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When avoidance leads to approach: How ear preference interacts with neuroticism to predict disinhibited approach

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A series of eight studies focuses on how the avoidance system represented by neuroticism can lead to disinhibited approach tendencies. Based on research which argues that hemispheric preferences predispose the left hemisphere to fast action goal formation, and contralateral pathways between ear and brain, it is proposed that (a) people with a right ear preference will engage in fast action goal formation and (b) disinhibited approach results from neurotic people who reduce anxiety by means of fast action goal formation. Study 1 provides evidence from telesales operators of a link between self-rated ear preference and objective ear preference and provides evidence that disinhibited approach is predicted by a neuroticism × ear preference interaction. Studies 2, 3, and 4 provide evidence that ear preference is related to other measures of objective aural preference and action goal formation. Studies 5, 6, 7, and 8 provide evidence that the neuroticism × ear preference interaction predicts a variety of different disinhibited approach tendencies.

Disinhibited approach behaviours are important to understand because "arguably, few constructs play so central a role in conceptions of developmental psychopathology" (Nigg, 2000, p. 220). They are linked to anxiety and shyness, attention deficit disorder, adultery, anti-social behaviour, alcoholism, and addictive substance use (Albano, Chorpita, & Barlow, 1996; Barkley, 1997; McAlister, Pachana, & Jackson, 2005; Newman & Wallace, 1993; Patterson & Newman, 1993; Sher & Trull, 1994). Disinhibited approach is also positively predictive of sales performance, and Jackson and colleagues (Jackson, 2001, 2005a, in press; O'Connor & Jackson, in press) argue that this trait cluster provides a common basis to both functional and dysfunctional learning. The aim of the current research

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is to provide a new model of disinhibition based on neuroticism and hemispheric preference.

EAR PREFERENCE AS A BIOLOGICAL MARKER OF ACTION GOAL FORMATION

Many ways of measuring laterality exist, and all seem to have different tendencies (Papousek & Schulter, 2006). These researchers provide a review of different measures of lateral preference and find fault with all measures, but especially dwell on the situational problems associated with psychophysiological measures. Ear preference, on the other hand, is a behavioural self-report measure of lateral preference that is less likely to be confounded by situational problems. Although self-report measures are indirect, the general view that differences in lateral preferences reflect hemispheric preferences is ultimately supported by Dean and Reynolds (1997) and Kinsbourne (1970, 1997).

The current research focuses on ear preference (Jackson, 2005b; Jackson, Furnham, & Miller, 2001). There are several good reasons to think that ear preference could be a suitable method for measuring lateralised tendencies associated with emotion. First, auditory pathways have a long history of usage for this purpose in terms of dichotic listening (see Kimura, 1967). Second, auditory pathways link directly to emotional processing structures of the brain. The ears connect via the thalamus to the auditory cortex and the thalamus is a central site of emotional processing (Corr, 2006). As a result, the connection of ears to auditory cortex via emotional centres provides a neural pathway by which aural pathways may interact with neuroticism, which is a central focus of the current research. In contrast, hand preference is more related to structural hemispheric asymmetries associated with differential motor control of the hands (e.g., White, Lucas, Richards, & Purves, 1994; but see also Jackson, 2008).

Right ear preference is indicative of left hemisphere activity based on the well-accepted superior contralateral connections between ear and brain compared to ipsilateral connections (e.g., Springer & Deutsch, 1993). The first hypothesis aims simply to show that self-reported ear preference provides a valid measure of objective aural behaviour:

H1: Self-reported ear preference is related to objective aurally based behaviour.

A large variety of studies by Davidson and others (e.g., Cacioppo & Petty, 1980; Davidson, 1995, 1998; Davidson & Sutton, 1995; Davidson, Ekman,

Saron, Senulis, & Friesen, 1990; Harmon-Jones & Allen, 1997; Miller & Cohen, 2001; Sobotka, Davidson, & Senulis, 1992; Sutton & Davidson, 1997, 2000; Tomarken, Davidson, Wheeler, & Doss, 1992; Wheeler, Davidson, & Tomarken, 1993) provide evidence of cerebral asymmetries such that a preponderance of left hemispheric activity is related to general approach behaviour. A more specific argument is that a preponderance of left hemispheric activity is related to action goal formation (e.g., Sutton & Davidson, 1997).[1] Not all researchers agree with either the broad or the precise version of these arguments (e.g., Hagemann, Naumann, Backer, Maier, & Barussek, 1998; Heller, Nitschke, Etienne, & Miller, 1997; Hewig, Hagemann, Seifert, Naumann, & Bartussek, 2004). Nevertheless, ear preference may provide a biological marker of differential asymmetric hemispheric activity such that right ear preference is associated with action goal formation tendencies of the left hemisphere, which leads to following directional hypotheses:

H2: Right ear preference will be related to shorter time estimates for how long it takes to undertake actions than left ear preference,

and

H3: Right ear preference will be related to a "lack of restraint" compared to left ear preference.

Support for H2 and H3 would provide direct support for the idea that right ear preference is related to action goal formation. As far as is known, no studies have examined the possibility that ear preference is a biological marker of action goal formation. H2 is quite specific in that it tests *estimates* for how long it takes to complete *actions* as opposed to passive waiting or actual time to complete actions.

The possible finding of a direct relationship between ear preference and action goal formation would provide useful and straightforward support in favour of Davidson and colleagues' specific theory concerning the role of the left hemisphere in contrast to the broad version of the theory. It also provides a building block concerning how action goal formation relates to neuroticism in the prediction of disinhibited approach.

[1] More precisely, Sutton and Davidson (1997) state that the "left prefrontal cortex is a biological substrate of approach behaviour and 'pre-goal attainment positive affect' because it facilitates representation of desired goal states in the absence of explicit sensory cues, thus guiding the behaviour towards the acquisition of these goals" (p. 209).

NEUROTICISM INTERACTING WITH EAR PREFERENCE IN PREDICTION OF DISINHIBITED APPROACH

Neuroticism is a central component of the avoidance pathway in personality. It is a bipolar dimension of emotional stability, such that highly neurotic individuals are avoidant and emotionally unstable compared to low neurotic people (Eysenck, 1967; Eysenck, Barrett, Wilson, & Jackson, 1992). Neurotic people want to reduce their levels of anxiety, and this can be achieved in one of two ways:

a. The first way a high neurotic person can reduce anxiety is through fast action goal formation, which leads to disinhibited approach (i.e., fast, spontaneous action-oriented behaviour associated with lessening of control and reduction of inhibition). Disinhibited approach provides a rapid reduction of anxiety, but also prevents full exploration and understanding of the problem due to its rapid nature (Patterson & Newman, 1993). Given these limitations, it is unsurprising that disinhibited approach is usually dysfunctional and reliant on previous conditioned habitual responses (such as a psychopath's resistance to punishment once an approach behaviour has been conditioned; Avila, Molto, Segarra, & Torrubia, 1995; Newman, Widom, & Nathan, 1985; Patterson, Kosson, & Newman, 1987).
b. The second way is through excessive vacillation, reflection, procrastination, rumination, and passive avoidance. Nothing active is done to reduce anxiety and this leads to low disinhibited approach. This should be associated with slow action goal formation.

Given it has been theorised that right ear preference provides a marker for fast action goal formation, all this leads to a fourth directional hypothesis at the heart of the current research:

H4: Disinhibited approach will be predicted by an ear preference × neuroticism interaction such that right ear preference and high neuroticism is predictive of high approach.

Support for H1, H2, H3, and H4 would provide a substantially new theory of disinhibited approach that may be in addition to, or potentially superior to, present conceptualisations of disinhibition which argue that: (a) Disinhibition is little different from rash impulsivity and therefore is purely a function of the approach pathway (e.g., Carver, Sutton, & Scheier, 2000) which in the current research is represented by extraversion (Depue & Collins, 1999; Smillie, Pickering, & Jackson, 2006a); (b) Disinhibition results from low neuroticism (Fowles, 1988; Gray, 1987); (c) Disinhibition results

from high extraversion and/or low neuroticism (Patterson & Newman, 1993); (d) Approach results from differentially more left hemispheric activity than right (e.g., Wheeler et al., 1993).

OVERVIEW OF STUDIES

This research comprises two parts. In Part 1, evidence is collected in favour of the relationship between self-reported ear preference, objective aural behaviour, and fast action goal formation. Study 1 aims to show that self-report ear preference is related to objective aural behaviour and to provide initial evidence in favour of the proposed interaction between neuroticism and ear preference in the prediction of telesales. It will be argued that telesales is a functional example of disinhibited approach. Study 2 confirms that self-report ear preference is related to objective aural behaviour. Studies 3 and Study 4 are designed to provide evidence that self-reported ear preference is a biological marker for action goal formation by showing that it is related to estimated time estimates to complete an action and lack of restraint coping.

In Part 2, evidence is collected in favour of the proposed interaction between self-reported ear preference and neuroticism in the prediction of various examples of disinhibited approach. Two methodologies (laboratory and psychometric) are used over the course of four very different studies to add to the initial evidence collected in Study 1. The proposed model is simultaneously pitted against alternative models within a single moderated multiple regression model. Study 5 aims to predict disinhibited approach in terms of conflict resolution time (measured as response latencies), Study 6 aims to predict a disinhibited approach scale, Study 7 aims to predict practical-reflective behaviour as a further example of disinhibited approach and uses schoolchildren as participants, and Study 8 aims to predict alcohol and drug use as specific examples of disinhibited approach.

STUDY 1: PREDICTING TELESALES PERFORMANCE FROM EAR PREFERENCE × NEUROTICISM

It is now widely accepted that personality is predictive of job performance (De Fruyt & Salgado, 2003; Hough & Oswald, 2000; Schmidt & Hunter, 1998; Tett, Jackson, & Rothstein, 1991) and other key organisational criteria, such as absenteeism and job satisfaction (Ones, Viswesvaran, & Schmidt, 2003). Meta-analyses using Eysenck's (1967) model of personality indicate that job performance can be predicted from extraversion but not neuroticism (e.g., De Fruyt & Salgado, 2003). Meta-analysis also shows that

there is no consistent relationship between neuroticism and vocational interests (Larson, Rottinghaus, & Borgen, 2002).

All this indicates a general failure for neuroticism to be a significant main effect predictor of work performance. Potentially, one of the reasons why neuroticism fails to predict work performance effectively is that its influence is moderated by other variables. Jackson and colleagues (Smillie, Yeo, Furnham, & Jackson, 2006b), for example, highlight the interaction between busyness and Neuroticism in predicting sales performance.

The most important aim of the present study is to test whether neuroticism interacts with ear preference to predict telesales performance in a call centre environment. On first consideration, disinhibited approach seems unlikely to be conceptually similar to a positive personality characteristic such as telesales performance, but there are at least three reasons why this may be the case. First, impulsive-like behaviour is associated with exploration and learning (see Jackson, 2002, 2005a, in press; O'Connor & Jackson, in press) and can in fact be positive (Dickman, 1990). Second, one element of disinhibited approach, which is perseverance with approach in the face of adversity (Patterson & Newman, 1993), would seem to be a generally useful characteristic in business but particularly beneficial in telesales. Here it is important to establish rapport with each customer quickly (i.e., impulsively, or by acting without too much forethought), as well as to be resistant to negative and abusive customers and negative feedback due to failure to achieve sales (i.e., resistance to passive avoidance learning). Seligman and Schulman (1986) provide a similar description of an effective sales person in their application of attributional styles to sales. They argue that even the best salesperson will fail far more often than succeed, so perseverance is critical to success. Disinhibited approach captures the drive to sell and also the need to overcome resistance, rejection, and hostility from disinterested customers. Third, Jackson (2001) reports a positive relationship between impulsivity and sales.

Two further aims of this study stem from the use of headsets by telesales operators. First, their use raises the possibility of validating the ear preference scale with objective use of headsets. Second, it is possible to test whether headset use moderates neuroticism in the prediction of sales performance.

Method

Participants and procedure

Participants were 122 telesales consultants (65 females and 57 males) working in a call centre in Brisbane, Australia. Participants received a pack containing written instructions and the questionnaires, to complete in their own time. Participation was voluntary, and participants were advised that

the researcher would ensure the confidentiality of individual data. The operational performance manager prepared a spreadsheet outlining all participants' sales and customer service performance data. The telesales centre manager's executive assistant organised and collated the other performance ratings supplied by the team leaders. In common with all the other studies in this research, all individuals completed questionnaires and tasks individually.

Measures

Average sales performance. Objective sales performance ratings made by supervisors were collected for each participant. Sales consultants were assessed each month, according to whether they had met or exceeded targets (on a 5-point scale, where 1 = lowest and 5 = highest). Ratings for four consecutive months were collected for each participant and the mean used in the analyses. Average sales performance was the dependent variable of interest since sales performance could be expected to interpretable in terms of disinhibited approach, for the reasons outlined previously.

Average call quality. Supervisors randomly monitored their team members' calls and rated each consultant on the level of customer service provided. These ratings (which were on a 5-point scale, where 1 = lowest and 5 = highest) were collected over six consecutive months. The mean was used in the analyses as an independent variable to partial out the effects of sales skill from average sales performance. Ratings of average call quality were missing for six participants.

NEO-FFI (Form S). Developed by Costa and McRae (1992) as a short form of the NEO-PI-R, the NEO-FFI is a 60-item self-report measure that employs Likert-type scales, with response options ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). It is a commercially available instrument, specifically designed to measure the Big Five factors of neuroticism, extraversion, openness to experience, agreeableness, and conscientiousness. Costa and McRae (1992) report strong correlations between the NEO-FFI and the NEO-PI-R (.92 for neuroticism; .90 for extraversion; .91 for openness; .77; for agreeableness; and .87 for conscientiousness). Both instruments have been extensively validated against other self-report inventories (e.g., McCrae & Costa, 1987, 1992; McCrae, Costa & Piedmont, 1993). In the present study, only results for extraversion and neuroticism are reported.

Hand, eye and ear preference questionnaire. The HEEP consists of a seven-item ear preference scale, a 5-item eye preference scale, and a 10-item

hand preference scale and is an adaptation of the Lateral Preference Inventory (Coren, Porac, & Duncan, 1979). Coren et al.'s (1979) measure of lateral preferences has a demonstrated concordance of 92% between self-reports and direct behavioural observation. Example ear preference items used in the current questionnaire are: In which ear would you place the earphone of a transistor radio? If you wanted to listen to a conversation going on behind a closed door, which ear would you place against the door? What ear would you place against someone's wrist to listen to a ticking watch? A high score on the ear preference scale reflects a tendency to habitually prefer the right ear across multiple situations and a low score reflects a tendency to habitually prefer the left ear.

For the purpose of the present research, results for all three measures of lateral preference are presented in Studies 2, 3, and 4 whereas in the other studies only ear preference results are reported.

Headset lateral preference. The participants completed a single-item self-report measure describing the laterality of their headset use in telesales. The available response options were 1 = always left, 2 = sometimes left, 3 = either or stereo, 4 = sometimes right, and 5 = always right. Responses to this item were missing for eight participants.

AWA award. This item (scored Yes/No) measured whether the participant had signed an Australian Workplace Agreement (AWA). An AWA is an individual agreement between a worker and his or her employer about wages and employment conditions. AWA award is an important variable because it enables flexibility in setting wages and conditions, allowing employees to negotiate a package that reflects their skills and experience, and employers to suit their needs in a competitive marketplace.

Wonderlic Personnel Test (WPT). The WPT is a short-form measure of cognitive ability designed for simple administration and interpretation. It provides a measure of g derived from a variety of item styles. An example question is: When rope is selling at $.10 a foot, how many feet can you buy for sixty cents?

Length of time in organisation. This was a simple measure of how many years the participant had been employed by the organisation. Eight people were excluded who had been with the organisation for at least 15 years, as a histogram showed that they were outliers. This follows the similar methodology adopted by Smillie et al. (2006b).

This study therefore uses average sales performance derived from supervisor ratings as a dependent variable. Past research suggests that supervisor ratings can be both reliable and valid measures (Furnham, Crump, &

Whelan, 1997a). Doubts may still remain concerning their accuracy and restriction of range, but supervisor ratings make good criteria in the context of this study because supervisors are very unlikely to have much understanding of disinhibited approach and its possible basis in a neuroticism × ear preference interaction.

Statistical analysis

Study 1 and Studies 5, 6, 7, and 8 employ a near-identical statistical methodology. First, alpha reliabilities are assessed to show that the internal consistencies of the scales employed in the studies are at least adequate (defined as above 0.70). Second, the correlations between the scales are examined to show the interrelationships between them. Third, hierarchical moderated multiple regression is used to identify significant main effects and interaction terms. All independent variables are mean-centred prior to the multiple regression procedure. At Step 1, age and sex are entered. Age and sex are important variables to enter at Step 1 of a regression incorporating analyses related to personality because there are often subtle sex effects (e.g., Petrides, Jackson, Furnham, & Levine, 2003) and potentially age might also be related to disinhibited approach. At Step 2, ear preference and relevant personality scales are entered. At Step 3, interaction terms between ear preference and each of the personality scales are entered, as well as an extraversion × neuroticism term. At Step 4, a single three-way interaction term—extraversion × neuroticism × ear preference—is entered. Significant two or three way interactions are then plotted (Jaccard, Turrisi, & Wan, 1990) to illustrate the relationship between the independent variable (such as neuroticism) and its moderator (such as ear preference–1 *SD* above and 1 *SD* below the mean) in the prediction of the relevant dependent variable. Simple slopes analysis of the interaction is reported to determine which slopes are significantly different from zero. Conservative two-tailed significance tests are used. Where the statistics package provides a precise indication of significance this is recorded; otherwise a less-than reporting method is used.

This hierarchical moderated multiple regression model is useful because it enables a simultaneous test of all competing models of disinhibited approach. The finding of a significant neuroticism × ear preference effect on the other hand would support H4. The finding of a significant extraversion main effect would support the idea that disinhibited approach is purely a function of the approach pathway (e.g., Carver et al., 2000). The finding of a significant extraversion × neuroticism interaction, in which disinhibited approach is related to a combination of high extraversion and neuroticism, would provide support for the Patterson and Newman (1993). However, if disinhibited approach were related to high extraversion and low neuroticism or just low neuroticism, then this would be consistent with the

positions taken by Gray (1987) and Fowles (1988). A finding that ear preference directly predicts disinhibited approach or that the approach system (represented by extraversion in this research) would support the broad position of Davidson and colleagues.Means, standard deviations, alphas and scale intercorrelations are available from the author on request.

Results and discussion

Alpha reliabilities of all variables were high (above 0.70). Although there were significant correlations between the performance measures, the correlations were not so high that they could be regarded as alternative measures of the same construct. Extraversion was significantly correlated with average sales performance ($r = .19$, $p < .05$) and with average call quality ($r = .29$, $p < .01$), which supports the idea that disinhibited telesales involves approach behaviours. The personality scales of extraversion and neuroticism were not significantly correlated with ear preference, and ear preference was not significantly correlated with either of the two performance measures. Ear preference positively correlated with headset lateral preference ($r = .41$, $p < .01$), which provides direct validation evidence of the ear preference scale.

Two hierarchical moderated multiple regressions were used in the prediction of average sales performance. In Step 1, age and sex were entered; in Step 2, neuroticism, extraversion, and headset lateral preference were entered together with main effects specifically appropriate to this study. These were average call quality, AWA, WPT, and length of time in organisation. The reason for these extra variables was to partial from average sales performance the effects of skill in selling, flexible work conditions, ability from sales performance, and thereby to facilitate a clearer focus on personality. In Step 3, two-way interactions between extraversion, neuroticism, and headset were entered, and in Step 4, the single three-way interaction between these variables was entered. In the second regression, ear preference was substituted for headset lateral preference.

In the first regression, which uses headset lateral preference as a moderating variable, average call quality is the only significant main effect predictor of average sales ($\beta = .62$, $p < .001$). The interaction between neuroticism and headset lateral preference approaches significance ($\beta = .18$, $p = .06$). While neither simple slope of the interaction is significantly different from zero, there is a clear trend in which high neuroticism interacts with right headset lateral preference to predict higher sales performance and left headset lateral preference to predict lower sales performance.

In the second regression, which uses ear preference as a moderating variable, the only main effects from Step 1 and Step 2 to reach significance in

the prediction of average sales were sex ($\beta = -.16$, $p = .05$) and average call quality ($\beta = .60$, $p < .001$). The only other significant effect was a neuroticism × ear preference interaction ($\beta = .26$, $p = .005$). Adding the two-way interaction terms to the regression model added 6% in terms of incremental validity to the model, which is fairly typical for an interaction term.

The plot of the simple slopes associated with the significant interaction term shows that right ear preference has a positive slope and left ear preference has a negative slope in the prediction of average sales from neuroticism. Simple slopes analysis indicates that the slope for right ear preference is almost significantly different from zero ($B = .22$), $t(93) = 1.89$, $p = .06$, and the slope for left ear preference is significantly different from zero ($B = -.37$), $t\ (93) = -2.30$, $p = .023$. Results therefore provide reasonable initial support for H4 such that neurotic people who have a right ear preference tend to exhibit disinhibited approach. The lack of other significant effects provides no evidence in favour of the alternative models of disinhibited approach.

Interestingly, in this study, low neuroticism also significantly interacted with left ear preference to predict disinhibited sales performance. This suggests that emotionally stable people who are relatively attentive to their right hemisphere (which Jackson, 2005b, argues is associated with emotional expression) are also good at producing sales. This can be explained by arguing that a combination of emotional consistency and relating well to customers provides another good sales strategy. However, this finding will not be dwelled on because, as will be seen, it is not replicated in Studies 5, 6, 7, and 8.

It is interesting to compare the effect of using headset lateral preference and ear preference as moderating variables. Headset lateral preference reflects a specific preference for one ear over the other *at work* whereas ear preference reflects lateral preference to a far broader range of stimuli. It is therefore likely that ear preference provides a better index of action goal formation than the more limited measure of headset lateral preference. In line with H4, greater habitual preference for the right ear over the left ear should lead to a greater habitual predisposition for action goal formation tendencies and consequent positive relationship between neuroticism and disinhibited approach (measured as average sales performance). It is unsurprising therefore that ear preference was a better predictor than headset lateral preference.

STUDY 2: VALIDATION OF THE EAR PREFERENCE QUESTIONNAIRE

Study 1 provided initial evidence that ear preference is related to handset lateral preference. The aim of this study is to validate the ear preference scale by showing how it correlates with a range of objective aurally based behaviours.

Method

Participants

Participants ($n = 66$; average age = 21.93, $SD = 6.31$; 87% females and 13% males) from the campus of a large Australian university took part in the study in exchange for partial course credit. Participants completed a large battery of electronically administered questionnaires including those relevant for this study under the direct supervision of a research assistant. Each participant was given verbal instructions on how to complete the survey.

Measures

Hand, Eye and Ear Preference Questionnaire (HEEP; Jackson, 2005b). This was as Study 1.

Objective aural behaviours. As part of a larger study, such that participants did not complete the HEEP immediately before or after this activity, participants performed four actions which provided measurement of objective aural behaviour: (1) Pick up a watch and listen to it ticking; (2) Answer a phone; (3) Listen to a tape recorder; and (4) Eavesdrop through a door. Participants were observed and the ear used in each behaviour was recorded with a high score indicating objective preference for right objective aural behaviour.

Results and discussion

Alphas of the three lateral preferences and the objective aural behaviour were at least 0.76. Objective aural behaviour was significantly correlated with self-report ear preference ($r = .645$, $p < .001$). This finding suggests ear preference is a valid indicator of objective aural behaviour and provides evidence that the proposed scale of ear preference is acting as a valid index of actual aurally based behaviour.

Ear preference is also significantly correlated with hand and eye preference and objective aural behaviour is also correlated with hand preference ($r = .406$, $p < .001$) and eye preference ($r = .377$, $p < .001$). The

correlations between the different lateral preferences are similar to those reported previously (Jackson, 2005b). The size of the correlations suggests that each lateral preference has both a common element associated with laterality while also possessing some individual characteristics. It is therefore unsurprising that hand and eye preference are also correlated with objective aural behaviour but to a lesser extent than ear preference.

STUDY 3: RELATIONSHIP BETWEEN EAR PREFERENCE AND TIME ESTIMATION

Having established that ear preference is an accurate index of objective aural behaviour, the next step is to show that ear preference is predictive of action goal formation. This can be achieved by showing a direct relationship between ear preference and measures highly associated with the construct of action goal formation.

Time perception is a fundamental capability of the human brain because precise timing is essential in many human actions such as organising a sequential set of muscles so that an arm can make an action (Hazeltine, Helmuth, & Ivry, 1997). It is thus essential that we keep careful track of our moments as they pass, and evolution has provided a network of cortical areas that includes the prefrontal cortex which has been consistently associated with time measurement as reported in neuroimaging and lesion studies (Harrington & Haaland, 1999). Some people might estimate the likely time taken to undertake an action to be faster than others and this is likely to be one good indicator of fast action goal formation. Predicting events such as when a traffic light will change to red are also closely linked to effective time estimation but are not related to action goal formation because the person is passive as opposed to committing the action.

Study 3 aims to provide simple and direct support for H2, which is that fast estimates of time taken to complete an action will be related to right ear preference whereas slow estimates will be related to left ear preference. It is not expected that ear preference will be related to actual time taken to complete a task or estimates of how long it would take to passively wait for something to happen since these are not related to action goal formation cognitions.

As shown in Study 2 and Jackson (2005b), it is further expected that ear, hand, and eye lateral preferences are likely to be modestly intercorrelated and therefore provide some evidence of a common basis of laterality, but that they will not be so strongly correlated that they measure the same thing. It is expected that ear preference will be a better predictor of time estimates to complete an action than hand or eye preference. As noted already, hand preference is a reasonably well-accepted measure of structural hemispheric

asymmetry but unlikely to be related to action goal formation because it is more associated with structural hemispheric asymmetries associated with hand control (Jackson, 2008; White et al., 2004).

Pilot study

A pilot study using a sample of 104 participants completed the Hand, Eye and Ear Preference Questionnaire (HEEP; Jackson, 2005b), a battery of questionnaires, and were asked to solve a jigsaw in a small team of up to five people. The 65 participants who failed to complete the jigsaw in 5 minutes were asked within the questionnaire battery how long they estimated it would take them to complete the jigsaw on their own, with possible response options of 5, 10, or 15 minutes. Estimated time to complete the jigsaw significantly correlated with ear preference ($r = -.26$, $p < .03$) such that right ear preference was associated with fast time estimates. This pilot study provides initial evidence in favour of H2.

Method

Participants

Participants ($n = 90$; average age = 19.78, $SD = 2.77$; 66% females and 34% males) from the campus of a large Australian university took part in the study in exchange for partial course credit. Participants completed a battery of electronically administered questionnaires (including completing a maze) under the direct supervision of a research assistant. Each participant was given verbal instructions on how to complete the survey.

Measures

Hand, Eye and Ear Preference Questionnaire (HEEP; Jackson, 2005b). This was as Study 1.

Actual task time. Actual time taken to complete the whole task was recorded.

Estimated task time. Participants were also asked: "How long do you estimate that completing this study will take? (mins)".

Two further questionnaires were designed by the author specifically to measure how long it might take to actively complete a complex task and how long it might take to passively wait for a task to be completed. Particular care was taken to choose items that are common to all people, as fair as possible to people of different age, gender, size, and health, and for the actions to be defined as clearly as possible:

Estimated time to complete an action. How many minutes would you estimate that it takes you to do the following if you did them at a steady pace and if you were in good health: (1) Make a cup of coffee if all the ingredients are in front of you but you have to boil a full kettle of water? (2) Peel five large apples? (3) Drink a litre of water and eat two large peeled apples (or similar)? (4) Read a five-page short story of 2000 easy words? (5) Walk round five buses which are all parked together lengthwise (i.e., front to back)? (6) Empty a standard-sized watering can by sprinkling water over a flower bed? (7) Complete 5 mazes of the type that you have just tried? (8) Make an average-sized double bed (2 sheets and 2 blankets)? (9) Answer 200 easy questions in a survey?

Estimated time to wait for an action to be completed. How many minutes would you estimate that you would have to wait for the following:(1) To get to the front of a checkout at a supermarket if there were five people each with five goods in front of you? (2) To speak to a company representative on the telephone (if there are four people in a queue in front of you)? (3) To be served a first course in a restaurant (after you have ordered and the restaurant is quiet)? (4) To be served at a bank when there are seven people in front of you? (5) For a friend who is late? (6) For a thick crust pizza (dinner plate sized) to cook in a correctly heated oven? (7) For three cups of coffee to be made in a café (one at a time)? (8) A helium-filled party balloon to disappear from sight on a calm day? (9) To be seen by a doctor if you were on time for an appointment?

The items of estimated time to complete an action and estimated time to wait for an action to be completed scales were log transformed to provide a more symmetrical distribution appropriate for parametric testing and the items were standardised to remove scale differences between the items.

Results and discussion

All alphas are greater than 0.70 except for the estimated time to wait for an action to be completed scale which was 0.63. The key findings of this study are that high scores of ear preference (indicating a right ear preference) are negatively correlated with estimated task time ($r = -.25$, $p < .05$) and estimated time to complete an action ($r = -.23$, $p < .05$). The results of the pilot study also support this finding. These results indicate that people with a right ear preference tend to estimate that time taken to complete an action will be shorter than people with a left ear preference. Ear preference is not significantly correlated with actual task time or estimated time to wait for an action to be completed. No other lateral preferences are significantly correlated with actual or estimated times. This study provides evidence that

people with a right ear preference tend to have faster action goal formation tendencies than people with a left ear preference, and that goals must be active as opposed to passive in orientation for this relationship to hold. Moreover, ear preference is related to estimates of time required to complete an action as opposed to actual time taken to complete an action. All this supports the idea that ear preference predicts action goal formation as opposed to actual goal behaviour or passive behaviour.

Similar to the previous studies, ear preference also has moderate correlations with the other lateral preferences such that it has a correlation of $r = .25$, $p < .05$ with hand preference and $r = .37$, $p < .01$ with eye preference. Such results lend further support to the idea that ear preference is a measure of lateral tendency but also has specific qualities which set it apart from the other measures of lateral preference.

Furthermore, validation support for the time measures is also shown in Table 1. Actual task time is significantly correlated with estimated task time ($r = .21$, $p < .05$), estimated task time is significantly correlated with estimated time to complete an action ($r = .42$, $p < .01$) as well as estimated time to wait for an action to be completed ($r = .22$, $p < .05$), and estimated time to complete an action is significantly correlated with estimated time to wait for an action to be completed ($r = .53$, $p < .01$).

In summary, results provide support for H2 and directly suggest that ear preference is a biological marker for psychological processes associated with action goal formation. The size of the relationship is relatively small but consistent across two different measures and a pilot study. However the relatively small correlation might be a cause for concern so it would be useful to show a similar relationship between ear preference and a further variable related to action goal formation. This is the purpose of Study 4.

STUDY 4: RELATIONSHIP BETWEEN EAR PREFERENCE AND RESTRAINT COPING

Study 4 investigates H3, which is that ear preference is related to a cognitive measure of coping with stress such that right ear preference is associated with low restraint coping. Carver, Scheier, and Weintraub (1989, p. 269) define restraint coping as follows:

> Another tactic from the arsenal of problem-focused coping is the exercise of restraint. Although restraint is often overlooked as a potential coping strategy, it sometimes is a necessary and functional response to stress. *Restraint coping* is waiting until an appropriate opportunity to act presents itself, holding one-self back, and not acting prematurely. This is an active coping strategy in the sense that the person's behaviour is

focused effectively with the stressor, but it is also a passive strategy in the sense that using restraint means *not* acting.

Low restraint therefore represents an action-oriented coping strategy with a resemblance to fast action goal formation and high restraint is a passive-oriented coping strategy. Evidence in support of H3 would provide further evidence that ear preference is a biological marker for action goal formation.

In line with the literature (e.g., Jackson, 2005b), Study 2, and Study 3, it is also expected that hand, eye, and ear measures of lateral preference will be moderately intercorrelated and therefore reflect a general tendency to measure laterality, yet also suggesting that each modality of lateral preference will have specific properties unrelated to the others.

Participants and procedure

Participants ($n = 150$; average age = 18.00, $SD = 4.11$; 71.3% females; 28.7% males) from the campus of a large Australian university took part in the study in exchange for partial course credit. Participants completed a battery of electronically administered questionnaires under the direct supervision of a research assistant. Each participant was given verbal instructions on how to complete the survey.

Measures

Hand, Eye and Ear Preference Questionnaire. This was as Study 1.

Eysenck Personality Questionnaire – Revised. The revised version of the Eysenck Personality Questionnaire (EPQ-R; Eysenck, Eysenck, & Barrett, 1985) comprises well-established measures of psychoticism, extraversion, and neuroticism. The alpha reliability of each scale has been shown to be high (Eysenck et al., 1985).

The Cope (dispositional format; Carver et al., 1989). The Cope is a 60-item questionnaire designed to measure how people respond when they confront difficult or stressful events in their lives. All scales were administered but the "Restraint" scale was the scale of most interest because of its similarity to a desired scale reflecting cognitions associated with action goal formation (such that low restraint is associated with high action goal formation). The items from this scale are: 10. I restrain myself from doing anything too quickly; 22. I hold off doing anything about it until the situation permits; 41. I make sure not to make matters worse by acting too soon; 49. I force myself to wait for the right time to do something. Low scores of restraint therefore represent fast action goal formation.

Results and discussion

All alpha reliabilities are high, except for the restraint scale of the Cope which has an alpha reliability of 0.60. There are moderate correlations between all the scales of ear preference, hand preference, and eye preference, which again supports the proposal that measures of lateral preference provide a general measure of lateral tendency; yet at the same, it should be noted that the correlations are not so large as to suggest that they are measuring entirely the same thing.

Only the restraint scale from the Cope is significantly correlated with ear preference ($r = -.23$, $p < .05$, $df = 148$). This correlation supports H3 such that right ear preference is related to a lack of restraint. Restraint as a coping style is not correlated with either eye or hand preference, but it was also significantly negatively correlated with extraversion such that low restraint is related to high extraversion.

Importantly, restraint from the Cope questionnaire reflects restraint *when needing to cope with stressful situations.* From this perspective, the reported results provide further evidence of the appropriateness of focusing on ear preference as a potential moderator of neuroticism in Studies 1, 5, 6, 7, and 8. This is because lack of restraint when under stress represents a behaviour likely to be affected by high neuroticism since a neurotic person is likely to experience stress as a result of high emotionality.

Overall Studies 1, 2, 3, and 4 provide reasonable support for the construct of ear preference as representing both objective aural behaviours and having a role as a biological marker of action goal formation. Study 1 also provided evidence of a significant neuroticism × ear preference interaction in the prediction of disinhibited approach. Part 2 of the research provides more evidence in favour of this relationship.

STUDY 5: PREDICTING CONFLICT RESOLUTION TIME

The aim of Study 5 is to determine if an objective measure of disinhibited approach (i.e., conflict resolution time measured as a response latency) can be predicted from a neuroticism × ear preference interaction in a mixed incentive (i.e., neither punishment alone nor reward alone) conflict-inducing laboratory task that could be expected to directly evoke anxiety. The aim of this study is to provide laboratory evidence in support of H4 by showing that high neurotic people with right ear preference will tend to have faster response latencies than high neurotic people with left ear preference.

The stimuli used in this study were vignettes in which two alternative actions or responses were available to participants. The alternative actions were designed to cause conflict of the type that occurs when there is

simultaneous drive towards incompatible motives. Such conflict results in unpleasant emotions, such as anxiety, which neurotic people usually seek to reduce. When two stimuli are presented together, and both are equally motivating, responses to these stimuli will compete and inhibit each other, and the stronger the motivations, the more intense the conflict. This continues until one stimulus becomes more reward-valued than the other, and the conflict is resolved.

There are several categories of conflict as noted by Dollard and Miller (1950). Approach–avoidance conflicts involve concurrently occurring stimuli that signal approach and avoidance. When these motivations are equal, a participant with high passive avoidance can be expected to vacillate between approaching the goal and avoiding punishment. Avoidance–avoidance conflicts involve two avoidance motivations, while approach–approach conflicts result from the participant being confronted with a choice between two equally desirable responses. In reality, however, approach–approach and avoidance–avoidance conflicts that simulate real-life situations will tend to be special cases of approach–avoidance conflicts, since generally one alternative will be more rewarding than the other as people place different expectations and values on components of the conflicts. Vacillation, rumination, and reflection as a response to conflict will lead to long response latencies, whereas disinhibited approach will lead to short response latencies.

The laboratory methodology chosen for this study has both advantages and disadvantages over the classic go/no-go discrimination task design that has often been used to measure disinhibited approach (e.g., Newman & Kosson, 1986; Newman et al., 1985). In a typical go/no-go experiment, participants must learn by trial and error to respond to one class of stimulus (target) but not to another (distractor). Correct responses are then rewarded while incorrect responses are punished. Disinhibited approach is defined in terms of commission errors. Studies using these tasks show that extraversion, neurotic extraversion, and psychopathy are all predictive of disinhibited approach (i.e., more errors of commission) and therefore provide support for Patterson and Newman's (1993) model of disinhibition (Newman & Kosson, 1986; Newman et al., 1985; Patterson et al., 1987).

The current study represents a departure from this classic task. In this study, descriptions of realistic everyday problem situations are used to present participants with two competing and conflicting solutions in each trial. As such, rewards and punishments are all provided as conflict-inducing stimuli. In contrast, the rewards and punishers in the classic go/no-go discrimination task follow the presentation of the stimulus, and participants are expected to learn from them. Thus the current design is not a learning task in which behaviour is expected to change over time, but instead provides an index of habitual response to conflict.

A further advantage of the present methodology is that the criterion of interest (conflict resolution time or time taken to resolve a conflict) is easily interpreted as disinhibited approach, whereas the commission error (i.e., failure to inhibit responses to stimuli paired with punishment) measured in the classic go/no-go design is a more complex measure of disinhibited approach. A further contrast is that the current experiment consists only of mixed incentive conflicts (although some of the vignettes were biased towards approach–approach and avoidance–avoidance conflicts), whereas the classic design by Newman and colleagues only allows for the demonstration of disinhibited approach in the mixed incentive condition (as opposed to simple reward and punishment only conflicts). Finally, conflict resolution time can be measured across all the stimulus presentations of the current study, whereas it is impossible to measure reaction time across all trials in the classic go/no-go design because participants are not required to make a response in every trial (as noted by Patterson et al., 1987).

Like most of the studies except for Study 1, no aural stimuli are presented or measured, so this study tests the efficacy of ear preference as an index of contralateral preference *outside* the ear domain. This is important because significant effects will show that possible moderating effects of ear preference are not related to trivial environmental variables related to hearing as suggested by some (Furnham, Richardson, & Miller, 1997) or peripheral cochlear mechanisms.

Method

Participants and procedure

Participants from an Australian university participation pool ($n = 77$) took part in the study in exchange for course credit. Their average age was 20.71 years (SD = 4.92) and 79.2% of the sample was female. Participants completed a battery of questionnaires, including timed vignettes, under the direct supervision of a research assistant. Each participant was given verbal instructions.

Measures

Eysenck Personality Questionnaire-Revised. This was as Study 4.

Hand, Eye and Ear Preference Questionnaire. This was as Study 1.

Approach–avoidance vignettes. A total of 30 conflict vignettes were used, consisting of 10 describing approach–avoidance situations, 10 approximations of avoidance–avoidance situations, and 10 approximations of

approach–approach situations. The conflicts were developed to represent common everyday conflict situations, and were expressed as though they related directly to participants, in order to increase their sense of personal involvement in each conflict. The conflicts were presented in randomised order for each participant. To resolve each of the conflicts the participant pressed one of two buttons that signified the alternative response options. The software provided accurate reporting of response times (to a millisecond). The key measure was the response latency for each item, which was defined for each conflict as the difference between the onset of presentation and the time of resolution. As expected, the response latencies for the three categories of stimuli were very highly correlated, which confirms that they are all essentially examples of approach–avoidance stimuli. Conflict resolution time, computed as the total response latency (measured in milliseconds) over the 30 situations, was therefore used as the criterion of interest in this study, in which people with fast response latencies have resolved the conflicts rapidly.

Results and discussion

Internal reliabilities of all measures are 0.74 or more. Conflict resolution time was negatively correlated with extraversion ($r = -.23$, $p < .05$) suggesting that extraverts tend to respond quickly. Ear preference was not significantly correlated with either personality scores or conflict resolution time.

Moderated multiple regression of personality and ear preference was used in the prediction of conflict resolution time. In line with expectations derived from H4, there was a significant neuroticism × ear preference interaction ($\beta = -.32$, $p = .012$), but also a significant extraversion × ear preference interaction ($\beta = -.28$, $p = .022$). Very similar results were also obtained by conducting multiple regression analyses on conflict resolution time when split into the three conflict categories (pure approach–avoidance, approximated approach–approach, and approximated approach–avoidance). No other predictors were significant.

The simple slopes of the significant interactions were plotted separately. Among participants with right ear preference, both high neuroticism ($B = 38453.28$), $t(65) = 2.44$, $p = .018$, and high extraversion ($B = 39474.41$), $t(65) = 2.53$, $p = .014$, predicted fast conflict resolution time. Among participants with left ear preference, both low neuroticism ($B = -32491$), $t(65) = -2.10$, $p = .039$, and low extraversion ($B = -41010.69$), $t(65) = -2.64$, $p = .010$, predicted fast conflict resolution time.

The results of this laboratory study therefore strongly support H4. The existence of a further extraversion × ear preference effect was not

hypothesised, but is not problematic to the proposed model of disinhibited approach. It seems reasonable to think of impulsive behaviours stemming from the activation and impulsive properties of extraversion being "amplified" by action goal formation associated with right ear preference. Such results therefore support the argument that ear preference is a biological marker of action goal formation tendencies.

In summary, Study 5 provides laboratory support for H4 using the objective measure of conflict resolution time as a measure of disinhibited approach. It is useful now to broaden the test of H4 to determine if neuroticism × ear preference predicts various general and specific scales of disinhibited approach.

STUDY 6: DISINHIBITED APPROACH AND IMPULSIVITY

This cross-sectional psychometric study aims to test H4 by means of a cross-sectional psychometric study to determine if ear preference × neuroticism predicts a scale of disinhibited approach.

Method

Participants and procedure

Participants were 39 males and 106 females ($n = 145$; average age = 20.80, $SD = 4.11$) from the campus of a large Australian university, who were participating in exchange for partial course credit. Participants completed a battery of electronically administered questionnaires under the direct supervision of a research assistant. Each participant was given verbal instructions on how to complete the survey.

Measures

Hand, Eye and Ear Preference Questionnaire. This was as Study 1, but only the ear preference scale is reported.

Eysenck Personality Questionnaire – Revised. This was as Study 4.

Disinhibited approach. An 18-item questionnaire was specially constructed to measure everyday, non-deviant behaviours associated with disinhibition and approach. The questionnaire was specifically designed to measure a general spread of activities associated with appetitive activity and general approach. A common thread to the items is that they represent impulsivity, lessening of control, gung-ho activities, letting go, or letting your hair down kinds of behaviour. The questionnaire does not seek to distinguish between impulsivity and disinhibition because impulsivity and

disinhibition are similar in terms of behavioural outcomes. The disinhibited approach questionnaire was specifically designed not to contain any items likely to be indicative of negative emotionality or laterality.

The items comprising the questionnaire are: (1) I like to go out with friends; (2) If I feel physically attracted to someone, I would immediately tell the person; (3) I like to flirt; (4) I like good food; (5) I like to drink alcohol; (6) I am happy to borrow money from a friend so that I can buy something I want; (7) I can easily turn down an invitation from a friend if I have something better to do; (8) I get no particular pleasure out of acquiring things (R); (9) I would most likely refuse an offer of food if I had already eaten (R); (10) I can easily control my food intake if I am dieting (R); (11) I find it difficult to resist alcohol in a social gathering; (12) I avoid as much as possible bad habits such as smoking or alcohol intake (R); (13) I really enjoy going to parties; (14) When I go shopping at the supermarket, I always buy more than I planned; (15) I seek thrilling and exciting activities; (16) I like to buy consumer goods; (17) When I buy electronic goods, I turn them on before reading the instructions; and (18) I am often one of the first to come up with a possible solution to a problem. Responses to the disinhibited approach questionnaire were on a Likert-type scale (1 = *Strongly disagree*, 2 = *Disagree*, 3 = *Undecided*, 4 = *Agree*, 5 = *Strongly agree*).

The disinhibited approach questionnaire was expected to be positively correlated with other measures of approach behaviour including existing BAS measures (Carver & White, 1994), functional impulsivity and dysfunctional impulsivity (Dickman, 1990) and Jackson's Appetitive Motivation Scale (JAMS; Jackson & Smillie, 2004).

Carver and White's (1994) BIS/BAS scales. This questionnaire contains 24 items with scale responses of "very true for me" (4), "somewhat true for me" (3), "somewhat false for me" (2), and "very false for me" (1). The BIS/BAS scales have high convergent and discriminant validity and, although they are brief, they have reasonable alpha reliabilities (generally around 0.70; Carver & White, 1994). Carver and White provide three measures of BAS, which are reward responsiveness, drive, and fun seeking. The results of recent studies, as well as the definitions of the scales, indicate that reward responsiveness and drive seem to be mainly associated with reward sensitivity and the behavioural activation system, whereas fun seeking is more associated with impulsivity (Quilty & Oakman, 2004). For this reason, the focus in this study is on BAS fun seeking.

Dickman's (1990) Impulsivity Questionnaire. This questionnaire contains 23 items, each measuring functional or dysfunctional impulsivity. Both the functional and dysfunctional scales have high internal consistency (Dickman, 1990). Recently, Jackson and Smillie (2004) and Smillie and

Jackson (2006) showed that functional impulsivity is similar in both theory and practice to BAS activity, whereas dysfunctional impulsivity is related to rash Impulsivity. For this reason, the focus in this study is on dysfunctional impulsivity.

Jackson's Appetitive Motivation Scale (JAMS; Jackson & Smillie, 2004). This questionnaire contains 20 items and has an internal consistency in excess of 0.70. Jackson and Smillie report that appetitive motivation is a useful measure of BAS activity.

Results and discussion

All alpha reliabilities are equal to or greater than 0.70 except for BAS reward responsivity, which has an alpha of 0.68. Convergent validity of the disinhibited approach questionnaire was demonstrated by positive and significant correlations between it and all other extraversion, psychoticism, and BAS scales. The highest correlation was with BAS fun seeking ($r = .45$, $p < .01$) and the lowest significant correlation was with dysfunctional impulsivity ($r = .19$, $p < .05$). In line with expectations, the disinhibited approach questionnaire showed divergent validity from BIS, ear preference, and neuroticism. It was therefore concluded that the disinhibited approach questionnaire was acting in the proposed manner, such that it correlated positively with other approach scales, and was not correlated with scales unrelated to disinhibited approach.

Next, hierarchical moderated multiple regressions were used to separately predict disinhibited approach, BAS fun seeking, and dysfunctional impulsivity. The independent variables were sex and age in Step 1; ear preference, extraversion, neuroticism, and psychoticism in Step 2; extraversion × neuroticism, extraversion × ear preference, and neuroticism × ear preference in Step 3; and extraversion × neuroticism × ear preference in Step 4.

In the prediction of disinhibited approach, extraversion had a significant main effect ($\beta = .40$, $p < .001$). There was also a significant psychoticism main effect ($\beta = .20$, $p = .02$). The extraversion × neuroticism interaction did not quite reach significance ($\beta = -.15$, $p = .07$). In support of H4, there was a significant neuroticism × ear preference interaction ($\beta = .21$, $p = .027$). No other predictors were significant. Step 3 of the regression explained a further 6% of the variance in disinhibited approach once the Step 1 and Step 2 variables had been entered.

In the prediction of BAS fun seeking and dysfunctional impulsivity, there were significant psychoticism main effects ($\beta = .22$, $p = .004$; $\beta = .50$, $p = <$ .001 respectively) and there were significant extraversion and neuroticism main effects in the prediction of BAS fun seeking ($\beta = .56$, $p < .001$; $\beta = .17$,

$p = .03$). For both dependent variables, the interaction between neuroticism and ear preference was very close to significance ($\beta = .15$, $p = .060$; $\beta = .17$, $p = .051$ respectively) in further general support of H4.

The significant neuroticism × ear preference interaction in the prediction of disinhibited approach was plotted using standard methodology (Jaccard et al., 1990) and shows a significant positive relationship between neuroticism and disinhibited approach for people with a right ear preference ($B = 0.45$), $t(133) = 3.66$, $p < .001$, while the simple slope for people with a left ear preference was negative, but not significantly different from zero.

The interactions of neuroticism with ear preference were also plotted in the prediction of BAS fun seeking and dysfunctional impulsivity. In both plots, the simple slope depicting right ear preference was positive and significant ($B = 0.13$), $t(133) = 2.60$, $p = .010$ for BAS fun seeking; ($B = 0.43$), $t(133) = 3.49$, $p < .001$ for dysfunctional impulsivity. Again, in each case, the line representing people with a left ear preference was not significant, suggesting that neuroticism has no relationship with rash impulsivity for people with left ear preference. These plots provide further directional support for H4.

These results shed light on how neuroticism predicts disinhibited approach and other impulsive approach behaviours in various ways. First, in line with H4, the results indicate that high disinhibited approach and impulsive-like tendencies can be predicted from neurotic people with a right ear preference. Moreover, the extraversion × neuroticism interaction was not significant in the prediction of disinhibited approach and impulsive-like behaviour. These results provide little support for the viewpoint that high neuroticism and high extraversion predict disinhibited approach or that high extraversion and low neuroticism predict disinhibited approach. Further, because the extraversion x neuroticism × ear preference interaction was not significant, there was no evidence to suggest that the proposed model requires a multiplicative effect of extraversion to be predictive of disinhibited approach.It is noted, however, that extraversion as a main effect is generally highly predictive of disinhibited approach and rash impulsivity. Such a finding reinforces the widely held belief that approach tendencies have at least a partial basis in extraversion (Depue & Collins, 1999). The results of this study suggest that these effects are additive or independent of those represented by the separate neuroticism × ear preference interaction.

Finally, it has been argued that neuroticism × ear preference should predict disinhibited approach, yet it is shown that it also predicts impulsive-like behaviours and it has been concluded that such findings also support H4. This is justified because impulsive behaviour and disinhibition are very similar behaviours such that measures of impulsivity are likely to have similar properties to measures of disinhibition. Nevertheless, the current research perspective is that impulsivity mainly has a basis in the approach

system and that disinhibition mainly has a basis in the avoidance system (i.e., neuroticism) especially when moderated by active goal formation (as measured by ear preference).

In summary, Study 6 provides psychometric evidence of the importance of ear preference × neuroticism interactions in the prediction of a validated scale of disinhibited approach and two existing measures of rash Impulsivity. Study 7 extends Study 6 by testing whether an ear preference × neuroticism interaction predicts disinhibited behaviour in young teenage schoolchildren.

STUDY 7: PREDICTING PRACTICAL–REFLECTIVENESS IN YOUNG TEENAGE SCHOOLCHILDREN

The aim of this study is to show the replicability and generalisability of the findings of Study 6, by testing whether a further measure of disinhibited approach can be predicted by a different measure of neuroticism in interaction with ear preference in a sample of schoolchildren (i.e., different age group and country). In this study, the dependent variable was the practical–reflective scale from the Eysenck Personality Profiler (EPP; Eysenck et al., 1992; Jackson et al., 2000; Petrides et al., 2003). Practical–reflective measures tendencies to be expedient versus reflective and provide an alternative measure of disinhibited approach.

Method

Participants and procedure

Schoolchildren ($n = 88$, average age = 14.76; $SD = .66$; age range = 14–16; 47.1% boys and 52.9% girls) attending the same school in the UK completed an Internet questionnaire in a classroom under the supervision of a teacher.

Measures

Practical–reflective scale (Eysenck et al., 1992). The scale consists of 20 items, each of which is scored on a "Yes/No/Can't decide" basis. Example items are: Do you like work that involves action rather than thinking? Are you so thoughtful and reflective that your friends sometimes call you a dreamer (R)? Do you often stop just to think about things in general (R)? The scale is reported have an alpha of at least 0.73 (Eysenck et al., 1992). The author, in conjunction with the principal of the school, decided that some of the adult-oriented items were not appropriate for use with schoolchildren resulting in minor changes to re-express them in a manner appropriate for young teenagers, while retaining their meaning.

School knowledge. This questionnaire consisted of three questions: (1) I know a lot about what happens at school; (2) I know what the school vision is; (3) I am knowledgeable about school affairs that concern me. It was important to measure this variable because knowledge might be expected to be related to the practical–reflective scale of the EPP such that reflective people would have a tendency to be knowledgeable as opposed to simply being disinhibited. By using school knowledge as an independent variable in the regression equation, it is possible to assess the effects of personality on practical-reflectiveness once the effects of school knowledge have been removed.

NEO-IPIP personality questionnaire. The International Personality Item Pool (International Personality Item Pool, 2001) captures personality superfactors similar to Costa and McCrae's NEO Personality Inventory (NEO-FFI), and measures extraversion, agreeableness, conscientiousness, neuroticism, and openness to experience. The 50 items employ Likert-type scales, with response options ranging from 1 (*strongly disagree*) to 5 (*strongly agree*), with 3 (*undecided*) as the midpoint. Items were used in their adult form. In the current research, only extraversion and neuroticism scales are reported in all the studies utilising the Big 5 model of personality.

Hand, Eye and Ear Preference Questionnaire. This was as Study 1.

Results and discussion

All alphas are over 0.80 except for school knowledge, which has an alpha of 0.68. As expected, there is a significant negative correlation between school knowledge and practical–reflectiveness ($r = -.31$, $p < .01$) such that children who are high in knowledge tend to be reflective. Extraversion has a low positive correlation with school knowledge ($r = .21$, $p < .05$).

Hierarchical moderated multiple regression was used to predict practical–reflectiveness. In Step 1, age and sex were entered; in Step 2, school knowledge, ear preference, extraversion, and neuroticism were entered; in Step 3, extraversion × neuroticism, extraversion × ear preference, neuroticism × ear preference were entered; and in Step 3, extraversion × neuroticism × ear preference was entered. There is a significant school knowledge main effect ($\beta = -.43$, $p < .001$). Importantly for the main focus of the present research, there is also a significant neuroticism × ear preference interaction ($\beta = .27$, $p = .024$). No other predictors were significant.

A plot of the significant interaction shows that, for people with right ear preference, there is a positive and significant prediction of the practical–

reflective scale ($B = 0.35$), $t(80) = 0.017$, while its effect was non-significant for people with a left ear preference. In other words, for people with a right ear preference, neuroticism significantly predicts high expedience and little reflection, but for people with left ear preference there is no effect. The simple slopes analyses therefore provide reasonable general support for H4 and the expected effect of right ear preference on neuroticism in the prediction of disinhibited approach.The results again provide little support for the argument that high extraversion and high neuroticism combine to predict impulsive-like behaviour, or that high extraversion and low neuroticism combine to predict impulsive-like behaviour. Results of this study do not find a significant extraversion main effect. This is unsurprising since the operationalisation of disinhibited approach in terms of a practical–reflective scale is quite different from the operationalisation in terms of impulsivity used in Study 6.

The aim of Study 8 is to test whether the proposed model will predict specific dysfunctional appetitive behaviours classically thought to be related to disinhibited approach.

STUDY 8: PREDICTION OF ALCOHOL AND DRUG USE

A consistent finding in the literature is that personality traits related to disinhibited approach and impulsivity are associated with alcohol and substance use (Mann, Chassin, & Sher, 1987). However, neuroticism-like scales generally do not seem to be strongly predictive of alcohol and substance (e.g., Cloninger, Sigvardsson & Bohman, 1988; Johnson, Turner & Iwata, 2003; Jones, 1968, 1971; Khavari, Humes, & Mabry, 1977; Loxton & Dawe, 2001; Shadel, Niaura, Goldstein, & Abrams, 2000).

Given the consistency of intuitively appealing findings suggesting that approach-type behaviours predict consumption of alcohol and addictive substances, and a less than consistent finding that neuroticism predicts these behaviours, the aim of Study 8 is to investigate whether a right ear preference moderates neuroticism in the prediction of addictive disinhibited approach (i.e., alcohol consumption and drug use). The finding of a neuroticism × ear preference interaction could be expected to explain why there are contradictory findings concerning neuroticism main effects in the prediction of addictive substance use.

In line with H4 it is expected that, among people with right ear preference, there will be a positive relationship between neuroticism and addictive substance use as a result of disinhibited approach, whereas among people with left ear preference (indicative of expression of emotions) there will be no relationship between neuroticism and addictive substance use.

This study utilises a student sample, as opposed to a clinical sample, since clinical samples will generally present with neurotic symptoms, such as anxiety and depression, as "collateral" symptoms during detoxification (Liappas, Paparrigopoulos, Tzavellas, & Christodoulou, 2002). It is therefore more sensible to test the disinhibited approach model with community drinkers and drug users. Moreover, clinical samples may be in denial of alcohol and drug consumption, whereas this is much less likely to be the case for student samples.

Method

Participants and procedure

Participants were 48 males and 120 females ($n = 168$, $M = 18.21$ yrs, $SD = 2.34$). The majority were undergraduates from two campuses of a large Australian university, who were participating in the study in exchange for partial course credit. Participants completed a battery of electronically administered questionnaires, under the direct supervision of a research assistant. Each participant was given verbal instructions.

Measures

Khavari Alcohol Test (KAT; Khavari & Farber, 1978). The KAT is a 12-item questionnaire that provides quantitative information on consumption of beer, wine, and spirits. Administration of the KAT yields data on the frequency of the respondents' alcohol consumption, the volume they usually consume on each occasion, and the maximum quantity consumed for each of the three beverage types. Information taken from these questions serves as the basis for calculating the participants' Absolute Annual Alcohol Intake (AAAI), which is one of the dependent variables used in this study.

Drug Abuse Screening Test (DAST-20; Skinner, 1982). The DAST-20 is a 20-item scale measuring the extent of problems or consequences related to drug use and abuse. Items assess physical dependence (e.g., "Can you get through the week without using drugs?") and behavioural aspects of drug use (e.g., "Have you neglected your family because of your use of drugs?"). Responses utilise a Yes/No format. DAST-20 scores range from 0 to 20, with greater values representing more extensive drug abuse-related problems.

NEO-IPIP. This was as Study 7, but in its standard adult format. Only the extraversion and neuroticism scales are reported.

EPQ-Revised. This was as Study 4.

Hand, Eye and Ear Preference Questionnaire. This was as Study 1, but only the ear preference items were administered.

Results and discussion

Alphas were all greater than 0.74. The KAT was positively correlated with the DAST-20 ($r = .32$, $p < .01$). Predictably, the personality measures tended to have high correlations when measuring the same construct, and lower correlations with personality scales measuring different constructs. Thus, EPQ-R extraversion and NEO-IPIP extraversion were highly correlated, as well as EPQ-R neuroticism and NEO-IPIP neuroticism. EPQ-R psychoticism was a significant predictor of alcohol consumption and drug use, and NEO-IPIP neuroticism was a significant predictor of drug use. Ear preference was uncorrelated with the measures of personality, which supports H2.

The same regression procedure used in the previous studies was applied again. Two separate sets of independent variables are used (EPQ-R and NEO-IPIP extraversion and neuroticism scales) in the prediction of alcohol consumption and drug usage, resulting in four separate regressions. In Step 1, sex and age were entered; in Step 2, ear preference, extraversion, neuroticism (and psychoticism with the EPQ-R) were entered; in Step 3, the two-way interaction terms were entered; and in Step 4, extraversion × neuroticism × ear preference was entered.

Sex and age were significant predictors of alcohol consumption, such that being older and male generally led to increased use. Being male was also a significant predictor of higher drug use within the NEO-IPIP multiple regression. Extraversion from the EPQ-R ($\beta = .16$, $p = .03$) and the NEO-IPIP ($\beta = .17$, $p = .04$), as well as psychoticism ($\beta = .31$, $p < .001$) from the EPQ-R were all significant predictors of alcohol consumption, whereas neuroticism from the NEO-IPIP ($\beta = .20$, $p = .013$) was the only personality main effect from this questionnaire to predict drug use.

In line with H4, a neuroticism × ear preference interaction predicted alcohol consumption (EPQ-R: $\beta = .25$, $p = .001$; NEO-IPIP: $\beta = .27$, $p = .001$) and drug use (EPQ-R: $\beta = .16$, $p = .049$; NEO-IPIP: $\beta = .17$, $p = .038$). Following the standard methodology employed in all studies, all significant interaction terms were plotted to aid interpretation. Across all four plots of the neuroticism × ear preference interaction, there was a positive relationship between neuroticism and addictive behaviour for individuals with right ear preference. In all but one case (where the slope approached significance), each simple slope for participants with right ear preference was significantly different from zero, such that high neuroticism was related to higher addictive behaviour—in the prediction of alcohol consumption: EPQ-R:

$B = 459.91$, $t(156) = 2.70$, $p = .001$, NEO-IPIP: $B = 540.13$, $t(158) = 3.82$, $p < .001$; in the prediction of drug usage: EPQ-R: $B = 0.07$, $t(156) = 1.62$, $p = .107$, NEO-IPIP: $B = 0.12$, $t(158) = 3.02$, $p = .002$. Except in one instance where left ear preference and low neuroticism were associated with high alcohol consumption ($B = -392.47$), $t(156) = -2.28$, $p = .024$, Neuroticism did not predict alcohol and drug use in people with left ear preference. Again, these replicated results can be interpreted as providing evidence in favour of H4.

The EPQ-R extraversion × ear preference interaction was also significant in the prediction of alcohol intake ($\beta = .21$, $p = .004$). Simple slopes analysis showed that high extraversion significantly predicted alcohol consumption for people with a right ear preference ($B = 643.00$), $t(156) = 3.54$, $p < .001$, but that the slope was not significant for people with left ear preference. This suggests that the active, impulsive, and socialising effects of extraversion are amplified by action goal formation associated with right ear preference to predict alcohol intake. This interaction is also plausible as a source of impulsive behaviours. No other predictors were significant.

GENERAL DISCUSSION

The proposed new model of disinhibited approach is based on the integration of multiple literatures which each support individual components of the overall model. Part 1 of the current research (Studies 1, 2, 3, 4) investigates ear preference as a marker of actual aural behaviour and as a marker for action goal formation tendencies such that preponderance of left hemisphere activity or attention could be expected to be related to fast action goal formation tendencies. Part 2 (Studies 1, 5, 6, 7, 8) tests a model in which ear preference interacts with neuroticism to predict disinhibited approach.

Ear preference as a measure of objective aural behaviour and action goal formation

Study 1 introduces the research by validating the ear preference scale against actual headset use in telesales operators and showing a neuroticism × ear preference interaction in the prediction of telesales performance (which is argued to be an example of functional disinhibited approach). Study 2 validates the ear preference scale in its prediction of a variety of aurally based behaviours. Study 3 provides evidence that ear preference is a marker of action goal formation tendencies by showing that ear preference is significantly correlated to two different measures of action goal formation tendencies measured directly as estimated time to complete actions as well a

similar measure within a pilot study. Importantly, ear preference was not related to actual task time or estimated time to wait for an action to be completed. Such evidence implies that ear preference is related to action goal formation but not when the person is as a passive participant and not in terms of actual action-oriented behaviour. Such findings suggest that right ear preference predicts faster action goal formation compared to left ear preference. Study 4 broadens the proposed role of ear preference by showing that it is also correlated with restraint coping such that right ear preference is related to low restraint.

Given the well-accepted contralateral argument in which the right ear is seen as an indicator of left hemispheric activity, these results provide new, useful, and direct evidence in favour of left hemispheric activity involving action goal formation. Such results support a specific argument that the left hemisphere is associated with action goal formation (e.g., Sutton & Davidson, 1997).

However, little evidence is produced in any of the studies to support a broader version of Davidson's model which argues that left hemispheric activity is associated with general approach activity (e.g., Davidson, 1995, 1998; Davidson & Sutton, 1995). This is because extraversion, a personality scale representing approach (Depue & Collins, 1999; Smillie et al., 2006a) is not significantly correlated with any of the lateral preferences and because disinhibited approach has little direct relationship with any of the lateral preferences.

The size of the correlations between ear preference and time estimates and between ear preference and restraint coping (as reported in Study 3 and Study 4 respectively) might be considered to be quite low. However, while this is the case, the finding seems quite robust since it is reported using two measures of action goal formation in Study 3, a pilot study in Study 3, and a scale representing low restraint coping in Study 4. The finding of a low correlation between a behaviour and a related biological marker is to be expected since there are likely to be many confounding variables. Nevertheless, it will be interesting to see if other laboratories can replicate this interesting and important finding.

Interaction between neuroticism and ear preference in prediction of disinhibited approach

Robust support for the predictions of disinhibited approach from a neuroticism × ear preference interaction was demonstrated across five studies (Studies 1, and 5–8). Support for the proposed model of disinhibited approach was found across three methodologies (psychometric, field, and laboratory), in the prediction of different representations of disinhibited

approach (conflict resolution time measured as a response latency, scales of disinhibited approach, rash impulsivity, practical versus reflective, specific scales of alcohol and drug use, and even sales performance), in the prediction of adaptive and maladaptive disinhibited approach (sales performance versus alcohol and drug use) with different samples (workers, schoolchildren, and students), and in two different countries (UK in Study 7 and Australia in all the other studies).

As well as the robustness of the findings across multiple situations, it is important to take into account effect size to determine the usefulness of the proposed model of disinhibited approach. In Study 5 a change from -1 standard deviation to $+1$ standard deviation from the mean in EPQ neuroticism for people with right ear preference led to a over 3.5 standard deviations of increase in conflict resolution time. In Study 8 the same standard deviation changes in NEO-IPIP neuroticism for people with right ear preference led to over 0.7 standard deviations of increases in alcohol and drug consumption, whereas they were between 0.3 to 0.5 when using the EPQ neuroticism scale. A change from -1 standard deviation to $+1$ standard deviations using the NEO-FFI neuroticism in Study 1 led to a 0.5 standard deviation increase in sales for people with right ear preference but only a .1 standard deviation increase in sales in people who use a right headset. Increases by between .6 to .7 standard deviations of disinhibited approach, rash impulsivity, and practical – reflective scales in Studies 6 and 7 were related to changes from -1 to $+1$ standard deviations of change in neuroticism for people with right ear preference. Effect sizes across the studies therefore range from the relatively modest to very large. Quite why the effect sizes vary so much is difficult to explain, but it may be that Study 5 provided the purest measure of disinhibited approach in the form of response latencies and an actual conflict situation whereas the scales used to represent disinhibited approach in Studies 5 and 6 were more varied in composition and without a direct conflict situation.

Overall, these are significant, meaningful, and robust results, especially given the inherent difficulty of detecting complex moderations in regression.The need for the proposed model of disinhibited approach is clear, since Patterson and Newman's (1993) existing model of disinhibited approach has not performed well when simultaneously included in multiple regression with the proposed model. Studies 1, 5, 6, 7, and 8 did not yield significant extraversion $\times$ neuroticism interactions in the prediction of disinhibited approach and therefore provide virtually no evidence in favour of Patterson and Newman's (1993) existing model of disinhibited approach.

However, the current research does provide general evidence of an *independent* extraversion main effect (consistent with the idea that disinhibited approach is related to the approach system), and also occasional evidence of an extraversion $\times$ ear preference interaction. These observations

suggest that extraversion predicts impulsive-like behaviour, both alone and in conjunction with right ear preference. These findings support previous research, which also argues that the cluster of traits associated with extraversion and approach are likely to predict impulsivity (which, in terms of displayed behaviour can be argued to be very similar to disinhibited approach; e.g., Newman et al., 1985; Patterson et al., 1987; Patterson & Newman, 1993). Overall this research therefore provides solid evidence of two independent approach mechanisms underlying disinhibited approach. In fact, the occasional evidence of an extraversion × ear preference interaction is to be expected if ear preference is a marker of action goal formation, since action goal formation could be expected to amplify the effects of extraversion in the prediction of impulsive-like behaviour.

All this leads to the notion that impulsiveness and disinhibited approach could be thought of as highly related behaviours, but with different neurobiological underpinnings. Impulsiveness and its associated cluster of traits seem more easily understood in terms of general approach behaviour such as stimulus-seeking curiosity (Raine, Reynolds, Venables, & Mednick, 2002), a desire to explore and learn about the environment (Jackson, 2002, 2005a, in press; O'Connor & Jackson, in press), or simply a desire to forge ahead without the motivation to plan in advance. Here, impulsivity is seen as being derived from an approach-type mechanism, which in the current research is represented by extraversion (e.g., Carver et al., 2000; Depue & Collins, 1999; Smillie et al., 2006a). In terms of behaviour, disinhibited approach may appear to be similar to impulsivity in terms of actual behaviour, but it may be construed as stemming from a neurotic person's fast action goal formation tendencies. Altogether, the current research argues for two approach mechanisms—one associated with extraversion which leads to impulsive behaviour and the other associated with the avoidance system (represented by a neuroticism × ear preference interaction) which leads to disinhibited approach.

Another perspective on the current research is that it reconciles the ways in which different researchers have understood the role of neuroticism in the prediction of disinhibited approach. Patterson and Newman (1993) argue for a positive relationship, while others, including Fowles (1980, 1993) and Gray and McNaughton (1983), argue for a negative association. In reality, there is a general finding in the literature of a varied or even a null main effect of neuroticism in the prediction of general approach behaviours (e.g., in meta-analyses of work performance, Tett et al., 1991; in the prediction of drug and alcohol use, Cloninger et al., 1988; Shadel et al., 2000). These viewpoints can be reconciled by noting that a positive association between neuroticism and disinhibited approach is likely to be found in people with right ear preference, and a null relationship is likely in people with a left ear

preference. Such findings are important for integrating divergent theories of disinhibition in which the role of neuroticism remains poorly understood.

In general, the focus of the current research has *not* been on how disinhibited approach is related to perseverance of approach in the face of punishment. This contrasts with the broader definition of disinhibited approach, which is associated with perseverance in previously rewarded responses despite punishment (Newman et al., 1985; Patterson et al., 1987). However, while not directly measured in the current research, the dependent variables in Studies 1, 5, 6, 7, and 8 are likely to indirectly contain this element of perseverance in the face of punishment. For example, disinhibited sales staff are likely to achieve greater sales performance as a result of appetitive conditioning towards achieving the sale, *and* resistance to continued exposure to punishing stimuli (i.e., abusive, indifferent, and negative customers) as argued by Seligman and Schulman (1986).

Studies 5, 6, 7, and 8 show that ear preference acts as a moderator of neuroticism in the prediction of disinhibited approach *outside* the ear domain. This is a key feature of the research, because it indicates ear pathways are acting as a marker of internal mechanisms, as opposed to acting passively as receptors of environmental cues (Previc, 1991) or resulting from peripheral cochlear mechanisms. Moreover, ear preference is designed to be an index of habitual lateral preference over many different situations so this also rules out ear preference being mainly predicted by specific and trivial environmental variables related to hearing (e.g., Furnham et al., 1997b). Together with its moderate correlation with other measures of lateral preference, all this adds further evidence in favour of the proposed contralateral relationship between ear preference and hemispheric preference. Such a central role for ear pathways in laterality was foreseen by Previc (1991). Clearly, more research will provide answers concerning the parameters of this developing model of ear preference, laterality, and its potential therapeutic possibilities.

There is also reason to believe that the effects of lateralised preferences on personality might be complex in ways that have yet to be explored. Personality scales other than just neuroticism are moderated by lateral preferences (e.g., in the present research, ear preference moderated extraversion on occasion and Jackson et al., 2001, reported interactions with social desirability). Another complexity that has not been reported in this current research is that there are occasional interactions between non-ear lateral preference measures and personality in the prediction of disinhibited approach and associated measures. The current research and these other results suggest that interactions between lateral preference and personality is a promising but complex new area of research.

Limitations

Five important limitations to this research need to be noted. First, no claims can be made with regard to more serious forms of disinhibited approach, such as clinical psychopathy or clinical addiction to alcohol and drugs, since no data about these are presented.

Second, causality has not been tested in the proposed model. Theory such as that presented by Patterson and Newman (1993) suggests that it is appropriate to predict disinhibited approach from neuroticism, rather than the other way round. Disinhibited approach is argued to be the result of the way conflict is resolved and therefore disinhibited approach is sensibly seen as arising from neuroticism. However, a theoretically sound argument can be made that ear preference should act as a moderator of disinhibited approach in the prediction of neuroticism. From an evolutionary perspective this conceptualisation of the relationship might have particular appeal, since it could be argued that approach should evolve first, followed by some mechanism to inhibit approach.

Third, it is important to remember that the links between ear preference and hemispheric preference, and between the left hemisphere and action goal formation, both remain contentious conclusions within their specific literatures. The robustness of the present results provides further evidence in favour of such conclusions but the precise nature of ear preference, like so many variables associated with laterality research, remains somewhat confused.

Fourth, power is a common problem in studies that use hierarchical moderated multiple regression procedures and this is a limitation for the current research. Nevertheless, consistent replication across multiple diverse studies suggests that the reported findings are robust and generalisable.

Fifth, most of the studies comprise a majority of females and this might affect results.

In summary, a new model is presented which argues that disinhibited approach can be predicted from the interaction between neuroticism and ear preference as well as an independent extraversion effect. A range of diverse studies support the proposed model.

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REFERENCES

Albano, A. M., Chorpita, B. F., & Barlow, D. H. (1996). Childhood anxiety disorders. In E. J. Mash & R.A. Barley (Eds.), *Child psychopathology* (pp. 196–241). New York: Guilford Press.

Avil, C., Molto, Â. J., Segarra, P., & Torrubia, R. (1995). Sensitivity to primary or secondary reinforcers, what is the mechanism underlying passive avoidance deficits in Extraverts? *Journal of Research in Personality*, *29*, 373–394.

Barkley, R. A. (1997). Behavioural inhibition, sustained attention, and executive function: Constructing a unified theory of ADHD. *Psychological Bulletin*, *121*, 65–94.

Cacioppo, J. T., & Petty, R. E. (1980). The effects of orienting task on differential hemispheric EEG activation. *Neuropsychologia*, *18*, 675–683.

Carver, C. S., Scheier, M. F., & Weintraub, J. K. (1989). Assessing coping strategies: A theoretically based approach. *Journal of Personality and Social Psychology*, *56*, 267–283.

Carver, C. S., Sutton, S. K., & Scheier, M. F. (2000). Action, emotion, and personality: Emerging conceptual integration. *Personality and Social Psychology Bulletin*, *26*, 741–751.

Carver, C. S., & White. T. (1994). Behavioural inhibition, behavioural activation, and affective responses to impending reward and punishment: The BIS/BAS scales. *Journal of Personality and Social Psychology*, *67*, 319–333.

Cloninger, C. R., Sigvardsson, S., & Bohman, M. (1988). Childhood personality predicts alcohol abuse in young adults. *Alcoholism: Clinical and Experimental Research*, *12*, 494–505.

Coren, S., Porac, C., & Duncan P. (1979). A behaviourally validated self report inventory to assess four types of lateral preferences. *Journal of Clinical Neuropsychology*, *1*, 55–64.

Corr, P. C. (2006). *Understanding biological psychology.* Oxford, UK: Blackwell.

Costa P. T., & McCrae, R. R. (1992). *Revised NEO Personality Inventory (NEO-PI-R) and the NEO Five-Factor Inventory (NEO-FFI): Professional manual*. Odessa, FL: Psychological Assessment Resources, Inc.

Davidson, R. J. (1995). Cerebral asymmetry, emotion and affective style. In R. J. Davidson & K. Hugdahl (Eds), *Brain asymmetry* (pp. 361–387). Cambridge, MA: MIT Press.

Davidson, R. J. (1998). Affective style and affective disorders: Perspectives from affective neuroscience. *Cognition and Emotion*, *12*, 307–330.

Davidson, R. J., Ekman, P., Saron, D. D., Senulis, J. A., & Friesen, W. V. (1990). Approach-withdrawal and cerebral asymmetry: Emotional expression and brain physiology. *Journal of Personality and Social Psychology*, *58*, 330–341.

Davidson, R. J., & Sutton, S. K. (1995). Affective neuroscience: The emergence of a discipline. *Current Opinion in Neurobiology*, *5*, 217–224.

De Fruyt, P., & Salgado, J. F. (2003). Applied personality psychology: Lessons learned from the IWO field. *European Journal of Personality*, *17*, 123–131.

Dean, R. S., & Reynolds, C. R. (1997). Cognitive processing and self-report of lateral preference. *Neuropsychological Review*, *7*, 127–142.

Depue, R. A., & Collins, P. F. (1999). Neurobiology of the structure of personality: Dopamine, facilitation of incentive motivation and Extraversion. *Behavioural and Brain Sciences*, *22*, 491–517.

Dickman, S. J. (1990). Functional and dysfunctional impulsivity: Personality and cognitive correlates. *Journal of Personality and Social Psychology*, *58*, 95–102.

Dollard, J., & Miller, N. E. (1950). *Personality and psychotherapy: An analysis in terms of learning, thinking and culture*. New York: McGraw-Hill

Eysenck, H. J. (1967). *The biological basis of personality.* Springfield, IL: Thomas.

Eysenck, H. J., Barrett, P., Wilson, G., & Jackson, C. (1992). Primary trait measurement of the 21 components of the P-E-N system. *European Journal of Psychological Assessment*, *8*, 109–117.

Eysenck, S. B. G., Eysenck, H. J., & Barrett, P. (1985). A revised version of the psychoticism scale. *Personality and Individual Differences*, *6*, 21–29.

Fowles, D. C. (1980). The three arousal model: Implications of Gray's two-factor earning theory for heart rate, electrodermal activity, and psychopathy. *Psychophysiology*, *17*, 87–104.

Fowles, D. C. (1988). Psychophysiology and psychopathology: A motivational approach. *Psychophysiology*, *25*, 373–391.

Fowles, D. C. (1993). Electrodermal activity and antisocial behaviour: Empirical findings and theoretical issues. In J. C. Roy, W. Boucsein, D. Fowles, & J. Gruzelier (Eds.), *Experimental personality and psychopathology research* (pp. 263–284). New York: Springer Publishing Company.

Furnham, A., Crump, J., & Whelan, J. (1997a). Validating the NEO personality inventory using assessors' ratings. *Personality and Individual Differences*, *22*, 669–675.

Furnham, A., Richardson, S., & Miller, T. (1997b). Ear dominance and telephone sales. *Perceptual and Motor Skills*, *85*, 451–457.

Gray, J. A. (1987). *The psychology of fear and stress*. Cambridge, UK: Cambridge University Press.

Gray, J. A., & McNaughton, N. (1983). Comparison between the behavioural effects of septal and hippocampal lesions: A review. *Neuroscience and Biobehavioural Reviews*, *7*, 119–188.

Hagemann, D., Naumann, E., Backer, G., Maier, S., & Barussek, D. (1998). Frontal brain asymmetry and affective style: A conceptual replication. *Psychophysiology*, *35*, 372–388.

Harmon-Jones, E., & Allen, J. J. (1997). Behavioural activation sensitivity and resting frontal EEG asymmetry: Covariation of putative indicators related to risk for mood disorders. *Journal of Abnormal Psychology*, *106*, 159–163.

Harrington, D. L., & Haaland, K. Y. (1999). Neural underpinnings of temporal processing. *Review of Neuroscience*, 10, 91–116

Hazeltine, E., Helmuth, L. L., & Ivry, R. B. (1997). Neural mechanisms of timing. *Trends in Cognitive Science*, *1*, 163–169.

Heller, W., Nitschke, J. B., Etienne, M. A., & Miller, G. A. (1997). Patterns of regional brain activity differentiate types of anxiety. *Journal of Abnormal Psychology*, *106*, 376–385.

Hewig, J., Hagemann, D., Seifert, J., Naumann, E., & Bartussek, D. (2004). On the selective relation if frontal cortical asymmetry and anger-out versus anger-control. *Journal of Personality and Social Psychology*, *87*, 926–939.

Hough, L. M., & Oswald, F. L. (2000). Personnel selection: Looking toward the future – remembering the past. *Annual Review of Psychology*, *51*, 631–664.

International Personality Item Pool. (2001). A scientific collaboratory for the development of advanced measures of personality traits and other individual differences. Retrieved June 1, 2007, from http://ipip.ori.org/

Jaccard, J., Turrisi, R., & Wan, C. K. (1990). *Interaction effects in multiple regression [Sage University paper series on quantitative applications in the social sciences]*. Newbury Park, CA: Sage.

Jackson, C. J. (2001). Comparison between Eysenck's and Gray's models of personality in the prediction of motivational work criteria. *Personality and Individual Differences*, *31*, 129–144.

Jackson, C. J. (2002). *Learning style and its measurement*. Sydney: Cymeon.com

Jackson, C. J. (2005a). The neuropsychological model of learning and its application to business, education, training and clinical psychology. Sydney: Cymeon.com

Jackson, C. J. (2005b). How preferred ear for listening moderates emotional cognitions in the prediction of personality. *Laterality: Asymmetries of Body, Brain, and Cognition*, *10*, 305–320.

Jackson, C. J. (2008). Prediction of hemispheric asymmetry as measured by handedness from digit length and 2D:4D digit ratio. *Laterality,* 13, 34–50.

Jackson, C. J. (in press). Measurement issues concerning a personality model spanning temperament, character and experience. In G. Boyle, G. Matthews, & D. Saklofske (Eds.), *Handbook of personality and testing.* New York: Sage Publishers.

Jackson, C. J., Furnham, A., Forde, L., & Cotter, T. (2000). The dimensional structure of the Eysenck Personality profiler. *British Journal of Psychology*, *91*, 223–240.

Jackson, C. J., Furnham, A., & Miller, T. (2001). Moderating effect of ear preference on personality in the prediction of sales performance. *Laterality: Asymmetries of Body, Brain, and Cognition*, *6*, 133–140.

Jackson, C. J., & Smillie, L. D. (2004). Appetitive motivation predicts the majority of personality and an ability measure: A comparison of BAS measures and a re-evaluation of the importance of RST. *Personality and Individual Differences*, *36*, 1627–1636.

Johnson, S. L., Turner, R. J., & Iwata, N. (2003). BIS/BAS levels and psychiatric disorder: An epidemiological study. *Journal of Psychopathology and Behavioural Assessment*, *25*, 25–36.

Jones, M. C. (1968). Personality correlates and antecedents of drinking patterns in adult males. *Journal of Consulting and Clinical Psychology*, *32*, 2–12.

Jones, M. C. (1971). Personality antecedents of drinking patterns in women. *Journal of Consulting and Clinical Psychology*, *36*, 61–69.

Khavari, K. A., & Farber, P. (1978) The Khavari alcohol test. *Journal of Studies on Alcohol*, *39*, 1525–1539.

Khavari, K. A., Humes, M., & Mabry, E. (1977). Personality correlates of hallucinogenic drug use. *Journal of Abnormal Psychology*, *86*, 172–178.

Kimura, D. (1967). Functional asymmetry of the brain in dichotic listening. *Cortex*, *3*, 163–178.

Kinsbourne, M. (1970). The cerebral basis of lateral asymmetries in attention. *Acta Psychologica*, *33*, 193–201.

Kinsbourne, M. (1997). Mechanisms and development of hemispecialization in children, In E. Fletcher-Janzen & C. R. Reynolds (Eds.), *Handbook of clinical child neuropsychology* (2nd ed., pp. 102–119). New York: Plenum.

Larson, L. M., Rottinghaus, P. I., & Borgen, F. H. (2002). Meta-analyses of big six interests and big five personality factors. *Journal of Vocational Behavior*, *61*, 217–239.

Liappas, J., Paparrigopoulos, T., Tzavellas, E., & Christodoulou, G. (2002). Impact of alcohol detoxification on anxiety and depressive symptoms. *Drug and Alcohol Dependency*, *68*, 215–220.

Loxton, N. J., & Dawe, S. (2001). Alcohol abuse and dysfunctional easting in adolescent girls: The influence of individual differences in sensitivity to reward and punishment. *International Journal of Eating Disorders*, *29*, 455–462.

Mann, L. M., Chassin, L., & Sher, K. J. (1987). Alcohol expectancies and risk for alcoholism. *Journal of Consulting and Clinical Psychology*, *55*, 411–417.

McAlister, A., Pachana, N., & Jackson, C. J. (2005). Predictors of young dating adults' inclination to engage in extradyadic sexual activities: A multi-perspective study. *British Journal of Psychology*, *96*, 331–350.

McCrae, R. R., & Costa, P. T. (1987). Validation of the five-factor model of personality across instruments and observers. *Journal of Personality and Social Psychology*, *52*, 81–90.

McCrae, R. R., & Costa, P. T. (1992). Discriminant validity of the NEO-PI-R facet scales. *Educational and Psychological Measurement*, *52*, 229–237.

McCrae, R. R., Costa, P. T., & Piedmont, R. L. (1993). Folk concepts, natural language and psychological constructs: The California Psychological Inventory and the five-factor model. *Journal of Personality*, *61*, 1–26.

Miller, E. K., & Cohen, J. D. (2001). An integrative theory of prefrontal cortex function. *Annual Review of Neuroscience*, *24*, 167–202.

Newman, J. P., & Kosson, D. S. (1986). Passive avoidance learning in psychopathic and nonpsychopathic offenders. *Journal of Abnormal Psychology*, *95*, 252–256.

Newman, J. P., & Wallace, J. F. (1993). Diverse pathways to deficient self-regulation: Implications for disinhibitory psychopathology in children. *Clinical Psychology Review*, *13*, 690–720.

Newman, J. P., Widom, C. S., & Nathan, S. (1985). Passive avoidance in syndromes of approach behaviour: Psychopathy and extraversion. *Journal of Personality and Social Psychology*, *48*, 1316–1327.

Nigg, J. T. (2000). On inhibition/approach behaviour in developmental psychopathology: Views from cognitive and personality psychology and a working inhibition taxonomy. *Psychological Bulletin*, *126*, 220–246.

O'Connor, P. J., & Jackson, C. J. (in press). Learning to be saints or sinners: The mediating effect of responsibility on impulsivity. *Journal of Personality.*

Ones, D. S., Viswesvaran, C., & Schmidt, F. L. (2003). Personality and absenteeism: A meta-analysis of integrity tests. *European Journal of Personality*, *17*, 19–38.

Papousek, I., & Schulter, G. (2002). EEG correlates of behavioural laterality: Ear dominance. *Perceptual and Motor Skills*, *94*, 355–362.

Patterson, C. M., Kosson, D. S., & Newman, J. P. (1987). Reaction to punishment, reflectivity and passive avoidance learning in extraverts. *Journal of Personality and Social Psychology*, *52*, 565–575.

Patterson, C. M., & Newman, J. P. (1993). Reflectivity and learning from aversive events: Towards a psychological mechanism for the syndromes of approach behaviour. *Psychological Review*, *100*, 716–736.

Petrides, K. V., Jackson, C. J., Furnham, A., & Levine, S. Z. (2003). Exploring issues of personality measurement and structure through the development of a revised short form of the Eysenck Personality Profiler. *Journal of Personality Assessment*, *81*, 272–281.

Previc, F. H. (1991). A general theory concerning the prenatal origins of cerebral lateralisation in humans. *Psychological Review*, *98*, 299–334.

Quilty, L. C., & Oakman, J. M. (2004). The assessment of behavioural activation: The relationship between impulsivity and behavioural activation. *Personality and Individual Differences*, *37*, 429–442.

Raine, A., Reynolds, C., Venables, P. H., & Mednick, S. A. (2002). Stimulation seeking and intelligence: A prospective longitudinal study. *Journal of Personality and Social Psychology*, *82*, 663–674.

Schmidt, F. L., & Hunter, J. E. (1998). The validity and utility of selection methods in personnel psychology: Practical and theoretical implications of 85 years of research findings. *Psychological Bulletin*, *124*, 262–274.

Seligman, M. E., & Schulman, P. (1986). Explanatory style as a predictor of productivity and quitting among life insurance sales agents. *Journal of Personality and Social Psychology*, *50*, 832–838.

Shadel, G. S., Niaura, R., Goldstein, M. G., & Abrams, D. B. (2000). Does the five factor model of personality apply to smokers? A preliminary investigation. *Journal of Applied Biobehavioural Research*, *5*, 114–120.

Sher, K. J., & Trull, T. J. (1994). Personality and approach behaviour in psychopathology: Alcoholism and antisocial personality disorder. *Journal of Abnormal Psychology*, *103*, 92–102.

Skinner, H. A. (1982). Drug Abuse Screening Test. *Addictive Behaviours*, *7*, 363–371.

Smillie, L. D., Pickering, A. D., & Jackson, C. J. (2006a). The new RST: Recent revisions to reinforcement sensitivity theory, and implications for psychometric measurement. *Personality and Social Psychology Review*, 10, 320–335.

Smillie, L., Yeo, G., Furnham, A., & Jackson, C. J. (2006b). Benefits of all work and no play: The relationship between neuroticism and performance as a function of resource allocation. *Journal of Applied Psychology*, *91*, 139–155.

Smillie, L. D., & Jackson, C. J. (2006). Functional impulsivity and reinforcement sensitivity theory. *Journal of Personality*, *74*, 47–83.

Sobotka, S. S., Davidson, R. J., & Senulis, J. A. (1992). Anterior brain electrical asymmetries in response to reward and punishment. *Electroencephalography and Clinical Neurophysiology*, *83*, 236–247.

Springer, S., & Deutsch, G. (1993). *Left brain, right brain* (3rd ed.). New York: Freeman.

Sutton, S. K., & Davidson, R. J. (1997). Prefrontal brain asymmetry: A biological substrate of the behavioural approach and inhibition systems. *Psychological Science*, *8*, 204–210.

Sutton, S. K., & Davidson, R. J. (2000). Prefrontal brain electrical asymmetry predicts the evaluation of affective stimuli. *Neuropsychologia*, *38*, 1723–1733.

Tett, R. P., Jackson, D. N., & Rothstein, M. (1991). Personality measures as predictors of job performance: A meta-analytic review. *Personnel Psychology*, *44*, 703–742.

Tomarken, A. J., Davidson, R. J., Wheeler, R. E., & Doss, R. C. (1992). Individual differences in anterior brain asymmetry and fundamental dimensions of emotion. *Journal of Personality and Social Psychology*, *62*, 676–687.

Wheeler, R. E., Davidson, R. J., & Tomarken, A. J. (1993). Frontal brain asymmetry and emotional reactivity: A biological substrate of affective style. *Psychophysiology*, *30*, 82–89.

White, L. E., Lucas, G., Richards, A., & Purves, D. (1994). Cerebral asymmetry and handedness. *Nature*, *368*, 197–198.