

Developing a New Apathy Measurement Scale

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Abstract

Apathy is both a symptom and syndrome prevalent in many pathological populations that affects motivation to display goal directed functions. Apathy has been established as having a triadic substructure by various researchers but has never been directly detected in normative and non- normative populations. Levy and Dubois (2006) proposed three apathetic subtypes, Cognitive, Emotional- Affective and Auto Activation, all with particular neural correlates and functional impairments. The aim of this study was to create and begin the validation process of a new apathy measure called the Dimensional Apathy Scale (DAS), which assesses the three previously mentioned apathetic subtypes. There were 311 participants (mean = 37.4, SD = 15.0) ranging from 18 to 70 years old .Upon performing an Horn's parallel analysis of principal factors and Exploratory Factor Analysis, 4 factors (labelled Executive, Emotional, Cognitive Initiation and Behavioural Initiation) were extracted accounting for 28.9% of the total variance. The factors and their meanings fitted Levy and Dubois' definitions of the three apathetic subtypes with the exception of the Auto Activation apathy. Upon closer examination thematically the Auto Activation apathy subtype definition accounted for Behavioural Initiation and Cognitive Initiation factors. These were found to be thematically intertwined and therefore were labelled as Behavioural/Cognitive Initiation. The 24 item DAS contained 3 subscales – Executive, Emotional and Behavioural/Cognitive Initiation, each composed of 8 items. The DAS items for each subscale showed good reliability and validity against depression based on a normally ageing population. Preliminarily, this serves as evidence for further research using this robust scale and should be further validated in various pathological populations. Research into apathetic subtypes, the DAS scale and implications for eventual clinical use are discussed.

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Introduction

1 Defining the Concept of Apathy

Apathy has been aptly defined by Dr Robert S. Marin (1996) as reduced motivation corresponding with goal directed behaviours. This can often be observed overtly as a loss of energy, interests and emotion (Marin, 1991). There has been great misunderstanding of the relationship between apathy and depression but an important and observable distinction between apathy and depression exists. While apathy and depression can coexist, and often do (van Reekum, Stuss, & Ostrander 2005), apathy can stand alone, relating to disorders of motivation where depression is an affective disorder (Levy et al., 1998). The overlap between the two lies in symptoms such as fatigue and loss of pleasure, both of which can have affective and motivational roots. However, apathetic individuals will lack motivation to do anything due to what could be termed as a reduction of goal directed behaviour associated with indifference to positive or negative outcomes (Marin, 1991). Whereas apathy will manifest itself via reduction of concentration, initiative and “non- responsive neutrality” in emotional domains, depression is more related to negative affective symptomology that relates to suicidal behaviour, despair and guilt (Landes, Sperry, Strauss, & Geldmacher, 2001).

In a healthy population, apathy is a normal fluctuating state that is frequently experienced by many individuals, however, when the state becomes reoccurring or constant it may be indicative of underlying pathology impairing motivational functioning. In a review by van Reekum et al. (2005), normal aging in particular was found not to have any association with apathy level. This was further confirmed by recent unpublished research assessing different domains of cognition and healthy ageing (20 to 64 years old) in relation to apathy (Radakovic, 2011). However, other longitudinal evidence suggests that increasing apathy level is associated with healthy ageing of older individuals, particularly men 58 to 85 years old (Brodaty, Altendorf, Withall, & Sachdev, 2010). This could be associated with various factors such as the approach of age related, or in some cases, forced retirement, marital relations, social support, work associated change or financial comfort (van Solinge, 2007). This could also be due to cultural differences between populations, in that Radakovic (2011) recruited British participants whereas Brodaty et al. (2010) recruited Australian participants from the Sydney Stroke Study. This, however, warrants further research.

2 Prevalence of Apathy in Clinical Populations

Apathy has been found to occur both symptomatically in relation to varying disorders and syndromatically in clinical practice (Marin, 1996). As a symptom of other disorders, apathy has been frequently observed in a variety of neuropsychiatric diseases (Chase, 2011). In dementia of the Alzheimer's type (DAT), apathy prevalence in patients was found to be 61% to 92% (e.g. Landes, Sperry, & Strauss, 2005) with an almost equally high prevalence in other forms of dementia such as the frontotemporal variant (FTD; e.g. Mendez, Lauterbach, & Sampson, 2008). Over a third of Parkinson's disease (PD) patients have been found to exhibit apathy (e.g. Pedersen, Larsen, Alves, & Aarsland, 2009; Pluck, & Brown, 2002) with marked variability of its effects on the clinical presentation of PD (Dujardin, 2007). In both first episode and chronic schizophrenia, apathy (or avolition) has been to be of high prevalence (Chase, 2011), which is associated with functional deficits such as executive dysfunction that independently contributes to the life quality of schizophrenic patients (Evensen et al., 2012, Konstantakopoulos et al., 2011). Recent neuroimaging research in to Amyotrophic lateral sclerosis (ALS), a form of Motor Neurone Disease (MND), has shown new evidence of neuroanatomical correlates relating to apathy of abnormalities in the anterior cingulate of the frontal lobe (Woolley, Zhang, Schuff, Weiner, & Katz, 2011). In relation to apathy as a syndrome, it has not been fully established in clinical research and diagnostic settings. It does, however, fall within the category of Disorders of Diminished Motivation (DDM; Marin, & Wilkosz, 2005). These issues will be discussed in reference to the development of the new method of measuring apathy.

3 Existent Methods of Assessing Apathy

There are a several methods of assessment of apathy in various pathological populations both directly and as a part of a sub- scale. Examples of such direct methods include the well utilised Marin's Apathy Evaluation Scale (AES; Marin, Biedrzycki, & Firinciogullari, 1991), Lille Apathy Rating Scale (LARS; Sockeel et al., 2006) and the Apathy Inventory (AI; Robert et al., 2002). The widely used Neuropsychiatric Inventory (NPI; Cummings, Mega, Gray, Rosenberg- Thompson, Carusi and Gornbein, 1994) and the Frontal Systems Behavioural Scale (FrSBe; Grace, & Malloy, 2001) contain items that are part of an apathy sub- scale (for review see Clarke, Ko, Kuhl, van Reekum, Salvador, & Marin, 2011). All of the scales and sub- scales in the aforementioned review were found to hold relatively

good discriminant and low convergent validity with various depression measures (Clarke et al., 2011), which is indicative of the robustness of items assessing apathy in each measure.

The aforementioned scales and sub- scales test apathy as a singular concept whereas Marin et al. (1991) original research in validating the AES (self, clinical and informant versions) through factor analyses found a triadic subtypal structure representing cognitive, emotional and behavioural (both sensory and motor) apathetic domains (Marin, 1991). This raises the question why the AES and other scales only produce an overall total apathy score. Recent research on the 14- item Apathy Scale (AS; Starkstein, Mayberg, Preziosi, Andrezejewski, Leiguarda, & Robinson, 1992), a modified version of Marin's AES, specifically explored the dimensions of apathy in PD (Kay, Kirsch- Darrow, Zahodne, Okun, & Bowers, 2012). Exploratory factor analysis yielded a three factor solution representative of behavioural, cognitive and affective domains of apathy. While the 14 items in the AS can only serve as a mere screening instrument for apathy, it still shows a factorial substructure analogous with Marin's original apathetic triad. Recent research assessing apathy and impulsivity in PD has provided evidence using the AES Clinical version that apathy has a 2 factor structure that were labelled "cognitive-behaviour" and "social indifference" (Ahearn, McDonald, Barraclough, & Leroi, 2012), which creates even more ambiguity associated with the substructure of apathy.

One of the only apathy measures that recognised the presence of an apathetic substructure through its assessment method is the LARS (Sockeel et al., 2006). During the validation process of the LARS in PD patients, the authors found there to be four factors dimensionally representing apathy as a construct; intellectual curiosity, self- awareness, emotion and action initiation. Unlike the AES, the LARS allows for factorial sub- scores to be calculated based on each subdivision (Sockeel et al., 2006). However, it should be noted that the LARS differed in the number of apathetic factorial subdivisions – four instead of the established triadic structure – which were also labelled differently compared to the original cognitive, emotional and behavioural classifications. In addition, the LARS itself still focused on apathy as a total summative score despite evidence of four dimensions of apathy. These studies show the importance of developing a new method, and a lack of said method to assess apathy levels.

4 Focus on Triadic View on Apathetic Disorders

The aforementioned triadic structure of apathy was further explored by Levy and Dubois (2006). They considered apathy as detectable reduced goal directed behaviour (GDB), unlike Marin's (1996) definition, which was focused primarily on motivation. Figure 1 shows the suggested steps in the organisation and implementation of GDB where apathy is thought to occur as a result of disruption in either one or a combination of these stages (such intention, evaluation, action etc.). These are thought to be best observed through overt or covert behavioural impairments pertaining to GDB (Levy, & Dubois, 2006).

Through Levy and Dubois' (2006) review of neurological findings, they proposed a functionally grounded prefrontal cortex (PFC) – basal ganglia (BG) system, wherein differing impairments to parts of this system resulted in specific apathetic behavioural deficits. This system is thought to be responsible for reward processing in addition to GDB in primates (Schultz, Tremblay, & Hollerman, 2000) and, more importantly, humans (Hollerman, Tremblay, & Schultz, 2000).

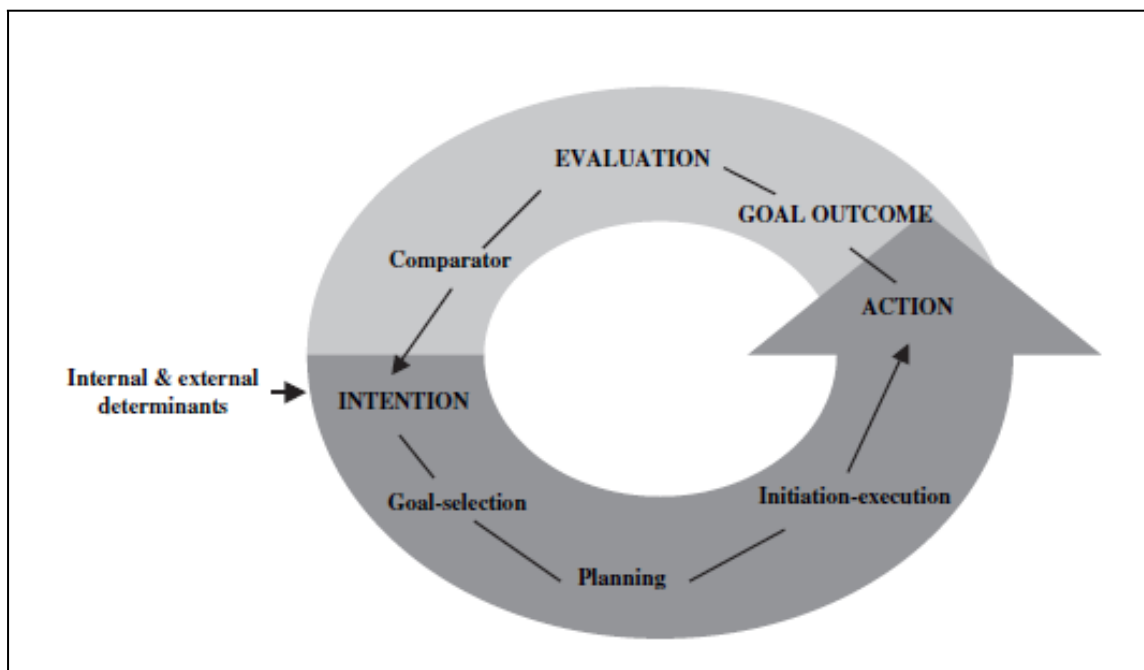


Figure 1. Organisation and implementation of GDB. Levy and Dubois (2006), adapted from Brown and Pluck (2002)

Based on observations of varying brain lesion patients with PFC and BG damage, Levy and Dubois (2006) proposed three underlying apathetic subtypes, which they termed Auto- activation (AA), Emotional- affective (EA) and Cognitive (COG). These subtypes arise when different stages of the GDB process are impaired (see Figure 1). While these three subtypes have overlapping similarities to Marin's proposed triadic cognitive- behavioural- emotional structure, the main difference is the Levy and Dubois' AA subtype being substituted for the behavioural subtype. The AA apathetic deficit has been observed as early as 1981 by Laplane (in Habib, 2004) as "loss of psychic auto- activation" in patients with bilateral hypodensities of the globi palli. It is most commonly characterised by decreased psychic and physical initiative activity. From this, Levy and Dubois' (2006) AA mechanistic disruption has been suggested to be characterised by lessened initiation of thoughts or behaviours that are relayed to functionality. These result in lack of motor responsiveness (akinesia) and lack of discourse (alogia, Habib, 2004). Specifically, lesions to the medial PFC and limbic region BG have been found to manifest as AA deficits akin to apathy (Levy, & Dubois, 2006). Levy, R., & Czernecki (2007) found that lesions that focally damaged the areas of the BG were associated with reduced GDB due to disconnectivity with the frontal lobes, decreasing its activation. However, while self- initiated behaviour and cognition are a core deficit of this subtype, reactivity to external stimulation is preserved (Levy, & Dubois, 2006), making it a difficult subtype deficit to detect.

The EA subtype of apathy is characterised by diminished integration, processing and expression of emotional behaviours and cognition resulting in what could be considered a continuous lack of extreme affect. It should be noted that this can be specifically distinguished from depression due to the presence of emotional neutrality, whereas depression results in either extreme sadness or, in the case of bi- polar affective disorder, also happiness. Research has found that most commonly impairment of the orbito- medial regions of the PFC were associated with this type of apathy (Levy, & Dubois, 2006). The orbito- medial PFC regions are connected to limbic regions (associated with emotional processing), visceromotor regions, and sensory cortex areas (somatosensory, gustatory, and olfactory), which facilitate emotional processing of information pertaining to GDB (Levy, & Dubois, 2006). Damage to the orbito- medial PFC disrupts this flow of emotional processing which may result in reduced processing of emotional behaviour, context or outcome. Levy and Dubois (2006) pointed out dysfunction of the orbito- medial PFC has been commonly observed as emotional blunting, a common neuropsychiatric symptom of DAT, schizophrenia

and localised brain damage (Berenbaum, & Oltmanns, 1992; Boone, Miller, Swartz, Lu, & Lee, 2003; Rao, Spiro, Schretlen, & Cascella, 2007). Damage to such systems could disrupt the motivation for GDB due to emotional desensitisation to both positive and negative stimuli. The emotional ambivalence may influence decision making due to lack of emotional context. A study assessing positive and negative symptoms relationships within DAT and FTD found significant relationships between the prevalence of apathy with asociality, avolition, anhedonia and emotional blunting (Boone, Miller, Swartz, Lu, & Lee, 2003), which could all be interpreted elements of the EA apathetic subtype.

Finally, COG apathy, or 'Cognitive inertia' (Levy, & Dubois, 2006), has been suggested to be characterised by the inability to manage goals and cognitively strategize, which has a negative impact on cognitive and action planning. This GDB is thought to be reduced due to impaired cognitive functions needed to implement planned actions resulting in COG apathetic subtype impairment (Levy, & Dubois, 2006). This could be indicative of dysexecutive functioning affiliated with motivation, which has been found to be strongly associated with the dorsolateral PFC damage (Fuster, 1999; for review see Stuss, 2011). Motivation is thought to be one of the primary impairments associated with apathy. Research has also shown that this type of motivationally related cognitive impairment occurs comorbidly with disorders such as schizophrenia, both chronic and first episode (e.g. Faerden et al., 2009, Roth, Flashman, Saykin, Thomas, McAllister, & Vidaver, 2004), PD (e.g. Pluck, & Brown, 2002) and various forms of dementia (e.g. DAT: McPherson, Fairbanks, Tiken, Cummings, & Back- Madruga, 2002). However, these are all somewhat extrapolatory in nature as they purely infer a relationship between apathy, or motivational deficit, and cognitive impairment due to there being no way of direct method of assessment.

More extreme DDMs, associated with varied levels of impairment of different subtypes of apathy, include abulia, athymhormia and akinetic mutism (Marin, & Wilkosz, 2005). All these could be interpreted in terms of Levy and Dubois (2006) apathetic subtype impairments. Abulia is the inability to make decisions or lack of initiative. When aligned with the Levy and Dubois apathy subtypes, abulic patients would have focal impairment to COG and AA mechanisms, which would be associated with the lack of decision making and initiation. Athymhormia is a disorder where there is a reduced interest in relation to preferences, both negative and positive, and reduced initiation of voluntary action. It would, therefore, be best represented by EA and COG impairment. Finally, akinetic mutism, the

most extreme form of DDM, is where the individual progresses in their deterioration of both speech and movement until they cannot do either. Early on in the progression of this disorder the individual experiences increased passivity. This could be considered to be mostly grounded in AA impairment due to the decreasing speech and motion. However, the increasing passivity prior to this could be associated with either the COG or EA subtypes.

5 Proposed Diagnostic Criteria for Apathy and Issues

Robert et al. (2009), in a recent article, summated the results of a draft consensus meeting for the criteria for diagnosing apathy in DAT and other neuropsychiatric disorders (see Table 1). The need for such specific criteria has increased due to the prevalence of apathy in various neuropsychiatric and neurodegenerative disorders. Marin's (1991, 1996, Marin et al., 1991) motivational and Levy and Dubois' (2006) varying GDB definitions highlight disagreements in conceptualising apathy. Yet, they could be seen as pertaining to similar and interrelated foundations of apathy that only vary at a semantic level (Robert et al., 2009), the main difference being in viewpoints; neurological (GDB) and psychiatric (motivation). The new proposed diagnostic criteria take this in to account through including motivation, GDB and cognition as definitions of apathy. A total of four criteria, all of which have to be fulfilled, were proposed (see Table 1).

Fundamental consideration will be given to Criterion B due to the relevance it has to this study. This criterion has been sub- divided in to three domains representative of the typical behaviour, cognition and emotion triadic domains of apathy. The characteristic details of these domains seem to coincide quite well with Levy and Dubois (2006) established mechanisms of apathy. However, further symptom sub- division of Domains B1, B2 and B3 suggests that there are self- initiation symptoms in addition to responsiveness to external stimulation symptoms in apathy (see table 1). Conceptually, the desensitization to external stimuli symptom is thought to be flawed (Starkstein, 2012). This is primarily due to the nosology of apathy in the motivational disorder spectrum, wherein more extreme DDMs such as athymhormia can be reversed briefly specifically with external stimulation (Habib, 2004).

Table 1. Proposed apathy diagnostic (A, B, C and D) criteria taken from Robert et al. (2009)

For a diagnosis of Apathy the patient should fulfil the criteria A, B, C and D

A Loss of or diminished motivation in comparison to the patient's previous level of functioning and which is not consistent with his age or culture. These changes in motivation may be reported by the patient himself or by the observations of others.

B Presence of at least one symptom in at least two of the three following domains for a period of at least four weeks and present most of the time

Domain B1 : Loss of, or diminished, goal-directed behaviour as evidenced by at least one of the following:

–Loss of self-initiated behaviour (for example: starting conversation, doing basic tasks of day-to-day living, seeking social activities, communicating choices)

–Loss of environment-stimulated behaviour (for example: responding to conversation, participating in social activities)

Domain B2 : Loss of, or diminished, goal-directed cognitive activity as evidenced by at least one of the following:

–Loss of spontaneous ideas and curiosity for routine and new events (i.e., challenging tasks, recent news, social opportunities, personal/family and social affairs).

–Loss of environment-stimulated ideas and curiosity for routine and new events (i.e., in the persons residence, neighbourhood or community)

Domain B3 : Loss of, or diminished, emotion as evidenced by at least one of the following:

–Loss of spontaneous emotion, observed or self-reported (for example, subjective feeling of weak or absent emotions, or observation by others of a blunted affect)

–Loss of emotional responsiveness to positive or negative stimuli or events (for example, observer-reports of unchanging affect, or of little emotional reaction to exciting events, personal loss, serious illness, emotional-laden news)

C These symptoms (A–B) cause clinically significant impairment in personal, social, occupational, or other important areas of functioning.

D The symptoms (A–B) are not exclusively explained or due to physical disabilities (e.g. blindness and loss of hearing), to motor disabilities, to diminished level of consciousness or to the direct physiological effects of a substance (e.g. drug of abuse, a medication).

Mulin et al. (2011) conducted a study that included a variety of different clinical samples that experienced apathy that attempted to validate and replicate the diagnostic criteria in clinical practice. This study found that generally the diagnostic criteria were representative of apathy both in clinical practice and research, however, the self- initiation sub-symptoms of Domain B1, B2 and B3 were more commonly displayed than that of responsiveness symptoms in clinical samples. Additionally, based on a thorough review of non-pharmacological interventions for apathy after a variety of different acquired brain impairments, external compensatory techniques were found to be most effective and successful in increasing functionality of apathetic individuals (Lane- Brown, & Tate, 2009). This suggests that apathetic individuals are able to be externally stimulated out of their apathetic state for a brief period. Effectively, these could be seen as providing evidence against the inclusion of diminished responsiveness to external stimuli as a function of apathy diagnosis.

6 The Current Study

The importance of research into the sub- divisions of apathy relating to pathological populations and their possible effects on cognition has been highlighted (Drijgers, Verhey, Leentjens, Köhler, & Aalten, 2011; Mulin et al., 2011). The incongruence in exploratory findings of the structure of apathy using existent apathy scales (Ahearn et al., 2012; Kay et al., 2012; Marin et al., 1991; Sockeel et al., 2006) further indicates the need for an apathy assessment that focuses on identifying the structure of apathy that measures the level of impairment associated with each subtype. Such a comprehensive and direct system of assessing and detecting levels of disruption of apathetic subtypes has not yet been devised. Through the validation of a new scale to assess these subtypes, normative data created a base profile of apathy subtypes. In the long term, through the ability to distinguish different apathy subtypes associated with different disease profiles, a more appropriate assessment of cognitive function and treatment interventions can be implemented.

7 Aims and Predictions

Based on the literature reviewed and the need for a measure for different types of apathy, the aim of this study is to begin to develop a new method of evaluation of apathy as a multi-dimensional concept, the first stage of which will be done in a healthy, ageing population.

Our prediction is that the preliminary scale will yield items that load on to three distinct factors associated with COG, EA and AA subdivisions of apathy. These items will be extracted to produce a scale which is sensitive to varying dimensions of apathy. The study will then explore how the subtypes associate and dissociate based on the items in the newly formed scale. In addition to beginning the validation process, exploring the relationship of the previously mentioned and operationalized subtypes of depression will then further the reliability and understanding of the scale

Method

1 Study Design

There were two parallel methods of data collection. Study A was an online questionnaire and Study B was a paper and pencil version of the study which also tested participants levels of depression using the Becks Depression Inventory II (BDI2). Study B was used to monitor depression as a descriptor variable in our study while being used identify apathy item and subtype correlations with depression. Additionally, Study B was used to validate the 24 items and total subtype scores extracted from the preliminary analysis against the BDI2. Data collection for both studies was conducted simultaneously due to the Study A being in the form of a self- sustaining, on- line questionnaire.

This study was approved by the University of Edinburgh PPLS Ethics Committee.

2 Scale Design and Item Development

Items were carefully developed based on adapted and redefined Levy and Dubois (2006) apathy subtypes, experience of colleagues, evaluation of relevant publications and other scales that assess apathy (for review see Clarke et al., 2011).

A systematic review of literature relating to apathy and clinical use of apathy related tools of assessment was implemented (see Figure 2).

A total of 180 items from twelve existent English scales and subscales (see Table 2) were extracted, reviewed and grouped based on definitions of EA, AA and COG subtypes of apathy. Items from the AS- 14 (Starkstein et al., 1992), AS- 10 (Lueken, Seidl, Volker, Schweiger, Kruse, & Schroder, 2007) and AS- 7 (Resnick, Zimmerman, Magaziner, & Adelman, 1998) were not used due to them being regarded as shortened versions of the AES; having many items in common. Additionally, upon examination of the Behavioural Assessment of Dysexecutive Syndrome- DEX, Frontal Systems Behaviour scale and the Brief Psychiatric Rating scale, some items evaluating executive functioning were included due to them meeting the definition of COG apathy subtype.

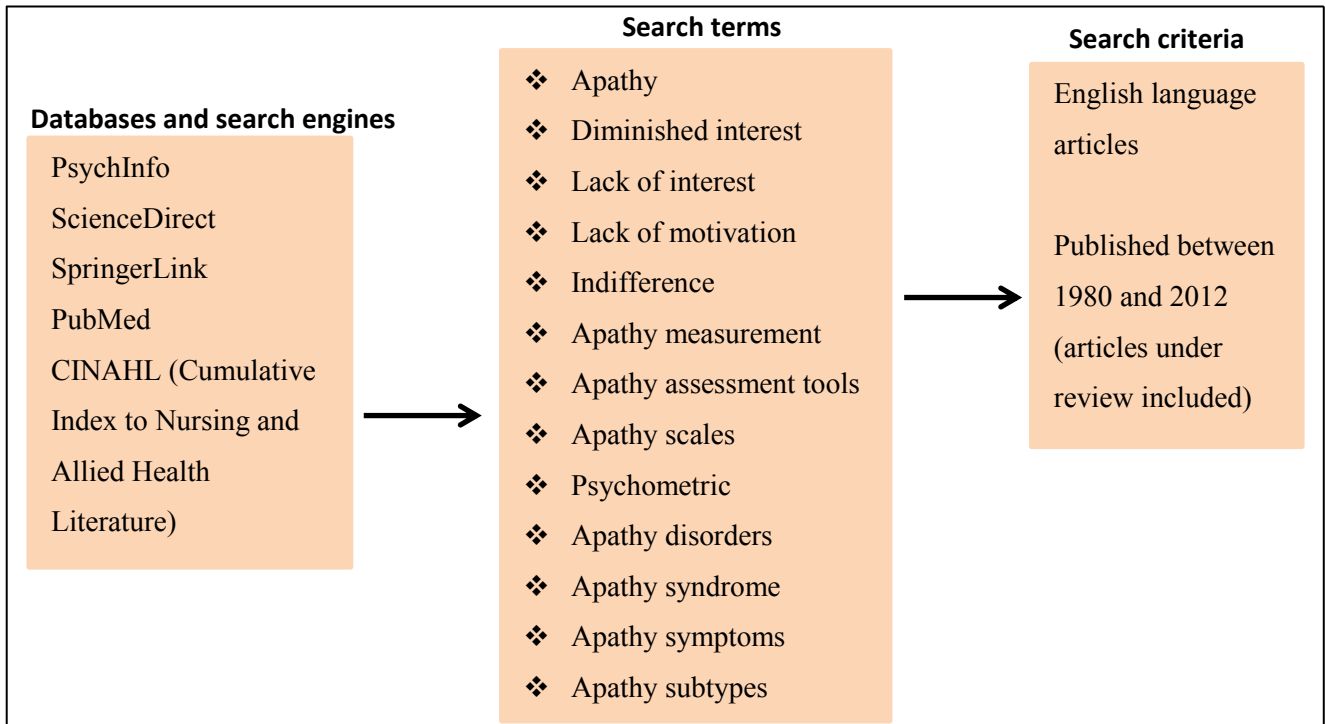


Figure 2. Method of systematic review of literature, showing the selected databases/ search engines, terms and criteria used

Common themes based on each item subtype were determined followed by a structured design of new items based on these. Both positive and negative syntax was employed when writing the items resulting in a total of 45 items (see Appendix A). The scale was designed to be a self-rated measure, which was scored by 4 point Likert scale (Hardly Ever, Occasionally, Often, Almost always) on rate of occurrence in the last month. Scoring will be 0, 1, 2, 3 respectively, in addition to employing a method of reverse scoring for some items (see Appendix B).

3 Item Selection

A preliminary scale of 45 items was reduced to 24 items (8 for each subtype) based on the meaningfulness of factor loadings produced by exploratory factor analysis of all 311 participant item responses (see results section). Each of the 8 items per subtype was then summed based on the Likert scale scores to give overall apathy level.

Table 2. Apathy measures, types (full or sub-scales), number of items extracted and references

Scale	Type	Number of Items Extracted	Reference
Apathy Inventory	Full	8	Robert et al. (2002)
The Behavioural Assessment of Dysexecutive Syndrome-DEX	Sub-scale	20	Norris and Tate (2000)
Brief Psychiatric Rating scale	Sub-scale	5	Overall and Gorham (1962)
Dementia Apathy Interview and Rating	Full	16	Strauss and Sperry (2002)
Apathy Evaluation Scale	Full	18	Marin et al. (1991)
Frontal Systems Behaviour scale	Sub-scale	27	Grace, and Malloy (2001); Grace et al. (1999)
Irritability Apathy scale	Sub-scale	5	Burns, Folstein, Brandt and Folstein, (1990)
Key Behaviour Change Inventory	Sub-scale	28	Belanger, Brown, Crowell, Vanderploeg and Curtiss (2002)
Lille Apathy Rating scale	Full	28	Sockeel et al. (2006)
Neuropsychiatric Inventory	Sub-scale	9	Cummings et al. (1994)
Positive and Negative Symptoms scale	Sub-scale	8	Kay, Opler and Lindenmayer (1989)
Assessment of Negative Symptoms	Sub-scale	8	Andreassen (1982)

4 Participants

A total of 311 participants (217 females and 94 males) were recruited from the University of Edinburgh Departmental Subject Pool, the University of Hull and various other volunteer groups with a mean age of 37.4 (SD = 15.0) and mean education level of 17.2 (SD = 3.0). Study A had a sample of 261 participants with a mean age of 37.7 (SD = 14.7) and education level of 17.3 (SD = 3.0). Study B was a 50 participant subsample paper and pencil version (where the questionnaire and the BDI2 were completed) with a mean age of 35.6 (SD = 16.5) and mean education level of 16.8 (SD = 2.7). The mean BDI2 score was 5.6 (SD = 5.4) with no severely depressed participants.

5 Procedure

Prior to completion of the questionnaires, demographic variables of age, sex and years of education were recorded. Both the studies were presented as a 'Motivation in the General Population' as to avoid any negative connotations and demand characteristics that may be related to the concept of apathy. The description and consent forms can be found in Appendix C. Participants were asked to rate items based on the frequency of occurrence in the last month associated with how they felt, behaved or thought. Items were presented randomly as to avoid any order effects.

Study A

The on- line questionnaire was designed and administered using Limesurvey, a free and open source survey software tool. Participants from the University of Edinburgh Departmental Subject Pool, the University of Hull and various other volunteer groups were contacted via email requesting them to complete a short 10 to 15 minute on- line survey. Participants were told that they may withdraw from the study at any time and that all information they provide would be kept anonymous with no link between the data acquired and the personal information they supplied. Participants were required to provide an answer to all 45 items through automated prompts indicating if answers were omitted. This was to ensure complete item profiles for each participant to make validating the items more efficient. Upon completion of the questionnaire, by providing their email, participants were entered in

to a prize draw to win one of three £25 vouchers to redeem on the website Amazon. Once they completed the questionnaire, they were debriefed via an on- line information sheet.

Study B

Administration of the paper and pencil version of the study was conducted at the University of Edinburgh Psychology department and participants' houses. The study took approximately 15 minutes and participants were compensated with £5 upon completion. Participants were asked to complete two questionnaires. Firstly, they were given consent forms explaining that their involvement is voluntary and that they are allowed to withdraw from the study at any point. They were then assured that the personal information they provided on the consent forms would be kept separate and anonymous through the use of a participant number. Following this, participants were presented with the questionnaire and asked to read the instructions very carefully. The experimenter then ensured that participants understood the instruction before they proceeded further. Once participants completed the first questionnaire they were then provided with the second questionnaire (BDI2) and asked to read the instructions carefully before completing it. Upon completion of the questionnaires, participants were debriefed revealing the true nature of the study and permitted to ask questions.

6 Statistical Analysis and Design

All 311 participant responses to the 45 items were analysed using RStudio version 0.94.110 for MS windows.

Stage 1

A Monte-Carlo based simulation, Horn's parallel analysis of principal factors (Horn, 1965, Turner, 1998), was used in comparing eigen values derived from uncorrelated normal variables to the observed eigen values. It was used to determine the number of factors to be extracted. An exploratory factor analysis (EFA) was conducted on the 311 responses to the 45 items. Items were extracted based on factor loadings and Levy and Dubois (2006) subtype definitions to construct new scale.

Stage 2

Correlation analysis was performed on extracted subtype items with the 50 participant subsample that were also tested using the BDI2, specifically item- depression and subtype- depression correlations. Inter- rater, Inter- item and Item- subscale analysis was performed using all 311 participant responses to determine reliability of the 24 item scale.

Results and Discussions

1 Data Preparation

Firstly, the mean values for missing age and years of education were imputed for a total of 13 cases. Based on examination of histograms and kurtosis, participant responses for each item were found to be relatively normally distributed with some positive and negative skews. The whole sample of 311 participants was used (217 females and 94 males). To avoid any possible gender effects on the item responses, based on research by Radakovic (2011), Brodaty et al. (2010) and bias of female participants in the sample, a regression was run on each item in relation to gender from which the residuals were extracts.

2 Analysis Stage 1

Factor Extraction and Structure

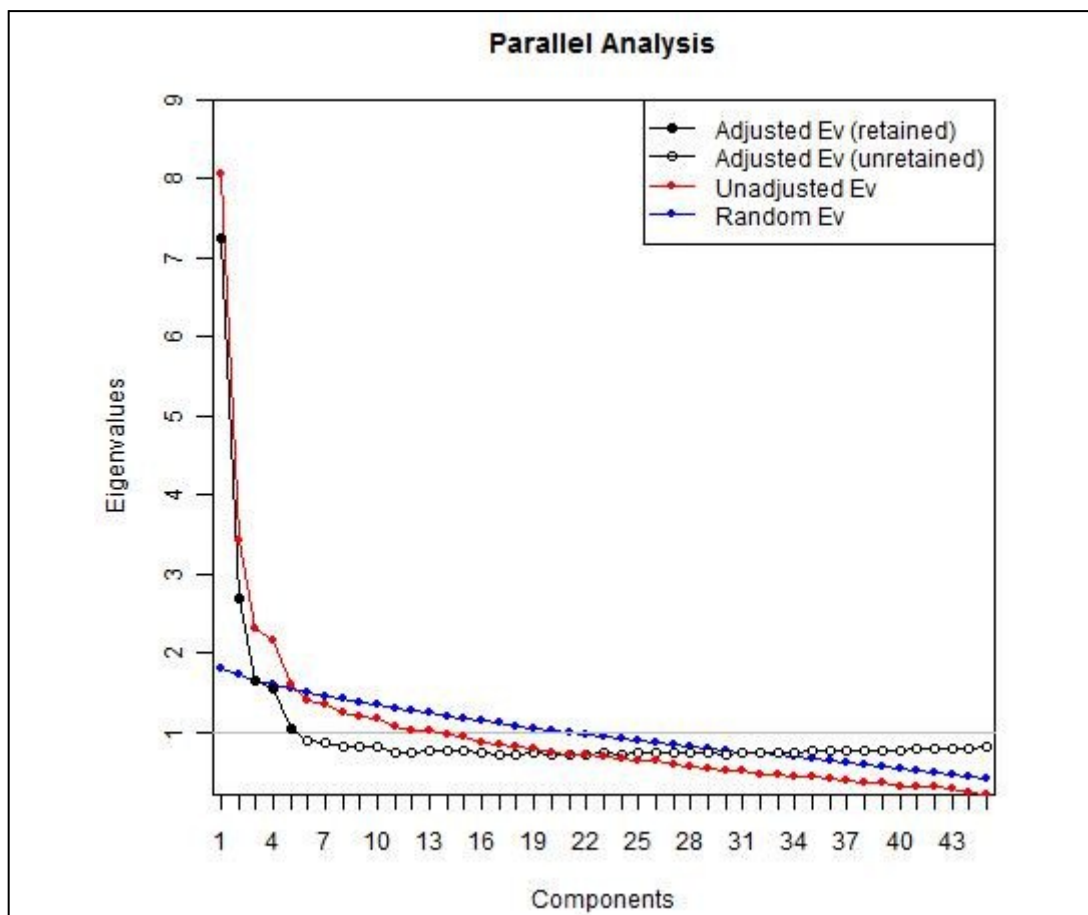


Figure 3. Horn's Parallel Analysis of Principle Factors in Apathy questionnaire 45 items sample

Using all 311 participants' data collected from Study A and Study B, the Kaiser-Meyer-Olkin (KMO) and Mean Measure of Sample Adequacy (MSA) showed the sample to be factorable (KMO = 0.837, Mean MSA = 0.800). Horn's parallel analysis of principal factors (Horn, 1965, Turner, 1998) showed that 5 factors should be extracted from the analysis (Figure 3). However, based on a combination of theory driven factor extraction associated with the Levy and Dubois apathy subtypes and the characteristic "elbow" or steep decline in eigen values, 4 factors were extracted.

An Exploratory Principle Axis Factor (PAF) Analysis with Promax (Oblique) rotation- due to factor 1 (PA1) and factor 4 (PA4) being inter correlated (Table 3) - was used for data analysis, the results of which can be seen in Table 4. Eleven items were excluded due to them being below the .350 factor loading cut- off. The 4 factor solution cumulatively accounted for 28.9% of the total variance. This was further supported by visual inspection and a suitable square root mean residual (SRMR < .05).

Table 3. Oblique rotated inter-factor correlation matrix

	PA1	PA2	PA3	PA4
PA1	1.000			
PA2	0.211	1.000		
PA3	0.246	0.182	1.000	
PA4	0.386	0.130	0.251	1.000

Seventeen items loaded on PA1, accounting for 12.9% of the total variance, one of which loaded negatively (A11). For illustrative purposes, Table 4 shows the cross loading of item A11 on PA4 (despite it being slightly below .350 cut- off). Item A33 and A18 displayed the highest loadings. From Table 4 it is clear that items loading on PA1 are similar to that described by Levy and Dubois as COG apathy subtype but were particularly associated with organization abilities and executive functions or dysfunctions. This factor was subsequently labelled as the Executive (Ex) apathy subscale. A total of 8 items, A4, A10, A18, A27, A33, A35, A29 and A12, were subsequently used to create the Ex apathy subscale according to their high loadings and relevant meanings. Higher loading items such as A1 and A45 were not used due to their respective similarities to items A18, A27 and A35.

Eight items loaded on PA4, accounting for 6.2% of the total variance. The highest loading items related to this factor were A34 and A13. The emotional themes were similar to the EA subtype of Levy and Dubois. This factor was subsequently labelled Emotional (Em) subscale. All eight items were retained for the Em apathy subscale part of the 24 item scale.

Five items loaded on factor 3 (PA3) and five items loaded on factor 2 (PA2), accounting for 5.3% and 4.6% of the total variance, respectively. Item A28 loaded most highly on PA3 whereas items A17 and A40 exhibited highest loadings on PA2. Thematically, both factors were associated with functional initiation associated with motivation corresponding to the AA subtype. PA2 and PA3 were more akin to behaviour and cognitive initiation, respectively. Therefore, PA2 was labelled as Behavioural Initiation (BI) while PA3 was characteristically more oriented to Cognitive Initiation (CI). These both concomitantly were renamed Behaviour and Cognitive Initiation (BCI) subscale due to their overlapping similarities. Item A42 was not used as a BCI subscale measure due to its low loading on PA2. Therefore items A23, A24 and A28 from PA3 alongside items A17, A40, A7 and A14 from PA2 and item A32 – which loaded on both PA3 and PA2 – were used to represent the BCI apathy subscale part of the scale. These 8 previously mentioned items per apathy subscale were used to construct the new 24 item apathy scale, the Dimensional Apathy Scale (DAS).

Table 4. Factor loadings > .350 of items with item codes (see Appendix A for labels) following oblique rotation Exploratory PAF and factor labels Ex, Em, CI and BI

Item Code	PA1	PA4	PA3	PA2
	Ex	Em	CI	BI
A33	0.736			
A18	0.696			
A10	0.650			
A35	0.640			
A27	0.610			
A45	0.604			
A1	0.594			
A4	0.585			
A29	0.481			
A30	0.471			
A12	0.461			
A22	0.418			
A3	0.409			
A25	0.381			
A19	0.370			
A26	0.364			
A11	-0.450	0.350		
A34		0.504		
A13		0.487		
A44		0.478		
A16		0.411		
A36		0.408		
A9		0.400		
A15		0.370		
A8		0.363		
A28			0.570	
A23			0.559	
A24			0.547	
A32			0.530	0.395
A14			0.450	
A17				0.708
A40				0.622
A7				0.481
A42				0.381
Eigen Values	5.785	2.784	2.373	2.067
Proportional % variance	12.9	6.2	5.3	4.6
Cumulative % Variance	12.9	19.0	24.3	28.9
No of Items	17	8	5	5

3 Discussion

Based on factor loadings a four factor structure was supported in relation to the 45 items assessed. There were sixteen items that loaded positively on to the Ex apathy factor and were represented by motivationally influenced cognitive and behavioural dysfunction. Item A10 was the most thematically focused on motivation. A1, A4, A18, A27, A33, A35, A45, A19, A25, A26 and A29 related to concentration on and organization of task related activities where, items A3, A12, A22 and A30 were associated with presence (or what can be interpreted as poverty) of thought. These all held strong associations with executive dysfunction due to motivational impairment. The negative loading and, therefore, negative relationship of item A11 (“After having done something, I spend time thinking whether it was good or bad”) could be due to the participants interpretation of the item. The primary focus of participants was perhaps directed towards the emotive part of the item (“... whether it was good or bad”) imposing a negative relationship on to the executive part of the item (“After having done something, I spend time thinking...”), which is shown by the almost above cut- off loading on to the Em factor.

The Em factor was found to have eight items loading on it all distinctively relating to affective experience. Item A36 was linked with general emotional neutrality and indifference. Items A8, A9, A15 and A16 were associated with individual’s emotional expression and interaction with others. Items A34, A44 and A13 were more related to both personal and vicarious emotional experience, the latter of which could also be called sympathizing. All eight of these items were considered functionally informative of this particular apathy factor.

The final two factors were not completely supportive of the established triadic structure of apathy and did not directly follow previous research (Levy, & Dubois, 2006; Marin et al., 1991; Robert et al., 2006). Consequently, the prediction of results associated with Levy and Dubois’ three apathetic subtypes was not specifically confirmed due to the division of the BI and CI as separate factors. Upon closer examination of the four items that loaded just on the BI factor, A17, A40, A7 and A42 were characteristic of behavioural initiation, both socially and with general actions. Interpretations of items loading on the CI factor are slightly more complex in that A23 and A14 ascertain more precisely to initiation of cognition such as planning, conversing and goal- setting whereas A24 (“I act on things I have thought about during the day”) and A28 (“I keep myself busy”) seem to be associated

with a combination of behaviour and cognitive imitation. The loading on the CI factor of items A24 and A28 could be due to the phrasing and interpretation of the items in that “keeping oneself busy” and “acting on things one has thought about during the day” requires a primary cognitive aspect before the secondary behavioural aspect.

The CI and BI apathetic factors were the only two factors that produced an overlapping above threshold item loading, A32 (“I think of new things to do during the day”). The phrasing of item A32 seems to relate to both cognition (“thinking of”) and behaviour (“to do”) while primarily being about initiation (“new things”). This could be regarded as an adequate explanation to the cross loading on the CI and BI factors. Due to the overlap observed and the integrative features associated with of these two factors, combining them in to the BCI apathetic factor would be suitable and appropriate solution in assessing apathy as multidimensional concept. Therefore, this could be construed as evidence to maintain our predicted primary three- domain structure of apathy with a conceptual breakdown of the BCI apathy factor.

4 Analysis Stage 2

Depression, Apathy Subscale and Scale item inter-correlations

Table 5. Pearson product moment correlation matrix of total apathy subscale total scores (Ex, Em and BCI) with depression (BDI2)

***significant at .05 level**

****significant at .01 level**

*****significant at .001 level**

	BDI2
BDI2	1.000
Ex	0.553***
Em	0.365**
BCI	0.354*

The 50 participant subsample collected from Study B was not controlled for gender effects due to the representative and relatively equal number sex participants (male = 22, female = 28). An exploratory examination of 24 final DAS scale items (selected above in Stage 1 of the analysis) revealed a low mean correlation (Pearson product moment) of .221 between items (SD = .149, lowest coefficient = -.002, highest coefficient = .660). Items held

a weak to moderate correlation with depression with a mean r of .258 (SD = .141, lowest coefficient = .015, highest coefficient = .467).

Table 5 shows correlations of apathy subscales totals and depression as measured by the BDI2. All factors held moderate positive correlation with depression (lowest coefficient = .354, highest coefficient = .553). BDI2 was most positively and highly correlated with the Ex subscale ($r = .553$) while the BCI ($r = .354$) and, interestingly, Em ($r = .365$) subscales were less positively correlated.

24 Item DAS Scale Characteristics

Using all 311 participants' data from both Study A and Study B on the above-mentioned 24 items that make up the new apathy scale, baseline data was produced for each of the apathy subscales. Internal consistency reliability was established using Cronbach's standardized α for all the measures. Between items α value for the whole scale was 0.798. The item- subscale total correlations were found to be moderate for each subscale, with the Ex subscale correlating most highly (mean $r = .639$, SD = .081), followed by the BCI subscale (mean $r = .541$, SD = .085) and then the Em subscale (mean $r = .495$, SD = .133). However, item A16 ("I express/ show my emotions") assessing the Em subscale was found to be of a low correlation ($r = .191$), which resulted in adjustment of the wording to "I *express* my emotions". Inter-rater reliability was examined by the intraclass correlation coefficient (ICC: Shrout, & Fleiss, 1979) and which was found to be adequate for scale items (ICC= .154 (95% CI [0.098; 0.265])).

Table 6. Pearson product moment correlation matrix between Ex, Em and BCI apathy subscale total scores.

***significant at .05 level**

****significant at .01 level**

*****significant at .001 level**

Apathy Subscale	Ex	Em	BCI
Ex	1.000		
Em	0.091	1.000	
BCI	0.648***	0.236***	1.000

Table 6 shows all the subscales total scores were positively correlated. The Ex subscale was found to be most strongly correlated with the BCI subscale ($r = .648$) while being least correlated with the Em subscale ($r = .091$), indicating a stronger apathetic executive association with lack of initiation rather than emotional processing. The BCI subscale held the weak correlation with the Em subscale ($r = .236$).

Table 7. Mean, Standard Deviation (SD), Range, Minimum and Maximum subscale scores (Ex, Em and BCI)

Apathy Subscale	Mean (SD)	Range	Minimum score	Maximum score
Ex	6.91 (3.90)	19	0	19
Em	7.38 (3.06)	16	0	16
BCI	9.42 (3.40)	18	1	19

Table 7 shows the mean, standard deviation, range, minimum and maximum scores for each subscale. The mean Ex subscale total score was found to be 6.91 (SD = 3.90) with a range of scores from 0 to 19 out of a 24, with the mean Em apathy subscale total score being quite similar (mean = 7.38, SD = 3.06). While also having the minimum score of 0, the Em subscale maximum score was 16. The mean BCI apathy subscale total score was the highest out of all three subscales (mean = 9.42, SD = 3.40), with a range of 1 to 19. These normative results served as a preliminary basis for the proposed cut-offs for each subscale, which is represented by approximately 1.5, 2.0 and 2.5 standard deviations away from the mean of each subscale with respectively increasing apathetic impairment severity, as shown in Table 8. The fully constructed self- version of DAS with a scoring sheet can be found in Appendix D.

Table 8. Preliminary proposed cut-offs for increasing severity (mild, moderate and severe) for each apathy subscale (Ex, Em and BCI) scale scores

Apathy Subscale	Mean (SD)	Proposed cut-off for apathy diagnosis		
		Mild	Moderate	Severe
Ex	6.91 (3.90)	≥ 12	≥ 15	≥ 17
Em	7.38 (3.06)	≥ 11	≥ 13	≥ 15
BCI	9.42 (3.40)	≥ 14	≥ 16	≥ 18

5 Discussion

The total apathy scores for each subscale were all found to be positively, moderately associated with depression, but at varying degrees. This could be due to the previously mentioned overlap between apathy and depression (Levy et al., 1998, van Reekum et al., 2005). Comorbidity between apathy and depression has been well documented in clinical populations (e.g. Marin, Firinciogullari, & Biedrzycki, 1994, Pluck, & Brown, 2002) The Ex subscale was most highly, albeit moderately, associated with depression. Depression has been well documented to affect a variety of cognitive functions (for review see McClintock, Husain, Greer, & Cullum, 2010) and is comorbid with motivational deficits associated with apathy potentially influencing inclusive control of cognitive domains, such as executive functioning. It should be noted, however, the low, moderate correlation between the BCI and Em apathy subscale. Therefore, these moderate correlations could also be interpreted as a degree of separability of these subscales from depression or its influence.

In the case of Ex apathy subscale items, characteristics of symptoms such as dysexecutive functioning in DAT (Drijgers et al., 2011) and, more specifically, working memory and encoding strategy in PD (Pluck, & Brown, 2002, Varanese, Perfetti, Ghilardi, & Di Rocco, 2011) were focal. Particular items were chosen that assess impairments associated with lack of planning, lack of presence or disorganized thoughts, such as susceptibility to distractions, confusion associated with difficult tasks and maintaining focus.

The eight Em apathy subscale items mostly focused on indifference to one's actions and emotional impartiality to others, whereas there is no motivation for either positive or negative affective experience or interpretation. The low relationship of item A16 ("I express/show my emotions") with the Em apathy subscale total score could be due to the complex wording of the item. The item contained a forward-slash that could be interpreted as an "or" between these two words. The words "express" and "show" could be interpreted as differing, where the latter of the two represents a conscious decision in relation to emotion. This resulted in rephrasing of the item to only using the word "express", as it is more representative of the Em apathy subscale. The altered version item A16 ("I *express* my emotions") was also included as a part of the subscale to assess more unconscious expression of emotional apathy.

The BCI apathy subscale items evaluate instigator behaviours or cognitions that are internally manifested. Apathy has often been observed in MND (Woolley et al., 2011) but could be polluted by other neurodegenerative, motor symptoms. However, the items for the scale are able to isolate initiative apathetic impairment untainted by other deteriorating motor functions, such as in MND and PD. Examples of such would be the phrasing of item A24 (“I act on things I have thought about during the day”), where “act” on does not imply as much physical or motor behaviour as word like “do” or “perform”. Some items were also worded generally enough but do not imply any motor activity while still assessing the behavioural or cognitive initiation apathy impairments directly. For example item A40 (“I am spontaneous”) could be interpreted as either spontaneous behaviours or thoughts, which could be seen as independent of symptom severity. Item A28 (“I keep myself busy”) could be associated with physical or planning tasks.

Varying relationships were found between apathy subscale total scores within this sample. The BCI apathy subscale was predictably the most positively related to Ex apathy subscale due to the relationship between planning and initiating behaviour and cognition being strong. Additionally Em apathy subscale was positively associated with the BCI apathy subscale. This bodes well with Levy and Dubois (2006) where AA apathy subtype can affect both cognitive and emotional responses. They also proposed that the AA subtype was a summative effect of both COG and EA subtype deficits, implying a relationship between the two. However, the Ex apathy subscale was shown to have no relationship with Em apathy subscale which could be due to the item phrasing being distinctly task and emotively oriented, for respective subtypes.

The significantly higher mean BCI subscale total score could be due to its evidential subdivision in to BI and CI factors. Research within different disorders would be important in establishing this scale for clinical use. It should be stated that while the proposed cut-off score for mild, moderate and severe apathy for each subscale are valid, due to the presence of apathetic behaviour in normative functioning, they are based on normative data and would benefit from a more detailed, pathologically based partitioning.

General Discussion

1 DAS and Apathy Subtypes

The preliminary 24 item self-rated apathy scale (DAS) was constructed on the basis of Levy and Dubois' (2006) neurologically based apathy subtypes. This was due to the obvious lack of a direct assessment of a recognised characteristic of apathy. The three domains of apathy are assessed by the Ex, Em and BCI apathy subscales. A mixture of negatively and positively phrased items was employed in an attempt to control for acquiescence and social desirability bias. The eight items chosen to assess each subtype were detailed in evaluating symptomatic or syndromic characteristics related to apathy. This methodical, theory-based item design and thorough examination of already established items from apathy scales and subscales (for review see Clarke et al., 2011) could be said to increase the validity of this measure. The use of standardized scoring in the form of a Likert scale as a part of the DAS allowed for more efficient measurement of apathy subtypes. The limitation of each item to only four choices of response attempted to eliminate possible central tendency bias. Additionally, the internal consistency reliability was further supported by a high inter-rater reliability. The item-subscale total correlations were found to be satisfactory for the reliability of the scale in a normal ageing population.

The EA subtype, according to Levy and Dubois, seems to result in impairment of expressing one's own or interpretation of others' emotional states, either positive or negative. The diminished motivation for the expression of these functions can more reliably be observed through lack of interest in others' experiences and activities or how their own behaviour is perceived and affects others. Therefore, the more directly emotive elements of this apathetic subtype have been a focus of the Em apathy subscale because of the empathetic and egocentric implications of affective functionality of this particular impairment.

In considering COG apathy, Levy and Dubois' definition seems to be dedicated to the disruption of executive type functions of daily living such as planning their day or carrying a task through to the end. This resulted in the postulation that this type of apathy is significantly more motivationally executive in its nature, where organisation of thoughts and actions is centrally disrupted. The Ex apathy subscale part of the new apathy measure assesses these aspects of Levy and Dubois COG apathy subtype. Unpublished research by

Radakovic (2011) showed consistent impairment in normal, healthy ageing population on working, semantic and episodic memory neuropsychological measures. This could be interpreted as general reduced functioning in cognitive domains associated with executive dysfunction. However, further research is needed to confirm the specific association between apathy and executive functioning.

AA apathy, when more methodically explored, has features of both behaviours and thoughts alike in that thinking of new things to do and getting things started of their own accord is impaired. Based on this, there seems to be an indication that specific initiatory cognition and behaviour impairment is present, motivating the need for a further research in the BI and CI factors. However, within the AA subtype, behaviour and cognition are strongly related in that impairments occur inclusive of both domains (Levy, & Dubois, 2006), serving as evidence for the inclusion of it as a unitary subtype and, relatedly, the inclusion of a BCI apathy subscale instead of further subdivisions.

2 DAS and Apathy Diagnostic Criteria

In consideration with the proposed diagnostic criteria for apathy by Robert et al. (2006), the DAS takes into account the valid characteristics of Criterion B (see Table 1). Items from the BCI apathy subscale satisfy self- initiated behaviours and cognitions subdomains of Criterion B, specifically the spontaneous ideas part of Domain B2 and self-initiated behaviour (e.g. seeking social activities and communicating choices). The Em apathy subscale is parallel to Domain B3 of the diagnostic criteria through emotional responsiveness to positive or negative stimuli and spontaneous emotion. Upon closer examination of Domain B2, it does not seem to associate with the Ex apathy subscale features due to intermixing of symptoms with AA apathy subtype, such loss of spontaneous ideas and new events. The COG apathy subtype, assessed by the Ex subscale in DAS, was mostly disregarded as a general subtype in the proposed diagnostic criteria barring scattered recognition, in the form of doing basic tasks of day to day living (Domain B1) and challenging tasks (Domain B2). In relation to the subscale total score results of this study, this diagnostic intertwining of the Ex and BCI apathetic subscales could be due their positive relationships. In Figure 1., there is a suggested indirect connection between intention and action with sub- stages of planning and initiation-execution of GDB, which implies a relationship between executive functioning (COG apathy subtype) and initiation of

behaviours or cognitions (AA apathy subtype). These impairments, therefore, could result in deficits associated with the COG and AA apathy subtypes. However, these two subtypes are still independently distinguishable in clinical populations (Levy, & Dubois, 2006) despite the high likelihood of occurring together.

This conventional cognitive-behavioural-emotional triadic view adopted by the proposed diagnostic criteria for apathy does not account for Levy and Dubois' representative subdivision associated with functional impairment and symptomology of apathy. Therefore, it would be more representative, and strongly recommended, to divide apathy into the Levy and Dubois (2006) proposed subtypes within the diagnostic criteria (Robert et al., 2006). This and the results from this study challenge the substructure of Criterion B and the general aim of the diagnostic criteria. Identification of the apathy subtypal functioning should be a more primary focus alongside diagnosing the "general" presence of apathy as to allow for easier classification and therapy.

3 Limitations and Further Research

While this study was adequate in providing evidence for groundwork to assist further development of the DAS, there are several points to consider. Primarily, the use of healthy, normal ageing populations in validating method of assessing what is usually detected in pathological populations. However, apathy as a concept is observable in a normative population (Brodaty et al., 2010) but fluctuates. This still makes it measurable and detectable in the normal population, albeit at lower and less variable levels in subtypes than in pathological populations. Due to the high prevalence of apathy as a symptom in a variety of neurodegenerative diseases and disorders, such as MND, PD, DAT and other forms of dementia, the DAS should be further validated in such populations. Due to the neurodegenerative nature of these disorders and their effect on disorder perception of individuals experiencing them, the self- version of the scale should be adapted as carer/informant and clinical version in aid of assessing apathy subtype impairment in more severe illness progressions.

By specifically identifying the characteristics of the underlying apathy subtype mechanisms, a more direct measurement of apathy can also be developed, unpolluted by the more extreme symptomology associated with neurodegenerative disorders. An example of

this would be to have better understanding of AA apathy subtype in terms of initiation of both motor and cognitive functions (Levy, & Dubious, 2006). In relation to this study, relationship between the BI and CI factor should be further explored as to determine if further subsampling of the DAS. Such a precise classification of this subtype would allow for a valid assessment to eventually be devised, which is not limited by motor disability or deterioration relating to MND or PD.

While the sample size is considered large enough for an Exploratory Factor Analysis (EFA) method, a larger sample would be needed to perform a Confirmatory Factor Analysis (CFA). This would allow for the fit of the pre-specified factor model to be tested using the DAS scale. Future research should aim to create such models based on differing patient groups.

More research is needed to explore the complex relationship of demographic variables and different apathy subtype levels. Brodaty et al. (2010) discussed such effects on overall apathy level, citing possible negative and positive occupational, social and developmental factors as being influential; an example being retirement. It has a complex effect on mental health in that the outcome can be positive, but becomes negative when such a change is age inappropriate or creates other difficulties (Drentea, 2002; van Solinge, 2007). Cultural differences should also be documented as the effects of apathy might not be constant through different populations. Additionally, research should not shy away from qualitative alongside quantitative research into apathy subtypes allowing for formation of a “gold standard” associated with different apathy subtype impairments both in occupational, social, developmental and, more relevantly, neuropsychological areas of functioning.

4 Conclusion

The findings from this study have capably utilised a normal ageing sample and began to validate a new method of measuring levels of impairment associated with different apathy subtypes – named the DAS. The methodological design of the DAS at this early stage of the validation process is significant in its development and as a practically usable scale. It has been shown to be a reliable and viable way of utilising variable apathy subtype impairments. Studies in different patient groups to further validate the DAS are paramount. Accordingly, disease aetiologies can be supplemented by apathy subtype impairments that will help

evaluate and influence the implementation of types of pharmacological or non-pharmacological treatments and their outcomes.

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Appendix A

Apathy items and codes

Item Code	Apathy item
A1	I find it hard to concentrate on things
A2	I am affectionate to those I care about
A3	I have difficulty thinking of things to do
A4	I need a bit of encouragement to get things started
A5	I am not interested in other people's news
A6	I feel emotionally flat
A7	I contact my friends
A8	I become emotional easily when watching something happy or sad on TV
A9	I am unconcerned about how others feel about my behaviour
A10	I lack motivation
A11	After having done something, I spend time thinking whether it was good or bad
A12	I find myself staring in to space
A13	Before I do something I think about how others would feel about it
A14	I plan my days activities in advance
A15	I struggle to empathise with other people
A16	I express/ show my emotions
A17	I try new things
A18	I am easily distracted
A19	When faced with several options, I arrive to a decision easily
A20	When criticized I feel the need to defend myself
A21	I am a good problem solver
A22	I sit and think of nothing for most of the day
A23	I set goals for myself
A24	I act on things I have thought about during the day
A25	I am organized
A26	I need to be prompted to perform everyday tasks
A27	When doing a demanding task, I have difficulty working out what I have to do
A28	I keep myself busy
A29	I get easily confused when doing several things at once
A30	My mind tends to go blank
A31	I struggle to keep track of conversation
A32	I think of new things to do during the day
A33	I find it difficult to keep my mind on things
A34	I am concerned about how my family feel
A35	I am able to focus on a task until it is finished
A36	I feel indifferent to what is going on around me
A37	When I want to do something I can make an effort
A38	I am uninterested in what others have to say
A39	If I think I will forget something, I make an effort to remember it
A40	I am spontaneous
A41	When I make a mistake, I try and correct
A42	When I can, I start conversations
A43	I am not concerned about failing or succeeding
A44	When I receive bad news I feel bad about it
A45	I sometimes start things but find it hard to finish them

Appendix B

Apathy questionnaire used in Study A and Study B

PPT No:

Choose the answer on how you have **felt, behaved or thought**, based on the **rate of occurrence in the last month**: (Circle statement that applies)

1. I find it hard to concentrate on things.
 - ◇ Almost always
 - ◇ Often
 - ◇ Occasionally
 - ◇ Hardly Ever
2. I am affectionate to those I care about.
 - ◇ Almost always
 - ◇ Often
 - ◇ Occasionally
 - ◇ Hardly Ever
3. I have difficulty thinking of things to do.
 - ◇ Almost always
 - ◇ Often
 - ◇ Occasionally
 - ◇ Hardly Ever
4. I need a bit of encouragement to get things started.
 - ◇ Almost always
 - ◇ Often
 - ◇ Occasionally
 - ◇ Hardly Ever
5. I am not interested in other people's news.
 - ◇ Almost always
 - ◇ Often
 - ◇ Occasionally
 - ◇ Hardly Ever
6. I feel emotionally flat.
 - ◇ Almost always
 - ◇ Often
 - ◇ Occasionally
 - ◇ Hardly Ever
7. I contact my friends.
 - ◇ Almost always
 - ◇ Often
 - ◇ Occasionally
 - ◇ Hardly Ever
8. I become emotional easily when watching something happy or sad on TV.
 - ◇ Almost always
 - ◇ Often
 - ◇ Occasionally
 - ◇ Hardly Ever
9. I am unconcerned about how others feel about my behaviour.
 - ◇ Almost always
 - ◇ Often
 - ◇ Occasionally
 - ◇ Hardly Ever
10. I lack motivation.
 - ◇ Almost always
 - ◇ Often
 - ◇ Occasionally
 - ◇ Hardly Ever
11. After having done something, I spend time thinking whether it was good or bad.
 - ◇ Almost always
 - ◇ Often
 - ◇ Occasionally
 - ◇ Hardly Ever
12. I find myself staring in to space.
 - ◇ Almost always
 - ◇ Often
 - ◇ Occasionally
 - ◇ Hardly Ever
13. Before I do something I think about how others would feel about it.
 - ◇ Almost always
 - ◇ Often
 - ◇ Occasionally
 - ◇ Hardly Ever
14. I plan my days activities in advance.
 - ◇ Almost always
 - ◇ Often
 - ◇ Occasionally
 - ◇ Hardly Ever

15. I struggle to empathise with other people.

- ◇ Almost always
- ◇ Often
- ◇ Occasionally
- ◇ Hardly Ever

16. I express/show my emotions.

- ◇ Almost always
- ◇ Often
- ◇ Occasionally
- ◇ Hardly Ever

17. I try new things.

- ◇ Almost always
- ◇ Often
- ◇ Occasionally
- ◇ Hardly Ever

18. I am easily distracted.

- ◇ Almost always
- ◇ Often
- ◇ Occasionally
- ◇ Hardly Ever

19. When faced with several options, I arrive to a decision easily.

- ◇ Almost always
- ◇ Often
- ◇ Occasionally
- ◇ Hardly Ever

20. When criticized I feel the need to defend myself.

- ◇ Almost always
- ◇ Often
- ◇ Occasionally
- ◇ Hardly Ever

21. I am a good problem solver.

- ◇ Almost always
- ◇ Often
- ◇ Occasionally
- ◇ Hardly Ever

22. I sit and think of nothing for most of the day.

- ◇ Almost always
- ◇ Often
- ◇ Occasionally
- ◇ Hardly Ever

23. I set goals for myself.

- ◇ Almost always
- ◇ Often
- ◇ Occasionally
- ◇ Hardly Ever

24. I act on things I have thought about during the day.

- ◇ Almost always
- ◇ Often
- ◇ Occasionally
- ◇ Hardly Ever

25. I am organized.

- ◇ Almost always
- ◇ Often
- ◇ Occasionally
- ◇ Hardly Ever

26. I need to be prompted to perform everyday tasks.

- ◇ Almost always
- ◇ Often
- ◇ Occasionally
- ◇ Hardly Ever

27. When doing a demanding task, I have difficulty working out what I have to do.

- ◇ Almost always
- ◇ Often
- ◇ Occasionally
- ◇ Hardly Ever

28. I keep myself busy.

- ◇ Almost always
- ◇ Often
- ◇ Occasionally
- ◇ Hardly Ever

29. I get easily confused when doing several things at once.

- ◇ Almost always
- ◇ Often
- ◇ Occasionally
- ◇ Hardly Ever

30. My mind tends to go blank.

- ◇ Almost always
- ◇ Often
- ◇ Occasionally
- ◇ Hardly Ever

31. I struggle to keep track of conversation.

- ◇ Almost always
- ◇ Often
- ◇ Occasionally
- ◇ Hardly Ever

32. I think of new things to do during the day.

- ◇ Almost always
- ◇ Often
- ◇ Occasionally
- ◇ Hardly Ever

33. I find it difficult to keep my mind on things.

- ◇ Almost always
- ◇ Often
- ◇ Occasionally
- ◇ Hardly Ever

34. I am concerned about how my family feel.

- ◇ Almost always
- ◇ Often
- ◇ Occasionally
- ◇ Hardly Ever

35. I am able to focus on a task until it is finished.

- ◇ Almost always
- ◇ Often
- ◇ Occasionally
- ◇ Hardly Ever

36. I feel indifferent to what is going on around me.

- ◇ Almost always
- ◇ Often
- ◇ Occasionally
- ◇ Hardly Ever

37. When I want to do something I can make an effort.

- ◇ Almost always
- ◇ Often
- ◇ Occasionally
- ◇ Hardly Ever

38. I am uninterested in what others have to say.

- ◇ Almost always
- ◇ Often
- ◇ Occasionally
- ◇ Hardly Ever

39. If I think I will forget something, I make an effort to remember it.

- ◇ Almost always
- ◇ Often
- ◇ Occasionally
- ◇ Hardly Ever

40. I am spontaneous.

- ◇ Almost always
- ◇ Often
- ◇ Occasionally
- ◇ Hardly Ever

41. When I make a mistake, I try and correct it.

- ◇ Almost always
- ◇ Often
- ◇ Occasionally
- ◇ Hardly Ever

42. When I can, I start conversations.

- ◇ Almost always
- ◇ Often
- ◇ Occasionally
- ◇ Hardly Ever

43. I am not concerned about failing or succeeding.

- ◇ Almost always
- ◇ Often
- ◇ Occasionally
- ◇ Hardly Ever

44. When I receive bad news I feel bad about it.

- ◇ Almost always
- ◇ Often
- ◇ Occasionally
- ◇ Hardly Ever

45. I sometimes start things but find it hard to finish them.

- ◇ Almost always
- ◇ Often
- ◇ Occasionally
- ◇ Hardly Ever

Appendix C

Instructions, Consent form and Debrief for Study A and Study B

Ppt No: _____

Participant Information Sheet



You are being asked to take part in a study by Ratko Radakovic, supervised by Dr Sharon Abrahams, of the University of Edinburgh, which is looking at motivation.

In this study you will be asked to complete a questionnaire based on rating how you have felt, behaved or thought, in the last month.

The survey typically takes 10-15 minutes to complete.

Compensation

You will receive £5 in return for your participation.

Participant's rights

Your participation in this study is voluntary so you may withdraw from the study at any time without explanation.

You have the right to have your questions about the procedures answered (unless answering these questions would interfere with the study's outcome).

Confidentiality & Anonymity

All information will be confidential and the data anonymous. There will be no link between the data acquired from the survey and any personal information that you have supplied.

Benefits and Risks

There are no known risks or benefits.

Further Information

We would be glad to answer your questions about the study at any time or, at a later date, the outcome of the study.

Student: Ratko Radakovic s1135017@sms.ed.ac.uk

Supervisor: Dr Sharon Abrahams s.abrahams@ed.ac.uk

CONSENT FORM

By signing below, you are agreeing that: (1) you have read and understood the Participant Information Sheet, (2) questions about your participation in this study have been answered satisfactorily, (3) you are aware of the potential risks (if any), and (4) you are taking part in this research study voluntarily (without coercion).

Date

Participant's Name (Printed)*

Participant's signature*

Participants email address (Optional)

Principal investigator (Printed)

Signature Principal investigator

**Participants wishing to preserve some degree of anonymity may use their initials (from the British Psychological Society Guidelines for Minimal Standards of Ethical Approval in Psychological Research)*



Debrief for participants

The aim of this study is to develop a new method that assesses apathy level. We are interested to know whether there are different types of apathy. Apathy can be defined as reduced motivation that occurs in a variety of different disorders but can also be detected in normal individuals. Some people may be apathetic because they cannot initiate new thoughts, others cannot organise themselves to do things, while others may have difficulty eliciting emotions.

This study hopes to identify different domains of apathy that are detectable and variable in the healthy population. This will further lead to validating this and an informant-based version of this apathy scale in clinical populations such as Parkinson's Disease, Dementia, Motor Neurone Disease.

If you have any further questions about the study or the outcome of the study please email:

Student: Ratko Radakovic s1135017@sms.ed.ac.uk

Supervisor: Dr Sharon Abrahams s.abrahams@ed.ac.uk

Appendix D

Self- DAS and Scoring sheet

Name..... Age..... Sex.....

Marital Status..... Years of Education.....

Choose the answer on how you have **felt, behaved or thought**, based on the rate of occurrence in the last month: (Circle the statement that applies)

- | | |
|--|--|
| <p>1. I need a bit of encouragement to get things started</p> <ul style="list-style-type: none">◇ Almost always◇ Often◇ Occasionally◇ Hardly Ever <p>2. I contact my friends</p> <ul style="list-style-type: none">◇ Almost always◇ Often◇ Occasionally◇ Hardly Ever <p>3. When I receive bad news I feel bad about it</p> <ul style="list-style-type: none">◇ Almost always◇ Often◇ Occasionally◇ Hardly Ever <p>4. I think of new things to do during the day</p> <ul style="list-style-type: none">◇ Almost always◇ Often◇ Occasionally◇ Hardly Ever <p>5. I am unconcerned about how others feel about my behaviour</p> <ul style="list-style-type: none">◇ Almost always◇ Often◇ Occasionally◇ Hardly Ever | <p>6. I find myself staring in to space</p> <ul style="list-style-type: none">◇ Almost always◇ Often◇ Occasionally◇ Hardly Ever <p>7. Before I do something I think about how others would feel about it</p> <ul style="list-style-type: none">◇ Almost always◇ Often◇ Occasionally◇ Hardly Ever <p>8. I plan my days activities in advance</p> <ul style="list-style-type: none">◇ Almost always◇ Often◇ Occasionally◇ Hardly Ever <p>9. I struggle to empathise with other people</p> <ul style="list-style-type: none">◇ Almost always◇ Often◇ Occasionally◇ Hardly Ever <p>10. I am easily distracted</p> <ul style="list-style-type: none">◇ Almost always◇ Often◇ Occasionally◇ Hardly Ever |
|--|--|

- 11.I lack motivation
- ◇ Almost always
 - ◇ Often
 - ◇ Occasionally
 - ◇ Hardly Ever

- 12.I express my emotions
- ◇ Almost always
 - ◇ Often
 - ◇ Occasionally
 - ◇ Hardly Ever

- 13.I set goals for myself
- ◇ Almost always
 - ◇ Often
 - ◇ Occasionally
 - ◇ Hardly Ever

- 14.I try new things
- ◇ Almost always
 - ◇ Often
 - ◇ Occasionally
 - ◇ Hardly Ever

- 15.I am concerned about how my family feel
- ◇ Almost always
 - ◇ Often
 - ◇ Occasionally
 - ◇ Hardly Ever

- 16.I act on things I have thought about during the day
- ◇ Almost always
 - ◇ Often
 - ◇ Occasionally
 - ◇ Hardly Ever

- 17.When doing a demanding task, I have difficulty working out what I have to do
- ◇ Almost always
 - ◇ Often
 - ◇ Occasionally
 - ◇ Hardly Ever

- 18.I keep myself busy
- ◇ Almost always
 - ◇ Often
 - ◇ Occasionally
 - ◇ Hardly Ever

- 19.I get easily confused when doing several things at once
- ◇ Almost always
 - ◇ Often
 - ◇ Occasionally
 - ◇ Hardly Ever

- 20.I become emotional easily when watching something happy or sad on TV
- ◇ Almost always
 - ◇ Often
 - ◇ Occasionally
 - ◇ Hardly Ever

- 21.I find it difficult to keep my mind on things
- ◇ Almost always
 - ◇ Often
 - ◇ Occasionally
 - ◇ Hardly Ever

- 22.I am spontaneous
- ◇ Almost always
 - ◇ Often
 - ◇ Occasionally
 - ◇ Hardly Ever

- 23.I am able to focus on a task until it is finished
- ◇ Almost always
 - ◇ Often
 - ◇ Occasionally
 - ◇ Hardly Ever

- 24.I feel indifferent to what is going on around me
- ◇ Almost always
 - ◇ Often
 - ◇ Occasionally
 - ◇ Hardly Ever

SELF- DAS (DIMENSIONAL APATHY SCALE)

Scoring Instructions

Using the scoring instructions below, sum the total scores for each subscale.

Scoring Instructions

Positive Item Scoring +		Negative Item Scoring	
◇ Almost always	0	◇ Almost always	3
◇ Often	1	◇ Often	2
◇ Occasionally	2	◇ Occasionally	1
◇ Hardly Ever	3	◇ Hardly Ever	0

Scoring Sheet

Executive Subscale	Emotive Subscale	Behaviour/Cognitive Initiation Subscale																																																						
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