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APPENDIX A

Thematic Facets and Empirical Scales

In order to guide model building of the RST-PQ, the structures of the FFFS and BIS were modelled on the conceptual scheme of Gray and McNaughton (2000; see Fig. 2.3; see Table 1 below).

In regards to the FFFS, we adopted flight, freeze and active avoidance (this form of avoidance contrasts with the passive avoidance characteristics of the BIS). Also, discussed in Appendix D, for sound theoretical and empirical reasons, defensive fight was not included under the FFFS factor. In regards to the BIS, there exists a necessary distinction between defensive approach to avoidable and unavoidable dangerous stimuli. To avoidable dangerous stimuli, we assign motor interruption, behavioral caution/risk assessment, and worry. In this context, when approach-avoidance conflict is detected by the BIS, ongoing motor programs (entailing both FFFS and BAS) are inhibited (i.e., motor interruption); this is followed by behavioral caution and a process of risk assessment of the environment (including the scanning of memory), which we modelled as behavioral caution and risk assessment; and Worry is the ruminative (cognitive) process that accompanies BIS activation and the above behavioral consequences, entailing more abstract cognitive processing concerning the perceived threat. Turning to defensive approach behaviors to stimuli that cannot be avoided, we include two component processes: (a) obsessional thoughts, and (b) behavioral disengagement. Obsessional thoughts concern cognitive/emotional engagement with a danger that cannot be identified, located, or avoided (e.g., contaminated objects, disease, etc). Behavioral Disengagement refers to withdrawal (including cognitive and emotional terms) from situations where identifiable danger cannot be avoided (e.g., the thoughts and stimuli associated with a significant loss, e.g., personal or financial).

Turning to the BAS, we developed operational definitions for five BAS thematic facets: Reward Interest, Goal Planning, Drive-Persistence, Reward Reactivity, and Impulsivity.

Reward Interest. This putative facet taps openness to new experiences and opportunities that are potentially rewarding. People high on this facet are more likely to engage in anticipatory approach, exploration of new objects, places and people, and are comparable to an animal exploring different territories, sniffing and sensing, looking for opportunities to expose themselves to rewarding experiences. It is a "In it, to win" attitude. It may be distinguished from Reward Reactivity in that it does not depend upon the presence of actual reward. It is a form of anticipatory reward expectation and associated exploration of potentially rewarding stimuli (e.g., exploring new hobbies).

Goal Planning. Central to our conceptualisation is the assumption that successful BAS behavior must include an element of goal planning. This proposition runs the risk of verging on the obvious; however, it has not been obvious enough to be included in any of the existing BAS measures developed. Goal-planning measures the motivation to put in place goals and sub-goals to achieve the ultimate aim of obtaining reward, albeit often at the expense of short-term or immediate reward (e.g., saving for a holiday).

Drive-Persistence. To achieve BAS goals, especially in complex human contexts, it is necessary to maintain motivation and be persistent, especially when reward is not immediately available. The 'drive' aspect is similar to the Carver and White (1994) Drive scale; and the 'persistence' aspect is comparable to Cloninger's (1986) Persistence scale which relates to the maintenance of positive motivation over time when immediate reward is not available. We propose that the attainment of sub-goals is, itself, positively reinforcing, and this helps to establish the 'temporal bridging' necessary to continue with behaviors that are aimed at a larger (super-ordinate) appetitive goal. For example, monitoring one's bank account when saving for something desirable (e.g., holiday or car).

In human beings, the above three thematic facets may be likened to Mowrer's (1960) notion of 'hope' of anticipated desirable outcomes, and this may be especially relevant to rewarding stimuli associated with fulfilling sub-goal procedures.

Reward Reactivity. Often seen as the only important aspect of the BAS, this essential facet relates to the generation and experience of reward (i.e., 'pleasure') when things are going well and provides the positive reinforcement for BAS behavior. In conceptual terms, this factor is very similar to the Carver and White (1994) Reward Responsiveness scale.

Impulsivity. This is often inimical to the goal-planning and behavioral restraint that characterises the early stages of successful BAS behavior; however, it comes into its own at the later stages when continued planning and behavioral caution are not appropriate, replaced by the need for rapid action sufficient to 'capture' the final biological reinforcer (this can be seen in the lion jumping on its prey after stealthful approach, or human drinking, eating or copulation after preparatory planning and approach). Rash impulsivity is appropriate when cognitive planning can be replaced, at short temporo-spatial distance, by fast 'getting', or a physical grabbing, action (Carver, 2005). At this point, the BAS interfaces with dedicated consummatory systems. This facet is similar to the Carver and White (1994) Fun-Seeking scale, and with the numerous impulsivity scales found in the personality and clinical literature. It consists of non-planning and fast reactions.

Table 1

The relationship between (a) thematic facets and (b) the empirical sub-scales derived from the preliminary factor analyses for fight-flight-freeze system (FFFS), behavioral inhibition system (BIS) and behavioral approach system (BAS) – see Appendix B

Factor	Thematic Facets	Empirical Sub-scales
FFFS:		
	Flight	Flight
	Freeze	Freeze
	Active Avoidance	Active Avoidance
BIS:		
	Motor Planning Interruption	Motor Planning Interruption
	Obsessive Thoughts	Obsessive Thoughts
	Behavioral Disengagement	Behavioral Disengagement
	Worry	Worry
	Cautious Approach	
	Risk Assessment	
BAS:		
	Reward Interest	Reward Interest
	Reward Reactivity	Reward Reactivity
	Impulsivity	Impulsivity
	Drive Persistence	Goal-Drive Persistence
	Goal Planning	
Additional Factor:		
	Defensive Fight	Defensive Fight

Note. In subsequent studies 2 and 3, the sub-scales of the FFFS and BIS collapsed to form unitary factors, but the four BAS scales were recovered: This six factor model was recovered by exploratory factor analysis (Study 1) and then confirmed by confirmatory factor analysis (Study 2).

APPENDIX B

Life Situation Questionnaire

The 19 situations were (designated domain not shown to participants):

1. A situation in which you took rapid flight from something unpleasant [FFFS: Flight]
2. An unpleasant situation which you avoided [FFFS: Active Avoidance]
3. A situation in which you had to fight back (if only verbally) [Fight]
4. A situation in which you found yourself 'frozen to the spot' by fear [FFFS: Freeze]
5. Something pleasant you found yourself particularly interested in [BAS: Reward Interest]
6. Something pleasant that you have been driven to achieve [BAS: Drive Persistence]
7. Something pleasant that you found yourself taking active steps to get [BAS: Goal Planning]
8. A pleasant situation that had taken some persistence by you to achieve [BAS: Drive Persistence]
9. A pleasant situation that you found particularly rewarding [BAS: Reward Reactivity]
10. Something pleasant that you have reacted to without much thought [BAS: Impulsivity]
11. A situation which has led to some degree of hesitation [BIS: Motor Interruption Interruption]
12. A situation that has led you to be very cautious [BIS: Cautious Approach]
13. A decision which required you to weigh up the pro and cons of different options [BIS: Risk Assessment]
14. Something which made you think very hard about the possible consequences [BIS: Risk Assessment]
15. Something which has taken you a long time to come to a decision about [BIS: Cautious Approach]
16. Something which has caused you a lot of worry [BIS: Worry]
17. A situation in which you were forced to reconsider the best way forward [BIS: Risk Assessment]
18. Something unpleasant that you have found yourself thinking obsessively about? [BIS: Obsessive Thoughts]
19. Something that made you very sad, making you feel like disengaging from the world and 'going into your shell'? [BIS: Behavioral Disengagement]

Items were screened and excluded according to the following criteria. (a) Those that were identified by, at least, 20% of the participants as being unclear or ambiguous in meaning or wording; this was ascertained via a short qualitative questionnaire given after the item pool to those 151 participants who completed the pen-and-paper version of the item pool. (b) Those items that had highly skewed endorsement rates across the four response categories (i.e., endorsement rates greater than 90% of the total sample in either the highest or lowest response category).

APPENDIX C

The Reinforcement Sensitivity Theory Personality Questionnaire (RST-PQ) and Scoring Key

Instructions

Below are a list of statements about everyday feelings and behaviors. Please rate how accurately each statement describes you in general. Circle only one response. Do not spend too much time thinking about the questions and please answer honestly. Your answers will remain confidential.

	How accurately does each statement describe you?	**Response**			
		Not at all	**Slightly**	**Moderately**	**Highly**
1	I feel sad when I suffer even minor setbacks.	1	2	3	4
2	I am often preoccupied with unpleasant thoughts.	1	2	3	4
3	Sometimes even little things in life can give me great pleasure.	1	2	3	4
4	I am especially sensitive to reward.	1	2	3	4
5	I put in a big effort to accomplish important goals in my life.	1	2	3	4
6	I sometimes feel ‘blue’ for no good reason.	1	2	3	4
7	When feeling ‘down’, I tend to stay away from people.	1	2	3	4
8	I often experience a surge of pleasure running through my body.	1	2	3	4
9	I would be frozen to the spot by the sight of a snake or spider.	1	2	3	4
10	I have often spent a lot of time on my own to “get away from it all”.	1	2	3	4
11	I am a very active person.	1	2	3	4
12	I’m motivated to be successful in my personal life.	1	2	3	4
13	I am always ‘on the go’.	1	2	3	4
14	I regularly try new activities just to see if I enjoy them.	1	2	3	4
15	I get carried away by new projects.	1	2	3	4
16	Good news makes me feel over-joyed.	1	2	3	4
17	The thought of mistakes in my work worries me.	1	2	3	4
18	When nervous, I sometimes find my thoughts are interrupted.	1	2	3	4
19	I would run quickly if fire alarms in a shopping mall started ringing.	1	2	3	4

20	I often overcome hurdles to achieve my ambitions.	1	2	3	4
21	I often feel depressed.	1	2	3	4
22	I think I should ‘stop and think’ more instead of jumping into things too quickly.	1	2	3	4
23	I often feel that I am on an emotional ‘high’.	1	2	3	4
24	I love winning competitions.	1	2	3	4
25	I get a special thrill when I am praised for something I’ve done well.	1	2	3	4
26	I take a great deal of interest in hobbies.	1	2	3	4
27	I sometimes cannot stop myself talking when I know I should keep my mouth closed.	1	2	3	4
28	I often do risky things without thinking of the consequences.	1	2	3	4
29	My mind is sometimes dominated by thoughts of the bad things I’ve done.	1	2	3	4
30	I get very excited when I get what I want.	1	2	3	4
31	I feel driven to succeed in my chosen career.	1	2	3	4
32	I’m always finding new and interesting things to do.	1	2	3	4
33	I’m always weighing-up the risk of bad things happening in my life.	1	2	3	4
34	People are often telling me not to worry.	1	2	3	4
35	I am very open to new experiences in life.	1	2	3	4
36	I always celebrate when I accomplish something important.	1	2	3	4
37	I find myself reacting strongly to pleasurable things in life.	1	2	3	4
38	I find myself doing things on the spur of the moment.	1	2	3	4
39	I would instantly freeze if I opened the door to find a stranger in the house.	1	2	3	4
40	I’m always buying things on impulse.	1	2	3	4
41	I am very persistent in achieving my goals.	1	2	3	4
42	When trying to make a decision, I find myself constantly chewing it over.	1	2	3	4
43	I often worry about letting down other people.	1	2	3	4
44	I would go on a holiday at the last minute.	1	2	3	4
45	I would run fast if I knew someone was following me late at night.	1	2	3	4
46	I would leave the park if I saw a group of dogs running around barking at people.	1	2	3	4
47	I worry a lot.	1	2	3	4

48	I would freeze if I was on a turbulent aircraft.	1	2	3	4
49	My behavior is easily interrupted.	1	2	3	4
50	It’s difficult to get some things out of my mind.	1	2	3	4
51	I think the best nights out are unplanned.	1	2	3	4
52	There are some things that I simply cannot go near.	1	2	3	4
53	If I see something I want, I act straight away.	1	2	3	4
54	I think it is necessary to make plans in order to get what you want in life.	1	2	3	4
55	When nervous, I find it hard to say the right words.	1	2	3	4
56	I find myself thinking about the same thing over and over again.	1	2	3	4
57	I often wake up with many thoughts running through my mind.	1	2	3	4
58	I would not hold a snake or spider.	1	2	3	4
59	Looking down from a great height makes me freeze.	1	2	3	4
60	I often find myself ‘going into my shell’.	1	2	3	4
61	My mind is dominated by recurring thoughts.	1	2	3	4
62	I am the sort of person who easily freezes-up when scared.	1	2	3	4
63	I take a long time to make decisions.	1	2	3	4
64	I often find myself lost for words.	1	2	3	4
65	I will actively put plans in place to accomplish goals in my life.	1	2	3	4

RST-PQ Scoring Key

Fight-Flight-Freeze System (FFFS) 10 items: 9, 19, 39, 45, 46, 48, 52, 58, 59, 62

Behavioral Inhibition System (BIS) 23 items: 1, 2, 6, 7, 10, 17, 18, 21, 29, 33, 34, 42, 43, 47, 49, 50, 55, 56, 57, 60, 61, 63, 64

Behavioral Approach System (BAS = RI + GDP + RR + I)

- Reward Interest (RI) 7 items: 11, 13, 14, 15, 26, 32, 35
- Goal-Drive Persistence (GDP) 7 items: 5, 12, 20, 31, 41, 54, 65
- Reward Reactivity (RR) 10 items: 3, 4, 8, 16, 23, 24, 25, 30, 36, 37
- Impulsivity (I) 8 items: 22, 27, 28, 38, 40, 44, 51, 53

Defensive Fight (DF) 8 items (see supplementary material, Appendix D)

APPENDIX D

Defensive Fight:

Rationale, Factor Loadings, Descriptive Statistics and Personality Correlations

For a number of theoretical and empirical reasons, the decision was made to keep the thematic facet of Fight separate in the RST-PQ. Although the rodent behavioral literature that underlies revised RST indicates that Fight should be associated with the FFFS – or more appropriately, putative FFFS-mediated behavioral reactions -- there are significant counter-indications that, in the case of human personality, this alignment is not justified. In developing the RST-PQ, we eschewed the naïve assumption that, by fiat, this facet 'belongs' to the FFFS because of the association in animal data.

Based on the animal literature, predatory, or instrumental, fight (and aggression) should be associated with the BAS and does not pose a problem for RST. However, defensive fight proper should be associated with the FFFS as its function is to remove the animal from the source of a high intensity and immediate threat (e.g., cat to rat), especially when other forms of escape are not available. When cornered by a predator, animals do fight-back, and the same is often seen in human behavioral reactions in comparable situations.

However, we are confronted with several problems when attempting to measure Fight by questionnaire (Corr, 2013). First, in operational terms, it is often difficult to distinguish reactive, defensive aggression (putatively controlled by FFFS) from instrumental aggression (putatively controlled by the BAS) – language may simply fail to differentiate the psychological states of each type. Secondly, Fight scales correlate with measures of the BAS (Harmon-Jones, 2003; Smits & Kuppens, 2005) which may reflect the fact that aggression involves behavioral activation, even when defensive – for example, fight may produce BAS-related safety signals. This seems to be a case in which the simultaneous operation of multiple systems is important; and, in this specific regard, the FFFS-related fight component is likely potentiated by the BAS.

Thirdly, for defensive fight, low base rates may be a problem if items that describe behaviors are manifested very infrequently in normal human life: Most people (at least those who take part in psychology studies) simply do not encounter high intensity and immediate threat which necessitates a functional fight-back response. Flight and active avoidance are usually sufficient to pre-empt the types of threats that would require defensive fight behavior – and, in the immediate situation and over the longer term, the BIS typically resolves these conflicts before such a FFFS reaction is needed. Therefore, respondents may have difficulty reflecting on defensive fight questionnaire items and may then be forced to sample instances of instrumental fight, albeit of a less intense nature, which are probably far more frequent. Lastly, measurement of Fight may be a case in which it is best achieved by a behavioral measure, not a questionnaire one, especially if it represents a form of automatic, prepotent, reaction to a high intensity, and inescapable, threat.

However, our approach to Fight in revised RST does not claim that human defensive reactions are not seen in high-intensity, immediately threatening situations, mediated by the FFFS; only that these are not adequately measured by human personality questionnaires. By developing a truly stand-alone measure of Fight, it is possible to provide a fair examination of the associations that exist.

Table 1.

Defensive Fight Factor Loadings and Descriptive Statistics

Defensive Fight Items	**Factor Loading**
I usually react immediately if I am criticized at work.	0.50
I have found myself fighting back when provoked.	0.83
I think retaliation is often the best form of defense.	0.65
I think you have to stand up to bullies in the workplace.	0.70
I would defend myself if I was falsely accused of something.	0.60
If I feel threatened I will fight back.	0.82
I would not tolerate bullying behaviour towards me.	0.77
I can be an aggressive person when I need to be.	0.74
Mean	23.30
SD	4.74
Cronbach's alpha	0.84

Table 2.

Correlations Between Defensive Fight and RST-PQ factors and Other Personality Scales

	Defensive Fight
RST-PQ:	
FFFS	-.01
BIS	.05
BAS	
Reward Interest	.23**
Goal-Drive Persistence	.19**
Reward Reactivity	.21**
Impulsivity	.39*
BIS/BAS Scales:	
BIS	-.04
BAS: Drive	.33**
BAS: Reward Responsivity	.20*
BAS: Fun-Seeking	.14
Mini-IPIP:	
Extraversion	.33**
Neuroticism	.01
Conscientiousness	-.01
Agreeableness	-.01
Openness	.11*
STAI:	
Trait Anxiety	.19*

Note.* = $p < .05$, ** $p < .01$, two-tailed. BIS/BAS Scales = Carver and White (1994); Mini-IPIP = Cooper, Corr and Smillie (2010).

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