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Title: The Multi-States (MuSt) Theory for Emotion- and Action-regulation in Sports

Year: 2021

Version: Accepted version (Final draft)

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Please cite the original version:

Ruiz, M. C., Bortoli, L., & Robazza, C. (2021). The Multi-States (MuSt) Theory for Emotion- and Action-regulation in Sports. In M. C. Ruiz, & C. Robazza (Eds.), *Feelings in Sport : Theory, Research, and Practical Implications for Performance and Well-being* (pp. 3-17). Routledge. <https://doi.org/10.4324/9781003052012-2>

1 **Ruiz, M. C.**, Bortoli, L., & Robazza, C., (in press). The multi-states (must) theory for emotion- and
2 action-regulation in sports (pp. XX-XX).. In M. Ruiz & C. Robazza (Eds.). *Feelings in sport:
3 Theory, research, and practical implications for performance and well-being*. New York, NY:
4 Routledge.

5

6 **Chapter 1:** The Multi-States (MuSt) Theory for Emotion- and Action-Regulation in Sports

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15 **Abstract**

16 Feeling states - including emotional experiences - are fundamental to human adaptation, as they
17 influence effort, attention, decision making, memory, and behavioural responses of individuals, as
18 well as their interpersonal interactions. Thus, the ability to self-regulate is crucial for athletic success.
19 This chapter presents the multi-states (MuSt) theory as a holistic approach for both emotion- and
20 action-centred self-regulation for performance enhancement and optimization. Central to the MuSt
21 theory is the notion that a combination of emotion- and action-regulation strategies is more effective
22 than focusing on one aspect alone. In this chapter we describe psychobiosocial feeling states and core
23 action components—the most relevant components of functional performance—as the targets for self-
24 regulation. We then present guidelines for the identification, prediction, and regulation of optimal and
25 dysfunctional psychobiosocial feeling states and core action components. Finally, we discuss avenues
26 for future research and practical implications.

27 During the 2019 final of the tennis Grand Slam Roland-Garros, Rafael Nadal played against
28 Dominic Thiem. Nadal won the first set 6-3, and lost the second set 5-7, with Thiem receiving a
29 standing ovation from the public. Up until this point, Nadal had committed 12 unforced errors while
30 had Thiem 7. After the second set, Nadal left the court and returned with a fresh set of clothes, wet
31 hair, and changed bandana. He then won the next 16 of 17 points in the third set. He won the next two
32 sets 6-1 and 6-1, and ended up winning the championship. It seems like what happened during that
33 break was a turning point for Rafael Nadal who re-entered the court with renewed energy.

34 The ability to regulate one's thoughts, emotions, and behaviours, especially in high pressure
35 situations, is crucial for athletic success. How can athletes regulate their emotional and other feeling
36 states to achieve or regain their optimal edge when needed? How can they regulate their task-
37 execution to produce consistent performance? In this chapter, we describe key concepts for optimal
38 emotion- and action-regulation in an attempt to provide answers to these questions. First, we present
39 the multi-states (MuSt) theory, a holistic framework for self-regulation in a sporting context. We then
40 describe the main targets for self-regulation: psychobiosocial states as the focus of emotion
41 regulation, and core action components as the focus of action regulation. Next, we provide a stepwise
42 procedure for the optimization of performance. Finally, we outline avenues for future research and
43 practical implications.

44 **The Multi-states (MuSt) Theory for Self-Regulation**

45 The MuSt theory is here proposed as a holistic and integrative perspective to account for the
46 variety of performance states athletes experience in training and competition. The MuSt theory is
47 intended to describe and understand idiosyncratic performance experiences, predict performance, and
48 identify the most effective emotion- and action-centred self-regulation strategies. The MuSt theory is
49 conceptualized as a dynamic and multidimensional process that involves the interactions between
50 individual, task, and environment, appraisals of perceived resources to manage task demands,
51 emotion- and action-based self-regulation, and performance process and outcome. Central to the MuSt
52 theory are: (1) the concept of psychobiosocial states, with emotion as a core component; (2) core
53 action components; and (3) the notion that a combination of emotion- and action-regulation strategies

54 is more effective than focusing on one aspect alone (see Robazza & Ruiz, 2018). The MuSt theory
55 draws upon and develops ideas from the individual zones of optimal functioning (IZOF) model
56 (Hanin, 2000, 2007), the multi-action plan (MAP) model (Bortoli, Bertollo, Hanin, & Robazza, 2012;
57 Robazza, Bertollo, Filho, Hanin, & Bortoli, 2016), the identification-control-correction program
58 (Hanin & Hanina, 2009), and the task execution design approach (Hanin, Hanina, Šašek, & Kobilšek,
59 2016). In particular, emphasis in the MuSt theory is placed on a dynamic process that extends (a) the
60 IZOF model by including an action monitoring/control dimension in interaction with performance
61 functionality, and (b) the MAP model by considering a wide range of psychobiosocial states.
62 Individualized profiling procedures are fundamental in the identification of functional and
63 dysfunctional psychobiosocial states and core action components of optimal performance, which are
64 the basis for the regulation.

65 **Psychobiosocial Feeling States**

66 Feeling states, including emotional experiences, are fundamental to human adaptation, as they
67 influence effort, attention, decision making, memory, and behavioural responses of individuals, and
68 their interpersonal interactions. Within the IZOF model (Hanin, 2000), emotions are conceptualized as
69 central components of performance-related psychobiosocial states, the performance process, and
70 overall human functioning. Psychobiosocial states manifest themselves in emotional (subjective
71 experience), as well as cognitive, motivational, volitional, bodily, motor-behavioural, operational, and
72 communicative state modalities (Hanin, 2010; Ruiz et al., 2016). A comprehensive description of each
73 state modality is presented elsewhere (e.g., Ruiz et al., 2016).

74 Emotional subjective experiences are conceptualized based on the interaction between
75 valence (pleasant vs. unpleasant) and functionality (functional vs. dysfunctional) distinctions (see
76 Figure 1, left lower side). Thus, some experiences can be unpleasant (e.g., feeling anxious) but helpful
77 for performance by providing energy, while others can be pleasant (e.g., feeling satisfied) but
78 dysfunctional, reflecting a lack of effort or complacency. Athletes' experiences can be divided into
79 state-like experiences (right-now feelings), trait-like experiences (typical patterns of experiences), and
80 meta-experiences (experience about the experiences). For example, an athlete may have a tendency to

81 feel anxious in competitions (pattern), and thus, experience high anxiety at a specific encounter
82 (state). However, they may not accept such anxiety and feel that they should be relaxed (negative
83 meta-experience of anxiety). The concept of meta-experience is critical for self-regulation. An
84 effective implementation of regulation strategies requires an individual's awareness of state-like
85 experiences and of their impact on performance. Afterwards, acceptance of these inner experiences is
86 needed to self-regulate effectively (Hanin, 2007).

87 [INSERT FIGURE 1 HERE]

88 The MuSt theory shares with the IZOF model the notion of individual zones of optimal/non-
89 optimal state intensities as related to performance. In the MuSt theory, this notion is extended to
90 incorporate functional action components.

91 **Core Action Components**

92 Similar to the MAP model (Robazza et al., 2016), the MuSt theory claims that directing
93 attention to a few 'core' components of the action helps the athlete execute a movement pattern within
94 a functional range of variability, and therefore perform more consistently, particularly under pressure.
95 Core action components are conceived as fundamental movements or action-related behaviours, such
96 as 'positioning', 'grip', 'aiming', and 'timing', in precision sports (Bortoli et al., 2012), 'effort',
97 'acceleration', and 'rhythm' in endurance sports (Meijen, 2019), and visual information sources for
98 pattern recognition and anticipation in situational sports (North & Williams, 2019). These core
99 components are subjected to higher variability and accuracy fluctuations than automated technical
100 elements, which are typically executed without conscious attention. Core action components are
101 encoded and stored in long-term memory and determine the effectiveness of movement patterns.
102 Their mental representations are idiosyncratic, and therefore differ widely among athletes. Focusing
103 on core components is expected to enhance movement mastery and self-confidence in practice and
104 competition.

105 Self-regulation strategies should involve regulation of feeling states as well as attention
106 monitoring/control of core action components, resulting in a $2 \times 2 \times 2$ interplay between action

107 monitoring/control, valence, and performance functionality. These relationships are illustrated in
108 Figure 1 (left side). Four performance types derive from the interaction between performance
109 functionality and action monitoring/control (upper part), and the interplay between functionality and
110 valence (lower part). These $2 \times 2 \times 2$ relationships (right side) result in eight theoretically assumed
111 performance related feeling states.

112 In Type 1 state, high-level performance is associated with little action monitoring/control and
113 functional/pleasant states. In this flow-like state, usually triggered by a challenge appraisal, the
114 attention focus is limited to ‘supervising’ the action. Task execution, which does not rely on working
115 memory and controlled attention (Furley, Schweizer, & Bertrams, 2015; Furley & Wood, 2016),
116 appears to be autonomous, effortless, smooth, consistent, and effective (Csikszentmihalyi, Latter, &
117 Duranso, 2017; Harmison, 2006). The performer feels in complete control, confident, and full of
118 energy. However, this highly self-rewarding psychophysiological state is rarely experienced,
119 especially when sought after. Type 2 state, which is more frequently experienced, is also prompted by
120 a challenge appraisal, and typified by higher action monitoring with effortful attentional focus
121 voluntarily directed toward a limited number of action components (e.g., Vitali et al., 2019).
122 Performers in this state report pleasant or unpleasant functional states experienced with novel
123 problems, unexpected events, demanding tasks, strenuous physical activities, competitive stress, and
124 other situational difficulties. To attain a Type 2 state, attention should be directed to previously
125 identified core action components to prevent excessive attention reinvestment or distraction from
126 task-relevant cues, and to ease the transition to a more autonomous execution.

127 Types 3 and 4 states arise from the perception of threatening situations under stress or
128 unpredictable issues that cause task disruption or disengagement. In Type 3 state, the performer’s
129 attempts to deal with situational demands or recover from underperformance lead to distraction from
130 task-relevant cues, excessive reinvestment of conscious attention to the execution of automated skills,
131 loss of energy, impaired movement fluidity and automaticity (Masters & Maxwell, 2008; van
132 Ginneken, Poolton, Masters, Capio, Kal, & van der Kamp, 2017). Performers usually report
133 dysfunctional/unpleasant states. Finally, Type 4 state features low task engagement, low energy spent

134 to goal-directed behaviours, and unfocused attention. Pleasant emotional experiences accompanying
135 poor performances may be triggered by insufficient awareness or unstructured meta-experiences. For
136 example, an overconfident athlete may overestimate the current situation appraising gain (victory)
137 before the competition ends, and therefore may mobilize less energy or resources than those needed to
138 accomplish the task. Another athlete may feel relieved from competition pressure after making a
139 mistake s/he perceives diminishing the chance to win, and thus may decrease effort or engagement in
140 the activity. Beyond these four performance states, and the eight feeling states emerging from the $2 \times$
141 2×2 (monitoring/control \times valence \times performance functionality) interplay, athletes experience a
142 range of finely tuned patterns of performance states in attempts to adapt to or deal with situational
143 demands.

144 **Self-regulation Process**

145 The MuSt theory process for self-regulation is depicted in Figure 2. In this process, the notion
146 of individual appraisal is central, similar to existing theoretical views, such as the biopsychosocial
147 model (Blascovich, 2008), the theory of challenge and threat states in athletes (Jones, Meijen,
148 McCarthy, & Sheffield, 2009; Meijen, Turner, Jones, Sheffield, & McCarthy, 2020; Uphill, Rossato,
149 Swain, & O'Driscoll, 2019), and the cognitive-motivational-relational theory (Lazarus, 2000).
150 Positive (i.e., challenge) and negative (i.e., threat) appraisals are motivational states that depend on
151 one's evaluation of anticipated benefits and harms in relevant person-environment transactions
152 (Lazarus & Folkman, 1984) considering situational demands and personal resources. A positive
153 appraisal reflects enough perceived personal resources to manage task demands, whereas a negative
154 appraisal occurs when task demands are perceived as exceeding personal resources (see also Sammy,
155 Harris, & Vine, 2020). Environmental factors, task demands, and personal characteristics are
156 interactive determinants of individual appraisals, and are also critical for skill acquisition and
157 development of sport expertise (see Renshaw, Davids, Newcombe, & Roberts, 2019). Environmental
158 factors comprise both the location characteristics in which performance takes place (e.g., surface,
159 climate, wind, altitude, affordances, constraints) and the social environment (e.g., teammates, coach,
160 parents, spectators), while task demands depends on the characteristics of the skills (e.g., closed and

161 open, self-paced and externally-paced) and type of sport (e.g., individual and team, short and long
162 duration). Personal characteristics encompass, among others, individual motor skills, physical
163 capacities, experience, personality traits (e.g., perfectionism, optimism, mental toughness, emotional
164 intelligence, sensation seeking, self-efficacy, confidence; e.g., Mosley & Laborde, 2016), preferences
165 for emotional experiences (e.g., feeling tranquil, anxious, angry), attitudes toward action
166 monitoring/control (e.g., external and internal attentional focus, flow experiences, clutch states; e.g.,
167 Swann, Crust, & Vella, 2017), and spontaneous or acquired self-regulation skills.

168 [INSERT FIGURE 2 HERE]

169 A positive appraisal is expected to lead to either pleasant or unpleasant functional states and
170 high or low action monitoring levels. In a functional state, the athlete can ‘fluctuate’ among pleasant
171 and unpleasant states and levels of action monitoring depending on the situation. The possible
172 transition among states is indicated by the circular-dashed arrow in Figure 2 at the intersection of
173 action monitoring, valence, and performance functionality axes. Rather than shifts among opposing
174 categories, transition should be viewed as a continuum among multiple states underpinned by
175 different levels of pleasant/unpleasant experiences and high/low action monitoring conditions.
176 Competitive pressure, perception of challenge, fatigue, and/or unexpected events can determine
177 changes from pleasant to unpleasant functional states and from low to high levels of action monitoring
178 to manage external and/or internal demands and adapt to the situation. These functional states can
179 reinforce a positive appraisal and exert beneficial effects toward performance process and outcome. In
180 contrast, competitive stress, threat perception, exhaustion, and unpredictable events can determine an
181 imbalance between perceived demands and personal resources. The resulting negative appraisal is
182 conducive to dysfunctional states, which can be mostly unpleasant, and step-by-step control of action
183 rather than action monitoring. Fluctuations occurring among hedonic valenced states and levels of
184 action control are pointed out by the circular-dashed arrow (Figure 2, lower part). Again, transition
185 among different levels of valenced experiences and action control is conceptualized as a continuum.
186 Dysfunctional states can further enhance a negative appraisal of the situation and eventually result in
187 detrimental effects on the performance process and outcome.

188 Performers can move not only among a range of functional states and action monitoring levels
189 or dysfunctional states and action control levels, but also from a functional state to a dysfunctional
190 state and vice versa (Figure 2, double-headed dashed arrow) in function of the unfolding events and
191 related appraisal changes. A combination of emotion- and action-centred self-regulation strategies is
192 therefore recommended to remain within optimal performance conditions across multiple states (large
193 circular arrow in the upper part of Figure 2), or to regain optimal performance (solid arrow).

194 **Applied Recommendations**

195 According to the MuSt theory, the step-wise procedure for performance enhancement self-
196 regulation involves: (a) identification of psychobiosocial states and core action components to
197 enhance awareness, (b) prediction of performance and acceptance of the individual's states, and (c)
198 use of self-regulation strategies. To illustrate this procedure, the experience of a 27 year-old male elite
199 archer is briefly described. In this case, Steve (pseudonym) requested counselling to deal with
200 competitive pressure and to improve performance.

201 **Identification of Psychobiosocial States and Core Action Components**

202 The identification and description of idiosyncratic performance experiences is based on
203 individualized profiling of both psychobiosocial states (e.g., Ruiz, Hanin, & Robazza, 2016) and
204 action components (Bortoli et al., 2012). With the help of a practitioner, athletes recall successful past
205 performances and identify the content and intensity of their functional and dysfunctional states. Next,
206 they are guided to become aware of idiosyncratic movement patterns underlying effective and
207 ineffective task executions, and to identify the most influential core action components, those that
208 differentiate optimal from suboptimal performance. Then, they rate the level of execution accuracy in
209 their action components. The same procedure is repeated for their least successful past performances.

210 In the case of Steve, he was firstly presented a stimulus list of psychobiosocial states (see
211 Appendix 1). This list is an extended version of the individualized profiling proposed by Ruiz et al.
212 (2016). Using a retrospective method, Steve selected functional and dysfunctional state descriptors
213 that best represented frequently occurring personal experiences, recalled optimal and suboptimal

214 performances, and rated their intensities using a modified Borg's Category Ratio scale (CR-10; Borg,
215 1998). Steve was then asked to describe a personally relevant sequence of actions (from start to finish)
216 needed for the most effective shooting execution. Identified action components were rated in terms of
217 execution accuracy as related to optimal and suboptimal performances using the CR-10 scale (see
218 Figure 3).

219 [INSERT FIGURE 3 HERE]

220 In a second step, Steve identified most critical functional and dysfunctional states and core
221 action components, which clearly differentiated optimal and suboptimal performances under pressure.
222 The key question was: 'Imagine yourself performing in a challenging situation, or in a mental or
223 physical nonoptimal state, for example when you are under stress or fatigued, after a mistake, or a
224 poor execution. What are the functional emotions and their related manifestations that you need to
225 self-regulate in order to maintain or regain good performance and execute in a consistent and accurate
226 manner?' The same question was asked to identify dysfunctional psychobiosocial feeling states.
227 Finally, the following question was asked to identify core action components: 'What are the actions or
228 behaviours that you need to self-regulate...?'

229 Steve selected 'secure' (Confidence modality), 'nervous' (Anxiety), and 'energetic' (Bodily) as
230 core functional psychobiosocial states to be upregulated (i.e., increased in intensity). In the athlete's
231 perception (i.e., meta-experience), a high level of nervousness was needed to be energetic. 'Worried'
232 (Anxiety modality) was again selected together with 'unstable-performance' (Operational) as a
233 dysfunctional state to be downregulated (i.e., decreased in intensity). A high level of worry was
234 perceived as a main cause for unstable performance. Interestingly, nervous and worried as descriptors
235 of the Anxiety modality were experienced as having opposite effects on the performance process (i.e.,
236 energy or performance instability). Regarding the action, Steve chose 'aiming', 'feeling relaxed', and
237 'timing' as core components. Communicative and Social support modality levels did not differ across
238 optimal and nonoptimal performances, and therefore Steve did not need to regulate these modalities.
239 In contrast, intensity levels of the identified core psychobiosocial states showed greater differences.

240 Similarly, accuracy levels of the selected core components were largely different across
241 performances.

242 **Prediction of Performance**

243 The recall (retrospective) method to develop the individual profile of Steve was revised and
244 refined regularly in combination with a direct (empirical) assessment. This involved a longitudinal
245 assessment of psychobiosocial state intensity and core components accuracy before or after several
246 competitions, and their correspondence with actual performance process and outcome levels. The
247 MuSt theory advocates that individual profiles based on recalled and direct assessments allow
248 predicting performance. Successful performance is predicted when the intensity of functional states
249 and execution accuracy of action components are close to the individual's optimal intensity/accuracy
250 levels, and dysfunctional states intensities and accuracy levels of action components are distant from
251 nonoptimal ranges. This 'in-zone' condition is typified by maximum enhancing and minimum
252 impairing effects. In contrast, poor performance is expected with intensities and accuracy levels near
253 dysfunctional states and far from functional states. This 'out-of-zone' condition is characterized by
254 high inhibitory and low enhancing effects. Intermediate performance outcomes are expected in a
255 mixed condition, namely, when some state intensities and/or action component accuracy levels are
256 closer to optimal states while others are closer to nonoptimal states. These predictions were verified
257 and confirmed based on Steve's experience and performance.

258 **Self-regulation**

259 To reach and remain in the in-zone condition, athletes can apply emotion- or action-centred
260 self-regulation, or a combination of the two strategies. Based on psychobiosocial states and action
261 core components profiling, as well as performance predictions, Steve was encouraged to identify and
262 apply emotion-centred self-regulation strategies (e.g., self-talk, arousal regulation, and imagery;
263 Vealey & Forlenza, 2015; Williams, Zinsser, & Bunker, 2015) to enhance feelings of confidence,
264 functional anxiety, energy, and reduce feelings of worry. He was also recommended to use action-
265 centred self-regulation by directing attention to his three core components of the action.

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Conclusions

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In summary, according to the MuSt theory athletes experience a wide range of performance states in practice and competition originating from the action monitoring/control and functionality/valence interplay. To consistently reach and maintain optimal performance states, and recover from transitory performance drops, athletes can focus on their core functional states and core action components depending on current needs and situational demands. At first, performers should be helped to appraise the competition as challenging rather than threatening (Hase, O'Brien, Moore, & Freeman, 2019). This can be accomplished by improving their skills, ability, and knowledge and, consequently, their self-efficacy and perceived control, as well as by reframing or restructuring their thoughts, beliefs (Williams et al., 2015), and psychobiosocial reactions. Assessing and revisiting regularly individualized profiles of feeling states and action components can facilitate reappraisal, increase individual awareness of own responses to the competition, and enhance confidence and sense of agency. Furthermore, attending to core states and action components can help the performer focus on and mindfully accept the present moment situation rather than wasting energies in the struggle to exert control over the situation and own action (see Fink & Ruiz, 2020). In a mindful state, athletes are more prone to effectively apply emotion-centred and action-centred self-regulation to enter and remain in an optimal performance state and enjoy the experience.

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The MuSt theory tenets here proposed may seem speculative. However, they are mainly rooted in the IZOF model (Hanin, 2007), the identification-control-correction program (Hanin & Hanina, 2009), the task execution design approach (Hanin et al., 2016), and the MAP model (Bortoli et al., 2012; Robazza et al., 2016), which have received substantial empirical support (see Robazza & Ruiz, 2018; Ruiz, Raglin, & Hanin, 2017). A number of additional views share interesting commonalities with the MuSt theory including, among others, the biopsychosocial (Blascovich, 2008), challenge and threat (Jones et al., 2009, see Sammy et al., 2020), dual-process (Furley et al., 2015), flow and clutch (Swann et al., 2017), integrative cognitive affective motor neuroscience (CAM) model (Hatfield, 2018), motoric (Carson & Collins, 2016, see Carson & Collins, 2020), and attentional control (Eysenck & Wilson, 2016) models. Thus, future research is necessary to: (a) test the specific

293 predictions stemming from the MuSt theory; (b) investigate similarities, differences, and specific
294 contributions in comparison with other theoretical views; and (c) examine the effectiveness of
295 emotion- and action-centred self-regulation strategies separately and in combination.

296 References

- 297 Blascovich, J. (2008). Challenge and threat. In A. J. Elliot (Ed.), *Handbook of approach and*
298 *avoidance motivation* (pp. 431–445). New York, NY: Psychology Press.
- 299 Borg, G. (1998). *Borg's perceived exertion and pain scales*. Champaign, IL: Human Kinetics.
- 300 Bortoli, L., Bertollo, M., Hanin, Y., & Robazza, C. (2012). Striving for excellence: A multi-action
301 plan intervention model for shooters. *Psychology of Sport and Exercise, 13*, 693–701.
302 doi:10.1016/j.psychsport.2012.04.006
- 303 Carson, H. J., & Collins, D. (2016). The fourth dimension: A motoric perspective on the anxiety–
304 performance relationship. *International Review of Sport and Exercise Psychology, 9*, 1–21.
305 doi:10.1080/1750984X.2015.1072231
- 306 Carson, H. J., & Collins, D. (2020). Training success under stress: Appropriately embedding motor
307 skills in sport. In this book.
- 308 Csikszentmihalyi, M., Latter, P., & Duranso, C. W. (2017). *Running flow*. Champaign, IL: Human
309 Kinetics.
- 310 Eysenck, M. W., & Wilson, M. R. (2016). Sporting performance, pressure and cognition-Introducing
311 attentional control theory: Sport. In D. Groome & M. W. Eysenck (Eds.), *An introduction to*
312 *applied cognitive psychology* (2nd ed., pp. 329–350). New York, NY: Routledge.
- 313 Furley, P., Schweizer, G., & Bertrams, A. (2015). The two modes of an athlete: Dual-process theories
314 in the field of sport. *International Review of Sport and Exercise Psychology, 8*, 106–124.
315 doi:10.1080/1750984X.2015.1022203
- 316 Furley, P., & Wood, G. (2016). Working memory, attentional control, and expertise in sports: A
317 review of current literature and directions for future research. *Journal of Applied Research in*
318 *Memory and Cognition, 5*, 415–425. doi:10.1016/j.jarmac.2016.05.001
- 319 Hanin, Y. L. (Ed.). (2000). *Emotions in sport*. Champaign, IL: Human Kinetics.
- 320 Hanin, Y. L. (2007). Emotions in sport: Current issues and perspectives. In G. Tenenbaum & R. C.
321 Eklund (Eds.), *Handbook of sport psychology* (3rd ed., pp. 31–58). Hoboken, NJ: John Wiley
322 & Sons.

- 323 Hanin, Y., & Hanina, M. (2009). Optimization of performance in top-level athletes: An action-
324 focused coping approach. *International Journal of Sports Science & Coaching*, 4, 47–58.
325 doi:10.1260/1747-9541.4.1.47
- 326 Hanin, Y., Hanina, M., Šašek, H., & Kobilšek, A. (2016). Emotion-centered and action-centered
327 coping in elite sport: Task execution design approach. *International Journal of Sports Science*
328 *& Coaching*, 11, 566–588. doi:10.1177/1747954116654782
- 329 Harmison, R. J. (2006). Peak performance in sport: Identifying ideal performance states and
330 developing athletes' psychological skills. *Professional Psychology: Research and Practice*,
331 37, 233–243. doi:10.1037/0735-7028.37.3.233
- 332 Hase, A., O'Brien, J., Moore, L. J., & Freeman, P. (2019). The relationship between challenge and
333 threat states and performance: A systematic review. *Sport, Exercise, and Performance*
334 *Psychology*, 8, 123–144. doi:10.1037/spy0000132
- 335 Hatfield, B. D. (2018). Brain dynamics and motor behavior: A case for efficiency and refinement for
336 superior performance. *Kinesiology Review*, 7, 42-50. doi:10.1123/kr.2017-0056
- 337 Jones, M., Meijen, C., McCarthy, P., & Sheffield, D. (2009). A theory of challenge and threat states in
338 athletes. *International Review of Sport and Exercise Psychology*, 2, 161–180.
339 doi:10.1080/17509840902829331
- 340 Lazarus, R. S. (2000). How emotions influence performance in competitive sports. *The Sport*
341 *Psychologist*, 14, 229–252. doi:10.1123/tsp.14.3.229
- 342 Lazarus, R. S., & Folkman, S. (1984). *Stress, appraisal, and coping*. New York, NY: Springer-
343 Verlag.
- 344 Masters, R., & Maxwell, J. (2008). The theory of reinvestment. *International Review of Sport and*
345 *Exercise Psychology*, 1, 160–183. doi:10.1080/17509840802287218
- 346 Meijen, C. (Ed.). (2019). *Endurance performance in sport: Psychological theory and*
347 *interventions*. London, UK: Routledge.
- 348 Meijen, C., Turner, M., Jones, M. V., Sheffield, D., & McCarthy, P. (2020). A theory of challenge and
349 threat states in athletes: A revised conceptualization. *Frontiers in Psychology*, 11(126).
350 doi:10.3389/fpsyg.2020.00126

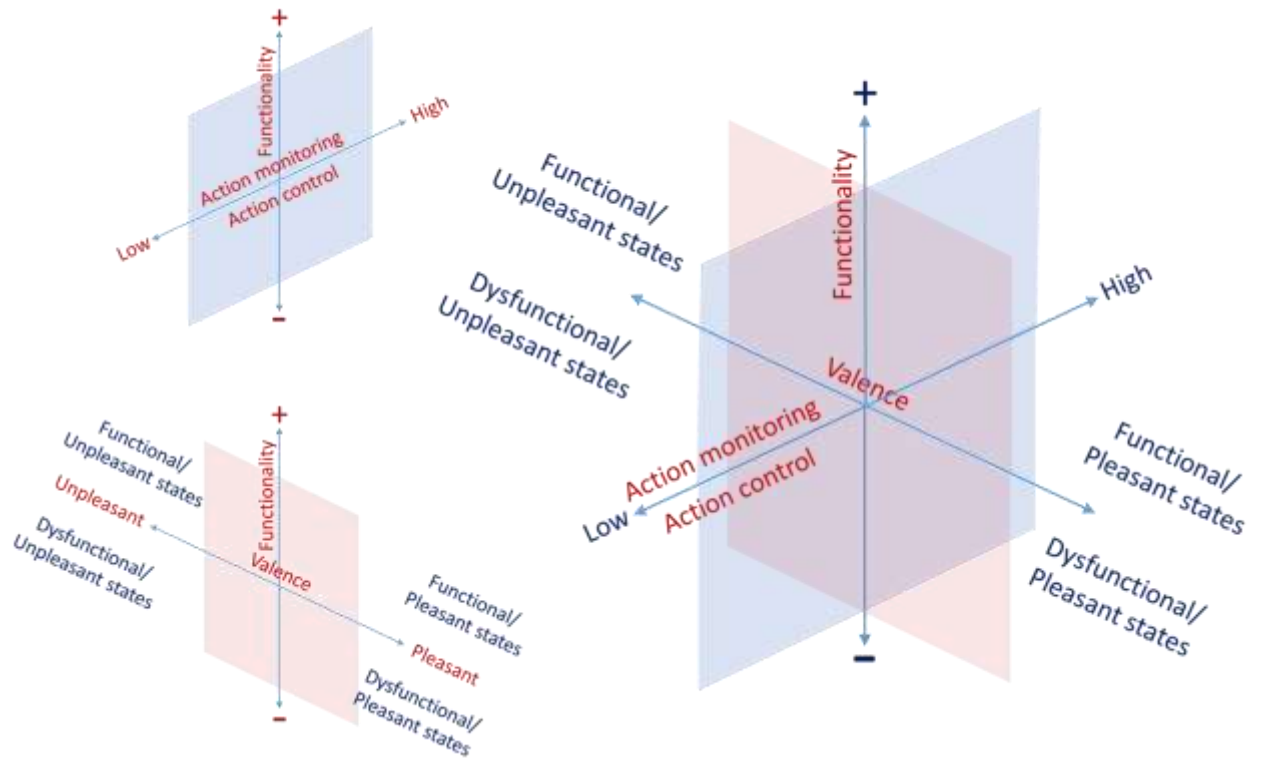
- 351 Mosley, E., & Laborde, S. (2016). Performing under pressure: Influence of personality-trait-like
352 individual differences. In M. Raab, B. Lobinger, S. Hoffmann, A. Pizzera, & S. Laborde
353 (Eds.). *Performance psychology: Perception, action, cognition, and emotion* (pp. 291–314).
354 London, UK: Elsevier.
- 355 North, J. S., & Williams, A. M. (2019). Familiarity detection and pattern perception. In A. M.
356 Williams & R. C. Jackson (Eds.). *Anticipation and decision making in sport* (pp. 25–42). New
357 York, NY: Routledge.
- 358 Renshaw, I., Davids, K., Newcombe, D., & Roberts, W. (2019). *The constraints-led approach-*
359 *Principles for sports coaching and practice design*. New York, NY: Routledge.
- 360 Robazza, C., Bertollo, M., Filho, E., Hanin, Y., & Bortoli, L. (2016). Perceived control and hedonic
361 tone dynamics during performance in elite shooters. *Research Quarterly for Exercise and*
362 *Sport*, 87, 284–294. doi:10.1080/02701367.2016.1185081
- 363 Robazza, C., & Ruiz, M. C. (2018). Emotional self-regulation in sport and performance. *Oxford*
364 *Research Encyclopedia of Psychology*. Retrieved 1 August 2018 from
365 [http://psychology.oxfordre.com/view/10.1093/acrefore/9780190236557.001.0001/acrefore/97](http://psychology.oxfordre.com/view/10.1093/acrefore/9780190236557.001.0001/acrefore/9780190236557-e-154)
366 [80190236557-e-154](http://psychology.oxfordre.com/view/10.1093/acrefore/9780190236557.001.0001/acrefore/9780190236557-e-154)
- 367 Ruiz, M. C., Hanin, Y., & Robazza, C. (2016). Assessment of performance-related experiences: An
368 individualized approach. *The Sport Psychologist*, 30, 201–218. doi:10.1123/tsp.2015-0035
- 369 Ruiz, M. C., Raglin, J. S., & Hanin, Y. L. (2017). The individual zones of optimal functioning (IZOF)
370 model (1978-2014): Historical overview of its development and use. *International Journal of*
371 *Sport and Exercise Psychology*, 15, 41–63. doi:10.1080/1612197X.2015.1041545
- 372 Sammy, N., Harris, D., & Vine, S. (2020). Challenge and threat states and emotions. In this book
- 373 Swann, C., Crust, L., & Vella, S. A. (2017). New directions in the psychology of optimal performance
374 in sport: Flow and clutch states. *Current Opinion in Psychology*, 16, 48–53.
375 doi:10.1016/j.copsyc.2017.03.032
- 376 Uphill, M. A., Rossato, C., Swain, J., & O’Driscoll, J. M. (2019). Challenge and threat: A critical
377 review of the literature and an alternative conceptualisation. *Frontiers in Psychology*,
378 10(1255). doi:10.3389/fpsyg.2019.01255

- 379 van Ginneken, W. F., Poolton, J. M., Masters, R. S. W., Capio, C. M., Kal, E. C., & van der Kamp, J.
380 (2017). Comparing the effects of conscious monitoring and conscious control on motor
381 performance. *Psychology of Sport and Exercise*, *30*, 145–152.
382 doi:10.1016/j.psychsport.2017.03.001
- 383 Vealey, R. S., & Forlenza, S. T. (2015). Understanding and using imagery in sport. In J. M. Williams
384 & V. Krane (Eds.). *Applied sport psychology: Personal growth to peak performance* (7th ed.,
385 pp. 240–273). New York, NY: McGraw-Hill Education.
- 386 Vitali, F., Tarperi, C., Cristini, J., Rinaldi, A., Zelli, A., Lucidi, F., . . . Robazza, C. (2019). Action
387 monitoring through external or internal focus of attention does not impair endurance
388 performance. *Frontiers in Psychology*, *10*(535). doi:10.3389/fpsyg.2019.00535
- 389 Williams, J. M., Zinsser, N., & Bunker, L. (2015). Cognitive techniques for building confidence and
390 enhancing performance. In J. M. Williams & V. Krane (Eds.). *Applied sport psychology:
391 Personal growth to peak performance* (7th ed., pp. 274–303). New York, NY: McGraw-Hill
392 Education.
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395 *Figure 1. A multi-states (MuSt) theory representation deriving from monitoring/control,*
 396 *functionality/valence, and performance level interactions.*

397

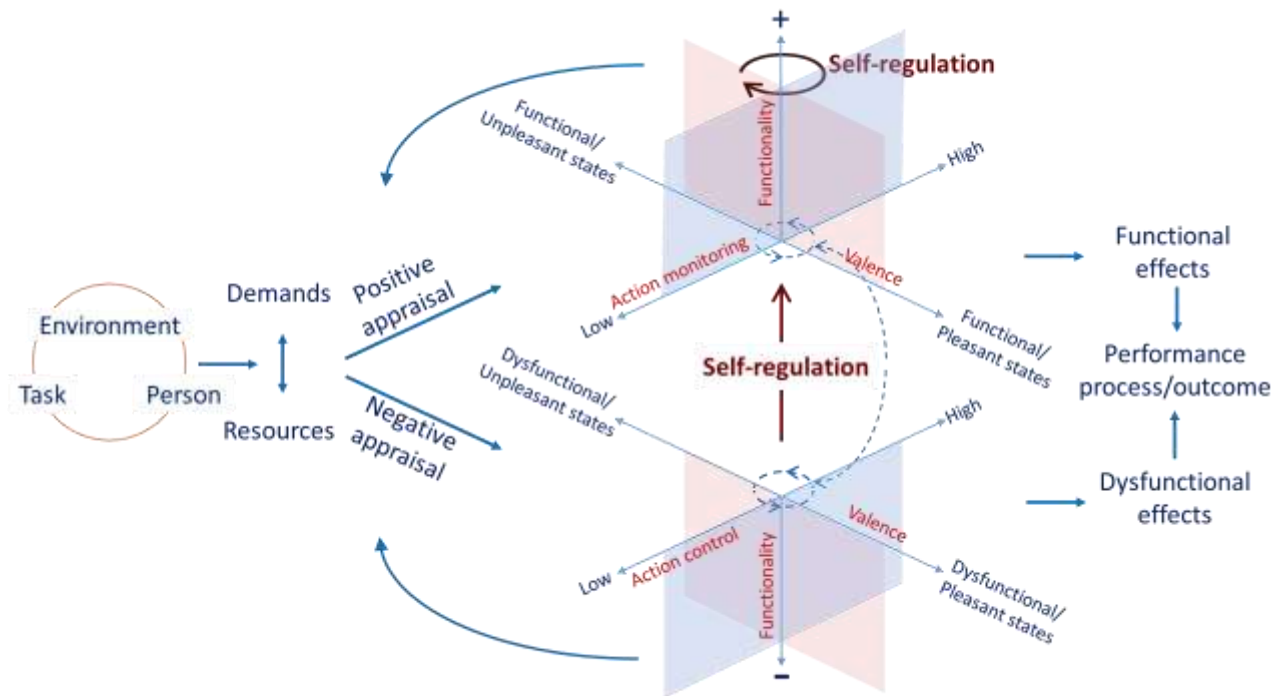
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401 *Figure 2.* The multi-states (MuSt) theory and the self-regulation process.



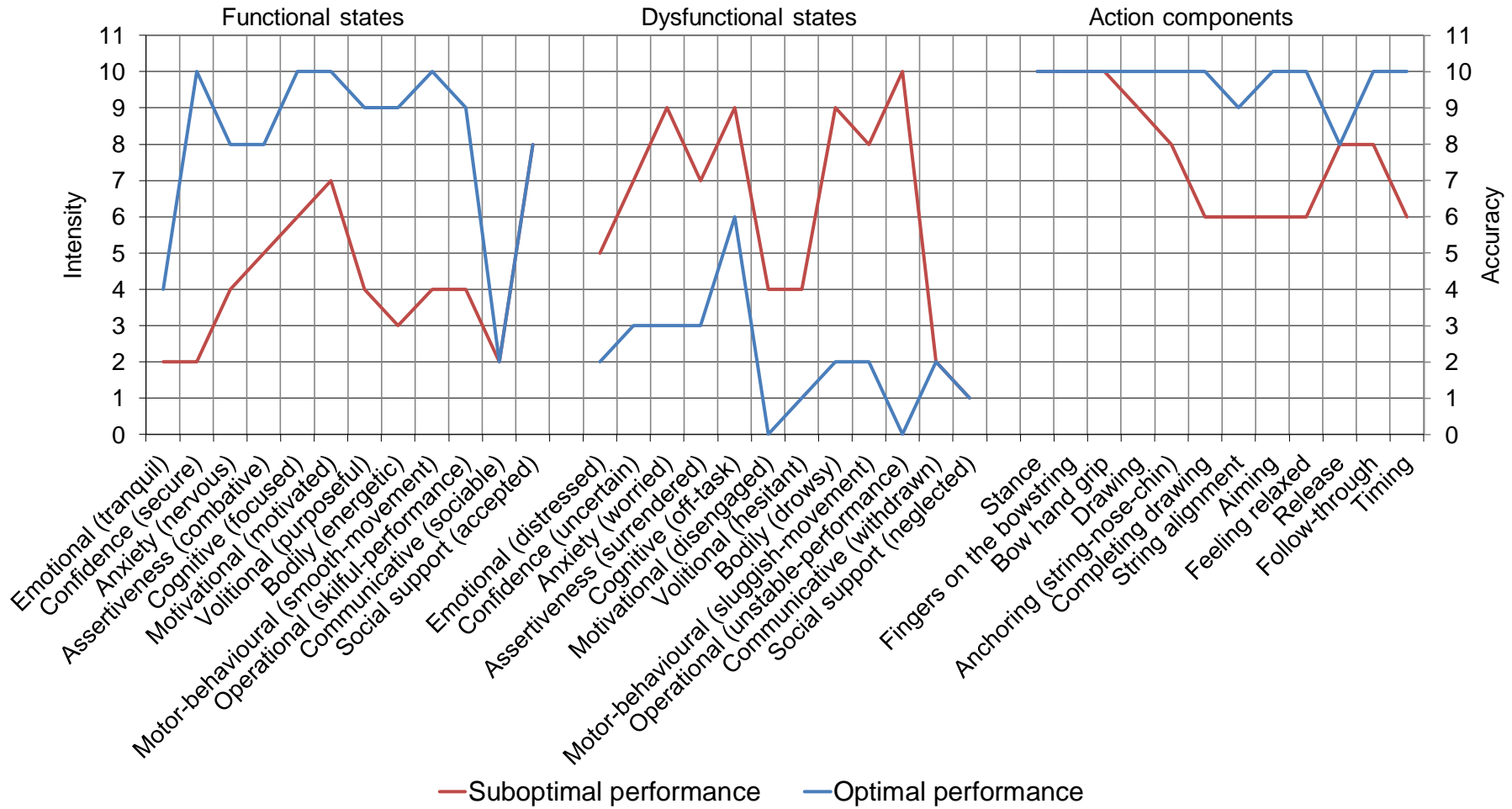
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405 *Figure 3.* Individualized profile of an archer during recalled optimal and suboptimal performances. The archer's selected descriptors of each functional and
406 dysfunctional state modality are in parentheses

407



408

409 **Appendix 1**

410 *Individualized Multidimensional Profiling of Psychobiosocial States*

411 Below are labels that athletes use to describe their performance-related experiences. Read carefully all descriptors in each row and circle the one that
 412 describes best how you feel. Then, rate the intensity according to the following scale: 0 = nothing at all; .5 = very, very little; 1 = very little; 2 = little; 3 =
 413 moderate; 5 = much; 7 = very much; 10 = very, very much; • = maximal possible.

414

| | | | | | | | | | | | | | |
|---|---|----|---|---|---|---|---|---|---|---|---|----|---|
| 1. Enthusiastic, happy, joyful, cheerful, tranquil, calm | 0 | .5 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | • |
| 2. Fighting spirit, fierce, aggressive, combative | 0 | .5 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | • |
| 3. Active-, coordinated-, dynamic-, smooth-movement | 0 | .5 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | • |
| 4. Distracted, off-task, inattentive, unfocused | 0 | .5 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | • |
| 5. Effective- skilful- stable- consistent-performance | 0 | .5 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | • |
| 6. Uncommunicative, withdrawn, disconnected | 0 | .5 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | • |
| 7. Anxious, worried, tense, nervous | 0 | .5 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | • |
| 8. Abandoned, ignored, neglected, rejected | 0 | .5 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | • |
| 9. Vigorous, energetic, charged, rested | 0 | .5 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | • |
| 10. Sluggish-, uncoordinated-, clumsy-, weak-movement | 0 | .5 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | • |
| 11. Alert, on-task, attentive, focused | 0 | .5 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | • |
| 12. Unmotivated, uninterested, disengaged, uninspired | 0 | .5 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | • |
| 13. Dejected, unhappy, sad, distressed, upset | 0 | .5 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | • |
| 14. Ineffective-, unskilful-, unstable-, inconsistent-performance | 0 | .5 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | • |
| 15. Communicative, sociable, expansive | 0 | .5 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | • |
| 16. Purposeful, decisive, persistent, determined | 0 | .5 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | • |

| | | | | | | | | | | | | | |
|--|---|----|---|---|---|---|---|---|---|---|---|----|---|
| 17. Unconfident, incapable, insecure, uncertain | 0 | .5 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | • |
| 18. Motivated, interested, inspired, engaged | 0 | .5 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | • |
| 19. Fatigued, tired, drained, drowsy | 0 | .5 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | • |
| 20. Timid, fragile, reserved, surrendered | 0 | .5 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | • |
| 21. Hesitant, indecisive, undetermined, irresolute | 0 | .5 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | • |
| 22. Confident, capable, secure, certain | 0 | .5 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | • |
| 23. Assisted, considered, supported, accepted | 0 | .5 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | • |

415 Modalities: Row 1 = Pleasant states (+); 2 = Assertiveness (+); 3 = Motor-behavioural (+); 4 = Cognitive (-); 5 = Operational (+); 6 = Communicative (-); 7 =
416 Anxiety (+ or -); 8 = Social support (-); 9 = Bodily (+); 10 = Motor-behavioural (-); 11 = Cognitive (+); 12 = Motivational (-); 13 = Unpleasant states (-); 14 =
417 Operational (-); 15 = Communicative (+); 16 = Volitional (+); 17 = Confidence (-); 18 = Motivational (+); 19 = Bodily (-); 20 = Assertiveness (-); 21 =
418 Volitional (-); 22 = Confidence (+); 23 = Social support (+).

419 Appendix 1