Article

Measuring Behavioral Inhibition and Behavioral Activation in Older Adults: Construct Validity of the Dutch BIS/BAS Scales

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Abstract

Research on the validity of the behavioral inhibition system/behavioral approach system (BIS/BAS) scales focused on adolescent, student and adult populations. This study is the first to examine the psychometric properties of the BIS/BAS scales in a community ($n = 368$) and a clinical sample ($n = 160$) of older adults. Exploratory structural equation modelling with target rotation to the Carver and White model supported the construct validity of the BIS/BAS scales. Internal consistencies of the scales were generally satisfactory. Female participants scored higher on BIS and BAS-Reward Responsiveness compared with males. The community-dwelling sample scored higher on BAS-Drive and BAS-Reward Responsiveness compared with the clinical sample. Concerning the nomological net, BIS was positively related to Anxiety, Depression, maladaptive coping strategies, Neuroticism and Cluster C personality disorders. BAS was positively related to Openness, Extraversion, Active Confronting and Cluster B personality disorders and negatively related to the schizoid personality disorder. The BIS/BAS Scales are a useful instrument for measuring Gray's theory of personality in older adults.

Keywords

older adults, personality assessment, behavioral inhibition, behavioral activation, construct validity, factor structure

The reinforcement sensitivity theory (RST) developed by Gray (1970, 1981) started off as a neurobiological explanation for inhibited and activated approach behavior in animal research. It was not applied to human personality until much later, as a theoretical framework in personality assessment of emotional and motivational processes (Gray, 1981; Smillie et al., 2006). According to Gray (1981), RST comprised two main factors: a behavioral inhibition system (BIS) and a behavioral activation system (sometimes referred to as behavioral approach system; BAS). BIS represented a feedback mechanism that responded to stimuli considered as punishment or termination of reward by an individual. At its counterpart, BAS responded to stimuli that were regarded as a reward or an ending of punishment, as perceived by the individual. The bilateral functioning of BIS and BAS gave expression to an individual's emotions and motivations, which Gray proposed to be the underlying process of trait dimensions (Gray, 1982, 1991). An active BIS is indeed associated with emotions of anxiety and with neuroticism, while BAS is associated with impulsivity and with extraversion or hope (Gable et al., 2000; Smillie et al., 2006; Smits & De Boeck, 2006). RST as such became a renowned theory in personality research and its appliance has become indispensable (Corr, 2009).

In 2000, Gray and McNaughton proposed a revision of the RST (r-RST): While BAS stays essentially the same, BIS is reconceptualized as a conflict detector and regulator of conflicting or novel stimuli. Its main liability is to either reduce or resolve a conflict by engaging the innovated flight-fright-freeze system (FFFS); or by inhibiting behavior (Gray & McNaughton, 2000).

The most popular instrument to assess RST, are the BIS/BAS Scales introduced by Carver and White in 1994. The instrument can be considered as an orthogonal approach of measuring BIS and BAS, respectively as anxiety and impulsivity (Carver & White, 1994; McFarland & Hornsby, 2016), capturing how sensitivity to the scales affects an individual's emotional experience. More specifically, the

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measure comprises four scales: one unidimensional BIS-scale, and three BAS-scales: BAS-Drive, BAS-Reward Responsiveness and BAS-Fun Seeking. BIS items are developed to gauge sensitivity to specific negative situations or negative emotions that stem from such situations (e.g. "I feel worried when I think I have done poorly at something important"). These negative incentives are often socially characterized. On the other hand, BAS items attempt to assess how an individual responds to reinforcement (BAS-Reward Responsiveness; e.g. "It would excite me to win a contest"); how motivated an individual is to pursue such a reinforcement (BAS-Drive; e.g. "I go out of my way to get things I want"); and how much they crave new, potentially reinforcing stimuli (BAS-Fun Seeking; e.g. "I crave excitement and new sensations"; Carver & White, 1994).

Multiple studies have validated the BIS/BAS Scales in numerous translations (e.g. Franken et al., 2005; Heubeck et al., 1998; Jorm et al., 1999; Leone et al., 2001; Smits & De Boeck, 2006). In these studies, BIS has found to be strongly related to neuroticism and measures of anxiety and even depression, while it is negatively related to measures of psychoticism. BAS subscales are always found to be highly related to one another, and they also show at least a small positive correlation ($>.20$) with Extraversion. BAS-Drive especially correlates positive with Impulsivity (Franken et al., 2005).

Some studies (e.g. Corr, 2009; Harmon-Jones, 2003) also accentuate that BIS and BAS are not exclusively related to emotions and motivations but can, among others, be considered as more broadly related to coping-styles. For instance, a study by Smits and Kuppens (2005) found that BIS is more related to an anger-in coping style (i.e., turning anger inward), while BAS is positively linked to anger-out (i.e., express anger outwards, often directed toward the trigger). Hasking (2006) suggests a positive relationship between BIS and maladaptive coping; and a positive relationship between BAS-Reward Responsiveness and problem solving. Sun et al. (2020) examined the mediating role of cognitive emotion regulation in BIS/BAS sensitivity among a community-dwelling, older sample. They found that a higher BIS reactivity was related to maladaptive emotion regulation strategies (e.g. self-blame and rumination), as was the case for higher BAS reactivity and adaptive cognitive emotion regulation strategies (e.g. acceptance and positive reappraisal).

Specifically concerning substance abuse (which is most relevant to our clinical sample), a literature review by Bijttebier et al. (2009) points out that BAS is often found significantly correlated with different kinds of substance abuse. Even in a general sample, an elevated BAS reactivity can be linked to alcohol craving and sensitivity to alcohol cues (Franken, 2002; Zisserson & Palfai, 2007). The relationship between BIS and substance abuse remains unclear (Bijttebier et al., 2009; Santens et al., 2018). Furthermore, several review studies (Bijttebier et al., 2009; Santens et al., 2020) point to the moderating role of self-regulatory temperament ("effortful control") in the relationship between BIS/BAS reactivity and psychopathology. With regard to the substance abuse disorder, Santens et al. (2018) reports three clusters in a clinical sample with substance abuse disorder based on BIS/BAS reactivity and Effortful Control (EC): a resilient group (scoring low on BIS and BAS and high on EC), an anxious group (scoring high on BIS, moderate on BAS and low on EC) and a reward sensitive group (scoring high on BAS, moderate-to-low on BIS and low on EC).

Though most studies confirm the validity and reliability of the BIS/BAS Scales, some important limitations are at hand. An important critique from the research field is that the division of a unidimensional BIS and a multidimensional BAS cannot be theoretically motivated (Corr, 2016). Some psychometric studies indicate BIS to be structurally divided in two subscales: BIS and FFFS (e.g. Beck et al. 2009; Heym et al., 2008; Poythress et al., 2008). However, the FFFS-scale would only include two or three items which are reverse-scored. This suggests that a multidimensional BIS might just be a psychometric artefact. Overall, the assessment of the psychometric properties has been rather limited in the sense that most studies use a homogenous sample of Caucasian adults or college students who endured similar levels of education. So far, insufficient research has been performed on the effect of age on BIS/BAS Scales or even on the RST as a theoretical framework. This is most certainly necessary given the practical appliance of the measure in social services and mental health care.

Older age has been linked to changing personality which might affect the current understanding of BIS and BAS. For instance, a literature review by Debast et al. (2014) concluded that both cross-sectional and longitudinal studies pointed out that personality characteristics do change over the life span of an individual. Specifically, the traits neuroticism, extraversion, and openness tend to decrease over time, while agreeableness and conscientiousness tend to expand over the course of a lifetime. Given the relations between BIS and neuroticism and BAS and extraversion, one might expect BIS and BAS sensitivity to decline over age. Considering specifically emotions and motivation, the socioemotional selectivity theory (Carstensen et al., 2003) has been widely accredited. The socioemotional selectivity theory postulates that individuals who perceive time as limited, will focus less on negative thoughts and are less motivated to fulfil long-term goals. These individuals focus more on the present moment, fulfilling short-term goals and warranting positive, meaningful emotions (Carstensen, 2006). When people age, they might be confronted with the limits of their future time. This shift in an individual's motivation might also have implications for the expression of

the behavioral inhibition and behavioral activation systems. A question that raises is whether this shift in expression can be reproduced by the BIS/BAS Scales of the instrument. So far, the few studies that have been executed confirmed this hypothesis. Jorm et al. (1999) found that a sample of older aged adults (50-79 years old) scored significantly lower on both BIS and BAS-scales in comparison with age groups of 18 to 29 and 40 to 49 years old. Furthermore, in this study, the sample of older aged adults displayed a larger gender difference for BAS-Drive and showed more variation in BAS scores. These results comply with findings by Eysenck et al. (1985) who consistently found lower scores on Neuroticism and Extraversion in an older aged sample. Another interesting longitudinal study is executed by Windsor et al. (2012) and confirms these results. Despite some studies examining the effect of age on the BIS/BAS Scales, nowadays, there are no studies on the factor structure or the nomological net of the BIS/BAS Scales in older adults.

Therefore, the main goal of our study is to ascertain whether Carver and White's BIS/BAS Scales can be validated in a sample of older aged adults. More specifically, we will explore the underlying factor structure as well as the internal consistency of the scales. The possible differences between a clinical and a community-dwelling sample in terms of scale means and nomological net will also be examined.

Concerning the factor structure, structural validity will be examined by means of exploratory structural equation modelling (ESEM), with target rotation to the factors and subscales of the Carver and White (1994) model. We hypothesize to realize at least a comparable four-factor structure, in analogy to the one found by Franken et al. (2005): comparative fit index (CFI) = .83, root mean squared error of approximation (RMSEA) = .07, and χ^2/ degrees of freedom (*df*) quotient = 2.0 who examined the Dutch BIS/BAS Scales in a sample of 246 undergraduate students. In analogy to Jorm et al. (1999; age range in that study was 18-79 years, thus included older adults), we will also fit a two-factor structure—with BAS as one unitary factor—but we expect the two-factor model to perform significantly worse than the four-factor model (as seen in Heubeck et al., 1998; Leone et al., 2001; Ross et al., 2002). Regarding internal consistency, we expect to find at least sufficient reliability indices for all scales ($\alpha > .60$), congruent with Franken et al. (2005).

Differences between a community-dwelling and clinical sample and gender differences will be explored. In terms of differences between subgroup (community-dwelling vs. clinical), our analysis is rather exploratory. As pointed out earlier, the relationship between BIS/BAS and substance abuse is unclear (Bijttebier et al., 2009) and might be dependent of the cluster (Santens et al., 2018) being resilient, anxious or reward sensitive. With regard to gender, we expect that female participants will show a higher BIS sensitivity

(Jorm et al., 1999) which is congruent with their higher scores on neuroticism (Jorm, 1987). Additionally, we hypothesize that females score higher on BAS-Reward Responsiveness, as literature points out that reward responsiveness has a component of neuroticism and negative affectivity on which female participants incline to score higher than males (Jorm et al., 1999; Ross et al., 2002).

As stated before, the research on older adults in terms of BIS and BAS is rather sparse. We do have a similar sample of community-dwelling older adults that has been used in the research by Jorm et al. (1999). We expect scores in the community-dwelling sample of older adults to be similar to the results reported by Jorm et al. (1999) by gender in the age group of 60 to 69 and 70-79 years.

Last, we examined the nomological net of the BIS/BAS Scales in older adults. We hypothesize that BIS will show significantly positive correlations with neuroticism, with anxiety and depression, and with avoidant, obsessive–compulsive and depressive personality disorders (Cluster C) and the borderline personality disorder. Carver and White (1994) stated earlier that a higher BIS activation can make an individual behaviorally inhibited, meaning to avoid any confrontation or negative outcome, which in turn can lead to more frustration and anxiety. We consequently expect BIS to be related to avoiding, passive coping strategies, as was the case in a study by Sun et al. (2020). We hypothesize BAS to be positively correlated to extraversion, adaptive coping strategies such as seeking social support, expressing emotions and reassuring thoughts, and cluster B scales (Sun et al., 2020). We expect BAS to be negatively related to avoidant personality disorder. We expect no significant correlation with the Cluster A disorders since literature points out a mixture of both BIS and BAS sensitivity is represented (Claes et al., 2009; Pastor et al., 2007)

This study should allow for a better comprehension of the BIS/BAS constructs and of the consistency of their assessment across age-groups. This will be important for the utility of the BIS/BAS Scales in clinical practice and psychodiagnostics specifically for older adults. Moreover, the implications of this study might contribute to a better understanding of the BIS and BAS concepts in an older aged population, since literature on the subject is rather sparse.

Method

Participants and Procedure

For the clinical sample, patients consecutively admitted to a psychogeriatric ward of a residential psychiatric hospital in Flanders between November 2013 and May 2020 were included in the study. Other patients from the same psychiatric ward were also included as long as they were 60 years old or older. Within the first three weeks of their admission, as part of their assessment, patients filled in a standardized

set of instruments and signed an informed consent that allowed the use for research objectives. Research procedures were approved by the internal ethics committee of the hospital and the medical ethical committee of the University Hospital Brussels and Vrije Universiteit Brussel (VUB). Patients with degenerative disorders (such as dementia) and/or patients with a Mini Mental State Examination score below 24 (Folstein et al., 1975; Kok & Verhey, 2002) were excluded from the study as they were assumed not being capable of filling out the questionnaires due to cognitive limitations.

The community-dwelling sample was collected through snowball sampling by VUB undergraduate psychology students between September 2017 and February 2020 to complete their master thesis. Participants were contacted by email or phone. After this first contact, there was a face-to-face appointment where the participants were informed about the study and they received an informed consent, which explained that participation was voluntary, unpaid, and could be stopped at any moment. After signing this consent form, participants were screened to exclude cognitive impairment (older adults scoring lower than the conventional cut-off of 24 on the Mini Mental State Examination were excluded) and to ensure a healthy sample, older adults with clinical diagnoses were excluded (by administering the Mini International Neuropsychiatric Interview 5.0; Overbeek et al., 1999).

In analogy to the clinical sample, where patients can be admitted from the age of 60 years, data sampling in community-dwelling adults started at the age of 60 years. There was no preconceived ceiling age. The clinical sample consisted of 160 participants (M_{age} = 67.56; SD = 4.95; age range 60-82 years) of whom 52.20% were male. In terms of primary diagnosis, most patients suffered from a substance-related disorder (77.54%). The other patients were diagnosed with a mood disorder (14.49%) and a smaller number was diagnosed with anxiety disorders (2.90%), autism spectrum disorders (0.72%), adjustment disorders (1.45%), post-traumatic stress disorder (0.72%), severe and persistent grief and mourning reaction (0.72%), and psychotic disorders (1.45%). The community-dwelling sample comprised 368 participants (M_{age} = 70.33; SD = 7.26; age range 60-93 years) of whom 42.93% were male. In terms of education, 30.60% completed higher education, 31.97% completed secondary education and 37.43% completed basic education or less. In total, a sample of 528 adults was included in the study. In the clinical sample, 59.48% reported taking antidepressant drugs, 20.26% antipsychotic drugs and 24.18% benzodiazepines, in comparison with the community-dwelling sample, respectively, 6.25%, 0.54% and 7.88%.

Instruments

The Dutch version of the BIS/BAS Scales (Franken et al., 2005) comprises 24 items that are to be answered on a 4-point scale ranging from 1 (*totally disagree*) to 4 (*totally agree*). In the Franken et al. study, Cronbach α coefficients for the scales were as follows: BIS (7 items) = .79, BAS-Drive (4 items) = .68, BAS-Fun Seeking (4 items) = .59, and BAS-Reward Responsiveness (5 items) = .61. The remaining 4 items were filler items.

To assess internalizing and externalizing symptoms, the subscales Anxiety and Depression of the revised Symptom Checklist (SCL-90-R; Arrindell & Ettema, 2003) were used. The complete questionnaire comprises 90 items to be scored on a 5-point Likert-type scale ranging from 1 (*not at all*) to 5 (*extremely*). Earlier research supports the instrument in its internal consistency, test–retest reliability and convergent validity (for an overview, see Arrindell et al., 2003). The present sample contributes evidence of internal consistency, with Cronbach α coefficients of respectively α = .87 (Anxiety; 10 items) and α = .92 (Depression; 16 items).

Characteristic coping behavior was measured using the Dutch Utrecht Coping List (UCL; Scheurs et al., 1993). The questionnaire comprises 47 items to be rated on a 4-point Likert-type scale ranging from 1 (*rarely or never*) to 4 (*very often*). Each subscale represents a way of coping with stressful life events. The current study supports the UCL as a reliable measure: Active Confronting (α = .77; 7 items), Seeking Social Support (α = .82; 6 items), Reassuring Thoughts (α = .68; 5 items), Expressing Emotions (α = .53; 3 items), Palliative Reaction (α = .72; 8 items), Passive Reaction (α = .76; 7 items), and Avoiding (α = .70; 8 items).

To assess personality traits, a different measure was used for each subgroup (clinical and community dwelling), focusing on a more maladaptive versus more adaptive range of traits respectively. In the clinical sample, dimensional personality disorder traits were measured through the assessment of the fourth edition of the *Diagnostic and Statistical Manual of Mental Disorders–Fourth edition* (*DSM-IV*; American Psychiatric Association, 1994) Personality Disorder Questionnaire (ADP-IV; Schotte & De Doncker, 1998). The ADP-IV is a self-report inventory comprising 94 items representing *DSM-IV* Axis II criteria, with each personality disorder scale containing 7 to 9 items. Each item examines the presence of a trait, as well as the distress or impairment that it conducts. For the current study, we used dimensional trait scales. The internal consistency of the personality disorder scales was found acceptable in this study, ranging from α = .62 for the Antisocial subscale to α = .85 for the Depressive subscale.

For the community-dwelling sample, we used the Big Five Inventory (BFI; Denissen et al., 2008). BFI measures the big five personality traits through 44 items to be rated on a 5-point Likert-type scale ranging from 1 (*disagree strongly*) to 5 (*agree strongly*). The psychometric properties of the BFI have been found satisfactory (John & Srivastava, 1999).

The current study confirms good internal consistency for the five scales: Openness (α = .79; 10 items), Conscientiousness (α = .73; 9 items), Extraversion (α = .75; 8 items), Agreeableness (α = .65; 9 items) and Neuroticism (α = .72; 8 items).

Statistical Analyses

Construct Validity and Internal Consistency. We used IBM SPSS version 26 and M*plus* version 8 to analyse the data. An ESEM (Asparouhov & Muthén, 2009) with oblique target rotation was applied to the joint sample to evaluate the resemblance with the factor structure outlined by Carver and White (1994) and further confirmed by Franken et al. (2005) and Jorm et al. (1999). A target rotation can theoretically be placed between the mechanical approach of an exploratory factor approach and the hypothesis-driven approach of a confirmatory factor approach (Marsh et al., 2014; Muthén & Muthén, 2008). The target matrix comprised a 'one' for items belonging to that specific factor in Carver and White's (1994) model, and a 'zero' otherwise. As data are scaled on a 4-point Likert-type scale, they are considered ordinal. As such, the parameters of the model were evaluated with weighted least squares means and variances adjusted estimation.

To evaluate model fit, goodness of fit was determined for each model using χ^2, the CFI, and the RMSEA. If χ^2 is insignificant (>.05), the hypothesized model does not significantly deviate from the observed model. Since χ^2 is rather dependent of sample size (Ullman & Bentler, 2009), two additional fit indices are taken into account. CFI analyses fit improvement by assessing the discrepancy between the data and the hypothesized model after controlling for sample size. RMSEA attempts to analyse the discrepancy between the population covariance matrix and the hypothesized model, equally independent of sample size (Ullman & Bentler, 2009). Cut off-values are RMSEA < .10 and CFI >.90 for an adequate model fit; and RMSEA < .05 and CFI > .95 for a good model fit (Hu & Bentler, 1999). The Tucker–Lewis index (TLI; >.95 is indicative for a good fit) and the standardized root mean squared residual (SRMR; <.08 is indicative for a good fit) are added as well (Yu, 2002).

Reliability coefficients of all instruments were determined using Cronbach's α coefficients. The standards formulated by George and Mallery (2003) were used as follows: >.90—excellent; >.80—good; >.70—acceptable; >.60—questionable; >.50—poor; and <.50—unacceptable. Since the BAS subscales consisted of 5 or less items, we additionally computed the average interitem correlation (AIC) as an index of internal consistency. AIC is, contrary to Cronbach's α, independent of the number of items of a scale and should fall in the range of .15 to .50 as a rule of thumb (Clark & Watson, 2019).

Differences in Mean Scores Across Subgroups. To compare the data according to subgroup (clinical sample and the community-dwelling sample) and gender, we used independent samples *t* tests and differences were interpreted according to Cohen *d* effect sizes (*d* = .20 indicates a small effect, *d* = .50 indicates a moderate effect, and *d* = .80 indicates a large effect; Cohen, 1988). Cohen's *d* was also used as an indicator for magnitude of difference between the scores found by Jorm et al. (1999) in older adults and the scores from our community-dwelling sample for a similar age group as reported by the latter authors: 60 to 69 years and 70 to 79 years.

Nomological Net. To examine the external validity of the BIS/BAS Scales, Pearson correlations were computed for the SCL-90, UCL, BFI, and ADP-IV. Next, A Fisher *r*-to-*z* transformation was performed to investigate whether the correlations between BIS/BAS Scales and external validity measures in community-dwelling older adults differed significantly from the correlations in the clinical older adults. The difference between two z-scores was interpreted using Cohen's *q* effect sizes for correlation coefficients (Cohen, 1988): .10—small; .30—medium; and .50—large.

Results

Construct Validity and Internal Consistency

The four-factor (BIS, BAS-Drive, BAS-Fun Seeking and BAS-Reward Responsiveness) model of Carver and White (1994) fitted to our data (Table 1). On item-level, item 7 ("When I get something I want I feel excited and energized"), item 14 ("When I see an opportunity for something I like, I get excited right away"), and item 5 ("I'm always willing to try something new if I think it will be fun") loaded higher on another factor than what was set out by the original model (Table 2). In light of earlier research, a two-factor solution was also fitted: BIS and BAS (as seen in Jorm et al., 1999; Ross et al., 2002). The fit indices for the two-factor solution were considered inadequate (see Table 1 for an overview of the fit indices of the two- and four-factor models).

Concerning reliability, Cronbach's α coefficients and AICs were calculated for the different scales: Cronbach's α was .74 for BIS (7 items; AIC = .29) and .79 for BAS (AIC = .23), with α coefficients for the subscales being .73 for BAS-Drive (4 items; AIC = .41), .49 for BAS-Fun Seeking (4 items; AIC = .19) and .62 for BAS-Reward Responsiveness (5 items; AIC = .26).

Differences in Mean Scores Across Subgroups

When comparing the clinical and the community-dwelling groups (Table 3), a medium difference can be found for

Table 1. Fit Indices for the Exploratory Structural Equation Models (ESEM) ($N = 528$).

Model	$\chi^2(df)$	χ^2/df quotient	RMSEA	90% CI	TLI	CFI	SRMR
Four-factor original model	290.629 (116)**	2.51	.053	[.046, .061]	.925	.954	.034
Two-factor model (BIS and BAS)	674.833 (151)**	4.47	.081	[.075, .087]	.827	.862	.060

Note. df = degrees of freedom; RMSEA = root mean square error of approximation; TLI = Tucker–Lewis index; CFI = comparative fit index; 90% CI = 90% confidence interval of the RMSEA value; BIS = behavioral inhibition system; BAS = behavioral approach system; SRMR = standardized root mean squared residual.
*$p < .05$. **$p < .01$.

BAS-total score ($t = 7.29$; $df = 520$; $p < .01$) and BAS-Drive ($t = 7.93$; $df = 525$; $p < .01$); and a large difference is found for BAS-Reward Responsiveness ($t = 8.31$; $df = 246.47$; $p < .01$), with the community-dwelling groups scoring significantly higher in comparison with the clinical sample. Provided that some significant differences were found in mean score by subgroup, the mean differences in gender were examined for each subgroup separately (Table 4). Female participants were found to score higher on BIS in comparison with male participants. For the community-dwelling sample, females also scored higher on BAS-Reward Responsiveness. These were rather small differences.

A comparison was also made between the 60- to -69 and 70- to -79 aged adults of our community-dwelling sample and the analogue samples by Jorm et al. (1999; see Table 5) per gender. The differences in mean scores are overall small. There are four medium differences between our sample and the sample by Jorm et al.: For the age group 60 to 69 years, a medium difference was found for the female BAS-Drive score ($d = -0.73$). Concerning the age group 70 to 79 years, medium differences were found for the female BAS score ($d = -0.52$), the male BAS-Reward Responsiveness score ($d = -0.70$) and the female BAS-Drive score ($d = -0.70$).

Nomological Net

Internalizing and Externalizing Symptoms. The correlations between the BIS/BAS Scales and the relevant measures (SCL-90-R and UCL) are shown in Table 6. When comparing the clinical sample and the community-dwelling sample through the use of Cohen's q, small effect sizes were found for the BIS-Depression relation. Considering BAS, small effect sizes were found for the relationship between BAS-Reward Responsiveness with Anxiety, Active Confronting and Passive Reaction; for BAS-Drive with BIS, Avoiding, Expressing Emotions and Reassuring Thoughts; for BAS-Fun Seeking with BIS, BAS-Reward Responsiveness, BAS-Drive, Palliative Reaction and Reassuring Thoughts. A medium effect size was only found for the relation between BAS-Reward Responsiveness and BIS. For the majority of the correlations, there were no differences between the subgroups.

Personality and Personality Pathology. The correlations between the BIS/BAS Scales and the relevant measures (ADP-IV and BFI) are shown in Table 7. For the community-dwelling sample, the BFI was measured. BIS correlated significantly positive with Neuroticism ($r = .52$) and negative with Extraversion ($r = -.19$). The BAS subscales correlated positive with Extraversion ($r = .13$-.27). BAS-Drive and BAS-Fun Seeking also correlated with Openness ($r = .21$ and .18, respectively). In the clinical sample, BIS related positively with Borderline ($r = .36$), Histrionic ($r = .35$), and the cluster C-scales ($r = .33$-.40). BAS-Reward Responsiveness correlated negatively with Schizoid PD ($r = -.18$). BAS-Drive correlated with Cluster B ($r = .24$), as did BAS-Fun Seeking ($r = .19$).

Discussion

A self-report measure like the BIS/BAS Scales can be seen as an effective instrument to assess the sensitivity of an individual to BIS and BAS in the social services and mental health care. This study was the first to specifically examine the psychometric properties of the Dutch BIS/BAS Scales in a sample of clinical and community-dwelling older adults. Generally speaking, the results are congruent with the existing research in terms of internal consistency, construct validity, differences in mean scores and nomological net. Additionally, this study extends the current literature by introducing the correlates with coping mechanisms.

The ESEM analyses supported the structure that was originally set out by Carver and White (1994). All fit indices suit the preconceived criteria. Of note is that the four-factor structure offered a significantly better fit in comparison with the two-factor solution. This premise supports the theory that BAS is a multidimensional construct. However, four items did not load as expected. They showed cross loadings or did not load on their designated factor at all. A possible explanation for items 5, 7, and 14 might lie in the convergence between the designated factors BAS-Reward Responsiveness and BAS-Fun Seeking ($r = .23$). Especially since these three items all have an overlapping content considering the thought of

Table 2. Factor Loadings and Correlates of the Four-Factor Solution (*N* = 528).

Scale	Item	Four-factor solution			
		1	2	3	4
BIS	16. If I think something unpleasant is going to happen, I get pretty "worked up."	**0.677**	0.031	0.069	−0.056
	24. I worry about making mistakes.	**0.641**	0.259	−0.108	0.014
	8. Criticism or scolding hurts me quite a bit.	**0.517**	0.040	0.110	0.034
	13. I feel pretty worried or upset when I think or know somebody is angry at me.	**0.629**	0.202	0.064	0.027
	2. Even if something bad is about to happen to me, I rarely experience fear or nervousness.[a]	**−0.588**	0.101	0.090	0.093
	19. I feel worried when I think I have done poorly at something important.	**0.627**	0.213	−0.011	0.001
	22. I have very few fears compared with my friends.[a]	**−0.504**	**0.320**	0.135	0.017
BAS-Reward Responsiveness	7. When I get something I want I feel excited and energized.	0.214	−0.007	**0.386**	0.242
	4. When I'm doing well at something, I love to keep at it.	0.003	**0.653**	−0.272	0.200
	18. When good things happen to me, it affects me strongly	0.361	**0.535**	0.063	0.062
	23. It would excite me to win a contest.	0.083	**0.604**	−0.022	0.050
	14. When I see an opportunity for something I like, I get excited right away.	0.136	**0.367**	**0.456**	0.127
BAS-Fun Seeking	10. I will do things for no other reason than that I think they might be fun.	−0.097	0.025	**0.566**	0.023
	20. I crave excitement and new sensations.	−0.105	−0.036	**0.537**	0.152
	5. I'm always willing to try something new if I think it will be fun.	−0.152	**0.490**	0.084	0.180
	15. I often act on the spur of the moment	0.222	−0.138	**0.428**	0.109
BAS-Drive	9. When I want something, I usually go all-out to get it.	0.132	−0.157	−0.152	**1.058**
	21. When I go after something, I use a "no holds barred" approach.	−0.234	0.281	0.137	**0.396**
	12. If I see a chance to get something I want I move on it right away.	−0.055	0.260	0.198	**0.478**
	3. I go out of my way to get the things I want.	−0.126	−0.098	−0.006	**0.680**
1			.14**	.13**	.05
2				.23**	.47**
3					.46**

Note. All factor loadings >.30 are printed in bold. Filler items (1, 6, 11, and 17) are excluded from the analysis.
[a]Reversed item.
*$p < .05$. **$p < .01$.

being excited when trying something new. As a reverse-scored item, item 22 loads negatively on BIS as expected, but also loads positively on BAS-Reward Responsiveness. Possibly, considering how many fears someone has in comparison with friends, can also lead to a positive, self-reinforcing conclusion. The overlap of some items has been noted in previous studies (Franken et al., 2005; Jorm et al., 1999). Removing these items would deteriorate the internal consistency of the scales, but future studies should look into the replacement of these items, for it might have strong implications for the BAS subscales. However, the chance of cross-loadings in measuring psychological constructs such as BIS and BAS cannot be excluded (Asparouhov & Muthén, 2009).

The reliability of the scales was found adequate. Though Cronbach's α coefficient seemed unacceptable for the variable BAS-Fun Seeking (= .49), we also computed AIC which is independent from the number of items in a scale. Since the AIC (= .19) seemed sufficient, we decided to include BAS-Fun Seeking in the analyses.

Results also provided support for the differences in average scores for subgroup (clinical vs. community-dwelling) and gender. Both the clinical and the community-dwelling sample showed a positive correlation between BIS and BAS-Reward Responsiveness, respectively $r = .51$ and $r = .20$. In terms of subgroup, we found that the community-dwelling sample scored significantly higher on BAS-Reward Responsiveness and BAS-Drive, which was not

Table 3. Means and Standard Deviations of the BIS/BAS Scales by Subgroup.

	Community-dwelling sample		Clinical sample				
	n	*M* ± *SD*	*n*	*M* ± *SD*	*t* test	*p*	Cohen's *d*
BIS	364	20.36 ± 3.78	160	19.73 ± 3.81	$t(522) = 1.772$	$p = .077$	0.17
BAS	362	37.23 ± 5.58	160	33.22 ± 6.25	$t(520) = 7.292$	$p \leq .001$	0.68
BAS-Reward Responsiveness	366	16.54 ± 2.14	160	14.51 ± 2.75	$t(246.47) = 8.313$	$p \leq .000$	0.82
BAS-Drive	367	10.65 ± 2.68	160	8.67 ± 2.54	$t(525) = 7.931$	$p \leq .000$	0.76
BAS-Fun Seeking	365	10.03 ± 2.22	160	10.04 ± 2.28	$t(523) = -0.022$	$p = .983$	0.00

Note. Cohen's *d* > 0.20 signifies a small effect size; > 0.50 a medium effect size; > 0.80 a large effect size (Cohen, 1988). BIS = behavioral inhibition system; BAS = behavioral approach system.

Table 4. Means and Standard Deviations of the BIS/BAS Scales by Gender.

	Male		Female				
	n	*M* ± *SD*	*n*	*M* ± *SD*	*t* test	*p*	Cohen's *d*
Community-dwelling sample							
BIS	157	19.34 ± 3.52	207	21.14 ± 3.80	$t(362) = -4.625$	$p < .001$	.490
BAS	157	36.69 ± 5.00	205	37.64 ± 5.96	$t(360) = -1.612$	$p = .108$	.173
BAS-Reward Responsiveness	158	16.24 ± 2.08	208	16.77 ± 2.15	$t(364) = -2.382$	$p = .018$	.251
BAS-Drive	158	10.44 ± 2.38	209	10.80 ± 2.88	$t(362.009) = -1.314$	$p = .190$	.136
BAS-Fun Seeking	157	9.99 ± 2.16	208	10.07 ± 2.28	$t(363) = -.340$	$p = .734$	.036
Clinical sample							
BIS	83	19.05 ± 3.83	76	20.46 ± 3.71	$t(157) = -2.359$	$p = .020$	.374
BAS	83	33.13 ± 6.29	76	33.20 ± 6.20	$t(157) = -.065$	$p = .948$	.011
BAS-Reward Responsiveness	83	14.30 ± 2.68	76	14.68 ± 2.80	$t(154.232) = -.880$	$p = .380$	.139
BAS-Drive	83	8.82 ± 2.64	76	8.46 ± 2.41	$t(157) = .374$	$p = .374$	.142
BAS-Fun Seeking	83	10.01 ± 2.10	76	10.05 ± 2.49	$t(157) = .911$	$p = .911$	.017

Note. Cohen's *d* > 0.20 signifies a small effect size; >0.50 a medium effect size; >0.80 a large effect size (Cohen, 1988). BIS = behavioral inhibition system; BAS = behavioral approach system.

expected. However, since no norms are available for these subgroups, this might be a sample characteristic. Another explanation might liea in the possible interaction between age and psychopathology. Older adults in clinical samples often have experienced multiple diagnoses and treatments over a lifetime. As Lampe et al. (2001) points out, these treatments can result in more apathy and thus a lower score on impulsivity-related scales such as BAS-Drive and BAS-Reward Responsiveness.

The results also indicate that men and women score alike on the general BAS scale, but women do tend to score (slightly) higher for BIS and BAS-Reward Responsiveness than males, as was expected. The idea that BAS-Reward Responsiveness has some component of neuroticism, which is an explanation for these differences in means, can also be found in their correlates.

Based on the comparison with analogue samples in the study by Jorm et al. (1999), support is provided for an

age-related decline in BIS and BAS. Some small-to-medium differences were found, but the results are congruent with each other. The resemblance of the data indicates that the older aged sample scores lower on BIS and BAS in comparison with a group of younger adults but might not be so outspoken as the results by Jorm et al. (1999) tend to claim. More research is necessary to evaluate this premise.

The correlation pattern between the BIS/BAS Scales and other relevant personality and symptomatic measures further supports the notice that BIS is largely related to internalizing symptoms such as Anxiety and Depression. In terms of coping styles, the results showed that BIS is related to Palliative Reaction, Avoiding, Social Support and especially Passive Reaction. The correlations between BAS and UCL subscales were more divided according to subscale and subgroup. BAS-Reward Responsiveness was related to Palliative Reaction and Social Support for both subgroups. In the clinical sample a positive correlation was also found

Table 5. Comparison of the Community-Dwelling Sample With the Scores by Jorm et al. (1999).

Age (years)	Samples	Gender	Current study		Jorm et al. (1999)		Cohen's *d*
			n	*M* ± *SD*	*n*	*M* ± *SD*	
60-69	BIS	Male	96	19.53 ± 3.23	112	19.9 ± 2.8	0.12
		Female	93	21.47 ± 3.96	99	20.1 ± 3.4	−0.37
	BAS	Male	97	36.49 ± 5.03	112	35.2 ± 6.6	−0.22
		Female	93	38.04 ± 5.57	99	35.5 ± 6.1	−0.43
	BAS-Reward Responsiveness	Male	97	16.18 ± 2.09	112	15.5 ± 2.4	−0.30
		Female	93	17.11 ± 2.00	99	16.4 ± 2.5	−0.31
	BAS-Drive	Male	97	10.49 ± 2.26	112	9.8 ± 2.8	−0.27
		Female	94	10.94 ± 2.79	99	8.9 ± 2.8	−0.73
	BAS-Fun Seeking	Male	97	9.82 ± 2.15	112	9.9 ± 2.8	0.03
		Female	94	10.03 ± 2.12	99	10.2 ± 2.4	0.08
70-79	BIS	Male	47	19.21 ± 3.99	54	18.8 ± 3.3	−0.11
		Female	72	21.10 ± 3.89	71	19.8 ± 3.6	−0.35
	BAS	Male	46	37.24 ± 5.06	54	34.3 ± 6.9	−0.48
		Female	70	36.90 ± 5.88	71	33.6 ± 6.7	−0.52
	BAS-Reward Responsiveness	Male	47	16.40 ± 2.13	54	15.0 ± 2.7	−0.57
		Female	72	16.53 ± 2.12	71	16.0 ± 2.6	−0.22
	BAS-Drive	Male	47	10.36 ± 2.58	54	9.6 ± 2.7	−0.29
		Female	72	10.33 ± 3.03	71	8.2 ± 3.1	−0.70
	BAS-Fun Seeking	Male	46	10.41 ± 2.15	54	9.7 ± 2.6	−0.30
		Female	72	10.04 ± 2.06	71	9.5 ± 2.5	−0.24

Note. Cohen's *d* > 0.20 signifies a small effect size; >0.50 a medium effect size; >0.80 a large effect size (Cohen, 1988).

between BAS-Reward Responsiveness and Active Confronting and Reassuring Thoughts. For BAS-Drive, only the correlation with Active Confronting is noteworthy. Looking at BAS-Fun Seeking there are no significant relations for the community-dwelling subgroup. In the clinical sample, positive correlations were found with BAS-Fun Seeking and Active Confronting, Palliative Reaction and Reassuring Thoughts. In general, BIS is found more related to passive/depressive and avoiding coping strategies. For BAS, the relations are more ambiguous. With regard to the clinical subgroup, all BIS/BAS Scales were correlated with Palliative Reaction. A more complex relation, with effortful control as a moderating role, might be possible for these constructs (Claes et al., 2009).

Looking at personality and personality pathology, we can see a clear differentiation. BIS is related to Neuroticism, while the BAS subscales are related to Extraversion and Openness. BIS is related to Cluster C and borderline personality disorders, while BAS-Drive and BAS-Fun Seeking are largely related to Cluster B scales. BAS is not correlated with avoidant personality disorder, while a negative relation was expected. It appears that BAS-Reward Responsiveness is generally uncorrelated with personality pathology in the clinical sample. As Pastor et al. (2007) point out, the BAS subscales are likely to approach the latent dimensions of anger, extraversion and/or impulsivity within the ADP-IV constructs. As we have seen that the clinical subgroup

shows a strong relationship between BIS and BAS-Reward Responsiveness, it is less surprising that BAS-Reward Responsiveness does not behave like the other BAS subscales. The current findings do support a good divergent validity between BIS and BAS with regard to internalizing and externalizing symptoms, coping, personality and personality pathology.

It is worthwhile to mention the limitations to this study. First of all, all used measures were self-report measures. These self-report measures can only offer the perspective of the participant and it remains uncertain to what extent an individual can assess their own BIS or BAS sensitivity (Smillie et al., 2007). Future research should focus on expanding the RST-research in terms of method. For instance, a behavioral instrument such as the signal detection theory (Macmillan & Creelman, 1991) measure, which assesses response-sensitivity and response bias. Second, it is important to introduce specific norms for older adults. Since the BIS/BAS Scales are used in the community and clinical field, the availability of appropriate cutoffs is necessary for the scales to be applied as an adequate instrument in older adults. A data collection technique of stratified sampling to gather a representative sample might be useful, and will also add to the research body as this sample was collected through snowball sampling.

In 2000, a revision of the theory by Gray (1981) was introduced by Gray and McNaughton. The revision especially

Table 6. Convergent and Divergent Validity of the BIS/BAS Scales for the Clinical Sample (*n* = 160) and the Community-Dwelling Sample (*n* = 368).

	BIS			BAS								
				Reward Responsiveness			Drive			Fun Seeking		
	Clinical sample	Community-dwelling sample	*q*	Clinical sample	Community-dwelling sample	*q*	Clinical sample	Community-dwelling sample	*q*	Clinical sample	Community-dwelling sample	*q*
BIS/BAS Scales												
BIS				.51**	.20**	.36	.07	-.12*	.19	.19*	-.00	.19
Responsiveness							.44**	.46**	-.03	.56**	.39**	.22
Drive										.57**	.44**	.18
Fun Seeking												
SCL-90-R												
Anxiety	.37**	.34**	.03	.15	.02	.13	-.08	-.02	-.06	-.00	-.06	.06
Depression	.28**	.38**	-.11	.06	-.02	.08	-.12	-.06	-.06	-.05	-.07	.02
UCL												
Active confronting	-.15	-.15**	.00	.21**	.11*	.10	.25**	.19**	.06	.19*	.10	.09
Palliative reaction	.19*	.14**	.05	.24**	.15**	.09	.19*	.08	.11	.30**	.04	.27
Avoiding	.21**	.22**	-.01	.01	-.06	.07	-.12	-.14**	.02	-.09	-.07	-.02
Social support	.21**	.15**	.06	.25**	.20**	.05	.12	.11*	.01	.13	.06	.07
Passive reaction	.40**	.42**	-.02	.08	-.04	.12	-.04	-.11*	.07	.01	-.06	.07
Expressing emotions	.16*	.08	.08	.10	.13*	-.03	.12	.22**	-.10	.01	.06	-.05
Reassuring thoughts	.08	.16**	-.08	.30**	.07	.24	.15	-.04	.19	.22**	.00	.22

*p < .05. **p < .01.

Table 7. Convergent and Divergent Validity of the BIS/BAS Scales for the Clinical Sample (C; *n* = 160) and the Community-Dwelling Sample (CD; *n* = 368).

| | BIS | | Reward Responsiveness | | Drive | | Fun Seeking | |
| | | | BAS | | | | | |
	Clinical sample	Community-dwelling sample	Clinical sample	Community-dwelling sample	Clinical sample	Community-dwelling sample	Clinical sample	Community-dwelling sample
BFI (only CD)								
Openness		−.07		.15**		.21**		.18**
Conscientiousness		−.03		.14**		.11*		−.04
Extraversion		−.19**		.20**		.27**		.13*
Agreeableness		.09		.16**		−.06		.03
Neuroticism		.52**		.02		−.15**		−.08
ADP-IV (Only C)								
Paranoid	.20*		.06		.11		.08	
Schizoid	.11		−.18*		−.11		−.17*	
Schizotypal	.21**		.01		.05		.05	
Antisocial	.02		−.02		.21**		.16*	
Borderline	.36**		.12		.15		.13	
Histrionic	.35**		.10		.17*		.16*	
Narcissistic	.09		.09		.26**		.17*	
Avoidant	.36**		.06		−.04		.01	
Dependent	.38**		.03		−.07		−.02	
Obsessive–compulsive	.33**		.00		.02		.05	
Depressive	.40**		.01		−.06		.03	
Passive–aggressive	.14		.05		.04		.16*	
Cluster A	.12*		−.05		.01		−.02	
Cluster B	.26**		.10		.24**		.19*	
Cluster C	.39**		.02		−.04		.02	

Note. CD = Community dwelling sample; C = Clinical sample; Cluster A = summation of Paranoid, Schizoid and Schizotypal; Cluster B = summation of Antisocial, Borderline, Histrionic, Narcissistic; Cluster C = summation of Avoidant, Depressive and Obsessive–Compulsive.
*$p < .05$. **$p < .01$.

altered the meaning of BIS, updating it as a mediator of conflict and ascribing the sensitivity to negative stimuli more to the Fight-Flight-Freeze System. Due to these alterations, the question of the relevance of the BIS/BAS Scales should be taken into account. Since the instrument is currently widely used in psychological assessment, it remains imperative that its appliance should be studied in an older age sample. Especially since new measures that do comply with the revision are currently limited to research purposes and are not polished enough to be applied to clinical or social service practices (Corr, 2001). Nevertheless, future research should focus on implementing such new measures in the community and find bridges between the older and newer instruments.

This study is interesting because it is one of the first to examine BIS/BAS sensitivity in an older age group, and the first to look at a possible relationship between BIS, BAS and coping mechanisms for both a community-dwelling as a clinical sample. The study supports the factor structure that has been aligned by Carver and White (1994) in their development of the questionnaire. The BIS/BAS Scales has been found a valid and reliable measure to assess their respective sensitivity. We can conclude the BIS/BAS Scales have much to offer in providing insight in sensitivity to behavioral inhibition and behavioral activation in older adults.

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