinations of these cues.

**Results:** The results of multivariate and univariate analyses of variance indicated that all five cues had a positive effect on judgments of pleasure, engagement, and meaning. The participants used three different information integration rules, depending on the pathway to happiness being probed.

**Conclusions:** The information integration and the integration rules highlighted the different contributions of pleasure, engagement, and meaning in cognitive building of happiness.

*Keywords:* happiness, judgment, trail running

### **Judgments of Happiness in Trail Running: Pleasure, Engagement, and Meaning**

Like many other leisure or sports activities, trail running can generate a sense of well-being among participants (e.g., MacBride-Stewart, 2019). To understand the determinants of this well-being, sports psychology researchers have applied various theoretical frameworks (see Lundqvist & Sandin, 2014). With regard to subjective well-being, some researchers have applied information integration theory (IIT (Anderson, 2008)) to understand the judgment process and the manner in which athletes combine different information cues to judge their level of well-being in sport (e.g., Fruchart & Rulence-Pâques, 2020). One of today's most frequently studied approaches to subjective well-being (see Durayappah, 2011) is the "orientations to happiness" model, which identified three pathways to happiness: pleasure, engagement, and meaning (Seligman, 2002). The primary objective of the present study was to apply IIT and the "orientations to happiness" model to judgments of happiness during trail running.

#### **The orientations to happiness model**

In different life domains, happiness is derived from three major sets of life experience: pleasure, engagement, and meaning (Seligman, 2002). In a pleasant life, individuals experience pleasantness regularly, and the latter is associated with greater well-being (Schueller & Seligman, 2010). In an engaged life, individuals experience a high level of engagement in activities, i.e. the extent to which they are absorbed/engrossed in their activities (Joseph Sirgy & Wu, 2009). In a meaningful life, individuals experience a sense of connectedness to a greater whole. People achieve meaning in an activity when the latter is felt to be significant, understandable, and purposeful (Tov & Lee, 2016). In Schueller and Seligman's (2010) study, these three pathways to happiness (pleasure, engagement, and meaning) differed in their relative contributions to well-being. To the best of our knowledge, this perspective has not previously been applied in mountain sports. Hence, we decided to

apply this model to the judgment of happiness during trail running and considered this approach with regard to IIT (Anderson, 2008).

### **Information integration theory, and cognitive rules**

According to IIT (Anderson, 2008), each perception, thought or action is goal-oriented and depends on the integration of different information cues (also referred to as factors). By applying ITT, researchers seek to understand the manner in which people mentally combine various pieces of information when making a decision or a judgment (e.g., Fruchart et al., 2018). Information integration theory focuses on the cognitive psychological rules used to integrate several stimuli (e.g., Anderson, 2008). The goal is to discover which cognitive algebraic operations people use to process information in different situations. This cognitive algebra concerns the individual's psychological considerations or the subjective values given to stimuli, rather than the stimuli *per se* (for an illustration in the domain of sport, see Rulence-Pâques et al., 2005). In cognitive algebra, rules can be additive, disjunctive or conjunctive. By way of an example, imagine that a person is presented with a series of six situations (defined by the relatedness and the competence), in order to judge his/her level of satisfaction during an activity. There are two level of relatedness (no relatedness, and relatedness) and three levels of competence (low competence, medium competence, and high competence). Once the levels of satisfaction have been rated, they are plotted as a factorial graph (Figure 1). With an additive rule (Figure 1(a)), relatedness and competence are given the same weight (i.e. the same importance): the lines will be parallel. In an analysis of variance (ANOVA) of the raw data, the effect of the relatedness x competence interaction would not be significant. With a conjunctive rule (Figure 1(b)), the lines form a fan open to the right, and the effect of the relatedness x competence interaction is significant. With a disjunctive rule (Figure 1(c)), the lines form a fan open to the left, and the effect of the relatedness x competence interaction is significant. With disjunctive or conjunctive rules,

relatedness has more or less weight than competence (or vice versa). This approach has already been used to understand the judgment of well-being in sport (Fruchart & Rulence-Pâques, 2019, 2020).

Fruchart and Rulence-Pâques (2019) explored the way in which non-athletes, athletes doing mountain sports, and athletes doing non-mountain sports used five informational cues (relatedness, autonomy, competence, risk-taking, and weather conditions) to judge their degree of arousal and their degree of satisfaction experienced during mountain rambling. All three groups integrated the informational cues in the same way. The impacts of relatedness and risk-taking varied according to the judgment condition. Autonomy, relatedness, and competence had a positive effect on judgments of satisfaction and arousal. Furthermore, Fruchart and Rulence-Pâques (2020) demonstrated the positive impact of autonomy, relatedness, and competence on an overall judgment of well-being in sport but also highlighted positive effects of mental vitality and physical vitality (e.g., Salama-Younes, 2011). These two studies showed that the psychological needs (autonomy, relatedness, and competence (Deci & Ryan, 2017) and the subjective vitality (mental vitality and physical vitality (e.g., Salama-Younes, 2011) were predictors of the judgment of well-being.

The present study focused on the judgment of happiness during trail running; it explored the way in which individuals cognitively combine various information cues to judge the degree of pleasure, engagement and meaning during a trail running session.

The first hypothesis was that the five information cues (autonomy, relatedness, competence, mental vitality, and physical vitality) would all have a significant effect on the judgment of each pathway to happiness (e.g., Fruchart et al., 2020). The second hypothesis was that the five cues would differ in the magnitude of their effects on judgments of pleasure, engagement, and meaning (Seligman, 2002).

## **Method**

## Participants

A total of 104 adult male athletes ( $M_{age} = 32.70$ ;  $SD = 10.86$ ) participated in the study. Participation was voluntary and unpaid. The participants were recruited from trail running clubs in the Occitanie region of France. The club coaches approved the athletes' participation in the study.

## Material

The material consisted of three sets of 32 scenarios. The athletes judged the degree of pleasure in the first set, the degree of engagement in the second, and the degree of meaning in the third. In all three sets, the scenarios were built according to a five within-subject factor design: Relatedness (no relatedness vs. relatedness)  $\times$  Autonomy (no autonomy vs. autonomy)  $\times$  Competence (no competence vs. competence)  $\times$  Mental Vitality (no mental vitality vs. mental vitality)  $\times$  Physical Vitality (no physical vitality vs. physical vitality), i.e.  $2 \times 2 \times 2 \times 2 \times 2$ . Each scenario contained a brief description of the sports situation, a question, and a rating scale.

One typical scenario was as follows: "Judson goes trail running with a group at Font-Romeu. He does not feel competent in trail running. It was not his idea to go trail running but he feels obliged to comply with the group's decisions about the run's difficulty, duration and location. He gets on well with the other athletes. Since starting the run, he has felt mentally sharp but not physically energetic".

In the "pleasure" condition, each scenario was followed by the question "To what extent do you think that Judson experiences pleasure while trail running?" and an 11-point response scale ranging from "No pleasure at all" on the left to "A lot of pleasure" on the right. In the "meaning" condition, the question was "To what extent do you think that Judson experiences meaningfulness while trail running?", and the 11-point scale ranged from "No meaningfulness at all" on the left to "A lot of meaning" on the right. Lastly, in the

“engagement” condition, the question was “To what extent do you think that Judson is absorbed by trail running?”, and the 11-point scale ranged from “Not absorbed at all” on the left-hand to “Very absorbed”.

### **Procedure**

The study was performed in accordance with the University of Perpignan’s ethical standards and the tenets of the 1964 Declaration of Helsinki and its amendments. The experiment took place in a room at a sports centre. The investigator explained the procedure to each participant individually. Participants were instructed to read the scenarios (presented one at a time, in random order) and then give their responses on the response scale.

In line with Anderson’s method (2008), the test was administered in two phases. In a familiarization phase, each participant was presented with 6 scenarios, so that they could familiarize themselves with the task, the procedure, and the test materials (Anderson, 2008). The six scenarios were chosen by the investigator, so as to expose participants to the full range of stimuli. The participants were asked to identify with the trail runner described in the scenario and then to express an opinion about the degree of pleasure, meaning or engagement experienced by that runner during the trail run. During the subsequent experimental phase, the 32 scenarios were administered to the participants. Participants gave their responses at their own pace.

One third of the participants was presented with the pleasure scenarios first, the meaning scenarios second, and the engagement scenarios last. The two other thirds of the participants were presented with the same sets of scenarios but in different respective orders.

### **Data Analysis**

We performed a multivariate analysis of variance (MANOVA) with the three pathways to happiness (pleasure, engagement, and meaning) as dependant variables and relatedness, autonomy, competence, mental vitality, and physical vitality as independent

variables. Three follow-up univariate analyses of variance (ANOVAs) with a Relatedness x Autonomy x Competence x Mental Vitality x Physical Vitality design were then conducted, based on each variable's statistical significance in the MANOVA.

### Results

The MANOVA showed a significant difference between pleasure, engagement, and meaning:  $F(3, 101) = 14915.17$ ; Wilks' lambda = 0.002,  $p < .001$ ,  $\eta^2_p = 0.998$ .

The main results of the three ANOVAs are presented in Table 1, whereas Figure 2 shows the combined effect of relatedness and mental vitality on judgments of pleasure, meaning, and engagement. Each panel corresponds to one of the three pathways to happiness. The mean ratings are on the y-axis. The two levels of the Relatedness factor are on the x-axis. Each line corresponds to one level of the Mental Vitality factor. Even if the totality of possible interactions was tested by the researchers, the number of interactions is too large to present them all. As suggested in IIT literature (Anderson, 2008), the authors' choice was guided by the research question and hypotheses.

In all three panels, the fact that the lines rise from left to right indicates an effect of Relatedness, and the fact that the lines are separate indicates an effect of Mental Vitality. In the “pleasure” panel (the left-hand graph in Figure 1), the lines form a fan open to the left, indicating that the participants used a disjunctive integration rule. The Relatedness x Mental Vitality interaction was statistically significant ( $p < .001$ ):  $F(1, 103) = 34.73$ ,  $p < .001$ ,  $\eta^2_p = .25$ . In the “meaning” panel (middle graph in Figure 2), the lines form a fan open to the right, indicating that the participants used a conjunctive integration rule. The Relatedness x Mental Vitality interaction was significant:  $F(1, 103) = 19.54$ ,  $p < .001$ ,  $\eta^2_p = .10$ . In the “engagement” panel (right graph in Figure 2), the fact that the lines are parallel indicates that the participants used an additive integration rule. The Relatedness x Mental Vitality interaction was not significant  $F(1, 103) = 11.17$ ,  $p = .002$ ,  $\eta^2_p = .09$ .



### Discussion

The objective of the present study was to understand the manner in which athletes cognitively integrate or combine relatedness, autonomy, competence, mental vitality, and physical vitality when judging the degree of pleasure, engagement, and meaning experienced by a trail runner during a run.

The first hypothesis was the five information cues (autonomy, relatedness, competence, mental vitality, and physical vitality) would all have a significant effect on the judgment of each pathway to happiness (e.g., Fruchart & Rulence-Pâques, 2020). Indeed, the five information cues positively influenced the judgments of pleasure, engagement and meaning. The higher the level of relatedness, competence, autonomy, mental vitality or physical vitality, the higher the judged level of happiness. This finding extends Fruchart and Rulence's (2020) results by showing that psychological needs (Deci & Ryan, 2017) and subjective vitality (e.g., Salama-Younes, 2011) are reliable predictors of happiness in sport.

The second hypothesis was that the five cues would differ in the magnitude of their effects on judgments of pleasure, engagement, and meaning (Seligman, 2002). This hypothesis was supported by the present data; there were statistically significant differences between the respective judgments of pleasure, meaning, and engagement. The apparent cognitive interpretation rules also confirmed these differences. The participants used different information integration rules, depending on the pathway to happiness being probed. In fact, the participants developed a conjunctive rule for judgments of pleasure, a disjunctive rule for judgments of meaning, and an additive rule for judgments of engagement. This result shows that people cognitively build the 3 pathways of happiness (pleasure, engagement, meaning) in various ways. The information integration and the integration rules underlined their different contributions in cognitive construction of well-being (Shueller & Seligman, 2010). The observation of different cognitive rules is a useful way of comparing the processes involved in

the judgment of happiness.

This result is similar to the various cognitive rules previously found for judgments in sport. For example, Fruchart et al. (2019) observed different cognitive rules in judgments of the acceptability of nutritional supplement use in sport. These various cognitive rules evidenced inter-individual differences in the same type of judgment. In the present study, each of the three judgments (pleasure, meaning, and engagement) had a different cognitive rule. Our comparison of the cognitive rules used for single elements (pleasure, meaning, and engagement) forming an overall concept of well-being (happiness) is an innovative scientific approach, and merits replicative studies in the field of well-being and in other fields.

Our study had a number of limitations, which could be investigated in future research. Firstly, with 5 information cues, there was a vast number of interaction possibilities. But, our study presented only the Relatedness x Mental Vitality interaction. Secondly, the relationship between the three pathways to happiness and well-being was not directly investigated. Using the three pathways of the happiness as independent variables and an overall judgment of well-being as a dependent variable might help to establish the weight of each predictor in judgments of well-being in sport. Thirdly, potential inter-individual differences in judgment process were not studied, and other factors (such as gender) could also have been investigated (e.g., Fruchart et al., 2019). Fourthly, our study was about the assessment of pleasure, meaning, and engagement in others. It is very difficult to know whether effects in other-perception are easily transferable to situations where the runner's self is involved. Fifthly, our within-design was statistically nice and pushed the fact to differentiate between the different combinations. In addition, the participants were led through 6 practice runs so that they "learned" to recognize the different criteria. Whether the effects would be found in a between-design, could be doubted therefore. A well-known example from the judgment research to it: There is an effect of fluency on "judgments of truth" (e.g., Wänke, & Hansen, 2015). But only

as long as the variable is emphasized in the within-design (by the differences). If we do the same in a between design, we will not find anything (Bless & Burger, 2016). Sixthly, other models of happiness could be investigated from the standpoint of cognitive rules. For instance, Lyubomirsky et al. (2005) developed a happiness formula  $H = S + C + V$ , where H is happiness (H), S is the biological set point, C is the life circumstance (C), and V is voluntary control. Will this equation be confirmed by an additive integration rule?

The last limitation concerns the way to determine the “fan” typology of the lines and the corresponding rule. Here, we applied the approach typically used in studies of Anderson’s framework (Anderson, 2008; Fruchart & Rulence-Pâques, 2020; Rulence-Pâques et al., 2005). This consisted of a two-step analysis: statistical and graphical. The first stage involved a statistical analysis (repeated-measure ANOVA) to identify the effect for the factors’ interaction. For additive rule, the interaction was not significant. For non-additive rules (conjunctive and disjunctive rules), the interaction was significant. The second stage involved the graphical analysis (the form of curves) and the difference between mean judgments in determining whether the rule was disjunctive or conjunctive. A fan opening to the right illustrated a conjunctive rule and a fan opening to the left illustrated a disjunctive rule. But, another analytical technique could be used to specify the cognitive rules such as linear mixed model (e.g., West et al., 2007). As results, (a) a positive and significant coefficient would support a conjunctive rule (fan opening to the right), (b) a negative and significant coefficient would support a disjunctive rule (fan opening to the left), and (c) a non-significant interaction effect would support an additive rule. Using linear mixed model (West et al., 2007) could be tested in future research to develop the information integration approach and to determinate the various cognitive rules.

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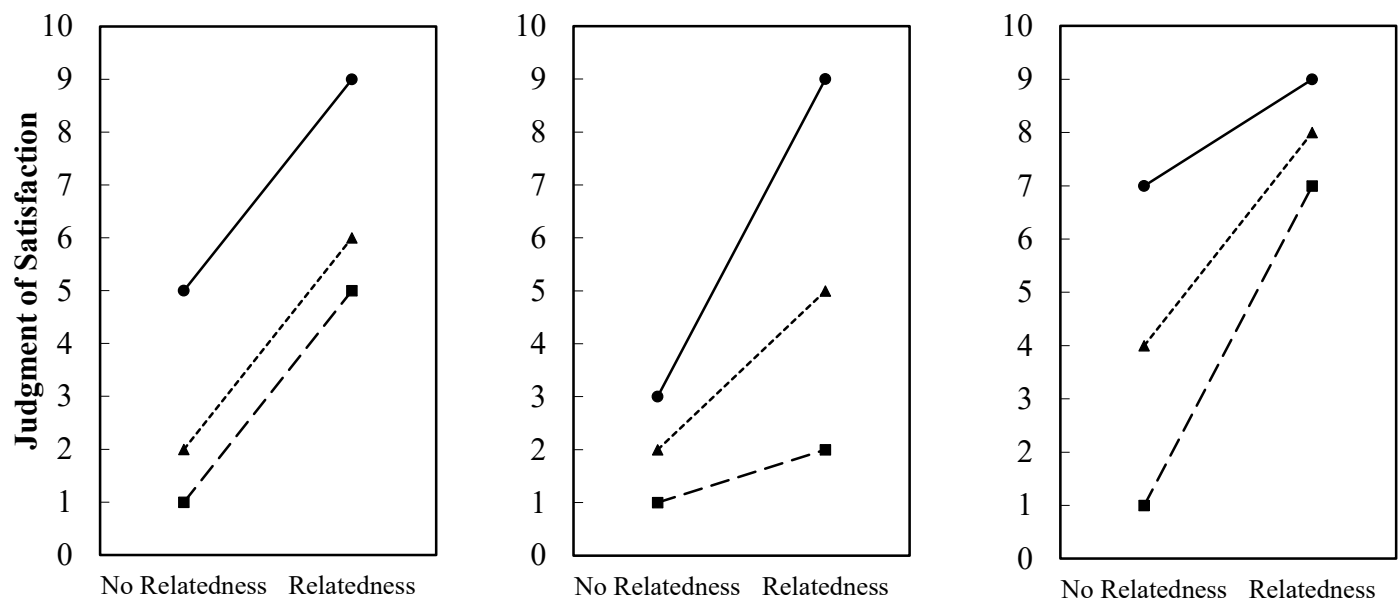


Figure 1. Typical data patterns obtained with (a) additive, (b) conjunctive, and (d) disjunctive integration rules.

*Legend:* The vertical axis corresponds to the decision to get involved in the activity. The horizontal axis corresponds to the two level of relatedness. Each line corresponds to a level of competence (the solid line = high competence; the dotted line = medium competence; the dashed line = low competence).

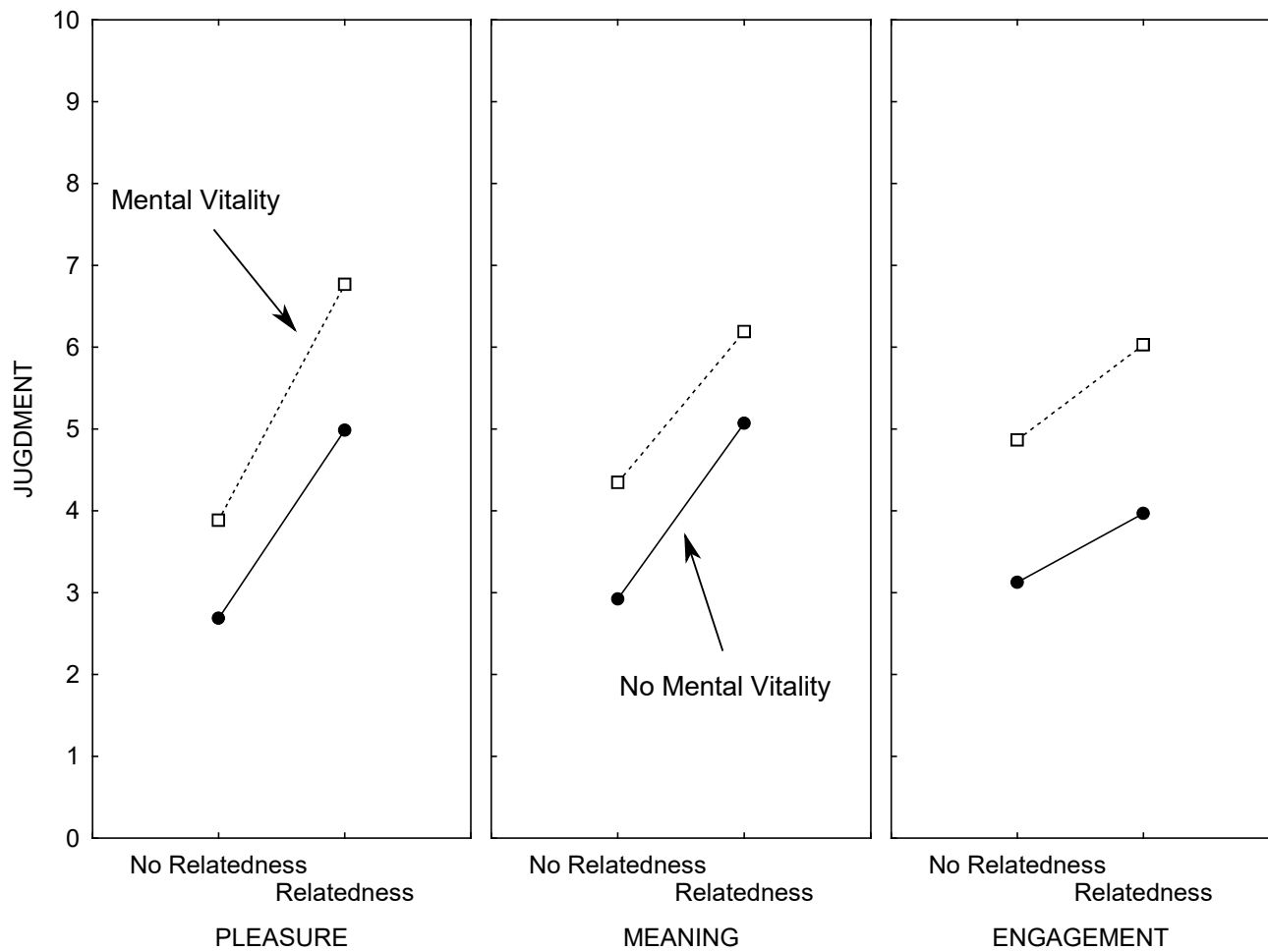


Figure 2. Effect of the relatedness x mental vitality interaction on judgments of pleasure, meaning, and engagement.

Table 1

*Main results of the univariate ANOVAs performed on judgments of pleasure, meaning, and engagement, and Mean SD Scores for the Five Factors.*

Factors	Effect		Error		<i>F</i>	<i>p</i>	$\eta^2_p$	No		Yes	
	<i>df</i>	<i>MS</i>	<i>df</i>	<i>MS</i>				<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PLEASURE											
Relatedness (R)	1	5592.13	103	3.43	1632.28	<.001	.94	3.28	0.17	5.88	0.17
Autonomy	1	611.02	103	2.66	229.92	<.001	.69	4.15	0.15	5.01	0.17
Competence	1	1854.04	103	2.16	857.00	<.001	.89	3.85	0.14	5.32	0.17
Mental Vitality (MV)	1	1845.10	103	2.93	629.23	<.001	.86	3.83	0.15	5.32	0.17
Physical Vitality	1	2369.25	103	2.80	845.87	<.001	.89	3.73	0.16	5.42	0.16
R x MV	1	70.39	103	2.03	34.73	<.001	.25				
MEANING											
Relatedness (R)	1	3314.01	103	4.40	770.93	<.001	.88	3.63	0.23	5.63	0.16
Autonomy	1	1891.55	103	3.00	629.79	<.001	.86	3.87	0.18	5.38	0.19
Competence	1	1723.57	103	2.48	694.58	<.001	.87	3.91	0.16	5.35	0.20
Mental Vitality	1	1349.21	103	2.75	490.28	<.001	.83	3.99	0.18	5.26	0.19
Physical Vitality	1	1498.28	103	2.36	636.06	<.001	.86	3.96	0.15	5.30	0.20
R x MV	1	19.54	103	1.61	12.15	<.001	.10				
ENGAGEMENT											
Relatedness (R)	1	838.01	103	3.11	269.22	<.001	.72	3.99	0.15	4.99	0.20
Autonomy	1	776.94	103	2.58	301.06	<.001	.74	4.01	0.16	4.98	0.17
Competence	1	2722.39	103	2.66	1023.89	<.001	.91	3.59	0.15	5.40	0.18
Mental Vitality	1	3004.28	103	3.10	968.89	<.001	.90	3.54	0.19	5.44	0.16
Physical Vitality	1	3368.12	103	3.70	909.34	<.001	.90	3.49	0.19	5.50	0.18
R x MV	1	21.58	103	1.93	11.17	.002	.09				

Threshold for statistical significance:  $p < .001$