

**IOWA SCALES OF
PERSONALITY CHANGE**

Professional Manual

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Manual Version: 07/10/2023

Citation: Barrash, J. (2023). *Iowa Scales of Personality Change: Professional manual*. Iowa City, IA: Benton Neuropsychology Laboratory, Department of Neurology, University of Iowa.

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Acknowledgments

I gratefully thank my colleagues and good friends, Steve Anderson, PhD, Rob Jones, PhD, and Dan Tranel, PhD, for their many contributions to the development of the initial version of the Iowa Scales of Personality Change. I am indebted to Julie Hathaway-Nepple, MA, LPC, for contributing her insights, and to the many outstanding psychometrists of the Benton Lab, especially Joan Brandt, MA, Ellen Steffensmeier, BA, Stephen Cross, BA, Ann Axelson, BA, Audrey Grieder, BA and Tasha Feuerbach, BA for their assistance with data collection and scoring of countless ISPCs, and for their reliable helpfulness and good humor; and a special thanks to Ken Manzel, BA, who over the years has played a special role in too many aspects of work with the ISPC to list here, but his contributions have been major. Marta Leira provided invaluable assistance with her translation of Spanish-language research. Chris Nguyen, PhD, Andy Jones, PhD and Christian Zirbes, BS are commended for their determined efforts at all stages of the execution of notable studies of the ecological validity and psychometric characteristics of the ISPC; and to Aaron Boes, MD, PhD, for his expertise and enthusiasm for investigation of the neural underpinnings of acquired personality disturbances and for his unfailing collegiality. I am thankful for the meticulous translations of the ISPC into French and German by my dear friends, Anne-Claude Juillerat Van der Linden, PhD, and Caroline Kuhn, PhD, and excellent translations into Spanish, Italian and Slovenian by María Pilar Jiménez-Cortés, PhD, Angelo Cantagallo, PhD, Simon Brezovar, PhD, respectively. Thanks to Steve Anderson, PhD, and Natalie Denburg, PhD, for their leading role in developing adaptations of the ISPC for individuals with childhood onset brain damage and healthy adults, respectively. Finally, I am tremendously thankful for the many contributions of Professors Arthur Benton and Donald Stuss, giants of neuropsychology and illuminators of frontal lobe functions, for their encouragement, insights, mentorship, and above all their modeling of gentlemanliness and lives well-lived.

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1. Introduction

1.1. Intended Use

The *Iowa Scales of Personality Change* (ISPC, or “Iowa Scales”) assess personality disturbances that may occur in patients with brain damage. The Iowa Scales were created as a component of neuropsychological and neuroscientific investigations of prefrontal functions under the leadership of Antonio Damasio at the University of Iowa Benton Neuropsychology Laboratory. “Personality” refers to enduring tendencies that impact psychosocial functioning across real-life situations including drive, behavior, emotional modulation and cognitive tendencies such as self-awareness, pervasive attitudes, judgment and decision-making, and planfulness (Stuss, Gow, & Hetherington, 1992). The Iowa Scales were designed to assess a wide range of specific personality disturbances that have been frequently reported following brain disease whether developmental, acquired or neurodegenerative, and whether damage is in the frontal lobe or elsewhere. Intended use is assessment of personality changes for both clinical purposes (diagnosis, rehabilitation and treatment planning) and research purposes.

1.2. Personality Changes with Brain Damage

Personality changes after frontal lobe injury have been described as far back as 1835 in the French literature (Blumer and Benson, 1975) and in the English popular press in 1840 by Edgar Allen Poe (Altschuler, 2004). A few decades later in North America, an especially compelling demonstration of dramatic personality changes following injury to the frontal lobes was presented by the famous case of Phineas Gage (Harlow, 1868): Gage was a polite, responsible and industrious young man until an accidental explosion drove a tamping iron through his frontal lobe, resulting in profound personality changes including poor judgment, lack of planning, disinhibition, socially inappropriate behavior, emotional dysregulation, and insensitivity. At the end of the 19th century, an investigation examining location of brain damage and development of psychiatric disturbances in 225 patients with gunshot wounds found that damage to frontal lobes was associated with disturbances of “higher psychic phenomena and psychiatric disturbance” (Phelps, 1898, cited in Lishman, 1968). A wide array of personality changes in patients undergoing partial resection of frontal lobes for tumor or abscess was noted to bear a striking resemblance to the disturbances found in previous studies, and it was concluded that these disturbances were frequent and specific sequela of frontal lobe lesions (Rylander, 1939). In the early 20th century, several German investigations of personality disturbances in returning soldiers with frontal damage from war injuries documented problems with apathy, poor planning, irritability, tactlessness, facetiousness, euphoria and moral defects, as well as problems with attention and planning. A review of the frequent findings of generalized and wide-ranging personality and emotional disturbances led to the conclusion “We have learned to recognize a ‘frontal lobe syndrome’ which does not depend on cognitive disturbance at its core” (Lishman, 1968, p. 374). Contemporaneously, a similar collection of disturbances in emotion, cognition and behavior were seen among 261 patients surviving subarachnoid hemorrhage and were referred to as “frontal lobe syndrome” although the nature of observed disturbances was quite varied (Storey, 1970), and similar set of personality changes has been reported following anterior communicating artery aneurysms (DeLuca & Diamond, 1995; Steinman & Bigler, 1986; Tang, Wang, Tsoi, Barrash & Kim, 2022).

In a departure from the prevailing focus on a general frontal lobe syndrome, some earlier investigators discerned differentiated patterns among the disturbances. Holmes (1931) suggested three types of personality changes, and Kleist (1939) noted differences in the consequences of damage to the lateral convexity, with cognitive changes more common, and those involving orbital cortex, with emotional disturbances predominating. Walch (1956), studying a series of 356 patients with frontal brain injuries, and shortly thereafter Kretschmer (1956) and

then Luria (1969), each described two major types of personality changes: one including disinhibition, impulsivity and euphoria associated with orbital damage; the other including apathy and restricted interests associated with damage elsewhere. In 1975, Blumer and Benson reviewed 140 years of literature on personality changes after frontal lobe injury and concluded that there are two types of changes: “pseudopsychopathic,” associated with orbital prefrontal damage, and “pseudodepressed,” associated with damage to the prefrontal convexity. Four dimensions of disturbances emerged from a principal components analysis of neurological, cognitive, emotional and personality changes recorded in a series of 79 patients surviving anterior cerebral aneurysm ruptures (Logue, 1968). The most prominent dimension was characterized by cognitive, executive and memory deficits. The second dimension was bipolar, reflecting either decreased tendency to worry, reduced irritability, elevated mood and increased sociability; or changes in the opposite direction. The third reflected disinhibition, “affective flattening” vs. “affective release” (i.e., exaggerated emotional expressiveness), and being more sociable, outspoken, and irritable. The fourth reflected left-sided neurological damage and aphasic symptoms. More recently, Stuss and colleagues explicated *personality* as “stable and predictable response patterns of a person interacting with his or her environment,” including mood, affect, drive, and cognitive functions such as flexibility, freedom from interference, self-reflectiveness and judgment (Stuss, Gow, & Hetherington, 1992). They argued that “frontal personality disturbance” was a more appropriate term than “frontal lobe syndrome” to refer to the diverse complex of disturbances arising from prefrontal dysfunction.

In addition to the disturbances associated with damage to prefrontal cortex, personality disturbances may be seen in association with (a) subcortical lesions in frontal-subcortical circuits (Corbetta et al., 2015; Cummings, 1993; Strub, 1989); (2) non-frontal brain regions (Mulders, Llera, Tendolkar, van Eijndhoven, & Beckmann, 2018; Simon, Varangis, & Stern, 2020), especially limbic regions involved in emotion (Adolphs, 2009); and (3) various neurological conditions that typically damage prefrontal integrity such as frontotemporal dementia (Mahoney, Rohrer, Omar, Rossor, & Warren, 2011), Huntington’s disease (Lyketsos, Rosenblatt, & Rabins, 2004), Parkinson’s disease (Boussac et al., 2021; Glosser, Clark, Freundlich, Kliner-Krenzel, Flaherty, & Stern, 1995), amyotrophic lateral sclerosis (Waldron, Barrash, Swenson & Tranel, 2014), and traumatic brain injury (TBI) (Lezak, 1987; Zappala, de Schotten, M. T., & Eslinger, 2012). Other diseases with reported personality changes include Alzheimer’s (Robins Wahlin, & Byrne, 2011), and temporal lobe epilepsy (Bear & Fedio, 1977) although evidence regarding the nature of epileptic changes has been inconsistent (Blumer, 1999; Devinsky & Najjar, 1999; Tremont et al., 2012).

1.3. Assessment of Acquired Personality Disturbances

Accurate characterization of personality changes with brain damage is important because personality disturbances following brain injury are persistent and are major causes of real-life psychosocial disability (Lezak, 1987; Prigatano, 1986), sometimes more so than cognitive changes (Eslinger & Damasio, 1985; Barrash et al., 2020). Clinically, careful assessment is critical for education of patient, family and care providers, and staff regarding these neurobehavioral disturbances and for optimal treatment planning, targeting specific disturbances for pharmacological or behavioral interventions (Grace & Malloy, 2001). Obtaining information regarding these potentially disabling personality disturbances is not necessarily provided by standard neuropsychological examination of cognitive functioning as performances may be completely normal on cognitive tests despite the presence of acquired personality disturbances that are disabling in real life (Barrash et al., 2020; Eslinger & Damasio, 1985; Lezak, 1987; Waldron et al., 2014).

In the past, efforts were made to assess acquired personality disturbances with

instruments designed to assess primary psychiatric disturbances. However, these instruments proved insensitive to marked personality disturbance in premorbidly normal individuals who developed disturbance following brain disease (Barrash, Tranel, & Anderson, 1994; Gainotti, 1993; Lannoo, De Deyne, Colardyn, De Soete, & Jannes, 1997; Livingston, Brooks, & Bond, 1985; Tate, 1999). Several instruments were developed for assessment of symptoms or behavioral disturbances in neurological patients. However, the ability of such instruments to characterize acquired personality disturbances per se following brain damage was limited by several factors including assessment of exceedingly broad domains of functioning such as “social function” or “mood,” assessment of a limited set of neurobehavioral symptoms in specific brain diseases, no assessment of change, and psychometric weaknesses (Barrash, Tranel, & Anderson, 2000; Malloy & Grace, 2005; Tate, 1999).¹

Instruments developed for assessment of normal personality — that is, assessing five statistically independent dimensions as determined by factor analyses — have been employed in various neurological populations with mixed findings. Investigators noting a failure to find any personality changes concluded “It is possible that head-injury-related personality changes present in head-injured patients and not in control patients might not have been measured by the NEO-FFI” (Lannoo et al., 1997, pp. 509-510). One explanation for this observation is that inventories designed to assess independent dimensions of normal personality — such as NEO and BFI inventories (McCrae & John, 1992) — may not be sensitive to particular disturbances associated with different brain diseases. An additional concern is that scores from inventories for normal personality dimensions have not been calibrated to discern a threshold at which change in personality is clinically notable: high or low scores on the dimensions do not necessarily indicate functional impairment (D’lorio et al., 2018). As a result, these measures have unclear clinical relevance to neuropathological personality disturbances.

These issues led Stuss and colleagues to note that investigation of acquired personality disturbances had been limited by the lack of methodologies for quantifying the types of behavioral changes seen after brain damage (Stuss et al., 1992). Since that time, the Iowa Scales of Personality Change (ISPC; Barrash, Anderson, Hathaway-Nepple, Jones & Tranel, 1997a) and the Frontal Systems Behavior Scale (FrSBe; Grace & Malloy, 2001) were developed to address these issues. There is significant overlap in these instruments, both of which were designed to assess behavioral syndromes based on models of three functional systems linked to different prefrontal-subcortical circuits (Cummings, 1993; Stuss, 2011a), as elaborated below in section 5.5 (subsection “Neuroanatomical Correlates”). There are also similarities in the basic approach to assessing disturbances. A major difference, however, is that the FrSBe assesses three higher-order disturbances — apathy, disinhibition and executive dysfunction — that are theoretically associated with three prefrontal systems, while the ISPC assesses 26 characteristics selected to characterize function and dysfunction of the three systems in greater detail as well as assessing other personality changes that are not theoretically associated with the three prefrontal systems, or even with frontal lobe integrity more generally, but which have been frequently observed in the empirical literature as sequelae of brain damage.

¹ The Neuropsychiatric Inventory and other instruments designed to assess behavioral disturbances in neurological patients may have limited ability to characterize personality problems following brain damage due to several factors (Tate, 1999). Such instruments are limited in the scope of personality disturbances assessed because they were developed to assess neurobehavioral symptoms of specific clinical conditions such as dementias (Cummings et al., 1994), TBI (Dywan & Segalowitz, 1996), or “dysexecutive” syndrome (Wilson et al., 1996). Second, scores yielded by these instruments almost universally refer to the level of a disturbance — that is, the degree to which a characteristic is problematic — but they do not actually assess *change*. Thus, it is not always clear whether an individual’s problematic behavior is a qualitative change in personality, an intensification of premorbid tendencies, or merely a longstanding premorbid characteristic (Tate, 1999). Third, reliability is a significant concern (Elsass & Kinsella, 1989; Kreutzer, Kreutzer, Marwitz, Seel, & Serio, 1996) because ratings are typically left to the subjective judgment of the rater, without benefit of a behavioral measuring stick. Also, many instruments assess exceedingly broad domains of functioning such as “social function” and “executive functioning” or “mood,” and so do not provide detailed information about specific aspects of personality (e.g., Alfano, Neilson, & Fink, 1993; Brooks, Campsie, Symington, Beattie, & McKinlay, 1986; Katz & Lyerly, 1963; Kreutzer et al., 1996; Malia, Powell, & Torode, 1995; Nelson et al., 1989; Prigatano & Fordyce, 1986).

1.4. Features of the ISPC

The ISPC comprises rating scales of 30 particular personality characteristics (Table 1) which allow for characterization of a broader range of potential disturbances, and in more fine-grained detail than is available in other measures of acquired personality disturbances. Assessment with the ISPC is a time-efficient means for the clinician and the researcher to obtain reliable, relatively comprehensive information about personality changes: while the patient is engaged in other assessment activities the informant can complete the ratings, obviating the need for a lengthy interview of informants.

Table 1. Scales of the ISPC

<i>Aggressive Behavior</i>	<i>Indecisiveness</i>	<i>Manipulativeness^b</i>
<i>Anxiety</i>	<i>Inflexibility</i>	<i>Obsessiveness</i>
<i>Apathy</i>	<i>Insensitivity</i>	<i>Perseverative Behavior</i>
<i>Dependency</i>	<i>Irritability</i>	<i>Poor Judgment</i>
<i>Depression</i>	<i>Lability</i>	<i>Social Inappropriateness</i>
<i>Easily Overwhelmed^a</i>	<i>Lack of Initiative</i>	<i>Social Withdrawal</i>
<i>Frugality^b</i>	<i>Lack of Insight</i>	<i>Suspiciousness</i>
<i>Impatience</i>	<i>Lack of Persistence</i>	<i>Type A Behavior^b</i>
<i>Impulsivity</i>	<i>Lack of Planning</i>	<i>Unemotional^c</i>
<i>Inappropriate Affect</i>	<i>Lack of Stamina</i>	<i>Vanity^b</i>

Note. ^a *Easily Overwhelmed* had been labeled “*Vulnerability to Pressure*” in earlier versions of the ISPC, and was changed to minimize ambiguity. ^b *Frugality*, *Manipulativeness*, *Type A Behavior*, and *Vanity* are control scales. ^c *Unemotional* had been labeled “*Unemotional*” in earlier versions of the ISPC, and was changed to minimize ambiguity.

ISPC scales feature a focus on observable behavioral tendencies, with minimization of inferences concerning internal states or thoughts of the patient. Rating points along the 7-point scales have behaviorally-anchored rating guidelines and behavioral examples to enhance reliability (Schwarz, 1999), and to explicitly focus raters’ attention on enduring behavioral tendencies that may be in evidence across a variety of situations. The scales are asymmetric to help informants to focus attention on different levels of disturbance (if present); that is, a rating of 3 explicitly indicates an average level of the characteristic for individuals of the patient’s gender, age and cultural background, there are four rating points (4 – 7) to specify increasing levels of disturbance and the two rating points (1 – 2) to indicate higher than average levels of functioning. The asymmetric scale encourages raters to use the full set of ratings in the “disturbed” range (if the ratee is disturbed), ameliorating the tendency of raters to assign near-average ratings.

Ratings are completed by a spouse or family member rather than the patient themselves because of known problems with insight in the self-reports of individuals with brain injuries (Burgess, Alderman, Evans, Emslie, & Wilson, 1998; Lima et al., 2007; Prigatano, 1986; Zirbes, Jones, Manzel, Denburg, & Barrash, 2021). This results in ratings by patients that may be significantly discrepant from and less accurate than those by a familiar informant (Gaznick, 2015; Modestin & Puhan, 2000), with underestimation of disturbance (Lannoo et al., 1998). Two ratings are made for each trait: a “Before” rating of premorbid functioning, i.e., characteristic functioning over the adult years prior to the onset of the neuropathological condition, and a “Now” rating of current functioning, i.e., characteristic functioning over the past half-year (or past year if the onset was prior to a year earlier). These paired ratings by an individual who has known the patient well both premorbidly and after development of the neurological disorder enables meaningful characterization of the extent to which disturbances seen after the onset of brain changes reflect change from premorbid levels.

The pattern of ISPC ratings provides information about four subtypes of acquired personality disturbances: Emotional/Social Personality Disturbance, Dysexecutive Personality Disturbance, Hypoemotional Disturbance, and Distressed Personality Disturbance. Disturbances in these dimensions may have implications for the integrity of underlying prefrontal systems. In addition to the 26 clinically-relevant scales, the ISPC includes four scales as “control scales” to signal biased ratings. These four characteristics are not expected to increase to a problematic degree as a consequence of brain damage (based on comprehensive review of the literature on clinical reports of personality changes dating back to 1868). Endorsement of significant changes in *Frugality*, *Type A Behavior*, *Manipulativeness*, and *Vanity* may indicate significantly biased ratings whose validity should be carefully considered.

Assessment of the wide range of characteristics assessed with the ISPC is useful for clinical purposes for patients with any neurological disorder, contributing to education of patients and family regarding personality changes, planning for rehabilitation or therapy, and monitoring course and treatment progress over time. For scientific investigations, the ISPC allows for analysis of acquired personality changes that are associated with real-world impairments in social, occupational, and financial domains, and characterization of sequelae of various neuropathological conditions.

2. Administration and Scoring

2.1. Materials

There are distinct forms of the ISPC for male and female patients. The two versions are identical other than gender-specific pronouns. The cover page collects basic information about the rater and their relationship to the patient, and lists important instructions for the rater. Each of the pages that follow present one of the 30 characteristics to be rated, with a brief definition, the scale with guidelines behavioral guides lines for ratings of 1, 3, 5 and 7, and two columns for the premorbid and current ratings to be circled by the rater. The last page has areas for the informant to add information, should they choose, about additional behavioral changes not covered by the scales. An Excel spreadsheet (see Appendix A) is used to enter ratings and associated information, and it will produce a printed score sheet that includes scores on the four subtypes of acquired personality disturbance.

2.2. Appropriate Populations

The ISPC is designed for use with adults with onset at age 18 or later of any neuropathological condition causing brain dysfunction, including developmental disorders such as autism or attention deficit disorder; acquired disorders such as traumatic brain injury, anoxia, brain tumor or post-traumatic epilepsy; focal lesions from stroke, ruptured aneurysm, and neurosurgical resection; progressive neurodegenerative diseases including Alzheimer’s Parkinson’s, vascular dementia, frontotemporal dementia, Huntington’s disease, multiple sclerosis and amyotrophic lateral sclerosis; and psychiatric conditions with prefrontal involvement such as schizophrenia and mania. Although the performance of the ISPC for patients of different cultural and demographic backgrounds has not been formally evaluated, the validity of ratings is facilitated by ratings that are referenced to the family member’s perspective of what is “average” for individuals with similar backgrounds and demographic characteristics as the ratee, and ratings of current functioning are compared to the functioning of that individual prior to the onset of the disease.

The ISPC is not recommended for use with individuals younger than 18, or whose neuropathological condition developed at an earlier age. As personality is still developing and may be in flux, and because the life circumstances do not have the relative stability of adult

psychosocial roles, ratings of personality characteristics and of changes in those characteristics are considered questionable. That said, the ISPC may be helpful for simple descriptive purposes at a point in time, without inferences regarding changes or brain function. For assessment of personality in individuals with developmental conditions present at birth or with onset in the early years of life, an adaptation of the ISPC, the Iowa Scales of Personality Development (ISPD; Anderson & Barrash, 2005) is available. This adaptation does not assess premorbid personality and does not provide information about change, it describes current functioning on the 30 characteristics.

Although the ISPC can be administered at any point in time after onset of a brain condition, administration within a short interval (i.e., less than 2-3 months) must be interpreted with caution because instances of uncharacteristic behavior during that early period may reflect acute factors (neurological and non-neurological) and may not be manifestations of enduring personality changes. Additionally, the short interval may not provide sufficient time and opportunities to allow for the situations in which personality changes may be observable.

Administration of the ISPC after an interval of four months or longer, if possible, is recommended as this may improve raters' ability to make accurate ratings. The four-month interval provides a good balance between the competing considerations of (a) an insufficient interval potentially limiting the accuracy of ratings, and (b) obtaining information regarding personality changes when the opportunity is available. Advantages with longer intervals since the event/onset include: (i) more time for the patient to have resumed a wide range of their usual activities; (ii) increased opportunities for the informant to observe the patient's behavior in many situations over time; (iii) more time for the spouse/family to adjust to the shock and distress of the development of a chronic neurological condition in a loved one; (iv) 3 months provides ample time for chronic lesions to stabilize. After four months, ratings by different informants tend to show high interrater reliability (Barrash, Anderson, Jones, & Tranel, 1997b), as illustrated dramatically by Waldron and colleagues (Waldron et al., 2014), and most raters can make meaningful ratings (data on this issue are presented below in Section 4.3). Of course, ratings made less than 2-3 months after onset may provide useful information, but interpreting ratings as valid measure of enduring personality changes cannot be assumed but requires conscientious critical evaluation.

2.3. Appropriate Raters

Ratings should be completed by an adult who knows the ratee well and had regular opportunities to observe the ratee in a variety of situations both premorbidly and after the lesion onset. This is typically a spouse, parent, (adult) child or sibling. However, close friends are often able to provide well-informed ratings. The nature of relations between the informant and patient does not appear to vary systematically by type of familial relationship (Dawson, Markowitz, & Stuss, 2005; Gaznick, 2015), although the exact nature of rater/ratee relations (e.g., idealizing, demeaning, etc.) very likely can influence ratings.

If there is no family member or close friend available to complete the ISPC, but there is someone who has had the opportunity to observe the patient in a wide range of situations over a significant period of time (i.e., more than a few weeks) — such as a postmorbidity residential caretaker — that rater can complete ratings of current functioning. This will provide valuable information about the patient's current functioning, although these ratings cannot speak to the degree to which disturbances are changes from premorbid functioning. Similarly, if there are family members who knew the premorbid behavior well, but have not had the opportunity to observe the patient in a wide range of situations over several months or years, that rater can complete premorbid ratings. If information about current functioning can be gathered from other sources, then the premorbid ratings can help describe premorbid personality and inform the degree to which current disturbances are changes from premorbid functioning. In general, lay

ratings are evidently more accurate than the patient's self-rating (Gaznick, 2015), although lay ratings may be less critically-minded than the ratings of clinical psychologists who have had substantial opportunities to observe the ratees (Fiske, 1949).

A 6th grade reading level is required to complete the ISPC. Adequate psychological-mindedness and social intelligence are also critical to valid ratings, and this may be assessed when presenting the sample scale (*Selfishness*) during presentation of ISPC instructions (section 2.5). Concerns about psychological-mindedness may contribute to an overarching judgment regarding the validity of ratings (as discussed in section 2.6). However, if there is sufficient doubt regarding the adequacy of the rater's psychological-mindedness, it is recommended that the clinician inquire about personality changes by interview rather than ratings. If more than one appropriate rater is available, obtaining multiple sets of ratings may provide valuable information.

2.4. Professional Requirements

The interpretation of ISPC scores requires graduate training from an accredited college or university in clinical psychology, neuropsychology, counseling psychology, behavioral neurology, psychiatry or in a closely related field, with graduate coursework and training in the interpretation of psychological tests, according to the Standards for Educational and Psychological Testing (American Educational Research Association, American Psychological Association, & the National Council on Measurement in Education, 1999). Administration and scoring of the ISPC can be performed by professionals with appropriate coursework and training, and such qualified professionals may also supervise administration and scoring by individuals without formal training as above.

However, it is emphasized that administration of the ISPC is more complex than for most standardized cognitive tests and, accordingly, careful training of individuals in proper administration procedures is critical for valid results. Such individuals will have read this manual carefully and have developed reliable competence with administration procedures and judgements to be made. It is incumbent on the supervising professional to ensure that competence.

2.5. Administration Procedures

Ratings typically require about 75 minutes to complete, but can take 90 minutes or more. A quiet, private area should be made available for test instructions to be presented to the rater, and for completion of the ratings. A copy of the ISPC, a pen or pencil, and a blank sheet of paper are required. A table is desirable, but a clipboard will suffice.

On presenting the ISPC to the rater, the examiner should say:

We have good tests to help us understand how [the patient's] different thinking abilities might have changed, but we cannot test how [he/she] acts in real life. It will be very helpful information for you to help us understand ways that [the patient] may have changed as a result of their condition, or possibly due to changes in [his/her] circumstances. Changes in behavior can be very important to understand because they may cause significant problems for [him/her] or those who interact with [him/her].

It is important that the examiner actively gauge the rater's comprehension, and the examiner should personally explain the instructions to ensure that the rater satisfactorily understands various issues in determining the appropriate ratings of personality change.

Open the ISPC form to the training scale on the first page, *Selfishness*. Use a folded piece

of plain paper to cover the page below the gray box with the scale title and brief definition. The script which follows should be presented to the rater. Although it is important that each point be understood, once the rater clearly understands the point, recitation of the instructions may be abbreviated.

You will be making ratings for 30 characteristics, one on each page. Each page is laid out in the same way. We will go through this sample characteristic to explain some important points about making the ratings.

Point to the brief definition at the top of the page. ***At the top of each page will be the name of the characteristic to be rated, along with a brief definition. It is important that you read the definition carefully so you will be thinking of the same characteristic that we have in mind.***

Next, uncover all 7 points of the “rating guidelines.” ***Each characteristic will have guidelines for ratings of 1, 3, 5 or 7, with higher ratings indicating more of a problem with the characteristic. For all characteristics, a rating of “3” indicates the average, what you consider the typical amount of the characteristic for people of the patient’s age and gender.***

So, let’s say [he/she] tends to be moderately more selfish than most people. You can read the guidelines for “3,” average, and for “5,” which indicates “more than average.” You may feel [he/she] has more than what is described for 3, but not as much as is described for 5, so you can give the “in-between” rating of 4. The examples in the guidelines do not have to be present to give [him/her] that rating; examples are provided just to give you an idea of what behavior may be like for a particular rating.

It is important that you make your ratings based on [patient’s name] behavior — regardless of WHY you believe [he/she] acts that way. For example, sometimes a neurological patient’s behavior or mood may change due to medication effects, or frustration or being unable to work, etc., but you should rate the way they have been behaving whatever the cause might be. If you think that it will help us understand his personality to give comments on why, or in what situations, some behaviors occur, your comments are helpful. At the bottom of the page there is a box for your comments, including if you and if you would like to provide a good example of his behavior.

Next, uncover the gray boxes for BEFORE and NOW ratings. ***For each characteristic you will make two ratings by circling one number in each box. The first rating, “BEFORE,” should describe [his/her] typical behavior over the years before the start of his condition. Select only one rating: Even if the patient had behaved differently at different times — as many people do — please decide on the one rating that best describes [his/her] behavior overall before the start of [his/her] condition.***

For conditions without onset at a distinct point in time (e.g., frontotemporal dementia), it is critical to clarify for the rater that the BEFORE rating refers back in time to the period when the patient’s behavior and emotional functioning were still in their characteristic state — before the start of subtle shifts in personality that may not have been understood to be the beginnings of changes that would grow more prominent over time. This may require discussion with the rater to ensure that the BEFORE ratings truly characterize behaviors prior to the onset of pathological behavioral changes, as best as can be determined.

The second rating, “NOW,” should describe the way [he/she] has been for the past year (or, if onset was within the past 12 months: “the way [he/she] has been since the first couple months after developing [his/her] condition.”) *Even if it is hard to decide between two ratings, rather than leaving the item blank please select one rating as the best overall description.*

Have the rater complete the sample scale to confirm that rater understands the instructions and has adequate “psychological-mindedness.”

Multiple raters. When possible, it is desirable to have multiple informants complete ratings. If multiple raters are available, add: ***It is important that the two of you complete your ratings separately, without discussing with one another. Once you have completed your ratings and turned them in, you are free to discuss if you wish.*** Ideally, the multiple raters do not work on the ISPC while seated close to each other.

However, in some circumstances, it may be deemed advantageous to instruct the multiple informants to discuss items and make joint ratings. One example of such a situation would be an aging widow/widower with two adult children available to complete ratings, but each has had limited, incomplete opportunity to observe the patient over the two years since a stroke: if the two of them pool their observations and discuss their perceived significance, this may result in more accurate ratings than either child would be able to produce independently (and without the complication of having to reconcile divergent ratings). Such an approach is perfectly acceptable — the clinician is encouraged to decide the approach they believe will provide the most useful information.

Serial ratings. If the patient is returning to clinic for a follow-up exam, it is often illuminating to obtain a follow-up set of ISPC ratings, especially if the initial informant is again available to provide ratings. If there has not been a major change in neurological status in the intervening period, provide the following instruction: ***When making the BEFORE ratings, keep in mind that those ratings are to describe [his/her] typical behavior over the years before the onset, they do not refer to any interim period between your earlier ratings and the current period.***

If there has been an intervening event such as a traumatic brain injury that has occurred since the initial ratings, this presents a complicated situation. In this situation, provide these modified instructions: ***When making the BEFORE ratings, keep in mind that those ratings are to describe [his/her] typical behavior over the years before the onset of [his/her] [first condition], and the NOW ratings refer to [his/her] current functioning — since the onset if [the second condition].***

2.6. Scoring

A completed score sheet can be generated by entering ratings into the Excel document “ISPC Score Sheet.” This document may be obtained from the author.² Enter background information and raw scores from the ISPC form into the Excel spreadsheet (under the “Data” tab). Scores will automatically transfer to “Score Sheet” tab. The Score Sheet, shown in Figure 1, can then be printed out. In addition to the premorbid and current ratings, the printed score sheet will also include the degree of change and the presence/absence of an acquired disturbance for each characteristic, as well as information about the four subtypes of acquired personality disturbance.

² This Excel document may be obtained by emailing the author at the University of Iowa Benton Neuropsychology Lab: joseph-barrash@uiowa.edu.

Change. *Change scores* for each characteristic are calculated by subtracting the premorbid rating from the current level. A change score is not calculated for Lack of Insight, for which there is no premorbid rating (since there were no acquired personality changes for the patient to have insight into). Positive change scores indicate an increase in the characteristic, and a lower level of functioning.

Acquired Personality Disturbances. The presence of an *acquired personality disturbance* indicates a characteristic that has significantly increased since the onset of their condition, and which constitutes a disturbance postmorbidly. Acquired personality disturbance requires two elements: (a) Change ≥ 2 (i.e., a change score of 1 suggests mild change of unclear clinical significance); and (b) NOW rating ≥ 4). There are two exceptions to this algorithm: (i) If a characteristic is given a BEFORE rating of 6 and NOW rating of 7, the patient is considered to have an acquired personality disturbance. In this situation, the scale's ceiling precludes the change score from exceeding 1, but the rater has indicated a noticeable intensification of the disturbance after the onset of the neurological condition. Accordingly, the impact of the neurological condition adding to disturbance is considered clinically significant. (ii) If *Lack of Insight* is given a rating is 5 or higher, the patient is considered to have an acquired disturbance of insight. In this situation, BEFORE ratings are not made for *Lack of Insight*, but for the purpose of identifying acquired disturbances, rates are assumed to be average at baseline (because, logically, most rates would be average) and NOW ratings of 5 or higher indicate significantly more disturbance than an average BEFORE level.³

A patient with a BEFORE rating of 7 cannot be said to have an acquired personality disturbance (i.e., "acquired" as a consequence of the neurological disease that is the subject of the ISPC ratings).

Disturbance Subtypes. For clinical purposes, a subtype of acquired personality disturbance is considered present to a clinically significant extent if the patient meets criteria for acquired personality disturbance for two or more of the core features of the subtype.⁴ Patients often meet criteria to be considered to have disturbances of more than one type. The Score Sheet will indicate whether core features of a subtype meet criteria for acquired personality disturbance.

For research purposes, if a quantitative variable is needed, the mean level of disturbance (Now ratings) of subtype core features may be calculated. It is reiterated that, for clinical purposes, the mean level of disturbance is considered less illuminating of clinically significant acquired subtype disturbance than the criteria above.

Validity Judgment. The professional overseeing the evaluation records their *clinical judgment* regarding the overall validity of the set of ratings for the patient. If ratings are judged to be of reduced validity, the professional should judge whether the set of ratings will be considered (a) questionable or (b) not valid. Secondly, while there may be multiple factors compromising validity, the professional should identify the *primary* factor from among three basic issues:

³ Of course, for any individual patient, the presumptive average level may not be accurate. Nevertheless, regardless of the individual's general level of insight premorbidly, the NOW rating of 5 or higher indicates an acquired deficit in their understanding of the consequences of their brain disease, with possible adverse impacts on real life psychosocial functioning.

⁴ The core features are: (i) **Emotional/Social Personality Disturbance:** irritability, impatience, socially inappropriate behavior, insensitivity, and inflexibility; (ii) **Dysexecutive Personality Disturbance:** lack of planning, lack of persistence, lack of initiative, and perseverative behavior; (iii) **Hypoemotional/Amotivation Disturbance:** apathy, unemotional, and social withdrawal — in the absence of depression (if the NOW rating for Depression ≥ 5 or Change ≥ 2 , this disturbance is not diagnosed); and (vi) **Distressed Personality Disturbance:** anxiety, depression, and easily overwhelmed. These core features are based on previously published analyses (Barrash et al., 2022).

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Yes No</p>				RATINGS	Before	Now	Irritability (p.1)	0	0	Lack of Initiative (p.2)	0	0	Perseverative Behavior (p.3)	0	0	Depression (p.4)	0	0	Impulsivity (p.5)	0	0	Obsessiveness (p.6)	0	0	Lability/Moodiness (p.7)	0	0	Lack of Stamina (p.8)	0	0	Lack of Persistence (p.9)	0	0	Lack of Planning (p.10)	0	0	Inflexibility (p.11)	0	0	Poor Judgment (p.12)	0	0	Anxiety (p.13)	0	0	Insensitivity (p.14)	0	0	Social Inappropriateness (p.15)	0	0	Dependency (p.16)	0	0	Impatience (p.17)	0	0	Type A Behavior (p.18)	0	0	Unemotional (p.19)	0	0	Social Withdrawal (p.20)	0	0	Aggression (p.21)	0	0	Indecisiveness (p.22)	0	0	Vanity (p.23)	0	0	Suspiciousness (p.24)	0	0	Apathy (p.25)	0	0	Frugality (p.26)	0	0	Inappropriate Affect (p.27)	0	0	Manipulativeness (p.28)	0	0	Easily Overwhelmed (p.29)	0	0	Lack of Insight (p.30)	0	0	<table style="width: 100%;"> <thead> <tr> <th colspan="4" style="text-align: left;"><u>DIMENSIONS OF PERSONALITY DISTURBANCE*</u></th> </tr> <tr> <th style="width: 60%;"></th> <th style="width: 10%; text-align: center;">Now</th> <th style="width: 10%; 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<p>‡ Acquired Personality Disturbance requires a significant increase (Change ≥ 2) that results in some degree of disturbance (Now ≥ 4). Dimensions are as defined in Barrash et al., Cortex, 2022. * A dimension is considered significantly disturbed if two or more of the core characteristics meet the definition for acquired personality disturbance. § Hypoemotional Disturbance is not diagnosed if Depression NOW rating ≥ 5 or Change ≥ 2.</p> <p>Copyright © 1997, Benton Neuropsychology Laboratory, University of Iowa Carver College of Medicine ISPC Score Sheet 10/08/2022</p>																																																																																																																																																																																																																																																								

Figure 1. ISPC score sheet

inadequate comprehension, minimization of negative changes, and exaggeration of negative changes. Those two judgments are reported on a seven-point nominal scale: 1 = “Valid,” 2 = “Questionable, weak comprehension” 3 = “Questionable, possible minimization,” 4 = “Questionable, possible exaggeration,” 5 = “Not valid, inadequate comprehension,” 6 = “Not valid, minimization,” 7 = “Not valid, exaggeration.” Further discussion of validity ratings and their interpretation is presented in section 3.6.

3. Interpretation

3.1. Overview

For all characteristics, a rating of 3 indicates an “average” amount of the characteristic, that is, what the rater judges to be typical of people the patient’s gender and age. Higher scores reflect more of the characteristic, and more of a problem: 1 = “very good functioning,” 2 = “somewhat better than average,” 3 = “average functioning,” 4 = “present, relatively mild degree,” 5 = “moderate disturbance,” 6 = “moderately severe disturbance,” 7 = “severe disturbance.”

First, BEFORE ratings are reviewed to get a general sense of the patient’s premorbid personality. Of particular note would be any premorbid disturbances in personality functioning, or patterns of ratings above 3 that would suggest preexisting difficulty in areas such as interpersonal relations or chronic vulnerability to stress and dysphoric emotions. Identifying strengths and weaknesses in premorbid personality allows for a richer appreciation for potentially subtle alterations in personality.

Prior to reviewing ratings of current functioning, it is helpful to consider whether there is a basis for a priori hypotheses regarding the changes and disturbances that could be expected to be seen (given their condition and life circumstances). Any hypotheses can then be evaluated in light of the informant ratings of current functioning. NOW ratings are then reviewed, with examination focused on individual scales to identify any specific disturbances in current functioning for the 26 clinically-relevant characteristics.

We emphasize that a grand summary score is not calculated as it is not informative to review the total score for all clinical scales. A summary ISPC score is not considered meaningful; rather, it is the severity of disturbance in specific characteristics and especially in the dimensions of disturbance that is associated with impaired psychosocial functioning. Research employing the sum across ISPC scales has generally yielded nonsignificant or marginal results (Gaznick, 2015; Gleason, 2004; Hommel et al., 2009; Lima et al., 2007; Simioni et al., 2008). The pattern of findings across studies indicates that attention to specific ISPC scales and dimensions of disturbance have been more illuminating. A summary score obscures specific types of changes that might occur; it is *the pattern* of disturbances that the Iowa Scales were designed to provide.

Additional information may come from reviewing any rater comments that may provide helpful examples of a disturbance, or explanations of related factors.

3.2. Individual scales

Interpretation of many of the individual characteristics assessed with the ISPC are self-explanatory: ratings indicate the level of problems (or absence of problems) with that trait in the patient’s usual functioning, as reported by the informant. However, several of the individual scales warrant additional comment, as below. (For simplicity, female and male versions of descriptions are interspersed.) Relationships between specific scales and higher-order subtypes are informed by factor analysis performed on the ratings of current functioning of 182 patients from Sample 2 (Barrash et al., 2022), with results presented in Table 2.

Table 2. ISPC items with highest loadings for four factors of personality disturbance

Personality Disturbance Factors							
Emotional/Social Personality Disturbance		Dysexecutive Personality Disturbance		Hypoemotional Personality Disturbance		Distressed Personality Disturbance	
Scale	Loading	Scale	Loading	Scale	Loading	Scale	Loading
Irritability	.807	Lack of Planning	.824	Unemotional	.827	Anxiety	.622
Insensitivity	.755	Lack of Persistence	.815	Social Disinterest	.608	Easily Overwhelmed	.580
Impatience	.748	Lack of Initiative	.795	Apathy	.451	Depression	.522
Inflexibility	.709	Lack of Stamina	.730	Lack of Insight	.326	Dependency	.438
Social Inappropriateness	.650	Poor Judgment	.669	Indecisive	.315	Indecisiveness	.426
Lability	.625	Impulsivity	.599	Perseverative Behavior	.241	Manipulativeness	.423
Aggressive Behavior	.615	Perseverative Behavior	.551	Poor Judgment	.217	Apathy	.376
Lack of Insight	.611	Easily overwhelmed	.513	Insensitivity	.211	Lability	.329
Inappropriate Affect	.514	Indecisiveness	.504	Lack of Planning	.186	Lack of Stamina	.328
Lack of Planning	.158	Apathy	.464	Lability	-.168	Social Withdrawal	.305

Note. Results come from factor analysis performed on the ratings of current functioning of 182 patients from Sample 2 who were participants in a study of the neuroanatomical correlates of acquired personality disturbances. Adapted from Barrash et al., 2022.

Insensitivity. Disturbance on this characteristic refers to insensitivity specifically in the social/interpersonal realm. At a moderate level of disturbance, the individual tends to be very focused on his own circumstances so that his actions may often be inconsiderate of others. He seems to have more difficulty than most people understanding others' feelings, so he tends to say or do things which may hurt people's feelings, upset them, or embarrass them. These incidents are usually not very serious. Ratings of severe disturbance indicate an individual who is very insensitive to the feelings and circumstances of others, with a great deal of difficulty knowing how others are feeling, even when it would be obvious to most people that someone is feeling unhappy, upset or worried. He frequently says or does things that hurt other people's feelings or irritate them. Even if he should know — or it is pointed out to him — that what he did was insensitive, he may continue to do the same sort of thing again and again. As may be seen in Table 2, *Insensitivity* loads highly on the Emotional/Social Personality Disturbance (.76), but also loads weakly on Hypoemotional Disturbance (.21), in which case the insensitivity is likely reflecting inattentiveness and absence of concern with the feelings of others more than engaging in behaviors that are aggravating or hurtful to others.

Inflexibility. Disturbance on this characteristic refers to inflexibility in interpersonal interactions (i.e., being seen as “stubborn”). At a moderate level of disturbance, the individual has a pretty strong opinion about most things, and it is unusual for others to get her to change her mind. She usually thinks her point of view is the right one, and she doesn't like others telling her otherwise. If she wants things a certain way, she tends to be stubborn about it. Her inflexibility might sometimes irritate friends or family. At a severe level of disturbance, the individual is so inflexible that friends and family often get very frustrated with her. As a result, people might avoid discussing certain topics with her to avoid arguments. Or, she may be difficult to be around because she usually wants things her way, and is generally unwilling to let others have their way. Ratings of *Inflexibility* load highly on Social/Emotional Disturbance (.71, see Table 2). Although a patient rated highly on *Inflexibility* may also have cognitive inflexibility, this is not necessarily so; cognitive inflexibility is distinct from the maladaptive interpersonal behavior, and ratings of *Inflexibility* are not significantly associated with Dysexecutive Personality Disturbance.

Lack of Initiative. Moderate disturbance on this characteristic indicates an individual who often has difficulty getting himself started on a task or project, even when he is aware that he needs to get it done, or wants to get it done. As a result, he often requires some prompting to get to work on tasks for which he is responsible, or else they may not get done on time. Additionally, unless prompted by others, he may not engage in many recreational activities (other than very passive activities like watching TV). At a severe level of disturbance, the individual has a great deal of difficulty getting started with activities. This causes problems because, unless others nag him to get him started, he regularly does not get to work on tasks even when he knows they are important. He may have difficulty doing simple things that are part of his normal routine. For example, he may go days without taking a shower, brushing his teeth, or changing his clothes (unless prompted by someone else). Day after day, he may spend much of his time doing very little (such as watching a lot of TV or staying in bed much of the day). *Lack of Initiative* is a core feature of dysexecutive personality disturbance, and its presence raises a question of broader executive difficulties. Conceptually, this disturbance may also be an aspect of Hypoemotional and Distressed types of disturbance. Empirically, however, it was not significantly associated with Hypoemotional Disturbance or Distressed Disturbances, as may be seen in Table 2. Of course, lack of initiative may be present in patients with Hypoemotional Disturbance or Distressed Personality Disturbance, but its presence, by itself, is most likely a manifestation of executive deficits.

Indecisiveness. The disturbance of *Indecisiveness* is rather straightforward descriptively. At a moderate level of disturbance, the individual often has more difficulty than most people making decisions. She takes longer to arrive at many decisions than most people would, and she may change her mind a lot. She may often put off making decisions, even decisions that should not be that difficult. At a severe level of disturbance, she regularly has great difficulty making decisions, even about simple matters. She frequently takes a very long time or is unable to make a final decision. As a result, others might often have to step in and help her decide, or make the decision for her. *Indecisiveness* is not a core feature of any higher-order type of disturbance. Conceptually, indecisiveness is associated with Dysexecutive Personality Disturbance, Hypoemotional Disturbance and Distressed types of disturbance. Empirically, it is significantly associated with those three types of disturbance in the 2022 factor analysis (Table 2). Although this scale loads most highly on Dysexecutive disturbance, inferences about an underlying (higher-order) type of disturbance should be based on the pattern of disturbances on other scales.

Impulsivity. This characteristic refers to difficulty resisting impulses to act. At a moderate level of disturbance, the individual acts more impulsively than most people. He tends to act without thinking over what he is about to do. As a result, he might make "stupid" mistakes. He often does things because he wants to even if he knows it is not a good idea. For example, if he sees something that he wants in a store, he may go ahead and buy it even if it costs more than he can afford to spend and he doesn't really need it. At a severe level of disturbance, he regularly does things on the spur of the moment just because "he felt like it" or did not think about it first, and this causes him problems. For example, he may buy things that he couldn't resist, but could not afford, and this may cause financial difficulties. Or, he may cause embarrassment to himself or his family or have gotten into legal difficulties because of impulsive behavior. For example, he might blurt out sexually suggestive comments or impulsively touch someone in an offensive way. His impulsive behavior may even place him or others in risky or dangerous situations from time to time. In some conceptualizations of subtypes of acquired personality disturbances, impulsivity is considered to be the predominant characteristic of the "Disinhibition" subtype (Grace & Malloy, 2001). Although there is considerable overlap between ISPC Emotional/Social Personality Disturbance and "Disinhibition" as conceptualized in the FrSBe (Grace & Malloy, 2001, p. 17), the ISPC *Impulsivity* scale loads significantly on the Dysexecutive Personality Disturbance (.60, Table

2)⁵ and does not load significantly on Emotional/Social Personality Disturbance or any other dimension. Thus, unless the other core features of Emotional/Social Personality Disturbance are disturbed for an individual patient, the presence of impulsivity should not be interpreted as indicative of a broader disturbance in the realm of social behavior.

Poor Judgment. Disturbance on this characteristic indicates a tendency to make a poor decision when a better decision would be obvious to most people. At a moderate level of disturbance, the individual has some difficulty with her judgment. She might frequently make decisions that do not turn out very well, but do not cause serious problems. From time to time, she might make a bad decision that causes problems which are significant but not disastrous. At a severe level of disturbance, her poor judgment tends to cause significant problems. Often, she makes a poor decision when a better decision would be obvious to most people. Her poor decisions have led to, or could have led to serious problems (such as, for example, losing a large sum of money, getting fired from a job, getting into legal trouble, or ruining a close personal relationship). In some conceptualizations of acquired personality disturbances, poor judgment and impaired decision-making are viewed as being associated with diminished emotional experience and pronounced problems with social functioning (Damasio, 1995; Eslinger & Damasio, 1985). However, factor analysis (Barrash et al., 2022) revealed that *Poor Judgment* also loaded most highly on the Dysexecutive Personality Disturbance (.67)⁶ and does not load significantly on Emotional/Social Personality Disturbance, but is modestly associated with the Hypoemotional dimension (.22). Interpretively, this pattern suggests that even though poor judgment may play out dramatically in the social realm, elevated ratings on *Poor Judgment* likely reflect an underlying disturbance of real-life executive functioning.

Lack of Stamina. Lack of stamina is typically referred to as “fatigue” in the literature, and the term “central fatigue” has been defined as a feeling of constant exhaustion and difficulty in initiation or sustaining a voluntary activity (Chaudhuri & Behan, 2004), to distinguish this symptom from muscle fatigability (or “peripheral fatigue”). Central fatigue is a common symptom and may be among the most disabling in many neurological disorders that may severely limit a patient’s return to their previous level of functioning (Staub & Bogousslavsky, 2001). The ISPC scale does not rely on inferences to parse out biological and psychological factors; rather, it focuses on observable behavior. With ratings indicating a moderate level of disturbance for *Lack of Stamina*, the individual tends to have less stamina than most people. When he has been in demanding circumstances, he often gets more exhausted or tired than you would expect for a man his age. He may even tend to wear out in situations that would not be too demanding for most people. At a severe level of disturbance, he has very poor stamina. He regularly gets much more exhausted or tired than you would expect for a man his age. He even gets exhausted or tired after engaging in activities that aren’t very demanding. In the development of the ISPC, *Lack of Stamina* was conceptualized as a nonspecific consequence of brain damage that was not expected to be particularly related to any one dimension. However, *Lack of Stamina* loaded highly on the Dysexecutive factor (.73) and otherwise it was loaded weakly with Distressed Personality Disturbance (.33). Interpretively, *Lack of Stamina* may be elevated from different mechanisms, and interpretation at the narrow behavioral level — difficulty getting activities completed or initiated due to fatigue — is encouraged.

Apathy. A moderate level of disturbance on *Apathy* indicates a disturbance in which the individual seems to be less interested in things than most people. She often lacks enthusiasm

⁵ *Impulsivity* is not included as a core characteristic of the Dysexecutive Personality Disturbance (for calculation of mean disturbance) due to the conceptual ambiguity concerning this characteristic, although empirically it is a major feature of individuals with Dysexecutive Personality Disturbance.

⁶ *Poor Judgment* is not included as a core characteristic of the Dysexecutive Personality Disturbance (for calculation of mean disturbance) due to the conceptual ambiguity concerning this characteristic, although empirically it is a major feature of individuals with Dysexecutive Personality Disturbance.

for everyday activities and most leisure activities. In general, she doesn't seem to care very much about things going on with family or friends. However, she will usually participate in activities if others encourage it. At a severe level of disturbance, very little seems to interest her. She has very little interest in things going on with family or friends. Even if she engages in an activity that most people would enjoy, she might just "go through the motions." A disturbance on the scale *Apathy* does not by itself indicate a particular underlying mechanism because that characteristic may be attributable to different underlying conditions. Apathy may reflect loss of interest as is frequently seen in major depression (American Psychiatric Association, 2000), and *Apathy* loads significantly onto the Distressed factor (.38). In brain-damaged populations, however, apathy is often not associated with low mood (Cahn-Weiner, Grace, Ott, Fernandez, & Friedman, 2002), but rather with cognitive disengagement associated with indecisiveness and impaired attention (Siegert, Walkey, & Turner-Stokes, 2009), and *Apathy* loads significantly onto the Dysexecutive factor (.46). In patients with prefrontal damage, apathy is associated with disorders of drive and self-activation (Ready, Ott, Grace, & Cahn-Weiner, 2003; Stuss et al., 1992), and *Apathy* loads significantly on Hypoemotional Disturbance (.45).

Dependency. This scale is concerned with *interpersonal* dependency (seeking excessive assistance and emotional support), and not with dependency due to physical limitations. At a moderate level of disturbance, the individual relies on other people more than he needs to. If he is faced with an activity that he should be capable of managing by himself, he might want help from others or might look for reassurance from others. If he has to deal with a situation that is a little out of the ordinary, he might want someone else to tell him how it should be handled. If he is feeling down or upset, he might look to someone else to make him feel better. At a severe level of disturbance, he regularly relies on others much more than he needs to. He needs frequent reassurance, encouragement, and approval. He often looks for help with things that he is clearly capable of doing by himself. If he is feeling down or upset, he usually relies on others to make him feel better in much the same way that a young child who skins his knee wants his parent to make it "all better." He might like to stay nearby a family member, especially away from home, because he doesn't like to be left alone. The scale *Dependency* is specifically associated with the Distressed Personality Disturbance; in fact, it has the highest loading on this dimension (.44) outside of the three core characteristics.

Social Withdrawal. At a moderate level of disturbance, the individual seems to get less enjoyment than most people from socializing. With the exception of some close friends, she might not go out to socialize very frequently or have people over to visit very often. Even at home, she might not spend a lot of time doing things with her family. At a severe level of disturbance, most of the time she seems to find it a bother to socialize with other people. She spends most of her time by herself, and avoids going out to socialize. If she does get into a social situation, she may not participate and may want to leave before very long. She doesn't get together with good friends that often, either. She rarely invites others over to her place. Even at home, she may spend little time around her family. Like some other scales, this characteristic may reflect different underlying types of disturbance. When present in the context of Distressed Personality Disturbance (loading, .31), it is likely to be a manifestation of depression. However, it is most strongly associated with Hypoemotional Disturbance (loading, .61) and when present in the absence of depression it may be interpreted as social disinterest — a lack of motivation for relationships with others, a prominent aspect of Hypoemotional Disturbance.

Unemotional. At a moderate level of disturbance, emotions are generally less strong than most people's. For example, in situations that would make most people sad or angry or excited, his emotional response is weaker than most people's would be. At a severe level of disturbance, the individual shows very little emotion, even in situations that would make most people quite sad, afraid, excited, etc. Although he might sometimes get irritated (for example) for a short period of time, he returns to his usual unemotional state before too long. Earlier in the history of the ISPC,

this scale was labeled “*Blunted Affect*.” The only higher-order dimension this scale loads on is Hypoemotional Disturbance (.83). Although the behavior to be rated is focused on observable behaviors, interpretation of postmorbidity changes in this characteristic includes an inference that the observable dearth of emotional behavior is a manifestation of diminished emotional experience by the patients.

Depression. This scale does not assess the syndrome of depression with its range of varied symptomatology (APA, 2000). Rather, elevated ratings on the *Depression* scale indicate a pervasive, persistent low mood and “depressive thinking,” but not necessarily a diagnosable affective disorder (Kemp et al., 2013). The guidelines for a rating of moderate disturbance indicate the individual seems to be down much of the time, though her mood improves when things are going really well. She gets less enjoyment out of things, even some of her favorite activities, than most people would. She often has a pessimistic attitude about the future. She might blame herself for things that go wrong. At a severe level of disturbance, her mood is sad almost all the time. She rarely gets any enjoyment out of things, even her favorite activities. She might believe that things will never get any better, and that the rest of her life will be miserable. She might often put herself down, blaming herself for things that go wrong even when it should be clear they are not her fault. The only higher-order dimension that the *Depression* scale is significantly associated with is Distressed Personality Disturbance (.52). Although *Depression* is related to some scales in the higher-order dimension of Hypoemotional Disturbance, patients with that disturbance are not significantly depressed and the presence of depression is an exclusionary factor for Hypoemotional Disturbance.

Easily Overwhelmed. At a moderate level of disturbance, the individual tends to get overwhelmed more easily than most people would. More than most people, pressure or stress interferes with his ability to think clearly, and may upset him. At a severe level of disturbance, he is very easily overwhelmed. He regularly gets very overwhelmed by the kinds of stressful circumstances such as having to work very quickly at a task, having a lot of activity going on around him, or having to do more than one thing at a time. He may even have some difficulty handling circumstances most people would not find very stressful. Having to work under pressure may overwhelm him to the point that he cannot think clearly or get much done. This scale had been labeled “*Vulnerability to Pressure*” at an earlier point, but was re-labeled for greater clarity.

Type A Behavior. At a moderate level of disturbance, the individual is the kind of person who has to be doing something most of the time. She often does more than one activity at a time. If nothing is going on, she'll often find something to do instead of sitting around “wasting time.” As a result, it is often hard for her to enjoy quiet, peaceful leisure activities. At a severe level of disturbance, she feels she has to make every minute count, so it is very difficult for her to relax. This occurs even during her “free time,” because she is almost always thinking about what she could be getting done. She feels so much pressure to get everything done that she has a very hard time taking more than a little time away from those tasks. Type A behavior is not expected to increase as a consequence of brain damage, and this scale was included in the ISPC as a control scale. Increases on this scale are infrequent and modest, and are often associated with exaggerated ratings. However, *decreases* following brain injuries are not uncommon and may be seen in association with any of the types of disturbance.

Manipulativeness. At a moderate level of disturbance, the individual puts forth more effort than most people would to get others to do things for him, even if they indicate that they don't want to. He may ask several times. He may try to change someone's mind by trying to make them feel guilty for not helping. For example, he might say things like: “Helping out is what friends are all about, I'd do the same thing for you!” or “If you don't help me out I'll be in big trouble!” At a severe level of disturbance, if he wants someone to do something for him, he can be very sneaky or calculating if necessary. He often tries to make someone feel guilty or obligated. If

that doesn't work, he is willing to do things like becoming friends with someone he doesn't really care about for selfish reasons. Or, he might lie and make up stories to change the mind of someone who isn't going along with what he wants. Manipulativeness is not expected to be an acquired disturbance as a consequence of brain damage, and this scale was included in the ISPC as a control scale. Change in the disturbed direction is generally not considered clinically relevant. However, patients with Distressed Personality Disturbance who were not manipulative premorbidly may be rated as become manipulative postmorbidly. Manipulativeness has negative loadings on the other three types of disturbance, but it loads .42 on Distressed Personality Disturbance.

Other clinical and control scales need no additional interpretive guidance.

3.3. Change

Reviewing change scores may quickly highlight the specific characteristics with the most notable change. However, it is also important to consider the overall pattern of change because less dramatic alterations, when affecting many areas of functioning, can have negative consequences for psychosocial functioning, including intimate relationships. For example, a pattern of changes in which the individual went from previously strong functioning to average or mildly compromised functioning may cumulatively result in “upsetting the applecart” with damaging consequences for psychosocial equilibrium. Additionally, it should be borne in mind that some raters are predisposed to understate acquired disturbances in their loved one, so interpretation solely focused on high ratings of disturbance risks overlooking a pattern in which a patient might be rated as having gone from premorbidly stellar functioning to merely “average” in several related characteristics that collectively can interfere with expected functioning. Such an individual may have developed a clinically-recognizable syndrome more than a patient whose ratings have increased “5” to “7” on a few unrelated scales.

3.4. Acquired Personality Disturbances

The presence of an *acquired personality disturbance* indicates there has not merely been *some* change in a specific characteristic; it indicates the change is non-trivial (change score of at least 2) and the resultant disturbance has a significant adverse impact on psychosocial functioning (BEFORE rating ≥ 4). This definition means that an acquired personality disturbance can be present when the patient's current functioning is rated 4, which by itself indicates a mild disturbance of unclear real-life impact. In this situation, however, the criterion requiring a change score of at least 2 necessitates that the rater has observed a change in which the patient has gone from *better than average functioning* premorbidly (i.e., 2) to *weaker than average functioning* since the onset of the brain injury. This is identified as an acquired disturbance because, even though the disturbance is “mild,” extensive experience with ISPC ratings of patients has shown that this state of affairs may be clinically significant because of its potential to “upset the applecart” in the patient's relationships or activities.

3.5. Higher-order Subtypes of Disturbance

The strength of disturbance for the dimensions of Emotional/Social Personality Disturbance, Dysexecutive Personality Disturbance, Hypoemotional Disturbance, and Distressed Personality Disturbance are indexed by the number of defining characteristics that show an acquired personality disturbance. Results showing more than one acquired personality disturbance within a dimension suggest a higher-order disturbance in that dimension, and APDs among additional core features confer increased confidence in the clinical meaningfulness of the higher-order disturbance, with more widespread manifestations of the disturbance and increasing

interference in real-life functioning.

The ISPC is not designed to make quantitative comparisons of strength-of-disturbance across dimensions, and the number of defining characteristics is not constant across the dimensions (9, 7, 3 and 4, respectively). Additionally, such quantitative comparisons are precluded by the fact that the dimensions are not discrete, non-overlapping subtypes: the higher-order disturbances do not usually occur in isolation; rather, it is common for patients to have some degree of acquired disturbance in more than one dimension (intercorrelations among personality disturbance subtypes are presented in Table 3). Accordingly, interpretation is performed independently for each type of disturbance.

Table 3. Intercorrelations among subtypes of personality disturbances

Personality Disturbance			
	Emotional/social ^a	Dysexecutive	Hypoemotional
Dysexecutive	.476***		
Hypoemotional	.199**	.520***	
Distressed	.580***	.674***	.333***

Note. ^a Partial Spearman correlations between Emotional/Social Personality Disturbance and other disturbances, controlling for gender effect. * = <0.05, ** <0.01, *** < 0.001. Adapted from Barrash et al., 2022.

Emotional/Social Personality Disturbance. This disturbance had initially been conceptualized as two distinct disturbances, one characterized by emotional hyperreactivity and irascibility (lability, irritability, impatience, aggressive behavior and inappropriate affect), and the other characterized by disturbances in social behavior (interpersonal insensitivity, socially inappropriate behavior, inflexibility). However, a series of investigations (Barrash et al., 2011, 2018, 2022) indicated that, despite the conceptual distinction, the two subsets of characteristics load on the same factor, co-occur strongly, and share the same neuroanatomical correlates in ventromedial prefrontal cortex (Barrash et al., 2022). In-depth analysis suggested that the two subsets of disturbances and lack of insight are each manifestations of the same underlying neurofunctional disturbance, with the interpersonal disturbances becoming increasingly problematic as the severity of emotional dysregulation increases (Barrash et al., 2018).

It is interesting to note that a very early depiction of a specific acquired personality disturbance following brain injury, presented more than two centuries ago by Sir Walter Scott in his novel *Ivanhoe* (1819), clearly described Emotional/Social Personality Disturbance: despite his role as the jester in a Saxon court, the personality of Wamba had changed years early after a traumatic brain injury so that he had become irritable, impatient, inflexible and emotionally labile, although he did not develop wider-ranging symptomatology.

The core characteristics of this subtype overlap considerably with those of the Disinhibition subscale of the FrSBe. However, the recommended interpretation of that subscale explicitly emphasizes a primary role for problems with inhibitory control (Grace & Malloy, 2001, p. 17). In contrast, the label “Emotional/Social Personality Disturbance” was selected to emphasize primacy for the role of impaired emotional experience and emotional processing, with disturbances in social behavior reflecting downstream consequences of the primary emotional abnormalities (Damasio, 1994). Empirically, *Impulsivity* loads significantly on Dysexecutive Personality Disturbance (.60) and does not load significantly on Emotional/Social Disturbance (Table 2).

Dysexecutive Personality Disturbance. Dysexecutive Personality Disturbance reflects classic aspects of executive dysfunction widely associated with prefrontal damage (core features

include lacks of initiative, persistence and planning, and perseverative behavior). Patients with this set of problems tend to also have a lack of stamina, poor judgment, impulsivity, and indecisiveness, and to get overwhelmed easily (Table 2). The presence of these disturbances is most highly associated with bilateral dorsolateral lesions.

At first glance, one may wonder whether activities most often thought of as cognitive phenomena should be considered “personality characteristics.” And if characteristics assessed by these scales is redundant with results from corresponding cognitive tests, what is the value of personality ratings given the availability of established neuropsychological tests? Further consideration indicates that careful assessment of both is important because there are critical distinctions between them. Personality ratings of executive abilities are distinct from scores on neuropsychological tests of executive abilities in several respects: (1) Cognitive tests are performed in a setting that is highly atypical for the examinee (i.e., in a clinic or laboratory). (2) The tests present cognitive tasks that are artificial and unnaturally constrained so as to place demands on a specific cognitive ability. (3) The cognitive test typically unfolds over a few minutes, yielding a score indicating level of performance *at that point in time* with the assumption that the performance in that brief window of time is a reliable index of an ability — an ability whose level remains relatively constant over a long period of time (an assumption that does not always hold). In contrast, ratings of personality characteristics measure behavioral tendencies across a variety of real-life situations, occurring in natural settings, and enduring over long spans of time. The importance of the distinctions between the modes of assessment is highlighted by the facts that individuals with substantial impairment in real life functioning following brain damage due to manifest, severe executive dysfunction may not show impairment on any tests in extensive neuropsychological exams due to critically important distinctions between the laboratory setting and real life (Eslinger & Damasio, 1985; Waldron et al., 2014), and the presence of impaired scores on neuropsychological tests of executive abilities does not necessarily indicate discernible dysfunction in real life (Burgess et al., 1998). On the other hand, family-rated personality disturbances have been associated with poor psychosocial outcomes in neurosurgical patients, while performances on neuropsychological executive tests were not associated with outcome (Abel et al., 2016; Barrash et al., 2019). This suggests that behavioral ratings by those who know the patient well may be more sensitive to changes in complex behavioral domains than are laboratory tests of cognition (Stuss et al., 1992). In sum, personality ratings of executive functioning provide unique, clinically-important information related to the focus on real life behavior.

Hypoemotional Personality Disturbance. The core features of this disturbance are impoverished emotional experience (the “*Unemotional*” scale), diminished motivation (“*Apathy*”), and social disengagement (“*Social Withdrawal*”) — in the absence of depression, which is an exclusionary factor. This disturbance was previously labeled “Hypoemotionality/Diminished Motivation” to emphasize the two related but distinct features. The label of this subtype was shortened for simplicity, while highlighting the critical role of impoverished emotional experience: “Hypoemotional Disturbance” is the only higher-order disturbance on which the *Unemotional* scale loads, and the association between the *Unemotional* scale and the higher-order Hypoemotional disturbance (.83) is the strongest association between any scale and a higher-order dimension. A lack of insight and indecisiveness are also modestly but significantly associated with Hypoemotional disturbance (Table 2).

This subtype of disturbance has a neuroanatomical basis as demonstrated by studies showing that damage to the anterior cingulate cortex results in impoverished experience and expression of emotion as well as apathy (Campanella, Shallice, Ius, Fabbro, & Skrap, 2014; Damasio & Van Hoesen, 1983; Schäfer et al., 2007). As theorized by Stuss, the critical role of

the dorsomedial prefrontal region is characterized as “energization” of thought and behavior (Burgess & Stuss, 2017; Stuss, 2011a; Stuss & Alexander, 2007; Stuss et al., 1992). The association between Hypoemotional disturbance and damage in anterior cingulate cortex and the dorsomedial prefrontal cortex more broadly has been demonstrated among 182 patients with focal lesions (Barrash et al., 2022).

Similar sets of disturbances in patients with prefrontal damage have often been referred to as “apathy” (e.g., Grace & Malloy, 2001). However, the label “hypoemotional” was selected because (1) the set of specific disturbances is broader than apathy, with impaired emotional experience and deficient activation at its core, and (2) the term “apathy” is somewhat ambiguous as a descriptor because the reduction in interest and activity may occur for different reasons, and not all of them are related to the hypoemotional subtype of disturbance (Barrash et al., 2018; Stuss, Van Reekum, & Murphy, 2000). That is, in addition to (a) the behavioral reduction in activity and motivation consequent to damage to the dorsomedial activation system; (b) apathy characterized by a prepotent psychological dimension — lack of interest — is a common consequence of depression or low mood (Cahn-Weiner, Grace, Ott, Fernandez, & Friedman, 2002); and (c) dysexecutive syndromes may include “executive apathy,” i.e., an absence of the executive activities of flexibility, selection, novel responsiveness that should lead to a behavioral response (Stuss, Picton, & Alexander, 1999).

Consistent with this multiplicity of mechanisms for apathetic behavior, factor analysis of 182 focal lesion patients in Sample 2 (Barrash et al., 2022) showed *Apathy* loading .45 on the Hypoemotional factor, but also .46 on the dysexecutive factor and .38 on the distressed factor. Regarding the association of *Apathy* with Dysexecutive Personality Disturbance, an individual who is apathetic, unemotional, and socially disengaged may also show problems with lack of initiative, indecisiveness and lack of planning (i.e., characteristics of Dysexecutive Disturbance). However, if the individual does not show other impairments that are characteristic of Dysexecutive Personality Disturbance but not Hypoemotional Disturbance (viz., poor judgment, impulsivity and perseverative behavior), the lack of initiative, indecisiveness, and lack of planning may be considered as secondary to the Hypoemotional Disturbance rather than a primary dysexecutive syndrome. This issue may have implications for education and rehabilitation. Regarding the association of *Apathy* with Distressed Personality Disturbance, it is well-established that clinically significant depression is often accompanied by apathy (American Psychiatric Association, 2000). However, Hypoemotional Disturbance is not merely a variant of depression, it is a clinically distinct syndrome despite the considerable overlap in symptomatology. The clinically challenging endeavor of disambiguating the two disorders is addressed by the definition for Hypoemotional Disturbance, which requires that the apathy, unemotionality, and social withdrawal are not attributable to depression. Previous cluster analysis (Barrash et al., 2018) has demonstrated the existence of blue ribbon cases of Hypoemotional Disturbance without depression. Indeed, it has been suggested that in a population with neuropathological conditions, it may be more accurate and clinically useful to see apathy as a neuropathological symptom with differential treatment implications than for apathy-as-depression (Boyle & Malloy, 2004).

Distressed Personality Disturbance. This type of disturbance is characterized by depression, anxiety, and easily becoming overwhelmed. Other characteristics often seen with this disturbance are interpersonal dependency, indecisiveness, apathy, emotional lability, diminished stamina, and social withdrawal. These patients may be viewed by raters as having increased manipulateness (i.e., when present, it typically reflects an increase from a premorbidly normal level).

In contrast to a discrete episode of significant mood disturbance or time-limited situational reactions that would be referred to more properly by a diagnosis of affective disorder, distressed

personality disturbance refers to an enduring way-of-being characterized by low self-confidence, proneness to worry about and be easily overwhelmed by day-to-day life, difficulty making decisions, regularly becoming distressed by circumstances that would not significantly upset most individuals, and looking to others to help him or her deal with life. These personality characteristics are highly similar to what has been referred to in the past as “asthenic personality,” an enduring condition characterized by oversensitivity to emotional stress, lack of enthusiasm, marked incapacity for enjoyment, low energy level, and easy fatigability (American Psychiatric Association, 1968, p. 43). That said, multivariate analyses have shown that anxiety rather than depression is the more prominent phenomenology in patients with this set of disturbances (Table 2).

There is no evidence suggesting that Distressed Personality Disturbance is directly attributable to cerebral dysfunction per se. In contrast to the three higher-order disturbances above, Distressed Personality Disturbance is not associated with damage to any aspect of prefrontal cortex, or other specific cortical areas (Barrash et al., 2022). Rather, a Distressed Personality Disturbance likely reflects indirect consequences of developing a pathological brain condition. Interpretively, it is important to review PREMORBID ratings to ascertain the extent to which a Distressed Personality Disturbance is attributable to an individual’s premorbid emotional adjustment versus difficulty with adjustment to the neurological condition.

3.6. Clinical Judgment of Validity

The validity of personality ratings made by a lay rater requires careful consideration, and an integral aspect of interpreting ISPC results requires *clinical judgment* regarding the overall validity of ratings. The evaluating professional is required to characterize validity on a 7-category nominal *Validity* scale with a series of determinations, as follows. First, a judgment is made whether (i) the set of ratings are considered “Probably valid.” If they are judged less than valid but “of questionable validity,” a judgment is then made as to whether the primary cause of questionable validity was (ii) inadequate comprehension, (iii) minimization, or (iv) exaggeration. If the set of ratings are judged “not valid,” a follow-up judgment is made as to whether the primary cause of invalidity was (v) inadequate comprehension, (vi) minimization, or (vii) exaggeration. It may be noted that a judgment of invalidity does not inherently indicate *intentional* dissimulation, and rater intent is not a consideration in arriving at the judgment of validity.

In the interpretation of sets of ratings judged to be of questionable validity, the clinician may note that ratings on several scales appear likely to be valid while ratings on specific other scales are considered either invalid or biased (positively or negatively). With explication of validity issues and with appropriate caution, the clinician may incorporate validity judgments into their interpretation of the obtained ratings on specific scales. Ratings judged to be invalid should not be interpreted as accurate indications of personality functioning. In the research context, a priori exclusion of sets of ratings judged to be invalid is recommended (unless validity issues are an aspect of the study). It is emphasized that a determination of invalidity of ISPC ratings provided by the informant does not, in and of itself, indicate that *the patient’s exam results* are also invalid. In forensic evaluations for potentially compensable brain injuries in which the ISPC ratings by informants that were determined to be invalid, the patient did not produce any positive symptom validity or performance validity test results in approximately half of those evaluations (Manzel, Barrash & Tranel, In preparation).

The ISPC ratings provide several types of information to help assess the validity of ratings. These include: (1) behavioral observation during work on the sample scale, *Selfishness*, (2) internal coherence of ratings, (3) control scales, and (4) consistency of rated personality functioning with information from external sources (i.e., sources other than the ISPC rater).

(1) During presentation of the sample scale to the rater, there may be some discussion of

the ratee's behavior and how it maps onto the rating guidelines presented for the scale. This may provide the clinician with insight into the rater's social understanding and psychological-mindedness, as well as possible biases.

(2) Internal coherence refers to the degree to which ratings conform to typical patterns for characteristics that tend to co-occur (e.g., lack of initiative and lack of persistence, irritability and impatience, or anxiety and being easily overwhelmed), or for characteristics that tend to have an inverse relationship (e.g., lack of initiative vs. type A behavior, inflexibility vs. indecisiveness, and lability vs. being unemotional). A general pattern that may also suggest diminished validity would be a "scattershot" set of ratings; that is, ratings indicating marked disturbances in an incoherent set of traits with no pattern suggesting any particular type of higher-order disturbance.

(3) A high number of extreme ratings —and 6s and 7s for Now ratings — may raise concerns of exaggerated ratings, especially when accompanied by frequent Before ratings of 1. The judgment whether the extreme ratings are accurate or exaggerated may be informed by examples the rater may have included on the ISPC form, of by interview of the rater or others to determine whether the ratings of severe disturbance are warranted.

(4) Four control scales assess characteristics which are not expected to significantly increase as a consequence of acquired brain damage. Two of these scales concern characteristics typically viewed negatively (*Vanity* and *Manipulativeness*), and the other two control scales assess characteristics often viewed as positive (*Frugality*, and *Type A Behavior*). When a rater rates one, and especially more than one, of these characteristics as having increased by more than one point, this raises questions of bias or possibly dissimulation in the set of ratings. (While an increase in type A behavior is rare and suggests rater exaggeration, a decrease in type A behavior in association with decreased initiation and persistence is not unusual among brain-injured individuals such a decrease, in and of itself, is not suggestive of bias.)

(5) Information regarding personality functioning will be available to a greater or lesser degree from records bearing on real world functioning. This may include evidence of personality strengths or weaknesses in clinical notes and non-clinical documents. Additionally, clinical interview of the patient, spouse, family members and friends can provide descriptions of prominent personality characteristics premorbidly, and salient changes postmorbidly. Finally, valuable information may come from clinical observations during the interview and test sessions (and sometimes, quite dramatically, during the patient's time interacting with the receptionist and in the waiting area).

Collectively, these five types of information may provide a rich basis for whether ratings should be considered valid, invalid, or an in-between status that the ratings can be reviewed and factored into a clinical formulation of the patient, tempered by concerns about the validity of some of the ISPC ratings. If the overall judgment is "questionable validity," the clinician may consider some ratings as of doubtful validity but others as likely valid based on agreement of the ratings with other sources of information.

3.7. Multiple ratings

Multiple Raters. When multiple informants are available, they are instructed to complete their ratings independently. Ideally, there is strong agreement between raters and this increases our confidence in the accuracy of the ratings. However, to the extent that there are discrepancies for some scales, the clinician should judge the relative validity and insightfulness of the raters. If one rater is judged to have produced the most accurate set of ratings, that set should be considered "the index ratings" on which interpretation is based. However, sometimes different raters appear to have comparable validity but they have different perspectives (e.g., a spouse and an adult child) and the patient may tend to behave differently around the different raters. This

provides for particularly rich data for understanding the nature of the patient's personality changes.

Serial Ratings. Serial ratings completed by the same rater over a period of time are sometimes available. If there has not been a major change in neurological status in the intervening period, longitudinal ratings may provide important information regarding reliability and validity of the ratings. Especially informative in this regard are BEFORE ratings, which should remain essentially unchanged. If there are more than trivial discrepancies in the BEFORE ratings, this is a strong indication of unreliability, which may be present for a variety of reasons. If there are significant discrepancies in the NOW ratings, the reasons for this should be explored by further interview of the rater to determine if there have in fact been significant changes in postmorbidity behavior during the interim (valid ratings) or if the discrepancies indicate unreliability of ratings (reduced validity). If intervening event such as a traumatic brain injury has occurred since the initial ratings, the rater can be instructed to rate the patient for three time points: premorbidly; after onset of the initial neurological condition; and after the second neurological event. Changes between the initial and second neurological conditions would speak to possible add-on effects from the second condition. In circumstances in which the ISPC was completed at different points in time by different raters, the clinician should be extremely cautious and conservative in drawing conclusions about personality changes over the interim period.

4. Descriptive and Normative Information

4.1. Description of Samples

Sample 1. Data concerning normative characteristics, reliability and validity of the Iowa Scales of Personality Change come from three samples. "Sample 1" is the initial sample on which personality ratings were obtained with the Iowa Rating Scales of Personality Change, the predecessor of the ISPC. 115 brain-damaged individuals who came from two sources at the University of Iowa Hospitals and Clinics (UIHC), the Benton Neuropsychology Clinic and the Iowa Patient Registry ("the Registry") of the Division of Neuropsychology and Cognitive Neuroscience at the University of Iowa Department of Neurology. Inclusion criteria for the Registry include a single stable focal brain lesion with parenchymal damage evident on structural imaging; exclusion criteria include a history of significant alcohol or substance abuse, psychiatric disorder, or other neurologic disorder unrelated to the lesion that may affect brain functioning. Additionally, eligibility for any analyses of the IRSPC/ISPC reported in this manual also required that the lesion was acquired at age 18 or older, the interval since onset was at least 4 months, and ISPC ratings judged to be valid or probably valid. The patients of Sample 1 were evaluated between 1993 and 1996, with etiologies including stroke (54), TBI (26), brain tumor (9), temporal lobectomy for intractable seizures (3), and 23 with other neurologic conditions (including epilepsy, Huntington's, Parkinson's, anoxia, neurotoxic exposure, herpes simplex encephalitis, and MS). All were at least 3 months past the onset of their condition, with a mean interval of 4.2 ± 4.8 years since onset. 77 were male and 38 were female, mean age was 49.7 ± 16.3 years, and mean education was 12.7 ± 2.3 years. They had been known by the informant 29.6 ± 16.2 years. Spouses were the informant 67.8% of the time, 13.9% were parents, 6.1% siblings, 3.5% adult children, 6.1% friends. Patients in the Registry or seen in the Benton Neuropsychology Clinic were largely Caucasian patients, with the proportions of non-Caucasian patients mirroring the demographics of the state of Iowa.

Sample 2. "Sample 2" is an ever-growing set of patients from the Registry, with data collection for this sample beginning with the transition to implementation of the ISPC study in 09/1997. ISPCs are sought for all registry patients meeting the inclusion and exclusion criteria

presented above; accordingly, the number of participants has increased over time, up to 234 individuals for the most recent analyses (Barrash, 2022). Etiologies include ischemic stroke, 62 (34.1%), surgical resection cavity following benign tumor resection, 40 (22.0%), hemorrhagic stroke, 38 (20.9%) — including 7 ruptured anterior communicating artery aneurysms, surgical resection for epilepsy, 30 (16.5%), traumatic brain injury with focal contusion, 6 (3.3%), herpes simplex encephalitis, 4 (2.2%), and anoxia, 2 (1.1%).

Sample 3. “Sample 3” consists of 62 neurologically healthy, independently living and community-dwelling individuals aged 60 or older. They were recruited by community advertisement. They had no history of psychiatric disease or any detectable neurological disease that may affect brain functioning as determined by extensive clinical interview (Tranel, Benton, & Olson, 2009), and they were cognitively intact as determined by neuropsychological testing. Sample 3 included 33 women and 29 men with a mean age of 72.3 ± 7.4 years and mean education of 16.2 ± 2.6 years. An adaptation of the ISPC was developed (Denburg & Barrash, 2007) to characterize personality functioning in healthy adults (i.e., without neurological disorder). In this adaptation, raters of the healthy older adults were instructed to make a rating firstly for a “BEFORE” period regarding the ratee’s characteristic personality throughout middle age (i.e., from approximately age 40 to 55), and secondly a “NOW” rating (i.e., characteristic functioning for the year prior to the assessment).

A comparison group of 62 older adults with brain disease was drawn from the Benton Neuropsychology Clinic (39 patients) and the Registry (23 patients) (Nguyen, Barrash, Koenigs, Bechara, Tranel, & Denburg, 2013). Each patient was selected to provide the closest 1:1 match with a healthy elderly participant for sex, age (all age 60 or older) and education. The comparison group had a mean age of 72.3 ± 7.4 years and mean education of 15.9 ± 2.7 years. Primary neurological disease in the comparison group, as clinically diagnosed by neurological evaluation, included stroke (19), Alzheimer’s disease (10), Parkinson’s disease (9), microvascular disease (6), multiple sclerosis (4), mild cognitive impairment-amnesic (4), frontotemporal lobar degeneration (3), subdural hematoma (3), traumatic brain injury (2) and amyotrophic lateral sclerosis (2). All patients in the comparison group were at least 4 months beyond the onset of their disease (mean, 4.5 ± 2.7 years).

4.2. Normative Information

A distinctive feature of the ISPC compared to the standard neuropsychological measurement is that normative judgments are incorporated into the ratings. Raters are explicitly instructed to make ratings for which a “3” reflects the average, typical amount of the characteristic *for people of the patient’s age and gender*; the normative judgment is also repeated in the guidelines for ratings of 3 for all characteristics. Accordingly, by definition the normative score for any scale is 3. The validity of ratings of 3 indicating normative personality functioning may be evaluated by examining whether empirical data indicate that raters’ ratings of healthy individuals conform to expectations for normative scores.

Premorbid Ratings. In the healthy older adults of Sample 3, mean BEFORE ratings were at or below 3.1 for 23 of 26 clinical scales, and all clinical scales were below 3.5 (Appendix A), indicating normal premorbid personality functioning. The same pattern of results was seen for the comparison group of older adults with brain diseases. These findings are consistent with normative expectations as there is no basis for abnormal *premorbid* personality functioning among a group of individuals developing a heterogeneous set of neurological disorders as older adults. With Bonferroni correction for multiple comparisons ($.05 \times 26$ clinical scales = $.002$) Bonferroni, there were no significant differences in premorbid personality ratings between the two groups on any scale. The strong tendency for mean premorbid scores to be at similar levels for

both groups, with an average discrepancy of mean BEFORE ratings of .12, supports the normative inferences incorporated into ratings as premorbid function as average or better *regardless of the ratee's clinical status*.

Current Disturbance. For ratings of current personality functioning (Appendix A), healthy older adults had mean NOW ratings between 1.9 and 3.5 for all clinical scales, and an overall mean rating of 2.56. These findings are consistent with normative expectations for personality functioning in the absence of a neurological disorder.

Change. Normative data regarding change from baseline to current functioning in healthy older adults (Appendix B), the average magnitude of change was minimal (mean change = 0.10). No scales showed significant change (with Bonferroni correction as above), with the sole exception of a 1.1 mean increase in *Lack of Stamina*, change that approached significance at the Bonferroni-corrected level ($p < .007$). Of course, diminishing stamina as individuals age from the middle age to older age (mean, 72 years), is to be expected. In contrast to normative findings of minimal change, in the brain-damaged comparison group significant change on 20/26 clinical scales, with a large average effect size, .86).

Acquired Personality Disturbances. Normative information regarding the frequency with which healthy older adults were rated as having developed acquired personality disturbances are presented in Appendix C. The rates were quite low, below 8.1% for 22 of the 26 clinical scales. However, four clinical scales had rates of acquired personality disturbances exceeding 10%: *Lack of Stamina* (19.4%), *Lack of Insight* (17.7%), *Lability* (14.5%) and *Inflexibility* (11.3%). These may be considered the normative base rates in healthy older adults, with normal aging presumably being the primary explanation for development of these disturbances. The findings of increases in these maladaptive changes in healthy older adults are consistent with longitudinal studies of community populations studies assessed with the NEO-PI-R (Costa & McCrae, 1992) and other instruments assessing personality with the Five Factor Model (Zirbes et al., 2021). In the clinical situation, however, if the relevant clinical condition is associated with high rates of one of these four characteristics, then older adults who may be predisposed to develop the disturbance with normal aging may be at higher risk to develop such a disturbance consequent to the adverse effect of the clinical condition.

4.3. Influence of Potentially Confounding Factors

Age Effect. The limited age range of Sample 3 does not provide full coverage of the adult age span. However, within the sample of older adults (range, 60-92; mean 72.3 ± 7.4 years), Spearman correlations were calculated to examine potential age effects across the 30 BEFORE and 30 NOW scales. No correlations between ISPC ratings and age were significant at the Bonferroni-corrected .002 level. However, five correlations were of moderate magnitude ($r > .30$; Cohen, 1988). Four scales concerned ratings for the middle-age ("BEFORE") epoch: *Lack of Stamina* ($r = -.37, p = .003$), *Lack of Persistence* ($r = -.37, p = .003$), *Lack of Planning* ($r = -.34, p = .008$) and *Indecisiveness* ($r = -.33, p = .008$); one concerned current functioning: *Lack of Stamina* ($r = -.37, p = .003$). These correlations indicate that, among patients 60 or older, age accounted for *at most* less than 14%, with only one such scale concerning ratings of current personality functioning. The general lack of appreciable age effect suggests that the instruction to rate functioning relative to others of the ratee's age and gender are effective at minimizing an age effect.

Adding evidence suggesting that normal aging effects are unlikely to have a significant

impact when assessing middle-aged adults with brain disease comes from minimal age effects seen across middle age in community samples assessed with Five-Factor Model inventories (Costa & McCrae 1994; Graham et al., 2020; Soldz & Vaillant, 1999; Terracciano, Costa, & McCrae, 2006).

Gender effect. Gender effects were examined in a clinical sample and a sample of healthy older adults (Barrash, 2022)⁷, with significant results presented in Appendix D. Results show Change scores were not significantly related to gender for any of the 30 characteristics in either sample. The only two significant differences in the healthy older adults had the largest effect sizes of any gender effect. These were seen for *Social Withdrawal-BEFORE* and *Social Withdrawal-NOW*. Ratings for both the middle age epoch (i.e., BEFORE) and currently indicated that men were consistently rated as average (“3”) while the women were consistently rated as “2” (i.e., they were seen as being more sociable than what the rater believes is the average level for the typical woman of comparable age). The effect sizes for the premorbid and postmorbid epochs were .66 and .71, respectively; both are medium effect sizes (Sawiliowsky, Sawiliowsky & Grissom, 2010). In the clinical sample, two BEFORE-NOW sets of ratings were both significant and including a gender effect of medium magnitude. For the scale *Insensitivity*, premorbidly men were seen as average and women as somewhat lower than average (i.e., more sensitive than the average woman); and postmorbidly both showed increases, with the mean rating for men indicating mild disturbance and for women it indicated they were no longer better than average but had become merely average. The effect sizes for the premorbid and postmorbid epochs were .47 and .56, respectively. For the scale *Unemotional*, premorbidly men were seen as very mildly in the disturbed direction and women were average; and postmorbidly both were rated identically, with no discernible change. The effect sizes for the premorbid and postmorbid epochs were .50 and .33, respectively. Four other scales (*Lack of Stamina*, *Social Inappropriateness*, *Inflexibility*, *Aggressive Behavior*) showed a statistically significant gender effect, each with small effect size.

In summary, in the normative sample, only one scale showed a sex difference and this indicated better than average sociability among women. Reliable sex differences are seen in personality research in non-clinical populations with Five-Factor Model inventories — which do not have built-in normative judgments (Costa, Terracciano, & McCrae, 2001; Schmitt et al., 2017). In juxtaposition, the general absence of gender differences with the ISPC in a non-clinical population suggests that this instrument’s approach of instructing raters to incorporate gender into their ratings is effective, and that gender biases are not an issue of concern for ISPC ratings. In the clinical sample, six scales showed a gender effect, and in general the effects were low magnitude and reflected women tending to have less disturbance or more facility with a characteristic (with the exception of poor stamina). The pattern of differences in the clinical sample suggests that those differences are more likely accurate ratings of slight differences between the genders, rather than ratings compromised by bias.

Interval Effect. The interval between onset of the brain condition and completion of ISPC ratings was unrelated the ratings of current level of personality functioning for any personality characteristics in Sample 2. It must be noted, however, that ratings completed at less than four months after onset were not included in this sample. Although the ISPC can be administered at any point in time, administration after at least 4 months have passed since the onset of a brain

⁷ Analyses were conducted on the 62 healthy older adults of Sample 3 (29 men, 33 women) and 234 patients from Sample 2 (123 men, 111 women). Differences in group means for males and females were tested for 180 comparisons (30 scales x 3 variables [BEFORE, NOW and Change] x 2 samples). A liberal alpha level of 0.10 was employed to reduce type II error (failing to observe a gender effect when one actually exists). In addition to statistical significance of mean differences, to examine the effect size Cohen’s *d* was calculated to present the magnitude of the differences. Gender differences that were both significant and of moderate effect size (Cohen’s $d \geq 0.50$; Sawiliowsky, Sawiliowsky & Grissom, 2010) were accorded particular consideration in discussion.

condition are presumed to be more accurate than ratings made after a shorter interval. This practice is supported by empirical analysis: The full data base was searched for any patients who had two sets of ISPC ratings completed by the same rater at two points in time, the first ratings at 4-6 months after onset and the second set at 12 months or longer after onset. Ten patients met these criteria and they were split into two groups: Five patients had initial ratings at 4 months and the second group of five different patients had initial ratings at were rated at 5-6 months. The stability of ratings made by the two groups were compared, with group stability considered to be an index of the accuracy of initial ratings (because of their consistency with ratings made with benefit from a lengthier period during which to observe the patient's behavior)⁸. These analyses indicate that by four months post-onset, ratings by an appropriate rater show reasonably stable ratings.

Effect of Rater Characteristics. The relationship of the rater to the ratee (i.e., spouse, parent, adult child, sibling) was unrelated the ratings of current level of personality functioning for any personality characteristics in Sample 2.

5. Development, Reliability, and Validity

5.1. Development of the ISPC

The original version of the Iowa Scales, the *Iowa Rating Scales of Personality Change* (IRSPC, Barrash & Anderson, 1993), was initially developed as an instrument for neuroscientific investigations of prefrontal functions under the leadership of Antonio Damasio at the University of Iowa. However, in addition to changes specifically associated with prefrontal damage, the IRSPC was designed to assess the myriad of disturbances reported in the literature in different aspects of social behavior, mood, affect, motivation/drive and executive control following damage to the brain — whether in prefrontal cortex or elsewhere, and regardless of the neuropathological mechanism. A primary goal of development was to balance detailed, relatively comprehensive assessment of reported disturbances with the time burden on raters. Twenty-six characteristics were selected to cover the range of frequently reported disturbances by a panel of neuropsychologists with considerable experience assessing personality disturbances in neurological patients.⁹

Behavioral guidelines for each scale were constructed to enhance the reliability of ratings by lay informants. Ratings were obtained on a sample of 115 brain-damaged individuals (sample 1, described in Section 4.1) and comprehensive psychometric analyses were performed on the IRSPC ratings (Barrash et al., 1997b). Informed by those analyses, the IRSPC was revised and renamed the ISPC. Based on the analyses, three scales with undesirably high intercorrelations with another scale or with weak reliability were replaced with the scales of *Aggressive Behavior*, *Easily Overwhelmed*, and *Lack of Stamina*. Other scales with fair reliability underwent tailored revisions to enhance reliability.

5.2. Reliability

Interrater Reliability. Interrater agreement of the IRSPC was evaluated on scores for 15

⁸ We calculated the discrepancy from Time 1 to Time 2 for each of 12 key NOW ratings (i.e., the ratings used to calculate the four types of personality disturbance). The absolute value of each discrepancy was used to preserve the magnitude of discrepancy regardless of direction. The mean discrepancy (across 12 ratings) for the first group was $.30 + 1.2$; the mean discrepancy for the second group was $.32 + 1.0$. This is an admittedly crude analysis with small sample sizes, and inferential statistics are not meaningful. However, the analysis indicates that, in our sample, ratings made at 4 months and ratings made at 5-6 months were virtually identical in terms of stability at 12 months or longer, with an average discrepancy of 0.30 - 0.32 ratings points.

⁹ Arthur L. Benton, Steven W. Anderson, Robert D. Jones, Daniel T. Tranel, and Joe Barrash.

patients in Sample 1 who had been rated independently by two informants. Interrater agreement, weighted by magnitude of discrepancy, was high across all “NOW” ratings and “Change” scores, ranging from 0.80 to 0.96. Chance-corrected agreement was assessed with Cohen’s kappa, a stringent evaluation of agreement. The mean kappa for “NOW” scales was .48, and for “Change” scores, .52, indicating fair chance-corrected agreement overall. In a notable case report of a patient with amyotrophic lateral sclerosis, Waldron and colleagues (2014) reported that ISPC ratings, completed independently by the patient’s husband and two adult daughters, all showed striking agreement in reporting a specific pattern of major prefrontal personality disturbances. Reliability coefficients (Cronbach’s alpha) for two broad dimensions emerging from factor analysis (Beni, Rochat, & Van der Linden, 2007) of the French version of the ISPC (Juillerat, Peter-Favre, & Van Der Linden, 1998) — Internalizing disturbances and Externalizing — were found to be acceptable to high .69 and .86, respectively. Ratings with the Spanish version of the ISPC (Jiménez-Cortés et al., 2010) in 31 TBI patients showed strong interrater reliability: intraclass correlation coefficients of 0.96 (ratings of premorbid functioning) and 0.84 (ratings of current functioning) (Guallart-Balet et al., 2015).

Temporal Stability. The temporal stability of ratings was assessed in 19 subjects from Sample 1 who were rated a second time by the initial informant an average of 12.2 ± 9.2 months after the initial ratings. Despite the fact that the level of functioning for some characteristics may actually change over a year’s time, the mean correlation for current ratings of disturbance was 0.76 and for change 0.77. Ratings with the Spanish version of the ISPC with 31 TBI patients (Guallart-Balet et al., 2015) showed temporal stability over a 2-week period of 0.89 for premorbid characteristics and 0.94 for current ratings. Strong temporal stability was found for ISPC ratings in 31 TBI patients with the Spanish version of the ISPC (Jiménez-Cortés et al., 2010) with re-ratings obtained after a 2-week period: with intraclass correlation coefficients of 0.89 (ratings of premorbid functioning) and 0.94 (ratings of current functioning) (Guallart-Balet et al., 2015).

5.3. Structure

Factor Analysis. The initial study of the factor structure of the Iowa Scales was performed with factor analysis of the IRSPC (Barrash et al., 1997b). NOW ratings were analyzed for the 115 brain-damaged individuals of Sample 1. Six factors with an eigenvalue greater than 1.0 emerged. After varimax rotation, factors were interpreted as reflecting: (1) Distress/Emotional Reactivity, accounting for 28.5% of the variance; (2) Interpersonal Disturbance, 10.5%; (3) Impaired Ego Functioning, 7.6%; (4) Executive Dysfunction - Cognitive, 5.7%; (5) Executive Dysfunction - Behavioral, 5.2%; and (6) Hypoemotional, 4.2%. Collectively, these factors accounted for approximately 60% of the variance in personality ratings.

Replication was performed in an independent sample of 124 patients with stable focal lesions from Sample 2 (Barrash et al., 2011). Factor analysis of NOW ratings with varimax rotation yielded a factor structure largely congruent with that of the 1997 study. However, rather than two separate factors for emotional reactivity and interpersonal disturbance, the first factor to emerge was comprised of scales from both. This complex factor was labeled Disturbed Social Behavior/Emotional Reactivity. Three other factors were labeled Executive Dysfunction, Hypoemotionality/Diminished Motivation, and Distress. Three other weak factors emerged, each of which was very largely defined by two scales: a factor characterized by *Vanity* and *Suspiciousness*; a factor characterized by *Manipulativeness* and *Frugality*; and one characterized by *Obsessiveness* and *Type A Behavior*. In contrast to the first four factors, these factors do not reflect change from premorbid functioning on the defining characteristics; rather, premorbid ratings were elevated and there was an absence of change (Barrash et al., 2011). Accordingly, these factors do not bear on longstanding aspects of personality and not acquired personality

disturbances, and they are not considered further.

With the growth of Sample 2 over the ensuing decade, the factor analysis was re-performed with 182 patients to re-examine results with the substantially larger sample (Barrash et al., 2022, supplemental material). The four factors found in 2011 again emerged with eigenvalues greater than 1.0. The specific scales loading most highly on the four types of acquired disturbance are presented in Table 2. The first factor, reflecting Emotional/Social Personality Disturbance, had an eigen value of 10.57, and accounted for 35.2% of the variance. The second factor, Dysexecutive Personality Disturbance, had an eigenvalue of 2.79, and accounted for 9.3% of the variance. The third factor, Distressed Personality Disturbance, had an eigen value of 1.72, and accounted for 5.7% of the variance. The fourth factor, Hypoemotional Personality Disturbance, had an eigen value of 1.62, and accounted for 5.4% of the variance.

A factor analysis in Switzerland has also been performed on the French version of the ISPC (Juillerat et al., 1998) on ratings of 25 patients with traumatic brain injury (Beni et al., 2007). By a priori decision based on theoretical considerations, the factor analysis produced two factors that were labeled as “Externalizing” and “Internalizing” factors. High internal consistency was found for the externalizing factor (Cronbach’s alpha) 0.86 and internalizing factor, 0.69. The externalizing dimension comprises *Irritability, Impulsivity, Lack of Planning, Insensitivity, Social Inappropriateness, Impatience, Aggressive Behavior, and Inappropriate Affect*; the internalizing dimension comprises *Depression, Anxiety, and Social Withdrawal* subscales). It may be noted that the composition of the Externalizing and Internalizing factors is virtually identical to the factors of Emotional/Social Personality Disturbance and Distressed Personality Disturbance identified in the factor analysis of the English version (Barrash et al., 2011, 2022). Accordingly, unless theoretical considerations dictate otherwise, the labels “Emotional/Social Personality Disturbance” and “Distressed Personality Disturbance” are recommended for being behaviorally descriptive rather than referencing psychological constructs.

Intercorrelations among Subtypes. Pearson correlations between dimensions were calculated for 182 participants from Sample 2 (Barrash et al., 2022). Significant correlations were found between all pairs of disturbances (Table 3). Emotional/Social Personality Disturbance was moderately correlated with Dysexecutive and Distressed Disturbances ($r = .48$ and $.58$, respectively) and was weakly correlated with Hypoemotional Disturbance ($r = .20$). Dysexecutive Disturbance was highly to moderately correlated with all other dimensions, including the highest correlation which was between Dysexecutive and Distressed Personality Disturbances ($r = .67$). Hypoemotional and Distressed Personality Disturbances were modestly correlated ($r = .33$).

Cluster Analysis. Subtypes of acquired personality disturbances have been hypothesized by prominent models of prefrontal systems based on neuroanatomically-defined circuits, such as those elaborated by Cummings (1993, 1995) and Stuss (Stuss, 2011a; Stuss & Benson, 1984). Earlier factor analyses demonstrated dimensions of disturbance congruent with such subtypes. However, the earlier group-level factor analyses do not address whether variability in personality disturbances reflect discrete subtypes or are truly dimensional in nature. This issue was investigated with cluster analysis — analyses at the individual level — in a study of 194 adults with chronic, stable, focal lesions located in various aspects of prefrontal lobes and elsewhere in the brain (Barrash et al., 2022). Two fundamentally distinct cluster analysis techniques were applied to NOW ratings. One technique was a hypothesis-driven approach; the other was a set of strictly empirical analyses to assess the robustness of clusters found in the first analysis. The hypothesis-driven analysis yielded subtypes that were highly overlapping with the dimension produced by factor analysis. Results from the second (empirical) set of cluster analyses were consistent with findings from the hypothesis-driven cluster analysis. Overall,

findings across the two cluster analyses again demonstrated four types of acquired personality disturbances: Emotional/Social, Dysexecutive, Hypoemotional, and Distressed Personality Disturbances, as well as an undisturbed group that comprised approximately half of the entire sample. Results from earlier factor analyses (Barrash et al., 2011) had raised a question whether emotional dysregulation and disturbed social behavior are two distinct subtypes, and the results of the cluster analyses indicated clearly that despite the conceptual distinction, these disturbances are actually two aspects of one multifaceted type of disturbance. Details are presented in Table 4. Importantly, findings did not indicate discrete, non-overlapping subtypes; rather, results were consistent with earlier observations that many patients have a mixture of various types of disturbance (Barrash et al., 2011; Stout et al., 2003; Stuss & Benson, 1984).

Table 4. Mean personality ratings for clusters from Ward's cluster analysis

Scale	Disturbed (n=96, 49.5%)				Normal (n=98, 50.5%)
	"Dysexecutive Personality Disturbance" (n=30) (31.3%)	"Emotional /Social Disturbance" (n=33) (34.4%)	"Hypoemotional Disturbance" (n=20) (20.1%)	"Distressed Personality Disturbance" (n=13) (13.5%)	
<i>Poor Judgment</i>	5.8	3.9	4.7	4.6	2.8
<i>Lack of Planning</i>	5.7	3.6	5.6	4.8	2.7
<i>Perseverative Behavior</i>	5.3	4.2	4.8	4.2	2.9
<i>Lack of Initiative</i>	5.8	3.7	5.2	5.5	2.8
<i>Lack of Persistence</i>	5.2	3.5	4.9	4.3	2.6
<i>Indecisiveness</i>	5.6	4.2	5.0	5.2	3.2
<i>Impulsivity</i>	5.0	3.8	3.8	4.1	2.6
<i>Insensitivity</i>	5.1	4.5	3.5	3.6	2.5
<i>Social Inappropriateness</i>	5.3	4.2	3.3	4.0	2.4
<i>Inappropriate Affect</i>	5.0	3.0	3.0	3.9	2.6
<i>Aggressive Behavior</i>	4.0	3.2	2.4	2.7	2.3
<i>Lack of Insight</i>	5.1	3.0	3.3	3.5	2.4
<i>Apathy</i>	5.0	3.9	5.0	3.9	2.9
<i>Unemotional</i>	3.9	2.4	4.9	1.5	3.0
<i>Social Withdrawal</i>	4.0	4.2	5.2	2.7	2.8
<i>Impatience</i>	5.4	5.3	1.8	4.3	2.9
<i>Irritability</i>	5.1	5.1	2.6	3.9	3.0
<i>Lability</i>	5.4	5.0	2.8	5.0	3.2
<i>Inflexibility</i>	5.4	4.6	3.4	4.2	3.4
<i>Depression</i>	4.4	4.1	4.0	5.2	2.8
<i>Anxiety</i>	4.4	4.6	3.8	5.7	3.1
<i>Dependency</i>	4.1	4.0	3.6	5.9	2.7
<i>Easily Overwhelmed</i>	5.3	4.9	4.7	5.7	3.2
<i>Lack of Stamina</i>	5.6	4.6	5.7	5.5	3.6
<i>Obsessiveness</i>	4.0	4.1	3.7	4.4	3.7
<i>Suspiciousness</i>	3.7	3.6	2.5	2.9	2.9
<i>Type A Behavior</i>	3.3	3.3	2.1	1.6	2.9
<i>Vanity</i>	3.4	2.7	2.2	2.2	2.1
<i>Frugality</i>	3.2	3.5	3.7	3.8	3.4
<i>Manipulativeness</i>	4.0	2.8	2.0	4.0	2.3

Note. Adapted from Barrash et al., 2018.

5.4. Convergent Validity and Discriminant Validity

Clinician Ratings. An early investigation with the IRSPC examined correlations between informant ratings on the IRSPC and clinician ratings (Barrash et al., 1997b). Clinician ratings

were available for 9 characteristics: depression, irritability, apathy, impulsivity, poor judgment, lack of planning, lack of persistence, social withdrawal, and self-centeredness¹⁰. Twenty-five 25 patients were seen in the Benton Neuropsychology Clinic at the University of Iowa for evaluation of a diverse set neurological disorders that affect brain functioning. The evaluating

neuropsychologist rated the 9 characteristics on a 3-point scale (no problem/possible problem/definite problem) for premorbid and postmorbid epochs. Correlations with IRSPC ratings were evaluated with non-parametric Spearman's rho due to the ordinal nature of the data. The mean correlation between IRSPC NOW ratings and clinicians' postmorbid ratings was .55, and 8 of 9 were significant at the .01 level ($r > .41$). The mean Spearman correlation between change ratings by informants and clinicians was .57, with 8 of 9 significant correlations. Discriminant validity was shown by the fact that none of the 9 IRSPC scales correlated significantly with any clinician ratings other than for the corresponding characteristic.

Frontal Systems Behavior Scale (FrSBe). A study of behavioral changes in 39 patients with cerebral tumors (Gleason, 2004) included assessment with both the ISPC and the FrSBe. Ratings on individual ISPC scales were not reported; rather a composite score, "frontal personality changes," was calculated from the 18 scales previously found to be characteristic of bilateral ventromedial PFC damage (Barrash et al., 2000). Convergent validity was demonstrated with high correlations between the ISPC composite for current disturbance and the FrSBe total disturbance score, $r = .82$, $p = .001$, and between the ISPC composite for change scores with the FrSBe total change score, $r = .73$, $p = .001$.

Two patients who were 13 and 15 years post-TBI with documented orbitofrontal lesions and dramatic post-traumatic personality changes were assessed with German versions of the ISPC (Kuhn, 2008) and the FrSBe (Rohde, 2011). Both patients showed high levels of Apathy, Disinhibition, and Executive Dysfunction on the FrSBe, and on the ISPC both patients were rated as having severe disturbances on several ISPC scales that reflected marked disturbance on the three higher-order types of disturbances associated with prefrontal dysfunction — Emotional/Social Disturbance, Dysexecutive Personality Disturbance and Hypoemotional Personality Disturbance. Specifically, for patient 1 the ISPC showed disturbances in impulsivity, poor judgment, Aggressive Behavior, lack of planning, lack of initiative, lack of persistence, indecisiveness, obsessiveness, depression, unemotional, social withdrawal, irritability, emotional lability, inflexibility, suspiciousness, and becoming easily overwhelmed; for patient 2 the ISPC showed disturbances in impulsivity, poor judgment, lack of planning, lack of initiative, lack of persistence, perseverative behavior, indecisiveness, unemotional, apathy, interpersonal insensitivity, inflexibility, irritability, suspiciousness, and becoming easily overwhelmed. This evidence of convergent validity was only seen for informant ratings on the FrsBe; in contrast, very few acquired disturbances were reported in the patients' self-ratings on the FrsBe.

Dysexecutive Questionnaire (DEX). A study employing the French version of the ISPC (Juillerat et al., 1998) examined behavioral changes early in the course of MS (Lima et al., 2007). Ratings on the ISPC dysexecutive dimension were significantly correlated with problems with executive functioning *as reported by family members* on the DEX (Wilson, Alderman, Burgess, Emslie, & Evans, 1996) (Spearman $r = .52$). Additionally, considering items assessing the same characteristic by the ISPC and corresponding DEX, Spearman correlations in the MS group were significant for *Irritability*-DEX item 5 ($r = .56$), *Irritability* -DEX item 12 ($r = .47$), *Social*

¹⁰ The Iowa Ratings Scales of Personality Change had included the scale *Egocentricity*. However, psychometric analyses indicated suboptimal inter-rater reliability for this scale, prompting its removal. With tweaks to behavioral guidelines to increase reliance on observable behavior, that scale was replaced in the ISPC by the scale *Vanity*.

Inappropriateness-DEX item 13 ($r = .49$), *Apathy*-DEX item 8 ($r = .44$), *Lack of Persistence*-DEX item 18 ($r = .43$), and *Impulsivity*-DEX item 2 ($r = .39$). Correlations did not reach significance for *Lack of Planning*-DEX item 4 ($r = .23$), *Lack of Insight*-DEX item 7 ($r = .23$), and *Perseverative Behavior*-DEX item 14 ($r = .11$). Specific ISPC scales were not correlated with corresponding DEX items as reported by the patients.

Neuropsychiatric Inventory (NPI). In a study of 24 French patients with Parkinson's disease, ratings on the French version of the IRSPC ratings were associated with measures of psychiatric functioning on the NPI (Houeto et al., 2002). In a study of 31 TBI patients in Spain assessed with the Spanish version of the ISPC, scores on the four ISPC dimensions were highly correlated with scores on the NPI (Guallart-Balet et al., 2015).

Minnesota Multiphasic Personality Inventory-2-Restructured Form (MMPI-2-RF). Convergence of the ISPC and the MMPI-2-RF (Ben-Porath & Tellegen, 2008), a self-report inventory of psychiatric problems, was examined in a subset of 83 patients from Sample 2 for whom both measures were available (Barrash et al., 2022). Scores were computed for MMPI-2-RF clinical scales, higher-order scales, selected internalizing and externalizing scales, and validity scales. The three higher-order order scales of the MMPI-2-RF are Emotional/Internalizing Dysfunction (comprising difficulties associated with low positive emotions, negative emotional experiences and demoralization, such as depression, pessimism, anxiety, feeling overwhelmed and helpless); Thought Dysfunction (comprising a broad range of difficulties associated with disordered thinking, including paranoid and non-paranoid delusions, auditory and visual hallucinations, and impaired reality testing); and Behavioral/Externalizing Dysfunction (comprising a broad range of difficulties associated with deficient behavioral control, such as poor impulse control, abusive behavior, violent behavior, history of criminal behavior, and substance abuse) (Ben-Porath & Tellegen, 2008, pp. 33-34).

The pattern of correlations between the four ISPC higher-order personality disturbance scores and the three MMPI-2-RF higher-order scales, presented in Appendix E, provided support for convergent validity. As expected given the overlap of content, Emotional/Social Personality Disturbance was most highly correlated with Behavioral/Externalizing Dysfunction (.36), and Distressed Personality Disturbance was most highly correlated with Emotional/Internalizing Dysfunction (.38) as was Hypoemotional Disturbance (.24). Dysexecutive Personality Disturbance was meaningfully correlated with Emotional/Internalizing Dysfunction (.34) and with Behavioral/Externalizing Dysfunction (.35), but was not significantly correlated with Thought Dysfunction. Superficially, one might expect a strong correlation between Dysexecutive Personality Disturbance and Thought Dysfunction, however the latter is not concerned with deficits in executive functions but rather with "psychiatric" thought disorder such as delusions, hallucinations and paranoia which are quite distinct from dysexecutive problems. Discriminative validity was demonstrated for ISPC higher-order dimensions by their lack of meaningful correlations with higher-order scales of the MMPI that do not correspond conceptually.

Pearson correlations calculated between all 30 individual ISPC scales and 23 MMPI-2-RF scales are presented in the three-part Appendix F. The very large number of intercorrelations precludes comprehensive review. However, bearing in mind that relationships are being examined between ISPC ratings *by informants* and MMPI-2-RF *self-reported* scores, the overall pattern of correlations with the highest levels of significance are generally consistent with expectations based on conceptualizations of related scales.

Beck Depression Inventory (BDI). Correlations of higher-order disturbance scores with the BDI/BDI-II among 182 patients from Sample 2 (Barrash et al., 2022) showed the expected

strongest relationship with Distressed Personality Disturbance (.34) as well as a highly significant correlation with Dysexecutive Personality Disturbance (.29), while correlations were negligible for Emotional/Social Personality Disturbance (.10) and Hypoemotionality (.10). Although there was not an a priori basis for expecting patients with Dysexecutive Personality Disturbance to be prone to depression, patients with significant depression are prone to several of the core characteristics of Dysexecutive Personality Disturbance (deficits in initiative, persistence and planning, and perseverative behavior, as well as associated problems with lack of stamina, poor judgment, indecisiveness, and easily becoming overwhelmed). Overall, the pattern of correlations indicates good convergent validity and discriminant validity.

Big Five Inventory (BFI) and Revised NEO Personality Inventory (NEO-PI-R). Typical human personality often characterized by the “five-factor model” (FFM) (Digman, 1990; Goldberg, 1993; McCrae & John, 1992). Two widely used instruments developed to assess the factors of Neuroticism, Extraversion, Openness to Experience, Agreeableness, and Conscientiousness are the Big Five Inventory (BFI; John, Donahue, & Kentle, 1991) and Revised NEO Personality Inventory (NEO-PI-R; Costa & McCrae, 1992). Relationships of ISPC scales and the five scales of the FFM inventories in the characterization of acquired personality disturbances was examined in the 62 healthy, community dwelling older adults of Sample 3 (Zirbes, Jones, Denburg, & Barrash, 2020). Self-report versions of the BFI and NEO-PI-R were administered. Spearman correlations between BFI and NEO-PI-R scores for corresponding scales were variable: Neuroticism (.53), Extraversion (.63), Openness to Experience (.70), Agreeableness (.49), and Conscientiousness (.81) (Appendix G). Although some of these correlations are strong, the non-negligible disagreement between BFI and NEO-PI-R sets a ceiling on the reliability with which the underlying constructs of the FFM are measured, limiting the extent of convergence that ISPC ratings may show with the FFM measures. Considering both FFM inventories (Appendices H-I), correlations with ISPC scales (with ISPC scale presented first) exceeding the .01 alpha level¹¹ included *Lack of Planning* and NEO-Conscientiousness (-.38)¹², *Lack of Planning* and BFI-Conscientiousness (-.35), *Social Withdrawal* and BFI-Extraversion (-.37), *Lack of Initiative* and BFI-Agreeableness (-.35), *Lack of Stamina* and NEO-Extraversion (-.34), *Lack of Initiative* and BFI-Conscientiousness (-.33), *Inflexibility* and NEO-Neuroticism (-.33).

The results of these analyses show that there were a relatively small number of statistically significant, and these were of moderate magnitude. There were also a limited number of modest correlations that failed to reach the .01 alpha level, but which showed at least 5% shared variance between pairs of scales. There are several reasons for the low correlations. The BFI and NEO-PI-R assess statistically-derived oblique dimensions of “normal” personality in the general population. They were designed to be sensitive to the full range of functioning on broad behavioral tendencies, and were not designed to assess pathological characteristics (Robins Wahlin & Byrne, 2011). These features contrast sharply with the ISPC, whose scales were designed to assess the degree of disturbance on specific maladaptive characteristics common with neurological conditions. Instruments designed to assess psychopathological characteristics, including the MMPI (in its various forms), have been found to be insensitive to behavioral problems consequent to brain damage (Barrash et al., 2000). That the FFM inventories are self-report and this amplifies their lack of sensitivity (to acquired personality disturbances) due to the lack of insight frequently seen among brain-damaged individuals (Anderson & Tranel, 1989;

¹¹ The stringent Bonferroni correction for 300 tests (30 scales x 5 Big Five traits x 2 inventories) would be 0.0002. However, given the major differences between the two types of instruments, generally low correlations were expected. Accordingly, to balance concerns with both Type I and type II errors, by a priori decision alpha was set at .01.

¹² Higher ISPC ratings reflect greater disturbance whereas higher scores on the BFI and NEO-PI-R reflect higher (better) functioning, with the exception of the Neuroticism scale. Thus, with the exception of Neuroticism, a *negative* correlation between an ISPC scale and a BFI/NEO-PI-R score indicates agreement in terms of higher-than-average or lower-than-average functioning, and a *positive* correlation indicates disagreement.

Prigatano & Schacter, 1991). Furthermore, the degree of correlation an ISPC scale can achieve with a BFI score is attenuated by the reliability of the two measures. Despite the substantial differences between the ISPC and the FFM inventories, the correlations accounting for more than 5% variance between scales show convergence between scales of conceptually-related constructs.

Summary of studies concerning convergent validity. To summarize, studies bearing on convergent validity of the Iowa Scales fall into two groups. The first group compares IRSPC/ISPC ratings with other measures that rely on knowledgeable informants to assess disturbances that may occur after brain damage (neuropsychologist ratings, FrSBe ratings, DEX scores and NPI scores). The second group includes inventories designed to assess primary psychiatric disturbances (MMPI, BDI) or basic dimensions of normal personality (NEO-PI-R, BFI), with responses self-reported by the patient (in the studies reviewed). Studies from the first group demonstrate strong convergence on corresponding measures as would be expected; studies from the second group tend to find inconsistent correlations of generally unimpressive magnitude between the informant ratings of the ISPC and the patient-ratings on instruments that were not designed to assess personality changes after brain damage.

5.5. Construct Validity

Of especial importance is the construct validity of the ISPC — how well it measures the personality changes in individuals with brain damage, regardless of specific etiology of the damage or its location. The evidence bearing on the degree to which the ISPC functions as intended is examined for seven issues: (1) ratings of premorbid function; (2) sensitivity to change in clinical conditions; (3) relationships with neuroanatomy; (4) relationships to cognitive abilities; (5) ecological validity; (6) prognosis and response to treatment; and (7) control scales.

Ratings of Premorbid Function. The validity of inferences regarding pathological personality changes based on ISPC ratings depends on the foundational premise that retrospective ratings of premorbid functioning are valid. There are no studies with prospective, independent (non-ISPC) ratings of premorbid function to which ISPC ratings can be compared. However, data from several studies bear on the appropriateness of this premise. The patients in Sample 2 were, by exclusion criteria, premorbidly normal with no history of psychiatric disorder, significant alcohol or substance abuse, or neurologic disorder unrelated to the lesion. Accordingly, as a group, they should produce mean BEFORE ratings that are very close to 3, or “average,” or somewhat lower than 3. Analyses of the full set of 234 Sample 2 patients (Barrash, 2022) (presented in Appendix J), show mean premorbid ratings ranging between 2.3 (Interpersonal dependency) and 3.5 (Obsessiveness), with an overall mean of 2.9 across the 29 premorbid ratings (there is no BEFORE rating for *Lack of Insight*). Normal premorbid ratings have been found for all 29 scales in all published studies presenting relevant data for various subsets from Sample 2, including patients with ventromedial prefrontal lesions (Barrash et al., 2010; Tranel et al., 2005), sagging brain syndrome (Southwick et al., 2013), behavioral variant frontotemporal dementia (Barrash et al., 2014), and meningioma resection (Barrash et al., 2020), and an individual patient with ALS (Waldron et al., 2014). Independent studies of other clinical samples have also documented normal premorbid scores in patients with TBI (Rochat et al., 2009) or surgical treatment for epilepsy (Hébert-Seropian et al., 2017), and case studies of stroke patients (Annoni et al., 2005; Borg et al., 2013). Additionally, normal premorbid ratings have also been documented in the 62 healthy older adults of Sample 3 (Zirbes et al., 2021).

Sensitivity to Change in Clinical Conditions. The construct validity of the ISPC demands that ratings be sensitive to personality changes from the premorbid to postmorbid period in patients with brain damage.

Heterogeneous Clinical Group. Valid ISPC ratings should discriminate easily between relevant clinical groups and healthy control groups for ratings of current personality functioning. A particularly informative study compared the 62 healthy older adults of Sample 3 with age-, sex- and education-matched patients with brain diseases (Zirbes et al., 2021). The healthy adults did not show any significant personality changes from middle age to older adulthood; in contrast, the patient group showed significant change on 20/26 clinical scales, with large effect sizes (average effect size was .86).

Focal Prefrontal Lesions. Investigations of a dramatic case of brain-damaged patients with profound personality disturbance in the absence of discernible cognitive impairments — Phineas Gage (H. Damasio, Grabowski, Frank, Galaburda, & Damasio, 1994) and Patient EVR (Eslinger & Damasio, 1985) — established the major role of vmPFC for personality functioning. Accordingly, subsequent investigations into acquired personality disturbance at the University of Iowa have focused on the relationship between vmPFC and a wide range of acquired disturbances.

An early study (Barrash et al., 2000) examined whether the IRSPC could identify the nature of personality changes associated with bilateral ventromedial prefrontal lesions (Bi-vmPFC) in 7 patients with such lesions, 14 patients with other prefrontal cortical lesions (PFC), and a brain damage control group of 36 patients with cortical lesions outside of the prefrontal region (non-PFC). As predicted, IRSPC ratings identified a syndrome seen in all seven patients with bilateral vmPFC damage, including poorly modulated emotional reactions but, paradoxically, dampening of emotional experience generally; defective decision-making especially in the social realm; impaired goal-directed behavior; and striking lack of insight. The patients with unilateral vmPFC damage showed less severe disturbance than those with bilateral damage, but had significantly higher ratings in several of the same characteristics compared to the patients with focal cerebral lesions not involving prefrontal cortex. Specifically, patients with Bi-vmPFC lesions differed from all other patients with cortical lesions in having very high rates of acquired disturbances for lack of initiative, lack of persistence, indecisiveness, social inappropriateness, inappropriate affect and lack of insight. Additionally, Bi-vmPFC had significantly higher rates of acquired disturbances than non-PFC for irritability, poor judgment, emotional lability, blunted emotional experience, apathy, lack of planning, and poor frustration tolerance¹³. A subsequent study with the revised version, the ISPC, demonstrated a highly similar pattern of acquired personality disturbances in an independent sample of 28 patients with focal vmPFC lesions and 96 with lesions elsewhere (Barrash et al., 2011). A more recent study compared the effects of prefrontal lesions involving vmPFC, dorsolateral PFC (dlPFC) and/or dorsomedial PFC including the anterior cingulate (dmPFC) (Barrash et al., 2022). Differential subtypes of personality changes were predicted for each of these regions, and ISPC ratings were consistent with predictions: Emotional/Social Personality Disturbance was associated with vmPFC lesions; Hypoemotional Personality Disturbance was associated with anterior cingulate/dorsomedial PFC lesions; Dysexecutive Personality Disturbance was most strongly associated with dorsolateral PFC lesions, and Distressed Personality Disturbance was non-specific neuroanatomically (i.e., equally disturbed whether lesions were prefrontal or non-frontal).

A case study of a premorbidly unremarkable woman who developed personality changes following a left dorsolateral prefrontal stroke at age 69 (Salas, Gross, Rafal, Viñas-Guasch, & Turnbull, 2013) were consistent with associations noted above. Despite relatively preserved

¹³ This IRSPC scale was removed from the Iowa scales (due to a very high correlation with *Irritability*); it was replaced in the ISPC by the scale *Easily Overwhelmed* (which does not show the same high intercorrelation with other scales).

cognitive function overall on neuropsychological testing (only very mild difficulty with expressive language), ISPC ratings described notable deficits in real-life executive functioning (especially lack of planning) and decision-making, along with moderate increases in depression and anxiety.

In a landmark case study of childhood-onset damage to prefrontal cortex and subsequent impairments in social functioning, Ackerly and Benton (1948) postulated that enduring social deficits are the long-term developmental consequences of childhood-onset prefrontal damage. Anderson and colleagues examined the consistency of personality disturbances in 7 individuals developing circumscribed, stable prefrontal lesions by age 5 (Anderson, Wisnowski, Barrash, H. Damasio & Tranel, 2009). Personality disturbances in the early-onset group were assessed with an adaptation of the ISPC for use with individuals with childhood-onset brain damage (Iowa Scales of Personality Development; ISPD; Anderson & Barrash, 2005). It was found that 6 of the 7 patients showed a profile indicating primary impairments in emotional functioning, social competencies and behavior regulation, a profile that was not seen in a matched comparison group of patients with childhood-onset non-frontal lesions, consistent with the effects described by Ackerly and Benton.

A case study of a child with early focal prefrontal lesion and severe social disturbance was reported by Boes and colleagues (Boes et al., 2011; Boes, Grafft, Espe-Pfeifer, Rowe, & Stein, 2012). History was notable for onset of a seizure disorder at age 4. EEG indicated a focal origin, CT and MRI were read as unremarkable, he was started on divalproate and seizures resolved completely. By age 6 he was manifesting a wide range of antisocial (defiant) behaviors including stealing, lying, impulsivity, aggressive behavior, defiance and rude language. In the ensuing years he was strikingly impervious to psychotherapies and to consequences that were reliably implemented for unacceptable behavior. Although he was intelligent and academically capable, he had persistent lack of self-motivation. A psychiatrist diagnosed attention deficit hyperactivity disorder and bipolar disorder, and pharmacotherapy was initiated along with another course of counseling. At age 11, the boy was brought to the emergency room with suicidal ideation and suicidal gestures. During inpatient evaluation, a 3.0T MRI scan revealed focal cortical dysplasia (Taylor type) in the subcortical white matter of the left gyrus rectus in vmPFC. Neuropsychological evaluation documented average to high average intelligence, and performances on extensive testing of executive functions were normal with the exception of deficient planning on the Tower of Hanoi Test (Davis, Bajsjar, & Squire, 1995). Assessment with the ISPD (Anderson & Barrash, 2005) showed generally severe disturbance for insensitivity, poor judgment, lack of planning, impulsivity, irritability and aggressive behavior.

Collectively, this case along with those reported by Anderson et al. (2009), show a similar profile of acquired personality disturbances to those seen in adult-onset patients who acquired prefrontal lesions after normal emotional/social development premorbidly. However, the childhood-onset prefrontal patients tended to show markedly increased severity of disturbances in social behavior and behavioral control — with evidence suggesting the increased severity in the childhood-onset patients was related to the inability for normal emotional and social development from an early age. That ISPD ratings were able to suggest these differences between childhood-onset and adult-onset patients supports the construct validity of both the ISPC and the ISPD.

Traumatic Brain Injury (TBI). Patients with TBI are particularly relevant to construct validity because personality changes are common in this group and the disturbances may cause substantial disability (Lezak, 1987), in the context of TBI typically causing damage predominantly to frontotemporal regions although damage is not completely focal and injuries can be more widespread (Stuss, 2011b). One study examined the relation between social-emotional changes and dysexecutive syndrome in a sample of 25 patients with mild to severe TBI and a control group of 25 healthy adults (Rochat et al., 2009). The French version of the ISPC (Juillerat et al., 1998)

was administered and the investigators analyzed scores for *Externalizing* and *Internalizing* dimensions (Beni et al., 2007) — which correspond very closely to the factors of Emotional/Social Personality Disturbance and Distressed Personality Disturbance that are identified with the English version ISPC (Barrash et al., 2011). As expected, the TBI group showed significant pre- to post-morbid change for both dimensions, and the level of disturbance was significantly higher than in a matched healthy non-neurological group.

One study employed the Italian version of the ISPC (Cantagallo, Bianchi, & Contini, 2006) to compare 20 Italian patients with frontal damage from TBI to a control group of 20 patients with spinal cord or orthopedic injury (Cantagallo, Contini, & Bianchi, 2010). Changes in personality were significantly greater in the TBI group for 21/26 clinical scales (all except social withdrawal, suspiciousness, obsessiveness, unemotional, and inappropriate affect).

The German version of the ISPC (Kuhn, 2008) was employed to assess two patients with histories of prominent personality disturbances 13 and 15 years post-TBI, with the expectation that ratings should indicate acquired disturbances of behavioral control (disinhibition) and executive functioning (Rohde, 2011). The first patient showed substantial changes (increase of 4 or more points from premorbid ratings) for impulsivity, poor judgment, aggressive behavior, lack of planning, lack of initiative, lack of persistence, indecisiveness, obsessiveness, depression, unemotional, social withdrawal, irritability, lability, inflexibility, suspiciousness, and easily overwhelmed. The second patient showed substantial changes for impulsivity, poor judgment, lack of planning, lack of initiative, lack of persistence, perseverative behavior, indecisiveness, unemotional, apathy, insensitivity, inflexibility, irritability, suspiciousness, and easily overwhelmed.

A study in Spain assessed the validity and reliability of the Spanish version of the ISPC (Jiménez-Cortés et al., 2010) for evaluation of personality changes in 31 patients with damage to the vmPFC region from TBI (Gualart-Balet et al., 2015). The authors reported that the pattern of several significant pre- to post-morbid changes demonstrated construct validity for the Spanish version.

Dramatic personality changes were reported in a 45-year-old woman who sustained a TBI after being struck from behind, with serial MRIs (at 3, 12 and 36 months post-injury yielding identical results) showing roughly symmetrical bilateral damage to superior, middle and inferior temporal gyri with sparing of temporal poles (Coutinho, Miele, Moll, Mattos, & de Oliveira Souza, 2016). At a follow-up evaluation her husband described lifelong premorbid behavioral episodes indicating episodic dyscontrol syndrome, and he reported puzzlement at unexpected but welcome changes in her personality. He completed the ISPC at 1 year and 3 years post-injury, with ratings remaining identical across scales. Ratings documented that premorbid anxiety and indecisiveness remained unchanged, while several premorbidly disturbed characteristics showed significant decline — down to the average level or better — including inflexibility, lability, impatience, irritability, aggressive behavior, obsessiveness and lack of Stamina.

Another study conducted in Argentina examined the validity of the Spanish version for patients in a rehabilitation hospital consequent to TBI (2 patients) or CVA (2 patients) (Roqué, Murillo, & Vaiman, 2018). These four showed acquired disturbances on several clinical scales¹⁴,

¹⁴ Patient 1 was a 72-year-old woman who had had a right hemisphere stroke. Family ratings described acquired personality disturbances for lack of persistence, lack of stamina, poor judgment, indecisiveness, anxiety, easily overwhelmed, Unemotional, dependency, impulsivity, inflexibility, impatience, irritability, and interpersonal insensitivity. Patient 2 had a cerebellar stroke at age 60, and he was rated as having socially inappropriate behavior, perseverative behavior, obsessiveness, insensitivity, dependency, impatience, irritability, indecisiveness, apathy, Unemotional, and being easily overwhelmed. Patient 3 had a TBI at age 52, and he was rated as having acquired disturbances in lack of initiative, lack of persistence, lack of planning, indecisiveness, impulsivity, lack of stamina, easily overwhelmed, aggressive behavior, perseverative behavior, obsessiveness, impatience, socially inappropriate behavior, depression, Unemotional, and apathy. Patient 4 had a TBI at age 39, and he was rated as having acquired disturbances in lack of stamina, lack of persistence, lack of planning, dependency, social withdrawal, indecisiveness, easily overwhelmed, irritability,

with disturbances reported particularly in the emotional/social, dysexecutive and hypomotivational type impairments. The family ratings showed good agreement with personality characteristics reported by treating rehabilitation psychologists as problematic for the individual patients. The authors concluded that the ISPC contributes clinically useful information about acquired personality changes in patients undergoing treatment in a rehabilitation hospital.

Parkinson's Disease. Personality changes are often seen in patients with Parkinson's disease, especially dysexecutive behavior such as lacks in planning and initiative, cognitive inflexibility, apathy and depression, and lack of stamina; however, similar collections of changes may be seen in patients with other chronic medical diseases (Santangelo, Piscopo, Barone, & Vitale, 2017). Additionally, there has been debate regarding changes related to treatment for Parkinson's with deep brain stimulation, with a clear need for rigorous empirical data regarding possible postoperative changes with deep brain stimulation (DBS) (Gilbert, Viana, & Ineichen, 2018).

An early study employing the French version of the ISPC (Juillerat et al., 1998) examined potential personality change following surgical implantation and treatment with deep brain stimulation (DBS) in 24 patients with Parkinson's disease (Houeto et al., 2002). A subgroup of 8 patients with a postoperative decline in psychosocial circumstances showed personality changes most notable for emotional reactivity, with significant increases in several scales: impatience, irritability, lability, inflexibility, insensitivity, lack of planning, poor judgment, lack of initiative, lack of persistence, perseverative behavior, apathy, and easily overwhelmed. The subset of patients that showed improved psychosocial circumstances were found to have significant declines (improvement) in lack of initiative, perseverative behavior, depression, lack of persistence, lack of planning, lack of stamina, easily overwhelmed, social withdrawal and dependency.

Another study employing the Slovenian version of the ISPC (Sakić, Brezovar, Bon, Pirtošek, & Flisar, 2016) assessed 27 patients undergoing DBS in Ljubjana, Slovenia (Brezovar et al., 2022). Caregivers rated patients at least 6 months after DBS implantation (mean, 11 months). Significant personality changes were reported in the domains of executive disturbance and disturbed social behavior (most notable for poor judgment, irritability and lack of stamina).

Another study employing the French version of the ISPC examined how study design — prospective vs. retrospective ratings — affected results regarding personality changes after DBS in 22 patients with Parkinson's disease (Gronchi-Perrin et al., 2007). Ratings were obtained by caregivers within 3 months prior to surgery and again 6 months after surgery. Results suggested that ratings made retrospectively after surgery tended to underestimate the level of presurgical personality disturbances (compared to the BEFORE ratings completed preoperatively). Comparison of post-surgical ratings of current functioning to the BEFORE ratings obtained preoperatively provided objective findings of significant post-DBS *improvement* in anxiety level, obsessiveness, emotional lability, social inappropriateness and insight. In contrast, comparing postsurgical change to pre-surgical functioning as rated retrospectively after surgery, results suggested increased disturbance that was especially notable for increased impulsivity and being easily overwhelmed). The authors concluded that the prospective ratings obtained preoperatively presented a more accurate picture of DBS-related personality changes due to the underestimates of presurgical disturbance in retrospective ratings.

A recent study also featured a longitudinal design, with ISPC ratings obtained prior to surgery, and at 6 and 12 months post-surgery for 50 PD patients undergoing DBS (Gase et al., 2022). With benefit of longitudinal ratings, it was seen that no scales showed post-operative decline and the only significant change indicated a *decrease* in Distressed Personality Disturbance — findings consistent with the prospective ratings seen by Gronchi-Perrin and

impulsivity, inflexibility, impatience, apathy and poor judgment.

colleagues (2007).

Behavioral Variant Frontotemporal Dementia (bvFTD). Personality changes are hallmark features of bvFTD in the early stages, including impairments in emotional processing and modulation, social behavior, impulse control, motivation (Wittenberg, Possin, Rascovsky, Rankin, Miller, & Kramer, 2008). A study investigating neuropsychological deficits in bvFTD assessed personality changes with the French version of the ISPC in 12 such patients (Collette, Van der Linden, & Salmon, 2010). Results showed significant pre- to post-morbid change for social/emotional disturbance (including irritability, impatience, insensitivity, social inappropriateness, impulsivity and aggressive behavior), and for distressed personality disturbance dimension (including depression, anxiety, and social withdrawal).

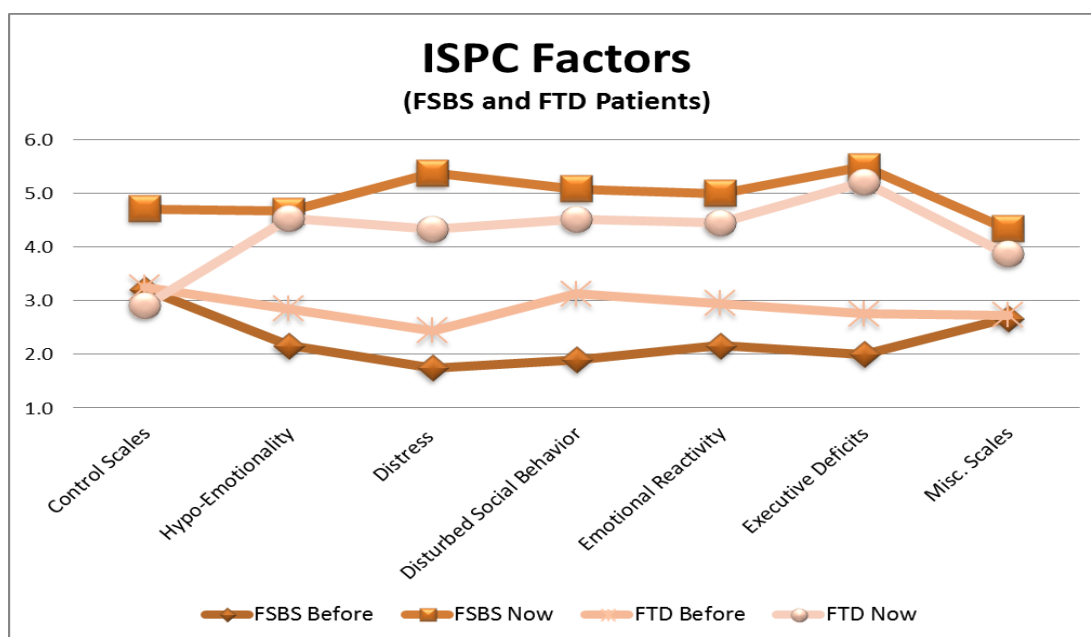
In light of the prominence of prefrontal dysfunction in the features of bvFTD, Barrash and colleagues (Barrash, Southwick, & Taylor, 2014) compared personality changes in 10 patients with bvFTD with those in 31 patients with focal vmPFC lesions (vmPFC) and 71 patients with focal non-frontal lesions. Compared to non-frontal patients, the bvFTD had significantly higher rates of acquired personality disturbances for lack of planning, poor judgment, lack of initiative, lack of persistence, perseverative behavior, impulsivity, indecisiveness, insensitivity, social inappropriateness, aggressive behavior, inflexibility, apathy, unemotional, social withdrawal, and lack of stamina. The profile of changes among bvFTD was highly similar to that among the focal vmPFC patients, but with more severe disturbance.

In a unique a multi-family study of genetic contributions to development of FTD at the University of British Columbia, among family members of patients with bvFTD, the personality characteristics of 8 *pre-clinical* carriers of *GRN* mutations (*GRN+*), a mutation that predisposes to development of FTD, were compared to 11 *pre-clinical* non-carriers (Wittenberg et al., 2014). Despite the small sample sizes, *GRN+* tended to show greater disturbance ($p < 0.12$) than non-carriers for lack of initiative, lack of persistence, perseverative behavior, irritability, depression, and being easily overwhelmed. Disturbance on these six items collectively significantly discriminated *GRN* carriers from non-carriers. Later analyses in this ongoing investigation compared 10 *GRN+* and 49 non-carriers and found considerably greater overall disturbance among the *GRN+*; however, change on specific scales was not reported as a summary measure for personality disturbance was used (Chatterjee et al., 2021).

Frontotemporal sagging brain syndrome (FSBS) describes patients with the clinical presentation of bvFTD but with sagging brain on MRI; this subset of patients does not show frontotemporal atrophy as is typical of bvFTD patients, but they have frontotemporal hypometabolism related to the brain sag (Wicklund et al., 2011). Personality changes similar to those seen in bvFTD groups could be expected (Walker & DeMeulemeester, 2008), but this is an empirical question. Southwick and colleagues examined this issue by comparing ISPC dimensional scores of 2 patients with FSBS with those of 20 patients with bvFTD and 62 healthy adults (Southwick, Barrash, Jones, & Tranel, 2013). Both clinical groups showed significantly greater change on all ISPC dimensions than did the healthy controls. The profile of dimensional scores, presented in Figure 2, was virtually identical for the FSBS patients and the bvFTD group, with the minor exception of distressed personality disturbance, which was more highly elevated for the FSBS (who suffered from chronic headache due to the FSBS).

A notable case report describes a 65-year-old Brazilian man with bvFTD who had become progressively more apathetic and socially disengaged (Prado, Lopes, Moll, DeSalles, & de Oliveira-Souza, 2015). Four years after the initial examination, he was indicted for several charges of molesting children, behavior that was initially taken as a manifestation of bvFTD. However, comprehensive evaluation included completion of the ISPC, and the ratings of premorbid personality function (i.e., prior the onset of any changes that could be related to bvFTD) revealed that the patient had exhibited pedophilic behavior many years prior to the onset of apathy

and social disengagement. The authors concluded that preexisting developmental pedophilia was “unmasked” in the context of deteriorating behavioral control caused by bvFTD.



Multiple Sclerosis. Among patients with multiple sclerosis (MS), behavioral changes including irritability, agitation, disinhibition and apathy have been reported as frequent sequela of disease-related brain changes (Diaz-Olavarrieta, Cummings, Velazquez, & Garcia de al Cadena, 1999). Lima and co-investigators in Switzerland designed a study to determine whether personality changes specifically related to MS pathology could be identified in 74 MS patients in the initial phase of the disease, by comparing them with 48 control patients with non-CNS systemic inflammatory diseases, using the French version of the ISPC (Lima et al., 2007). Both groups showed significant overall change from premorbid to postmorbid personality functioning. More than 50% of the MS patients had acquired personality disturbances in inflexibility, emotional lability and lack of stamina; and more than 30% (rates that were higher than for the control group) acquired disturbances in anxiety, easily overwhelmed and irritability. A comparison of MS patients with cognitive deficits to those without cognitive deficits showed that the former had more acquired personality disturbances.

Those investigators then designed a study to assess the correlates of compromised decision-making early in the course of MS (Simioni et al., 2008). 109 patients had definite MS and 56 patients had clinically isolated syndrome (CIS), with disease duration of 3 months to 5 years. Several measures of behavioral and affective disturbances were administered, including the DEX and BADS (Wilson et al., 1996). The number of personality changes rated on the ISPC was the sole behavioral measure to show a difference between the MS and CIS groups. The number of personality changes on the ISPC was associated with poor decision-making on the Iowa Gambling Task (Bechara, Damasio, Damasio & Anderson, 1994), but no association was found for cognitive testing including BADS subtests. It is noted that specific ISPC scales could be expected to predict poor decision-making, but only total number of personality changes was reported.

A follow-up study by this group featured longitudinal assessment of the course of decision-making integrity in 70 patients with MS (Simioni et al., 2009). The MS patients showed decline in

decision-making on re-assessment after the two-year interval. Longitudinal change on the cognitive and behavioral measures were not associated with change in decline in decision-making. Again, only total number of personality changes was reported, so the potential relationships of declining decision-making to increased disturbance on conceptually-relevant ISPC scales such as *Impulsivity*, *Inflexibility*, *Poor Judgment*, *Lack of Planning* and *Indecisiveness* were not evaluated.

Most recently, the sensitivity of the German version of the ISPC (Kuhn, 2008) to changes in emotion and personality functioning in five patients with MS was examined (Gaertner, 2015). All five patients were rated as having acquired personality disturbances on *Irritability*, *Perseverative Behavior*, *Lack of Stamina*, *Lack of Persistence*, *Inflexibility*, *Obsessiveness*, *Anxiety* and being *Easily Overwhelmed*. In contrast to several changes noted by others on the ISPC, patients did not indicate any changes on self-ratings.

Tumor. One study performed in Australia (Jenkins, Drummond & Andrewes, 2016) used the pre-revision version of the Iowa Scales (IRSPC) to compare a group of 44 patients with neurosurgical resection of a brain tumor to a control group of 26 spinal surgery patients. Tumor patients had a higher rate of personality changes than the control group. However, in this study changes not only referred to increased disturbance, but also to *improvement* in the trait, so the implications of results for sensitivity to tumor-related personality changes is unclear.

A second study investigated patients with meningioma resection and prediction of poor long-term outcomes (Barrash et al., 2020). The sample included 18 patients with anterior skull base meningiomas/resections impacting on the vmPFC region (vmPFC) and 20 patients whose meningiomas/resections did not impact on the vmPFC region (non-vmPFC). There were no significant differences between vmPFC and non-vmPFC on any demographic, clinical or neurosurgical variables (other than area of damage), or on basic cognitive variables. vmPFC had significantly lower depression (minimal symptoms) than non-vmPFC. Consistent with the effects of vmPFC damage, the vmPFC group had significantly higher rates of APD for poor judgment, perseverative behavior, lack of persistence, indecisiveness, irritability, inflexibility, lack of insight, apathy, and unemotional.

Amyotrophic Lateral Sclerosis (ALS). Development of behavioral disorders in patients with ALS have been documented (Grossman, Woolley-Levine, Bradley, & Miller, 2007), and may be understood as manifestations of dysfunction of prefrontal circuitry (Lomen-Hoerth, Anderson, & Miller, 2002). In a notable case report, Waldron and colleagues described a patient with ALS whose comprehensive neuropsychological assessment documented normal cognitive abilities including executive functions, but whose family reported marked personality changes (Waldron et al., 2014). ISPC ratings were completed independently by her husband and two daughters, with excellent agreement regarding a pattern of acquired personality disturbances with severe disturbances in all four types of disturbance: Dysexecutive Personality Disturbance (lack of planning, poor judgment, lack of persistence, perseverative behavior, impulsivity), Emotional/Social Personality Disturbance (lack of insight, impatience, irritability, inflexibility, social inappropriateness, emotional lability), Hypoemotional Disturbance (unemotional), and Distressed Personality Disturbance (anxiety and being easily overwhelmed). This patient was noted to have microsmia, and a second investigation assessed the hypothesis that personality changes in patients with ALS might be accompanied by olfactory dysfunction due to orbitofrontal involvement, and that anosmia might be a biomarker for personality disturbances in ALS (Ward, Jones, Nguyen, Swenson, & Tranel, 2014). Thirty patients with mild to moderate ALS were studied and it was found that reduced olfactory functioning was significantly associated with Dysexecutive Personality Disturbance, especially lack of planning and lack of persistence).

Focal Non-Prefrontal Lesions. In addition to the clinical groups reviewed above, the ISPC has been employed to describe personality changes in case studies of patients with focal lesions

elsewhere from varied etiologies. These studies have demonstrated sensitivity to change at the individual level, which may be valuable because the lesion method may indicate that the damaged brain region is at least partly necessary for functions disrupted by the focal lesion (H. Damasio & Damasio, 1989).

A study in England examined the effects of selective bilateral hippocampal damage on complex moral decision-making in five patients (McCormick, Rosenthal, Miller & Maguire, 2016). Personality changes in this group were greatest for being easily overwhelmed, dependency, lack of stamina, lack of initiative and social withdrawal. It was further noted that compared to previously reported changes in bilateral vmPFC patients (Barrash et al., 2000), patients with hippocampal damage tended to be more easily overwhelmed and socially withdrawn than patients with vmPFC damage (whereas, vmPFC lesions resulted in patients feeling more irritable and with unemotional).

An interesting case study described a 71-year-old man, a painter, with a minor left occipital stroke who reported developing marked changes in artistic style after the stroke (Annoni et al., 2005). He did not manifest any personality changes in real life, and ISPC ratings by his wife documented the absence of personality changes.

A 56-year-old man with semantic dementia and severe atrophy of the left temporal and unaffected right temporal pole was studied to test whether the left temporal pole is necessary for theory of mind (ToM) by determining whether unilateral damage to the left temporal pole impairs ToM (Michel et al., 2013). Because of impaired language abilities, nonverbal experimental tests of ToM were employed, and the patient's performances were normal on these tests. Although this patient was a pastor who pre-morbidly had been sensitive, calm and flexibly-minded, on the French version of the ISPC he was rated as showing changes primarily involving Emotional/Social Personality Disturbance including becoming insensitive, inflexible, with poor judgment and becoming easily overwhelmed, depressed, irritable and with aggressive behavior. The pattern of findings allowed investigators to note that the ability to infer the mental states of others is not sufficient for effective social functioning, which also requires the abilities to react appropriately to the inferred mental states and to take them into account in guiding social behavior.

An interesting case study described a 72-year-old professor and department head with prominent emotional changes after a left frontoparietal from an infarct at the border zone of the anterior and middle cerebral arteries with (Salas, Radovic, Yuen, Castro, & Turnbull, 2014). At the time neuropsychological evaluation demonstrated executive deficits and he underwent ongoing neuropsychological rehabilitation which allowed this insightful fellow to eventually return to work two days a week. At 8-year follow-up, executive deficits remained but he had developed effective compensatory strategies that minimized their impact on real world functioning. On semi-structured interview, the patient reported prominent changes in his phenomenological emotional experience including being able to attend to and perceive emotions (primarily negative emotions) that he said he had been unable to do previously. Additionally, he reported that his emotions tended to have greater intensity, and in general he felt quite happy about these changes. ISPC ratings by his wife showed major changes (from pre-morbid status) on the distressed personality disturbance and mild change for dysexecutive personality disturbance.

Another interesting case report described an unremarkable 48-year-old housewife (left-handed) who led a normal life until age 37 when she began experiencing hallucinations and delusions (de Oliveira-Souza et al., 2016). She was treated with antipsychotic medication and those symptoms subsided. However, according to her husband and daughter, dramatic personality changes became evident, with the patient becoming suspicious, mean-spirited and erratic behaviorally, a marked change from her pre-morbidly peaceful and agreeable personality. These persisted for several years, eventuating in a comprehensive medical evaluation. An MRI performed to investigate left eye disease incidentally revealed a large porencephalic cyst

occupying the left temporal lobe extending dorsally into the inferior parietal lobule and ventrally into the occipital lobe where it communicated freely with the ipsilateral ventricle. Neuropsychological evaluation showed normal intellect and unexpected sparing of comprehension of spoken and written language and praxis. ISPC ratings by her husband and daughter showed substantial changes in suspiciousness, inflexibility, emotional lability, irritability, impatience, insensitivity and interpersonal dependency; and significant changes in being easily overwhelmed and impulsive, aggressive behavior, socially inappropriate behavior, inappropriate affect, anxiety, indecisiveness, social withdrawal, unemotional, apathy, lack of stamina, lack of initiative and lack of planning; with a profound lack of insight into the personality disturbances.

One case report provides detailed memory characterization of a 48-year-old woman with profound amnesia following status epilepticus and an associated anoxic episode at age 30 (Warren et al., 2012). High-resolution structural MRI revealed substantial bilateral hippocampal atrophy. Despite severe amnesia, this patient was living a full and mostly independent adult life, facilitated by an extensive social support network of family and friends. The IRSPC documented a fairly severe lack of planning (consistent with her amnesia) and a dramatic increase in emotional lability.

Another case study investigated changes in emotional processing in a 36-year-old woman following a stroke causing a small lesion in left posterior insula-SII cortices (Borg et al., 2013). Specifically, experimental studies and the patient's self-report revealed diminished experience of disgust, including intensity. On the French version of the ISPC, family rated most striking changes as development of impoverished emotional experience, insensitivity, irritability and lability, being easily overwhelmed, impulsive behavior, lack of stamina and unemotional.

A hypothesis that the insula is critical to development of interpersonal trust was tested in 11 patients with insula damage compared with 27 patients with focal lesions elsewhere in the brain (Belfi, Kosciak, & Tranel, 2015). Experimental tests demonstrated a variety of abnormalities in expressions of trust in the group with damage to the insula. To determine whether impaired social decision-making in the lab was associated with real world disturbance, the *Social Inappropriateness* scale was examined and this showed substantial disturbance in insula group in sharp contrast to above average functioning in the brain-damaged control group.

Examination of how striatal damage affects impulsive behavior and self-awareness of impulsivity were the aims of a study by Gaznick (2015). It was predicted that participants with striatal damage (SD, $n=12$) would have less self-awareness of changes in impulsivity than a brain damage control group with focal lesions outside of frontal cortex (BDC, $n=22$), with awareness of impulsivity assessed by comparing self- and informant scores for impulsivity on two measures: the Barratt Impulsivity Scale (BIS; Barratt, 1959) and the ISPC *Impulsivity* scale (including a version modified to obtain self-ratings). The BIS was not sensitive to discrepancies in self- and other-ratings, whereas ISPC *Impulsivity* ratings showed a moderate effect size between (a) informant ratings indicating significant change and (b) self-ratings suggesting no changes.

The consequences of striatal lesions on social cognition were investigated in a 44-year-old man with focal damage to the head of the caudate from stroke (Kemp et al., 2013). Following the stroke, the patient showed difficulties recognizing emotions in others and a loss of empathy. The patient and his family noticed changes in his behavior and mood, including marked irritability and mood swings leading to tensions in his relationships. He described himself as someone who "became selfish", who "did not have any feelings toward others anymore" (e.g., he became insensitive to his daughters' crying). Furthermore, he cut ties with his friends, saying he "does not need them anymore." Approximately 5 months after the stroke, experimental tests demonstrated that damage to the head of the left caudate nucleus can lead to impairment of "theory of mind" and emotion recognition. Assessment with the French version of the ISPC documented marked personality changes in mood ("depression"), insensitivity, impatience,

apathy, inappropriate affect, unemotional, increased suspiciousness and becoming easily overwhelmed, as well as problems with greater irritability, lack of initiative, a pessimistic mood, a slight decrease of persistence, reduced stamina, difficulties in planning, slight judgment difficulties, discrete anxiety, and social withdrawal.

A novel study investigated the neuroanatomical correlates of positive personality changes following a discrete neurological event (e.g., stroke, benign tumor resection) in 97 patients from Sample 2 (King, Manzel, Bruss, & Tranel, 2017). The ISPC was employed to identify patients with positive changes in one or more domains of personality functioning. Patients with positive changes in personality following were rated as having had more disturbed functioning prior to the event. Lesion analyses indicated that positive changes were most consistently related to damage to the bilateral frontal polar regions and the right anterior dorsolateral prefrontal region. The authors concluded that results provided preliminary evidence that improvements in personality functioning following a neurological event may involve dampening of (premorbidly) more extreme expressions of emotion.

Specificity of Personality Changes. In addition to the sensitivity of ISPC ratings for different clinical conditions, construct validity also requires that ratings show *specificity*. That is, when an individual has in fact not changed on particular personality traits, it is important that those scales yield ratings that indicate no change. Although it is often not known — *independent of ISPC ratings* — whether patients truly do *not* have particular personality changes, several lines of evidence from research with the ISPC support the specificity of ratings, reviewed below.

(1) The 62 healthy, community-dwelling adults of Sample 3 did not show significant personality changes on ISPC scales from middle age to older adulthood, with the exceptions of increased lack of stamina, and very mild increases (a third of a point) in lack of initiative, lack of persistence and dependency — modest declines that are consistent with the literature on personality stability/change in community samples (Zirbes et al., 2021). No mean ratings approached even very mild disturbance. Furthermore, analyses at the individual level within that sample, found that the base rate of an acquired personality disturbance due to aging (i.e., change between middle age and older age) was approximately 5%¹⁵, and the rate of acquired personality disturbance was very low (mean, 2.7%) for 22 clinical scales and exceeded 10% for only four scales (*Lack of Stamina*, 19.4%; *Lack of Insight*, 17.7%; *Lability*, 14.5%; *Inflexibility*, 11.3%). Similarly, other studies employing control groups composed of healthy adults also do not show personality changes (Cantagallo et al., 2010; Chatterjee et al., 2021).

(2) Studies examining groups hypothesized to not develop personality changes found that those groups did not show significant personality changes. This includes patients with unilateral vmPFC damage (Tranel, Damasio, Denburg, & Bechara, 2005), unilateral amygdala damage (Tranel & Bechara, 2009), and patients with Parkinson's disease whose post-DBS personality was compared to their pre-DBS/post-Parkinson's functioning (Gase et al., 2022). Additionally, findings of no personality change were found for a young man status post left temporal lobectomy for epilepsy who abruptly developed dramatic changes in artistic preferences (Sellal et al., 2003), and a 71-year-old man with a minor left occipital stroke and alterations in artistic preferences but no changes in personality or occupational functioning (Annoni et al., 2005).

(3) Across studies of clinical groups reviewed in the section above, the clinical groups typically do not have significant personality changes more than half of the 26 ISPC clinical scales. There are only two exceptions to that level of specificity: A group of TBI patients assessed with

¹⁵ In the brain-damaged control group of this study, the mean rate of APDs for the four control scales — i.e., traits that do not develop disturbances as a consequence of brain injuries — was 4.9%, which was essentially identical to the 5.1% mean rate among the healthy older adults, with the lowest rate being 3.2%. Accordingly, these data suggest that a low but non-zero rate of APDs is normative, at least among adults over age 60 when compared to their middle-age years.

the Italian version of ISPC did not show personality changes for 9/26 clinical scales (Cantagallo et al., 2010); and even in the clinical group showing the most severe and widespread personality changes (i.e., 7 patients with bilateral vmPFC lesions), the majority of these patients did not have APDs in 8 clinical scales that were not hypothesized to develop disturbance with bilateral vmPFC damage (Barrash et al., 2000).

(4) In the largest study with ISPC ratings published to date, a cluster analysis of 194 patients from Sample 2 showed that 46% of this etiologically and anatomically heterogeneous brain-damaged group formed a “normal” cluster characterized by the absence of significant personality change on any scale (Barrash et al., 2018).

Neuroanatomical Correlates. Dimensions of acquired personality disturbances derived from factor analysis of ISPC ratings (Barrash et al., 2011) correspond closely to models of functionally distinct prefrontal systems elaborated by Cummings (Cummings, 1993, 1995) and by Stuss and colleagues. These models emphasize distinctive roles for different areas grounded in early cytoarchitectural and myeloarchitectural investigations of human brain development (Stuss, 1992, 2011a, 2011b; Stuss & Alexander, 2007; Stuss et al., 2002; Stuss & Benson, 1984).

An investigation of the neuroanatomical correlates of ISPC dimensions evaluated these models with predictions that three acquired personality disturbances would be associated with lesion involvement of distinct sectors of prefrontal cortex (Barrash et al., 2022). Specifically, it was hypothesized that: 1) Emotional/Social Disturbance would be associated with vmPFC lesions, 2) Hypoemotional Disturbance would be associated with anterior cingulate/dorsomedial lesions, and 3) Dysexecutive Personality Disturbance would be associated with dorsolateral lesions. Additionally, it was hypothesized that Distressed Personality Disturbance would not be associated with focal lesions in any PFC sector. Hypotheses were tested in 182 Sample 2 patients with adult-onset, chronic, focal brain lesions. Brain-behavior relationships were examined with two complementary analytic approaches: 1) a hypothesis-driven region-of-interest (ROI) regression analyses examining the associations of lesions in specific PFC sectors with acquired personality disturbances; and 2) a data-driven multivariate lesion-behavior mapping analysis, with no limitation to pre-specified regions. Each hypothesis received some support: (i) Emotional/Social Personality Disturbance was most strongly associated with ventromedial PFC lesions in both analytic approaches. (ii) Hypoemotional Disturbance was associated with dorsomedial PFC lesions in the ROI analyses, without any significant lesion-symptom mapping associations. (iii) Dysexecutive Personality Disturbance was associated with bilateral dorsolateral PFC lesions and ventromedial PFC lesions; lesion-symptom mapping showed maximal association of Dysexecutive Personality Disturbance with damage in the right middle frontal gyrus within the dorsolateral PFC. (iv) Distressed Personality Disturbance was not associated with lesions in any PFC sector. Collectively, the findings supported models of functionally distinct prefrontal systems, with corresponding associations between damage to a system and the nature of resultant personality disturbances.

Following up on an earlier study that had indicated that the right-sided sector of vmPFC was critical for emotional/social functioning while the left side appeared less important (Tranel, Bechara & Denburg, 2002), Tranel and colleagues investigated the possibility of sex differences in a functional asymmetry of PFC (Tranel et al., 2005). Same-sex pairs of men or women patients who had comparable unilateral lesions of either right or left vmPFC were identified from Sample 2. ISPC ratings were examined to determine the extent to which each patient was characterized by general dampening of emotional experience, poorly modulated emotional reactions, disturbances in social decision-making, disturbances in goal-directed behavior, and major lack of insight into these personality changes. A consistent sex effect was observed in which men showed severe emotional/social defects with unilateral right vmPFC lesions but not left-sided

damage, whereas women showed defects with unilateral left vmPFC lesions but only mild or absent disturbance with right-sided damage.

The amygdala is critical for a variety of social and emotion-related processes (Adolphs, 2003). Given the findings suggesting an intriguing sex-related functional asymmetry of vmPFC in regard to social conduct, emotional processing, and decision-making (Tranel et al., 2005), this led Tranel and colleagues to hypothesize a corresponding sex-related functional asymmetry of the intimately-related amygdala whereby for men the right and not the left amygdala would be important for emotional processing and social behavior, with the opposite pattern for women (Tranel & Bechara, 2009). Employing a case-matched lesion approach to investigate the study hypotheses, they identified 4 patients with unilateral amygdala cases from patients who had undergone anterior temporal lobectomy for epilepsy¹⁶, a pair of men with left or right amygdala damage and a pair of women with left or right amygdala damage. ISPC ratings indicated the male patient with unilateral right amygdala damage showed changes in personality and emotional processing marked especially by emotional lability and irritability; the male patient with left amygdala damage did not show personality change. In contrast, the female patient with unilateral left amygdala damage developed prominent difficulties in emotional functioning and personality, marked especially by emotional lability, irritability, depression and anxiety; the female patient with right amygdala damage showed no personality changes. The sensitivity of ISPC ratings to hypothesized personality disturbances in some patients but not others supports the construct validity of the ISPC.

Associations with Cognitive Abilities. In this section, “cognitive abilities” refers broadly to any purposive mental activities that have been measured with standardized lab procedures, including experimental procedures for neuroscientific investigations of complex decision-making, social cognition and aspects of emotional processing.

In a recent investigation of 182 focal lesion patients from Sample 2 (Barrash et al., 2022), the relationships between subtypes of acquired personality disturbances and cognitive integrity were examined. Pearson correlations between basic neuropsychological measures¹⁷ and personality disturbances are presented in Table 5. Emotional/Social Personality Disturbance and Hypoemotional Disturbance were not significantly correlated with any neuropsychological scores. Dysexecutive Personality Disturbance was correlated with several cognitive scores, most highly with the time required to complete Trailmaking Test Trail B, a measure of executive functioning, and it was also correlated with WAIS Full Scale IQ, WAIS Perceptual Organization Index, WMS General Memory Index, Auditory Verbal Learning Test delayed recall, and Beck Depression Inventory. Distressed Personality Disturbance was most highly correlated with Beck Depression Inventory score, and was also significantly but modestly correlated with WAIS Full Scale IQ, WMS General Memory Index, and Auditory Verbal Learning Test delayed recall.

Given the correlations with multiple cognitive domains, stepwise regression was performed for a more nuanced multivariate examination of the relationships of Dysexecutive and Distressed Personality Disturbances to neuropsychological variables (presented in Appendix K). Regarding Dysexecutive Personality Disturbance, once impairment on Trails B was taken into account, no other cognitive variable or Beck Depression (BDI) score accounted for significant variance in dysexecutive personality disturbance scores. Regarding Distressed Personality Disturbance, the presence of depression on the BDI was the most powerful predictor among the

¹⁶ In this study, patients had anterior temporal lobectomy for treatment of medically refractory epilepsy, resections that included the amygdala to variable extents. For these patients, the lesion is not restricted to the amygdala, and amygdala damage may not affect the entire amygdala structure.

¹⁷ For those tests that have one or more editions, the research participants in the University of Iowa Registry were tested with different (most recent) editions of tests as the protocol of the Benton Neuropsychology Lab has been updated regularly as new editions of the tests have come online. Accordingly, in the text we refer to the tests generically rather than specific editions.

neuropsychological variables, as expected. After removing variance accounted for by BDI status, no cognitive variable contributed significant incremental variance.

Table 5. Correlations between personality disturbances and neuropsychological scores

Neuropsychological score	Personality Disturbance Subtype			
	Emotional/ social	Hypoemotional	Dysexecutive	Distress
	<i>r</i>	<i>r</i>	<i>r</i>	<i>R</i>
FSIQ	-.111	-.068	-.221**	-.199*
VCI	-.076	.007	-.067	-.144
POI	-.078	-.016	-.183*	-.143
WMS Gen Mem	-.093	-.162	-.336***	-.206*
AVLT-DR	-.147	-.056	-.286***	-.173*
TMT-B (seconds) ¹	.105	.110	.374***	.124
BDI-II	.097	.099	.294***	.338***

Note. FSIQ = WAIS IV Full Scale IQ; VCI = WAIS IV Verbal Comprehension Index; POI = WAIS IV Perceptual-Organizational Index; WMS Gen Mem = Wechsler Memory Scales III General Memory Index; AVLT-DR = Auditory Verbal Learning Test-Delayed Recall; TMT-B = Trailmaking Test- Trail B; BDI-II = Beck Depression Inventory-II. ¹The pattern of negative correlations indicates worse cognitive performance was related to increased personality disturbance, with the exception of the Trailmaking Test- Trail B (seconds to completion) for which the positive correlations indicate worse cognitive performance was related to increased personality disturbance. For the Beck Depression Inventory, positive correlations indicate higher levels of depression are related to increased personality disturbance. * = <0.05, ** <0.01, *** <0.001. Adapted from Barrash et al., 2022, Supplemental Material.

In a study of patients with MS or clinically isolated syndrome (Lima et al., 2007), a general association was reported in which patients with cognitive impairment had, on average, more than twice as many acquired personality disturbances (7.7 ± 6.8) compared to patients without cognitive impairment (3.4 ± 3.5). The Dysexecutive Personality Disturbance score and DEX score (indicating executive deficits) were significantly related (Spearman correlation, 0.52). It was also reported that specific ISPC scales for irritability, apathy, social inappropriateness and lack of persistence were well correlated with DEX items assessing those deficits.

In a study of decision-making performance employing the Iowa Gambling Task (Bechara et al., 1994) among patients with early-stage MS or clinically isolated syndrome, those patients with stable deficits in decision-making were rated as having a higher number of acquired personality disturbances (Simioni et al., 2008).

An investigation of the neuropsychological outcomes of 7 individuals with damage to vmPFC in their first years of life (Anderson et al., 2009) included assessment of personality disturbances assessed with the Iowa Scales of Personality Development (ISPD), the adaptation of the ISPC for individuals with childhood-onset damage (Anderson & Barrash, 2005). Regarding relationships with cognitive abilities, it was noted that ISPD indication of the presence or absence of social defects was entirely unrelated to intellectual abilities.

A study investigating severe collecting behavior associated with brain damage examined the associations of this pathological behavior with selected personality disturbances (Anderson et al., 2005). It was found that lack of planning was markedly disturbed in all 9 patients with pathological collecting. Most of the hoarders were impaired on the Tower of Hanoi Test, a test requiring planning ability; otherwise, they demonstrated normal intellect and performed normally on all other neuropsychological measures including the Wisconsin Card Sorting Test.

A study with the French version of the ISPC examined the correlations of “internalizing” and “externalizing” dimensions of personality changes with executive functioning in patients who had suffered TBI (Rochat et al., 2010), with aspects of executive functioning assessed with the BADS (Wilson et al., 1996). Personality change on the externalizing dimension (i.e., disturbances in emotion regulation and social behavior, but also including disturbances in some executive functions such as lack of planning) was correlated with deficient performance on the BADS Modified Six-Elements Test (MSET) ($r = -.52$, a large effect size). Considering that association,

the investigators cited the explanation of Burgess (2000) that the MSET is a complex multitasking task that (a) provides few external constraints and (b) requires a combination of executive functions (e.g., shifting between mental sets, inhibiting prepotent responses and controlling emotional and behavioral responses in real time) that are not required by classical laboratory executive tests.

Using of the French version of the ISPC (Juillerat et al., 1998), Rochat and colleagues (2009) examined relationships between the “externalizing” and “internalizing” dimensions of the ISPC (i.e., Social/Emotional Disturbance and Distressed Personality Disturbance, respectively) and the BADS (Wilson et al., 1996) in TBI patients. The Externalizing score was significantly negatively correlated with the Modified Six Elements Test (MSET), -0.53 ($p < .01$), indicating that social/emotional disturbance was associated with compromised executive functioning in a real-life setting. Employing the Italian version of the ISPC, Cantagallo and colleagues (2010), examined relationships between personality changes and neuropsychological measures in TBI patients. There were no significant correlations between personality changes and decline in cognitive performances.

Another study examined whether poor decision-making in healthy older adults is associated with subtle decline in specific functional abilities with aging (Nguyen et al., 2013). The decision-making of 58 healthy older adults from Sample 3 was assessed with the Iowa Gambling Task (Bechara et al., 1994), and personality functioning over the past year (as well as during the middle age epoch) was assessed with an adaptation of the ISPC for use with healthy control individuals (Denburg & Barrash, 2007). It was hypothesized that deficits in decision-making would be associated with reduced current functioning in executive characteristics of *Lack of Planning*, *Poor Judgment*, *Lack of Persistence*, *Perseverative Behavior*, *Lack of Initiative*, *Impulsivity*, and *Indecisiveness* — whether the weaknesses were longstanding or of more recent development. Regression analysis showed that poor decision-making was significantly predicted by weaknesses in the executive personality characteristics.

The case study of a woman with ALS illustrates the complete dissociation that may be seen between intact functioning on a comprehensive neuropsychological evaluation and gross acquired disturbances in personality (Waldron et al., 2014). On neuropsychological exam 10 months after being diagnosed with bulbar-onset ALS, the performances of this 59-year-old woman were average or better on all tests, including tests of executive functioning, with the minor exception of low average copying of the Rey Complex Figure (Barrash, Tranel et al., 2014). Self-report measures of mood and personality were unremarkable. However, independent ISPC ratings by her husband and two daughters documented severe acquired disturbances on each of the higher order dimensions, especially for Emotional/Social and Dysexecutive Personality Disturbances.

Cognitive neuroscience studies have employed experimental paradigms to investigate complex mental abilities such as economic decision-making and moral judgment, and several of these studies have incorporated ISPC results to better understand the theoretical implications of findings. One cognitive neuroscience study of 7 patients with bilateral vmPFC lesions found, as hypothesized, that damage to vmPFC, an area critical for modulation of emotional reactions, would result in impaired economic decision-making in emotionally-charged situations (Koenigs & Tranel, 2007). The experimental paradigm presented participants with provocative, frustrating situations (i.e., unfair treatment by a research confederate), situations for which anger is the usual predominant reaction. In such circumstances, the modulation of emotional reaction is essential for financially advantageous decision-making, and this is precisely the circumstances in which the decision-making of vmPFC patients was disturbed. Previous assessment of personality changes in this group (Barrash et al., 2000) demonstrated highly defective modulation of emotion, with marked tendencies to exaggerated irritability, anger, emotional outbursts, and tantrums,

particularly in social situations involving frustration or provocation (Anderson, Barrash, Bechara, & Tranel, 2006; Grafman et al., 1996). The authors argued that the hyper-irrational behavior of the vmPFC patients could be explained by their personality changes which impaired their ability to modulate emotional reactions.

In a related study, Koenigs and colleagues (Koenigs, Young, Adolphs, Tranel, Cushman, Hauser, & Damasio, 2007) examined the effects of vmPFC damage on complex moral judgment. It was hypothesized that emotions play a causal role in moral judgement and, accordingly, emotion-related areas of the brain are important for this process. As the vmPFC is necessary for normal generation of emotions and, in particular, social emotions (Damasio, Tranel & Damasio, 1990), it was predicted that patients with vmPFC damage — when facing moral dilemmas *that pit compelling considerations of aggregate welfare against highly emotionally aversive behaviors* (for example, having to sacrifice one person's life to save a number of other lives) — would respond abnormally with a “utilitarian” pattern of judgements. Referencing the previous personality assessment of these patients (Barrash et al., 2000), the authors noted that this abnormality was consistent with the demonstrated lack of emotional reactions and a specific defect of social emotions in vmPFC patients.

Another study concerning the impairments in moral judgments of patients with bilateral vmPFC damage investigated the hypothesis that vmPFC patients would deliver abnormal moral judgments of harmful intentions in circumstances with an absence of harmful outcomes, as in failed attempts to harm (Young, Bechara, Tranel, Damasio, Hauser & Damasio, 2010). Findings demonstrated that, in contrast to the brain-damaged control group, vmPFC patients judged attempted harms, including attempted murder, as more morally permissible relative to controls. The investigators noted prior findings in this vmPFC group that patients with vmPFC lesions commonly fail to apply such knowledge in daily living and exhibit impairments in processing social emotions such as empathy and embarrassment (Barrash et al., 2000). It was concluded that study findings highlight the critical role of the vmPFC in processing harmful intent for moral judgment.

A study in England by McCormick and colleagues also followed up on the Koenig study of moral decision-making, examining the effects of selective bilateral hippocampal damage on complex moral decision-making (McCormick et al., 2016). The moral decision-making of 5 hippocampal patients showed a powerful tendency to deontological responses — that is, rejecting actions that harm even one person — a tendency that stood in contrast to the tendency of patients with bilateral vmPFC damage to respond with utilitarian judgments (Koenigs et al., 2007). Among the 5 hippocampal patients, the personality traits with the most change were being easily overwhelmed, dependency, social withdrawal, lack of initiative and lack of stamina. Possible associations with personality changes in emotionality were also examined. Compared to previously reported changes in bilateral vmPFC patients (Barrash et al., 2000), the patients with hippocampal damage tended to be more easily overwhelmed and socially withdrawn; by contrast, vmPFC lesions leave patients feeling less emotional but more irritable and impatient (Barrash et al., 2022). This pattern of ISPC ratings contributed to the investigators' conclusion that the abnormal moral reasoning of the hippocampal patients appears to reflect becoming overwhelmed by an immediate adverse emotional reaction to undesirable actions.

In summary, although there is some degree of inconsistency concerning relationships between acquired personality disturbances and cognitive abilities, four general trends are evident. First, for patients with Emotional/Social Personality Disturbances, it is not uncommon for results to indicate a lack of cognitive deficits, shown compellingly in the landmark case of patient EVR (Eslinger & Damasio, 1985). Second, patients with Dysexecutive Personality Disturbance are often found to be impaired on a variety of neuropsychological tests of executive functioning. That is, patients with enduring, cross-situational problems in real life activities with executive functions

such as planning and purposive behavior also tend to show impairments on lab measures of executive abilities. Third, in studies of clinical groups with frontal dysfunction, patterns of correlations indicate that patients with clinically significant cognitive impairments tend to have more acquired personality disturbances. Fourth, cognitive neuroscience studies employing experimental paradigms to investigate complex mental abilities such as economic decision-making and moral judgment show that characterization of personality disturbances contributes to illuminating the complex interplay of emotional processing and cognition in social behavior and complex decision-making.

Ecological Validity. Ecological validity concerns the ability of a measure to characterize behaviors in the real world. One interesting study focused on real world behavior examined the hypothesis that deficits in emotional processing associated with vmPFC damage play an important role in impairment of real-world competencies (Anderson et al., 2006). Patients had stable focal lesions involving vmPFC ($n = 7$), non-vmPFC (14), and non-PFC (36), with personality disturbances assessed previously with the IRSPC (Barrash et al., 2000). Emotional disturbances were characterized Hypoemotional Disturbance (*Apathy, Social Withdrawal, Unemotional, Impoverished Emotions*), and Emotional Reactivity (*Irritability, Lability, Anxiety and Poor Frustration Tolerance*). Impairments in complex real-world competencies were quantified by ratings on *Poor Judgment, Inflexibility, Lack of Planning, Disorganization, Indecisiveness, Lack of Initiative, Lack of Persistence, Inflexibility, Social Inappropriateness, Insensitivity, Impulsivity, and Dependency*). Results showed an invariant pattern in which participants with emotional reactivity or hypoemotionality had higher rates of real-world deficits than those without emotional disturbances. Emotional reactivity was significantly associated with impaired real-world competencies for 11 of 13 competencies, and hypoemotionality was significantly associated with impaired real-world functioning for 6 of 13.

Additionally, clinician ratings of long-term psychosocial outcomes quantified overall competency/impairment in key domains of everyday functioning (interpersonal behavior, employment, academic status, health and safety-related behavior, financial management, and leisure/recreational activities) were made independently and blindly by neuropsychologists who knew the research participants well and had available several sources of informant information, employing a 6-point scale ranging from normal to severely impaired. Ecological validity was supported by the finding that IRSPC scores for emotional reactivity and hypoemotionality were significantly associated with the clinician ratings of real-world psychosocial functioning. When both emotional reactivity and hypoemotionality were present, psychosocial outcome was invariably impaired (Anderson et al., 2006). There was a near-perfect correlation between severity of acquired personality disturbances by family members' ratings and long-term psychosocial outcomes (Gupta, Tranel & Duff, 2012).

A follow-up investigation of the effects of PFC damage on the regulation of emotion examined the extent to which emotional and behavioral dysfunction in the real world, as characterized by the ISPC, is associated with reduced ability to regulate emotions following PFC damage (Driscoll, 2009). Emotion regulation was assessed with validated psychophysiological measures (skin conductance responses and zygomatic responses to viewing unpleasant or upsetting pictures). In support of hypotheses, Emotional Reactivity scores were significantly correlated with increased skin conductance responses ($r = .49$), and with increased zygomatic responses to unpleasant pictures ($r = .47$). Hypoemotional Disturbance was not correlated with either response. Although the experimental observations reverse the usual paradigm for evaluating ecological validity, the association between ISPC ratings and "real behavior" (i.e., psychophysiological responses) is a meaningful demonstration of ecological validity.

A second study by Anderson and colleagues demonstrated ecological validity in an

investigation of pathological collecting behavior associated with brain damage (Anderson, Damasio, & Damasio, 2005). By behavioral criteria, 9 patients from Sample 2 (“collectors”) had severe and persistent collecting behavior that was refractory to interventions; a comparison group of 54 focal lesion patients had no abnormal collecting behaviors (“non-collectors”). All collectors had lesions involving PFC, and the area of greatest lesion overlap was vmPFC bilaterally. All collectors were found to have acquired disturbances in planning, and all but 2 collectors had an acquired disturbance in impulse control. The authors suggested that patients with vmPFC damage often have impairments in planning, decision-making and anticipating future consequence of their actions, and this damage disrupts the neural system underlying inhibition in normal collecting behavior in the real world, leaving a natural but disinhibited drive to hoard to run unchecked.

Other studies have reported correlations between ratings of APDs and independent evidence of impaired real life functioning. In a study of behavioral changes early in the course of MS (Lima et al., 2007), ratings of lack of stamina were significantly higher for patients in a high fatigue group compared to those in a low-normal fatigue group ($p = .002$), as determined by the Fatigue Assessment Instrument (Schwartz, Jandorf & Krupp, 1993).

In a study of real life social functioning after a first-ever stroke in 84 individuals of working age (Hommel et al., 2009), the Work and Social Adjustment Scale (Mundt, Marks, Shear & Greist, 2002) was employed to assess five domains: ability to work, home management, social activities, personal leisure activities, and close relationships with others. Unfortunately, personality changes were quantified as the mean change score across 29 ISPC scales, including control scales, creating a summary measure of mixed clinical relevance and limited sensitivity. Nevertheless, greater overall personality change was significantly associated with increasing impairment in psychosocial functioning after first stroke.

One study of psychosocial outcomes after DBS treatment of Parkinson’s disease (Houeto et al., 2002) divided the sample of 24 patients according to outcome. A strong association was found between personality change assessed with the French version of the IRSPC and psychosocial functioning as assessed by the Social Adjustment Scale (Weissman, 1975). Several acquired disturbances were seen in the subgroup with poor psychosocial outcomes, negligible personality change was seen in the group with unchanged psychosocial outcome, and widespread improvement in personality functioning was found in the group with improved psychosocial outcomes. Similarly, another study of patients with Parkinson’s disease (Gul & Yousaf, 2018) found that therapy with levodopa provided significant improvements in Dysexecutive Personality Disturbances and improvement in real life executive functioning as indicated by the Dysexecutive Questionnaire (Burgess, Alderman, Evans, Emslie, & Wilson, 1998).

A study bearing on the ecological validity of the Spanish version of the ISPC was performed at the Fundación Rita Bianchi Rehabilitation Clinic in Argentina with two patients with brain damage from TBI and two with damage from cerebrovascular accident (Roqué et al., 2018). Investigators examined the correspondence between ISPC ratings with the Spanish version and detailed characterization of the patients’ personality disturbances by rehabilitation clinicians, and they concluded that the Spanish version of the ISPC showed utility for informing rehabilitation staff of personality changes relevant to facilitation of treatment.

Response to Treatment and Course. Another important aspect of construct validity of the ISPC is the ability to provide information regarding relationships between rated personality disturbances and real-life functioning over time. There are several studies bearing on the association personality changes following surgical interventions for brain conditions and, although longitudinal studies have been infrequent, there some studies reporting data that bear on

personality changes over time in clinical groups.

An early investigation of personality changes in patients with primary cerebral tumors examined the association of personality disturbances with frontal lobe pathology and with adaptive functioning (Gleason, 2004). The sample comprised 39 patients with gliomas diagnosed at least three years earlier, 22 with frontal involvement and 17 non-frontal patients. Adaptive functioning was measured with the Community Integration Questionnaire (CIQ; Willer et al., 1993), which assesses functioning in the home, social network, and productive activities such as employment, school, or volunteer work. Of note, personality changes were not reported for individual ISPC scales; instead, summary measures of overall change and overall level of disturbance was calculated from 18 scales¹⁸. The ISPC total current level of disturbance and total change score were significantly associated with functional status (i.e., full independence vs. requiring at least part-time supervision and assistance). Additionally, regression analysis showed that even after accounting for the effect of neuropsychological measures of executive functioning, the ratings of behavioral change were of significant additional benefit in predicting patients' community functioning and supervision needs.

A second study aimed to characterize emotional and personality changes that may follow neurosurgical treatment of brain tumor, comparing 44 tumor patients with a control group of 26 patients who had undergone spinal surgery (Jenkins, Drummond & Andrewes, 2016). Compared to controls, the tumor patients were described as having significant changes in irritability, impulsivity, lability, inflexibility, and being easily overwhelmed.

A third study of tumor patients investigated whether long-term impairment in adaptive functioning after neurosurgical resection of meningioma can be predicted by personality disturbances that often develop with vmPFC lesions (Barrash et al., 2020). Specifically, it was hypothesized that acquired personality disturbances from two or more of the four subtypes of disturbance would be associated with poor outcomes at 3+ years after surgery among 38 neurosurgical patients, 18 with vmPFC lesions and 20 with non-vmPFC lesions. Regarding individual ISPC scales, poor long-term adaptive functioning was most highly associated with disturbances in indecisiveness, inflexibility, apathy and social inappropriateness, all significant associations beyond the .001 level. Regarding the hypothesis, of the 14 patients with more than one type of disturbance, 12 had impaired adaptive functioning (positive predictive power, .86); of the 24 patients with one or no types of disturbance, 22 had normal or only mildly compromised adaptive functioning (negative predictive power, .92).

Several studies have examined personality changes after successful treatment of Parkinson's disease with DBS. One study of 24 patients (Houeto et al., 2002), found that that personality changes after DBS, assessed with the French version of the IRSPC, were not unitary but varied in concert with social adjustment. Accordingly, several acquired disturbances were seen in the subgroup with poor psychosocial outcomes, negligible personality changes in the group with unchanged psychosocial outcome, and widespread improvement in personality functioning in the group with improved psychosocial outcomes. Post-DBS improvements in personality were also described in case studies of two patients who had addictive behavioral disorders prior to successful outcomes with DBS (Witjas et al., 2005). In a study of 27 patients with Parkinson's disease with DBS implantation in subthalamic nucleus, ratings with the Slovene version of the ISPC indicated increased problems with Dysexecutive Disturbance and Disturbed Social Behavior, suggesting that executive and social functioning are the two most vulnerable domains in patients with PD after DBS/subthalamic nucleus stimulation (Brezovar, Pažek, Kavčič,

¹⁸ These 18 scales were selected based on findings in a previous study of acquired personality disturbances in at least 50 percent of patients with frontal lobe damage of varied etiologies (Barrash et al, 1997b). The scales included *Apathy, Irritability, Lack of Initiative, Perseverative Behavior, Impulsivity, Lability, Lack of Stamina, Lack of Planning, Inflexibility, Poor Judgment, Anxiety, Insensitivity, Social Inappropriateness, Unemotional, Indecisiveness, Inappropriate Affect, being Easily Overwhelmed, and Lack of Insight*.

Georgiev, Trošt, & Flisar, 2022).

A study of Parkinson's patients that was notable for a prospective design (ISPC ratings prior to and again after DBS implantation in subthalamic nucleus) provided strong evidence of improvements in personality functioning, particularly for anxiety, lability, social inappropriateness, insight and obsessiveness (Gronchi-Perrin et al., 2007). A second longitudinal investigation that is currently in progress at the Cleveland Clinic examined ISPC ratings on 50 PD patients prior to DBS surgery, and at 6 and 12 months post-surgery (Gase et al., 2022). When compared to prospective preoperative ratings, no post-operative decline was found on any scales, and the only significant change was a *decrease* in Distressed Personality Disturbance — findings consistent with the pattern reported by Gronchi-Perrin and colleagues (2007).

Deficits in executive functioning and aspects of personality functioning in patients with Parkinson's disease may be related to dopamine depletion in prefrontal cortex (Menza, Golbe, Cody & Forman, 1993; Narayanan, Rodnitzky & Uc, 2013; Santangelo et al., 2017). The effects of therapy with levodopa-carbidopa (L-dopa) on personality disturbances and dysexecutive symptoms in Parkinson's patients were studied using a prospective test-retest design (Gul & Yousaf, 2018). Sixty patients treated for Parkinson's at a large hospital in Pakistan and whose daily dose of levodopa was stable for at least three months were assessed with the ISPC. Informant ratings showed that L-dopa therapy was associated with significant widespread improvement in personality disturbances that had been present prior to therapy, with large effect sizes (.78-.98) for all scales.

An interesting case report from Montreal concerns a 41-year-old man with no significant past medical history but daily seizures beginning at age 35, with spells were characterized by an aura of embarrassment and shame (Lacazette, Boucher, Mohamed, Bouthillier & Nguyen, 2019). The seizures proved refractory to pharmacotherapy and he was evaluated for potential epilepsy surgery. MRI failed to reveal an epileptogenic lesion, but video-EEG monitoring, fluorodeoxyglucose positron emission tomography and intracranial EEG consistently pointed to the right frontopolar region, the anterior medial frontal region, and the inferior frontal gyrus. Based on these findings, extensive right anterior frontal corticectomy was performed. However, within six months seizures recurred one to four times per month. A postoperative magnetoencephalographic study identified the probable source as being in the area of the right anterior insula and a few scattered sources in the right perisylvian area. The patient underwent a second epilepsy surgery with resection of the right frontal operculum, the anterior insula, and posterolateral orbitofrontal cortex. At follow-up five years after the second surgery, the patient has remained seizure-free. The French ISPC was administered at that time, and his wife reported that he had no personality changes compared to his premorbid personality functioning.

Noting that psychological adjustment following temporal lobectomy for treatment of pharmacoresistent epilepsy has been assessed primarily with self-report measures, King and Tranel (2017) used the informant-report ISPC to investigate post-lobectomy changes in 27 patients. The relation between seizure outcomes and personality changes was also examined. Personality characteristics were entirely within the normal range of functioning following surgery, and there were no significant differences between pre- and postoperative levels of emotional reactivity, social behavior, executive functioning, hypoemotionality or distress. Adaptive personality changes were seen in early follow-up assessments even in patients who were not seizure-free, however assessments at longer intervals indicated that only seizure-free patients showed improvements after 1–2 years. In a second group study of temporal lobectomy patients, no significant personality changes were found in patients undergoing surgical treatment for epilepsy (Hébert-Seropian et al., 2017).

In addition to these two studies employing the ISPC, a review of personality changes following surgical treatment for refractory epilepsy (Iurina, Bailles & Pintor, 2021) identified 9

studies in addition to the two just presented, with alternative measures of personality employed. The review reported that 5 of the 9 studies showed personality improvement and a 6th found stability. Iurina and colleagues reconciled findings by noting that their review indicated that development of personality changes (generally improvements) may be displayed within a short follow-up in both seizure-free and not-seizure-free patients, but at further follow-up these improvements were only maintained in groups that were seizure-free.

Another study described long-term outcomes to anterior capsulotomy for refractory depression in 20 patients (Christmas et al., 2011). Assessment of outcomes included a variety of measures of mood and quality of life, as well as the Personality Assessment Schedule (PAS; Tyrer, Alexander, Cicchetti, Cohen & Remington, 1979). Despite the investigators' observation that 55% of the sample showed overall improved with treatment, personality assessment with the PAS did not indicate any changes in personality. The investigators concluded that the personality assessments were not sensitive to improvement with amelioration of depression, and they reported that to address that issue the assessment protocol was modified to include the Iowa Scales of Personality Change.

An intriguing longitudinal study is investigating the *pre-clinical* course of family members of individuals with frontotemporal dementia (FTD) to monitor the progression of neuropsychiatric symptoms including personality disturbances in pre-clinical carriers of GRN and C9orf72 mutations for frontotemporal dementia (vs. non-carrier family members) (Chatterjee et al., 2021). Eighty study participants include 21 C9orf72+ mutation carriers, 10 GRN+ mutation carriers, and 49 non-carrier family members (with mean ages of 47 ± 13 years, 51 ± 9 years, and 54 ± 13 years respectively). Baseline assessment revealed trends for GRN carriers to be rated as having a higher level of disturbance on six scales: *Irritability*, *Lack of Initiative*, *Perseverative Behavior*, *Lack of Persistence*, *Depression*, and *Easily Overwhelmed* (Wittenberg et al., 2014). At follow-up exam after a mean interval of 5.8 years, only participants who had not converted to FTD were analyzed. Non-carriers had minimal change on all neuropsychiatric measures including ISPC, and there were no significant differences in neuropsychiatric progression rates between C9orf72+ carriers and non-carriers. In contrast, GRN+ carriers had significantly faster progression of total ISPC personality disturbances compared to non-carriers *prior to the onset of dementia* ($p = .0004$).

A novel study was designed to explore neuroanatomical correlates of positive changes after a neurological event, with a sample comprised of 97 patients with improved personality and behavioral functioning following a discrete neurological event (e.g., stroke, benign tumor resection) (King, Manzel, Bruss, & Tranel, 2017). ISPC ratings were obtained during the chronic epoch of recovery, when psychological status was stabilized, and scores on the higher-order dimensions of *Irascibility*, *Disturbed Social Behavior*, *Dysexecutive Disturbance*, *Hypoemotionality*, and *Distress* were analyzed. Patients who showed positive changes in personality and behavior in one or more domains were identified, and lesion mapping indicated that positive changes were most consistently related to damage to the bilateral frontal polar regions and the right anterior dorsolateral prefrontal region. Of note, patients who showed positive changes in personality following a neurological event had been rated as having more disturbed functioning prior to the event, and it was concluded that results provided preliminary evidence that improvements in personality may involve dampening of premorbid disturbances, particularly in emotional behavior.

Finally, an interesting recent study that did not employ the ISPC nevertheless produced intriguing results bearing on the construct validity of Emotional/Social Personality Disturbance (Barclay, Silvers, & Lee, 2022). This longitudinal study investigated the predictive validity of childhood irritability with respect to later development of adolescent internalizing and externalizing problems, controlling for demographic factors, clinical correlates, and baseline psychopathology

in 230 ethnically diverse 5-10-year-old youth. Three separate laboratory-based assessments were completed across 6-7 years. Childhood irritability uniquely predicted adolescent externalizing problems; contrary to hypotheses, none of the examined family or social factors (e.g., parenting behavior and social skills, respectively) significantly mediated adolescent externalizing problems. Childhood irritability was not related to adolescent internalizing problems. This pattern of findings supports the construct validity of Emotional/Social Personality Disturbance for which irritability is a core feature, as are externalizing behaviors such as emotional lability and dysmodulation of social behavior are also core features of this syndromal set of disturbances (Barrash et al., 2011; 2022; RoCHAT et al., 2009). That years after the core characteristic of irritability is recorded in youths, they are then observed to have other disturbances characteristic of the Emotional/Social Personality Disturbance — regardless of family factors or social factors — is consistent with developmental compromise of a specific functional system subserved by vmPFC that is critical to normal emotional/social functioning (Ackerly & Benton, 1948; Anderson et al., 2009).

Control Scales. Four control scales to detect bias in ratings are based on the premise that these characteristics — *Frugality*, *Type A Behavior*, *Manipulativeness*, and *Vanity* — do not increase as a consequence of brain damage. Findings from various studies support this premise. In all reports of ratings in groups of patients with brain damage, mean ratings on these scales are at the “average” level. In the full set of 234 patients in Sample 2 (i.e., the accumulated subjects at the time of analysis on 7/24/22), mean increases in the four control scales were negligible: *Frugality*, 0.14; *Type A Behavior*, -0.36 (i.e., on average, patients’ scores did not increase, but decreased by a third of a point); *Manipulativeness*, 0.23; and *Vanity*, -0.06.

The factor analysis of 234 focal lesion patients from Sample 2 (Barrash et al., 2022, supplemental material) is informative regarding the four control scales functioning as intended. The control scales had minimal mean loadings on the four factors reflecting the four subtypes of acquired disturbances: *Frugality*, 0.12; *Type A Behavior*, -0.01; *Manipulativeness*, 0.18; and *Vanity*, 0.08). These correlations indicate that control scales are not associated with any types of disturbance.

The study of 62 well-matched older adults (60 years or older) with brain damage (OA-BD) and neurologically healthy older adults (OA-H) well-matched on sex, age and education (Zirbes et al., 2021) compared mean ratings of the groups (presented in Appendix B). The OA-BD showed negligible increases from pre-morbid to post-morbid functioning across the four control scales. In fact, three of the scales showed mean *decreases* while the mean increase for *Manipulativeness* was a quarter of a point. Of particular relevance to the expected behavior of control scales, there were minimal differences in change between the OA-BD and OA-H, and only on one of the scales did the brain-damaged patients show a greater mean increase than healthy, non-neurological adults (*Manipulativeness*, with *eta* of .17 indicating a trivial effect size). Most importantly for their role as control scales, the frequency at which brain-damaged individuals are rated as having an acquired personality disturbance should be low and should not substantially exceed the rate for healthy older adults. The study of Zirbes et al. (2021) also showed that the rates of an acquired personality disturbance for any of the control scales were consistently low in the brain-damaged group, with no more than 6.5% of the group with an acquired personality disturbance. Importantly, the frequency at which a brain-damaged individual was rated as having an acquired personality disturbance on a control scale (mean, 5.3% across the four scales) was identical to the rate for healthy older adults (5.3%).

Validity of the control scales is also demonstrated by findings that various clinical populations do not show appreciable change on these scales. In addition to analyses of Sample 2 described above, all published papers that present detailed ISPC data for control scales have

shown that change — or more precisely, *increases*¹⁹ — on these scales is consistently negligible for rehabilitation patients following TBI (Rochat et al., 2009), a case study patient with a focal left parietal lesion following stroke (Salas et al., 2014) and a case study of a patient with a focal caudate lesion following stroke (Kemp et al., 2013).

Collectively, the findings presented above demonstrate strong construct validity — the ISPC successfully measures premorbid personality functioning, postmorbid personality functioning, and change following brain damage. Additionally, findings have shown that ratings of acquired personality disturbances in individuals with brain damage reflect clinical factors and not merely the passage of time or normal aging. Furthermore, ISPC ratings show meaningful relationships with real-world functioning, different clinical conditions, lesions in different prefrontal sectors, and prognosis/response to treatment.

6. Translations and Adaptations

The ISPC has been translated into French (Juillerat et al., 1998; Houeto et al., 2002; Rochat, Ammann, Mayer, Annoni, & Van der Linden, 2009), German (Kuhn, 2008; Gaertner, 2015; Rohde, 2011), Spanish (Jiménez-Cortés et al., 2010; Guallart-Balet et al., 2015), Italian (Cantagallo et al., 2006; Cantagallo, Contini, & Bianchi, 2010), and Slovene (Brezovar, Bon, Sakić, Pirtošek, & Flisar, 2016; Brezovar, Pažek, Kavčič, Georgiev, Trošt, & Flisar, 2022). Appendix L presents contact information regarding the translations. An adaptation of the ISPC was developed for patients with brain damage in early childhood, the Iowa Scales of Personality Development (Anderson & Barrash, 2005). An adaptation of the ISPC for adults without neurological conditions was developed for research purposes (Denburg & Barrash, 2007). In this adaptation, raters of the healthy older adults are instructed to make a rating firstly for the ratee's characteristic personality functioning throughout middle age (i.e., from approximately age 40 to 55), and secondly for their characteristic personality functioning for the past year.

¹⁹ It is noted that clinical patients may show a significant *decrease* in Type A behavior. This usually occurs in the context of diminished activity and acquired disturbances in traits such as initiative, stamina, apathy and depression. Accordingly, a significant decrease in Type A behavior is considered clinically-meaningful. In contrast, a significant *increase* in Type A behavior is rare and, considered in the context of the general pattern of rated change, it may be an indication of exaggerated postmorbid ratings.

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Appendix A. BEFORE and NOW ratings in healthy older adults (OA-H) and a brain-damaged comparison group (OA-BD)

ISPC Scale	BEFORE					Current					Effect size
	OA-H		OA-BD		<i>p</i>	OA-H		OA-BD		<i>p</i>	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
Poor Judgement	2.18	1.03	2.34	0.99	.407	2.37	1.21	4.02	1.67	<.001	1.12
Lack of Planning	1.95	0.98	2.39	1.16	.035	2.16	1.14	4.37	1.86	<.001	1.81
Perseverative Behavior	2.53	1.15	2.60	1.01	.672	2.71	1.15	4.29	1.53	<.001	1.17
Lack of Initiative	1.98	0.98	2.27	1.07	.140	2.32	1.25	4.32	1.84	<.001	1.26
Lack of Persistence	1.97	1.04	2.29	1.06	.069	2.26	1.18	4.13	1.85	<.001	1.20
Indecisiveness	2.66	1.42	2.61	1.29	.996	2.82	1.42	4.52	1.85	<.001	1.02
Impulsivity	1.97	1.07	2.26	1.24	.212	1.95	1.15	3.24	1.64	<.001	.91
Insensitivity	2.52	1.37	2.71	1.36	.331	2.71	1.45	3.68	1.71	.001	.61
Social Inappropriateness	2.19	1.25	2.37	1.30	.420	2.18	1.20	3.34	1.60	<.001	.82
Inappropriate Affect	2.15	1.06	2.24	0.91	.458	2.11	0.94	2.81	1.18	<.001	.65
Aggressive Behavior	2.10	1.30	2.37	1.38	.224	1.98	0.94	2.52	1.44	.055	.43
Lack of Insight ^a	—	—	—	—	—	2.66	1.25	3.56	1.97	.011	.54
Apathy	2.48	0.88	2.74	0.90	.049	2.52	1.14	3.95	1.45	<.001	1.09
Unemotional	3.13	1.21	3.11	1.30	.944	3.19	1.26	3.48	1.79	.700	.19
Social Withdrawal	2.44	1.35	2.77	1.44	.203	2.48	1.47	4.10	1.98	<.001	.92
Impatience	2.71	1.24	3.18	1.43	.065	2.82	1.42	3.87	1.67	<.001	.67
Irritability	2.37	1.15	2.73	1.27	.150	2.52	1.17	3.58	1.80	.001	.69
Lability	2.61	1.05	2.79	1.32	.609	2.87	1.22	3.74	1.86	.010	.55
Inflexibility	3.29	1.35	3.31	1.35	.814	3.30	1.43	4.05	1.58	.024	.44
Depression	2.66	1.09	2.21	0.89	.010	2.76	1.06	3.63	1.51	<.001	1.02
Anxiety	2.69	1.27	2.71	1.28	.856	2.71	1.37	3.90	1.82	<.001	.73
Dependency	2.16	1.03	2.10	1.05	.690	2.50	0.98	3.73	1.90	<.001	.80
Easily Overwhelmed	2.39	1.27	2.50	1.15	.446	2.55	1.30	4.31	1.94	<.001	1.06
Lack of Stamina	1.98	1.12	2.44	1.00	.007	3.13	1.34	4.79	1.71	<.001	1.07
Obsessiveness	3.48	1.32	3.32	1.22	.528	3.52	1.35	3.65	1.83	.915	.08
Suspiciousness	2.81	1.19	2.73	1.01	.941	2.85	0.98	3.19	1.55	.219	.26
<i>Type A Behavior</i>	3.50	1.24	3.31	1.68	.368	2.94	1.51	2.79	1.59	.524	-.09
<i>Vanity</i>	2.26	0.97	2.53	1.25	.290	2.31	1.00	2.27	1.17	.653	-.03
<i>Frugality</i>	4.02	1.26	3.63	1.28	.045	4.15	1.05	3.56	1.25	.003	-.50
<i>Manipulativeness</i>	2.11	1.13	2.44	1.41	.247	2.21	1.23	2.69	1.60	.108	.34

Note. Between group differences were tested by Wilcoxon signed-rank test. OA-H = Healthy older adults; OA-BD = Older adults with brain disease; ISPC = Iowa Scales of Personality Change. Control scales are presented in italics. ^a*Lack of Insight* is not rated for the Premorbid epoch. Effect sizes apply to NOW ratings among OA-BD compared to OA-H. Alpha is .002 for the tests presented in this table after Bonferroni correction for multiple tests (.05/26 clinical scales = .002). Adapted from Zirbes et al., 2021.

Appendix B. ISPC Change Scores in healthy older adults (OA-H) and a brain-damaged comparison group (OA-BD)

ISPC Scale	OA-H			OA-BD			Effect size
	<i>M</i>	<i>SD</i>	<i>p</i> ^a	<i>M</i>	<i>SD</i>	<i>p</i> ^a	
Poor Judgement	.19	0.86	.081	1.68	1.69	<.001	1.10
Lack of Planning	.21	1.05	.146	1.98	1.75	<.001	1.22
Perseverative Behavior	.18	0.82	.081	1.69	1.50	<.001	1.25
Lack of Initiative	.34	1.11	.020	2.05	2.12	<.001	1.00
Lack of Persistence	.29	1.03	.036	1.84	1.83	<.001	1.03
Indecisiveness	.16	1.08	.309	1.90	1.91	<.001	1.11
Impulsivity	-.02	0.64	.856	.98	1.60	<.001	.82
Insensitivity	.19	1.14	.189	.97	1.40	.001	.60
Social Inappropriateness	-.02	0.79	.749	.97	1.39	<.001	.87
Inappropriate Affect	-.03	0.65	.827	.56	0.93	<.001	.74
Aggressive Behavior	-.11	0.74	.233	.15	1.21	.04	.25
Lack of Insight	-.34	1.25	1.000	.56	1.97	.005	.54
Apathy	.03	1.02	.779	1.21	1.52	<.001	.90
Unemotional	.06	1.02	.789	.37	1.61	.60	.23
Social Withdrawal	.05	1.20	.890	1.32	2.06	<.001	.75
Impatience	.11	1.20	.749	.69	1.61	.002	.41
Irritability	.15	1.24	.445	.85	1.73	.003	.46
Lability	.26	1.11	.059	.95	1.76	.002	.47
Inflexibility	.10	1.23	.532	.74	1.56	.001	.45
Depression	.10	1.09	.548	1.42	1.37	<.001	1.06
Anxiety	.02	0.89	.850	1.19	1.56	<.001	.92
Dependency	.34	0.84	.004	1.63	1.76	<.001	.93
Easily Overwhelmed	.16	1.11	.375	1.81	1.82	<.001	1.18
Lack of Stamina	1.15	1.63	<.001	2.35	1.81	<.001	.70
Obsessiveness	.03	0.82	.692	.32	1.96	.27	.19
Suspiciousness	.05	0.87	.687	.47	1.39	.092	.36
<i>Type A Behavior</i>	-.56	1.23	.001	-.52	1.86	.42	.03
<i>Vanity</i>	.05	0.55	.475	-.26	0.90	.064	-.41
<i>Frugality</i>	.13	1.06	.248	-.06	1.22	.51	-.17
<i>Manipulativeness</i>	.10	0.76	.330	.26	1.11	.65	.17

Note. Differences between Premorbid and Now scores (within each study group) were evaluated by Wilcoxon Signed-Rank test. OA-H = Healthy older adults; OA-BD = Older adults with brain disease; ISPC = Iowa Scales of Personality Change. Control scales are presented in italics. ^aWithin-group significance of differences between premorbid and current ratings among OA-H. Effect sizes (η^2) for change among OA-BD compared to OA-H. Alpha is .002 for the tests presented in this table after Bonferroni correction for multiple tests (.05/26 clinical scales = .002). Adapted from Zirbes et al., 2021.

Appendix C. Rates of acquired personality disturbances in healthy older adults (OA-H) and a brain-damaged comparison group (OA-BD)

ISPC Scale	OA-H	OA-BD	<i>p</i>
Poor Judgement	4.8%	43.5%	<.001
Lack of Planning	4.8%	50.0%	<.001
Perseverative Behavior	3.2%	41.9%	<.001
Lack of Initiative	8.1%	53.2%	<.001
Lack of Persistence	4.8%	45.2%	<.001
Indecisiveness	4.8%	50.0%	<.001
Impulsivity	0%	24.2%	<.001
Insensitivity	6.5%	27.4%	.002
Social Inappropriateness	1.6%	24.2%	<.001
Inappropriate Affect	0%	6.5%	.059
Aggressive Behavior	0%	6.5%	.059
Lack of Insight	17.7%	50.0%	<.001
Apathy	6.5%	35.5%	<.001
Unemotional	3.2%	14.5%	.027
Social Withdrawal	6.5%	38.7%	<.001
Impatience	6.5%	24.2%	.006
Irritability	8.1%	35.5%	<.001
Lability	14.5%	32.3%	.016
Inflexibility	11.3%	22.6%	.075
Depression	6.5%	35.5%	<.001
Anxiety	4.8%	40.3%	<.001
Dependency	3.2%	40.3%	<.001
Easily Overwhelmed	6.5%	53.2%	<.001
Lack of Stamina	19.4%	62.9%	<.001
Obsessiveness	4.8%	21.0%	.007
Suspiciousness	1.6%	17.7%	.002
<i>Type A Behavior</i>	4.8%	6.5%	.500
<i>Vanity</i>	4.8%	4.8%	.96
<i>Frugality</i>	8.1%	4.8%	.36
<i>Manipulativeness</i>	3.2%	4.8%	.50

Note. Differences in rates between study groups were evaluated by Fisher Exact Test. OA-H = Healthy older adults; OA-BD = Older adults with brain disease. Control scales are presented in italics. Alpha is .002 for the tests presented in this table after Bonferroni correction for multiple tests (.05/26 clinical scales = .002). Adapted from Zirbes et al., 2021.

Appendix D. Gender differences on ISPC scales, significant at the .01 alpha level

ISPC Scale	ISPC Variable	Sample	Males (Mean)	Females (Mean)	Effect Size ¹
<i>Unemotional</i>	BEFORE	Clinical (n=234)	3.53	2.87	.50
<i>Unemotional</i>	NOW	Clinical (n=234)	3.50	2.95	.33
<i>Insensitivity</i>	BEFORE	Clinical (n=234)	3.13	2.52	.47
<i>Insensitivity</i>	NOW	Clinical (n=234)	3.95	3.02	.56
<i>Lack of Stamina</i>	BEFORE	Clinical (n=234)	2.27	2.77	.39
<i>Aggressive Behavior</i>	BEFORE	Clinical (n=234)	2.80	2.31	.35
<i>Social Inappropriateness</i>	NOW	Clinical (n=234)	3.67	3.03	.38
<i>Inflexibility</i>	NOW	Clinical (n=234)	4.28	3.67	.38
<i>Social Withdrawal</i>	BEFORE	Healthy Older Adults (n=62)	2.89	2.03	.66
<i>Social Withdrawal</i>	NOW	Healthy Older Adults (n=62)	3.04	2.03	.71

Note. ¹ Cohen's *d*. Coefficients between .20 and .49 indicate a small effect size; coefficients between .50 and .79 indicate a medium effect size (Sawiliowsky, Sawiliowsky & Grissom, 2010).

Appendix E. Correlations of higher-order ISPC disturbance subtypes and higher-order MMPI-2-RF scales

MMPI Higher-Order Scale	ISPC Subtype of Disturbance			
	Emotional/Social	Dysexecutive	Hypoemotional	Distressed
EID	.16	.34***	.24*	.38***
THD	.24*	.14	-.08	.18
BXD	.36***	.35***	.01	.26*

Note. MMPI Higher Order Scales: EID = Emotional/internalizing dysfunction; THD = Thought dysfunction; BXD = Behavioral/ externalizing dysfunction. Two-tailed significance tests are reported: * = <0.05, ** <0.01, *** < 0.001. Adapted from Barrash et al., 2022, Supplemental Material.

Appendix F. Correlations of ISPC scales and MMPI-2-RF scales

MMPI-2-RF Scale	ISPC Scale									
	IRRIT	LINIT	PERSV	DPRSN	IMPLS	OBSES	LABIL	LSTAM	LPERS	LPLAN
TRIN	.01	.15	-.05	.04	.06	-.03	-.03	.06	.22*	.16
VRIN	.10	.10	.12	.21	.08	.052	.14	.18	.09	.12
FBS	-.20	.04	-.07	.09	.06	-.04	.03	.07	.09	.10
F	.08	.22*	.24*	.12	.25*	-.21	.25*	.15	.28*	.36***
K	-.20	-.36***	-.31**	-.27*	-.29**	-.08	-.34**	-.34**	-.36***	-.46***
L	.11	-.03	.04	.13	-.11	.14	.15	.10	.04	-.16
EID	.13	.31**	.19	.26*	.22*	.04	.29**	.26*	.32**	.35***
THD	.18	.04	.24*	.09	.25*	.10	.19	-.02	.09	.14
BXD	.34***	.29**	.31**	.22*	.41***	.15	.30**	.05	.24*	.35***
AGGR-r	.18	.19	.10	-.01	.34**	-.08	.11	.03	.20	.25*
DISC-r	.30**	.19	.24*	.18	.18	.12	.27*	-.04	.20	.29**
INTR-r	-.09	.06	.03	.09	.09	-.03	-.08	.05	-.02	-.02
NEGE-r	.17	.16	.16	.26*	.26*	.10	.35***	.13	.24*	.34**
PSYC-r	.07	.05	.24*	.06	.09	.12	.11	-.03	.18	.19
RC1	.04	.18	.14	.21	.29**	.13	.19	.23*	.17	.24*
RC2	.00	.23*	.18	.13	.03	.03	.12	.22*	.14	.17
RC3	.35***	.35***	.37***	.12	.25*	.07	.33**	.25*	.30**	.29**
RC4	.33**	.34**	.37***	.26*	.39***	.11	.31**	.12	.33**	.40***
RC6	.25*	.11	.17	-.03	.29**	.21	.31**	-.09	.14	.11
RC7	.14	.14	.18	.28*	.21	.12	.29**	.13	.22*	.23*
RC8	.05	.03	.23*	.17	.21	.05	.03	.05	.13	.19
RC9	.30**	.21	.27*	.15	.39***	.08	.33**	.10	.25*	.36***
RCd	.00	.33**	.16	.24*	.24*	.07	.21	.24*	.34**	.39***

Appendix F, *continued*. Correlations of ISPC scales and MMPI-2-RF scales

MMPI Scale	ISPC Scale									
	INFLEX	PJUDG	ANX	INSEN	SI	DPEND	IMPAT	TYPEA	UNEMOT	SW
TRIN	.09	.05	.13	.04	-.03	.01	-.03	-.07	.04	.09
VRIN	.12	.13	.32**	.15	.13	.20	.16	-.08	-.16	.20
FBS	-.12	.08	.11	-.16	-.18	.24*	-.17	.08	-.10	.04
F	.11	.30**	.34**	.17	.06	.19	.08	-.09	-.13	.01
K	-.13	-.44***	-.39***	-.35***	-.30**	-.33**	-.18	.13	.06	-.13
L	.15	-.05	.17	.10	.04	.08	.19	.11	-.16	.06
EID	.07	.43***	.33**	.22	.18	.23*	.06	-.19	.01	.12
THD	.25*	.10	.20	.30**	.16	.12	.16	.10	-.16	.01
BXD	.27*	.42***	.21	.35***	.36***	.12	.21	-.05	-.02	-.06
AGGR-r	.25*	.13	-.03	.24*	.21	-.11	.17	.08	-.01	-.15
DISC-r	.25*	.30**	.20	.33**	.31**	.03	.21	.01	.02	-.03
INTR-r	-.14	.09	.03	-.01	-.07	-.07	-.19	-.09	.09	.25*
NEGE-r	.08	.30**	.41***	.22*	.15	.36***	.14	-.11	-.14	-.02
PSYC-r	.15	.11	.14	.19	.09	.10	.09	.05	-.05	.01
RC1	-.01	.29**	.27	.14	.02	.15	.09	.02	-.07	-.04
RC2	-.05	.30**	.11	.06	.02	.06	-.06	-.21	.08	.09
RC3	.33**	.40***	.18	.41***	.37***	.15	.36***	-.06	.05	.00
RC4	.17	.43***	.28**	.29**	.38***	.19	.22*	-.15	.01	.03
RC6	.37***	.10	.22*	.31**	.21	.11	.22*	.07	-.08	-.07
RC7	.14	.27*	.41***	.25*	.14	.27*	.07	-.02	-.12	.10
RC8	.03	.14	.14	.15	.06	.09	-.01	-.01	-.10	.09
RC9	.35***	.29**	.27	.39***	.30**	.22*	.21	.04	-.10	-.09
RCd	-.02	.35***	.30**	.10	.12	.24*	.00	-.17	-.07	.10

Appendix F, *continued*. Correlations of ISPC scales and MMPI-2-RF scales

MMPI Scale	ISPC Scale									
	AGGR	INDEC	VANITY	SUSP	APATH	FRUG	INAFF	MANIP	EO	LINS
TRIN	.12	.08	.11	.12	.13	.11	.1	.15	.09	.09
VRIN	.01	.09	-.04	.07	.08	.01	-.04	.28**	.14	.05
FBS	.03	.05	.10	-.06	.07	-.04	.14	-.04	.08	-.01
F	.26*	.17	.11	.14	.21	.19	.40***	.13	.23*	.13
K	-.25*	-.39***	-.12	-.14	-.31**	.00	-.42***	-.090	-.49***	-.22
L	-.10	.05	.02	.11	.06	.05	.03	-.01	.12	.20
EID	.21	.22*	.07	.03	.44***	.12	.34**	.07	.37***	.25
THD	.11	.05	.22*	.11	-.03	.04	.28	.17	.16	.23
BXD	.42***	.13	.13	.21	.11	-.19	.44***	.37***	.25*	.13
AGGR-r	.33**	-.04	.19	.11	-.10	-.22	.27*	.27*	.09	.30**
DISC-r	.41***	.10	.10	.18	.07	-.20	.30**	.28**	.22*	.06
INTR-r	.04	.02	-.14	-.03	.27*	.05	-.03	-.15	.02	.10
NEGE-r	.18	.20	.11	.10	.23*	.08	.36***	.15	.40***	.20
PSYC-r	.07	.07	.12	.02	.01	.04	.23*	.19	.10	.20
RC1	.17	.24*	.17	.03	.14	.10	.32**	.02	.28*	.05
RC2	.08	.15	.02	-.03	.32**	.14	.20	.04	.14	.10
RC3	.17	.27*	.12	.15	.17	-.05	.35***	.23*	.36**	.34**
RC4	.46***	.19	.00	.17	.25*	-.18	.46***	.29**	.31**	.11
RC6	.18	.03	.22*	.19	.06	.15	.31**	.16	.13	.34*
RC7	.14	.15	.09	.15	.24*	.16	.34**	.01	.36***	.26*
RC8	.08	.05	.06	-.04	.02	.02	.20	.11	.11	.10
RC9	.22*	.16	.29**	.16	-.01	-.10	.38***	.35***	.29**	.25*
RCd	.19	.25*	.07	.02	.33**	-.01	.33**	.08	.36***	.12

Note. Abbreviations: IRRIT = Irritability; LINIT = Lack of Initiative; PERSV = Perseverative Behavior; DPRSN = Depression; IMPLS = Impulsivity; OBSES = Obsessiveness; LABIL = Lability; LSTAM = Lack of Stamina; LPERS = Lack of Persistence; LPLAN = Lack of Planning; INFLEX = Inflexibility; PJDG = Poor Judgment; ANX = Anxiety; INSEN = Insensitivity; SI = Social Inappropriateness; DPEND = Dependency; IMPAT = Impatience; TYPEA = Type A behavior; UNEMOT = Unemotional; SW = Social Withdrawal; AGGR = Aggressive Behavior; INDEC = Indecisiveness; SUSP = Suspiciousness; APATH = Apathy; FRUG = Frugality; INAFF = Inappropriate Affect; MANIP = Manipulativeness; EO = Easily Overwhelmed; LINS = Lack of Insight; TRIN = True response inconsistency; VRIN = Variable response inconsistency; F(p) = Infrequency-Psychopathology; F = Infrequency; K =; L = Lie; EID = Emotional/internalizing dysfunction; THD = Thought dysfunction; BXD = Behavioral/externalizing dysfunction; AGGR-r = Aggressive Behavior-revised; DISC-r = Disconstraint-revised; INTR-r = Introversion/low positive emotionality-revised; NEGE-r = Negative emotionality/neuroticism-revised; PSYC -r= Psychoticism-revised; RC1 = Somatic complaints; RC2 = Low positive emotions; RC3 = Cynicism; RC4 = Antisocial behavior; RC6 = Ideas of persecution; RC7 = Dysfunctional negative emotions; RC8 = Aberrant experiences; RC9 = Hypomanic activation; RCd = Demoralization. Two-tailed significance tests are reported: * = <0.05, ** <0.01, *** < 0.001. Adapted from Barrash et al., 2022, Supplemental Material.

Appendix G. Spearman correlations between BFI and NEO-PI-scales

NEO-PI-R Trait	BFI Trait				
	Neuroticism	Extraversion	Openness	Agreeableness	Conscientiousness
Neuroticism	.53**	-.07	-.20	-.29	-.53**
Extraversion	-.25	.64**	.36*	.43*	.35*
Openness	-.09	.09	.70**	-.15	-.21
Agreeableness	-.31	.00	.07	.49**	.22
Conscientiousness	-.26	.15	-.05	.25	.81**

Note. BFI = Big Five Inventory. NEO = Revised NEO Personality Inventory (NEO). Correlation coefficients were evaluated by Spearman's rho. * $p < .01$, ** $p < .001$. Adapted from Zirbes et al., 2020.

Appendix H. Spearman correlations between ISPC and BFI scales

ISPC Scale	BFI Trait				
	Neuroticism	Extraversion	Openness	Agreeableness	Conscientiousness
Poor Judgement	-.15	.30	.14	.29	-.12
Lack of Planning	-.15	.16	.03	-.08	-.35*
Perseverative Behavior	-.08	-.02	-.01	-.15	-.04
Lack of Initiative	.22	.03	-.02	-.34*	-.33*
Lack of Persistence	-.06	.03	-.10	-.07	-.30
Indecisiveness	.14	.09	-.08	-.04	-.10
Impulsivity	.09	.21	.14	.09	-.15
Insensitivity	-.01	-.01	-.21	-.13	-.05
Social Inappropriateness	.13	-.04	-.23	-.02	-.15
Inappropriate Affect	-.06	.04	-.05	.20	.05
Aggressive Behavior	-.16	-.07	.08	-.07	.18
Lack of Insight	.00	.03	-.06	.00	-.00
Apathy	.00	-.18	-.17	-.20	-.14
Unemotional	-.17	-.13	-.08	-.03	-.16
Social Withdrawal	-.10	-.37*	.09	-.10	-.03
Impatience	.05	.05	-.02	-.20	.07
Irritability	-.13	.01	.00	-.11	.13
Lability	-.06	.10	.17	-.08	-.18
Inflexibility	-.06	.11	.02	-.15	.15
Depression	.04	-.01	.20	-.01	-.29
Anxiety	.27	.20	-.05	-.13	.04
Dependency	.06	.04	-.02	-.06	-.03
Easily Overwhelmed	.16	.02	-.19	-.10	.03
Lack of Stamina	.09	-.08	-.05	-.24	-.19
Obsessiveness	-.12	-.03	.32	-.17	.13
Suspiciousness	.13	.05	.00	-.16	.12
<i>Type A Behavior</i>	-.08	-.24	-.01	.28	.23
<i>Vanity</i>	.24	.07	.02	-.18	-.10
<i>Frugality</i>	.12	-.02	-.04	.01	.03
<i>Manipulativeness</i>	-.00	.08	-.00	-.10	.09

Note. BFI = Big Five Inventory. Correlation coefficients were evaluated by Spearman's rho. * = $p < .01$. The low number of significant correlations likely reflects the lack of variance for most ISPC scales as this sample is healthy elderly. Accordingly, when there are significant or nearly significant correlations in the sample, these suggest relevance of those specific traits in an aging population. Adapted from Zirbes et al., 2020.

Appendix I. Spearman correlations between ISPC and NEO-PI-R scales

ISPC Scale	NEO-PI-R Trait				
	Neuroticism	Extraversion	Openness	Agreeableness	Conscientiousness
Poor Judgement	.049	.130	.107	.048	-.258
Lack of Planning	.095	-.021	.139	.014	-.377*
Perseverative Behavior	-.007	-.039	-.059	-.102	.006
Lack of Initiative	.245	-.065	.208	-.198	-.226
Lack of Persistence	.057	-.061	-.052	.054	-.180
Indecisiveness	.166	.113	-.024	.160	-.028
Impulsivity	.125	.268	.136	-.172	-.107
Insensitivity	-.262	-.059	-.073	-.052	.081
Social Inappropriateness	.006	-.137	-.099	.014	-.099
Inappropriate Affect	.009	.060	.089	.142	-.021
Aggressive Behavior	-.230	.001	.117	-.036	.103
Lack of Insight	-.081	.146	-.047	-.128	-.062
Apathy	-.064	-.131	.085	-.248	-.036
Unemotional	-.075	-.218	.153	.046	-.140
Social Withdrawal	-.107	-.201	.267	.020	-.062
Impatience	-.062	-.091	.080	.043	.112
Irritability	-.262	-.070	-.047	-.008	.122
Lability	-.110	-.112	.178	.036	-.139
Inflexibility	-.334*	-.030	.059	-.167	.208
Depression	.083	-.251	.278	-.012	-.255
Anxiety	.204	.056	-.055	.007	.041
Dependency	.156	.129	-.046	-.174	-.096
Easily Overwhelmed	-.009	-.153	-.065	.036	.040
Lack of Stamina	.115	-.341*	.150	.074	-.168
Obsessiveness	-.035	.023	.131	.134	.090
Suspiciousness	.038	.115	.131	-.097	.060
<i>Type A Behavior</i>	-.271	-.078	-.224	.167	.158
<i>Vanity</i>	.121	.164	-.043	-.225	-.100
<i>Frugality</i>	.002	-.133	-.046	.094	-.006
<i>Manipulativeness</i>	-.034	.060	.192	.124	.034

Note. NEO = Revised NEO Personality Inventory (NEO). Neur = Neuroticism. Extr = Extraversion. Open = Openness to experience. Agree = Agreeableness. Consc = Conscientiousness. Correlation coefficients were evaluated by Spearman's rho. * = $p < .01$. The low number of significant correlations likely reflects the lack of variance for most ISPC scales as this sample is healthy elderly. Accordingly, when there are significant or nearly significant correlations in the sample, these suggest relevance of those specific traits in an aging population. Adapted from Zirbes et al., 2020.

Appendix J. Premorbid and current ISPC ratings and change in 234 patients with chronic focal lesions

ISPC Scale	BEFORE		NOW		Change	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Poor Judgement	2.6	1.3	3.8	1.7	1.2	1.7
Lack of Planning	2.6	1.4	3.8	1.8	1.2	1.8
Perseverative Behavior	2.7	1.2	3.8	1.5	1.1	1.7
Lack of Initiative	2.4	1.4	3.8	1.8	1.4	2.0
Lack of Persistence	2.4	1.3	3.5	1.6	1.2	1.7
Indecisiveness	2.8	1.3	4.1	1.7	1.3	1.8
Impulsivity	2.7	1.4	3.4	1.7	0.7	1.6
Insensitivity	2.8	1.4	3.5	1.7	0.7	1.6
Social Inappropriateness	2.4	1.3	3.4	1.8	1.0	1.5
Inappropriate Affect	2.5	1.1	3.2	1.4	0.7	1.3
Aggressive Behavior	2.5	1.4	2.7	1.4	0.2	1.3
Lack of Insight ^a	—	—	3.1	1.6	0.5	2.1
Apathy	2.8	1.1	3.7	1.4	0.9	1.6
Unemotional	3.2	1.4	3.2	1.7	0.0	1.9
Social Withdrawal	2.8	1.3	3.5	1.7	0.7	1.7
Impatience	3.1	1.4	3.8	1.8	0.7	1.7
Irritability	2.9	1.3	3.7	1.6	0.8	1.8
Lability	3.0	1.4	3.9	1.6	0.9	1.9
Inflexibility	3.3	1.5	4.0	1.6	0.7	1.7
Depression	2.6	1.3	2.6	1.5	1.0	1.8
Anxiety	2.9	1.4	3.9	1.7	1.0	1.8
Dependency	2.3	1.3	3.4	1.7	1.1	1.8
Easily Overwhelmed	2.8	1.4	4.2	1.8	1.5	2.1
Lack of Stamina	2.5	1.3	4.5	1.7	1.9	2.3
Obsessiveness	3.5	1.3	3.9	1.5	0.4	1.5
Suspiciousness	2.8	1.2	3.1	1.4	0.3	1.3
<i>Type A Behavior</i>	3.2	1.5	2.9	1.6	-0.4	1.8
<i>Vanity</i>	2.4	1.3	2.4	1.3	-0.6	1.1
<i>Frugality</i>	3.3	1.2	3.5	1.4	0.1	1.4
<i>Manipulativeness</i>	2.4	1.3	2.7	1.5	0.3	1.1

Note. Control scales are presented in italics. ^a*Lack of Insight* is not rated for the PREMORBID epoch (but is assumed to be “3” for the purpose of calculating change).

Appendix K. Stepwise regression of personality disturbances on neuropsychological impairment

Step entered	Variable ^a	R^2	B	SE B	β	Sig. β	Sig. model
Emotional/social personality disturbance							
<i>No neuropsychological variables entered into the equation.</i>							
Dysexecutive personality disturbance							
	(Constant)		-.129	.080			<.001
2	TMT-B impairment	.071	.671	.181	.266	<.001	
Hypoemotional personality disturbance							
<i>No neuropsychological variables entered into the equation.</i>							
Distressed							
	(Constant)		-.109	.081			.003
1	BDI: Depressed	.049	.552	.181	.221	.003	

Note. B = unstandardized regression coefficient; SE = standard error of B ; β = standardized regression coefficient. Impairment on the Wechsler tests was defined as an index score below 85 (i.e., below -1.5 SDs). Impairment on Trails B (seconds) was defined as a performance falling 1.5 SDs or more below the expected score, that is, below the 7th percentile according to demographically-adjusted norms (Heaton et al., 2004) applied to the individual patient. The Beck Depression Inventory-II is indicative of clinically significant depression with scores at or above a score of 13. Adapted from Barrash et al., 2022, Supplemental Material.

Appendix L. Contact information for the ISPC, adaptations and translations

The Iowa Scales of Personality Change and the Iowa Scales of Personality Development are available from the author (joseph-barrash@uiowa.edu).

The French version is available from Anne-Claude Juillerat Van Der Linden, PhD (Anne-Claude.Juillerat@unige.ch).

The German version is available from Caroline Kuhn, PhD (c.kuhn@mx.uni-saarland.de).

The Slovene version is available from Simon Brezovar, PhD (simon.brezovar@gmail.com).

There is not currently available contact information for the Spanish and Italian versions.