Article

Coupling of temperament with mental illness in four age groups

Psychological Reports
0(0) 1–26

DOI: 10.1177/0033294116639430
prx.sagepub.com

Irina Trofimova
Department of Psychiatry and Behavioral Neurosciences, Collective Intelligence Laboratory, McMaster University, Ontario, Canada

Julie Christiansen
School of Liberal Arts and Sciences, George Brown College, Toronto, Ontario, Canada

Abstract

Studies of temperament profiles in patients with mental disorders mostly focus on emotionality-related traits, although mental illness symptoms include emotional and nonemotional aspects of behavioral regulation. This study investigates relationships between 12 temperament traits (9 nonemotionality and 3 emotionality related) measured by the Structure of Temperament Questionnaire and four groups of clinical symptoms (depression, anxiety, antisociality, and dominance-mania) measured by the Personality Assessment Inventory. The study further examines age differences in relationships among clinical symptoms and temperament traits. Intake records of 335 outpatients and clients divided into four age groups (18–25, 26–45, 46–65, and 66–85) showed no significant age differences on depression scales; however, the youngest group had significantly higher scores on Anxiety, Antisocial Behavior, Dominance, and Thought Disorders scales. Correlations between Personality Assessment Inventory and Structure of Temperament Questionnaire scales were consistent with *Diagnostic and Statistical Manual of Mental Disorders, 4th Edition*, descriptors showing strong concurrent validity. Several age differences on temperament scales are also reported. Results show the benefits of differentiation between physical, social-verbal, and mental aspects of activities, as well as differentiation between dynamical, orientational, and energetic aspects in studying mental illness and temperament.

Corresponding Author:
I. Trofimova, Department of Psychiatry and Behavioral Neurosciences, Collective Intelligence Laboratory, McMaster University, 92 Bowman Street, Hamilton, Ontario, Canada, L8S 2T6.
Email: iratrofimov@gmail.com

Keywords
Temperament, mental illness, age differences, Personality Assessment Inventory, Structure of Temperament Questionnaire

Introduction

The concept of temperament refers to the individual differences in biologically based systems of behavioral regulation (Derryberry & Rothbart, 1988; Kagan, 1966; Rusalov & Trofimova, 2007; Strelau, 1998; Zentner & Shiner, 2012). In line with the original theory of Hippocrates and Galen about chemical imbalance as a basis of temperament, modern studies in neurochemistry, psychiatry, and psychopharmacology have linked temperament traits such as impulsivity, sensation seeking, neuroticism, endurance, plasticity, sociability, etc., to brain neurotransmitter and hormonal systems (Clark, Watson, & Mineka, 1994; Cloninger, 1986, 2003; Depue & Morrone-Strupinsky, 2005; Panksepp, 1998; Trofimova, 2015a; Trofimova & Robbins, in press). Misbalance between neurotransmitter systems linked to temperament traits, i.e. dopamine, serotonin, norepinephrine, GABA, oxytocin, neuropeptides, and hormones, appears to be a factor in mental disorders, considering a massive body of research in neuropharmacology used in treatment of these disorders.[1]

In the light of possible common neurochemical etiology in temperament and mental disorders, it is reasonable to suggest that temperament may reflect predispositions to psychological disorders. It is also possible, however, that causal relationships go in the opposite direction: mental (and physical) illness may shift biological systems of behavioral regulation, resulting in development of traits such as impulsivity, neuroticism, low sociability, low energetic level, etc. The question may be posed after examining these opposing perspectives: what came first, temperament dispositions or mental illness? For this reason, it is appropriate to explore whether temperament traits are "coupled" with mental illness rather assuming the existence of or directionality of causal relationships.

The majority of studies investigating coupling of temperament with mental illness describe associations of emotionality-related traits of temperament (such as Neuroticism or Negative Affect) with anxiety and mood disorders. Anxiety disorders were associated with higher scores on Neuroticism/Negative Affect scales within Watson's Positive/Negative Affects model (Brown, 2007; Clark et al., 1994; Sellbom, Ben-Porath, & Bagby, 2008; Weinstock & Whisman, 2006), Mehrabian's model (Mehrabian, 1995), Cloninger's model (Temperament and Character Inventory [TCI]; Heath, Cloninger, & Martin, 1994), Trofimova's Functional Ensemble of Temperament (FET) model (Trofimova & Sulis, 2010, 2015a), Akiskal's model (Karam et al., 2010), and the five-factor model (Ball, Tennen, Poling, Kranzlen, & Rounsaville, 1999; Kotov, Gamez, & Schmidt, 2010; Watson & Naragon-Gainey, 2014; Weiss et al., 2009). Neuroticism, however, appeared to be high not just in anxiety

disorders but in many types of mental illness and therefore did not differentiate between mental disorders. For example, in addition to the association between high Neuroticism and anxiety disorders, Neuroticism/Negative Affect was also reported to have a significant positive correlation with depression (Ball et al., 1999; Karam et al., 2010; Sellbom et al., 2008; Trofimova & Sulis, 2015b, 2015c; Weinstock & Whisman, 2006) and personality disorders (Brown, Chorpita, & Barlow, 1998; Kotov et al., 2010). Patients with histrionic personality disorder and major depression (MD) also scored higher on the Harm Avoidance scale (similar to Neuroticism) in studies using Cloninger's TCI test (Cloninger, 1986; Farmer & Seeley, 2009; Kusunoki et al., 2001).

Such global coupling of the trait of Neuroticism with mental disorders shows that the scales measuring Neuroticism/Negative Affects in various temperament models may not be sufficient to differentiate between different types of diagnoses, such as mood, anxiety, or personality disorders. First, a focus only on emotionality-related aspects of mental illness leaves behind other functional aspects of behavioral regulation that can be compromised in mental illness, such as endurance, speed of integration of behavioral acts, and information processing. These nonemotional aspects are, however, important to consider in clinical practice as the majority of symptoms listed in the *Diagnostic and Statistical Manual of Mental Disorders, 5th Edition* (*DSM-V*)/International Classification of Diseases (ICD-10) classifications of mental disorders relate to them. Examples of such symptoms include fatigue, poor attention, memory deficits, sleep dysfunction, appetite changes, psychomotor retardation, agitation, restlessness, lethargy, and poor impulse control. Second, nonemotional aspects of behavior are more often presented in temperament/personality models as traits of Extraversion and Sensation/Novelty Seeking; however, these two traits also do not differentiate between key functional aspects of behavior. Studies using the five-factor model reported a decrease in extraversion in depression and an increase of extraversion in mania (Costa, Bagby, Herbst, & McCrae, 2005; Klein, Kotov, & Bufferd, 2011; Kotov et al., 2010; Watson & Naragon-Gainey, 2014).[2] At the same time, the trait of Extraversion also correlated (negatively) with generalized anxiety disorder (GAD; Watson & Naragon-Gainey, 2014), and Extraversion appeared to conflate several traits of different psychophysiological etiologies: impulsivity, sociability, physical endurance, and sensation seeking (see Trofimova, 2015a for review). Studies using Cloninger's TCI found reduced scores on the TCI Self-Directedness scale in both anxiety and depression (Cloninger, 1986; Hansenne et al., 1999; Heath et al., 1994; Marco, 2013; Mochcovitch, Nardi, & Cardosa, 2012; Nery et al., 2009; Pelissolo & Corruble, 2002). While these types of studies merged the traits, the current study seeks to consider the various traits separately.

The structure of Cloninger's TCI model has stronger differentiating power than models using Extraversion/Neuroticism or Positive/Negative Affects dimensions. As a result, studies with the TCI have found more associations

between symptoms of mental illness and temperament. Thus, patients with MD scored lower on cooperativeness scales and patients with histrionic personality disorder scored high on Novelty Seeking and Reward Dependence scales of the TCI (Cloninger, 1986; Farmer & Seeley, 2009; Kusunoki et al., 2001).

A carefully structured temperament model should reflect neurotransmitter imbalances within systems of behavioral regulation; in the presence of mental illness, these profiles should exhibit distinct patterns consistent with *DSM-V* symptoms. A systemic model or classification of mental illness should therefore (a) differentiate between components in sufficient detail to be able to map empirically observed symptoms of mental disorders; and (b) should have both emotionality (affect)-related and nonemotionality-related components reflecting main functional aspects of behavior. Both of these components are provided by the FET. The primary objective of the present study was to examine the differential power of the neurochemical model FET by examining relationships between the symptoms of major mental illnesses and temperament traits described by the model. The model is based on the research of Rusalov (1989, 1997; Rusalov & Trofimova, 2007). Based on his experiments in psychophysiology of temperament and on a century-long experimental tradition within differential psychophysiology (Gray, 1964; Pavlov, 1941; Strelau, 1998; Teplov & Nebylitzyn, 1963), Rusalov suggested that social-verbal, physical-motor, and mental aspects of behavior are regulated by different neurophysiological systems. Subsequently, this approach was integrated into the FET model.

The FET model assesses temperament traits as functional aspects of behavioral regulation in a 3×4 matrix (Table 1) and links these 12 temperament traits to interactions between groups of brain neurotransmitters (Rusalov & Trofimova, 2007; Trofimova, 2010b, 2010c, 2015a; Trofimova & Robbins, in press; Trofimova & Sulis, 2011). Moreover, the FET model differentiates between orientational, energetic, and dynamic (i.e. speed of integration of actions) aspects of behavior within each type of activities (i.e. physical, social-verbal, or mental).

Table 1. The 12 Scales of the Functional Ensemble of Temperament model implemented in the Structure of Temperament Questionnaire.

Functional aspects of an action	Energetic aspects	Dynamical aspects	Behavioral orientation
Physical	Motor Endurance, ERM	Motor Tempo, TMM	. . . to sensations, SS
Social-verbal	Social Endurance, ERS	Social Tempo, TMS	. . . to others–Empathy, EMP
Mental	Intellectual Endurance, ERI	Plasticity, PL	. . . to probabilities, PRO
Emotionality	Self-confidence, SLF	Impulsivity, IMP	Neuroticism, NEU

SS: Sensation-Seeking scale;

Separation between traits related to social-verbal, motor-physical, and mental aspects of behavior within the FET model allows this model to be more compatible with symptoms described in DSM/ICD classifications of mental disorders and, therefore, facilitates the comparison of temperament profiles in people with such disorders. For example, similar to the noted above studies using the five-factor model, studies using the FET model found high Neuroticism and lower Social-verbal Endurance (equivalent to Extraversion) scores in patients suffering with MD, GAD, and comorbid depression and anxiety. If only these scales were used, the models would not have sufficient power for distinguishing between these major mental disorders.[3] Yet, in keeping with psychiatric observations of psychomotor retardation and lethargy associated with MD, Trofimova and Sulis (2010, 2015c) found that patients with MD but not GAD had significantly lower scores than a control group on the Physical Endurance and Physical Tempo scales of the FET model. At the same time, patients with comorbid MD and GAD differed from patients with MD, having significantly lower scores on the Plasticity, Intellectual Endurance, and Sensitivity to Probability scales of the FET-related test.

This illustrates the benefits of differentiation between the traits related to physical-motor versus mental (primarily regulated by the frontal lobes) aspects of behavior. Moreover, Trofimova and Sulis (2010, 2015b, 2015c) showed that patients with MD, and particularly comorbid MD and GAD, differed from healthy people in temperament traits related to speed of initiation of an action (specifically lower scores on Plasticity and Tempo scales) and higher scores on Impulsivity. There were no significant differences, however, related to orientation aspects of behavior (Sensation Seeking and Empathy). This demonstrates the benefits of the differentiation between orientation and integration aspects of behavior offered within the FET framework. From this perspective, the 12 components of the FET model appear to be more sensitive in differentiating at least between these three types of mental disorders than the Positive/Negative Affects model or the five-factor model.

Previous studies of the differential power of the FET model in reflecting patterns of mental illness did not use comprehensive tests assessing a wide spectrum of mental illnesses and investigated only specific mental disorders (either MD or GAD, Trofimova and Sulis (2010, 2015a, 2015b, 2015c). The current study examined relationships between the temperament traits described within the FET model and scores on a test evaluating main 18 types of mental illness. Given possible common etiology between temperament and mental illness, and correspondence between FET structure and key functional aspects of behavior, the first hypothesis of the study was that FET structure is capable of reflecting the main symptoms of four types of mental disorders in correspondence to the DSM/ICD symptoms of these disorders. This study used tests consisting of 18 clinical scales (Personality Assessment Inventory [PAI]) and 12 temperament scales (Structure of Temperament Questionnaire, Compact, and STQ-77).

To structure the analysis around possible associations between 18 clinical scales, they were clustered into a smaller number of groups. Grouping followed the structure of the *DSM-V* classification resulting in a total of four categories and therefore four parts of *the temperament-related hypothesis*:

1. PAI Depression-related scales were expected to have significant negative correlation with all Endurance- and Tempo-related scales of the STQ-77, in line with clinical observations of low energy and slowed activity of depressed patients. However, the temperament scales related to behavioral orientation (Sensation Seeking, Empathy, and Sensitivity to Probabilities) were not expected to correlate with the Depression-related scales of the PAI. If this component of the hypothesis is confirmed, it would show the benefits of differentiation between endurance, speed of integration, and orientation aspects of behavior, both in assessment of healthy psychological diversity and mental illness.
2. Anxiety-related scales of PAI were expected to have significant positive correlation with the STQ-77 scale of Neuroticism, negative correlations with Social Endurance (sociability), and a negative correlation with the STQ-77 scale of Intellectual Endurance (indicative of lower ability to concentrate, in line with symptoms of anxiety). In contrast to the Depression group of PAI scales, these scales were not expected to have significant correlations with the STQ-77 scales of Motor-physical Endurance and Tempo.
3. Antisocial scales of PAI were expected to have significant correlation with Sensation Seeking and Impulsivity scales of the STQ-77. In contrast to Depression and Anxiety groups of PAI scales, however, the scales of this group were not expected to correlate with other STQ-77 scales.
4. In contrast to other three groups of PAI scales, Dominance-Mania scales of PAI were expected to have significant positive correlation with the nonemotionality (i.e. activity and performance related) scales and with the Self-Confidence scale of the STQ-77.

As a part of the main objective of the study, a concurrent validity of the PAI and the STQ-77 implementing the FET model was examined.

Age may interact with mental illness and temperament

For many years, it was purported that temperament traits were stable or static over time and did not change once an individual passed the age of 30 (Eysenck & Eysenck, 1985); however, it appears that some aspects of temperament may continue to change as people age. Notably, people with a defined DSM diagnosis of antisocial personality disorder saw a reduction in the traits associated with it over a 12-year span, while those in schizoid, schizotypal, paranoid, obsessional, and avoidant groups experienced more pronounced symptoms over 12

years (Seivewright, Tyrer, & Johnson, 2002). In a correctional setting, it was also noted that the prevalence of antisocial traits declined with age, with noted reductions in impulsivity, social deviance, and antisocial behavior (Harpur & Hare, 1994). Further research has noted increases in obsessive compulsive and schizophrenic scales as patients aged, and significantly lower scores for anxiety over time, while there was no change in depression scales (Coolidge, Burns, Nathan, & Mull, 2008). In patients with a DSM diagnosis of Borderline Personality Disorder, it was noted that younger males scored higher for identity problems and self-harm than their older peers, and younger women too had higher scores for identity problems and affective instability than did the older women in the study (DeMoor, Distel, Trull, & Boomsma, 2009). Conversely, an increase in agreeableness was observed as people aged, as well as a decline in extraversion, and a significant decline in "energetic" characteristics (Field & Millsap, 1991). Some researchers suggested that there is a "middle age—middle sex" effect in leveling gender differences at least in sociability and physical endurance (Trofimova, 2013) as age progresses.

The secondary objective of this study was to investigate whether there are age differences in symptoms of mental illness as measured by the PAI and temperament profiles and the coupling between these two groups of characteristics. As age-related changes are linked to hormonal, endocrinal, and neuropeptidic changes, and as temperament traits are also based on neurochemical systems of behavioral regulation, it is reasonable to suggest that there might be age differences in correlations between temperament traits and the scales measuring mental illness. The *age-related hypothesis* of the study suggested that, considering neurochemical changes related to ageing, age differences in PAI scales measuring mental illness and in the scores on the STQ-77 scales measuring temperament traits will be evident.

Method

Sample

The intake records of 335 Canadian (M/F = 147/188) patients and healthy associates of Psychological Services, a private psychiatric and psychological practice (representing five different areas of Southern Ontario: Hamilton, Mississauga, Niagara Region, Haldimand-Norfolk, and Toronto) were examined for this study. Initial protocols (test results) were selected on the basis of validity scales of the PAI and the STQ. The sample was divided into four age groups: 17–24, 25–45, 46–65, and 66–85 years (Table 2). The practice has its own Late Life Memory Clinics operating under the Dunnville War Memorial Hospital (Dunnville, Ontario) that provide testing for dementia in clients and patients over 60 years of age. Only the records of clients without dementia were used.

Table 2. Information about the sample, $N = 335$, M/F = 147/188.

Age group	Range, age	Sex	*n*	*M* age	*SD* age
1	17–24	Total	65	19.12	2.45
1	17–24	Males	28	19.68	2.58
1	17–24	Females	37	18.70	2.30
2	25–45	Total	89	33.42	5.39
2	25–45	Males	42	33.62	5.41
2	25–45	Females	47	33.23	5.42
3	46–65	Total	95	56.29	5.22
3	46–64	Males	38	56.34	4.81
3	46–65	Females	57	56.19	5.53
4	66–85	Total	86	76.92	5.34
4	66–85	Males	39	76.87	5.38
4	67–85	Females	47	76.98	5.35

SD: Standard deviation.

Measures

The Personality Assessment Inventory. PAI (Morey, 1991/2007) is a self-administered assessment tool, providing information on critical clinical variables. The questionnaire is made up 344 items that comprise 22 scales: 4 validity scales—Inconsistency (INC), Infrequency (INF), Positive and Negative impression management (PIM, NIM); 11 clinical scales measure Somatic symptoms (SOM), Anxiety (ANX), Adjustment disorder (ARD), Depression (DEP), Mania (MAN), Paranoia (PAR), Schizophrenia (SCZ), Borderline personality (BOR), Antisocial (ANT), Alcohol problems (ALC) and Drug problems (DRG). Five scales indicate treatment considerations: Aggression (AGG), Suicidal ideation (SUI), Stress (STR), Non-support (NON), and Resistance to treatment (RXR). Finally, two interpersonal scales measure Dominance (DOM) and Warmth (WRM). Items were presented in a form of statements that should be assessed by respondents choosing four degrees of freedom: false, slightly true, mainly true, and very true. Scoring and processing were conducted using PAI software that did not allow viewing the raw data or associations of items by scales but provided total scores and *T* scores on each scale.

The Compact STQ-77. The STQ-77 (Rusalov & Trofimova, 2007; Trofimova, 2010a, 2010b, 2010c; Trofimova & Sulis, 2011)[4]consists of 77 statements, assigned to 12 temperament scales (six items each) and a validity scale (five items, addressing social desirability bias), which are listed below. Participants responded on a 4-point scale with response options 1 (*strongly disagree*), 2

(*disagree*), 3 (*agree*), and 4 (*strongly agree*). Protocols having scores of 15–20 on the validity scale were considered invalid as the respondents were likely to demonstrate a positive impression bias in their responses.

The temperament scales are organized in groups (Table 1). Scales 1–3 are the *Endurance group*, the scales of Motor, Social, and Intellectual Endurance, representing the ability of an individual to sustain prolonged physical (ERM, Cronbach's α for the current sample = .85), social (ERS, $\alpha = .75$), or mental/cognitive (ERI, $\alpha = .72$) activity. Scales 4–5 are the *Dynamics group*, the scales of Motor and Social Tempo (preferred speed of physical activity [TMM, $\alpha = .81$]), and speed of speech and reading and of other verbal activities (TMS, $\alpha = .70$), and the Plasticity scale, assessing the ability to adapt quickly to changes in situations, to change the program of action, and to shift between different tasks (PL, $\alpha = .74$). Scales 6–9 are the *Sensitivity group*: the Sensation-Seeking scale (SS, $\alpha = .78$), assessing the sensitivity of an individual to basic physical sensations and pleasures, a tendency for sensation-seeking and risk-taking behavior; the Empathy scale (EMP, $\alpha = .72$) assessing sensitivity of an individual to another person's emotional state, and the Sensitivity to Probabilities (PRO, $\alpha = .71$) scale assessing ability of an individual for adequate understanding and expectations of probable events, the efficient extraction, and processing of new knowledge. Scales 10–12 are the *Emotionality group*: the Self-confidence scale (SLF, $\alpha = .70$) measures the tendency to be optimistic and confident (sometimes overly optimistic) in one's own performance, to ignore other people's warnings and criticism; the Impulsivity scale (IMP, $\alpha = .73$) measures the speed of emotional reaction, a poor ability to control immediate impulses for actions; Neuroticism scale (NEU, $\alpha = .76$) measures the low tolerance of uncertainty with expectations of a negative outcome. Scale 13 is the Validity scale, measuring the social desirability tendency in answers. Results within the range of 15–20 on the Validity scale should be considered invalid, as the respondents are likely to demonstrate positive impression bias in their responses.

Procedure

All participants of this study signed consent for use of their intake forms for research purposes. Each participant completed the STQ and PAI. Patients and clients of Psychological Services completed these tests as a part of a diagnostic intake package, and volunteers completed only these tests and a brief demographic form.

Analysis

In accordance with the first, temperament-related hypothesis, descriptive statistics (means, *SD*, minimum and maximum values, α) for the STQ scales and Pearson product moment correlations between the scores of the PAI and the

STQ-77 scales were calculated. The results were analyzed in five above-noted groups of PAI scales measuring symptoms of Anxiety (scales ANX, ARD, STR, and PAR); Depression (DEP, SOM) SUI, and NON); Antisocial Behavior (ANT, ALC, DRG, AGG, and RTR); Dominance-sociability (MAN, DOM, and WRM); and Thought Disorders (SCZ and BOR).

In accordance to the age-related hypothesis, the means of four age groups on the PAI and STQ scales were submitted to one-way analysis of variance (ANOVA) to examine the effect of age (with age group as a parameter). *Post hoc* comparisons were performed using both Turkey and Fisher least square difference tests with an alpha level of .001.

Results

Coupling between temperament and mental illness

The summary of the correlational analysis is given in Table 3. All variables had normal distribution of scores.

The PAI Depression-related scales were significantly and negatively correlated with all three types of Endurance (physical, social, and intellectual). An especially strong correlation (−.47, $p < .001$) was found between two depression-related scales of PAI and Social-verbal Endurance scale of the STQ. Four dynamic scales (Motor Tempo, Social-verbal Tempo, Plasticity, and Impulsivity, all measuring speed of action initiation) also showed significant correlations with the Depression-related scales of the PAI. In line with previous reports (Perugi et al., 2011; Sellbom et al., 2008; Trofimova & Sulis, 2010, 2015b, 2015c), depression appears to be associated with either slower or more impulsive behavioral responses. Three scales of the PAI Depression group also negatively correlated with Self-Confidence and positively with the Neuroticism scale of the STQ-77; however, the correlations with orientation-related scales of the STQ were not significant at $p < .001$.

All four PAI Anxiety-related scales (ANX, ARD, PAR, and STR) were found to be positively correlated with the STQ scales of Neuroticism and Impulsivity and negatively with Social-verbal Endurance. Three of these scales (ANX, ARD, and PAR) also had statistically significant negative correlations with the Intellectual Endurance and Self-Confidence scales of the STQ.

In terms of the PAI scales related to antisocial behavior, most significant (and positive) correlations were found for the STQ scales of Sensation Seeking (correlating with ANT, DRG, and AGG) and Impulsivity (correlating with ANT, ALC, and AGG).

Within the Dominance-Mania group of PAI scales, the most statistically significant pattern of correlations emerged for the Dominance scale: it correlated positively with practically all performance (nonemotionality) scales of the STQ (except Empathy), i.e. with all three scales of Endurance, two scales of Tempo,

Table 3. Correlations of the STQ-77 scales with the *T* scores of the PAI scales, all ages together, $N = 335$.

	ERM	TMM	SS	ERS	TMS	EMP	ERI	PL	PRO	SLF	IMP	NEU
SOM	−.38	−.35		−.31	−.23		−.23	−.27			.28	.23
DEP	−.38	−.41		−.47	−.29		−.34	−.36		−.40	.36	.27
SUI				−.28				−.20		−.27	.32	.19
NON				−.40		−.21				−.25	.27	
ANX				−.30	−.19		−.22			−.28	.19	.21
ARD	−.30	−.25		−.37	−.22		−.24	−.34		−.38	.36	.38
PAR				−.30		−.18	−.21	−.20		−.21	.35	.18
STR				−.21				−.20			.31	.22
ANT		.27	.54		.31						.29	
ALC											.25	
DRG			.19									
AGG			.31								.46	
MAN		.23	.42		.29				.19	.19	.32	
RXR				.31			.23	.24		.26	−.37	−.27
DOM	.27	.30	.29	.42	.38		.28	.33	.19	.46		−.23
WRM	.25	.22		.57	.24	.35		.30		.37	−.20	
SCZ	−.25	−.21		−.48	−.21		−.31	−.33		−.31	.42	.25
BOR							−.22			−.18	.26	

Note: PAI: Personality Assessment Inventory; ERM: Motor Endurance; TMM: Motor Tempo; SS: Sensation-Seeking scale; ERS: Social Endurance; PRO: Sensitivity to Probabilities; TMS: Social Tempo; EMP: Empathy scale; ERI: Intellectual Endurance; PL: Plasticity; SLF: Self-confidence scale; IMP: Impulsivity scale; NEU: Neuroticism scale; STQ-77: Structure of Temperament Questionnaire; DEP: Depression; SOM: Somatic symptoms; SUI: Suicidal Ideation; NON: Non-support; ANX: Anxiety; ARD: Adjustment disorder; PAR: Paranoia; STR: Stress; ANT: Antisocial; ALC: Alcohol problems; DRG: Drug problems; RXR: Resistance to treatment; DOM: Dominance; AGG: Aggression; MAN: Mania; WRM: Warmth; SCZ: Schizophrenia; BOR: Borderline personality. Only the results with $p < .001$ are shown.

Plasticity, Sensation Seeking, and Sensitivity to Probabilities. It also had a significant negative correlation with the Self-Confidence scale. The WRM scale of the PAI also positively correlated with six nonemotionality scales of the STQ and with the Self-confidence scale, and the highest correlation was observed between the Warmth scale of PAI with the Social-verbal Endurance scale of the STQ.

While there were no specific expectations for the SZC scale of the PAI, two strong significant correlations were observed between this scale and the STQ

scales of Social Endurance and Impulsivity ($rs = -.48$ and $-.42$, respectively, $ps < .001$).

Age-related hypothesis

Age-related statistics for the PAI scales and the STQ scales are presented in Table 4. Factorial ANOVA processing using factors of age (with four age groups) and sex (two groups) showed significant differences for age on the multiple PAI scales, except on Somatization, Anxiety, Drug Addiction, Alcoholism, and Borderline Personality Disorder. The PAI scales related to antisocial behavior (ANT and AGG), dominance (DOM and MAN), as well as Paranoia showed a linear decline of the scores with age (Figure 1(a)), whereas the PAI

Table 4. Descriptive statistics, *M* (*SD*), and factorial ANOVA effect sizes (η^2) of the factor age for the *T* scores of the PAI scales.

PAI Scale	17–24 years ($n = 65$) *M* (*SD*)	25–45 years ($n = 88$) *M* (*SD*)	46–65 years ($n = 97$) *M* (*SD*)	66–85 years ($n = 85$) *M* (*SD*)	Age effect	
					F(3, 327)	η^2
Somatic concerns	58.72 (11.68)	62.03 (13.29)	64.99 (15.98)	61.80 (13.38)	2.13	.019
Depression	63.75 (14.30)	69.61 (17.69)	69.78 (19.55)	61.81 (13.68)	4.78†	.042
Suicidal ideation	62.25 (17.28)	57.80 (15.51)	59.16 (17.39)	51.94 (10.65)	5.55‡	.048
Nonsupport	60.12 (11.45)	59.35 (13.58)	57.88 (12.48)	51.24 (10.84)	9.46‡	.078
Anxiety	63.40 (11.81)	65.93 (14.44)	63.78 (15.43)	60.70 (45.36)	0.56	.006
Specific anxiety	62.32 (13.30)	62.92 (15.98)	60.26 (16.46)	52.98 (11.60)	9.25‡	.000
Paranoia	64.32 (10.94)	62.85 (13.74)	56.90 (13.13)	49.64 (10.40)	24.55‡	.182
Stress	57.85 (11.46)	61.44 (12.24)	60.04 (13.41)	49.78 (9.82)	16.97‡	.133
Antisocial features	62.74 (12.82)	54.34 (9.95)	49.67 (10.15)	45.88 (6.34)	45.17‡	.290
Alcohol problems	51.11 (10.35)	52.27 (10.66)	50.01 (11.50)	48.15 (9.03)	2.51	.022
Drug problems	54.68 (9.95)	55.89 (10.66)	53.18 (10.34)	51.73 (7.72)	3.21*	.028
Aggression	57.95 (11.58)	56.84 (14.06)	50.27 (11.91)	47.03 (9.58)	15.88‡	.126
Mania	59.05 (9.89)	53.53 (11.01)	50.02 (10.70)	43.13 (8.60)	34.08‡	.236
Treatment rejection	44.55 (9.05)	43.94 (10.09)	44.42 (12.56)	51.53 (9.55)	9.99‡	.083
Dominance	50.37 (9.99)	49.18 (10.42)	44.65 (12.07)	43.66 (9.17)	7.99‡	.067
Warmth	46.22 (9.79)	43.37 (11.82)	45.75 (11.74)	46.56 (10.92)	1.49	.013
Schizophrenia	62.05 (13.05)	63.81 (14.92)	61.52 (14.49)	55.35 (11.24)	6.38‡	.054
Borderline features	66.09 (12.44)	63.01 (12.45)	58.92 (13.11)	55.89 (54.95)	1.74	.015

Note: *SD*: standard deviation; ANOVA: analysis of variance; PAI: Personality Assessment Inventory. Zeros in η^2 values are omitted.
*$p < .05$. †$p < .01$. ‡$p < .001$.

scales that belong to other mental illness groups showed more complex patterns. The PAI scales of Depression, Stress, and Adjustment Disorder, as well as Schizophrenia had a trend for the U-shape changes between four age groups (Figure 1(b)). The scores on these scales were the highest for the group aged

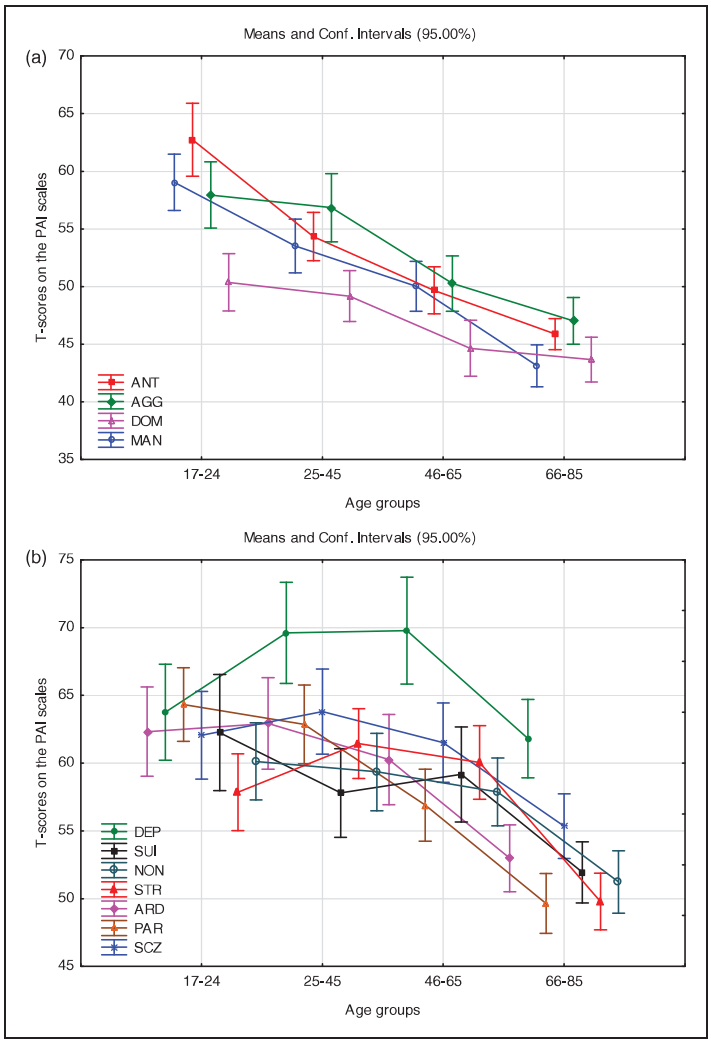

Figure 1. Age differences on the clinical PAI scales: (a) The scales of Antisocial Behavior, Aggression, Mania, and Dominance. (b) The scales of Depression group (DEP, SUI, and NON), anxiety group (STR, ARD, and PAR) and Schizophrenia. PAI: Personality Assessment Inventory; DEP: Depression; SUI: Suicidal Ideation; NON: Non-support; STR: Stress; ARD: Adjustment disorder; PAR: Paranoia.

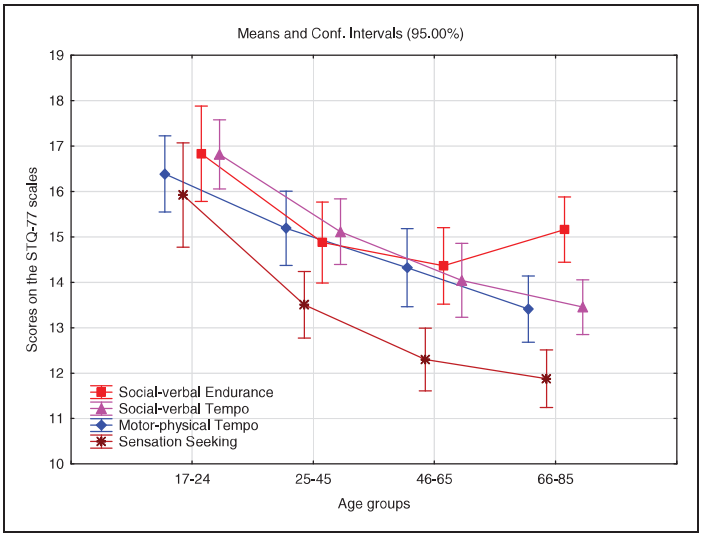

Figure 2. Significant age differences on the STQ scales. STQ: Structure of Temperament Questionnaire.

25–45 years but not for the youngest group, then also high at the age 46–65 years and then the lowest at the age 66–85 years.

Significant age effects were found on the STQ scales of Sensation Seeking, Social-verbal Endurance, and two scales of Tempo (Motor-physical Tempo and Social-verbal Tempo; Figure 2). [AQ1] The scores on the Tempo-related and Sensation-Seeking scales decreased linearly with age, whereas on the Social-verbal Endurance scale, the age differences showed an inverted U shape: Sociability was reported higher in the youngest group then decreased in the 25–45 and 46–65 year groups but then was higher in the eldest group.

Discussion

Table 5 summarizes the findings. The main hypothesis consisted of four components and suggested that the FET framework will allow differentiation between main four types of mental illness. This hypothesis was supported.

First of all, the pattern of correlations between the Depression group of PAI scales and the STQ scales showed a good convergence with the *DSM-V* symptoms of depression, such as physical fatigue (corresponding to low Motor-physical Endurance), social withdrawal (corresponding to low Social-verbal Endurance), poor concentration (corresponding to low Intellectual Endurance), and feeling of worthlessness (low Self-Confidence). In contrast to other temperament models, the STQ has scales related to the speed of

Table 5. A Summary of associations between the scales of the Personality Assessment Inventory and the Structure of Temperament Questionnaire.

High scores of this PAI scale . . .	. . . was associated with the scores on the STQ scales:	Age specifics
Depression group: SOM and DEP	Low: Endurance of three types, Motor and Social-verbal Tempos, Plasticity, Self-confidence. High: Impulsivity, Neuroticism	No significant age effects on PAI scales, but no association of DEP/SOM with ERM and ERI in Age 1. A decrease with age on the TMM, TMS, and SS scales of the STQ
Depression group: SUI and NON	Low: Social-verbal Endurance Self-confidence. High: Impulsivity	Only weak effects: SUI, NON scores are higher in Age 1
Anxiety group: ANX, ARD, STR (except TMM)	Low: Motor Endurance, Social-verbal Endurance, Motor Tempo, Plasticity, Self-confidence. High: Impulsivity, Neuroticism	Age 1 scores are significantly higher (especially in women) and Age 4 scores are lower (especially in men)
Antisocial: ANT, ALC (except TMS, EMP), AGG (except TMM)	Low: Empathy. High: Motor and Social-verbal Tempos, Sensation Seeking, Impulsivity	ALC: Age 2 scores are higher; ANT and AGG: highest in Age 1 and lowest in Age 4.
RXR	Low: Impulsivity, Neuroticism, Empathy. High: Social-verbal Endurance, Intellectual Endurance, Self-Confidence	Age 4 scores are significantly higher than in other age groups
Dominance group: DOM, MAN (except ERS and NEU), WRM (except ERM, PRO, and NEU)	Low: Neuroticism. High: Motor and Social-verbal Endurance, Motor and Social-verbal Tempos, Plasticity, Self-Confidence, Sensitivity to Probabilities	MAN scores are significantly higher in Age 1 and lower with age. DOM scores are lower in Age 3.
Thought disorders: SCZ, BOR	Low: Social-verbal Endurance, Intellectual Endurance, Self-Confidence. High: Sensation Seeking, Impulsivity, Neuroticism	Age 1 scores are significantly higher

Note: PAI: Personality Assessment Inventory; STQ: Structure of Temperament Questionnaire; SOM: Somatic symptoms; DEP: Depression; SS: Sensation-Seeking scale; TMM: Motor Tempo; TMS: Social Tempo; ERM: Motor Endurance; ERI: Intellectual Endurance; SS: Sensation-Seeking scale; SUI: Suicidal Ideation; NON: Non-support; ANX: Anxiety; ARD: Adjustment disorder; STR: Stress; ANT: Antisocial; ALC: Alcohol problems; TMS: Social Tempo; EMP: Empathy scale; AGG: Aggression; TMM: Motor Tempo; RXR: Resistance to treatment; DOM: Dominance; MAN: Mania; ERS: Social Endurance; NEU: Neuroticism scale; WRM: Warmth; PRO: Sensitivity to Probabilities; SCZ: Schizophrenia; BOR: Borderline personality.

integration of actions—and the results showed the benefits of having these scales for mapping the features of human diversity and mental illness into one framework. The *DSM-V* symptoms of depression include a psychomotor retardation, or slowdown, and in the current data, Somatization and Depression scales of the PAI had negative correlations with the Motor-Physical Tempo, Social-Verbal Tempo, and Plasticity of activities. Moreover, in contrast to the association of depression-related scales of the PAI with the STQ scales measuring endurance and speed of behavioral integration, there were no significant (at $p < .001$) correlations with the STQ-77 scales related to orientation aspects of behavior. This is an important finding in favor of the framework of the FET model's differentiation between three types of aspects in behavioral regulation (three columns depicted in Table 1). These results were also consistent with findings in clinical studies on depressed patients (Katainen, Raikkonen, & Keltikangas-Jarvinen, 1999; Polenick & Flora, 2013; Trofimova & Sulis, 2010, 2015b).

Second, and in line with the second component of the hypothesis, in contrast to the Depression group of the PAI scales, there were no significant correlations between the Motor-Physical Endurance and the PAI scales measuring Anxiety-related disorders, Antisocial Behavior, or Mania. Moreover, the correlations related to the Motor-physical Tempo showed the opposite pattern between Depression-Somatization, on one hand, and Antisocial behavior and Mania, on the other hand: slower Tempo associated with the first group and faster Tempo associated with the last two scales. In this sense, dynamical characteristics of behavior could be more carefully considered in developing diagnostic criteria and techniques.

Given the expectation that persons suffering from anxiety disorders should score higher on neuroticism (Clark et al., 1994), it was not surprising to find that the Anxiety scales of the PAI indeed had significant positive correlations with the NEU scale of the STQ-77. Neuroticism as described by Clark et al. (1994) is a stable but dimensional trait, characterized by "a temperamental sensitivity to negative stimuli." They noted that those displaying high neuroticism would experience a wide valence of negative moods: fear, anxiety, depression, guilt, anger, and low self-esteem, further identifying "non-mood" variables such as negative thought processes, poor appraisal of self and others, somatic complaints, and dissatisfaction in various areas of life (Clark et al., 1994). That higher anxiety was also associated with lower Self-Confidence and lower Social Endurance demonstrates the consistency of our findings with current theoretical models regarding nonaffective aspects of anxiety in relation to temperament.

Third, as expected, the PAI scales related to antisocial behavior (ANT, ALC, DRG, and AGG) showed high correlations with the STQ scales for Sensation Seeking and Impulsivity. In contrast to Depression and Anxiety groups of PAI scales, however, this group showed a remarkable absence of significant (at $p < .001$) correlations with other STQ-77 scales. The only exceptions were

significant correlations of Antisocial Behavior scale of the PAI with STQ scales of Motor-physical Tempo and Social-verbal Tempo. Such association is in line with common observations of high motor dexterity in thieves and the apparent sociability of sociopaths (Hare, 1999); however, more research investigating such associations is needed.

In line with the fourth part of the hypothesis, the Dominance scale of the PAI was found to have significant positive correlations with almost all nonemotionality scales of the STQ (i.e., the scales measuring endurance, speed of integration of actions, and orientation). It also had the highest positive correlation (out of all PAI scales) with the Self-Confidence scale of the STQ-77. Overall, the Self-Confidence scale of the STQ-77 appeared to differentiate between the four PAI scales in the Dominance-Mania group (MAN, RXR, DOM, and WRM) and the Depression, Anxiety, and Thought Disorders groups of PAI scales. The Dominance-Mania group had all significant (at $p < .001$) and positive correlations with the Self-Confidence scale and the other three groups had significant negative correlations (except the SOM and STR scales).

The hypothesis did not cover the scales related to thought disorders; however, the results showed that people reporting higher symptoms of schizophrenia had lower Social Endurance ($r = -.48$, $p < .001$). Such agreement with clinical observations suggests good content validity of the STQ temperament scales and its ability to recognize symptoms that are characteristic of thought disorders.

The number and strength of the correlations found in this study confirms the concurrent validity of STQ and PAI, and these are summarized in Table 6 (strongest relationships are noted).

Age differences in scores on clinical and temperament scales

Age differences are rarely taken into account in clinical studies. The age-related hypothesis suggested that there might be age-sensitive patterns in scales measuring clinical pathology and temperament. The results factorial ANOVA analysis of age and sex factors indeed showed significant (at $p < .001$) effects of age on 11 of the 18 clinical scales of the PAI. Such massive number of age effects demonstrates a significance of investigations of age differences in mental illness. Thus, the results suggest that the prevalence of symptoms associated with antisocial, dominance, and paranoid behavior might decline with age in a linear fashion. This is consistent with findings that people who display aggressive or antisocial tendencies may experience a "softening" of these tendencies as they get older (Rushton, Fulker, Neale, Nias, & Eysenck, 1986; Srivastava, John, Gosling, & Potter, 2003) and that there was an increase in agreeableness and altruism with age (Field & Millsap, 1991; Srivastava et al., 2003).

The results of this study showed a trend for the age groups of 25–45 years and 46–65 years to report higher Depression, Stress and Adjustment Disorder, and also Schizophrenia symptoms than the youngest (17–24 years) and the oldest

Table 6. Means, Standard Deviations (M_{SD}) and factorial ANOVA effect sizes (η^2) for the factor age on the scores of the STQ-77 scales.

FET/STQ-77 Scale	17–24 ($n = 65$) *M* (*SD*)	25–45 ($n = 88$) *M* (*SD*)	46–65 ($n = 97$) *M* (*SD*)	66–85 ($n = 85$) *M* (*SD*)	Effect of age	
					F(3, 327)	η^2
Motor Endurance	16.18 (4.47)	14.55 (4.22)	14.77 (4.64)	14.55 (3.80)	2.34	.021
Motor Tempo	16.38 (3.39)	15.19 (3.88)	14.32 (4.27)	13.41 (3.45)	8.39‡	.070
Sensation Seeking	15.92 (4.64)	13.51 (3.47)	12.30 (3.43)	11.88 (2.99)	19.04‡	.017
Social Endurance	16.83 (4.23)	14.88 (4.23)	14.36 (4.16)	15.16 (3.40)	4.82†	.042
Social Tempo	16.82 (3.07)	15.11 (3.43)	14.04 (4.04)	13.45 (2.84)	13.16‡	.107
Empathy	15.98 (4.19)	15.98 (3.40)	16.27 (3.77)	15.82 (3.30)	0.11	.001
Intellectual Endurance	14.85 (3.83)	15.30 (3.39)	14.59 (4.00)	14.17 (3.79)	1.25	.011
Plasticity	15.32 (3.03)	14.94 (3.53)	14.69 (3.64)	14.82 (2.88)	0.38	.003
Sensitivity to Probabilities	16.74 (3.64)	16.35 (2.95)	16.45 (3.72)	15.53 (3.70)	1.86	.016
Self-confidence	15.51 (3.80)	15.16 (3.69)	14.73 (3.82)	15.58 (3.29)	1.15	.010
Impulsivity	16.80 (3.71)	15.82 (4.02)	16.56 (4.29)	15.60 (3.49)	1.64	.015
Neuroticism	16.95 (3.67)	16.46 (3.44)	17.36 (3.43)	17.22 (3.38)	1.07	.010

Note: *SD*: standard deviation; ANOVA: analysis of variance; FET: Functional Ensemble of Temperament; STQ: Structure of Temperament Questionnaire. Zeros in η^2 values are omitted.
†$p < .01$. ‡$p < .001$.

groups (66–85 years). The discussion of the origin and clinical implications of such age differences is beyond the scope of this article. However, such age differences illustrate the importance of inclusion of age factors in studies of mental illness.

An interesting finding relates to the scores on the PAI Suicidal Ideation (PAI SUI) and Non-Support scales. These scores were high for youngest group; however, the highest suicide rates are noted in middle-aged Canadians (ages 40 to 59) as noted by Statistics Canada (Moscicki, 2001). One could speculate that Statistics Canada results reflect the rates of attempted and/or completed suicides but does not include cases of suicidal ideation, whereas the PAI SUI scale relates more to ideation rather than actions. In line with this argument, more recent research indicates that Millenials and Generation X-ers (comprising age groups 18–35 years and 36–49 years, respectively) experience greater stress than the older age groups (age 50+). They have greater difficulty with coping than their older peers, reflected in the fact that 34% of Millenials and 24% of Generation Xers report feeling isolated and lonely (i.e., lacking in support) compared to their elders (21% Boomers and 12% Matures; American Psychological Association, 2015). There are cultural differences, geographical

differences, and other factors such as socioeconomic status that may also come into play. Seeking to better understand the interplay of these variables is an object for further study, but age differences do appear to be important in research of mental disorders.

The findings of lower STQ scores on the Tempo-related scales and on the Sensation-Seeking scale in older groups, in comparison to younger groups, are in line with the current literature reporting a slowing of processes with age (Birren & Schaie, 2001) and a decrease in Sensation Seeking (Zuckerman, 1994). Intriguing are statistically significant differences between the four age groups in the means for sociability (Social-verbal Endurance): youngest and eldest group reporting higher sociability, in comparison to the participants aged 25–45 and 46–65 years. Age differences were not found for other types of endurance (i.e., Motor-physical and Intellectual). This highlights the benefits of differentiation between physical, social-verbal, and mental aspects of behavior in setting a framework for assessment of individual differences.

In conclusion, the main goal of this article was to determine whether the FET model with an extensive set of nonemotionality traits might provide better discrimination between four groupings of symptoms of mental disorders: Depression-related, Anxiety related, Antisocial behavior, and Dominance-Mania related. In order to assess this, correlations were examined between the 12 scales of a temperament test corresponding to the FET model and 18 clinical scales of the PAI. The results showed that the FET model's differentiation among 12 functional aspects of behavior helps to map specific symptoms of these mental disorders in line with the *DSM-V* descriptors with much more detail and concordance, in comparison to other temperament models. The results showed that Depression-related symptoms, in contrast to other three groups of mental illness symptoms, can be more accurately distinguished by considering the significant differences for the traits of Motor Endurance and Motor Tempo, with much lower values in Depression, and also by an absence of changes in orientational aspects of behavior in Depression. The group of PAI scales related to Antisocial Behavior was distinguished by having higher positive correlations with Sensation-Seeking scales, and the Dominance scale of the PAI differed from other diagnoses by having all-positive and significant correlations on practically all nonemotionality scales and also the Self-Confidence scale of the STQ-77.

In contrast to such specificity in correlations between clinical and temperament traits, the scales similar to the main scales of the five-factor model—Social-verbal Endurance (similar to the factor of Extraversion), Neuroticism, and Empathy (similar to Agreeableness) did not show much specificity. Neither did Neuroticism correlate (with four scales of Antisocial Behavior group) positively with 8 of the remaining 14 clinical scales of the PAI, differentiating only Dominance and Resistance to Treatment scales from the Depression and Anxiety groups of scales. Low social-verbal Endurance was associated with 9

of the 18 clinical scales. It showed no association on four scales related to Antisocial Behavior and contrasted only Dominance-related group but failed to differentiate between the Depression and Anxiety groups.

Moreover, the analysis of correlations between the PAI scales measuring mental illness and the STQ-77 temperament scales measuring formal dynamical properties of behavior showed age-sensitive patterns of both temperament traits and clinical pathology. A significant number of age differences reported in this study suggest that age is an important factor to consider in temperament and mental illness research. This analysis showed benefits of differentiation between endurance, dynamical, and orientational aspects of behavior as age differences that were found related to Tempo and Sensation-Seeking traits and also to Social-verbal Endurance. Knowing such patterns might help clinicians to deal with the diagnosis and treatment of described disorders more effectively.

Limitations and conclusion

The limitations of this study relate to the self-report nature of the STQ-77. The self-report format is standard in temperament research as well as in practice of clinical psychology and psychiatry. The STQ Validity scale and five PAI validity scales helped to minimize the effect of positive impression bias on data. The large sample size improves the power of the statistics. More research is needed to confirm the results reported here.

Overall, the results of this study suggest the benefits of differentiating between emotionality and nonemotionality-related traits and point to the utility of using a functional approach to both taxonomy of temperament and classification of mental disorders. The consistency between DSM symptoms and temperament traits within the FET model suggests that the FET matrix is a promising way to map functional aspects of behavior for the formal classification of symptoms of mental illnesses.

Acknowledgments

Authors are grateful to the administration of the Late Life Memory Clinic, Dunnville Memorial Hospital, and McMaster University for making this study possible.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

Notes

1. Research in neuropharmacology is represented in multiple journals specifically devoted to the role of neurotransmitters in mental illness and its treatment (e.g., *Neuropharmacology*, *Clinical Neuropharmacology*, *Journal of Neuroscience and Neuropharmacology*, etc.).
2. Some researchers consider the trait of extraversion to be trait of positive emotionality. The overlap between traits described within different temperament models is not the subject of this article. Here, we note that there is indeed an interlocking between emotionality and functional (nonemotionality) aspects of behavioral regulation. Such interlocking, however, does not mean that taxonomies of individual differences must be based only on emotionality aspects: after all, the regulation of human behavior is driven not only by moods. Moreover, the construct of Extraversion within various models includes nonemotional traits, such as sociability and sensation seeking. The FET model considers these aspects as separate temperament traits.
3. Statistical analysis of variance by itself is not a substitute for the analysis of how we can partition our variables (scales) that study for variance later. Most statistical analysis tends to use linear methods; and in these methods, indeed analysis of variance is relevant. However, if the variables are coupled in a nonlinear method, variance on the scales that are associated in a nonlinear fashion will be combined before the point of bifurcation and will differentiate between these scales only above the point of bifurcation. Moreover, feedback relationships between variables may cause their variance to be entangled as well. In this sense, statistical analysis is not a method of development of models (development stage should be based on the analysis of the experimental studies of real—not mathematical—or in this case, neurochemical systems) of behavioral regulation. Such studies demonstrate strong nonlinear, contingent, and feedback relationships between variables, and for this reason, the arguments from linear statistics might not be applicable.
4. The complete validation history can be found in Rusalov and Trofimova (2007), and a brief summary of validation results is provided in Trofimova (2010b, 2010c; Trofimova & Sulis, 2010).

References

American Psychological Association. (2015). *Stress in America: Paying with our health*. Retrieved from http://www.apa.org/news/press/releases/stress/2014/stress-report.pdf

Ball, S. A., Tennen, H., Poling, J. C., Kranzlen, H. R., & Rounsaville, B. J. (1999). Personality, temperament, and character dimensions and the DSM-IV personality disorders in substance abusers. *Journal of Abnormal Psychology*, *106*(4), 545–553.

Birren, J., & Schaie, W. (2001). *Handbook of the psychology of aging*. New York, NY: Academic Press.

Brown, T. A. (2007). Temporal course and structural relationships among dimensions of temperament and DSM-IV anxiety and mood disorder constructs. *Journal of Abnormal Psychology*, *116*(2), 313–328.

Brown, T. A., Chorpita, B. F., & Barlow, D. H. (1998). Structural relationships among dimensions of the DSM-IV anxiety and mood disorders and dimensions of negative affect, positive affect, and autonomic arousal. *Journal of Abnormal Psychology*, *107*(2), 179–192.

Clark, L. A., Watson, D., & Mineka, S. (1994). Temperament, personality, and the mood and anxiety disorders. *Journal of Abnormal Psychology*, *103*(1), 103–116.

Cloninger, C. R. (1986). A unified biosocial theory of personality and its role in the development of anxiety states. *Journal of Psychiatric Development*, *4*(3), 167–226.

Cloninger, C. R. (2003). Completing the psychobiological architecture of human personality development: Temperament, character, and coherence. In U. Staudinger & U. Lindenberger (Eds.), *Understanding human development: Dialogues with lifespan psychology* (pp. 159–181). Boston, MA: Kluwer.

Coolidge, F. L., Burns, E. M., Nathan, J. H., & Mull, C. E. (2008). Personality disorders in the elderly. *Clinical Gerontologist*, *12*(1), 41–55.

Costa, P. T., Bagby, R. M., Herbst, J. H., & McCrae, R. R. (2005). Personality self-reports are concurrently reliable and valid during acute depressive episodes. *Journal of Affective Disorders*, *89*, 45–55.

DeMoor, M. H. M., Distel, M. A., Trull, T. J., & Boomsma, D. I. (2009). Assessment of borderline personality features in population samples: Is the PAI-BOR features scale measurement invariant across sex and age? *Psychological Assessment*, *21*(1), 125–130.

Depue, R. A., & Morrone-Strupinsky, J. V. (2005). A neurobehavioural model of affiliate bonding: Implications for conceptualizing a human trait of affiliation. *Journal of Behavioural and Brain Science*, *28*(3), 313–350.

Derryberry, D., & Rothbart, M. K. (1988). Arousal, affect, and attention as components of temperament. *Journal of Personality and Social Psychology*, *55*, 958–966.

Eysenck, H. J., & Eysenck, M. W. (1985). *Personality and individual differences: A natural science approach*. New York, NY: Plenum Press.

Farmer, R. F., & Seeley, J. R. (2009). Temperament and character predictors of depressed mood over a 4-year interval. *Depression and Anxiety*, *26*(4), 371–381.

Field, D., & Millsap, R. E. (1991). Personality in advanced old age: Continuity or change? *Journal of Gerontology*, *46*(6), 299–308.

Gray, J. A. (1964). *Pavlov's typology: Recent theoretical and experimental developments from the laboratory of B.M. Teplov*. New York, NY: McMillan.

Hare, R. (1999). *Without conscience: The disturbing world of the psychopaths among us*. New York, NY: Guilford Press.

Hansenne, M., Reggers, J., Pinto, E., Kjiri, K., Ajamier, A., & Ansseau, M. (1999). Temperament and character inventory (TCI) and depression. *Journal of Psychiatric Research*, *33*(1), 31–36.

Harpur, T. J., & Hare, R. D. (1994). Assessment of psychopathy as a function of age. *Journal of Abnormal Psychology*, *103*(4), 604–609.

Heath, A. C., Cloninger, C., & Martin, N. G. (1994). Testing a model for the genetic structure of personality: A comparison of the personality systems of Cloninger and Eysenck. *Journal of Personality and Social Psychology*, *66*(4), 762–775.

Kagan, J. (1966). *Galen's prophecy: Temperament in human nature*. New York, NY: Basic Books.

Karam, E. G., Salamoun, M. M., Yeretzian, J. S., Neimneh, Z. N., Karam, A. N., Fayad, J., & Akiskal, H. S. (2010). The role of anxious and hyperthymic temperaments in mental disorders: A national epidemiologic study. *World Psychiatry*, *9*(2), 103–110.

Katainen, S., Raikkonen, K., & Keltikangas-Jarvinen, L. (1999). Adolescent temperament, perceived social support, and depressive tendencies as predictors of depressive tendencies in young adulthood. *European Journal of Personality*, *13*(3), 183–207.

Klein, W., Kotov, R., & Bufferd, S. J. (2011). Personality and depression: Explanatory models and review of the evidence. *Annual Review of Clinical Psychology*, *7*, 209–295.

Kotov, R., Gamez, W., & Schmidt, F. D. (2010). Linking "big" personality traits to anxiety, depressive and substance use disorders: A meta-analysis. *Psychological Bulletin*, *136*(5), 768–821.

Kusunoki, K., Sato, T., Taga, C., Yoshida, Y., Komori, K., Narita, T., & Ozaki, N. (2001). Low novelty-seeking differentiates obsessive-compulsive disorder from major depression. *Acta Psychiatrica Scandinavica*, *101*(5), 403–405.

Marco, L. (2013). Relationship between temperament and anxiety: A systematic review. *Mediterranean Journal of Clinical Psychology*, *1*(1), 1–25. doi:10.6092/2282-1619/2013.1.897

Mehrabian, A. (1995). Distinguishing depression and trait anxiety in terms of basic dimensions of temperament. *Imagination, Cognition and Personality*, *15*(2), 133–143.

Mochcovitch, M. D., Nardi, A. E., & Cardosa, A. (2012). Temperament and character dimension and their relationship to major depression and panic disorder. *Review of Brazilian Psiqiatrie*, *34*(2), 342–351.

Morey, L. C. (2007). *Personality assessment inventory professional manual*. Odessa, FL: Psychological Assessment Resources. Original work published in 1991.

Moscicki, E. K. (2001). Epidemiology of completed and attempted suicide: Toward a framework for prevention. Clinical Neuroscience Research*, 2001*, *1*, 310–323.

Nery, F. G., Hatch, J. P., Nicoletti, M. A., Monkul, E. S., Najt, P., Matsuo, K., & Soares, J. C. (2009). Temperament and character traits in major depressive disorder: Influence of mood state and recurrence of episodes. *Depression and Anxiety*, *26*(4), 382–388.

Panksepp, J. (1998). *Affective neuroscience: The foundations of human and animal emotions*. New York, NY: Oxford University Press.

Pavlov, I. P. (1941). *Lectures on conditioned reflexes, II. Types of the higher nervous activity, their interdependence with neuroses and psychoses and the physiological mechanism of neurotic and psychotic symptoms*. Translated by W. H. Gantt. New York, NY: International Publishers.

Pelissolo, A., & Corruble, E. (2002). Personality factors in depressive disorders: Contributions of the psychobiological model developed by Cloninger. *Encephale*, *28*(4), 363–373.

Perugi, G., Del Carlo, A., Benvenuti, M., Fornaro, M., Toni, C., Akiskal, K., & Akiskal, H. (2011). Impulsivity in anxiety disorder patients: Is it related to comorbid cyclothymia? *Journal of Affective Disorders*, *133*(3), 600–606. doi:10.1016/j.jad.2011.04.033

Polenick, C. A., & Flora, S. R. (2013). Behavioural activation for depression in older adults: Theoretical and practical considerations. *The Behaviour Analyst*, *36*(1), 35–55.

Rusalov, V. M. (1989). Motor and communicative aspects of human temperament: A new questionnaire of the structure of temperament. *Personality and Individual Differences*, *10*, 817–827.

Rusalov, V. M. (1997). *Questionnaire of formal-dynamical properties of individual. Manual*. Moscow: Russian Academy of sciences.

Rusalov, V. M., & Trofimova, I. N. (2007). *Structure of temperament and its measurement*. Toronto, Canada: Psychological Services Press.

Rushton, P. J., Fulker, D. W., Neale, M. C., Nias, D. K. B., & Eysenck, H. J. (1986). Altruism and aggression: The heritability of individual differences. *Journal of Personality and Social Psychology*, *50*(6), 1192–1198.

Sellbom, M., Ben-Porath, Y. S., & Bagby, R. M. (2008). On the hierarchical structure of mood and anxiety disorders: Confirmatory evidence and elaboration of a model of temperament markers. *Journal of Abnormal Psychology*, *117*(3), 576–590.

Seivewright, H., Tyrer, D., & Johnson, T. (2002). Change in personality status in neurotic disorders. *The Lancet*, *359*(9325), 2253–2254.

Srivastava, S., John, O. P., Gosling, S. D., & Potter, J. (2003). Development of personality in early and middle adulthood: Set like plaster or persistent change? *Journal of Personality and Social Psychology*, *84*, 5.

Strelau, J. (1998). *Temperament: A psychological perspective*. New York, NY: Plenum.

Teplov, B. M., & Nebylitzyn, V. D. (1963). Experimental study of properties of the nervous system in man. *Journal of Highest Nervous Activity*, *13*, 789–797.

Trofimova, I. (2010a). Exploration of the activity-specific model of temperament in four cultures. *International Journal of Psychology & Psychological Therapy*, *10*, 79–95.

Trofimova, I. (2010b). Questioning the general arousal models. *Open Behavioral Science and Psychology*, *4*(1), 1–8.

Trofimova, I. (2010c). An investigation into differences between the structure of temperament and the structure of personality. *American Journal of Psychology*, *123*(4), 467–480.

Trofimova, I. (2013). A study of the dynamics of sex differences in adulthood. *International Journal of Psychology*, *48*, 1230–1236. doi:10.1080/00207594.2012.756981

Trofimova, I. (2015a). The interlocking between functional aspects of activities and a neurochemical model of adult temperament. In M. C. Arnold (Ed.), *Temperaments: Individual differences, social and environmental influences and impact on quality of life*. New York, NY: Nova Science Publishers.

Trofimova, I., & Robbins, T. W. (in press). Temperament and arousal systems: A new synthesis of differential psychology and functional neurochemistry. *Neuroscience and Biobehavioral Reviews*. doi: 10.1016/j.neubiorev.2016.03.008

Trofimova, I., & Sulis, W. (2010). The lability of behaviour as a marker of comorbid depression and anxiety. *Advances in Bioscience and Biotechnology*, *1*, 190–199.

Trofimova, I., & Sulis, W. (2011). Is temperament activity-specific? Validation of the Structure of Temperament Questionnaire-Compact (STQ-77). *International Journal of Psychology and Psychological Therapy*, *11*(3), 389–400.

Trofimova, I., & Sulis, W. (2015a). Benefits of distinguishing between physical and social-verbal aspects of behaviour: An example of generalized anxiety. *Frontiers in Psychology*, *7*, 338.

Trofimova, I., & Sulis, W. (2015b). Universality of the coupling of temperament traits with depression across the adult age spectrum. Manuscript submitted for publication.

Trofimova, I., & Sulis, W. (2015c). There is more to mental illness than just negative affect: Comprehensive temperament profiles in depression and anxiety. Manuscript submitted for publication.

Watson, D., & Naragon-Gainey, K. (2014). Personality, emotions, and the emotional disorders. *Clinical Psychological Science*, *2*(4), 422–442. doi:10.1177/2167702614536162

Weinstock, L. M., & Whisman, M. A. (2006). Neuroticism as a common feature of the depressive and anxiety disorders: A test of the revised integrative hierarchical model in a national sample. *Journal of Abnormal Psychology*, *115*(1), 68–74.

Weiss, A., Sutin, A. R., Duberstein, P. R., Friedman, B., Bagby, R. M., & Costa, P. T. (2009). The personality domains and styles of the five-factor model are related to incident depression in Medicare recipients aged 65 to 100. *American Journal of Geriatric Psychiatry*, *17*/*7*, 591–601.

Zentner, M., & Shiner, R. (Eds). (2012). *Handbook of temperament*. New York, NY: Guilford Publications.

Zuckerman, M. (1994). *Behavioral expressions and biosocial bases of sensation seeking*. Cambridge, UK: Cambridge University Press.

Author Biographies

Irina Trofimova received her BSc in psychology from The Lomonosov Moscow State University, Department of Psychology in 1988, and obtained her PhD from the Laboratory of Differential Psychology and Psychophysiology, Institute of Psychology, Russian Academy of Sciences in 1995. She has published 7 books and 50 articles in the field of clinical psychology, differential and personality psychology, cognitive psychology, complex systems and modeling in psychology. She taught in several Moscow Universities till 1997 and then assumed her position as a senior researcher and an adjunct professor within the Collective Intelligence Lab, Department of Psychiatry and Behavioral Neurosciences, McMaster University, Canada. She also supervises thesis research of undergraduate students in Department of Psychology, McMaster University. Dr. Trofimova is also a licensed clinical psychologist with The Ontario College of Psychologists since 1999 and is a Co-Director of Psychological Services, a private practice in Hamilton, Ontario, Canada since 2004. She works with patients suffered from a wide range of mental illness and provides a spectrum of psychological assessment and treatment to adults. She also works as a psychologist in Late Life Memory Clinic under Dunnville Hospital, Ontario assessing elderly clients for possible dementia. Dr. Trofimova is a member of the American Psychological Association, the Association for Psychological Science, the Canadian Psychological Association, the College of Psychologists of Ontario and several international professional associations. She is also an associate member of the Canadian Psychiatric Association. She has been practicing clinical psychology since 1988, including practicing in Ontario since 1998. Her areas of expertise are temperament, personality, psychosemantics, psychometrics of psychological tests, and evolutionary and cognitive psychology. The detailed C.V. of Dr. Trofimova can be found at: http://www.fhs.mcmaster.ca/cilab/ira/ira.html

Julie Christiansen is adjunct faculty at Toronto's George Brown College in the School of Liberal Arts and Sciences since 2010. Ms. Christiansen holds her MA in counselling psychology from Yorkville University and has published several books relating to anger, bullying, and stress management including: *Bullying is Not a Game: A Parents' Survival Guide*, *Anger Solutions by the Book*, *When the Last Straw Falls: 30 Ways to Keep Stress from Breaking Your Back, Anger Solutions: Proven Strategies for Effectively Resolving Anger*, and *Getting Past Your Past*. Ms. Christiansen is also a registered psychotherapist in private practice in the Region of Niagara and practices counseling for about 15 years. Her areas of expertise are stress, anger management, bullying, mental health, and clinical psychology.