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The appetitive motivation scale and other BAS measures in the prediction of Approach and Active Avoidance

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Abstract

The Appetitive Motivation Scale (Jackson & Smillie, 2004) is a new trait conceptualisation of Gray's (1970, 1991) Behavioural Activation System. In this experiment we explore relationships that the Appetitive Motivation Scale and other measures of Gray's model have with Approach and Active Avoidance responses. Using a sample of 144 undergraduate students, both Appetitive Motivation and Sensitivity to Reward (from the Sensitivity to Punishment and Sensitivity to Reward Questionnaire, SPSRQ; Torrubia, Avila, Molto, & Ceseras, 2001), were found to be significant predictors of Approach and Active Avoidance response latency. This confirms previous experimental validations of the SPSRQ (e.g., Avila, 2001) and provides the first experimental evidence for the validity of the Appetitive Motivation scale. Consistent with interactive views of Gray's model (e.g., Corr, 2001), high SPSRQ Sensitivity to Punishment diminished the relationship between Sensitivity to Reward and our BAS criteria. Measures of BIS did not however interact in this way with the appetitive motivation scale. A surprising result was the failure for any of Carver and White's (1994) BAS scales to correlate with RST criteria. Implications of these findings and potential future directions are discussed.

Keywords: BAS; Impulsivity; RST; Appetitive Motivation scale; Approach; Active avoidance

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1. Introduction

Gray's (1970, 1982, 1991) Reinforcement Sensitivity Theory (RST) is a model of personality with a basis in approach-avoidance motivational processes. The major dimensions of this model are Anxiety and Impulsivity. Anxiety is presumed to have a causal basis in the activity of the Behavioural Inhibition System (BIS; Gray, 1982), although the focus of the present paper is the Behavioural Activation System (BAS; Fowles, 1980), which is Gray's proposed basis for Impulsivity. Gray (1970) and Gray, Owen, Davis, and Tsaltas (1983) originally suggested that the functioning of the BAS is responsible for motivation by and reactions to conditioned appetitive stimuli (reward). Recent revisions to the theory (Gray & McNaughton, 2000) indicate that the distinction between conditioned and unconditioned stimuli is not as important as originally considered, and as such the BAS mediates responses to all appetitive stimuli. It has therefore been suggested that the BAS may be a particularly important dimension of personality, with broader relevance to individual differences than has previously been supposed (Jackson & Francis, 2004; Jackson & Smillie, 2004).

An often overlooked feature of the BAS concerns the arbitrary nature with which this appetitive system was related to trait impulsivity (Diaz & Pickering, 1993; Pickering & Gray, 2001). Gray's (1970) model was first proposed as a theory of the neuropsychology of anxiety, couched in aversive motivational processes related to activity of the BIS. At the trait level, Gray represented BIS-mediated anxiety within Eysenck's (1967) 'Extraversion–Neuroticism' personality spaces, at an anticlockwise rotation from Neuroticism. Since anxiety was presumed to reflect aversive motivation, it was supposed that an equivalent rotation of Extraversion might reflect manifestations of appetitive motivation, and at the trait level have some descriptive correspondence to impulsivity (Gray et al., 1983). It is not entirely clear, however, to which kind of impulsivity the BAS is related (e.g., Pickering & Gray, 2001; Quilty & Oakman, 2004). Presently, there is no agreed psychometric representation of Gray's dimensions (Corr, 2001; Slobodskaya, Knyazev, Safronova, & Wilson, 2003), particularly for dispositional reactivity of the BAS (Pickering, 1997). For instance, Carver and White (1994) produced three possible psychometric conceptualisations of the BAS (Reward Responsiveness, Drive, and Fun-Seeking) on the basis that there was no consensus regarding how the BAS is to be measured. Reward Expectancy, as measured by the Generalised Reward and Punishment Expectancies Scale (GRAPES; Ball & Zuckerman, 1990) provides a cognitive interpretation of RST and conceptualises BAS reactivity as heightened general expectancy of attaining rewards. Conversely, Sensitivity to Reward, as measured by the Sensitivity to Punishment and Sensitivity to Reward Questionnaire (SPSRQ; Torrubia, Avila, Molto, & Caseras, 2001), conceptualises BAS reactivity as the extent to which individuals instinctively approach specific and unrelated appetitive situations.

We have recently suggested that existing representations of dispositional BAS reactivity fail to emphasise the motivational features of this system (Jackson & Smillie, 2004). To address this issue we developed a new measure called the Appetitive Motivation scale, which conceptualises BAS reactivity in terms of motivations by or reactions to appetitive stimuli. Psychometric validation indicated strong convergence with relevant RST measures, and also with broader personality measures, such as the scales of the Eysenck Personality Questionnaire (EPQ). As Pickering (in press) and Depue and Collins (1999) note, the dimension in Eysenck's system which corresponds most closely to the BAS is Extraversion, and indeed this was the strongest correlate with our Appetitive

Motivation Scale. A weaker positive correlation was found with Psychoticism, and a low (negative) to zero correlation was found with Neuroticism. While this suggests that our scale may be a valuable contribution to RST research, with particular respect to clarification of the 'BAS-related trait' (Pickering & Gray, 2001), further validation is clearly required. We are of the opinion that, for a measure to genuinely reflect the functioning of the BAS, it *must* correspond to BAS-mediated behaviour using a suitable experimental paradigm. This is because the general trait to which the BAS has been related (i.e., impulsivity) has many and varied conceptualisations which tend to correlate highly despite having quite different theoretical bases (Miller, Joseph, & Tudway, 2004; Parker & Bagby, 1997; Whiteside & Lynam, 2001). As such, any given impulsivity-type measure may have descriptive similarity to Gray's conceptualisation of the BAS-related trait, but show little relationship with appetitively motivated behaviour.

Gray (1987, 1991) described two major kinds of appetitive behaviour which are mediated by the BAS. The first of these is termed *Approach*, which concerns behaviour directed towards reward. In a classic animal learning paradigm, a rat trained to run towards a goal-box containing food would comprise an instance of approach behaviour. The second BAS-mediated behaviour is termed *Active Avoidance*, which involves making an action or response in order to avoid punishment (i.e., to approach relief Fowles, 1987). While it is descriptively useful to distinguish between Approach and Active Avoidance, the two responses are different manifestations of the same underlying process, and the only *meaningful* difference between them are the contexts within which they are executed (Fowles, 1987; Gray, 1987). As such, indices of Approach and Active Avoidance should have a very similar relationship with a measure of appetitive motivation or BAS. It is this prediction which shall be tested empirically in the present research.

Now, based upon our description of BAS-mediated behaviour, we see that appetitive motivation is not elicited simply by positive stimuli, but more accurately by the presentation of positive stimuli or the omission/termination of negative stimuli. Similarly, and although we do not consider the BIS in great detail here, aversive motivation is not elicited simply by negative stimuli, but more accurately by the presentation of negative stimuli or the omission/termination of positive stimuli. The fact that both positive and negative stimuli have the potential to activate the BAS and the BIS creates difficulty for devising a purely appetitive task. This is because a reward stimulus may elicit Approach, but also have some association with *failure* to attain the reward; similarly, a relief stimulus may elicit Active Avoidance, but also have some association with *failure* to successfully avoid punishment. This issue is not unrelated to the role of reward-expectancies, as discussed by Gray (1987) and Corr (2002a). Specifically, a stimulus will be perceived as rewarding only if it matches or exceeds expectancy of reward, otherwise it serves as a punisher. It can be seen, therefore, that even a paradigm designed to exclusively activate the BAS may also potentially engage the BIS.

Simultaneous BAS/BIS activation is a pertinent issue for experimental investigations of RST as it has the potential to cause significant problems with research criteria (see Pickering et al., 1997 and Pickering & Gray, 2001 for discussion). This is because the BAS and BIS have mutual inhibitory outputs, such that BIS activity will directly antagonise functioning of the BAS, and therefore reduce appetitively motivated responses (Gray & Smith, 1969; Pickering, 1997). It is this state of affairs which has led to Corr's (2001, 2002b) formation of a *Joint Subsystems Hypothesis* of RST. Traditionally, due to the physiological separability of the BAS and BIS, appetitive motivation or reward reactivity has been linked only to the functioning of the BAS, while aversive motivation or punishment reactivity has been linked only to the functioning of the BIS. However, Corr (2001, 2002b) suggests that, under certain experimental conditions, the mutual inhibitory links between the BIS and BAS result in appetitive motivation being strongest in those with a more active BAS and less active BIS, while aversive motivation will be strongest in those with a less active BAS and more active BIS. From this we can make the prediction that measures of BAS will be strongly related to Approach and Active Avoidance at low levels of BIS, but that this relationship will be diminished at higher levels of BIS.

In the present research we develop an experimental paradigm, based upon response latencies to reward (Approach) and relief (Active Avoidance), in order to continue validation of the Appetitive Motivation scale. It is expected that this measure, along with other well-known measures of the BAS, will predict faster responses to our Approach and Active Avoidance operations. Measures of BIS should not be related to response latency for either of these responses, however, they may antagonise their relationship with BAS scales. Therefore, we anticipate that at higher levels of anxiety the relationship that BAS scales have with active avoidance and approach will be weaker.

2. Method

2.1. Participants

One-hundred and forty-four students from the University of Queensland were recruited via a first year psychology research pool in exchange for course credit. The mean age of the sample was 20.4 years (SD = 2.5), and approximately 37% were male.

2.2. Questionnaires

Participants completed the following personality questionnaires: The Appetitive Motivation Scale (AM; Jackson & Smillie, 2004); the Sensitivity to Punishment and Sensitivity to Reward Questionnaire (SPSRQ; Torrubia et al., 2001); the BIS/BAS scales (Carver & White, 1994); and the Positive and Negative Affect Scales (PANAS; Watson, Clarke, & Tellegen, 1988). The SPSRQ is a leading RST measure which consistently shows high validity in experimental and psychometric research (e.g., Avila, 2001; Cesaras, Avila, & Torrubia, 2003). The BIS/BAS scales comprise one BIS scale and a three-factor representation of the BAS (Fun, Reward-Responsiveness and Drive). The PANAS was used to assess the effect of our manipulations on positive mood. It has a number of question formats, and we used the format which asked participants to indicate to what extent they feel a particular way *right now*.

2.3. Experimental task

The experimental task was conducted using a Pentium II computer and executed in a DOS environment, enabling timing accuracy to ±1 ms. Upon commencement of the program, a circular fixation point 3 cm in diameter appeared in the centre of a black screen. Below the circle was a tally which recorded the current total number of points in 9 mm white text. The task was broken into 150 trials of approximately 3000 ms in length, plus a 2000 ms inter-trial delay to enable participants to refocus. Participants' objective for each trial was to visually fixate upon the circular area while performing a continuous motor task, consisting of alternating presses of the LEFT and RIGHT shift keys on a standard keyboard, using their left and right index fingers. The purpose of this was (1) to ensure that all subjects' hands were equidistant from the target key (the space bar, discussed below), (2) to ensure that left hand users were an equal distance from the target key as right hand users, and (3) to keep subjects in a state of vigilance and thereby minimise any influence of task-irrelevant attention shifts.

The key manipulation of the experiment is as follows: on randomly determined trials, at a 40% expected probability for any given trial, a flashing message would appear in green text above the circle of white noise. This message signified (1) an Approach prompt: "*Press key now and win 50 points*"; or (2) an Active Avoidance prompt: "*Press key now or loose 50 points*". Participants had exactly 1500 ms to respond to either of these messages, by interrupting their continuous presses of the shift keys and striking the space bar on the keyboard with their preferred hand. As reaction times served as our criterion for Approach and Active Avoidance responding, and therefore indicated the extent to which a person was responding to reward and relief stimuli, the amount of points won (or not lost) was linked directly to the time taken to strike the target key, rounded up to the nearest whole unit. Hence, responding at a speed of 650 ms would attract a gain of 29 points (28.34 rounded up) if an Approach prompt was given, or a loss of 22 points (21.66 rounded up) if an Active Avoidance cue was presented. Responses of a latency greater than 1500 ms attracted a gain of 0 points if an Approach cue was presented, or a loss of 50 points if an Active Avoidance cue was presented. Therefore, faster responses resulted in larger gains and smaller losses. After a successful response to a prompt, or after 1500 ms had elapsed, the amount of points won/lost was displayed briefly above the circle, the points tally below the fixation was updated, and the next trial in sequence commenced.

2.4. Procedure

Participants were tested in individual cubicles in a room able to accommodate up to eight participants per experimental session. Upon arrival, the experimenter described the general aims of the experiment in terms of investigating the putative relationship that personality has with learning and performance. Next, the PANAS was completed to provide a baseline measure of current affect levels, along with the three personality questionnaires. The experimenter then collected all questionnaires and introduced the participants to the experimental task. A general description of the task was given, and it was explained that participants should remain vigilant, focussing upon the circular stimulus in the centre of the screen, and try to maximise the number of points won (and minimise the number of points lost) by responding quickly to Approach and Active Avoidance prompts.

Before commencing the experiment proper, participants completed a practice block of 15 trials. Following this, the experimenter answered any questions that arose. Participants were then given a short break before returning to the laboratory and beginning the task. This block of 150 trials took approximately 15 min to complete. Before a debriefing was given, the PANAS was administered a second time to determine the effect of the manipulations upon affect, relative to the baseline measure taken earlier. Full details of the experiment and its aims were then described by the experimenter, and participants were given an information sheet containing a summary of the research program with suggested readings.

3. Results

3.1. Preliminary statistics

Alphas and intercorrelations for all questionnaires are presented in Table 1. The AM Scale was observed to have a mean of 13.47 (SD is 3.19), and an alpha of .73, consistent with Jackson and Smillie (2004) findings. Correlations confirm that the measure is correlated with other indices of BAS and positive affect. Less consistent with RST are some moderate inverse correlations the AM Scale has with BIS and Sensitivity to Punishment (SP). Implications of this have been considered by Jackson and Smillie (2004). Table 2 depicts means, standard deviations, range, and skewness (z statistic) for response latencies to Approach and Active Avoidance prompts. These indicate that participants had a relatively broad range of response speeds, that the distribution of the criterion was normal, and that compression effects are unlikely to have occurred. The strong correlation between Approach and Active Avoidance responses is to be expected.

To evaluate the efficacy of our manipulations, post-test measures of the PANAS scales were correlated with response latency for approach and active avoidance trials respectively, controlling for pre-test (baseline) measures of affect. Latency for approach trials was significantly related to positive affect ($r = -.20$, $p < .016$) but not to negative affect ($r = .12$, $p = .17$), as was the case for active avoidance trials (positive affect = −.24, $p = .005$; negative affect = .16, $p = .06$). This indicates that faster responses, and hence greater amounts of points that were won or retained, were

Table 1
Means, standard deviations, inter-correlations and reliability (Cronbach's alpha) for personality and affect measures

	Alpha	Mean	SD	AM	SR	SP	RR	Fun	Drive	BIS	POS
AM	.73	13.47	3.19	–							
SR	.83	24.55	9.84	.35**	–						
SP	.74	21.43	9.86	−.23**	.05	–					
RR	.67	17.26	2.11	.32**	.30**	−.08	–				
Fun	.68	12.60	2.06	.50**	.28**	−.30**	.50**	–			
Drive	.74	11.00	2.28	.32**	.29**	−.20*	.34**	.36**	–		
BIS	.80	20.79	3.62	−.19*	−.03	.56**	.18*	−.20**	−.13*	–	
POS[a]	.73	25.95	6.27	.18*	.07	−.12	.10	.15	.27**	−.15	–
NEG[a]	.62	12.77	2.83	.03	.20*	.30**	.09	−.05	.01	.21*	.10

Note: $N = 144$.
The Appetitive Motivation Scale (AM) is described by Jackson and Smillie (2004); Sensitivity to Reward (SR) and Sensitivity to Punishment (SP) are from the Sensitivity to Reward and Punishment Questionnaire (Torrubia et al., 2001); Positive (POS) and Negative (NEG) affect is from the Positive and Negative affect scales (PANAS; Watson et al., 1988); BIS, Reward-Responsiveness (RR), Drive and Fun are from the BIS/BAS scales (Carver and White, 1994).
* $p < .05$.
** $p < .01$.
[a] From PANAS scales at pre-test.

Table 2
Mean, standard deviation, range and skew for Approach and Active Avoidance latency, and correlation between Approach latency and Active Avoidance latency

	Mean (ms)	SD (ms)	Range (ms)	Skew (*Z*)	*r*
Approach	797.58	157.62	322.85–1201.94	−.93	
Active avoidance	807.88	156.87	343.94–1196.30	−.37	.816**

Note: $N = 144$.
** $p < .01$.

associated with higher levels of positive affect. Accordingly, our latency operations are likely to relate to BAS functioning.

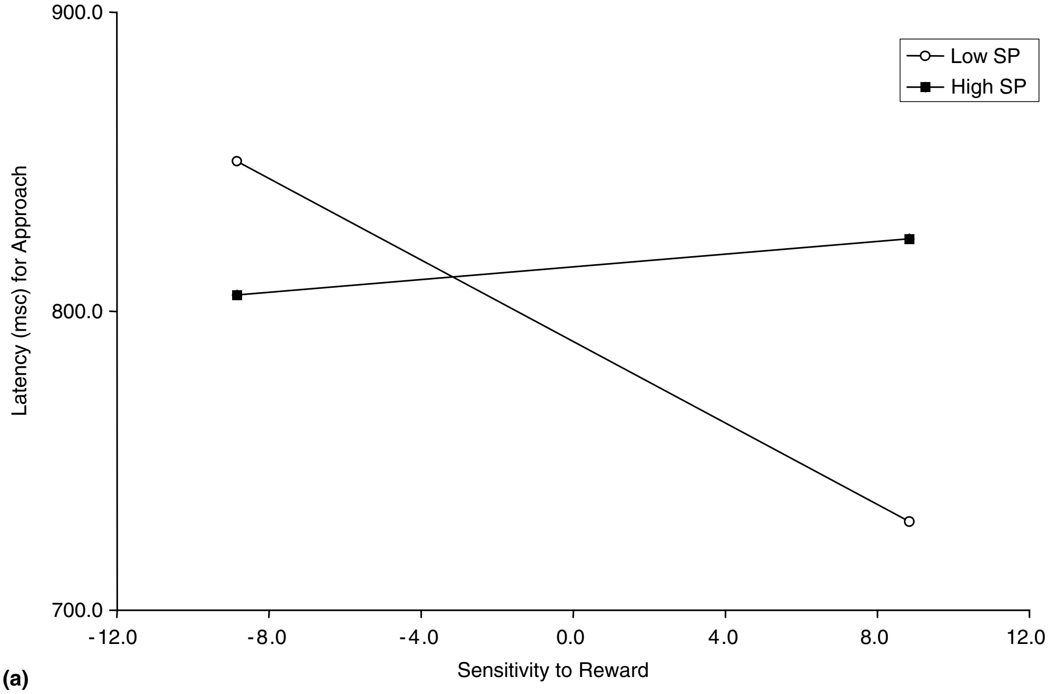
3.2. Relationship of Active Avoidance and Approach with RST measures

As predicted, the AM Scale was significantly correlated with response latency for approach ($r = -.21$, $p = .017$) and active avoidance ($-.27$, $p = .001$) trials. This suggests that AM is likely to reflect dispositional BAS reactivity, which is understood in RST to mediate approach of reward and active avoidance of punishment. If this is the case, then other measures of BAS would also be expected to show similar correlations with approach and active avoidance. The Sensitivity to Reward Scale (SR), was significantly correlated with response latency for approach ($r = -.20$, $p = .018$) and active avoidance ($-.23$, $p = .006$) trials. Therefore, the relationship AM shows to BAS is similar to that of a known and respected measure of this motivational system. The remaining BAS measures (Reward-Responsiveness, Drive and Fun) are from Carver and White's (1994) BIS/BAS scales. *None* of these scales were associated with latency for Active Avoidance (Fun: $r = -.08$, *ns*; Drive: $r = -.04$, *ns*; Reward-Responsiveness: $r = -.01$, *ns*) or Approach (Fun: $r = -.09$, *ns*; Drive: $r = -.02$, *ns*; Reward-Responsiveness: $r = .03$, *ns*). Potential reasons for the failure of these scales to predict BAS mediated behaviour are discussed later.

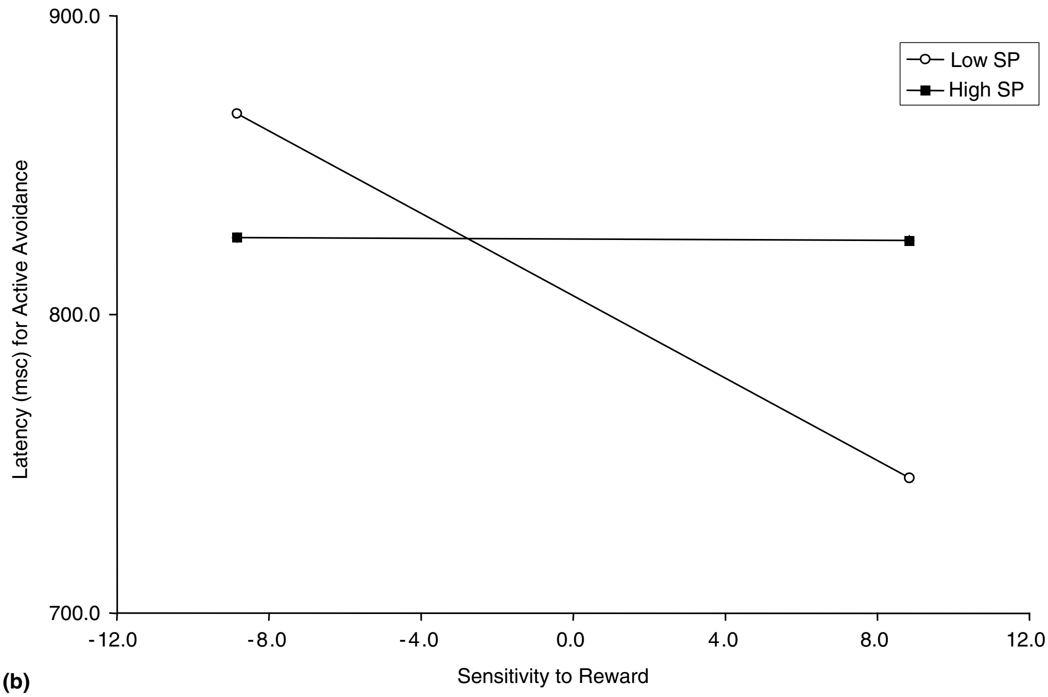
As our criterion measures are presumed to relate to the functioning of the BAS, measures of BIS should show no correlation with these criteria. It was of particular interest to examine the correlation between BIS and latency for active avoidance, due to the difficulty many (e.g., Wilson, Barrett, & Gray, 1989) have encountered when attempting to distinguish this response from passive avoidance (BIS-mediated), as discussed elsewhere (Jackson, 2003). As anticipated, neither BIS or Sensitivity to Punishment (SP) was correlated with latency for either approach or active avoidance trials. The largest absolute correlation was between SP and latency for approach trials, $r = -.09$, $p = .32$. Therefore, it is likely that our operations of Approach and Active Avoidance are genuinely unrelated to BIS functioning.

3.3. Joint effects of the BIS and BAS on Approach and Active Avoidance

According to joint-effects perspectives of RST, the relationships of the BAS with Approach and Active Avoidance may be weaker at higher levels of BIS. This was investigated using Hierarchical Moderated Multiple Regression (HMMR). Six HMMRs were conducted, firstly using response latency for Approach as the criterion, and then using Active Avoidance as the criterion (i.e., 12 analyses in total). The first HMMR assessed the interactive effect of SR and SP in the prediction



(a)



(b)

Fig. 1. Hierarchical Moderated Multiple Regression illustrating the interactive effect of Sensitivity to Reward (SR) and Sensitivity to Punishment (SP) on response latency to (a) Approach and (b) Active Avoidance prompts.

of our two criteria. Then, as AM was developed as a single measure of BAS—and therefore has no specific BIS scale to complement it—two further HMMRs were employed to predict our two criteria; firstly with the interaction of AM and BIS, and secondly with the interaction of AM and SP. The final three HMMRs examined the interaction between Carver and White's (1994) BIS scale and each of the BAS scales from the same questionnaire in the prediction of response latency.

All predictor variables were mean centred prior to entry, as advocated by Aiken and West (1991). For the first HMMR, SR and SP were entered as main effects at step one and their interaction at step two. In the prediction of Approach, the inclusion of the interaction term in the model resulted in a significant increment in R^2, $R^2ch = .04$, $Fch\ (1, 136) = 5.9$, $p = .016$. Simple slopes were analysed as detailed by Jaccard, Turrisi, and Wan (1990), revealing that the relationship between SR and Approach latency was significant at lower levels of SP, $B = -6.82$, $t(136) = 3.47$ $p < .001$, but not at higher levels of SP, $B = 1.06$, $t(136) = 0.45$ $p = .65$. This suggests that the relationship between SR and Approach responses was antagonised by SP (see Fig. 1a). In the prediction of Active Avoidance, the inclusion of interaction term in the model resulted in a significant increment in R^2, $R^2ch = .03$, $Fch\ (1, 136) = 4.37$, $p = .038$. Simple slopes revealed that the relationship between SR and Active Avoidance latency was significant at lower levels of SP, $B = -6.9$, $t(136) = 3.45$ $p < .001$, but not at higher levels, $B = -.06$, $t(136) = 0.24$ $p = .98$. This suggests that the relationship between SR and Active Avoidance responses was antagonised by SP (see Fig. 1b).

For the second HMMR, AM and SP were entered as main effects at step one and their interaction at step two. In the prediction of approach, the inclusion of the interaction term in the model did not contribute to prediction, $R^2ch = .003$, $Fch\ (1, 136) < 1$, *ns*. Similarly, in the prediction of active avoidance, the inclusion of this interaction term did not contribute to prediction, $R^2ch = .005$, $Fch\ (1, 136) < 1$, *ns*. For the third HMMR, AM and BIS were entered as main effects at step one and their interaction at step two. In the prediction of Approach, the inclusion of interaction term in the model did not contribute to prediction, $R^2ch = .01$, $Fch\ (1, 136) = 1.77$, $p = .19$. Likewise, in the prediction of Active Avoidance, the inclusion of this interaction term did not contribute to prediction, $R^2ch = .01$, $Fch\ (1, 136)\ 1.71$, $p = .19$. Collectively, these results suggest that the relationship between the Appetitive Motivation Scale and both Approach and Active Avoidance responding does not vary at different levels of BIS.

Not surprisingly, none of Carver and White's (1994) BAS scales interacted with the BIS scale in the prediction of Approach or Active Avoidance. In no case did the interaction term, or coefficients for simple slopes, approach significance (all $p > .20$).

4. Discussion

The purpose of this experiment was to assess the relationship between measures of Gray's BAS and appetitively motivated behaviour. Of particular interest was the new Appetitive Motivation scale which has not yet been evaluated using an experimental paradigm. In support of our hypotheses, two BAS measures (Appetitive Motivation and Sensitivity to Reward) were significantly correlated with response latency for Approach and Active Avoidance behaviour. None of the BAS scales from Carver and White's (1994) questionnaire yielded any relationship with the behavioural criteria, which may suggest problems with these scales. As predicted, neither BIS or Sensitivity to

Punishment were associated with our behavioural criteria. This is especially encouraging for our operation of Active Avoidance, a behaviour which can be conceptually confused with avoidance tendencies mediated by the BIS (Fowles, 1987). Finally, in accord with joint-effects perspectives of RST, we observed that the relationship between Sensitivity to Reward and our BAS criteria was significant at lower levels of Sensitivity to Punishment but not at higher levels. This suggests that BAS-mediated Approach and Active Avoidance behaviour is antagonised by activity of the BIS. Curiously, the relationship between Appetitive Motivation and these behaviours was not similarly contingent upon BIS or Sensitivity to Punishment.

Implications of primary interest concern the Appetitive Motivation scale, which we had developed as a contribution to what is perhaps the greyest area of Gray's personality model: measurement of the trait corresponding to BAS functioning. Initially linked to trait impulsivity in a relatively ad hoc manner (Gray et al., 1983; Diaz & Pickering, 1993), many have explored a range of specific conceptualisations of the BAS-related trait (as noted by Carver & White, 1994; Jackson & Smillie, 2004; Slobodskaya et al., 2003). Few of these conceptualisations appear to emphasise the motivational role of appetitive stimuli, which was the specific conceptual focus of the new Appetitive Motivation scale. In our initial psychometric validation of the Appetitive Motivation scale we concluded that it may indeed provide a promising measure for RST. The value of extending this validation via an experimental paradigm is clear, particularly as Gray's model concerns the behavioural functions which underlie personality more so than descriptive traits (Jackson, 2002).

While the Appetitive Motivation scale showed significant relationships with our behavioural criteria, these were not conditional upon BIS or Sensitivity to Punishment. One possible explanation for this is given by the low inverse relationship the appetitive motivation scale has with measures of BIS. Specifically, if higher levels of Appetitive Motivation are typically associated with somewhat lower levels of BIS, then it may be difficult to detect relationships reflecting higher BIS levels in combination with higher Appetitive Motivation levels. In this case the Appetitive Motivation Scale might be more correctly thought of as a measure of reward-reactivity (BAS+/BIS−; as described by Corr, 2002b) than a 'pure' measure of BAS per se. While such a possibility is interesting, preliminary data from our laboratory does not support this view. We have very recently used a go/no-go task very similar in nature to those employed routinely in RST research to investigate measures of BAS in the prediction of reinforcement-contingent response bias (Smillie & Jackson, submitted for publication). We found that, for participants who were rewarded for making a 'go' response, Appetitive Motivation predicted a response bias towards the 'go' response. Conversely, for participants who were punished for making a 'go' response, Appetitive Motivation did not predict response bias. (We have used a similar paradigm elsewhere to show that BIS measures predict response bias when punished, and BAS measures predict decision tendency when rewarded; Smillie, Jackson, & Dalgleish, 2002). Nevertheless, the Appetitive Motivation Scale remains to be fully validated, and the relationships it has with BAS, and possibly BIS, ought to be a prime focus of further research using this scale.

Findings also have relevance to the SPSRQ and the BIS/BAS scales, our comparison RST measures included in the experiment. The SPSRQ has shown high validity in a range of experimental and correlational research studies (Avila, 2001; Cesaras et al., 2003; O'Connor, Colder, & Hawk, 2004). In the present paper we show that (a) the sensitivity to reward scale is a significant predictor of approach and active avoidance, (b) the sensitivity to punishment scale does not predict Approach or Active Avoidance, and (c) both scales interact in the prediction of these criteria in the manner specified by joint-effects views of RST. These findings not only provide further confirmation of the validity of the SPSRQ, they also enable us to show that the relationships observed for the Appetitive Motivation Scale were similar to that of a known and respected BAS measure. With respect to the BIS/BAS scales however, our findings were not encouraging. None of the three BAS scales predicted our criteria, nor did they interact with the BIS scale in the prediction of our criteria. While the BIS/BAS scales are possibly the most widely used RST questionnaire, Carver and White's (1994) initial validation of the scales showed that only two of the scales (drive and reward-responsiveness) predicted reactions to reward. Similar inconsistencies in the association of each scale with relevant criteria have been reported elsewhere (e.g., Pickering, 1997). It is also worth noting that measures of internal consistency for these scales tend to be quite low (e.g., Carver & White, 1994), as was indeed the case in our sample. Overall, the available evidence suggests that the failure for our criteria to be predicted by BIS/BAS may to related to unresolved inadequacies of this questionnaire.

A particular strength of our experimental paradigm used to validate the Appetitive Motivation Scale is the inclusion of Approach responses (to cues of reward) and Active Avoidance responses (to cues of relief, viz, avoidance of punishment). Most experimental tests of RST (e.g., as reviewed by Pickering et al., 1997) examine responses to a single reward cue, which in most instances captures only Approach behaviour. As such, responses which involve actively avoiding an impending punishment are poorly represented in the literature to date. Also, previous attempts to quantify Active Avoidance and Approach tendencies tend not to be successful. For example, Wilson et al. (1989) attempted to measure these behaviours psychometrically, but found they were *negatively* rather than positively correlated. It is possible that separation of dispositional BAS reactivity into Approach and Active Avoidance may be more difficult at the psychometric level than at the level of actual behaviour. Manipulation checks, along with our general pattern of results, suggested that our operations of Approach and Active Avoidance could be validly considered manifestations of the BAS. In future research it may be useful to devise similar operations to examine BIS-mediated responses, however it is of significance that our experimental procedure explicitly avoided such operations, and was designed to activate the BAS only, as mixed incentive conditions can be very problematic in RST research (Pickering & Gray, 2001).

Our experimental operationalisation of Approach and Active Avoidance responding is an innovative component of the present research, yet some limitations of our methodology are worth noting. Firstly, the magnitude of effects observed in this study were relatively modest. This may genuinely reflect the explanatory power of RST, however is more plausibly explained by difficulty of providing a powerful test of the model (Pickering et al., 1997). In the present case, while no compression effects were detected on our latency measures, absolute individual differences in response times are likely to be small, and strongly related to sensori-motor coordination factors. This leaves little variance to then be accounted for by personality measures. A second possible criticism concerns our Approach and Active Avoidance responses, which were highly similar operations (i.e., button press in response to prompt), and therefore might not capture distinct responses. Nevertheless, the critical parameters for delivering reward and relieving non-punishment are clearly reflected in our paradigm. Furthermore, one should recall that Approach and Active Avoidance responses are simply a means of identifying the way in which different situations produce an appetitively motivated response, and therefore are not meaningfully distinct. Finally, as our response latency criteria was validated using positive-affect ratings from the PANAS, it is possible that our operations may be more correctly described as a mood induction procedure. Nevertheless, it should be noted that positive affect has always been considered of high relevance to BAS functioning, and would not change the interpretation of out findings in terms of BAS measures being associated with stronger reactions to reward.

In summary, two BAS measures, Appetitive Motivation and SPSRQ Sensitivity to Reward, were both found to be significant predictors of Approach and Active Avoidance response latency. This confirms previous experimental validations of the SPSRQ (e.g., Avila, 2001) and offers the first experimental evidence for the Appetitive Motivation Scale. Consistent with joint-effects views of RST, SPSRQ Sensitivity to Punishment antagonised the relationship between Sensitivity to Reward and our BAS criteria. Measures of BIS did not however interact in this way with the Appetitive Motivation Scale. Overall, findings suggest that the appetitive motivation scale is a promising psychometric measure for RST research. The next step in continuing the validation of this scale would be to further assess the relationships it has with behaviour relating to the BAS, and also any potential links it may have with the BIS.

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