UNIVERSIDADE FEDERAL DO RIO GRANDE DO SUL
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TEMPERAMENTO AFETIVO E EMOCIONAL: DESENVOLVIMENTO TEÓRICO, MENSURAÇÃO E ASSOCIAÇÃO COM RITMOS CIRCADIANOS

GUSTAVO DE LIMA OTTONI

Orientador: Prof. Diogo Rizzato Lara

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RESUMO

(Gustavo de Lima Ottoni; TEMPERAMENTO AFETIVO E EMOCIONAL: DESENVOLVIMENTO TEÓRICO, MENSURAÇÃO E ASSOCIAÇÃO COM RITMOS CIRCADIANOS) As atuais classificações nosológicas em psiquiatria são baseadas em um modelo categorial e fragmentador da atividade mental. Essa abordagem inflaciona a presença de comorbidades, não explica como uma mesma classe de medicações pode ser eficaz em diferentes transtornos, não oferece parâmetros de saúde mental e dificulta a interação com outras áreas como a psicologia e as neurociências. Por outro lado, há evidências de que o temperamento e os traços de personalidade individuais predispõem aos transtornos psiquiátricos manifestados e contribuem para sua alta recorrência e cronicidade. Nesse contexto, foi proposto o modelo de temperamento baseado em traços de Medo e Raiva (Lara e Akiskal, 2006; Lara et al., 2006). Focado em traços emocionais e afetivos, com base em conhecimentos gerados das neurociências, da psicologia e da psicofarmacologia, esse modelo se propõe a ser uma base coerente para o entendimento dos padrões de comorbidades psiquiátricas e das ações dos psicofármacos. Além da natureza emocional, há muitas evidências de alterações em ritmos circadianos entre os acometidos por transtornos mentais, com uma clara tendência a um atraso em seus relógios biológicos internos.

Na primeira parte desta tese, a partir do embasamento em diversos modelos de temperamento e personalidade, incrementamos o Modelo de Temperamento baseado em Medo e Raiva, rebatizado como Modelo de Temperamento Afetivo e Emocional (*Affective and Emotional Composite Temperament;* AFECT). A seguir, apresentamos a validação da primeira versão

da escala para avaliação do modelo (*Combined Emotional and Affective Temperament Scale*; CEATS) em uma amostra com alta prevalência de transtornos psiquiátricos e a validação da segunda e atual versão dessa escala, agora com o nome de *Affective and Emotional Composite Temperament Scale* (AFECTS).

O modelo AFECT propõe que o substrato emocional básico humano funcione como um sistema composto pelas seguintes dimensões: Ativação, Inibição, Sensibilidade, *Coping* e Controle (AIS2C *system*). Esse sistema é baseado no princípio de que a Ativação (Vontade e Raiva) e a Inibição (Medo e Cautela) são os vetores emocionais básicos. A forma como esse sistema reage ao ambiente é determinada pelas dimensões de Sensibilidade e *Coping.* Por último, o Controle monitora o ambiente e faz os ajustes necessários na ativação e inibição. De acordo com a interação dessas dimensões emocionais básicas, um temperamento afetivo resulta em uma matriz tipológica. São propostos 12 temperamentos afetivos: depressivo, ansioso, apático, obsessivo, ciclotímico, disfórico, volátil, eutímico, irritável, desinibido, hipertímico e eufórico, que se aproximam ou distanciam na matriz conforme seus sistemas emocionais básicos.

Tanto a CEATS quanto a AFECTS apresentaram boa qualidade psicométrica. Apresentaram alto índice de consistência interna e os perfis emocionais esperados para cada temperamento afetivo. Os temperamentos afetivos propostos compreendem os principais padrões afetivos existentes na população (97 a 99% das pessoas se identificaram com pelo menos um desses temperamentos). Ambas as escalas avaliam as dimensões emocionais de maneira quantitativa, enquanto os temperamentos afetivos são mensurados

tanto quantitativa quanto qualitativamente. Além disso, no fim são avaliados os níveis de problemas e vantagens decorrentes do temperamento. Em relação à CEATS, a AFECTS discriminou mais adequadamente os fatores emocionais e recebeu o acréscimo de dois temperamentos emocionais (sensibilidade e *coping*) e 2 temperamentos afetivos (obsessivo e eufórico). A AFECTS apresenta ainda a mensuração dos seguintes fatores compostos: o índice de Funcionamento Emocional Global (*Global Emotional Functioning*; GEF); os índices de Internalização, de Externalização e de Instabilidade; e o escore de Adaptação.

Na segunda parte da tese, apresentamos uma escala bastante simples para avaliação de preferência circadiana baseada em energia (*Circadian Energy Scale*; CIRENS). Essa escala apresentou boa correlação (r = - 0.70) com o instrumento mais amplamente utilizado para análise de cronotipos, o *Morningness-Eveningness Questionnaire* (MEQ). Além disso, seus resultados quanto a parâmetros externos comprovadamente associados à preferência circadiana foram adequados.

Na associação dos temperamentos afetivo e emocional (avaliados pela CEATS) com parâmetros subjetivos de sono, encontramos que uma ativação emocional disfuncional (alta raiva com baixo controle e vontade) esteve relacionada a problemas específicos de sono. Um padrão de sono disfuncional foi encontrado naqueles com temperamento depressivo, ciclotímico ou volátil.

O estudo da associação entre os temperamentos afetivo e emocional (avaliados pela AFECTS) e a preferência circadiana, demonstrou que a dimensão emocional do Controle foi a mais correlacionada ao cronotipo. O

baixo Controle foi a principal diferença daqueles com cronotipo noturno em relação aos matutinos ou aos sem preferência circadiana. Os resultados ampliaram para o nível de temperamento as evidências de preferência pela noite entre os pacientes com transtornos bipolar e de déficit de atenção com hiperatividade. O temperamento se mostrou mais associado aos escores absolutos de energia do que aos cronotipos. Baixa Vontade, *Coping* e Controle, e alta Sensibilidade foram associados a um perfil de energia baixa e instável ao longo do dia. Nossos resultados sugerem que temperamento e ritmos circadianos estão associados e que a atenção a estes parâmetros pode fornecer importantes informações para uma avaliação global dos pacientes psiquiátricos.

ABSTRACT

(Gustavo de Lima Ottoni, AFFECTIVE AND EMOTIONAL TEMPERAMENT: THEORETICAL DEVELOPMENT, MEASUREMENT AND ASSOCIATION WITH CIRCADIAN RHYTHMS). Current nosological classifications in psychiatry are based on a categorical and fragmented model of mental functioning. This approach overestimates the presence of comorbidities, does not explain how the same drug class can be effective in different disorders, offers no parameters of mental health, and hinder the interaction with other areas such as psychology and neuroscience. Moreover, there is abundant evidence that temperament and personality traits predispose individuals to psychiatric disorders and contribute to their high recurrence and chronic evolution. In this context, the Fear and Anger model of temperament (Lara and Akiskal, 2006; Lara et al., 2006) was proposed. Focused on emotional and affective traits, based on knowledge from neurosciences, psychology and psychopharmacology, this model aims to be a coherent basis for understanding patterns of psychiatric comorbidity and actions of psychoactive drugs. Besides temperament, differences in circadian rhythms of those affected by mental disorders have been shown, with great tendency towards a delay in their internal biological clocks.

In the first section of this thesis, based on several models of temperament and personality, we revised the Fear and Anger model of temperament, renamed as the Affective and Emotional Composite Temperament (AFECT) model. Then, the validation study for the first version of the scale for emotional and affective temperaments assessment (Combined Emotional and Affective Temperament Scale; CEATS) in a sample with high prevalence of psychiatric disorders is presented. The validation study of the

second and current version of this scale, now under the name of Affective and Emotional Composite Temperament Scale (AFECTS), is shown at the end of this first section.

The AFECT model proposes that human basic emotional dimensions work as a system composed by Activation, Inhibition, Sensitivity, Coping and Control (AIS2C). This system is based on the principle that *Activation* (Volition and Anger) and *Inhibition* (Fear and Caution) are the two main emotional forces or 'vectors of the mind'. The way this system reacts to the environment is determined by the dimensions of Sensitivity and Coping. Finally, Control monitors the environment and makes the necessary adjustments in activation and inhibition. According to the interaction of these basic emotional dimensions, affective temperaments result in a typological matrix. Twelve affective temperaments are proposed: depressive, anxious, apathetic, obsessive, cyclothymic, dysphoric, volatile, euthymic, irritable, disinhibited, hyperthymic, and euphoric. Their basic emotional configurations influence their vicinities in the typological matrix.

Both CEATS and AFECTS had good psychometric properties. They showed high internal consistency and the expected emotional profiles for each affective temperament. Respectively for CEATS and AFECTS, 97 and 99% of the volunteers were able to ascribe to at least one proposed affective temperament. These scales assess the emotional dimensions quantitatively, whereas the affective temperaments are measured both quantitatively and qualitatively. They also evaluate personal problems and benefits related to temperament. Comparing to the CEATS, the AFECTS discriminated emotional factors better and presented two additional emotional dimensions (Sensitivity

and Coping) and 2 new affective temperaments (obsessive and euphoric). The AFECTS presents the following composite factors: the Global Emotional Functioning (GEF) index, the Internalization, Externalizing, and Instability indexes, and the Adaptation score.

In the second section of this thesis, we present a simple scale for assessing circadian preference based on energy (Circadian Energy Scale; CIRENS). This scale showed a moderalty high correlation (r = - 0.70) with the most widely used scale to chronotype assessment, the Morningness-Eveningness Questionnaire (MEQ). Moreover, the CIRENS showed the expected results regarding the evaluated external parameters.

Using CEATS as the temperament assessment tool, a dysfunctional emotional activation (high anger and low control and volition) was related to specific subjective sleep problems. Sleep problems were found particularly in those with depressive, cyclothymic or volatile temperament.

Assessed by the AFECTS, Control was the emotional dimension most correlated to diurnal preference. Low control was the main difference between evening types and other chronotypes. The results extended to the level of temperament the evening preference previously reported for patients with bipolar and attention deficit hyperactivity disorders. Temperaments were more associated with absolute energy levels than with chronotype. Low Volition, Coping and Control, and high Sensitivity were associated with a profile of low and unstable energy throughout the day. Our results suggest the association of temperament and circadian rhythms and that their assessment could provide valuable insights for a more global evaluation of psychiatric patients.

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Lista de Abreviaturas

ADD - *attention deficit disorder*

ADHD - *attention deficit hyperactivity disorder*

AFECT - *Affective and Emotional Composite Temperament*

AFECTS - *Affective and Emotional Composite Temperament Scale*

AIS2C – Activation, Inhibition, Sensitivity, Coping and Control

ASRI - *Adult Self-Report Inventory*

ASRS - *Adult ADHD Self-Report Scale*

ASSIST - *Alcohol, Smoking and Substance Involvement Screening Test*

BAS - behavioral activation system

BIS - behavioral inhibitory system

BRAINSTEP - *Brazilian Internet Study on Temperament and Psychiatry*

CANMAT - *Canadian Network for Mood and Anxiety Treatments*

CEATS - Combined Emotional and Affective Temperament Scale; CEATS

CFA - *confirmatory factor analysis*

CID - Classificação Internacional das Doenças

CIRENS - *Circadian Energy Scale*

DSM - *Diagnostic Statistical Manual*

DSQ-40 – *Defense Style Questionnaire*

EEG - eletroencefalograma

EFA - *exploratory factor analysis*

EMDR - Eye Movement Desensitization and Reprocessing

GABA - ácido gama-aminobutírico

GEF - *Global Emotional Functioning*

HCL-32 - *Hypomania Check-List*

ICD - International Classification of Diseases

KMO - Kaiser-Meyer-Olkin

MBTI - Myers-Briggs Type Indicator

MCTQ - *Munich Chronotype Questionnaire*

MEQ - *Morningness-Eveningness Questionnaire*

MSF - *mid-sleep on free days*

MSFsc - *MSF corrected for compensatory sleep on free days*

NSQ - núcleo supraquiasmático

OCD - obsessive compulsive disorder

PANAS - Positive and Negative Affect Scale REM - *rapid eyes movement*

PTSD - post-traumatic stress didorder

RMSEA - *Root Mean Square Error of Approximation*

SCID II - *Structured Clinical Interview for DSM Disorders II*

SCL90 - *Symptom Check-List*

SRMR - *Standardized Root Mean Square Residual*

SNC – sistema nervoso central

SSRI - selective serotonin reuptake inhibitor

TCI - *Temperament and Character Inventory*

TDAH - transtorno de déficit de atenção e hiperatividade

TEMPS-A - Temperament Evaluation of Memphis, Pisa, Paris and San Diego-autoquestionnaire version

Capítulo I

Introdução Geral

1.1 Transtorno Mental e Temperamento

As atuais classificações nosológicas em psiquiatria são baseadas em um modelo categorial e representadas pelos manuais diagnósticos DSM-IV (*Diagnostic Statistical Manual*, 4ª edição) e CID-10 (Classificação Internacional das Doenças, 10ª edição). Nessas abordagens, os transtornos de humor, comportamento, cognição e personalidade são concebidos como entidades distintas, apesar de poucas evidências a favor e a despeito de muitas evidências contrárias (Widiger e Samuel, 2005; Lara et al, 2006; Parker, 2008), sendo a principal delas a alta taxa de comorbidade. No modelo categorial, cada transtorno somente pode ser considerado presente ou ausente ("preenchem critérios"), mesmo que muitos quadros subliminares ou subsindrômicos sejam clinicamente importantes (Judd e Akiskal, 2002). Apesar da fenomenologia descritiva ter um importante papel nos sistemas diagnósticos, os avanços em neurociências, psicologia e psicofarmacologia não têm sido incorporados adequadamente na nosologia atual (Insel e Quirion, 2005; Parker, 2008; Möller, 2008). Além da alta comorbidade de transtornos e da falta de "zonas de raridade" entre eles (Kendell e Jablensky, 2003), outra crítica à validade do modelo categórico fragmentado provém do fato de uma mesma classe de medicação ser efetiva para muitos transtornos distintos (Lara e Souza, 2001; Insel e Frenton, 2005).

Os modelos atuais da psiquiatria enfocam os transtornos que a pessoa *tem* sem levar em conta como a pessoa *é*, apesar das evidências de que temperamento e traços de personalidade predispõem aos transtornos psiquiátricos (Cloninger, et al, 1993; Lara e Akiskal, 2006) e de que a

maioria dos transtornos psiquiátricos é recorrente e crônico (Insel e Frenton, 2005). A proposta de transtornos de personalidade vigente (como o eixo II do DSM-IV) não tem um racional claro para a sua concepção atual e se isenta de definir parâmetros de normalidade ou saúde da personalidade. Além disso, esses construtos são mais similares do que diferentes e seu ponto comum pode ser entendido a partir dos traços de personalidade (Krueger, 2005).

Tentativas de descrever transtornos de humor e comportamento como espectros dimensionais têm sido propostas, como o espectro bipolar (Akiskal & Mallya, 1987; Akiskal & Pinto, 1999) e o espectro obsessivo-compulsivo ou impulsivo-compulsivo (Hollander, 1998; Hollander & Rosen, 2001; McElroy, 1996). O modelo de espectro de humor de Akiskal tem como base os temperamentos afetivos (ciclotímico, hipertímico, irritável, depressivo e ansioso), um maior poder explicativo que o modelo puramente categorial e o mérito de fornecer uma tipologia de compreensão e uso clínico simplificado. No entanto, os temperamentos afetivos descritos são limitados conceitualmente aos transtornos de humor. O instrumento usado para avaliar esse construto é breve e de uso gratuito, mas limitado a essencialmente dois fatores (Akiskal et al, 2005), não possibilita uma orientação terapêutica clara e não apresenta referenciais de saúde mental.

Cloninger e colaboradores (1993) descreveram um modelo psicobiológico dimensional de temperamento e caráter em que cada dimensão do temperamento é caracterizada por um traço herdado relacionado às emoções básicas de medo (evitação de dano), raiva (busca de novidades), dependência (dependência de reforço emocional) e ambição

ou determinação (persistência). Esse modelo já contempla a personalidade normal e patológica, mas apresenta limitações para a aplicação clínica de rotina pela sua complexidade e por não ter sido criado para identificar indivíduos com risco para transtornos de humor, de cognição e do comportamento. Além disso, o instrumento auto-aplicável relacionado a esse modelo, o *Temperament and Character Inventory* (TCI), é muito extenso (240 questões) para se tornar uma ferramenta útil na rotina clínica e não é gratuito.

Outros modelos psicológicos de personalidade, como o dos Cinco Grandes Fatores, surgiram a partir de análises psicométricas de diversas características psicológicas e comportamentais, sem um construto teórico consistente (McAdams, 1992). Esse modelo não propõe relações claras com os transtornos psiquiátricos e sua linguagem é mais afinada com a psicologia do que com a psiquiatria. Além disso, os instrumentos que avaliam personalidade por esse modelo são relativamente longos e não são disponíveis gratuitamente. Provavelmente por todas essas razões esse modelo nunca tenha sido incorporado à clinica psiquiátrica e psicológica, apesar de existente e bem estudado há cerca de 20 anos.

1.2 Modelo de temperamento baseado em Medo e Raiva

Recentemente foi proposto um modelo de temperamento baseado em traços emocionais de medo e raiva (Lara e Akiskal, 2006; Lara et al, 2006) a partir do conhecimento gerado das neurociências, da psicologia e da psicofarmacologia. Basicamente, se buscou integrar as vantagens da abordagem emocional ao modelo de Kraepelin e Akiskal para

temperamentos afetivos. As dimensões de medo e raiva propostas nesse novo modelo podem variar em intensidade (alta, moderada e baixa) de tal forma que suas diversas e mais comuns combinações gerariam 9 temperamentos afetivos, sendo que 5 já haviam sido propostos por Kraepelin e Akiskal (ciclotímico, hipertímico, irritável, ansioso e depressivo) e outros 4 foram propostos por Lara et al. (2006) (lábil, apático, eutímico e hiperativo). Esse modelo é baseado no princípio de que sistemas operam com vetores de raiva/vontade e medo separados. Aplicando esse princípio para a mente, a vontade é a ativação "positiva" que se manifesta pela energia, entusiasmo, confiança, sensação de prazer e busca de objetivos. Quando contrariada ou bloqueada, a ativação se expressa "negativamente" como raiva, com agressividade, irritabilidade, impaciência, rancor e paranóia. Portanto, a ativação mental é concebida como vontade e raiva. Já a inibição é representada pelo medo e se expressa pela timidez, preocupação, cautela e congelamento frente ao perigo, enquanto a baixa inibição se manifesta como impulsividade, ousadia e reatividade frente ao perigo.

Este modelo propõe que essa concepção integrada de temperamento emocional e afetivo seja uma alternativa viável e útil tanto para o uso clínico em psiquiatria e psicologia como para a pesquisa científica em neurociência básica e clínica. São incorporadas as dimensões normais e patológicas com uma abordagem tanto dimensional quanto tipológica, fundamentando-se em funções cerebrais nos níveis emocional, comportamental, cognitivo, neuroquímico e anatômico. O objetivo é caracterizar o fenótipo mental e

comportamental de modo válido e fidedigno, combinando conhecimentos dessas áreas.

Este modelo de temperamento também fornece uma matriz sobre a qual os transtornos de humor, comportamento e personalidade podem se desenvolver. Esses transtornos podem ser concebidos a partir da natureza emocional e afetiva subjacente e em função dos seus pontos comuns, e não pelas suas diferenças. A Figura 1 representa a interação dessa matriz de temperamento emocional e afetivo com os principais transtornos de humor, comportamento e personalidade. A proposta apresentada nessa figura é baseada em estudos do temperamento e personalidade em pacientes psiquiátricos usando outros construtos (revisado em Lara et al, 2006).

A ação das medicações psicotrópicas como moduladores da raiva e do medo excessivos ou deficientes também é concebida nesse modelo de temperamento.

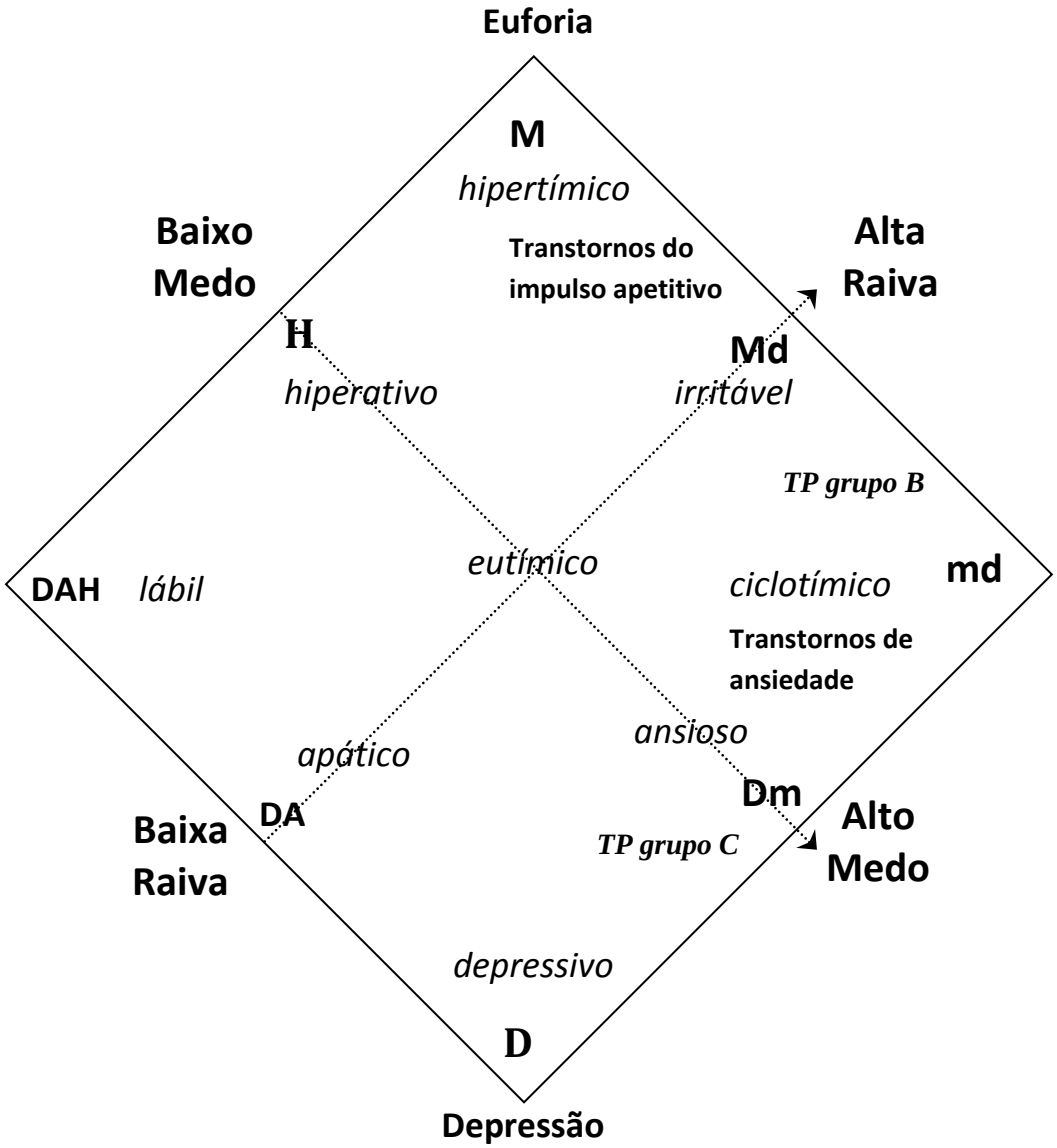

Figura 1. Matriz do temperamento e transtornos de humor, do comportamento e da personalidade em função dos traços de medo e raiva. Os temperamentos afetivos estão mostrados em itálico. Os transtornos de humor e de déficit de atenção estão expressos como siglas (M=mania, m=hipomania, D=depressão maior, d=depressão menor, DA= déficit de atenção, H=hiperatividade). Os transtornos de personalidade (TP) do grupo C são: dependente, obsessivo compulsivo e evitativo; os do grupo B são: borderline, narcisista, antisocial, histriônico, mas também se aplica ao paranóide. Os transtornos de ansiedade são: fobia social, transtorno do pânico, transtorno obsessivo-compulsivo, transtorno de estresse pós-traumático. Os transtornos de impulso apetitivo são: adição a álcool e drogas, compra compulsiva, jogo patológico, cleptomania, bulimia e outros. As setas bidirecionais mostram que os transtornos tendem a ocorrer em “faixas” ou “zonas”.

1.3 Estudos iniciais de desenvolvimento da escala de avaliação do temperamento afetivo e emocional

Para testar o modelo de temperamento baseado em medo e raiva, foi desenvolvida uma nova escala auto-aplicável, a *Combined Emotional and Affective Temperament Scale* (CEATS), já que escalas de outros modelos não contemplavam construtos da maneira proposta ou eram longas demais.

A validação dessa primeira versão da CEATS foi feita em uma amostra mista de 1007 voluntários (28% homens) composta por estudantes universitários que responderam a escala em papel e pela população geral que respondeu o instrumento pela internet (Lara et al., 2008).

No anexo 1 é apresentada a CEATS, composta por uma avaliação quantitativa dos temperamentos emocionais, e avaliações quantitativa e qualitativa dos temperamentos afetivos.

Na seção emocional da escala, quatro fatores com *Eingenvalue* > 1 explicaram 46% da variação. Naquele momento os fatores foram interpretados como *Drive, Control, Disinhibition-Fear* e *Anger.* Na seção afetiva, havia 10 temperamentos (depressivo, ansioso, ciclotímico, disfórico, apático, eutímico, irritável, lábil, desinibido e hipertímico). Os temperamentos afetivos da CEATS mais prevalentes naquela população foram o eutímico e o hipertímico (18-23%), seguidos pelo ciclotímico e o irritável (11-13%), o ansioso e o depressivo (8-9%) e o disfórico, o desinibido, o lábil e o apático (3-7%). Na avaliação dimensional dos temperamentos afetivos, 59% da amostra identificaram ao menos uma das opções de temperamento afetivo como “perfeita” para si, enquanto 36% identificaram ao menos uma “boa” descrição para o seu

temperamento afetivo. Na soma, 95% da população se identificaram com pelo menos um dos temperamentos afetivos propostos.

O capítulo III dessa tese mostra a validação da CEATS em uma amostra com alta prevalência de transtornos psiquiátricos. Concomitantemente com a evolução de nossa proposta de temperamento afetivo e emocional, mudanças foram necessárias na CEATS, que posteriormente foi rebatizada como *Affective and Emotional Composite Temperament Scale* (AFECTS). O estudo de validação da AFECTS está no capítulo IV dessa tese.

1.4 Ritmos circadianos

Visando a sobrevivência e a conservação de energia, os animais adaptaram seus períodos de atividade e descanso ao ciclo claro-escuro determinado pelo giro da Terra. Esses ritmos circadianos são alterações de processos biológicos que duram aproximadamente 24h (nos seres humanos 24,18 horas, segundo Czeisler el al., 1999). A ritmicidade circadiana é gerada de forma endógena por relógios internos, mas fortemente influenciada por sinalizadores ambientais, em especial a presença ou ausência de luz.

O relógio circadiano está localizado no núcleo supraquiasmático (NSQ), no hipotálamo anterior (Kafka et al., 1985). O trato retino-hipotalâmico conduz os estímulos luminosos, que atingem o NSQ através do glutamato, enquanto estímulos não-luminosos provêm de várias regiões cerebrais, mediados pela serotonina (Bunney e Bunney, 2000; Moore, 2002). Moduladores neuro-humorais também chegam ao NSQ, sendo a melatonina o principal (Liu et al., 1997). A sincronização para a transmissão dos ritmos do relógio para o resto

do organismo parece principalmente dependente do ácido gama-aminobutírico (GABA) (Liu e Reppert, 2000) e se dão em três direções principais, para o hipotálamo (projeções neuroendócrinas), para a medula espinhal e tronco cerebral (projeções autonômicas) e para neurônios intermediários do hipotálamo (Kalsbeek e Buijs, 2002). Entre os genes que representam os componentes do relógio biológico, os principais são: *Clock, Period e Cryptochrome* (Vitaterna et al, 1994; van der Horst et al., 1999; Vitaterna et al., 1999; Zheng et al., 1999) expressos em todo o sistema nervoso central (SNC), mas que realizam a regulação do ritmos circadianos através do NSQ.

O relógio circadiano provoca mudanças rítmicas da atividade dos sistemas neuroendócrinos humanos, determinando assim significativas diferenças entre o dia e a noite biológicos. O dia biológico se caracteriza por ausência de secreção de melatonina, aumento da temperatura corporal, redução da sonolência, redução da atividade teta do eletroencefalograma (EEG), redução da propensão a movimentos rápidos dos olhos (*rapid eyes movement* - REM) durante o sono, baixa produção de prolactina e níveis decrescentes de cortisol. Inversamente, a noite biológica apresenta aumento da secreção de melatonina, redução da temperatura corporal, aumento da sonolência, aumento da atividade teta do EEG e da predisposição ao sono REM, aumento da secreção de prolactina e níveis crescentes de cortisol (Wehr et al., 2001).

As formas de mensuração da preferência circadiana (cronotipo) clinicamente mais acessíveis são as escalas de auto-avaliação, dentre as quais a mais amplamente utilizada é o *Morningness-Eveningness Questionnaire* (MEQ) (Horne e Ostberg, 1976). Por ser uma escala relativamente longa (19 questões) e que necessita de ajuste dos escores de acordo com a idade

(Taillard et al., 2004), sua utilidade fica prejudicada para o uso na clínica e em estudos epidemiológicos ou de larga escala. Mais recentemente, foi desenvolvido o *Munich Chronotype Questionnaire* (MCTQ), que apresenta uma avaliação de cronotipo principalmente focada no horário de sono, na tentativa de ser uma mensuração mais relacionada às bases genéticas da organização temporal dos humanos (Roenneberg et al., 2003).

A ritmicidade circadiana possibilita que o organismo prepare-se, adapte-se e responda às mudanças regulares de ambiente. No ambiente clínico, presenciamos freqüentes relatos de grande variação do nível de energia circadiana. A percepção subjetiva de energia deve decorrer de capacidades fisiológicas e influencia as habilidades comportamentais do ser humano para melhor adaptar-se às exigências do ambiente. Portanto, decidimos investigar a possibilidade de que essas diferenças interindivíduais e variações intraindivíduo da energia circadiana fossem marcadores facilmente mensuráveis da preferência circadiana em humanos. Para isso, desenvolvemos uma escala composta de apenas três perguntas, a Escala de Energia Circadiana (*Circadian Energy Scale* - CIRENS), que será abordada no capítulo V da tese.

1.5 Desenvolvimento do sistema para coleta de dados

Para avaliarmos nossas hipóteses sobre temperamento afetivo e emocional seria preciso criar uma escala específica e validá-la. Inicialmente a coleta de dados para a validação da escala foi feita através da aplicação de questionários em papel para estudantes universitários. Para estudarmos o Modelo de Temperamento Afetivo e Emocional e suas relações com outros

modelos de temperamento, com transtornos psiquiátricos e doenças clínicas, e com uma ampla gama de variáveis psicológicas, comportamentais e familiares, seria necessária uma grande amostra. Para isso, elaboramos um sistema de coleta de dados pela internet.

A internet permite a coleta de grandes quantidades de dados a um custo relativamente baixo. A confiabilidade e a validade desses estudos dependem: i) da motivação das pessoas para participar, ii) do valor percebido pelo indivíduo para completar os instrumentos com atenção (por exemplo, para receber um retorno dos resultados), iii) de mecanismos para identificar baixa atenção dos participantes enquanto respondem (por exemplo, questões de validação inseridas nos instrumentos), iv) da garantia de anonimato aos participantes, o que permite respostas mais confiáveis em alguns domínios (por exemplo, sobre o uso de drogas e o comportamento sexual); v) da utilização de questionários e escalas validados; vi) de grandes amostras de diversos locais e níveis sócio-educacionais, particularmente com o acesso cada vez mais difundido da internet para a população. Com relevância, dados de pesquisa demonstraram que as pesquisas baseadas na internet têm mais vantagens do que desvantagens em relação aos estudos tradicionais que utilizam metodologias de auto-relatório (Meyerson e Tryon, 2003). No entanto, estes estudos não substituem totalmente os estudos epidemiológicos e não permitem a coleta de dados por entrevista direta ou por exames.

Então, foi criado o sistema para coleta de dados no site www.temperamento.com.br. Em sua primeira versão, o sistema foi dividido em 3 seções, cada uma exigindo cerca de 1h para ser concluída. Essas 3 seções eram constituídas pelos seguintes instrumentos:

- Seção demográfica e psicológica: dados demográficos; antecedentes psiquiátricos; a *Combined Emotional and Affective Temperament Scale* (CEATS) (Lara et al, 2008); o *Childhood Trauma Questionnaire* (Bernstein et al, 2003); história familiar de temperamento afetivo com base na CEATS; a CEATS correspondente aos 12 e 18 anos de idade; o *Alcohol, Smoking and Substance Involvement Screening Test* (ASSIST) para triagem de abuso de drogas (Newcombe et al, 2005);; o Inventário de Comportamento e Estilo, que avalia os diversos estilos de comportamento e hábitos, incluindo os relacionados aos ritmos circadianos. Nesse momento, uma versão inicial da *Affective and Emotional Combined Temperament Scale* (AFECTS) foi testada no sistema.

- Seção psiquiátrica: o *Adult Self-Report Inventory* (ASRI) para uma análise dimensional dos 19 transtornos psiquiátricos mais relevantes na atualidade (Gadow et al, 2004); a ASRI ao longo da vida, que investiga a presença destes 19 transtornos psiquiátricos ao longo da história pessoal dos voluntários; questionário sobre doenças clínicas comuns (diabetes, convulsões, enxaqueca ...); questionário de medicações psicotrópicas já utilizadas (eficácia e tolerabilidade percebidas); a *Adult ADHD Self-Report Scale* (ASRS) para rastrear transtorno de déficit de atenção e hiperatividade (TDAH) (Kessler et al, 2005); a *Hypomania Check-List* (HCL32), para avaliar os sintomas de hipomania (Angst et al, 2005); a *Symptom Check-List* (SCL90), para avaliar a presença de 8 grupos de sintomas psiquiátricos durante a última semana (Derogatis et al, 1976).

– Seção de personalidade: o *Temperament and Character Inventory* (TCI) (Cloninger et al, 1993), que é uma escala com 240 perguntas, considerado um

dos melhores questionários de auto-avaliação da personalidade atualmente disponíveis.

Ao final de cada uma das seções, os voluntários recebiam um retorno por escrito com base em seus resultados referentes a um instrumento de avaliação do perfil de temperamento (seção 1), à probabilidade de apresentarem algum transtorno psiquiátrico (seção 2) e ao seu perfil de personalidade (seção 3). Os indivíduos podiam completar as três seções do sistema em até 1 semana. Havia 8 questões de validação ao longo do sistema para se excluir aqueles que não respondessem com seriedade e atenção.

Com a criação da nova versão da Escala de Temperamento Afetivo e Emocional (*Affective and Emotional Composite Temperament Scale* - AFECTS) e a intenção de reduzir o tamanho do sistema e relacionar a escala a novos parâmetros, foi construída a sua segunda versão, ainda no site www.temperamento.com.br. Nessa versão o sistema é composto por 2 seções, cada uma demorando cerca de 1h para ser respondida.

- Seção demográfica e psicológica: dados demográficos; antecedentes psiquiátricos; a *Affective and Emotional Composite Temperament Scale* (AFECTS); história familiar de temperamento afetivo com base na AFECTS; o *Childhood Trauma Questionnaire* (Bernstein et al, 2003); o *Alcohol, Smoking and Substance Involvement Screening Test* (ASSIST) para triagem de abuso de drogas (Newcombe et al, 2005); o Questionário cognitivo de Young (Young et al., 2003); o *Defense Style Questionnaire-40* (Bond et al, 1983); a Escala de Estresse Percebido (Cohen et al, 1983); o Inventário de Comportamento e Estilo, que avalia os diversos estilos de comportamento e hábitos, incluindo os relacionados aos ritmos circadianos.

- Seção psiquiátrica: o *Adult Self-Report Inventory* (ASRI) (Gadow et al, 2004); a ASRI ao longo da vida; o questionário de medicações psicotrópicas já utilizadas (eficácia e tolerabilidade percebidas); o questionário sobre doenças clínicas e atitude com remédios; a *Adult ADHD Self-Report Scale* (ASRS) para rastrear transtorno de déficit de atenção e hiperatividade (TDAH) (Kessler et al, 2005); a *Hypomania Check-List* (HCL32), para avaliar os sintomas de hipomania (Angst et al, 2005); a *Symptom Check-List* (SCL90), para avaliar a presença de 8 grupos de sintomas psiquiátricos durante a última semana (Derogatis et al, 1976).

O voluntário segue dispondo de 1 semana para preencher o sistema a partir de iniciado. Ao final da 1ª seção é fornecido um retorno com o perfil de temperamento do indivíduo, e ao concluir a 2ª seção um relatório referente à probabilidade de apresentar ou ter apresentado algum transtorno psiquiátrico é gerado. Visando triar somente aqueles que responderam o sistema com seriedade e atenção, o sistema conta com 8 perguntas de validação.

1.6 Objetivos e organização dos trabalhos apresentados na tese

Esta tese está dividida em duas partes. Na primeira, propomos o Modelo de Temperamento Afetivo e Emocional (*Affective and Emotional Composite Temperament*; AFECT). São apresentados os princípios do modelo AFECT para saúde e doença mental; em um mapa dinâmico em que o temperamento assume papel central, uma organização de sintomas e patologias é proposta; finalmente, é feita a contextualização das principais classes psicofarmacologias e da psicoterapia no modelo de temperamento proposto. A seguir,

apresentamos estudos de validação da escala especificamente desenvolvida para a mensuração do temperamento com base no modelo AFECT. Inicialmente a primeira versão: *Combined Emotional and Affective Temperament Scale* (CEATS) em uma amostra de pacientes com alta prevalência de transtornos psiquiátricos; depois a segunda e atual versão da escala, renomeada como *Affective and Emotional Composite Temperament Scale* (AFECTS).

Na segunda parte da tese, apresentamos uma escala desenvolvida para a avaliação da preferência circadiana a partir do nível subjetivo de energia nos diferentes turnos do dia: a *Circadian Energy Scale* (CIRENS). Posteriormente, investigamos a associação do temperamento afetivo e emocional (avaliado pela CEATS) com parâmetros subjetivos de sono, e do temperamento afetivo e emocional (mensurado pela AFECTS) com preferência circadiana (mensurada pela CIRENS e por uma medida de cronotipo especificamente baseada em sono).

Finalmente, são discutidos os resultados mais relevantes da tese e apresentadas nossas conclusões finais.

1ª Parte

Temperamento

Capítulo II

Aspectos Históricos, Fundamentação e Proposta do Modelo de Temperamento Afetivo e Emocional (*Emotional and Affective Composite Temperament* - AFECT *model*)

The Affective and Emotional Composite Temperament (AFECT) model: a unifying approach for healthy and pathological mood, behavior, cognition and personality.

Diogo R. Lara[1], Luisa W. Bisol[1], Miriam G. Brunstein[2], Hudson Wander de Carvalho[3], Gustavo L. Ottoni[4]

1. Faculdade de Biociências e de Medicina, Pontifícia Universidade Católica do Rio Grande do Sul, Porto Alegre, Brazil
2. Departamento de Psiquiatria, Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil
3. Departamento de Psiquiatria, Universidade Federal de São Paulo, São Paulo, Brazil.
4. Departamento de Bioquímica, Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil

Corresponding author:

Diogo R. Lara

Faculdade de Biociências – PUCRS

Av. Ipiranga, 6681 – Pd12A

Porto Alegre, RS

Brazil

90619-900

FAX +55 51 33203612

drlara@pucrs.br

ABSTRACT

We have recently proposed a model based on emotional traits and affective temperaments for most psychiatric disorders. Here we review how bidimensional models for temperament have evolved since Hippocrates to recent research-based frameworks. We propose that emotional and affective temperament concepts can be integrated and form a common substrate for mood, behavior, personality and part of cognition. Since these mental functions are usually orchestrated in an integrative way, their separation in present nosology may be arbitrary and artificial, leading to excessive 'comorbidities'. As an alternative, a major part of mental health and psychiatric disorders could be understood from the standpoint of emotional temperament in a bidimensional and orthogonal model of emotional activation (expressed as volition and anger) and inhibition (expressed as fear and caution). The different combinations of activation and inhibition result in affective temperament types, namely depressive, anxious, apathetic, cyclothymic, dysphoric, irritable, volatile, disinhibited and hyperthymic. The model has been expanded herein to conceive i) sensitivity and coping, which reflect how the system reacts to the environment, particularly in stressful situations; ii) the control system, which monitors the environment and regulates activation and inhibition, with major implications especially for ADHD and OCD, and iii) to include the euphoric, dysphoric and obsessive affective temperaments. We also point out principles that may improve psychiatric diagnosis and a new approach to humoral medicine based on principles of self-regulated systems. Psychiatric disorders tend to occur in those with temperament extremes and in those whose life events leads to shifts in mental activation, inhibition, sensitivity, coping and/or

control. Consequently, therapeutic interventions for psychiatric disorders would attempt to restore optimum levels of these mental dimensions. In contrast to categorical inflationary models, this is a deflationary model, but both views can be used simultaneously and complementarily to improve both science and practice in psychiatry.

INTRODUCTION

In our recently proposed 'fear and anger model' (Lara et al., 2006; Lara and Akiskal, 2006), we presented a synthetic and integrative approach to normal and pathological mood, behavior and personality based on temperamental traits. Fear and anger/drive traits are the two orthogonal, independent but interacting emotional dimensions that form the basic framework of predisposition to most mental disorders and mental health. In a broader sense, this is a system with two independent dimensions of emotional activation (drive and anger) and inhibition (fear and caution), which produce the various affective states and temperaments according to their combinations. With this concept, we aimed to integrate the concepts of emotional temperament by Cloninger and affective temperaments by Kraepelin and Akiskal.

Both activation and inhibition traits have a normal distribution, according to the results using the first scale developed to test this model (Lara et al, 2008). This finding is in line with observations on novelty seeking and harm avoidance dimensions in previous studies (Cloninger et al, 1993). Conceptually, it is important to consider that lack of activation differs from excessive inhibition, and that excessive activation is distinct from deficient inhibition. These terms are often used interchangeably in current psychiatry, producing confusion and imprecision.

If activation and inhibition traits are broadly defined as excessive, moderate and deficient (to better reflect their normal distribution), rather than dividing them into only high and low as in many other models, their combinations would generate nine fundamental affective temperaments. The

probability of developing one or more psychiatric disorders and their prognosis would be related to the degree that activation and inhibition are excessive or deficient, with more pronounced clinical pictures if *both* vectors are altered in some way.

This bidimensional concept enables a better understanding of mixed/dysphoric mood and affective instability (conflict of excessive activation and inhibition, or activation expressed more as anger than as volition), which are in-between the mood extremes of mania and depression, but are clearly different from euthymia (moderation of activation and inhibition, with activation expressed as volition rather than anger). Since both euthymic and mixed/unstable configurations are intermediate state between mood extremes, at least two dimensions are required to explain this issue.

This orthogonal model can also be conceived as a basic map for the most common 'comorbidity' patterns and provides a framework to understand how mood/energy, behavior, personality and attention/cognition are modulated based mostly on these two inhibitory and activating emotional forces or vectors. Disorders related to excessive activation are mania, cluster B personality disorders and excessive behaviors (e.g., bulimia, compulsive buying, drug abuse, gambling) and to excessive inhibition are most anxiety disorders and cluster C personality disorders. Examples of disorders associated with low activation are depression and attention deficit and hyperactivity disorder (ADHD), especially the inattentive subtype, whereas low inhibition is linked with euphoric mania, ADHD (especially hyperactive/impulsive subtype), oppositional defiant disorder, and contributes to some excessive behaviors (for further details, see Lara et al, 2006).

This bidimensional model is also conceived at many levels, including neuroanatomical circuits, neurochemical modulation, genetics and thought/behavioral style. Activation is mostly modulated by dopamine and glutamate as the main neurotransmitter systems (probably also noradrenaline), and ventral striatum/nucleus accumbens and anterior cingulate neuroanatomically. Inhibition is related to serotonin and GABA, but also noradrenalin and vasopressin, with the amygdala and the periqueductal gray area as the main modulatory regions. Frontal areas and part of the anterior cingulate are involved in control, emotional regulation and coping, which will be further developed in this paper.

This model was also proposed to guide psychopharmacological interventions (drugs can increase or decrease activation, inhibition, or act simultaneously on both) and help understand the influential role of the environment (e.g. stress can produce learned fear, decrease volition and increase anger; emotional support can decrease fear and vulnerabilty; psychotherapy can also attenuate fear and anger/volition excesses and deficiencies).

Recent research on this and other models of temperament has led us to expand these concepts to increase explanatory power. Thus, the objectives of this article are: i) to review historical references based on bidimensional views of psychiatric disorders and personality, addressing the similarities and differences with the present model; ii) to include sensitivity and coping as emotional dimensions due to their strong interaction with basic emotions; iii) to include control as an important dimension to monitor the environment and to regulate activation and inhibition; iv) to include euphoric, dysphoric and

obsessive types as affective temperaments; v) to propose a unifying approach of temperament as a system involving emotion, affect and cognition, vi) to integrate these concepts in a more valid and useful model for clinical and research ends; and vii) to propose a common language to be used in basic and clinical neuroscience. The neurobiological bases of temperament is only superficially address in this article, but can be found elsewhere (Lara et al, 2006; Derryberry and Tucker, 2006).

HISTORICAL REMARKS ON BIDIMENSIONAL MODELS OF TEMPERAMENT AND MOOD

From Hippocrates and Galen to Kraepelin

The routes of universal bidimensional models can be tracked back to the traditional Yin and Yang concept of Taoism and dialectics in ancient Greece. In western medicine, Hippocrates proposed the humoral theory with the melancholic, phlegmatic, choleric and sanguine prototypes, inspired by Empedocles' elements that constitute the 'routes of matter': fire, water, earth and air. For Empedocles, these elements would arise from the interaction of the two basic forces of attraction and repulsion, which he poetically called 'love' and 'strife'. In humoral theory, the *two* basic features were temperature (hot or cold) and humidity (dry or wet). The interactions between them produce the following 2x2 combinations: choleric/fire is hot and dry; melancholic/earth is cold and dry; phlegmatic/water is cold and wet, and sanguine/air is hot and wet (Di Fiorino and Martinucci, 2007).

Hippocrates' theory was later developed in terms of temperament by Galen and further elaborated for the understanding of insanity in medieval Persian medicine. Specifically, Haly Abbas (al-Majusi, died 982–95 A.D.) stated that some emotions, such as anger, distress, fear, anxiety, and passionate love might be dangerous to one's health (Dols, 2006). Emotions were explained physiologically. For example, anger would be the boiling of the blood in the heart and the movement of the natural heat (activation in our model). "Grief may cause the innate heat to withdraw gradually into the body. If grief were excessive in those with a cold temperament, it extinguished the innate heat (…) Sometimes [melancholia] results from fear and grief, and the common symptoms of the melancholic are sadness, fear, and distrust." (Dols, 2006). Accordingly, in our model, pure depression derives from low activation and high inhibition.

For Avicenna (Ibn Sina – 980-1037 A.D.) the faculties that make animals superior to plants are shared by human beings and animals. Typically, they allow the human beings to be attracted to what they desire (volition or activation in our model), and to be repelled by anything harmful arousing fear or anger. Also, he stated that black bile (melancholia), mixed with yellow bile (choleric), produced agitation; when mixed with phlegm, caused laziness; that sadness, when mixed with anger, is mania (*apud* Dols, 2006). Avicenna considered the excess of grief or fear to be powerful causes of melancholia and treatment should aim at restoring the temperament. As can be seen, Avicenna advanced the concept of humours by elaborating on the results of their *combinations*. In our model, the fundamental unhealthy mood states are the product of activation (volition/anger) and/or inhibtion (fear and caution) imbalance: euphoric mania

results from high anger/drive and low fear; pure depression, from low volition and high fear; and mixed, dysphoric states are produced by the high anger and high fear combination. This concept includes depression with anger attacks (or sadness with anger for Avicenna), which would pertain to the bipolar spectrum. Euthymia, in contrast, results from activation expressed as volition rather than anger and moderate inhibition, more expressed as caution than as fear.

In a similar fashion, according to Algazel (al-Ghazali, 1058-1111 A.D.), when the main faculties of appetite, anger and intellect are moderate, harmonious and well-balanced, the virtues of temperance, courage, wisdom and justice arise. However, each of these faculties can be excessive or deficient, so various vicious characteristics can arise. For the Spanish physician Perquis, mania is rage and boldness (i.e. high activation and low inhibition), whereas depression is sadness and fear (i.e. low activation and high inhibition).

For Kraepelin (1921), in manic excitation, what predominates is the inconstancy of volition. Similarly, we posited that high volition and/or anger (activation) is the core of bipolar spectrum disorders, and that this excess can be intrinsically unstable. He also points out that during overwhelming joy, sudden choleric attacks emerge. In mania there is an excitation of volition and incoherent sequences of volitions, whereas depression is the reduction of volition, i.e., the impulses are not sufficient to overcome the inhibitions that oppose the act. Stuporous states are the total suppression of volition. In melancholia simplex, the patient is without courage and volition (low activation). Regarding mixed states, inhibition and excitation can separately attain partial dominance, and thus can coexist simultaneously in the same terrain. Thus, Kraepelin conceived excitation and inhibition separately and their different

combinations could contribute to the heterogeneity of mood disorder expressions. Furthermore, Kraepelin proposed four fundamental states, namely manic, irritable, cyclothymic and depressive, which are peculiar forms of psychic personality expressed in some individuals without psychiatric disorders, and in patients in the intervals between mood episodes.

Modern models of temperament and personality

Jung conceived that the mind followed basic Physics principles, e.g. libido would correspond to energy (Jacobi, 1942). He developed the theory of psychological types based on two axes: sensation-intuition and thinking-feeling. These functions could be manifested as introverted (oriented to their inner world) or extroverted (oriented to others and the external world) and one pole of each axis would be dominant. For the perceptive type, called 'sensation oriented', the stimulus is bound and attuned to the external reality and the 'intuitive' type blurs the details but apprehends the overall picture. For the 'thinking' type, data are evaluated according to logical principles and 'feeling' makes judgments based on values and relationships. Each individual has a preferred mode on each axis, so 8 basic types emerge, but everyone's psyche contains all types (Mohl and Weiner, 2000). The Myers-Briggs Type Indicator (MBTI) is the scale used to assess these types.

In the 60's Eysenck and colleagues (see Eysenck, 1997) developed a highly influential two-factor orthogonal model consisting of neuroticism (vs. emotional stability) and extraversion (vs. introversion). These two variables reflected levels of emotional instability and positive emotionality, respectively. Subsequent research led to the development of a third factor named

Psychoticism, which is better understood as a measure of disinhibition versus constraint. Eysenck's three-factor model (P.E.N. model) can be assessed via the Eysenck Personality Questionnaire.

Jeffrey Gray reformulated Eysenck's model and suggested a 45-degree shift in these axes. He proposed anxiety as the main constituent element of the behavioral inhibitory system (BIS) and impulsivity as the main element of the behavioral activation system (BAS) (Gray, 1973, Fowles, 2006). He also questioned the validity of the neuroticism concept, since it mixed anxiety and worry (inhibitory) with impulsivity and aggressive hostility (excitatory). Not surprisingly, the concept of neuroticism included mood instability, which according to our model arises most notably when these antagonistic emotional forces (activation and inhibition) coexist. Our interpretation is that the concept of neuroticism results from the interaction between independent emotional vectors, and is therefore a synthetic construct, which differs from Gray's perspective focusing on specific and independent vectors.

Gray (Gray, 1990; Pickering and Gray, 1999) proposed that the BIS is the avoidance system, responding to conditioned stimuli related to punishment and frustrative nonreward and to novel stimuli, meanwhile it suppresses operant ongoing behavior, increases attention to the environment and increments the level of nonspecific arousal. The BAS is the approach system and responds to conditioned stimuli related to positive and negative reinforcements, while motivates behavior towards particular and reinforcing goals. We consider that approach behavior results from the predominance of activation over inhibition, or the product of that interaction. The contrary is true for avoidance. In other words, low inhibition along with high activation leads to high approach behavior;

high inhibition and low activation leads to immobility, retraction or passive avoidance. Thus, high activation and high inhibition lead to ambivalence between immobility and approach, cautious approach, or even active avoidance. Low activation and low inhibition lead to ‘free floating’, volatility or indifference; finally, moderate activation and inhibition (or their balanced interaction) are associated with a stable and flexible position, or moderation (Figure 1). However, this is a categorical simplification in a 2x2 fashion. We understand that the interaction of both axes should be conceived dimensionally in all combinations and nuances, with changes over time according to the context. We also consider that the basic activation and inhibition systems are based on emotional grounds rather than being just behavioral.

Gray (1973) posited that excess inhibition is the core of anxiety disorders, and that high impulsivity and low anxiety is the basis of antisocial personality. Therefore, emotional stability would result from low anxiety and low impulsivity. Our activation-inhibition model is clearly divergent in this respect, since we posit that emotional stability arises from moderate activation (expressed as volition rather than anger) and moderate inhibition. Moreover, we propose that deficient inhibition (low anxiety) leads to reckless impulsivity, i.e. deficient fear and caution, which is present in euphoric mania, antisocial personality and ‘hyperactivity-impulsivity’ of ADHD (*disinhibition*, rather than *hyperactivation,* which is present in mania, but not particularly in ADHD). For Gray, impulsivity belongs to the BAS. We also distinguish appetitive *impulses* (excessive activation as excitation or volition) from reckless or disinhibited *impulsivity* (deficient inhibition, caution or constraint). In our model, reduced appetitive impulses belongs to the scope of deficient volition/anger (activation),

leading to apathy, reduced energy, and difficulty to maintain interest, to take decisions and to concentrate. This activation deficiency underlies depression and part of attention-concentration problems (in ADD or in combined ADHD). Thus, compared to Gray's model, our proposal includes a much wider range of mood, behavioral and personality disorders, as well as affective temperaments, from the combinations of activation and inhibition, and a clearly different view of emotional stability and euthymia.

Similarly to our activation dimension composed of volition and anger, Thayer (1978, 1989) proposed a model consisting of two bipolar activation dimensions: 'Energetic Arousal' with two opposite poles named Energy (formerly General Activation) and Tiredness (formerly Deactivation-Sleep), and 'Tense Arousal' with the two opposite poles Tension (formerly High Activation) and Calmness (formerly General Deactivation). Thayer considered arousal a basic element of mood and behavior in general and observed that each pole of the two activation dimensions is usually charged with either positive or negative 'hedonic tone'. Specifically, Energy and Calmness tend to be associated with positive hedonic tone, whereas Tension and Tiredness are associated with negative hedonic tone. The slight difference with our model is that we conceive anger rather than tension as the opposite pole of calmness. In our model tension can be more activated (agitation) or inhibited (worry), but mostly arises precisely from the *tension* between contrasting emotional forces (usually high activation x high inhibition). Tension is also a core feeling in dysphoria (as a mood state) and in the dysphoric affective temperament.

McCrae and Costa and (1987) have further developed Eysenck's concepts by including agreeableness, openness and conscientiousness for a

more complete model of personality. In fact, the accumulating data shows that the Big Five Factor model represents just an extension of Eysenck's thee-factor model. Neuroticism and extroversion in both models are essentially interchangeable. Moreover, psychoticism may be conceived as a higher-order factor that combines conscientiousness and agreeableness. Openness represents a real novelty in relation to Eysenck's model, but does show moderate positive correlations with extroversion (Markon et al, 2005).

In this line of reasoning, Digman (1997) proposed a higher-order bifactor structure for the Big Five based on the results from factor analyses conducted on 14 different data sets. The first factor, labeled α, accounted for the covariance among agreeableness, neuroticism and conscientiousness, while the second factor, labeled β, accounted for the covariance between extroversion and openness. The psychological meaning of Factor α could be understood as an impulse restrain factor (similar to our concept of inhibition and control) and factor β as a tendency to enhance experience and personal growth (similar to our concept of activation). Even though basic characteristics of inhibition and activation may be found distributed among the five factors (most prominently in extroversion and neuroticism, respectively) and more explicitly in Digman's α and β factors, respectively, we consider the five factors as synthetic measures.

Subsequently, other authors developed similar models. Watson and Clark (1992) proposed a three-factor structure model consisting of Negative Temperament, Positive Temperament and Disinhibition, while Tellegen (1985) architectured a structure consisting of Positive Emotionality (versus Anedonia), Negative Emotionality (versus Emotional Stability) and Constrain (versus

Disinhibition). Gough (1987) introduced higher-order vectors named Self-Realization, internality and Norm-Favoring in the reformulation of the California Personality Inventory. These vectors represent the low ends of Neuroticism, Extroversion and Psychoticism, respectively. Derrybery and Tucker (2006) also proposed a psychobiological perspective in which the interplay between defensive, appetitive and motivational/control systems is the core of personality and is highly influential in the development of psychopathology.

In contrast to the five-factor model (and Cloninger's model), ours does not address specifically the spheres of relationship with others (socialization). We agree that attachment (reward dependence in Cloninger's model), love, or agreeableness, are essential for personality models. Our temperament model in the present form focuses on the elementary structure and functioning of the person or the self, which is the basis of mood and general behavior. We posit that at least one of the emotional dimensions is affected in any psychiatric disorder. However, the inclusion of social and intellectual/existential planes will certainly allow for a better understanding of some personality disorders, autism and schizophrenia, but has been developed elsewhere (Lara, 2010).

In the late 80's, Cloninger proposed the tridimensional temperament model, which later evolved to the Psychobiological Model of Temperament and Character (Cloninger et al., 1993). For Cloninger, temperament is related to harm avoidance, novelty seeking, reward dependence and persistence. These dimensions are based on fear, anger, attachment and ambition, respectively, similar to Mira y Lopez's (1947) four giants of the soul, namely fear, anger, love and duty. Since the main dimensions of harm avoidance and novelty seeking are conceived similarly to Gray's model, our previous agreements and

divergences also apply. However, our concept of volition and coping are close to Cloninger's self-directedness that is ascribed to the character level. Thus, self-directedness is the well-balanced and healthy interaction between the main emotional forces, with volition and coping as the main components.

These different views have important implications at the conceptual level. For example, low self-directedness and high harm avoidance were the two predictors of relapse to depression (Cloninger et al, 2006) and self-directedness was found to be low in adults with ADHD (Anckarsäter et al, 2006). This would mean that individuals with depression or ADHD have deficits in character. However, we understand that these findings of low self-directedness are not necessarily a character problem, but the dysregulation of volition and coping, which are essential mental features. Volition is an expression of mental activation that requires good control to be of adaptive value. Anger arises mostly when volition is blocked, desire is frustrated or when something that is undesired happens. Anger would work as a strategy where an increase in energy (activation) could help to overcome the barriers that prevent the fulfillment of desire or to fight the contingencies and intrusions that support the undesired outcomes (e.g., the presence of opponents).

Akiskal and colleagues (1977) proposed the concept of affective temperaments based on Kraepelin's fundamental states (cyclothymic, manic, irritable and depressive) that represent premorbid traits or constitutional peculiarities. Akiskal also proposed the inclusion of the anxious temperament (Akiskal, 1998) and moved from the dysfunctional manic type towards a more adaptive concept of hyperthymic temperament. The Temperament Evaluation of Memphis, Pisa, Paris and San Diego-autoquestionnaire version (TEMPS-A)

was developed to evaluate these affective temperaments dimensionally (Akiskal et al, 2005). These types are frequently antecedents of mood disorders, e.g., hyperthymic and cyclothymic temperaments predispose to bipolar disorder types I and II, respectively. Although mostly strict to mood disorders, this model is clinically useful in psychiatry, with synthetic concepts used in a language that is in tune with psychiatric practice. According to this concept, around 20% of the population has a marked affective temperament, being depressive, cyclothymic and anxious temperament more frequent in women, and hyperthymic and irritable temperaments more prevalent among men (Rihmer et al, 2010).

Another two-factor model that has been extensively studied involves positive and negative affects, assessed with the Positive and Negative Affect Scale (PANAS), which can be used as a trait and a state evaluation (Watson et al, 1988). We interpret their concept of positive affect as related to volition, and negative affect mostly as traits of high fear and anger. We agree that these may be mostly negative affects, but they have a different nature compared to fear, have different neural substrates and respond differently to medication, e.g., D2 receptor blockers reduce hostility and aggression (and volition) but do not reduce fear (see Lara and Akiskal, 2006 for further details). However, similarly to our proposal, depression has been found to arise from high negative affect associated with low positive affect, whereas anxiety disorders are associated with high negative affect with normal or moderately positive affect (Clark, 2005). Two other dimensions that have been proposed to complete this model are disinhibition and anxiety (Clark, 2005). We strongly agree with Clark (2005) that temperament is a unifying concept behind personality and psychopathology and that it is best pictured dimensionally. However, prototypical affective

temperaments, which can be conceived both dimensionally and categorically, are also helpful, especially to include mood traits and states.

Based on studies in different developmental stages, Rothbart and colleagues (2000) conceived four main dimensions to explain temperament (fear, positive affect, anger-frustration and effortful control), resembling our basic construct of temperament, although there are differences in how each of these dimensions is conceived. Their major contribution was the inclusion of effortful control as playing a role in emotional self-regulation, similarly to conscientiousness in the five-factor model of personality.

Krueger and colleagues (see Krueger and Markon, 2006) examining patterns of diagnostic comorbidity among common mental disorders and psychometrical data in community-epidemiological samples proposed a hierarchic model consisting of two superordinate liabilities: internalizing – a general dimension of negative affect, mood instability and psychopathology related to phobia, anxiety and unipolar depression; and externalizing, a general dimension that accounts for unconstrained personality traits and disinhibited psychopathology related to substance use and antisocial behavior. Krueger et al (1998) suggested that internalizing and externalizing may be interpreted as "basic orientations towards the world" (p. 225), internalizing being conceived as a tendency to withdraw from the social-external world "weather by self referential thoughts pattern of major depressive episode or away from the world entirely, as in agoraphobia" (p.225). Meanwhile, externalizing would characterize people in conflict with society, weather by antisocial behavior or criminal lifestyle associated with substance misuse.

In the externalizing-internalizing spectrum model the concepts of inhibition and activation are accounted by internalizing and externalizing, respectively. As it is a model developed mainly to accommodate patterns of covariance among some selected types of psychopathology, its primary focus is on abnormal manifestations of inhibition and activation, leaving aside adaptative functions related to these constructs. Moreover, no attempt has been performed to understand ADHD, OCD, bipolar I and II disorders and borderline personality disorder, which would add significant complexity to the model because of their wide range of internalizing and externalizing expressions. In fact, despite not being detected, psychopathological data from the 12-15% of the population with this group of disorders probably have contributed to the +0.50 correlation between the main internalizing and externalizing factors. Disorders associated with social and developmental dysfunction such as autism and schizophrenia were also not included.

Our model advances in these two regards: first, the AFECT model intends to support clinicians to understand clinical phenomena whether pathological or normal; second, the AFECT model intends to circumscribe psychometrically and conceptually adaptative and pathological manifestations of combined emotional dimensions to understand a wider range of psychopathological expressions.

These models have been influential and thoroughly studied. However, none of them has been fully accepted or used in psychology and psychiatric settings, possibly because: i) the concepts can not be readily translated to clinical psychiatric practice (e.g. the five-factor model, some dimensions of the psychobiological model of temperament and character), or ii) the model is

limited to specific situations (e.g. the original 5 affective temperaments applied for mood disorders); iii) the instruments to measure are too long and not freely accessible; iv) the findings in psychopathology lack specificity for particular disorders and do not help guiding the treatment; and/or v) they lack a clear definition of mental health.

In the early 80's, these mind, temperament and personality models based on clinical observation and growing scientific grounds were somewhat overshadowed by the changes in DSM-III and ICD-9. Some of these traits were incorporated in the concept of personality disorder, which were treated apart from other psychiatric disorders (Axis I in DSM). Besides this axis distinction, the DSM applied purely categorical and descriptive strategies to classify mental illnesses (except for mental retardation) according to strict inclusion and exclusion criteria, starting a wealth of research with structured instruments reflecting its basic concepts. Psychiatry improved in terms of reliability of diagnosis as well as in the description and understanding of specific syndromes. This allowed a range of epidemiological, clinical and neurobiological studies. However, a large body of evidence has raised questions about many of the central assumptions and intentions of the DSM-III and DSM-IV (Hyman, 2010). Some of these debatable points are: i) the arbitrary distinction between Axis I and Axis II, ii) the longitudinal specificity and stability of diagnoses using such a categorical model (leading to high lifetime comorbidity); iii) the way to group disorders conceiving mood, behavior and personality disorders distinctively, as if they were separated and unrelated fields in the mind-brain (again leading to high comorbitidy) and iv) the assumption that traits can be bypassed and ignored as if they were not part of an individual's

mind-brain, leading to identical treatments for individuals presenting the same categorical disorder but different phenotypes (e.g. depression in someone with a cyclothymic or a depressive temperament) and neurobiological studies with a heterogenous group of subjects showing the "same" disorder. The lack of comprehension of how psychiatric disorders relate to each other and how they distort the basic mind function also narrow the view of how to approach them in the clinical setting. As a consequence, translational psychiatry is always at a high risk of getting "lost in translation", since the "languages" used by other fields, such as basic neuroscience, have totally different structures and concepts.

Another problem with this purely descriptive, analytical and categorical model is that it is inflationary, as can be noticed by the increasing number of diagnoses and subtypes in each new edition of diagnostic manuals. If not drastically reviewed, this inflationary process may lead DSM to be crushed by its own weight. Proposal of clusters (e.g. externalizing disorders) can be a substantial improvement for the field (Andrews et al, 2009), but the definition and underlying principles behind the cluster have to be clear and well founded. Theory can be very helpful to improve the conceptual design and provide a more solid meta-structure for a classificatory system.

In summary, many models and experts have described the basic functioning of the mind and mental disorders using two dimensions or two-factor models. A simple unidimensional model is clearly insufficient, since it does not resolve the paradox of the coexistence of theoretically opposing emotional states or conditions (mania and depression, impulsivity and compulsivity, externalizing and internalizing disorders, and many different mixtures between

them) without cancellation of one another. On the other hand, the challenge is not solved by using of a purely descriptive and categorical approach that lists hundreds of ‘distinct’ entities, excludes normality, conceives the mind in a fragmented way and fails to provide reasonable explanations for the occurrence of mental disorders. Although such limitations are mostly acknowledged, few alternatives have been clearly proposed. The use of endophenotypes can be fruitful to a certain level in research (Kendler and Neale, 2010), but their application and interpretation in the clinical setting would be complex and costly. However, endophenotypes and biological markers should be regarded only as complementary, since psychiatry is grounded on subjective first-person experiences (Kendler, 2005).

Thus, the Affective and Emotional Composite Temperament (AFECT) model is an attempt to keep the advantages and minimize the limitations of using dimensions or categories separately by integrating both approaches. The same applies to the combined use of traits and states. This approach can thus be regarded as an attempt to integrate emotions and affect with psychiatric disorders in a more comprehensive and rational way. We propose that the “language” of temperamental traits based on emotions and affect can bridge the fields of psychiatry, psychology and neuroscience (both basic and clinical). The use of a common system-based approach in these fields would lead to a more mature relationship to build interdisciplinary knowledge, reducing radically the need for “translation”. Temperament can also help reduce the artificial boundaries imposed by the arbitrary and controversial distinction between Axis I and II disorders in the DSM.

As we will further develop here, the AFECT model is generally coherent with and combines the proposals by Eysenck, Gray, Kraepelin/Akiskal, Costa & McCrae, Cloninger, Rothbart and Krueger & Markon. For this end, the AFECT model addresses both the emotional and affective temperament constructs in an integrative model. Emotional temperament is conceived in six dimensions (volition, anger, inhibition, sensitivity, coping and control, each one divided in two facets - Table 1) along with twelve affective temperaments (Table 2). Our goal was to create a model with clear definitions of mental health and dysfunction that can be easily applied in clinical practice, with apparent bridges with the most common psychiatric diagnosis, and to provide a short, valid, user-friendly and publicly available self-report instrument (AFECTS). We tried to overcome some inconsistencies from other dimensional trait models, keeping it as simple as possible without loosing explanatory power. Since activation and inhibition were not sufficient to adequately explain, differentiate and understand some clinical presentations (e.g. ADHD, OCD, borderline personality disorder), we expanded the model to include sensitivity, coping and control as new dimensions. The insights for their inclusion and how they are expressed in mental function were based on universal principles, preliminary data and our global interpretation of findings from the fields of neuroscience, psychology and psychiatry.

PRINCIPLES FOR THE AFECT MODEL FOR MENTAL HEALTH AND DISORDERS

It is conceptually impossible to have descriptive models that are atheoretical. In fact, any taxonomic model can be described as a scientific enterprise that

aims to classify natural phenomena based on theoretical principles. Furthermore, to say that the DSM and ICD are atheoretical is in sharp contrast with many of its basic theoretical assumptions (e.g. categorical view of distinct mental disorders, division between Axis I and II, separation of mood, anxiety and behavioral disorders). In contrast, the AFECT model is based on a series of principles, which are:

1. **The mind usually works coherently.** Understanding how the brain-mind works is essential to an understanding of mental health and mental disorders. Besides everyone's own experience of being 'one' rather than a series of systems and fragments, neuroscience data as a whole supports the idea that, generally, the brain-mind, the body-mind and the different mind modules work in an integrated, coordinated and coherent fashion. This is to say that although these modules can be conceived separately (which has valid didactic purposes), mood, affect, behavior, cognition, perception, attention and intentions tend to change and influence each other somewhat in the same direction. These domains are conceived separately in DSM-IV and ICD-10, artificially producing comorbidities (often being difficult to define what is comorbid of what) and much diagnostic confusion depending to the school of thought that one ascribes to (e.g., mood specialist, behaviorist, focused on personality or psychodynamics). Not surprisingly, these domains share neuroanatomical and neurochemical substrates, and psychopharmacological agents also affect many of these levels and modules simultaneously. As an example, a dopaminergic agonist may increase motor activity, improve cognition and attention, enhance

salience perception (possibly even leading to delusions), elevate mood (sometimes leading to mania), increase goal-directed activity, social dominance and sexual arousal (Aiken et al, 2007). This principle also underlies the mechanism of action of many treatments. For example, in the case of cognitive therapy, changing one's cognitive appraisal leads to similar changes in feelings and actions, or altering a behavior leads to modification in the same direction at the cognitive and emotional levels. On the other hand, changing the way one feels and perceives events, for example with medication, also leads to coherent adjustments in behavior and thought. Thus, conceiving these different mind domains as discrete entities without integration is to ignore the logic of how the mind/brain works. The combined view of these modules and planes allows for the comprehension of many aspects of mental health and pathology with a deflationary approach.

2. **The brain and the mind follow universal laws.** The principles and laws that govern the brain-mind are general principles observed in other processes and systems in the universe, i.e., it is unlikely that there would be principles or laws that have arisen exclusively to comprise special requirements for the brain-mind, no matter how complicated it may seem. Hippocrates used this principle when he translated the 4 humours from the 4 elements of the world proposed by the philosopher Empedocles. In our proposal, we used a system-based principle that we called Activation-Inhibition-Sensitivity-Coping-Control, or the AIS2C principle (as shown in Figure 1 and further explained below). This AIS2C principle can be applied to understand many systems and processes. This

concept of opposition between two interacting forces or elements pertains to the school of dialetics in western philosophy and the eastern Yin-Yang concept in Taoism.

3. **Categorical and dimensional views are complementary in their strengths and weaknesses and neither approach is sufficient to describe the whole of mental phenomena.** Many psychiatric disorders cannot be easily conceived in a classic disease model, as they are extremes of dimensions (e.g. Generalized Anxiety Disorder, ADHD). Conceptualizing such disorders as purely categorical will not change their essential nature as not being categorical. On the other hand, several behaviors and symptoms follow a 'yes or no' pattern, such as having a bulimic episode, a panic attack, and/or stealing, gambling or using cocaine. Once these behaviors have occurred, they can be quantitatively or dimensionally assessed, but they are not normally distributed in the population. However, many discrete behaviors are more likely to arise the more extreme the individual is in a certain dimension or group of temperamental dimensions (e.g. panic attacks are more likely to arise in patients with high fear and sensitivity traits; cocaine use is more likely in subjects with externalizing traits). This notion is applicable not only mental to health and disorders, but also to the integration of different concepts of temperaments (typological approaches).
4. **Temperament profile influences what disorders may develop in a deterministic and probabilistic way.** Temperamental traits form a setting on which mental phenomena take place, regardless of being adaptive or maladaptive, deliberate or reactive. Temperamental traits can

therefore be regarded as risk and protective factors for the development of mental disorders. This is similar to excessive weight as a risk factor for the development of several clinical dimensional (e.g. type II diabetes) and categorical (e.g. heart attack) diseases.

5. **Optimal levels of temperamental traits protect from psychiatric disorders.** Following longtime occidental and oriental traditions of the virtue of moderation, this principle also works in a probabilistic manner. However, more extreme temperaments can be highly functional if the context favors its profile, e.g. obsessive temperament is adaptive for environments that require structure and organization, but is more likely to be dysfunctional in situations requiring flexibility and innovation. Self-regulation, which results from the interplay emotional vectors as described in the AIS2C principle, is also crucial for adaptation and protection against psychiatric disorders.

Temperament as a central framework for mental phenomena

The AFECT model is founded on the assumption that temperament is a key element to understanding mental health and pathology, in agreement with other authors (Clark, 2005, Patrick and Bernat, 2006). The concept of temperament traditionally involves basic emotions (e.g. fear, anger, desire). The inclusion of their regulatory mechanisms (control) has been put forward by Rothbart et al (2000), which we incorporated. We also added that sensitivity to environmental events and coping skills are also crucial for emotional self-regulation, therefore they can also pertain to the concept of temperament.

The configuration of temperament influences the appraisal of events, biasing in quality and quantity the early perception and immediate assessment of stimuli, and how one deals with these stimuli. Thus, temperament is at a central position to influence and to be influenced by other domains such as behavior, cognition, perception, attention, relations, intention, mood and affect, working as a binding force among these modules (Figure 2).

In contrast to evaluating specific emotions, the concept of temperament by Kraepelin and Akiskal is synthetic and more directed to mood patterns, which facilitates categorization. We combined both emotional dimensions and affective categories (which can also be conceived dimensionally) in our model, since categories facilitate synthetic communication, sometimes at the expense of precision, whereas dimensions allow for better understanding and quantification of phenomena, at the expense of easy communication. The main dimensions are the two orthogonal axes of the complementary opposites of *activation* (volition and anger) and *inhibition* (fear and caution), which are modulated by *control,* and the system as whole has a certain *sensitivity* to environmental events and *coping* abilities (Figure 1). Different configurations of these emotional features produce the twelve categorical affective temperaments (Table 3). Importantly, 99% of the individuals ascribe to at least one of the proposed affective temperaments according to the results with the Combined Emotional and Affective Temperament Scale (Lara et al, 2008) and its recently revised version, the Affective and Emotional Composite Temperament Scale (AFECTS) developed to test our model. These data suggest that these basic affective temperaments comprehend most people's affective style in a practical and simple way. However, many identify with 2 or 3 affective temperaments,

what is reasonable since a typology denotes types without clear borders, unlike a classification. So, someone can be cyclothymic, dysphoric and irritable, for example.

This matrix forms a ‘map’ that defines the regions and vicinities of each affective temperament (and general psychiatric symptoms), with smooth transitions between each category (Figure 3). The central zone represents stability (with high control), the top and the bottom reflect externalizing and internalizing trends, respectively, and the lateral corners correspond to the most unstable zones. Thus, the euthymic affective temperament is the most stable, with moderate inhibition and activation. The hyperthymic is also a stable temperament, but is more activated and less inhibited. We added the obsessive temperament representing another stable configuration but with less activation and more inhibition compared to euthymics.

At the top edge is the newly created euphoric temperament as the most externalized, close to the other externalized types (disinhibited, irritable and hyperthymic). The euphoric temperament resembles the manic fundamental state as described by Kraepelin (1921) and predisposes to externalized disorders in general. This is in contrast with our description of the hyperthymic temperament, which is extroverted but stable (low sensitivity, high control and coping), and therefore is mostly protective against psychpathology. At the bottom margin is the most internalized depressive temperament, along with anxious and apathetic types.

The most unstable temperaments are the volatile (formerly called labile) and cyclothymic temperaments at the lateral poles, where activation and

inhibition are antagonistically expressed and/or control is low. However, volatiles are more characterized by restlessness, as described for ADHD patients, whereas cyclothymics have preferentially mood and emotional instability (more 'stormy'), as often described for bipolar spectrum disorders. To include a natural tendency for dysphoria, which is closely associated but not identical to cyclothymia (ups and downs), we proposed the dysphoric temperament, in which activation is more agitated and mixed. Dysphoric temperament can also be conceived as a more irritated and tense version of dysthymia. Although cyclothymic and dysphoric temperaments occupy nearby terrains and are often coexpressed in the same individual, sometimes they can be expressed purely (predisposition to mood swings without dysphoria, and dysphoria/tension without mood swings).

Sensitivity, coping and control as new dimensions for self-regulation and resilience to stress

Any system is sensitive to external stress to some degree and will have to cope with it. The sensitivity dimension reflects how someone usually reacts to common stressors, such as interpersonal events (rejection, criticism, offense) or general situations (frustration, pressure, trauma, loss). Thus, sensitive individuals are more prone to develop some kind of conditioned fear (in contrast to innate fear which is part of inhibition) and early life stress can also increase one's sensitivity, opening the way to many mental disorders, which will also depend on the other emotional dimensions. High sensitivity is therefore a general risk factor for mental suffering and development of mental disorders. In

the Five-factor model, the neuroticism dimension is based on sensitivity, but some aspects of fear and anger are also present.

Stress sensitivity is closely related to amygdala response and the HPA axis. Chronic increase of cortisol therefore may be associated with higher sensitivity. However, acute cortisol elevation may also induce activation, and depending on one's temperament, can lead to mania or mixed states. The strength of neurotrophic tone (e.g., BDNF, NGF, NT-3, NT-4) may also be related to sensitivity.

Coping is a process of dealing with adversity, and has major implications in mental health (Feder et al, 2009). Adaptive coping leads to long term learning, maturity and resourcefulness, as described in the character dimension of self-directedness in Cloninger's model. In contrast, low coping is maladaptive, leading to helplessness and poor repertoire of strategies. Our coping dimension regards how the individual faces adversities, is capable of finding solutions and learns with experience to become more adapted (Table 1). Thus, along with sensitivity and volition, coping is a major component of resilience. The medial prefrontal cortex is an important region for the coping process, providing an internal locus of control (Maier and Watkins, 2010).

In Figure 3, sensitivity and coping levels depend on the distance from the upward central white zone where the most resilient temperaments are (euthymic and hyperthymic). Sensitivity is particularly high and coping is low in unstable and internalized affective temperaments (see Table 3).

In order to operate steadily and coherently with the environment, activation and inhibition have to be controlled and regulated. Control and

regulation work by adjusting (facilitating or inhibiting) the subsystems they target (Derryberry and Tucker, 2006), but they do not *directly* provide energetic input to the system. Rothbart and colleagues (2000) clearly proposed the inclusion of effortful control, which promotes self-regulation, within the temperament construct. Control is roughly related to persistence and self-directedness in Cloninger's model, to conscientiousness in the big-five model and, in general, to executive functions. The concept of control in the AFECT model involves: i) monitoring of the environment by attention, ii) developing awareness, determining valence, and planning strategies; iii) the sense of organization and duty to promote adequacy. Control helps orient the expression of activation, avoiding the chaotic, destructive and often defensive manifestation of anger (this aspect is assessed in the anger construct rather than in control itself, Table 1). However, excessive control may lead to reduced flexibility and unnecessary interventions. In combination with fear and caution as a primary inhibitory system to avoid danger and harm, control promotes a cortical and general regulatory function to promote adaptation.

The affective temperaments associated with high control are euthymic, hyperthymic and obsessive, with the latter often resulting in impairment due to loss of flexibility and a more demanding emotional nature to deal with. In contrast, control is particularly low in those with the volatile, disinhibited and apathetic temperaments (and their associated disorders). Control here is represented as a circle with arrows towards the center to show its dynamic and adaptive role (Figure 1) and its expression across temperaments is highlighted as the "C" in Figure 3.

Temperament and adaptation to the environment

In the AFECT model, the different types of temperaments do not imply moral value, i.e., what is good or bad. Someone can be at one extreme of the normal curve but be perfectly adapted to a specific context. For example, someone with low activation may be well adapted in a job that requires low arousal, and hyperthymic temperament goes well with situations requiring leadership, innovation and initiative. Euthymics would adapt more easily in a wider range of situations, but may not be as fit for a given context compared to another 'specific' affective temperament (e.g. cyclothymic and disinhibited individuals may be particularly creative; anxious and obsessive individuals can be particularly organized and committed). Euthymics and hyperthymics are relatively protected against mental disorders, which arise as deviations from 'healthy' levels of emotional dimensions. However, even with low sensitivity and good coping levels, strong negative life events may interfere with activation, inhibition and control, shaping someone with euthymic predisposition into a *state* that is extreme in one or more emotional dimensions. The more chronic, powerful and early in life these negative experiences occur, the more they will shift the emotional configuration out of the central zone and influence traits. Both positive life events and bearable negative events are important to strengthen the system as a whole, through the development of coping strategies.

The concept of temperament can also be useful in the evaluation of the broad category of adjustment disorders, which is highly prevalent especially in primary care settings (Carta et al, 2009). The present view focuses only on stressors, and the inclusion of temperament allows for an understanding of the

constitution-environment interaction. For example, working in a rigid environment can be easy for someone with obsessive temperament, but stressful for volatiles and cyclothymics, and the reverse in a “loose” environment.

The upward central zone ascribed to the euthymic and hyperthymic temperaments (Figure 3) is associated with a lower chance of developing mental disorders, but adaptation is compatible with all temperaments, depending on the individual and the context. However, the further away from this central zone, especially in more than one dimension, the more likely one is to develop a mental disorder.

Organization of symptoms and disorders in a dynamic map

Instead of describing symptoms or diagnosing disorders as if they were isolated, the AFECT model allows for an understanding of how most symptoms and disorders frequently overlap and relate to one another. Regarding diagnosis, for example, borderline personality disorder is closely associated with dysphoric and cyclothymic temperaments (usually with high anger and sensitivity), which are also commonly seen in cases of bulimia and PTSD. Thus, they ‘map’ to a similar place in the temperament matrix. The ‘comorbidity’ patterns found in clinical studies are in general agreement with this matrix (see Lara et al, 2006 for details). However, the assumption that these categorical disorders exist independently of one another and occur at random is a major flaw of using categorical diagnoses in neuroscience and psychiatry research, unless an efficient clustering strategy is created. Conceiving the general

temperament profile that predisposes to disorders alike and protects from other disorders helps to resolve this issue. In other words, how someone *is* regarding traits influences what disorders one may *have* or may be *protected* to have (principle 5 above). Unfortunately, present categorical models disregard traits in the evaluation of Axis I disorders and offer a relatively poor categorical model for personality disorders, with no theoretical reference to normality or mental health. The approach of characterizing individuals by their disorders rather than by their phenotype can be particularly problematic for genetic and pharmacological studies. Thus, finding specific genes and drug treatments for specific disorders is a major challenge for those who endorse such fragmented approach.

If the mind is to be “divided to be understood”, which is the classical scientific approach, we suggest to select a set of specific traits (e.g. fear, volition) and conceive their influence on mood, emotions, behavior and cognition. In other words, a gene variant, a neuroanatomical region or a psychotropic drug is likely to have a more global impact on mind and behavior, which work as an integrated system. To understand this system, it is crucial to understand what part or aspect of the system is being studied and how it influences and interacts with the system as whole. To clarify this aspect, we developed an analogy of our temperament model with a water tank.

The water tank analogy

The elements and the dynamics of the AFECT model can be illustrated with a water tank analogy (Figure 4), which is a different approach to humours

(fluids) than Galen's and Hippocrates'. There are two basic forces in this particular 'tank' of temperament and mood, which are the tap (activation) and the drain (inhibition). The float switch (control) is a third regulatory element, which is able to monitor the system and adjust the flow by modulating the tap and the drain. The sensitivity and coping of the tank would represent how its structure reacts to impact and deals with stress. These 5 features of the system represent the *emotional* dimensions. This analytic approach is similar to the views by Cloninger, Gray and Rothbart for temperament.

The other essential element is the fluid (mood or humor), which can be regarded quantitatively (level or volume) and qualitatively (movement). The fluid level is unidimensional (high, moderate, low), but the movement also defines its behavior. For Eysenck, fluid level would refer to extraversion and fluid dynamics would be neuroticism (instability). Viewed even more synthetically, these fluid characteristics represent the concepts of five *affective* temperaments in the works of Kraepelin/Akiskal, complemented by our seven newly proposed affective temperaments. Thus, this analogy illustrates how these two contemporary views of temperament (emotional by Cloninger, Rothbart and Gray and affective/synthetic by Kraepelin, Akiskal and Eysenck) are interdependent but quite different conceptually, despite relating to the same phenomena.

Since each point of view is partial, the present model attempts to integrate all these approaches. Thus, mood level and dynamics depend mostly on the integration of volition as activation and fear/caution as inhibition. Uncontrolled or excessive activation produces turbulence (anger and agitation) and restricted activation produces high pressure (anger) and/or impaired flow

(sadness). Sensitivity mediates the interaction of the system with the environment, e.g. stress may shake (mood/fluid agitation) or crack the tank producing leakage and consequent reduction in fluid (mood) levels. Resilience can be conceived as a general property combining all elements, particularly sensitivity, coping, volition and control. Positive events can be conceived as an external source of or increment in fluid input, raising mood. Poor control (switch float) impairs adaptation of the system to the internal and external environments as in ADHD, but excessive control of the environment can also be maladaptive, as in OCD.

As in fluid mechanics, it is not possible to predict in detail how each fluid molecule moves, but the general pattern is fairly predictable. Therefore, this model is probabilistic and usually follows a non-linear pattern, but can be reasonably depicted using linear assumptions. If activation (inflow) and inhibition (outflow) are moderate, the fluid level will be intermediate and stable (euthymia). If both activation and inhibition are high, mean fluid level is the same as in the previous situation, but fluid dynamics is different, producing turbulence and churning (mixed states). If activation (inflow) is high and inhibition (outflow) is low, overflow (euphoria or mania) is imminent, unless control is sufficiently effective to prevent it (e.g. euphoric states triggered by very exciting news ‘automatically’ come down in a few hours in healthy individuals). The reverse is true for depression, which is associated with reduced activation (inflow) and increased inhibition (outflow) in a sufficient manner to overcome control and coping mechanisms, which can also be deficient. This analogy allows us to understand how healthy and pathological moods operate with the same variables and may reach such states as euphoric

mania, irritable mania, mixed states, mixed depression, anxiety, pure depression and euthymia. However, this should be conceived dimensionally, non-linearly and probabilistically. From the central and stable zone to the periphery of the AFECT matrix/map, there will be critical points where specific combinations of activation, inhibition, sensitivity, coping and control cross a threshold to produce mood, cognitive and/or behavioral disorders as presently conceived.

In ADHD, control mechanisms may not be switched on reliably or with adequate timing. This is probably due to a deficit at the control level itself (frontal areas), but ADHD may also be associated with a temperamental bias towards low activation contributing to attention and motivational symptoms, and low inhibition underlying impulsivity and 'hyperactivity'. If this is correct, 'hyperactivity' would be better termed 'behavioral disinhibition', leading to poor ability to slow down, rather than an increased acceleration/volition as implied in the term. As inattention may be partially ascribed to an activation deficit, this may relate to findings that the ADHD inattentive type is particularly prone to depression and social phobia (Biederman et al., 2004; Levy et al, 2005). Thus, low activation, along with poor control, would contribute to these three apparently unrelated diagnoses (attention deficit disorder, unipolar depression and social phobia). ADHD combined type has a temperament predisposition towards deficient inhibition, activation (as volition), control and coping, whereas predominantly "hyperactive"/impulsive type has low inhibition and control. Wisely, the terrain of ADHD (left side of Figure 3) is divided in three basic types and has the combined type as reference. In contrast, mood disorders (top, bottom and right side of Figure 3) occupy a larger terrain but are grossly divided

in unipolar and bipolar types, leading to an unproductive discussion of whether unstable mood and emotional disorders with clear depressive and dysphoric symptoms, but minimal manic symptoms, belong to the unipolar or bipolar realm. An easy approach to illuminate this problem, with considerable clinical consequences, would be to use a similar 3-part division as proposed by Kraepelin (1921), namely predominantly manic, mixed or depressive. This would allow psychiatry to tackle its major Achiles tendon, which is the cyclothymic/mixed quadrant of Figure 3, with all its mood, behavioral, cognitive and personality expressions. In Kraepelin's view, this intermediate group accounted for around 40% of mood episodes, being most relevant for irritable and cyclothymic fundamental states. This group is now represented by the popular concept of bipolar spectrum disorders (Akiskal and Pinto, 1999) and relates to patients with complex combinations and interactions of externalizing and internalizing symptoms and disorders. Just mixing the knowledge of the separate groups of externalized and internalized disorders is not adequate to characterize the clinical presentations and develop effect treatments for these patients. Thus, the creation of a special cluster on its own (e.g. unstable disorders) in classificatory systems would be an important contribution to clear this area.

Another issue regarding depression is the presence of stressors, which may lead to "stress-induced depression" (or a mixed mood disorder). The most important temperamental risk factor to develop a mood disorder in this case is low resilience, which depends on sensitivity, coping and volition. High and long-term stress levels can produce a mood disorder (usually major depression) even in stable and resilient individuals. Depending on the context, stressors and

constitution, even a patient with bipolar disorder may develop a clinical picture of stress-induced “unipolar” depression that responds adequately to some antidepressants (i.e. “unipolar” depression comorbid with bipolar disorder, unlike the “natural“ depressive episode of bipolar disorder that may respond poorly to antidepressants).

In a broad sense, ADHD and mood disorders can be conceived as dysregulations of ‘energy’, i.e., ADHD is in part a mood disorder, and mood disorders are also cognitive and motor disorders. The closeness to mania (in predominantly ‘hyperactive’/impulsive cases) and to depression (in predominantly inattentive cases) on the map/matrix should not be surprising. Since both volatile and cyclothymic individuals are mapped in zones of low control/high sensitivity and antagonism between activation and inhibition, these are the more unstable presentations. This would explain the executive function deficit in cyclothymics and the affective lability in volatiles, despite being placed on opposite sides of the map, and the comorbidity between their associated disorders (ADHD/bipolar type II/borderline personality disorder/bulimia).

Finally, volatile/ADHD persons would not be ‘true’ novelty seekers, but rather restless, disinhibited individuals with poor control and low coping. Alternatively, their search for novelty or excitement may be an attempt to compensate for their low level of intrinsic motivation and perceptual salience. In contrast, those with high activation (particularly euphoric temperament) search for novelty due to its pleasurable and ‘addictive’ effects, which are enhanced by their high perceptual salience, possibly leading to mania and psychosis (Kapur, 2003).

In a more general view, dysregulation of the basic functioning of this tank/fluid or emotional temperament/mood system predisposes to a wide variety of mood, behavioral, cognitive and personality disorders. If more than one emotional dimension (AIS2C dimensions) is dysregulated or dysfunctional, more severe clinical presentations and more comorbidities of psychiatric disorders will tend to develop.

Treatments as modulators of emotional dimensions

Treatments may work by restoring temperament dysregulations, as proposed many centuries ago. Eysenck (1983) indeed reviewed this concept historically and suggested that it is possible to create a taxonomy of psychotropic drugs according to how they modulate dimensions of personality in one direction or another. However, this was also one of the arguments used by Gray to rotate the extraversion-introversion and stability-neuroticism axes, creating the behavioral activation and inhibitory systems, because some drugs such as barbiturates and benzodiazepines are able to reduce both extroversion and neuroticism with a single mechanism of action (Gray, 1982). The AFECT model allows for a reconciliation of Eysenck's synthetic (the fluid) and Gray's analytical (the valves) approaches also in terms of treatment.

Conceptually, according to the water tank model, the fluid level can be affected by adjusting directly the inflow (activation/tap) and outflow (by inhibition/drain or by sensitivity/leakage), or indirectly by acting on control, sensitivity (leaking) and coping. That is, we cannot operate on the mood itself

(fluid) to raise or decrease its levels or make it less turbulent. This is to say that calling a treatment antimanic or antidepressant focuses on the *consequence* of adjusting activation, inhibition, sensitivity, coping and/or control. Looking solely at the fluid level, and not at what controls it, makes it puzzling or counterintuitive to understand how: i) antimanic agents have different profiles (e.g. lithium may work better in patients with a different profile compared to divalproate or antipsychotics); ii) antidepressants have different profiles (e.g., being more or less effective on comorbid anxiety) and iii) how one single medication can have antidepressant, anxiolytic, antiaggressive and antimanic properties at the same time (e.g. atypical antipsychotics, divalproate). Thus, the approach that focuses only on the fluid (mood) level gives us limited information and allows suboptimal comprehension of psychiatric phenomena.

Thinking in terms of AIS2C emotional dimensions as the primary loci of treatment action provides a unifying scenario. In psychopharmacology, medications could be regarded as being activators and deactivators, inhibitors and disinhibitors, control enhancers and reducers, coping enhancers and sensitivity reducers. Mental and behavioral adverse events can also be understood according this framework, e.g. a drug that decreased coping and volition in a given patient. Medications may have single or combined effects and here we speculate about their actions as follows:

- Typical antipsychotics (D2 receptor antagonists) are pure deactivators, so their antimanic and antiaggressive properties are sound and rapid, and they lack anxiolytic and antidepressant effects. Actually, by being too effective as pure deactivators, they can lead to depressive, avolitional states, which have low activation as a hallmark.

- Atypical antipsychotics (D2 and 5-HT2 antagonists, with some important effects on other neurotransmitter systems) act mainly as deactivators, but may have disinhibiting and antisensitivity actions *simultaneously*, with different ratios between theses effects. Therefore, they exert antimanic and antiaggressive effects (as high activation is the core of manias), but also have anxiolytic and some antidepressant effects, i.e. they can attenuate excessive activation, inhibition and sensitivity. This profile is also very suitable for the treatment of dysphoria. Of note, quetiapine (along with its active metabolites) has mechanisms of action related to deactivation (D2 and alpha-1-adrenergic receptor blockade), disinhibition/sensitivity (blockade of 5-HT2R, partial agonism of 5-HT1AR) and activation (inhibition of noradrenalin uptake) (McIntyre et al., 2007).
- Among medications with antidepressant properties, those with serotonergic effects (e.g. SSRIs) exert primarily disinhibitory and anti-sensitivity effects, which produce anxiolytic action, but may also secondarily produce activation (probably dopamine mediated; see Willner et al, 2005). A noradrenergic component may further increase activation. Thus, drugs with strong disinhibiting and activating properties would be more liable to induce manic switches, as in the case of venlafaxine and other noradrenergic-serotonergic uptake inhibitors (including tricyclics). In contrast, drugs with dopaminergic and perhaps noradrenergic mechanisms (e.g. bupropion, methylphenidate) may primarily increase activation and control, improving motivation and

attention, with limited disinhibitory/anxiolytic efficacy. This profile may produce irritable states if activation surpasses control.

- Mood stabilizers with more pronounced antimanic effects can bring mood down by producing mental deactivation, inhibition and/or increasing control. Divalproate may increase control of activation-tap (Na^+ channel inhibition), reduce activation *per se* (glutamatergic effects) and reduce sensitivity (glutamatergic and GABAergic effects). This profile can treat well bipolar spectrum disorders of euphoric, irritable, cyclothymic and dysphoric temperaments, but not ADHD. Carbamazepine and oxcarbazepine may increase control and inhibition, but may also act as deactivators. This profile is associated with efficacy for reckless impulsivity (due to disinhibition and low control) and appetitive impulsivity (due to activation and/or low control), as well as impulsive aggression. Such medications are therefore particularly effective in giving the patient time to think before acting. This profile seems to be useful also for ADHD symptoms associated with impulsivity-disinhibition (Silva et al, 1996, Davids et al, 2006), but not much for the motivation deficit associated with low activation and poor pro-activation control. Lithium probably works mainly as an inhibitor, and to a lesser degree as a deactivator, therefore having a different profile of responders − euphoric mania, mania-depression cycles, high interepisode frequency, absence of psychosis (Yatham et al, 2007) − compared to more effective deactivating agents used to treat mania. However, its trophic effects may also reduce sensitivity or even improve control and coping in general due to better wiring. In agreement with this view, it is interesting to note that

lithium, carbamazepine and oxcarbazepine may treat hyperactive and impulsive (disinhibition-related) symptoms of ADHD (Dorrego et al, 2002; Davids et al, 2006). The effect of lamotrigine is somehow linked to increasing volition, but it may also have anti-sensitivity effects. This profile would produce antidepressant and perhaps some cognitive enhancing effects, particularly in cyclothymic/dysphoric individuals or states. Compared to drugs acting primarily on mental activation and inhibition, medications that work primarily by regulating control may have a slower time of onset, less robust acute effects but significant effects on course.

- Methylphenidate may act primarily by increasing control, coping and activation. If ADHD is associated with low control, low activation (motivation/volition) and low coping, the therapeutic effects of psychostimulants in this disorder are logical, not paradoxical. However, in those who have more trait activation (e.g. anger/volition or manic features, conduct disorder and/or aggressive behavior), psychostimulants can induce abuse/dependence and manic switches. The widely used caffeine also increase activation, control and possibly coping, but agitation at high doses do to excessive activation.
- Benzodiazepines and other GABAergic drugs are mostly anti-sensitivity drugs, with some disinhibitory effect, i.e. they lack the activating properties that render antidepressant action. However, as mood (fluid level) is a product of activation (inflow), inhibition and sensitivity/leakage (outflow), antisensitive and disinhibiting drugs (by reducing outflow) can have some effect on mood in those with more prominent anxiety

symptoms. Of note, the ‘paradoxical’ effects of benzodiazepines are in line with its disinhibiting properties, which may become excessive and disruptive in some individuals.

- N-acetylcysteine is a drug that has been shown to be effective for disorders as diverse as schizophrenia (mostly negative and general symptoms) (Berk et al, 2008a), cocaine addiction (La Rowe et al 2007), bipolar depression (Berk et al, 2008b), pathological gambling (Grant et al, 2007), trichotillomania (Grant et al, 2009) and possibly nail biting (Berk et al, 2009). Such findings cannot be accommodated with a clinical view based on categorical disorders. However, our understanding based on these data and our clinical experience suggests that N-acetylcysteine is particularly effective for attenuating sensitivity, which is common to these and many other psychiatric disorders. By increasing frustration tolerance and resistance to stress, N-acetylcysteine can lead to “non-specific” improvement of a wide range of disorders and clinical situations.

Tang et al (2009) has provided the most elegant evidence to date that psychotropics may primarily act on traits. In their study, the effect of paroxetine was more robust on neuroticism (sensitivity and inhibition in our model) than on depressive symptoms when compared to placebo. Also, after 8 weeks of symptom improvement with placebo and no change in personality, patients were treated with paroxetine for further 8 weeks, leading to significant trait changes with minimal symptom improvement. These results support a “cause-correction” hypothesis for SSRIs on dysfunctional traits rather than a state

effect. The time required to act on temperament may also underlie or at least contribute to the delayed onset of action of antidepressants.

In global terms, pharmacological treatments can be conceived in two main categories: trait and state drugs. In general, trait treatments have a delayed onset of action and, after interrupting an effective treatment, traits tend to return to baseline. Their effects depend on brain structural changes. Examples of this pattern are SSRIs, SNRIs, divalproate, carbamazepine and lithium. In contrast, state drugs have immediate onset of action for target symptoms, but also a rapid offset, which take place with drugs such as benzodiazepines, psychostimulants (methylphenidate, amphetamines and modafinil). The actions of state drugs depend on their presence at minimally effective levels. Also, a given drug may be a state drug for one type of effect and a trait drug for another target (e.g. D2R reduce anger/agitation immediately, but improvement on psychotic and elated symptoms may be related to trait change). Hallucinogens such as ketamine and psilocybin may also be examples of combined state/trait drugs, since they induce rapid effects while they are present and also long term effects due to rapidly induced structural changes in the brain (Vollenweider and Kometer, 2010).

Psychotherapy and psychosocial interventions would also work on the same general substrates of the AIS2C emotional dimensions. However, psychotherapies work better for improvement of coping strategies to deal with adversities and in the terrain of memories, as for example, learned fears (which are related to sensitivity). Psychotherapies can also potentiate, expand and consolidate the mental state/trait changes produced by therapeutic pharmacological interventions on mood, emotions and behavior.

In conclusion, the AFECT model is a framework useful for both diagnosis and treatment regardless if the patient meets or not the criteria for specific disorders. It also provides guidance for those who meet criteria for more than one disorder, which is a common clinical situation with no clear direction according to current guides. Often the treatment for one disorder (e.g. bipolar disorder) may be impaired by the treatment for the other disorder (e.g. panic or bulimia with SSRIs). The concept of temperament may help delineate more sensible treatment approaches that can also be shared with the patient using a language and concepts that can be easily understood (e.g. “we should aim to reduce your anger and sensitivity to stress”). Dysfunctional trait characteristics have usually been felt by the patient for many years and are unwanted. This makes it easier for the patient to accept and adhere to treatment with the intuitive understanding that unless there is a curative treatment (e.g. psychotherapy, EMDR) or an understanding that the problem is transient and maintenance therapy would be probably required to prevent these traits to reemerge.

Broadening the scope of approaches to mind-brain and psychiatry

A more comprehensive and flexible view of the mind/brain requires the ability to conceive two ‘opposite’ views simultaneously, in a dialectic approach. This requires some degree of flexible thinking, using a strategy of shifting thoughts and views back and forth, as in a pendulum. This broader view can be applied to several aspects of psychiatry:

a) dimensions and categories;

b) longitudinal (course, development) and transversal aspects (profile);

c) traits and states;

d) individual (unique differences of individuals, clinical expertise of single physicians) and collective aspects (commonalities between people, epidemiological data, evidence-based findings, typology);

e) biological and psychosocial aspects of health and disease (i.e. brain and mind);

f) inherited (constitution, predispositions) and acquired (contingencies) factors;

g) health (protective factors) and pathology (risk factors);

h) structure and function;

i) theory (ideas, models) and practice (descriptions, data, clinical experience) – empirical data and experts views;

j) synthetic/intuitive/subjective and analytic/rational/objective views;

k) top-down and bottom-up approaches;

l) pharmacological and psychotherapeutic treatments;

m) prevention and treatment strategies.

A dogmatic approach to only one of the above strategies results in an incomplete view of mental phenomena. However, in many situations only one or the other view may be applicable and useful, so this pendular thinking should

enable the clinician to determine the value of each approach to specific contexts.

Concluding remarks

Compared to the concept of temperament, psychiatry as a medical field is quite young. New versions of diagnostic manuals would be enriched if modern temperament models were included. The attempt to classify mental disorders just by using putatively 'atheoretical' and categorical descriptions is insufficient and frames the minds of many psychiatrists to look for a label when evaluating a patient. This is often perceived negatively by the patient (and the society) in a negative manner, compared to a more humanistic approach. However, the benefits of a categorical, fragmented and inflationary model of which disorder(s) a person *has* can be merged with the benefits of a dimensional, integrated and deflationary model of how a person *is*, for both healthy and pathological situations. This is particularly important in an era of excitement about neuroimaging and molecular neurobiology. Technology has allowed the generation a vast amount of knowledge about mental phenomena, but may lead to even further fragmentation of the doctor-patient relationship, e.g., 'let's see what brain regions light up in this task', or 'how big is his/her dorsolateral prefrontal cortex', or 'I wonder if he/she carries the long or short allele of this gene or such and such variant of this polymorphism'. This is not to say that this kind information will be irrelevant for clinical practice. However, psychiatrists and clinical psychologists deal with people who have emotions as the background of their subjective minds and experiences. In other words, in

between ‘gene X environment interactions’ there are individuals who work as an integrated unit. For neurobiological studies in psychiatry, skipping the phenotype and looking only at mental disorders as if they were detached from the mental background on top of which they develop is ill-advised, counterproductive and naïve. The gap between genes and behavior is too large, and temperament constitution is strategically in between them. Analytical, precise and linear approaches of the hard sciences will have to be applied taking into consideration the synthetic, non-linear, imprecise and “soft” nature of the mind. Temperament and personality models that include healthy and dysfunctional mood, emotional, behavioral and cognitive aspects can help bridging both views.

Our temperament approach seeks to increase understanding of how the emotional/cognitive system of the mind relates to psychiatric disorders, allowing for an integrated view of mind constructs. In order to adopt this or other temperament or mind models, one has to take a reflexive position towards the way psychiatric diagnosis has been regarded. Conceiving temperament as a central element of the mind facilitates this approach and may also lead to diagnostic, neurobiological and treatment advances in psychiatry and clinical psychology.

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Table 1. Descriptions of emotional dimensions.

	LOW	HIGH
	Pessimistic	Optimistic
(positivity)	Low pleasure	High pleasure
	Sad	Cheerful
VOLITION	Low self-esteem	High self-esteem
	Indifferent to novelty	Excited about novelty
(energy)	Unmotivated	Motivated
	Low drive and goal-direction	High drive and goal-direction
ACTIVATION	Dull and low energy	Active and energetic
	Cool	Hasty
(intensity)	Moderate	Intense
	Flexible	Stubborn
ANGER	Patient	Inpatient
	Calm	Irritated
(irritability)	Peaceful	Aggressive
	Controlled	Explosive
	Trustful	Suspicious
	Daring	Fearful
(fear)	Spontaneous	Inhibited
	Unworried	Worried
INHIBITION	Reacts in danger	Freezes in danger
	Reckless	Cautious
(caution)	Impulsive	Thoughtful
	Careless	Careful
	Risk-taking	Risk-avoidant
	Low guilt proneness	Sensitive to guilt
(interpersonal)	Deals well with rejection	Sensitive to rejection
	Deals well with criticism	Sensitive to criticism
SENSITIVITY	Hardly feels hurt	Easily feels hurt
	Deals well with traumas	Sensitive to trauma
(events)	Deals well with stress	Sensitive to with stress
	Deals well with pressure	Sensitive to pressure
	High tolerance to frustration	Low tolerance to frustration
	Blames others for mistakes	Takes responsibility for mistakes
(facing)	Runs away from problems	Faces problems
	Wishes problems would go away	Tries to solve problems
COPING	Lets personal problems pile up	Solves personal problems at once
	Poor handling of issues with people	Easily handles issues with people
(ability)	Has trouble finding solutions	Easily finds solutions
	Tends to repeat mistakes	Learns with mistakes
	Suffering has made more fragile	Suffering has made stronger
	Low attention	Attentive
(focus)	Distracted	Focused
	Poor planning	Good planning
CONTROL	Fails to finish tasks	Finishes long tasks
	Disorganized	Organized
(order)	Undisciplined	Disciplined
	Irresponsible	Responsible
	Negligent	Perfectionist

Table 2. Descriptions of affective temperaments.

Depressive	I have a tendency towards melancholy and sadness, I see little fun and joy in things; I tend to put myself down; I don't like changes; I prefer to listen than to talk.
Anxious	I am very cautious and careful; I often feel insecure and apprehensive; I keep imagining that bad things are about to happen, I try to avoid high-risk situations; I am always alert and vigilant.
Apathetic	I have little initiative; I often drift away from what others are saying or doing; I often fail to finish what I have started; I tend to be passive and a bit slow.
Obsessive	I'm dedicated, demanding, perfectionist, painstaking and rigid; I need to be in control of things; I don't deal well with uncertainty and mistakes.
Cyclothymic	My mood is unpredictable and unstable (ups and downs or mood swings); my mood changes quickly or out of proportion to the facts; I have periods of great energy, enthusiasm and agility that alternate with other phases of sluggishness, loss of interest and discouragement.
Dysphoric	I have a strong tendency to feel agitated, tense, anxious and angry at the same time.
Euthymic	My mood is balanced and predictable, I usually have mood changes only when there is a clear reason; I have good spirits and, in general, I feel good about myself.
Irritable	I'm very frank, direct and determined, but also angry, explosive and suspicious.
Volatile	I am easily distracted and restless; often I switch off or drift away from what others are saying or doing, I often do things without thinking about the consequences; sometimes I am inconvenient and only realize it when it is too late; I quickly lose interest, and tend not to finish what I have started.
Disinhibited	I am restless, active, spontaneous and distracted; I often rush and do careless things; I often leave things for the last minute; when I lose my temper, I soon get well again.
Hyperthymic	I am always in good spirits; I am very confident and I have fun easily; I love novelty; I do many things without getting tired; I go after what I want until I get it; I have a strong tendency for leadership.
Euphoric	I am expansive, fast, talkative and intense; I have many ideas and I am easily distracted; I am hasty, explosive and impatient; I take risk by being overconfident or excited; I overdo things that are pleasurable; I do not like routine and rules.

Table 3. Emotional profile of affective temperaments.

Temperaments	Volition	Anger	Inhibition	Sensitivity	Coping	Control
Depressive	↓↓	↔	↑↑	↑↑	↓↓	↓
Anxious	↔	↔	↑↑	↑	↓	↑
Apathetic	↓	↓	↑	↑	↓↓	↓↓
Obsessive	↑	↑	↑	↔	↑	↑↑
Cyclothymic	↔	↑↑	↔	↑↑	↓	↔
Dysphoric	↔	↑↑	↔	↑	↓	↔
Volatile	↓	↑	↓	↑	↓↓	↓↓
Euthymic	↑↑	↓↓	↔	↓↓	↑↑	↑↑
Irritable	↑	↑↑	↔	↔	↑	↑
Disinhibited	↑	↔	↓↓	↔	↔	↓
Hyperthymic	↑↑	↓	↓	↓↓	↑↑	↑↑
Euphoric	↑	↑↑	↓↓	↔	↑	↔

↓↓ very low, ↓ low, ↔ moderate, ↑ high, ↑↑ very high

Figure Legends

1. The AIS2C (Activation-Inhibition-Sensitivity-Coping-Control) matrix. Activation and inhibition are the main vectors, which are regulated by control. Combinations of activation and inhibition levels produce the main synthetic results of expansion, stagnation, ambivalence, indifference and moderation. Sensitivity and coping refer to how the system responds to environmental adversity.

2. Key integrative role of temperament for mental functions.

3. Emotional temperament matrix producing affective temperament (inside) and general psychiatric symptoms (outside). Higher control is represented as the “C”. Low sensitivity and high coping are represented by the white shade. 1 = terrain of externalized disorders, such as mania, bipolar I disorder, antisocial, narcissistic and histrionic personality disorders, intermittent explosive disorder, excessive and compulsive behaviors associated with high desire, such as drug abuse and dependence (including cigarette smoking), buying, sex; 2 = terrain of externalized/internalized disorders, such as mixed mood states, bipolar II disorder, bulimia, PTSD, panic, borderline and paranoid personality disorders, mixed types of OCD, some attention deficit disorder, drug abuse to decrease sensitivity, such alcohol and benzodiazepines; 3 = terrain of internalized disorders, such as depression, generalized anxiety, social phobia, panic, inhibited types of OCD, cluster C personality disorders; 4 = terrain of ADHD, learning disorders (towards the bottom), oppositional defiant disorder

(towards the top); 5 = terrain of good mental health, with low risk for development of psychiatric disorders, and high chance of recovery if a psychiatric disorder develops.

4. The water tank model for temperament and mood. The tap works as activation, the drain as inhibition and the switch float as control of activation and inhibition. These components would correspond to emotional models by Cloninger, Gray, Rothbart, and Costa and McCrae. These emotional components/valves regulate fluid level and dynamics/movement, which correspond to mood and affective temperaments by Kraepelin/Akiskal and Eysenck. Sensitivity refers to the vulnerability of the system to stress and adversity, whereas coping refers to how the system is able to detect and solve its own problems. Coping mechanisms are less common in non-biological systems, but clearly present in living organisms for maintenance and recovery.

Figure 1

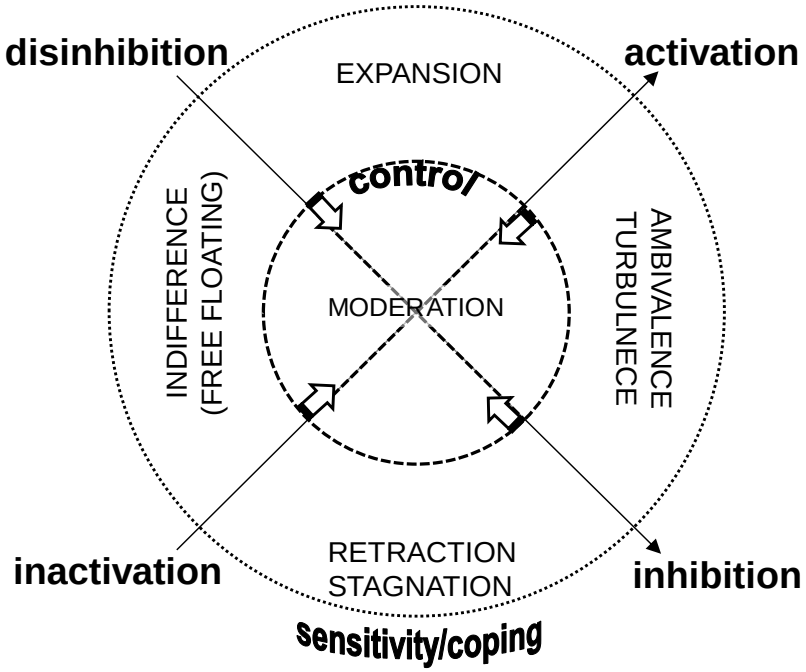


Figure 2

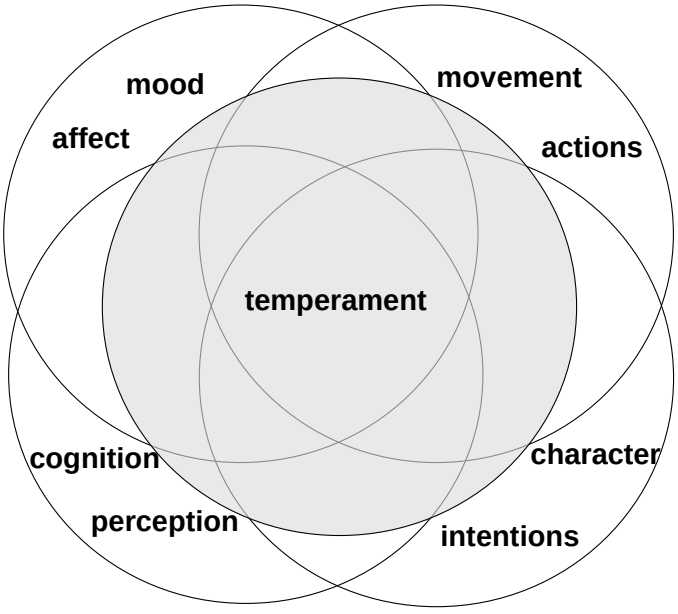


Figure 3

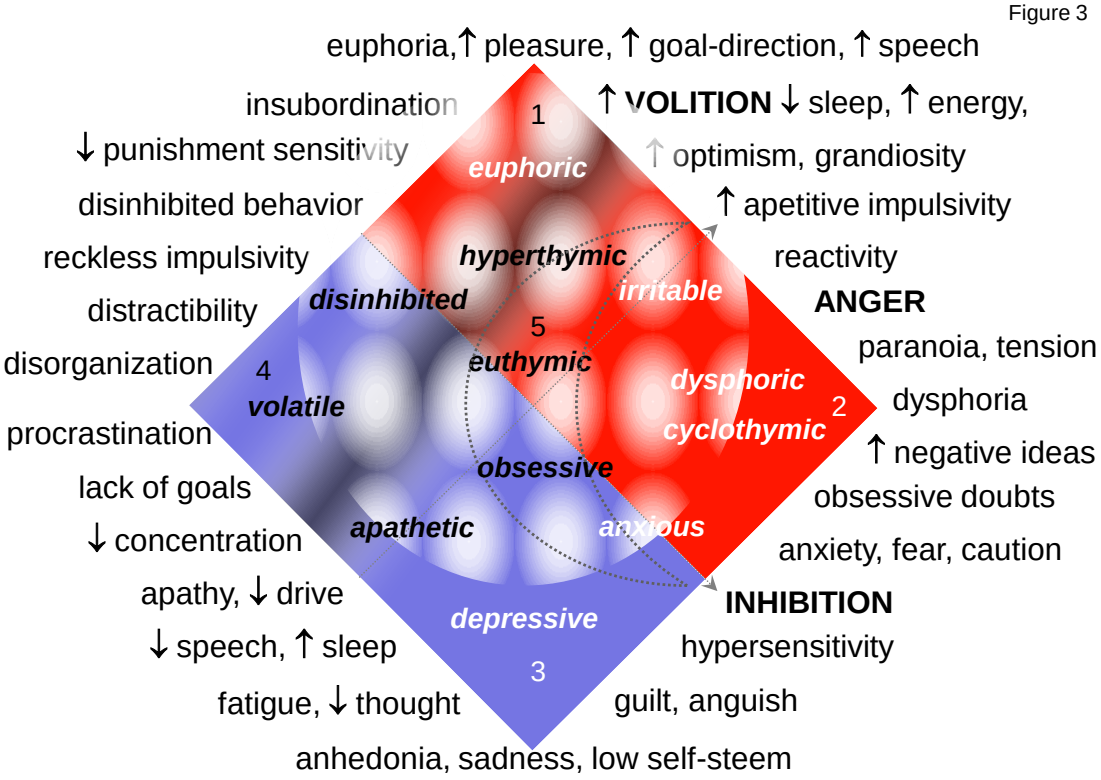
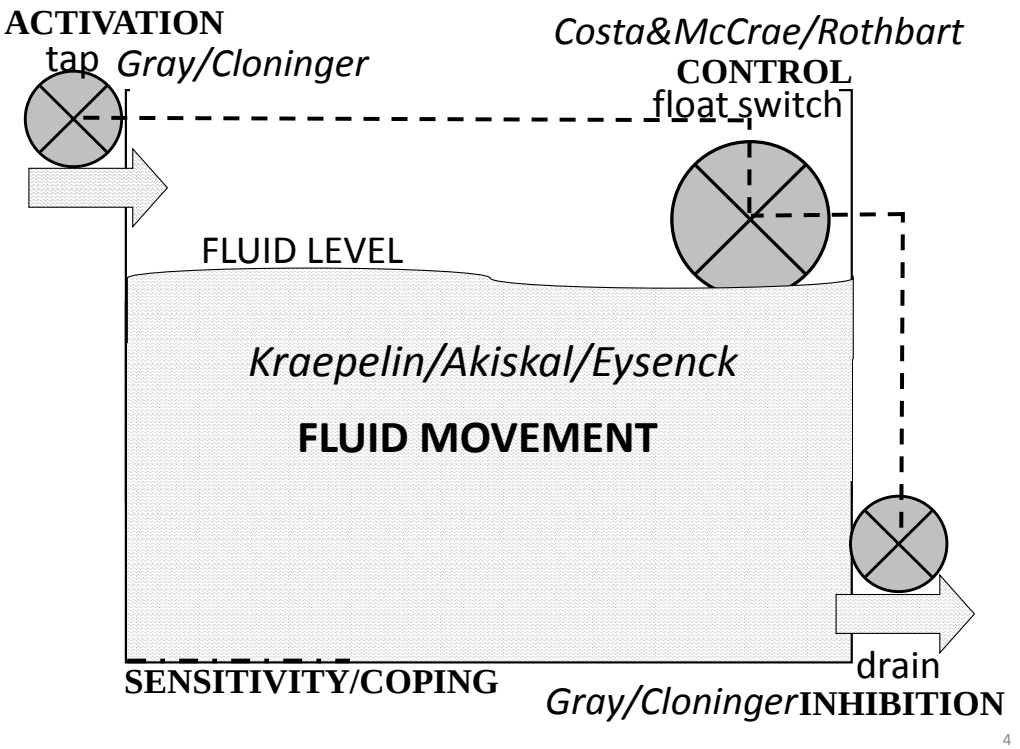


Figure 4



Capítulo III

Validação da Primeira Versão da Escala de Avaliação de Temperamento Afetivo e Emocional (*Combined Emotional and Affective Temperament Scale*; CEATS) em Amostra com Alta Prevalência de Transtornos Psiquiátricos

(publicado na Psychopathology)

Validation of the Combined Emotional and Affective Temperament Scale (CEATS) in a large sample with high prevalence of psychiatric disorders

Running title: CEATS validation in a large sample

Gustavo L. Ottoni[1], Taise M. Lorenzi[2], Caroline Reppold[3] Diogo R. Lara[2]

1. Departamento de Bioquímica, Instituto de Ciências Básicas da Saúde, Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil

2. Faculdade de Biociências, Pontifícia Universidade Católica do Rio Grande do Sul, Porto Alegre, Brazil

3. Faculdade de Psicologia, Universidade de Ciências da Saúde de Porto Alegre, Porto Alegre, Brazil

Corresponding author:
Diogo R. Lara
Faculdade de Biociências – PUCRS
Av. Ipiranga, 6681 – Pd12A
Porto Alegre, RS
Brazil
90619-900
Phone +55 51 81219187
Fax +55 51 33203612
diogorlara@gmail.com

ABSTRACT

Background: based on a model where temperament works as a system with activation, inhibition and control, which produce the affective tone, we developed and validated the Combined Emotional and Affective Temperament Scale (CEATS). This paper aims to validate the CEATS in a large population with high prevalence of psychiatric disorders.

Methods**:** 4381 subjects (25.5% males) completed an internet version of the scale in a psychoeducational website on bipolar disorders. The CEATS has both Emotional and Affective sections and an evaluation of problems and benefits related to temperament. Data was analyzed with standard psychometric batteries.

Results**:** in the Emotional section, 4 factors with Eingenvalue>1 explained 47.3% of the variation. They were interpreted as anger, control, fear and drive, had a normal distribution and satisfactory Chronbach's alphas. Anger was particularly associated with problems, and drive with benefits. In the Affective section, all 10 categorical affective temperaments were selected, being cyclothymic the most prevalent (32%), and 97.6% of the sample was able to ascribe to at least one affective temperament. Only the euthymic and hyperthymic temperaments were associated with a favorable problem/benefit profile. Each affective temperament had a particular emotional configuration. ***Conclusion*****:** the CEATS is adequate to assess emotional and affective temperament in subjects with high prevalence of psychiatric disorders.

Key words: temperament, scale, personality, psychiatric disorders, emotions.

INTRODUCTION

Temperament relates to the emotional nature and the quality of the prevailing mood, being mostly inherited and relatively stable over time [1,2]. Since the four humours of Hippocrates and Galen, the concept of temperament has had new interpretations by Eysenck [3], Gray [4], Cloninger [2], Akiskal [5] and others. In the psychiatric literature, two of the most intensively studied temperament constructs models address what can be conceived as *emotional* and *affective* temperaments, proposed by Cloninger [2] and Akiskal [5], respectively.

In Cloninger's model, the combination of four dimensions comprises the temperament [2]. They are named as behaviors that are routed in basic emotions: novelty seeking (anger), harm avoidance (fear), reward dependence (attachment) and persistence (ambition). This construct can be objectively assessed with the Temperament and Character Inventory (TCI) [2] and several studies have shown that at least one of these temperament dimensions is altered in virtually all psychiatric disorders compared to a mentally healthy control group (see [6] for review).

Akiskal has conceived temperament as the affective predisposition or reactivity, based on the original descriptions by Kraepelin [7] of fundamental states. These affective temperaments are called hyperthymic, irritable, cyclothymic, depressive [5] and anxious [8], and would be the predisposing ground for the development of mood disorders. The Temperament Evaluation of Memphis, Pisa, Paris and San Diego Autoquestionnaire (TEMPS-A) has been developed and validated as the self-report scale to assess this construct [9].

We have proposed an integration of *emotional* and *affective* temperament constructs [6,10], based on the principle that activation (anger and drive/pleasure) and inhibition (fear and caution) are the two main *emotional* forces or 'vectors of the mind', as coined by Thurstone [11]. Influenced by other models [2,12,13] and our preliminary versions of the scale, we also included a factor that is related to regulation of activation and inhibition, which we called control. This concept is highly attributed to frontal lobe function and, although not emotional per se, was included in the emotional construct due to its proposed role in emotional regulation and behavioral adaptation [13]. Moreover, besides those affective temperaments proposed by Akiskal, five new types were put forward [5,8], namely euthymic, dysphoric, apathetic, labile and disinhibited [6]. The presence of an euthymic temperament serves as an inbuilt reference group and the other new categories address more adequately the temperaments underlying those prone to attention deficit and hyperactivity disorders. The interaction of *emotional* forces (fear, anger, drive and control) would produce a resulting *affective* trend or prevailing mood. Using this rationale of the mind operating as a system, it is important to adequately characterize how activation, inhibition and control are processed.

There was no instrument suited to evaluate both emotional and affective temperament constructs simultaneously and rapidly. Also, some adaptations and changes were necessary to allow for the integration of the constructs put forward by Cloninger and Akiskal/Kraepelin. For example, mental activation in our model was defined by drive and anger, in contrast to Cloninger's view of Novelty Seeking, which would be based on anger [2]. In addition, the TEMPS-A is restricted to five affective temperaments. Taking these aspects into account,

we have recently developed and validated a brief self-report scale to evaluate emotional and affective temperaments simultaneously, The Combined Emotional and Affective Temperament Scale (CEATS) [14]. The CEATS has an emotional and an affective section. The emotional section consists of twenty seven 5-item multiple choice questions on fear, drive, anger and control. Fear relates to being fearful, cautious, thoughtful, shy and predisposed to freezing in danger whereas low fear (or disinhibition) is expressed as being daring, risk-taking, impulsive, spontaneous and reactive in dangerous situations. Drive is expressed as goal direction, excitement with novelty, high sense of pleasure, ambition and self-confidence, and anger as irritability, aggression, suspiciousness, impatience and resentfulness. Control mechanisms involve attention, concentration, responsibility, discipline, organization and ability to conclude tasks. The affective section includes descriptions of all 10 affective temperaments. These affective temperaments are assessed by a dimensional 5-point scale and by a categorical choice of the best fitting description. In the original study [14], all 10 categorical affective temperaments were selected: euthymic and hyperthymic (18-23%), cyclothymic and irritable (11-13%), anxious and depressive (8-9%) and dysphoric, disinhibited, labile and apathetic (3-7%). These data suggest the validity of the newly proposed affective temperaments.

In this paper we present the validation of the CEATS in a larger sample (n=4381) with high prevalence of psychiatric disorders (60%), especially bipolar spectrum disorders.

MATERIALS AND METHODS

Volunteers completed a CEATS' internet version and basic questions on psychiatric diagnosis in our website (www.bipolaridade.com.br) directed for bipolar patients and their family as well as for people interested in this theme. All participants gave their electronic informed consent before completing the scale. This form was elaborated to fulfill the requirements of the National Health Council of Brazil (Resolution 196/1996). Their participation was voluntary and they could cancel their participation at any moment without justification. The study was approved by the Institutional Review Board of Hospital São Lucas from Pontifícia Universidade Católica do Rio Grande do Sul.

DESCRIPTION OF THE CEATS

The CEATS has 40 items, typically takes 20-30 min to be completed and consists of:

- Emotional section: 27 five-item multiple choice questions arranged in the following order: fear (7 items), drive (8 items), control (6 items) and anger (6 items). The first alternative is a description of low and the last of high expression of the trait, except for fear items, which have a reversed score. This is in contrast with original validation article [14]. The total score of each dimension is the sum of scores from 1 to 5 for each question.

- Affective section: 10 short descriptions of the affective temperaments based on previous studies of the TEMPS, theoretical concepts, clinical observation and preliminary versions of the CEATS are presented with a 5-item

likert scale, from ‘exactly like me’ (rated as 5) to ‘nothing like me’ (rated as 1). This is the *dimensional* assessment of affective temperaments. After these 10 descriptions, the subject has to select which of these profiles is the most suitable to represent his/her temperament. This allows for a *categorical* evaluation of affective temperaments.

- Problems and benefits section: 2 final questions assesses the degree of problems and benefits that one conceives to have with his/her temperament with a 4-point scale (no, minimal, moderate and marked). This strategy is used because problems and benefits are not mutually exclusive and adaptation can be conceived as the result of both.

Statistical analysis

The emotional section was analyzed for factorial structure with Varimax rotation and for internal consistency. Only factors with an Eigenvalue>1 and items with factorial load over 0.30 were considered adequate. These factors were interpreted in accordance with the theoretical construct. Their means, standard deviations and Chronbach’s alphas were calculated.

The affective section was analyzed with Pearson’s correlation test. Also, the number of ‘exactly like me’ answers were counted. In those subjects who had no such answer, we counted how many chose the ‘a lot like me’ in order to evaluate if the 10 descriptions covered most of the population’s affective temperaments.

Comparisons between emotional and categorical affective temperaments were performed with ANOVA with Tukey`s test as *post hoc*. Age, problems and

benefits scores were also compared with emotional and dimensional affective temperaments using Pearson's correlation test. Statistical significance was considered if $p<0.01$ in order to reduce the impact of multiple comparisons. The SPSS 15.0 software was used for all analyses.

RESULTS

Our final sample consisted of 4381 subjects, with mean age of 29.75 ± 10.3 years (16-76), being 1117 (25.5%) males (30.5 ± 11.05 years) and 3264 (74.5%) females (29.5 ± 10.0 years). Sixty percent of subjects reported having received a psychiatric diagnosis by a mental health professional, being 89% a mood disorder.

EMOTIONAL SECTION

Exploratory factorial analysis revealed that the best solution involved four factors with Eigenvalues>1, accounting for 47.3% of the total variation (Table 1). These factors were interpreted as anger, control, fear and drive. The factors had Chronbach's alphas between 0.70 and 0.78 and showed normal distributions, with Lilliefors with $p<0.001$ (Table 1). The factorial matrix, item descriptions and loadings are shown in Table 2.

Table 3 shows that there was a moderately high negative correlation between the factors fear and drive ($r= -0.49$). Other correlations between emotional factors were weaker, but statistically significant. Regarding age, there

was a statistically significant negative correlation with anger and a positive correlation with control (Table 3). The perception of problems with temperament was particularly associated with higher anger and lower control. In contrast, the perception of benefits was mostly associated with higher drive (Table 3). Problem and benefit scores were significantly but weakly correlated ($r=-0.12$, $p<0.01$).

AFFECTIVE SECTION

All affective temperaments were selected, being cyclothymic (32.4%) the most prevalent, followed by irritable (10.7%), depressive (10.6%), euthymic (8.4%), labile (8.0%), hyperthymic (7.8%), disinhibited (6.7%), dysphoric (6.3%), anxious (5.5%) and apathetic (3.4%), as the least prevalent affective temperament.

As we postulate that the 10 proposed affective temperaments arise from the most commons combinations of activation, inhibition and control, we expected that most people would recognize at least one description as a perfect or good match (‘exactly like me’ or ‘a lot like me’, respectively). Indeed, 3316 subjects (75.7%) found at least one or more perfect matches (Figure 1). Among the 1065 (24.3%) individuals who failed to point out one perfect match, 961(21.9% of the total sample) found at least one good match. Thus, 2.4% (104 subjects) found no satisfactory description for their affective temperament.

Correlations of the dimensional part of the Affective Section are shown in Table 4. Except for a positive correlation with hyperthymic temperament,

euthymic temperament was negatively correlated with all temperaments, particularly with cyclothymic, dysphoric, labile and depressive temperaments. Depressive, anxious, cyclothymic, dysphoric, apathetic and labile temperaments were positively correlated. Labile and disinhibited temperaments as well as dysphoric and cyclothymic temperaments were particularly correlated (r=0.65). Inter-correlations between externalized temperaments (hyperthymic, irritable and disinhibited) were low to moderately positive. As expected, all categorical choices of affective temperaments were associated with higher score of the respective temperament in the dimensional part of Affective Section, with statistical separation from all the other groups ($p<0.05$), except for labile score from categorical disinhibited temperament.

COMPARISON BETWEEN EMOTIONAL PROFILE AND AFFECTIVE TEMPERAMENTS

The emotional profiles of categorical affective temperaments are shown in Figure 2 as mean ± 95% confidence intervals. Each affective temperament was associated with a fairly specific emotional signature, with the exception of dysphoric and cyclothymic temperaments, which expectedly had similar profiles.

DISCUSSION

Compared to the original sample from the general population [14], in the present sample there were less euthymics (8% x 23%) and more cyclothymics (32% x 13%). Hyperthymic temperament, which is the only affective

temperament positively related with the euthymic, also showed a lower prevalence (8% x 18%), while labile temperament, positively related with the cyclothymic temperament, was more frequent (8% x 4%). In this sample with a predominance of unstable temperaments and putatively psychiatric patients, the emotional section of the CEATS showed four factors, with satisfactory reliability coefficients (Chronbach's alpha values between 0.70 and 0.78), in agreement with the study in general population [14]. These results suggest that the scale performs adequately also in a patient population.

There were significant correlations between the emotional factors. With more relevance, a moderately high negative correlation (r= -0.49) between drive (activation) and fear (inhibition), which may be a bias to avoid ambivalence between approach and avoidance, and a positive correlation between drive and control and their negative correlation with anger. Despite being a more unstable sample, these correlations were similar to the findings in the general population sample. Our interpretation is that higher control favors the expression of activation as drive rather than anger, although these two are not mutually exclusive. If each emotional factor (drive, fear, anger and control) were independent and categorized as low, moderate or high to reflect their normal distribution, theoretically there would be 81 combinations or affective temperaments. The high rate of perfect/good matches with only 10 affective temperaments suggests that these descriptions capture the most common emotional combinations.

Dimensional assessment of affective temperaments identified 97.6% of subjects with either a perfect match (75.7% as 'exactly like me') or a good match (21.9 % as 'a lot like me'). However, 22% chose 4 or more perfect

matches. This profile is different from the original sample [14], in which 7% chose 4 or more perfect matches. This is probably due to the higher prevalence of cyclothymics, which indeed has a wide range of affective expressions, as shown by the positive correlations with all the other affective temperaments, except for euthymic and hyperthymic (see Table 4).

In a separate study, we have evaluated the external validity of the CEATS with the TCI-R by Cloninger (unpublished data). This study showed that harm avoidance is related to fear and drive, novelty seeking relates to low fear and control, and persistence and self-directedness (from the character section) are related to both drive and control. These results suggest that the way behavioral activation, inhibition and control are conceived in both scales have similarities, but also differences to be further studied. Besides these conceptual and psychometric approaches, the investigation of the biological substrates of temperament may help define its adequate structure. This dimensional characterization can also be useful clinically to evaluate patients regarding their traits, since current nosological systems emphasize states and categories. An example of the relevance of this concept is the clinical trial by Tang et al [15] showing that paroxetine treatment for depressive patients had a robust effect compared to placebo regarding change in neuroticism and extraversion traits independent of symptom improvement. After controlling for trait effects, paroxetine effects on symptoms were not significant. For this reason, short self-report instruments for temperamental traits in psychiatric patients may become scientifically and clinically useful. The CEATS seems to have these characteristics and is publicaly available.

This study and the scale have some limitations. This was a convenience sample and subjects had access to the web-based scale through a psychoeducational website on bipolar disorders. Although subjects were asked about psychiatric diagnoses received by mental health professionals, no operationalized psychiatric evaluation or diagnostic scale was conducted in the sample. As a self-report instrument, this instrument may include some degree of desirability, although more than 80% of the subjects chose affective temperaments that were not associated with a particularly favorable profile in terms of problems and benefits. Regarding results, the drive factor was not as pure as the other factors, with some loadings from the other factors. Data on test-retest reliability is still lacking for this scale. Finally, the dimensional assessment of affective temperaments is based on only one question, which has limitations for quantification compared to other scales such as the TEMPS-A, which has many items and wider scores.

CONCLUSION

In conclusion, this study showed adequate psychometric characteristics of the CEATS in a sample with high prevalence of psychiatric disorders, in agreement with results in general population [14]. Thus, CEATS may be a convenient instrument for both clinical and research ends to evaluate emotional and affective temperaments simultaneously in psychiatric samples. This scale may fulfill a need for a brief and accurate evaluation of temperament with constructs that are familiar to psychiatrists.

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Table 1. Psychometric properties of the Emotional Section of the CEATS.

Scale Factor	Number of items	Mean score ± S.D	Alpha	Skewness	Kurtosis
1. Anger	6	20.88 ± 5.15 (6-30)	0.78	-0.22	-0.64
2. Control	6	16.54 ± 4.79 (6-30)	0.76	0.04	-0.55
3. Fear	7	20.55 ± 4.85 (7-35)	0.70	-0.03	-0.30
4.Drive	8	22.37 ± 5.95 (8-40)	0.78	0.10	-0.43

Table 2. Factorial matrix of CEATS – Emotional Section.

Factor/items	Factorial load: F1	Factorial load: F2	Factorial load: F3	Factorial load: F4
Factor 1: ANGER				
Hardly/easily irritable	.81			
Non-aggressive/very aggressive	.72			
Short/long duration of anger	.56			
Non explosive/very explosive	.77			
Rarely/often gets suspicious	.53			
Patient/very impatient	.66			
Factor 2: CONTROL				
Non/very disciplined		.66		
Non/very organized		.65		
Distractful/ non distractful		.62		
Fails to finish tasks/finishes long		.69		
Low concentration and interest/high		.57		
Irresponsible/very responsible		.71		
Factor 3: FEAR				
Fearful/daring			.58	.37
Shy/extroverted			.76	
Cautious/risk-taking			.54	
Inhibited/spontaneous			.76	
Thoughtful/impulsive	.30		.50	
Worried/unworried	-.33		.33	
Freezing in danger – reactive in			.39	
Factor 4: DRIVE				
Pessimistic/optimistic	-.33		.32	.52
Low/high excitement with novelty				.55
Low/high sense of pleasure				.59
Sad/cheerful			.44	.49
Modest/ambitious plans				.69
Easily/hardly gives up		.37		.51
Insecure/self-confident		.31	.42	.40
low /high drive and goal direction		.42		.64

Only loadings ≥0.30 and ≤-0.30 are shown.

Table 3. Correlation between emotional factors, problems, benefits, adaptation and age.

	Fear	Drive	Control	Anger
Drive	-.49**	-		
Control	.06**	.27**	-	
Anger	-.13**	-.15**	-.23**	-
Problems	-.07**	-.19**	-.34**	.36**
Benefits	-.26**	.45**	.20**	-.16**
Age	-.02	-.01	.22**	-.11**

** Correlation is significant at the 0.01 level.

Table 4. Correlations between dimensional scores of affective temperaments.

	Dep	**Anx**	**Apat**	**Dysp**	**Cyc**	**Eut**	**Irri**	**Lab**	**Disin**
Anxious	**.41**	-							
Apathetic	**.43**	.23	-						
Dysphoric	.25	.17	.27	-					
Cyclothymic	.36	.19	.37	**.65**	-				
Euthymic	**-.41**	-.16	-.31	**-.51**	**-.63**	-			
Irritable	*.00*	.05	-.05	**.41**	.33	-.20	-		
Labile	.21	.06	**.45**	**.49**	**.54**	**-.42**	.31	-	
Disinhibited	*.03*	*.03*	.29	.39	.38	-.25	.25	**.65**	-
Hyperthymic	**-.49**	-.27	-.35	-.11	-.24	**.40**	.10	-.09	.11

Values >0.40 and <-0.40 are in **bold**. Values in *italics* were statistically non-significant (p>0.01).

Figure Legends

Figure 1. Frequency of perfect and good matches in the dimensional choice of affective temperaments. Perfect and good match are the descriptions marked as ‘exactly like me’ and ‘a lot like me’, respectively. A = number of perfect matches in the whole sample; B = number of good matches among those without a perfect match.

Figure 2. Emotional profile of categorical affective temperaments. Scores of fear (7-35), drive (8-40), control (6-30) and anger (6-30) are shown as mean ± 95% CI.

Figure 1

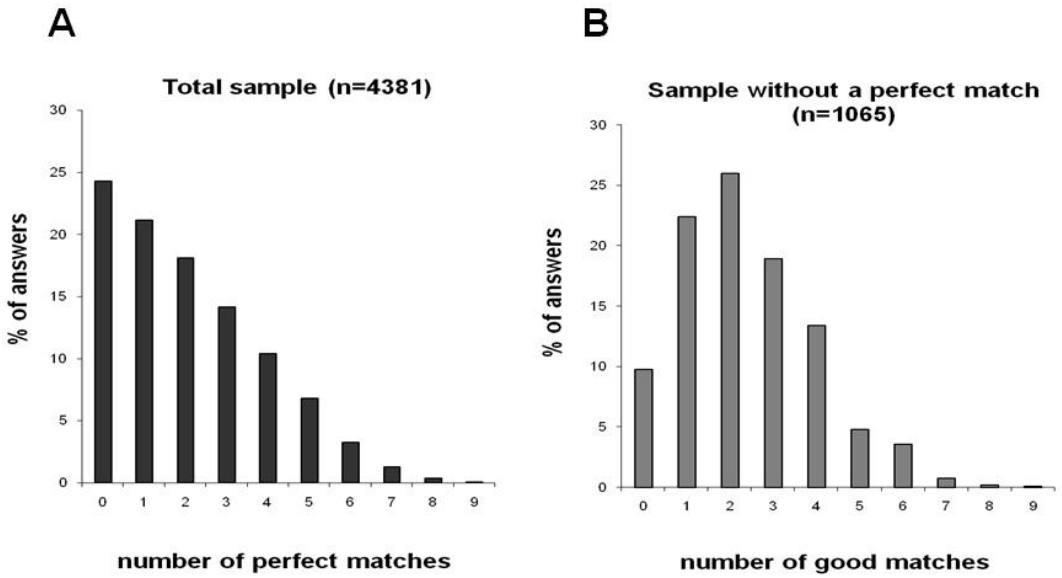
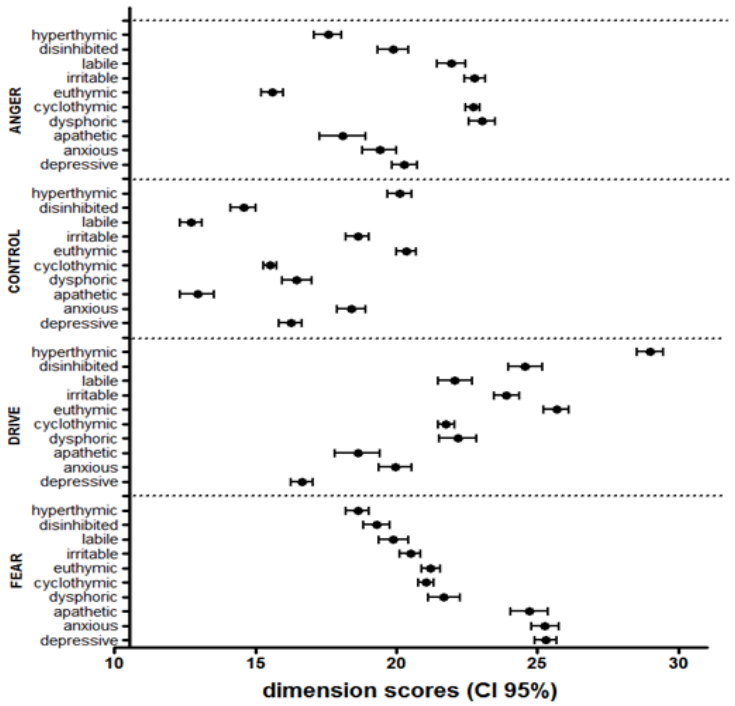


Figure 2



Capítulo IV

Validação da Versão Final da Escala de Avaliação de Temperamento Afetivo e Emocional (*Affective and Emotional Composite Temperament Scale* - AFECTS)

Development and validation of the Affective and Temperament Composite Temperament Scale (AFECTS) in a general population sample

Diogo R. Lara[1], Luisa W. Bisol[2], Caroline Reppold[3], Miriam G. Brunstein[4], Hudson W. de Carvalho[5], Claudio S. Hutz[6], Gustavo L. Ottoni[7]

1. Faculdade de Biociências, Pontifícia Universidade Católica do Rio Grande do Sul, Porto Alegre, Brazil
2. Departamento de Psiquiatria, Pontifícia Universidade Católica do Rio Grande do Sul, Porto Alegre, Brazil
3. Departamento de Psicologia, Fundação Faculdade de Ciências Médicas de Porto Alegre, Porto Alegre, Brazil
4. Departamento de Psiquiatria, Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil
5. Departamento de Psiquiatria, Universidade Federal de São Paulo, São Paulo, Brazil.
6. Instituto de Psicologia, Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil
7. Departamento de Bioquímica, Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil

Corresponding author:

Diogo R. Lara
Faculdade de Biociências – PUCRS
Av. Ipiranga, 6681 – Pd12A
Porto Alegre, RS. 90619-900
Brazil
FAX +55 51 33203612

E-mail: drlara@pucrs.br

ABSTRACT

Background: Temperament relates to specific emotions and general affective tone, but these different views are rarely integrated. We had developed and validated the Combined Emotional and Affective Temperament Scale (CEATS) to integrate these concepts. Here we show the data of a new version of this scale, called Affective and Emotional Composite Temperament Scale (AFECTS), which has two new emotional dimensions (sensitivity and coping) and two other affective temperaments (obsessive and euphoric).

Methods: 2,947 subjects (72% females, 35 ± 11 years old) filled the Internet version of the AFECTS. The AFECTS has 6 emotional dimensions with eight 7-point likert bipolar items and 12 affective temperament descriptions rated quantitatively and categorically (selection of the best fit). The data was analyzed with standard exploratory and confirmatory factor analysis.

Results: In the emotional section, 6 factors with high loading explained 50% of the variation. These factors were interpreted as voliton, anger, inhibition, sensitivity, coping and control, with good Chronbach's alphas for 5 dimensions (0.87–0.90) and acceptable alpha for Inhibition (0.75). In the confirmatory analysis, fit index indicated good absolute and parsimonious fit for the six-factor structure designed (RMSR = 0.063; RMSEA = 0.053). In the Affective section, all 12 categorical affective temperaments were selected in the categorical choice, being euthymic, cyclothymic, obsessive and anxious the most prevalent (11–13% each), and apathetic, volatile and dysphoric the least frequent (3–4% each), with 85% of volunteers selecting at least one affective temperament as “exactly like me”. Each affective temperament showed a specific emotional signature, except for the similar profile of dysphorics and cyclothymics.

Composite scores based on emotional and affective temperaments showed that euthymic and hyperthymic temperaments were the most favorable profiles, and depressive and volatiles were associated with poor emotional functioning. Volatiles, cyclothymic and dysphorics showed high externalization and internalization, and were the most unstable temperaments.

Limitations: Only the internet version was used and the sample was not evaluated for psychiatric disorders.

Conclusions: The AFECTS is a brief and adequate self-report instrument to evaluate emotional and affective aspects of temperament simultaneously, being more complete and with better discriminating power than the CEATS.

INTRODUCTION

Temperament relates to the emotional nature and the quality of the prevailing mood, being mostly inherited and relatively stable over time (Allport, 1961; Cloninger et al., 1993). Many authors have proposed very influential concepts of temperament and personality, which can be divided in two major groups. The first group views temperament with a more specific approach to emotions and behavioral systems, as in the case of Gray with Behavioral Activation and Inhibition systems (Pickering and Gray, 1999), Cloninger with the Temperament and Character model (Cloninger et al., 1993), Rothbart with the inclusion of effortful control (Rothbart et al., 2000), and McCrae and Costa's Big Five model (McCrae and Costa, 1987). The other group has a more synthetic view of temperament, such as Eysenck (1987) with extraversion (from internalized to externalized) and neuroticism (from stable to unstable), and Akiskal with the 5 affective temperaments (depressive, anxious, cyclothymic, irritable and hyperthymic) (Akiskal et al., 1998; Akiskal et al., 2005).

We have proposed an integration of emotional and affective temperament constructs, named as the "fear and anger model", with clinical (Lara et al., 2006), neurobiological and treatment implications (Lara and Akiskal, 2006). Based on this model we developed the Combined Emotional and Affective Temperaments Scale (CEATS) (Lara et al, 2008). The scale included disinhibition, drive, anger and control as emotional temperaments, and 10 affective temperaments: apathetic, labile, disinhibited, euthymic, dysphoric and the 5 affective temperaments from Akiskal's model. The CEATS provided a general and complementary view of temperament, which was useful to show specific emotional and affective features associated with cigarette smoking

(Bisol et al. 2010) and subject sleep parameters (Ottoni et al, 2011). However, the CEATS emotional dimension items were relatively large using whole sentences in a 5-point likert scale.

Based on the preliminary findings with the CEATS, our concept of temperament expanded and we included two new emotional dimensions (sensitivity and coping) and two other affective temperaments (obsessive and euphoric). We also restructured the emotional dimension section with 7-point bipolar items to increase discrimination and reduce time to complete the instrument. Here we present the validation data of the new scale, called AFECTS (Affective and Emotional Composite Temperament Scale).

METHODS

The data was collected in a websurvey on temperament and psychiatry conducted in Brazil (BRAINSTEP – Brazilian Internet Study on Temperament and Psychiatry - www.temperamento.com.br). The application of instruments by the internet improves and facilitates data collection because all items are necessarily answered, no mistakes of data transfer are expected to occur, identification is only partial (e-mail address, names were not required) and large samples are more easily achieved. Validation items were included to ensure attention and compromised participation. To stimulate sincerity and to provide motivation, this internet system provides a brief psychological profile as a feedback for volunteers after completion of 9 scales.

SUBJECTS

All participants gave their electronic informed consent before completing the scale. This form was elaborated to fulfill the requirements of the National Health Council of Brazil (Resolution 196/1996) and the Code of Ethics of the World Medical Association (Declaration of Helsinki). Their participation was voluntary and they could cancel their participation at any moment without justification. The study was approved by the Institutional Review Board of Hospital São Lucas from Pontifícia Universidade Católica do Rio Grande do Sul.

Validity items throughout the system checked for attention of participants. After demographic data, the AFECTS was the first scale of this system. The sample consisted of 3,274 subjects, but 327 (10%) were excluded in the validity checks. Thus, the final sample were 2,947 subjects (72% females, mean age 34.5 $\pm$ 11.4 y; 28% males, mean age 35.5 $\pm$ 11.6 y), 83.9% Caucasians, 84.8% with ≥11 years of education, 19.4% current smokers, and 30.7% reported having ever received a psychiatric diagnosis from a mental health professional.

AFECTS

The AFECTS is composed of separate emotional and affective sections, as well as two questions to evaluate problems and benefits associated with temperament, similar to our previous scale (Lara et al. 2008). It has 62 items in total, and typically takes around 20 min to be completed (see Appendix)

Emotional section

The emotional section is a 7-point bipolar scale with 48 items, divided in 6 dimensions of 8 questions. The dimensions were named Volition (1-8), Anger

(9-16), Inhibition (17-24), Sensitivity (25-32), Coping (33-40) and Control (41-48). The total score of each dimension is the sum of scores from 1 to 7 for each question (1 to 7 from left to right, and reversed in Inhibition and Sensitivity), so their scores range from 8 to 56. The Emotional section corresponds to question 1 of the AFECTS shown in the Appendix.

Affective section

For the quantitative assessment of affective temperaments, twelve short descriptions of the putative affective temperaments were presented with a 5-item likert scale, from ‘nothing like me’ (rated as 1) to ‘exactly like me’ (rated as 5). Another question asks to select which of these 12 profiles was the best fit to represent his/her affective temperament, allowing for a categorical evaluation. The Affective section corresponds to questions 2 and 3 of the AFECTS shown in the Appendix.

Problems, benefits and adaptation score

Two final questions assess the degree of problems and benefits that one conceives to have with his/her temperament with a 4-point scale (no, minimal, moderate and marked problems or benefits, from 0 to 3). Problems and benefits are weakly correlated (R=-0.19 in this sample). The reverse of problems score was added to benefits score to create what we called the Adaptation score (range 0 to 6).

Composite indexes

The combination of different scores allows a more synthetic view of the data. The following composite indexes were created:

- Global Emotional Functioning (GEF): Volition + Control + Coping + caution (facet of Inhibition) – Anger – Sensitivity – fear (facet of Inhibition) + 60 (score range -52 to 236). The dimensions or facets that contributed positively and negatively for this index were those with positive and negative correlations with the Adaptation score, respectively.

Internalization index: quantitative score (from 1 to 5) of depressive + anxious + apathetic temperaments (score range 3 to 15).

Externalization index: quantitative score (from 1 to 5) of euphoric + irritable + disinhibited temperaments (score range 3 to 15).

Externalization-internalization index: Externalization index – internalization index (score range -12 to 12).

Instability index: quantitative score of cyclothymic + volatile + dysphoric – euthymic temperaments + 5 (score range 3 to 19).

Statistical analysis

To evaluate the suitability of the dataset for factor analysis implementation, we examined the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) and the Bartlett's Test of Sphericity. The KMO tests whether the partial correlations among variables are robust enough to accommodate factor analysis. It offers an index for comparing the magnitudes of the observed correlation coefficients to the magnitudes of the partial correlation coefficients. A KMO value of 0.6 or higher is considered acceptable for a satisfactory factor analysis to proceed. The Bartlett's test of sphericity tests the null hypothesis that the correlation matrix for the dataset derives from a population in which

constituent variables are noncollinear, that is, it evaluates whether correlations among variables are equal to the identity matrix. A p-value of 0.05 or smaller serves as the criterion for rejection of the null hypothesis, indicating that the correlation matrix is not an identity matrix and implementation of factor analysis is possible.

Factor analytic evaluation of the dataset was conducted in three stages. First, we verified the unidimensionality and internal consistency of each AFECTS dimension using unweighted least squares exploratory factor analysis (ULS-EFA) and alpha coefficient estimation. Screeplot, root mean square residual (RMR ≤ .08) and alpha coefficient values served as criteria for unidimensionality. Second, ULS-EFA was implemented to estimate the approximate simple structure using the 48 item as continuous indicators via Promax (Kappa = 4) rotation. The fit of the extracted structure was assessed based on screeplot considerations, item's commonality values (≥ 0.4) and the interpretability of the extracted structure. We considered factor loadings interpretable only if they exceeded a value of 0.32, which represents a minimum of 10% of accounted common variance. Based on the previous results and on conceptual grounds, we used maximum likelihood confirmatory factor analysis (ML-CFA) to estimate the fit of a six-factor model. The Standardized Root Mean Square Residual (SRMR) was used to evaluate absolute fit and the Root Mean Square Error of Approximation (RMSEA) was used to evaluate parsimonious fit. Smaller values of SRMR reflect better fit, with values below 0.08 being considered to be indicative of adequate fit, and values below 0.05 indicative of close fit. Parsimonious models have an RMSEA of 0.06 or less.

Additionally, we explored the existence of sex differences using t-tests and chi-squares on the emotional and affective data. Spearman correlations were used to estimate the degree of association between affective temperaments scores. Alpha level of significance was $p<0.05$.

Structural analyses were carried out using the third version of Mplus computer package (Muthén and Muthén, 1998-2004); reliability analyses, sex differences estimations and Spearman correlations were performed using the 15th version of SPSS for Windows.

RESULTS

Emotional Section

Exploratory Factor and Internal consistency analyses

Sample adequacy indicators attested to the suitability of the dataset for implementation of factor analysis. The KMO index achieved adequate levels for each AFECTS dimension individually ($0.77 \leq KMO \leq 0.92$) and for all the items ($KMO = 0.95$), and the Bartlett's Test of Sphericity was significant in all cases ($p < 0.001$).

All scales but Inhibition displayed a unidimensional structure when freely estimated: Sensitivity, one factor accounted for 46.6% of total variance and item-factor loadings ranged from 0.48 to 0.74; Control, one factor accounted for 49.6% of total variance and item-factor loadings ranged from 0.58 to 0.73; Anger, one factor accounted for 50.0% of total variance and item-factor loadings ranged from 0.47 to 0.84; Volition, one factor accounted for 55.8% of total variance and item-factor loadings ranged from 0.57 to 0.85; Coping, one factor

accounted for 47.5% of total variance and item-factor loadings ranged from 0.55 to 0.78. ULS-EFA for Inhibition scale yielded a correlated two-factor structure ((RMR = 0.0175 and r = 0.434), with the first factor clustering five items (accounted covariance of 29.6% and item-factor loadings ranged from 0.32 to 0.77) and the second factor clustering three items (accounted covariance of 12.9% and item-factor loadings ranged from 0.52 to 0.86).

ULS-EFA using all 48 constituent items produced an interpretable oblique six-factor structure that accounted for 49.8% of the total variance. The first factor accounted for all Sensitivity items (25.8% of variance), the second factor accounted for all Control items (9.2% variance), the third factor accounted for all Anger items (7.5% of variance), the fourth factor accounted for all Volition items (3.2% of variance), the fifth factor accounted for all Coping items (2.4% of variance), and the sixth factor accounted for all Inhibition items (1.7% of variance). The six-factor structure accounted for 49.7% of total variance in the model and factors displayed low to moderate correlations. Table 1 displays the approximate simple factor structure. Table 2 shows correlations between emotional factors.

Cronbach's alpha coefficients indicated acceptable to excellent levels of homogeneity for all AFECTS dimensions: Sensitivity, 0.87; Control, 0.89; Anger, 0.88; Volition, 0.91; Coping, 0.87; Inhibition, 0.75.

Confirmatory Factor Analysis

The measurement model using all constituent items (i.e. eight items per factor) produced marginal parsimonious fit (RMSEA = 0.061) and poor absolute

fit (RMSR = 0.099). Nevertheless, after the exclusion from analysis of the three fear items from inhibition scale, the six-factor model produced good absolute and parsimonious fits (RMSR = 0.063; RMSEA = 0.053). Correlation pattern did not differ significantly from the ones produced by the exploratory factor analysis. Table 3 shows the modeled factors.

General characteristics of Emotional dimensions

Compared to females, males had lower Sensitivity, Inhibition and Anger and higher Volition (Table 4). Most factors showed negative skewness (right shift) and kurtosis (flat-topped curve) (Table 4). Age was significantly correlated with Control (0.15) and Coping (0.13) and negatively correlated with Anger (-0.10).

Affective Section

The frequency of categorical choices for affective temperaments is shown in Figure 1. Euthymic, cyclothymic, obsessive and anxious were the most prevalent (~12%), and apathetic, volatile and dysphoric the least frequent (3-4%) affective temperaments. Females were significantly overrepresented among cyclothymics and less frequent among euthymics.

Eighty-five percent of subjects selected at least one affective temperament as a perfect match (‘exactly like me’ – score 5) in the dimensional section of affective temperaments, and 52% chose between 1 and 3 perfect matches. Euthymics (categorical choice) had fewer perfect matches (mean 1.5) and, euphorics, depressives and cyclothymics identified more perfect matches (mean 3.3 to 3.5). Fourteen percent of the sample pointed no perfect match (‘exactly like me’) but selected at least one affective temperament as score 4

(corresponding to ‘a lot like me’). Therefore, only 1% failed to identify an adequate description for their affective temperament.

The correlations between the dimensional scores of affective temperaments are shown in Table 5.

Emotional profile of affective temperaments

Each categorical affective temperament was associated with a particular emotional dimensional profile, as shown in Figure 2. Anger was very low in euthymics and high in those with euphoric, irritable or cyclothymic temperament. Volition was particularly high in stable temperaments (hyperthymic and euthymic), very low in depressives and low in apathetics and volatiles. Inhibition was high in internalized temperaments (depressives, anxious) and low in euphoric, disinhibited, volatile and hyperthymic temperaments. The combination of high sensitivity and low coping was found in depressives, apathetics, volatiles, cyclothymics and dysphorics, whereas the reverse was observed in euthymics and hyperthymics. Control was high in euthymics, hyperthymics and obsessives, and very low in volatiles and apathetics.

Composite scores

The composite score Global Emotional Functioning (GEF) was based on the correlations of each emotional dimension with the Adaptation score (advantages + reverse score of problems with temperament, data not shown; see Methods). The GEF score showed normal distribution (Figure 3A). The

affective temperaments with the most favorable GEF index were hyperthymic and euthymic whereas in volatiles and depressives had the least favorable score (Figure 3B).

Affective temperament scores were combined to form composite indexes for externalization, internalization, externalization-internalization and instability (see Methods). As shown in Figure 4, each categorical affective temperament showed a particular profile of internalization, externalization and instability. Depressive, anxious and apathetic temperaments had high internalization and low externalization indexes, and the reverse was observed in irritable, disinhibited and euphoric temperaments. The remaining affective temperaments showed a balance between internalization and externalization indexes, but euthymics had both low, whereas unstable temperaments showed higher scores in both indexes. The instability index was particularly high in volatiles and cyclothymics, but also high in dysphorics and depressives. Euthymics and hyperthymics were the most stable temperaments.

In Figure 5, the internalization-externalization index was plotted with the instability index to locate the categorical affective temperaments in a matrix as proposed by Eysenck (1987). Their distribution in this matrix allowed grouping them in four groups of three: externalized (externalized and moderately unstable: euphoric, disinhibited and irritable), internalized (internalized and moderately unstable: depressive, apathetic and anxious), unstable (unstable and moderate in internalization-externalization: dysphoric, cyclothymic and volatile) and stable (stable and moderate to high internalization-externalization: euthymic, obsessive and hyperthymic). The temperaments that do not fit so well in this general classification were the hyperthymic, which is stable and

externalized, and the internalized and somewhat more unstable depressive temperament.

DISCUSSION

The present study showed that the AFECTS provides a global and specific assessment of temperament with 6 emotional dimensions and 12 affective temperaments. The composite scores also provide synthetic measures of global emotional functioning, affective instability, internalization and externalization.

The exploratory factor analysis identified 6 consistent emotional factors with high loading in their own factors, low factor loadings on other factors and very good internal consistency. These results were better in comparison with our previous scale CEATS (Lara et al, 2008) and two emotional dimensions were successfully added: Sensitivity and Coping. Confirmatory factor analysis, though not using all items designed for assessing Inhibition, deflagrated the statistical pertinence of the proposed six-factor structure emotional dimensionality.

Although Volition, Control, Sensitivity and Coping are substantially correlated, they represent subsystems with clear different adaptive functions. Volition represents the basic positively valenced energy in the system while Control relates to environmental monitoring, self organization and direction of the energy. Both functions are continuously active when not asleep. In contrast, Sensitivity and Coping reflect how one reacts to and deals with adversities and problems, i.e., they are active and more relevant in specific situations. Adaption relies substantially on the coordinated action of these four dimensions. Our

position is that to understand psychological functioning one should take into account each of the six emotional subsystems by itself and in relation to others. It is the global result of such subsystems interaction that produces the affective temperaments proposed and validated in this paper. The particular dysfunctions of these subsystems may also deflagrate the main psychopathological features of psychiatric disorders and comorbidity patterns.

AFECTS emotional dimensions present some practical advantages when compared with the previous scale (CEATS). All AFECTS emotional scales have 8 questions, which allow direct intra- and inter-individual emotional scores comparisons. The 7-point bipolar items of AFECTS are easier and quicker to respond than the items in the CEATS. Each dimension can also be divided into two facets of 4 questions with more specific content, based on content and their inter-item correlations (data not shown): Volition (positivity 1-4, energy 5-8), Anger (intensity 9-12, irritability 13-16), Inhibition (fear 17-20, caution 21-24), Sensitivity (interpersonal 25-28, events 29-32), Coping (facing 33-36, ability 37-40) and Control (focus 41-44, order 45-48). These facets permit a more detailed clinical description.

In the affective section, euphoric and obsessive types appear to be two important affective temperaments inclusions compared to CEATS (Lara et al., 2008). These were commonly chosen (~8% for euphoric and ~13% for obsessive) and may be responsible for the increase from 59% in CEATS (Lara et al, 2008) to 85% of volunteers pointing at least one affective temperament as “exactly like me”. The distinction of hyperthymic and euphoric temperament was essential to differentiate a stable and adaptative (hyperthymic) from a more unstable and maladaptive externalized temperament (euphoric). Also the

obsessive temperament is an important stable type that is somewhat more inhibited and sensitive than the euthymic temperament, and therefore comparatively more related to the anxious and depressive types.

The composite indexes generated a more synthetic description of temperament data. The most important contribution was to show that unstable affective temperaments (cyclothymic, volatile and dysphoric) show high internalization and externalization vulnerabilities simultaneously and at a similar level, whereas euthymics show both low. Thus, these indexes suggest that externalization and internalization do not cancel each other and their co-occurrence adds significant complexity to understand and treat patients with such temperaments. Another relevant contribution was to create an index that reflects global emotional functioning, the GEF score. Such score can be useful to have a general perception of mental health and may be useful to follow-up trait improvement with treatments. In fact, we have proposed that traits should be a primary target of treatment (Lara and Akiskal, 2006). Of note, recently Tang et al. (2009) showed that, compared to placebo, paroxetine had a much greater effect size treating trait neuroticism than depressive symptoms in patients with major depression. It is possible that such concept may apply for most psychiatric disorders and psychotropic treatments. Therefore, the combined use of specific emotional dimensions and the GEF score can be a useful strategy to measure the impact of therapeutic interventions, but a wealth of research will be needed to evaluate this possibility.

The AFECTS seems to provide measures that are compatible with most concepts of temperament and many personality measures. Gray's Behavior Inhibition and Activation Systems (Pickering and Gray, 1999), and Cloninger's

novelty seeking, harm avoidance, persistence, self-directedness and cooperation (Cloninger et al, 1993) are reflected in the emotional dimensions of the AFECTS. Rothbart's Effortful Control (Evans & Rothbart, 2007) and McCrae's and Costa (1987) Conscientiousness are expressed as Control. Neuroticism is represented in AFECTS as Sensitivity and the Instability index, and Extraversion may correspond to the reverse of Inhibition and Introversion index, the Extraversion index or the Extraversion-introversion index. Finally, the five affective temperaments assessed in Akiskal's TEMPS (hyperthymic, irritable, cyclothymic, anxious and depressive) (Akiskal et al, 2005) are represented quantitatively and categorically, along with 7 other affective temperaments. However, the euphoric temperament may also share features of hyperthymic, irritable and cyclothymic temperaments in TEMPS. Despite these theoretical considerations, future studies should examine the concurrent validity of AFECTS with the respective instruments of these constructs.

In conclusion, the AFECTS is a relatively short self-report scale with good psychometric properties and complementary approaches on the concept of temperament. Both emotional and affective temperaments were conceived to be useful for and readily understood by clinical psychologists and psychiatrists. Thus, the AFECTS may be a valuable instrument for both clinical and research mental health settings.

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Appendix

AFECTS – Temperament Scale

1. Check the option that most accurately corresponds to <u>the way you are and act in general</u>. There are no right or wrong answers, respond according to what you are and not according to what you would like to be. Each item has opposite characteristics. Choose the one that most precisely corresponds to you (<u>check only one option per line).</u> The first line shows an example of someone who feels moderately confident.

	Very	Some-what	A little	Neutral	A little	Some-what	Very		
Insecure						X		Confident	example
Pessimistic								Optimistic	1
I hardly feel pleasure								I easily feel pleasure	2
Sad								Cheerful	3
I have low self-esteem								I have high self-esteem	4
I am indifferent to new activities								I get excited about new activities	5
Unmotivated								Motivated	6
I am not goal oriented and have low drive								I am goal oriented and have high drive	7
I am dull and have low energy								I am active and energetic	8
Cool								Hasty	9
Moderate								Intense, all-or-nothing	10
Flexible								Stubborn	11
Patient								Inpatient	12
Calm								Irritated	13
Peaceful								Aggressive	14
Controlled								Explosive	15
I trust people								Suspicious	16
Fearful								Daring	17
Inhibited								Spontaneous	18
Worried								Unworried	19
I freeze in dangerous situations								I react quickly in dangerous situations	20

	Very	Some-what	A little	Neutral	A little	Some-what	Very		
Cautious								Reckless	21
Thoughtful								Impulsive	22
Careful								Careless	23
I avoid taking risks								I am risk-taking	24
I blame myself easily								I rarely feel guilty	25
I deal poorly with rejection								I deal well with rejection	26
I'm sensitive to criticism								I deal well with criticism	27
I easily get hurt emotionally								I hardly get hurt emotionally	28
I find it hard to overcome traumas								I find it easy to overcome traumas	29
I am sensitive to stress								I deal well with stress	30
I perform poorly under pressure								I deal well under pressure	31
I have low tolerance to frustration								I have high tolerance to frustration	32
I blame others for my mistakes								I take responsibility for my mistakes	33
I try to run away from my problems								I face my problems	34
I wish my problems would just go away								I try to solve my problems	35
I let my personal problems pile up								I tackle my personal problems at once	36
I have difficulty handling my conflicts with people								I easily handle my conflicts with people	37
I have trouble finding solutions								I easily find solutions	38
I tend to repeat my mistakes								I learn with my mistakes	39
Suffering has made me more fragile								Suffering has made me stronger	40

	Very	Some-what	A little	Neutral	A little	Some-what	Very		
It is hard for me to pay attention								I can easily pay attention	41
Distracted								Focused	42
I plan activities poorly								I plan activities well	43
I fail to finish tasks								I can even finish long tasks	44
Disorganized								Organized	45
Undisciplined								Disciplined	46
Irresponsible								Responsible	47
Negligent								Perfectionist	48

2. For each description below check the alternative that best corresponds to you (check only one alternative):

A) I have a tendency towards melancholy and sadness, I see little fun and joy in things; I tend to put myself down; I don't like changes; I prefer to listen than to talk.

Nothing like me □ □ □ □ □ **Exactly like me**

B) I am very worried and careful; I often feel insecure and apprehensive; I am, afraid that bad things will happen; I try to avoid risky situations; I am always alert and vigilant.

Nothing like me □ □ □ □ □ **Exactly like me**

C) I have little initiative; I often drift away from what others are saying or doing; I often fail to finish what I have started; I tend to be passive and a bit slow.

Nothing like me □ □ □ □ □ **Exactly like me**

D) I'm dedicated, demanding, perfectionist, painstaking and rigid; I need to be in control of things; I don't deal well with uncertainty and mistakes.

Nothing like me □ □ □ □ □ **Exactly like me**

E) My mood is unpredictable and unstable (ups and downs or mood swings); my mood changes very quickly or out of proportion to the facts; I have periods of great energy, enthusiasm and energy that alternate with other phases of sluggishness, loss of interest and discouragement.

Nothing like me □ □ □ □ □ **Exactly like me**

F) I have a strong tendency to feel agitated, tense, anxious and angry at the same time.

Nothing like me □ □ □ □ □ **Exactly like me**

G) I am restless, disorganized and easily distracted; sometimes I am hasty or inconvenient and only realize it when it is too late; I quickly lose interest; I often fail to do what I should and often do not finish what I have started.

Nothing like me □ □ □ □ □ **Exactly like me**

H) My mood is balanced and predictable, I usually have mood changes only when there is a clear reason; I have good spirits and, in general, I feel good about myself.

Nothing like me □ □ □ □ □ **Exactly like me**

I) I'm very frank, direct and determined, but also angry, explosive and suspicious.

Nothing like me □ □ □ □ □ **Exactly like me**

J) I am restless, active, spontaneous and distracted; I often rush and do careless things; I often leave things for the last minute; when I lose my temper, I soon get well again.

Nothing like me □ □ □ □ □ **Exactly like me**

K) I am always in good spirits, I am very confident and I have fun easily; I love novelty; I do many things without getting tired; I go after what I want until I get it; I have a strong tendency for leadership.

Nothing like me □ □ □ □ □ **Exactly like me**

L) I am expansive, fast, talkative and intense; I have many ideas and I am easily distracted; I am hasty, explosive and impatient; I take risk by being overconfident or excited; I overdo things that are pleasurable; I do not like routine and rules.

Nothing like me □ □ □ □ □ **Exactly like me**

3. Choose the description (from A to K) from the question 2 above that is closest to your profile (<u>only one alternative</u>). Please read carefully those descriptions that fit you best before choosing the alternative.

A	B	C	D	E	F	G	H	I	J	K	L

4. To what extend have you had <u>problems or personal losses</u> due to your usual mood and the way you are and behave?

No problems □ □ □ □ Many problems

5. To what extend have you gained <u>benefits and personal advantages</u> due to your usual mood and the way you are and behave?

No advantages □ □ □ □ Many advantages

Table 1: Exploratory factor structure.

	Factors					
	Sensitivity	**Control**	**Anger**	**Volition**	**Coping**	**Inhibition**
Sensitivity 1	**0.53**	0.03	-0.15	-0.12	0.08	0.00
Sensitivity 2	**0.77**	0.03	-0.08	0.03	-0.01	-0.09
Sensitivity 3	**0.77**	-0.05	-0.04	0.14	-0.06	0.01
Sensitivity 4	**0.77**	0.05	0.02	0.06	0.04	0.02
Sensitivity 5	**0.68**	0.06	-0.05	-0.10	-0.01	-0.03
Sensitivity 6	**0.67**	-0.02	0.06	-0.07	0.09	0.04
Sensitivity 7	**0.62**	-0.12	-0.03	0.04	-0.05	0.06
Sensitivity 8	**0.68**	0.03	0.05	-0.04	-0.02	-0.04
Control 1	-0.06	**0.77**	-0.00	0.05	-0.10	-0.10
Control 2	0.06	**0.84**	-0.02	-0.08	-0.07	-0.01
Control 3	0.02	**0.59**	-0.00	0.10	0.11	0.07
Control 4	-0.04	**0.65**	-0.00	0.04	0.05	0.00
Control 5	-0.08	**0.71**	-0.03	0.06	-0.06	-0.03
Control 6	0.01	**0.72**	-0.04	0.04	-0.07	0.09
Control 7	0.06	**0.58**	0.07	0.01	0.15	0.13
Control 8	0.07	**0.61**	0.12	-0.05	0.04	0.06
Anger 1	0.16	0.08	**0.64**	0.07	0.09	-0.03
Anger 2	0.08	0.03	**0.63**	0.02	0.05	-0.12
Anger 3	0.00	-0.00	**0.84**	-0.02	0.03	0.02
Anger 4	0.01	-0.08	**0.78**	0.05	-0.01	0.07
Anger 5	-0.10	0.03	**0.66**	0.01	-0.07	0.01
Anger 6	-0.13	-0.02	**0.75**	-0.06	-0.04	-0.06
Anger 7	-0.04	-0.04	**0.80**	0.013	0.01	-0.06
Anger 8	-0.19	0.10	**0.51**	-0.16	-0.11	0.09
Volition 1	-0.06	-0.00	-0.12	**0.49**	0.09	-0.16
Volition 2	0.05	-0.01	-0.05	**0.71**	-0.05	-0.07
Volition 3	-0.05	-0.09	-0.001	**0.94**	-0.08	0.07
Volition 4	-0.27	-0.03	0.01	**0.69**	-0.09	0.04
Volition 5	0.12	0.06	-0.02	**0.49**	0.12	-0.18
Volition 6	0.06	0.04	-0.00	**0.89**	-0.02	0.08
Volition 7	-0.03	0.07	0.06	**0.70**	0.07	0.10
Volition 8	-0.03	0.13	0.039	**0.71**	-0.02	-0.02
Coping 1	0.02	0.06	-0.11	-0.10	**0.58**	-0.02
Coping 2	-0.06	-0.01	0.02	-0.01	**0.75**	0.02
Coping 3	0.12	-0.02	0.06	-0.02	**0.92**	0.02
Coping 4	0.04	0.01	0.02	0.02	**0.77**	0.06
Coping 5	-0.31	-0.10	-0.06	0.12	**0.37**	0.00
Coping 6	-0.13	0.02	-0.03	0.10	**0.52**	-0.10
Coping 7	-0.11	0.11	-0.07	-0.01	**0.53**	0.08
Coping 8	-0.18	-0.12	0.02	0.16	**0.48**	0.02
Inhibition 1	0.19	-0.13	0.02	-0.03	-0.14	**0.45**
Inhibition 2	-0.04	-0.03	-0.05	-0.27	-0.11	**0.40**
Inhibition 3	0.26	0.05	0.16	-0.01	0.11	**0.43**
Inhibition 4	0.23	-0.19	0.02	0.07	-0.13	**0.37**
Inhibition 5	-0.07	0.07	-0.02	0.02	0.13	**0.65**
Inhibition 6	-0.14	0.05	-0.19	-0.01	0.02	**0.57**
Inhibition 7	-0.05	0.22	-0.03	-0.04	0.08	**0.57**
Inhibition 8	0.06	0.04	-0.02	0.01	-0.04	**0.58**

Factor loadings above 0.32 are in bold.

Table 2. Correlations between emotional dimensions.

	Factor Correlations					
	Sensitivity	**Control**	**Anger**	**Volition**	**Coping**	**Inhibition**
Sensitivity	1.00					
Control	**-0.43**	1.00				
Anger	**0.30**	-0.06	1.00			
Volition	**-0.63**	**0.55**	-0.20	1.00		
Coping	**-0.59**	**0.63**	-0.15	**0.67**	1.00	
Inhibition	0.20	0.19	-0.25	-0.23	-0.02	1.00

Correlations ≥0.30 are in **bold**.

Table 3: Standardized six-factor model parameter estimates.

Items	Sensitivity	Control	Anger	Volition	Coping	Inhibition	Θ
Sensitivity1	**0.483**	0.000	0.000	0.000	0.000	0.000	0.766
Sensitivity2	**0.697**	0.000	0.000	0.000	0.000	0.000	0.514
Sensitivity3	**0.725**	0.000	0.000	0.000	0.000	0.000	0.475
Sensitivity4	**0.681**	0.000	0.000	0.000	0.000	0.000	0.536
Sensitivity5	**0.708**	0.000	0.000	0.000	0.000	0.000	0.499
Sensitivity6	**0.713**	0.000	0.000	0.000	0.000	0.000	0.492
Sensitivity7	**0.699**	0.000	0.000	0.000	0.000	0.000	0.512
Sensitivity8	**0.730**	0.000	0.000	0.000	0.000	0.000	0.467
Control1	0.000	**0.737**	0.000	0.000	0.000	0.000	0.457
Control2	0.000	**0.744**	0.000	0.000	0.000	0.000	0.446
Control3	0.000	**0.739**	0.000	0.000	0.000	0.000	0.454
Control4	0.000	**0.728**	0.000	0.000	0.000	0.000	0.470
Control5	0.000	**0.693**	0.000	0.000	0.000	0.000	0.520
Control6	0.000	**0.712**	0.000	0.000	0.000	0.000	0.493
Control7	0.000	**0.688**	0.000	0.000	0.000	0.000	0.527
Control8	0.000	**0.567**	0.000	0.000	0.000	0.000	0.678
Anger1	0.000	0.000	**0.651**	0.000	0.000	0.000	0.577
Anger2	0.000	0.000	**0.667**	0.000	0.000	0.000	0.555
Anger3	0.000	0.000	**0.641**	0.000	0.000	0.000	0.590
Anger4	0.000	0.000	**0.758**	0.000	0.000	0.000	0.425
Anger5	0.000	0.000	**0.839**	0.000	0.000	0.000	0.296
Anger6	0.000	0.000	**0.765**	0.000	0.000	0.000	0.415

Anger7	0.000	0.000	**0.815**	0.000	0.000	0.000	0.335
Anger8	0.000	0.000	**0.476**	0.000	0.000	0.000	0.773
Volition1	0.000	0.000	0.000	**0.649**	0.000	0.000	0.578
Volition2	0.000	0.000	0.000	**0.650**	0.000	0.000	0.577
Volition3	0.000	0.000	0.000	**0.839**	0.000	0.000	0.297
Volition4	0.000	0.000	0.000	**0.770**	0.000	0.000	0.407
Volition5	0.000	0.000	0.000	**0.569**	0.000	0.000	0.676
Volition6	0.000	0.000	0.000	**0.847**	0.000	0.000	0.282
Volition7	0.000	0.000	0.000	**0.803**	0.000	0.000	0.355
Volition8	0.000	0.000	0.000	**0.796**	0.000	0.000	0.367
Coping1	0.000	0.000	0.000	0.000	**0.553**	0.000	0.694
Coping2	0.000	0.000	0.000	0.000	**0.773**	0.000	0.402
Coping3	0.000	0.000	0.000	0.000	**0.774**	0.000	0.401
Coping4	0.000	0.000	0.000	0.000	**0.760**	0.000	0.423
Coping5	0.000	0.000	0.000	0.000	**0.611**	0.000	0.627
Coping6	0.000	0.000	0.000	0.000	**0.712**	0.000	0.493
Coping7	0.000	0.000	0.000	0.000	**0.694**	0.000	0.518
Coping8	0.000	0.000	0.000	0.000	**0.629**	0.000	0.604
Inhibition3	0.000	0.000	0.000	0.000	0.000	**0.379**	0.857
Inhibition5	0.000	0.000	0.000	0.000	0.000	**0.731**	0.466
Inhibition6	0.000	0.000	0.000	0.000	0.000	**0.663**	0.561
Inhibition7	0.000	0.000	0.000	0.000	0.000	**0.731**	0.465
Inhibition8	0.000	0.000	0.000	0.000	0.000	**0.519**	0.730

Note: Loadings listed as 0.000 were fixed at that value and not estimated. Standardized residual variances are in the column labeled Θ.

Table 4. Descriptive statistics and sex differences of the emotional section of AFECTS.

Scale Factor	Mean score ± SD	Skewness	Kurtosis	T
Volition	M: 35.4 ± 12.0	-.21	-.96	2,372*
	F: 34.2 ± 12.1			
Anger	M: 31.9 ± 11.5	-.02	-.98	-4,693*
	F: 34.2 ± 11.6			
Inhibition	M: 37.7 ± 7.9	-.47	-.08	-5,178*
	F: 39.5 ± 8.3			
Sensitivity	M: 35.7 ± 11.4	-.46	-.46	-12,090*
	F: 40.9 ± 11.4			
Coping	M: 36.9 ± 11.4	-.37	-.69	-0,069
	F: 36.9 ± 11.4			
Control	M: 39.4 ± 10.6	-.44	-.67	1,512
	F: 38.7 ± 11.0			

* denotes significant difference between males (M) and females (F) at the level of 0.05.

Table 5. Correlations between dimensional scores of affective temperaments.

	Dep	Anx	Apat	Obs	Cyc	Dysp	Vol	Eut	Irrit	Disin	Hyper	Eup
Depressive	1											
Anxious	**.35**	1										
Apathetic	**.38**	.19	1									
Obsessive	.07	.23	-.10	1								
Cyclothymic	**.37**	.23	.25	.14	1							
Dysphoric	.29	.25	.15	.21	**.58**	1						
Volatile	.23	.03	**.50**	-.13	.29	.24	1					
Euthymic	**-.42**	-.16	-.25	-.04	**-.51**	**-.40**	-.29	1				
Irritable	.04	.16	-.05	.27	**.33**	**.40**	.06	-.13	1			
Disinhibited	.03	.00	.24	-.03	.24	.26	**.48**	-.10	.17	1		
Hyperthymic	**-.47**	-.20	**-.38**	.07	**-.32**	-.20	-.22	**.47**	.01	.02	1	
Euphoric	-.18	-.10	-.06	.07	.14	.22	.17	.02	.26	**.34**	**.30**	1
AGE	-.07	-.02	-.13	.02	-.18	-.13	-.14	.18	-.02	-.12	.09	.00

Correlations ≥0.30 are in **bold**.

FIGURE LEGENDS

Figure 1. Prevalence of categorical affective temperaments in males and females. Subjects had to choose the affective temperament description that best fitted their profile. N=3274, 72% females.

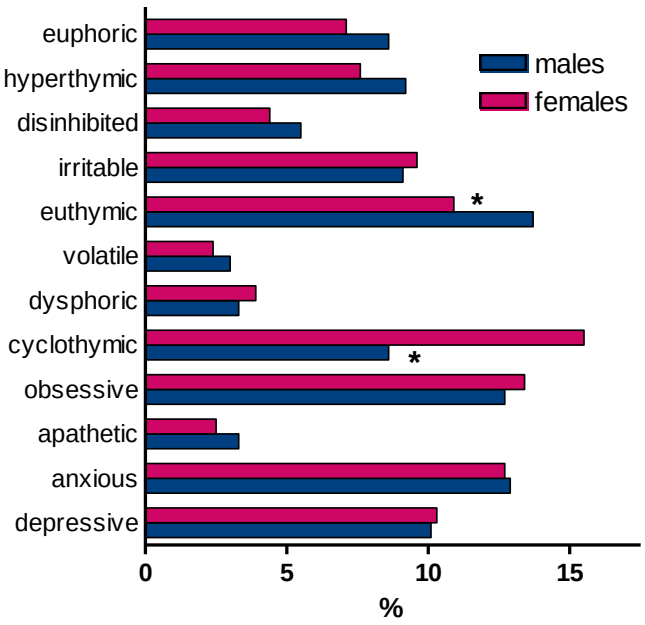
Figure 2. Emotional profile of categorical affective temperaments. Data are shown as mean ± 95% confidence interval.

Figure 3 Global Emotional Functioning (GEF) in the whole sample (A) and according to categorical affective temperaments (B). Data are shown as mean ± 95% confidence interval.

Figure 4. Internalization, Externalization and Instability indexes of categorical affective temperaments. Data are shown as mean ± 95% confidence interval.

Figure 5. Distribution of categorical affective temperaments in a matrix of Internalization-Externalization x Instability. Data are shown as means.

Figure 1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hyperthymic
disinhibited
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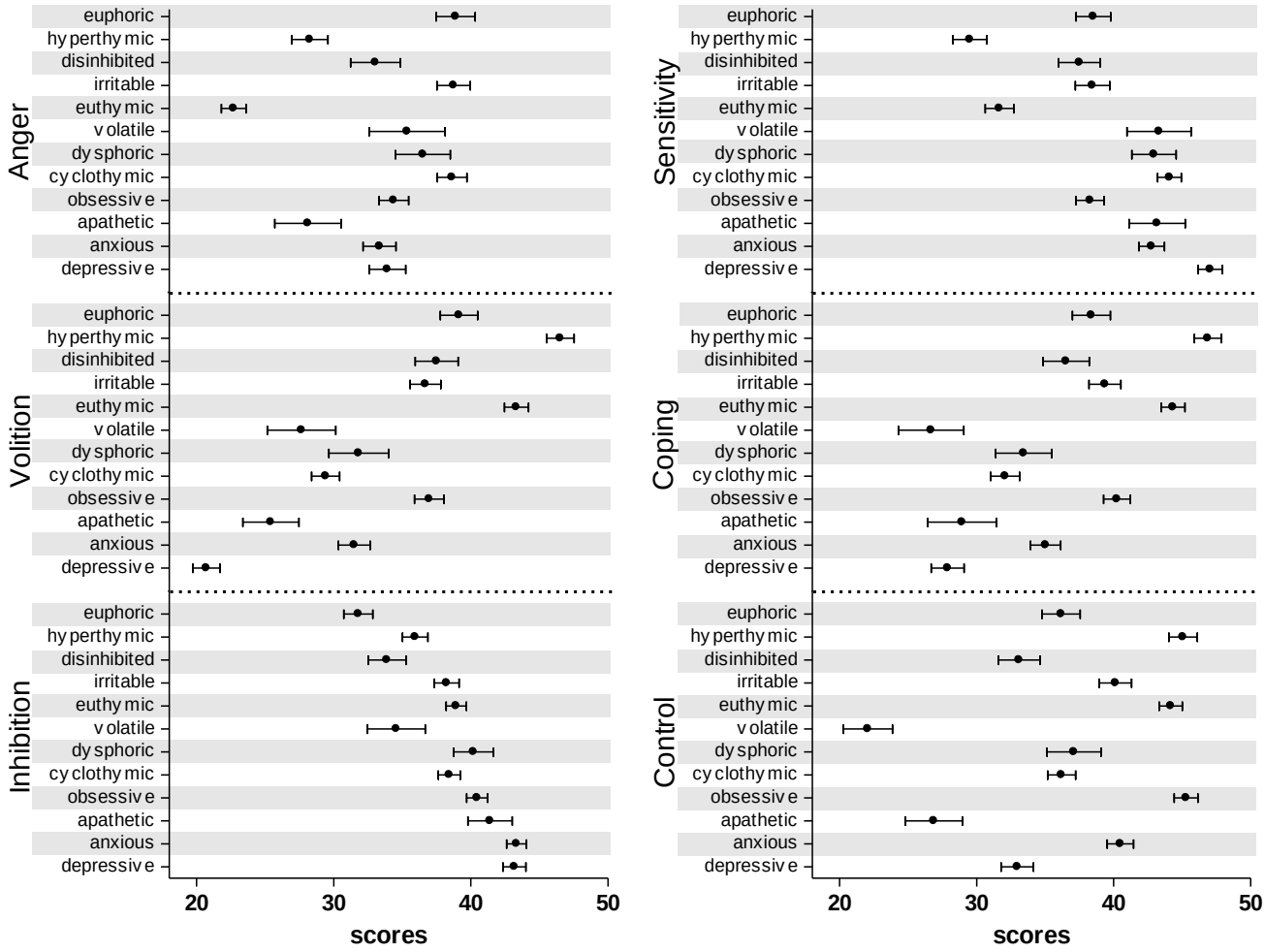
Figure 2


Anger
Volition
Inhibition
Sensitivity
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Control
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irritable
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scores

Figure 3

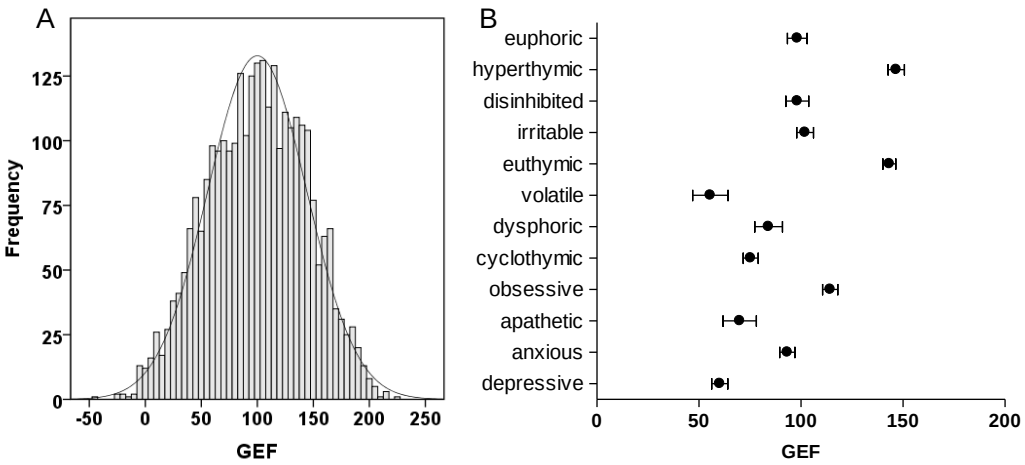


Figure 4

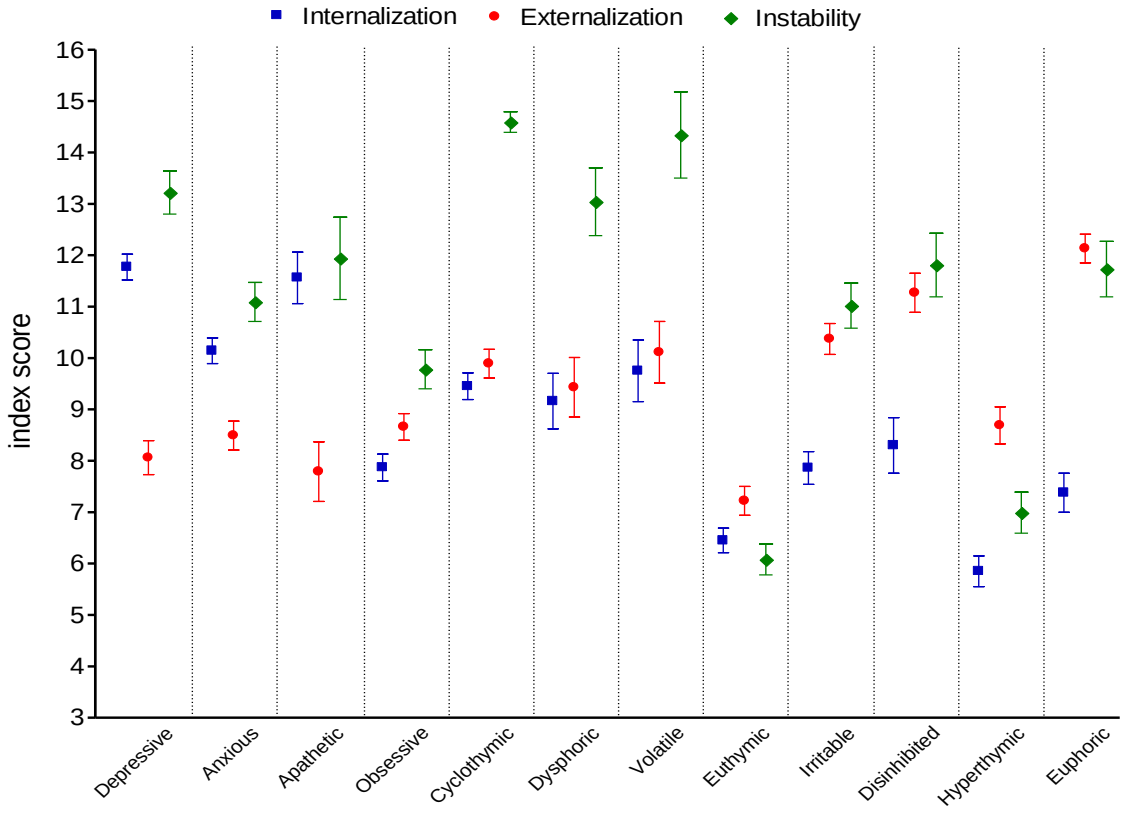
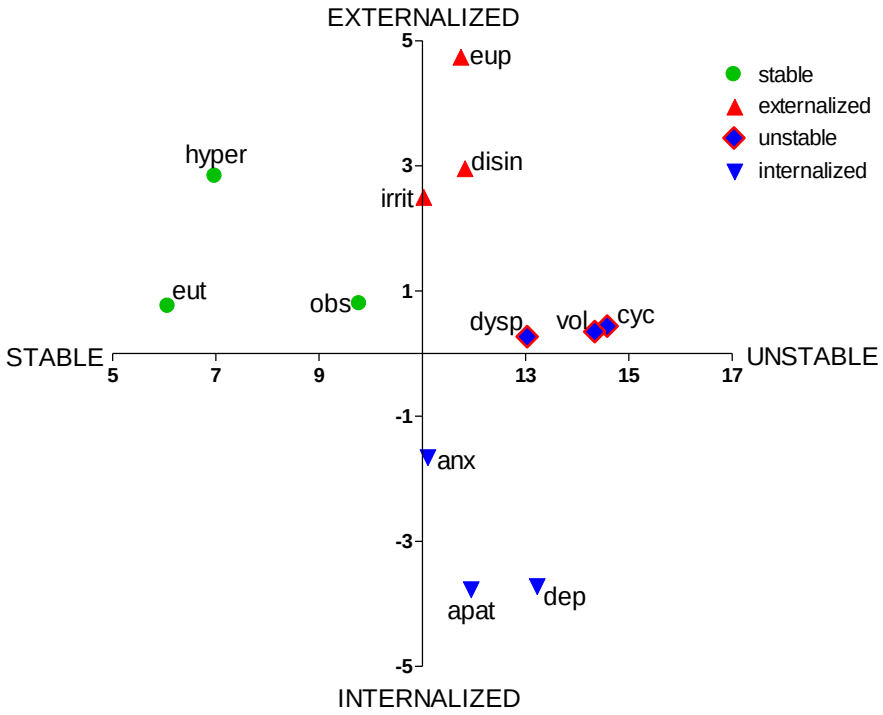


Figure 5


EXTERNALIZED
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apat
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stable
externalized
unstable
internalized

2ª Parte

Temperamento e Ritmos Circadianos

Capítulo V

Desenvolvimento da Escala de Avaliação da Energia Circadiana

(publicado na Chronobiology International)

The Circadian Energy Scale (CIRENS): two simple questions for a reliable chronotype measurement based on energy

Gustavo L. Ottoni[1], Eduardo Antoniolli[1], Diogo R. Lara[2]

4. Departamento de Bioquímica, Instituto de Ciências Básicas da Saúde, Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil
5. Faculdade de Biociências, Pontifícia Universidade Católica do Rio Grande do Sul, Porto Alegre, Brazil

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Corresponding author:

Diogo R. Lara

Faculdade de Biociências – PUCRS

Av. Ipiranga, 6681 – Pd12A

Porto Alegre, RS

Brazil

90619-900

Phone +55 51 81219187

Fax +55 51 33203612

diogorlara@gmail.com

ABSTRACT

This study aims to present the Circadian Energy Scale (CIRENS), a very short and simple chronotype measurement tool based on energy. The CIRENS consists of two introspective questions about the usual energy level (very low, low, moderate, high or very high, scored 1 to 5) in the morning and in the evening. The difference between energy level scores (-4 to 4) felt by respondents in the evening and morning defines the chronotype score and classification. A concurrent validity analysis of the CIRENS with the widely used Horne and Östberg Morningness-Eveningness Questionnaire (MEQ) was conducted in a sample of 225 college students, and with MSFsc, a sleep-based chronotype based on the Munich Chronotype Questionnaire (MCTQ) in a sample of 34,530 subjects (18-83 years, 27% males). This large sample was collected in a web-survey for behavioral correlates of the CIRENS with variables previously associated with chronotype differences. The correlation of the CIRENS chronotype score was r = -0.70 with the MEQ and r = 0.32 with the MSFsc. CIRENS chronotype scores declined with age and were not affected by gender. Both CIRENS and MSFsc chronotype scores were related to differences in tobacco, caffeine and cola soft drink consumption (all higher in evening types). Thus, the CIRENS provides a simple chronotype index and a measure of absolute energy throughout the day, and seems to be a reliable chronotype assessment tool that may be useful both clinically and for large scale studies.

Key words: chronotype, morningness-eveningness, circadian rhythm, scale validation.

INTRODUCTION

The most widely used tool for chronotype assessment is the Horne and Östberg Morningness-Eveningness Scale (MEQ) (Horne and Ostberg, 1976). The main objective of the MEQ is to identify how much the respondent prefers a particular time of the day to be active and not the time that he/she actually is active. Subsequent studies have found a skewed distribution towards morningness as a function of age (Taillard et al., 1999; Taillard et al., 2001), which could be due an inappropriate classification. Taillard et al. (2004) validated this scale in an older sample (30-49 years) of workers, suggesting new cut-offs for this population. Despite its widespread use, the MEQ has some potential limitations: the use of hypothetical situations, comparison of subject's preferences to the habits of others, scores that need adjustment according to age groups (Taillard et al., 2004), heterogeneity among intermediate types (Martynhak et al., 2010), and its length (19 multiple choice questions) may limit its widespread application in clinical settings and large epidemiological studies

Recently, to enable a better understanding of the genetic basis of temporal organization in humans, Roenneberg et al (2003) developed the Munich Chronotype Questionnaire (MCTQ). This questionnaire has a quantitative and a qualitative assessment of chronotype. The quantitative evaluation focuses on sleep time characteristics, determination of the mid-sleep time (midpoint between sleep onset and wake up times) as the phase reference point for sleep, and takes the influence of social stimuli into account in the chronotype determination. In a correlation study between the MEQ and the MCTQ, the mid-sleep on free days (MSF) was the MCTQ sleep time parameter with higher correlation with the MEQ chronotype classification (r = -0.73) (Zavada et al.,

2005). In a larger study, the same group demonstrated the need for MSF adjustment for sleep-debt accumulated during the workweek (MSFsc), and for age and sex (MSFsasc) for a more accurate estimation and standardization of chronotyping. In this same study, MCTQ correlations with MEQ were r = -0.74 for MSF, -0.66 for MSFsc, -0.59 for MSFsasc (Roenneberg et al., 2007).

Morning and evening types differ in several sleep parameters. Evening-types usually sleep and wake up later (Ishihara et al., 1987; Andrade et al., 1992), have more irregular sleeping and wakening times (Ishihara et al., 1987), and have shorter workday and longer free day sleep durations (Andrade et al., 1992; Ishihara et al., 1992; Roenneberg et al., 2007; Roenneberg et al., 2003). Regarding age, morning preference is more frequent up to 10-12 years, followed by a shift towards evening preference in different cultures, which is completed around 17 and 21 years, respectively for women and men (Carskadon et al., 1993; Roenneberg et al., 2004; Tonetti et al., 2008). In later adulthood, again a morning preference is observed (Carrier et al., 1997; Robilliard et al., 2002; Roenneberg et al., 2004). Especially between adolescence and menopause, probably due to sex hormones, women show significantly more morningness than men (Adan and Natale, 2002; Lehnkering and Siegmund, 2007; Randler, 2007). Morever, consumption of alcohol, coffee, caffeinated soft drinks and cigarettes are significantly higher in late chronotypes (Adan, 1994; Taillard et al., 1999; Wittmann et al., 2006).

Although chronotype refers to sleep-wake rhythm, most studies have focused on sleep parameters, with lower emphasis on introspective energy levels during the wake phase. Moreover, very short scales to assess circadian rhythm are lacking and would be useful for large scale studies (Di Milia and Bohle, 2009).

In order to easily and rapidly assess an energy-based circadian typology in the different shifts of the day, we created the Circadian Energy Scale (CIRENS). The CIRENS consists of two simple questions asking respondents to introspect about their energy levels in the morning and in the evening, with an optional question about how they feel in the afternoon. Respondents use a five-point scale ranging between very low (1) to very high (5). The difference between the scale values in the morning and in the evening result in a single score corresponding to chronotype; negative difference values are defined as morning types and positive difference values are evening types. This study aims to explore the data on the CIRENS, to perform a concurrent validity analysis with the MEQ in a sample of college students, and to evaluate how the CIRENS chronotype score correlates with the following demographic and behavioral parameters in a large web-based survey: age, gender, sleep-onset time, wake up time, and consumption of tobacco, coffee, tea and cola soft drinks.

METHODS

Participants

All participants gave their informed consent before completing the instruments. This form was elaborated to fulfill the requirements of the National Health Council of Brazil (Resolution 196/1996). Their participation was voluntary and could be cancelled at any moment without justification. The experimental protocol conformed to international ethical standards (Portaluppi et al., 2008), and the study was approved by the Institutional Review Board of Hospital São Lucas from Pontifícia Universidade Católica do Rio Grande do Sul.

The study consisted of two different samples:

College sample: 225 college students, 18-35 years old (20.9 ± 2.9 years), being 81 (36%) males (20.9 ± 2.9 years) and 144 (64%) females (20.9 ± 2.9 years) who answered pen-and-paper versions of the Circadian Energy Scale (CIRENS) and of the Brazilian version for the Horne and Östberg Morningness-Eveningness Questionnaire (MEQ) (Andrade et al, 1992).

Internet sample: the data here presented are part of a large web-based survey to study temperament, psychiatric disorders and psychobiological measures. This research website appeared in a newspaper article and was broadcasted once on a national TV news program in Brazil. For this study, the sample consisted of 34,530 subjects from the general population, 18-83 years old (32.2 ± 11.0 years), being 9,388 (27.2%) males (32.7 ± 11.4 years) and 25,142 (72.8%) females (32.1 ± 10.8 years) who answered the CIRENS and questions concerning sleep-onset time, wake up time, age, gender, tobacco, coffee, tea, and cola soft drinks intake, and psychiatric diagnosis by internet (www.temperamento.com.br). This sample represented 82.2% of the total sample (41,970 subjects) who had correct answers for all 8 built in validity questions throughout the system to test attention (5 questions asking the volunteer to mark a specific answer and 1 at the end asking about concentration level during the tests), reliability (“how seriously did you answer to these scales”) and sincerity (“how sincere were you answering these scales”) of answers.

Circadian Energy Scale (CIRENS)

The CIRENS was applied as follows:

In general, how is your energy level:

(1) in the morning? ( )very low ( )low ( )moderate ( )high ( )very high

(2) in the evening? ( )very low ( )low ( )moderate ( )high ( )very high

Optional question:

(3) in the afternoon? ( )very low ( )low ( )moderate ( )high ( )very high

The answers are rated from 1 (very low) to 5 (very high). The sum of morning and evening scores was considered as the total energy score, ranging from 2 to 10. With the inclusion of the optional third question, this score ranges from 3 to 15.

Chronotype (morningness-eveningness) classification was determined by subtracting the morning from the evening energy score. Therefore, in the *dimensional* evaluation, the CIRENS chronotype score ranges from -4 (most marked morning preference) to 4 (strongest evening preference). In the *categorical* classification, subjects are considered as morning-type (≤ -2), neither-type (≥ -1 and ≤ 1) or evening-type (≥ 2). These cut-offs were chosen because in the distribution data they corresponded roughly to the lower and higher quintiles.

Behavioral Parameters

The following sleep parameters were assessed with the respective questions from the Basic Nordic Sleep Questionnaire (Partinen and Gislason, 1995): 1)

bed time on workdays, 2) wake up time on workdays, 3) sleep-onset latency on workdays, 4) bed time on free days, 5) wake up time on free days, 6) sleep-onset latency on free days. The sleep-onset time resulted from the sum of the sleep-onset latency to the bed time. Total sleep duration was calculated as the interval between sleep-onset time and wake up time. From the sleep-onset time and the wake up time on free days, the mid-sleep on free days (MSF) was calculated and than corrected for compensatory sleep on free days (MSFsc) as in the MCTQ (Roenneberg et al., 2003; Roenneberg et al 2004).

Subjects were asked about their cigarette smoking status (non-smoker, currently smoker, quitter, and chipper, i.e. occasional user) and their coffee, tea, and cola soft drinks intake pattern. According to the amount of psychostimulant intake, subjects were stratified in categories: i) for coffee (1 regular 100 ml cup of brewed or instant coffee as used in Brazil, or 1 espresso): none, low (up to 100 ml/day), moderate (>100-300 ml/day), high (>300-500 ml/day), and very high (more than 500 ml/day); ii) for tea: none, low (up to 0.5 L/week), moderate (>0.5-2 L/week), high (>2-5 L/week), and very high (more than 5 L/week); and iii) for cola soft drinks: none, very low (up to 1 L/week), low (>1-2 L/week), moderate (>2-4 L/week), high (>4-10 L/week), and very high (more than 10 L/week).

Subjects from the internet sample were also questioned about having ever received a psychiatric diagnosis by a mental health professional, current intake of psychotropic medication, educational level, marital status, and personal income, since these also potentially influence chronotype.

Statistical analysis

The concurrent validity analysis between CIRENS and MEQ was analyzed with Pearson correlation coefficient. The comparisons of CIRENS scores with demographic (age and gender) and behavioral parameters (sleep, substance use) were performed with multivariate analysis of variance with Bonferroni confidence interval adjustment. When applicable, the following parameters were used as covariates in multivariate analyses: age, gender, educational level, personal income, marital status, coffee, tea, and cola soft drinks intake, smoking status, psychiatric diagnosis (yes or no), and psychotropic drug intake (yes or no).

To reach statistical significance, the criterion probably for a Type I error was 5% ($p < 0.05$) in every analysis. The SPSS 18.0 software was used for all analyses.

RESULTS

Energy scores for the different times of day (morning, afternoon, evening) and the total energy scores were normally distributed in the college sample (Figure 1A) and in the internet sample (Figure 1B). Figures 2A-C show the normal distribution of MEQ (for the college sample) and CIRENS chronotype scores for the college sample and internet sample, respectively.

The MEQ scores (sum of 19 questions scores) and the CIRENS chronotype scores (morning minus night energy score) had a negative correlation of -0.70 ($p < 0.001$, Figure 3A), as unlike the MEQ, high CIRENS chronotype scores indicate evening preference. Figure 3B shows the CIRENS energy scores

throughout the day according to MEQ chronotypes. The MEQ morning types had their highest energy score in the morning, decreasing this score in a gradual fashion during the day ($F = 32.1$, $df = 3, 190$, $p < 0.001$). The opposite was observed among the evening types, specially the definitely evening types ($F = 18.6$, $df = 3, 190$, $p < 0.001$). The neither types had the most stable energy distribution throughout the day, with a slightly higher energy score in the morning than in the evening ($F = 4.11$, $df = 3, 190$, $p = 0.007$).

Behavioral Correlates

In addition, we investigated if the CIRENS was associated with some variables in which differences between chronotypes have been reported.

Differently from the MEQ and other chronotype assessment questionnaires (e.g. MCTQ), the CIRENS does not specifically assess sleep parameters, but only energy levels. However, subjects with low CIRENS chronotype scores (morning preference) used to sleep and wake up 2 to 3 hours earlier than those with high scores (evening preference) (data for work and free days shown as means and 95%CI in Figure 4, $p < 0.001$ for all). As expected, compared to workdays, on free days subjects reported falling asleep later (0.89 ± 1.14 h), waking up later (1.89 ± 1.70 h), and therefore their sleep duration was longer (1.0 ± 1.6 h) on free days. The CIRENS chronotype score was also correlated with mid-sleep time on free days (MSF, $r = 0.43$, $p < 0.001$) and with MSF with correction for compensatory sleep on free days (MSFsc, $r = 0.32$, $p < 0.001$). There were no significant differences on sleep duration between CIRENS chronotypes either on work or on free days ($p > 0.05$ for all) (Figure 4).

As shown in Figure 5, morning energy level increased (Figure 5A) and evening level decreased with age (Figure 5C), whereas afternoon and whole day energy levels were not significantly affected by age (Figures 5B and 5D). Regarding chronotypes, younger subjects (18-19 years old) had the strongest evening preference, and morning preference increased steadily up to 70 years old or more (Figure 5E). At all shifts, energy score was significantly higher for males than females (morning: $F = 78.45$; afternoon: $F = 315.86$; evening: $F = 176.24$; whole day: $F = 467.15$; $df = 1, 34518$ and $p < 0.001$ for all). The influence of gender on dimensional chronotype was not significant ($p > 0.05$; Figure 5E). The correlation between the sum of morning and evening scores (total energy score using only 2 questions) and the sum of the three shifts was strong ($r = 0.89$, $p < 0.001$).

Figure 6 presents the association of CIRENS and MSFsc chronotype scores with cigarette smoking (6A) and with intake of coffee (6B), tea (6C), and cola soft drinks (6D). Non-smokers had significantly lower CIRENS and MSFsc scores (morning preference), whereas current smokers had significantly higher scores (evening preference). Quitters and occasional smokers (chippers) had intermediate CIRENS scores, significantly higher than non-smokers and lower than smokers, but not statistically different between them. The differences of MSFsc scores according to smoking status were more robust, with chippers having similar scores to current smokers. Regarding coffee, the non-drinkers showed an intermediate CIRENS score between low and very high consumers. Among coffee consumers, the CIRENS score increased (from morning to evening preference) in a gradual fashion from low to very high dose use. This trend was weaker with MSFsc scores. In contrast, there was no relation of

circadian preference with tea consumption with both CIRENS and MSFsc scores, except for a latter MSFsc chronotype for the very high consumers comparing with no consumers. The most striking differences were found among cola soft drinks consumers, in which both circadian scores increased in a gradual fashion from no/very low to very high drinkers.

DISCUSSION

In contrast to other scales, the CIRENS assesses chronotype considering energy, without taking into account sleep parameters. Despite this difference, CIRENS and MEQ chronotype scores were correlated (r = -0.70), and evening chronotypes as identified by the CIRENS have much later bed and wake up times than morning-types. The results on CIRENS energy score in different MEQ chronotypes (Figure 3B) are similar to the findings of Natale and Cicogna (2002), who showed the subjective alertness throughout the day varies substantially according to MEQ chronotypes. Moreover, despite a lower correlation between CIRENS and MSFsc chronotype scores (0.32), they related similarly to the behavioral parameters evaluated (Figure 6). Thus, the CIRENS chronotype score seems to reflect circadian preference and sleep habits.

Factor analysis have identified that MEQ is constituted of two factors related to sleep parameters and one to time of greatest efficiency (Adan and Natale, 2002), similar to our energy concept. A dimensional chronotype assessment focused on the sleep factors is provided by the MSFsc of the MCTQ, which has correlations of -0.66 with MEQ (Roenneberg et al., 2007) and 0.32 with the CIRENS chronotype scores. This lower correlation between the CIRENS and

MSFsc suggests that they do not assess the same circadian characteristics. Thus, some individuals who go to bed and wake up late may refer morning preference in terms of energy, although usually this is not the case. More importantly, intermediate types regarding sleep parameters may show a clear energetic preference for a specific time of the day. However, despite this lower correlation between CIRENS and MSFsc chronotype scores, which is exclusively based on sleep, they seem to relate similarly to the behavioral characteristics evaluated, especially cola drink intake (Figure 6).

As expected, subjects slept longer on free days than on workdays, particularly because of later wake up times. Previous studies have reported that the increased sleep on free days compared to workdays was more evident in evening types (Andrade et al., 1992; Roenneberg et al., 2007; Roenneberg et al., 2003). This was not observed with the CIRENS, which does not address work and free days separately, but possibly the perception of someone's energy level is the same on work and free days, with different ways to adapt depending on the context.

Energy score was age-dependent in the morning and in the evening, but not in the afternoon and throughout the day. Since the CIRENS chronotype score considers the difference between evening and morning energy, it was also dependent on age. As observed with the MEQ (Ishihara et al., 1992; Carrier et al., 1997) and the MCTQ (Roenneberg et al., 2004; Roenneberg et al., 2007), the CIRENS chronotype detected the same pattern of progressively higher morning preference from late adolescence to late adulthood. Interestingly, men showed higher energy scores than women at all times of day and therefore total energy score, especially before 40-45 years old. Although not addressed in this

study, this difference in energy levels may be associated with more inhibited temperaments and higher risk of depression and anxiety in women (McLean and Anderson, 2009). The CIRENS chronotypes showed no relevant gender differences, in contrast to the commonly reported morning preference for women using measures heavily based on sleep parameters, especially between puberty and menopause (Adan and Natale, 2002; Lehnkering and Siegmund, 2007; Randler, 2007; Roenneberg et al, 2007). However, our results on absolute energy scores also point to a similar energy level between males and females from 40-50 years of age onwards.

Regarding the association of psychostimulant consumption and chronotype, higher use was related to more evening preference, except for tea consumption. These results are in agreement with data on the MCTQ by Wittman et al. (2006), reporting a positive correlation of cigarette smoking and intake of caffeinated drinks with evening preference and the lack of correlation between tea intake and chronotype. For coffee intake, they reported a small negative association with evening preference, but we found a non-linear relationship between coffee and chronotype: low coffee intake was associated with more morning preference than no intake, but among coffee users, evening preference increased with higher doses. Accordingly, Adan (1994) reported a positive association of evening type with nicotine, coffee and cola consumption. The most striking result in our data was the association with cola soft drinks, with almost one point difference between intake extremes. This magnitude is similar to the chronotype change from 18 to 40 years of age. One simple interpretation of these results is that evening types consume more caffeine to improve their adaptation during the day. However, this would not explain why the association

was stronger with cola-drinks, which have less caffeine than coffee (Barone and Roberts, 1996), and is not readily applicable for the cigarette data. An alternative explanation is that evening types have a personality profile that is more associated with drug use in general due to a pattern of more immediate gratification. Indeed, evening type subjects have higher novelty-seeking, lower harm avoidance, persistence and self-directedness according to Cloninger's psychobiological model (Adan et al, 2010), and lower conscientiousness (self-discipline and deliberation) than morning types (Tonetti et al., 2009).

Compared to other chronotype scales, the CIRENS has advantages and limitations. The main advantage is that only 2 simple questions (the morning and evening questions) and the derived chronotype index were clearly sufficient to identify chronotypes both dimensionally and categorically. Also their sum provides an index of total energy level, which is not provided by other scales. Being so short, this is particularly useful for large scale studies which evaluate many variables simultaneously. In comparison, the MEQ has 19 questions and does not provide an absolute measure of energy or efficiency along the day. Other advantages of approaching chronotype from a subjective energy perspective is that adjustments for being employed, work/free days and other daily variations, job type (e.g. shift workers), children care taking, and routine participation in morning activities during the weekend (e.g. religious meetings), and culture-related variations, which heavily influence sleep parameters, are not necessary. For some studies (e.g. genetics), the design or analysis should take into account that age may weakly affect the results, since the mean variation was around 1 point (out of 9 points) between ages 18-60. Age adjustments are more critical for the MEQ, also limiting its use in large scale studies. As

limitations, the CIRENS relies on a subjective perception rather than more objective measures (such as time), and the CIRENS has a limited score range compared to other scales, which makes it less discriminative for small variations and changes. Of note, unlike other scales, gender is not a relevant variable for chronotype measurement with the CIRENS.

Our study has limitations to be considered. First, the correlation with the MEQ was conducted in a relatively small sample of college students, with a narrow age range and probably healthier profile than the general population. Second, an independent sample collected by the internet was used to evaluate demographic and behavioral correlates of the CIRENS scores.

In conclusion, the CIRENS is an introspective, energy-based chronotype assessment tool correlated with the MEQ, but without the need for several adjustments required for sleep-based chronotype measures. CIRENS chronotype scores were clearly related to sleep parameters and other variables classically linked to chronotype. Thus, the CIRENS is a simple, very short and reliable tool to study the role of circadian energy and absolute energy levels as important parameters for temporal organization in human behavior. This profile makes it particularly suitable for large scale studies and to be used in clinical settings. Further studies are warranted to confirm the validity and utility of CIRENS.

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Acknowledgments

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FIGURE LEGENDS

Figure 1. Frequency distribution of the CIRENS energy score for the different times of day, and of the CIRENS total energy score in the college (A) and in the internet (B) samples. The energy scores range from 1 (very low) to five (very high). The sum of morning and evening scores corresponds to the total energy score (from 2 to 10).

Figure 2. Frequency distribution of the MEQ dimensional scores and chronotypes in the college sample (A), and frequency distribution of the CIRENS dimensional scores and chronotypes in the college (B) and in the internet sample (C). The MEQ score ranges from 16 to 86. MEQ chronotype classification: evening-type (16-41), neither-type (42-58), and morning-type (59-86). The CIRENS chronotype score ranges from -4 to 4. CIRENS chronotype classification: morning-type (-4, -3, and -2), neither-type (-1, 0, 1), and evening-type (2, 3, and 4).

Figure 3. Correlation between the CIRENS chronotype score and the MEQ score (A) and CIRENS energy scores according to MEQ chronotypes (B). **(A)** The CIRENS chronotype score ranges from -4 to 4 (extremely morning to extremely evening) andthe MEQ score ranges from 16 to 86 (extremely evening to extremely morning). **(B)** The CIRENS energy score ranges from 1 (very low) to 5 (very high). Results are shown as means and 95% confidence interval of CIRENS energy scores. MEQ chronotypes are definitely morning (DM, 70-86), moderately morning (MM, 59-69), neither (N, 42-58), moderately evening (ME,

31-41), and definitely evening (DE, 16-30). DM and MM types were merged because only one subject was DM type.

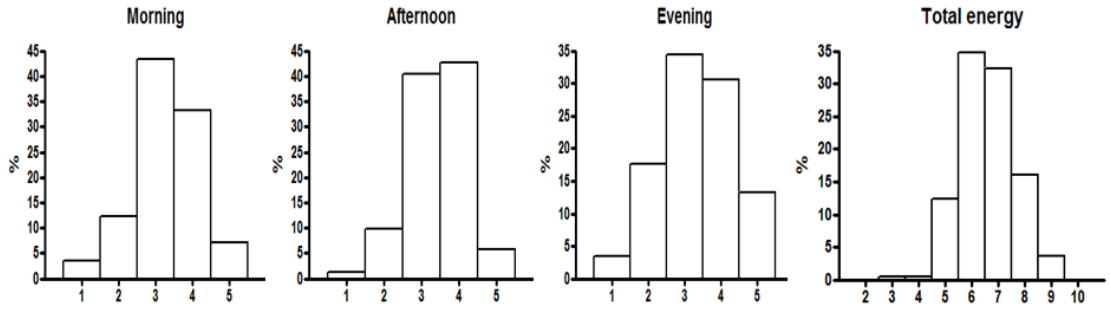
Figure 4. Association of the CIRENS chronotype score with sleep-onset time and wake up time both on work and on free days. The CIRENS chronotype score ranges from -4 to 4 (extremely morning to extremely evening). Results are shown as means and 95% confidence interval. Some 95% confidence interval bars are not visible because they are smaller than the symbol representing the mean. Sleep-onset time and wake up time are presented in hours.

Figure 5. Association of morning (A), afternoon (B), evening (C), total (D), and circadian (E) energy scores for males and females with age. The morning, afternoon, and evening scores range from 1 (very low) to 5 (very high); the total energy score ranges from 2 to 10; the circadian energy score ranges from -4 to 4 (extremely morning to extremely evening).Results are shown as means. The sample consisted of 9,388 males and 25,142 females. Age is presented in years.

Figure 6. Association of the CIRENS and MSFsc chronotype scores with cigarette smoking status (A), and consumption of coffee (B), tea (C), and cola soft drinks (D). The CIRENS chronotype score ranges from -4 to 4 (extremely morning to extremely evening) and the MSFsc score is shown as hour. Results are shown as means and 95% confidence interval.

Figure 1

A (n=225)



B (n=34530)

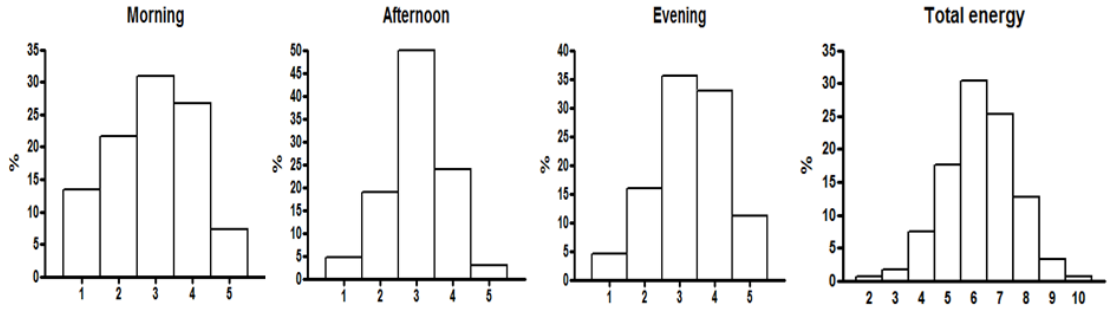


Figure 2

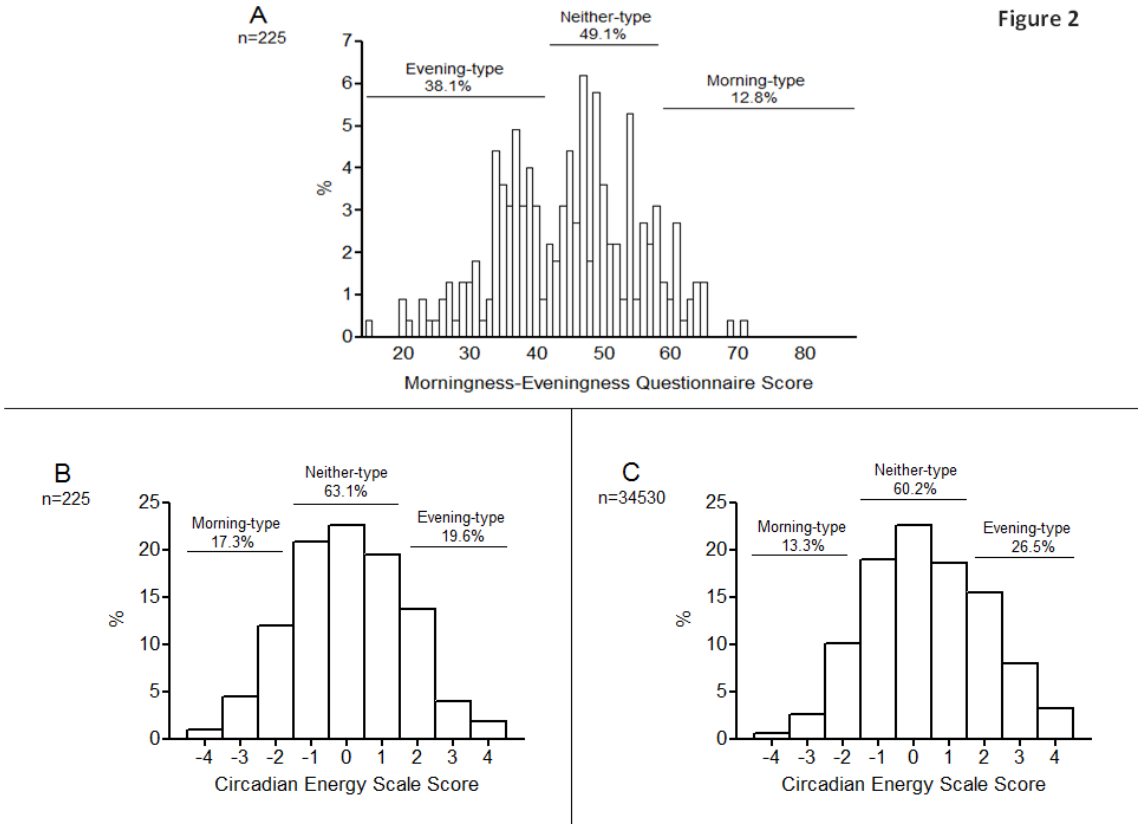


Figure 3

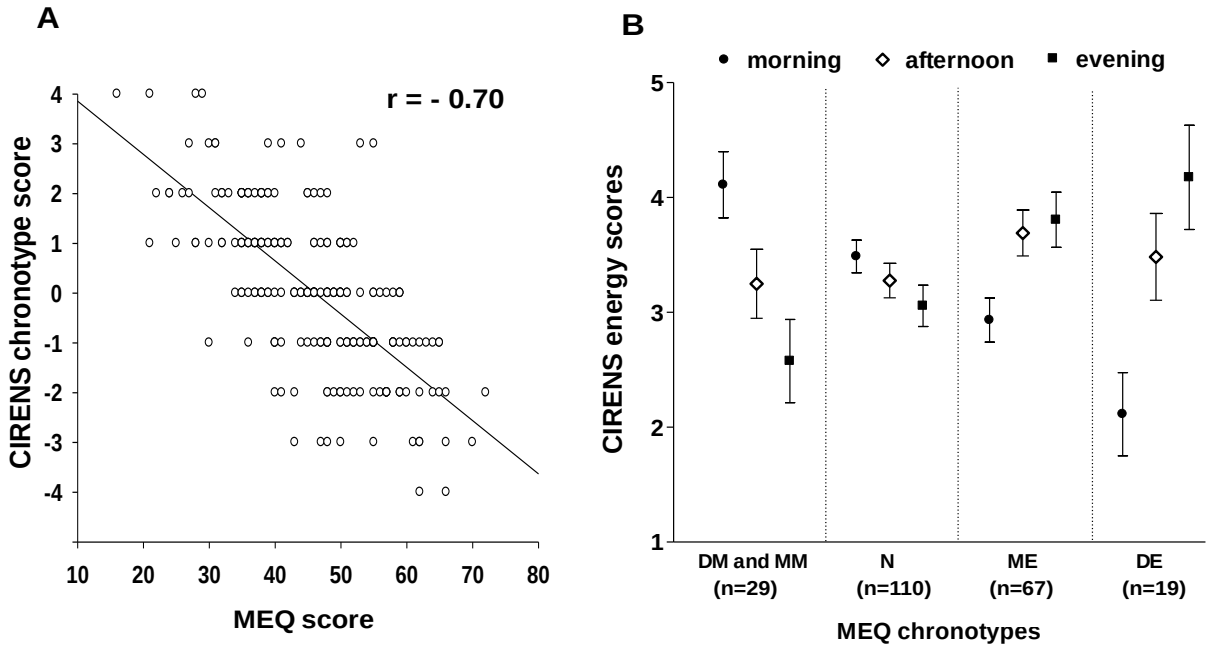


Figure 4

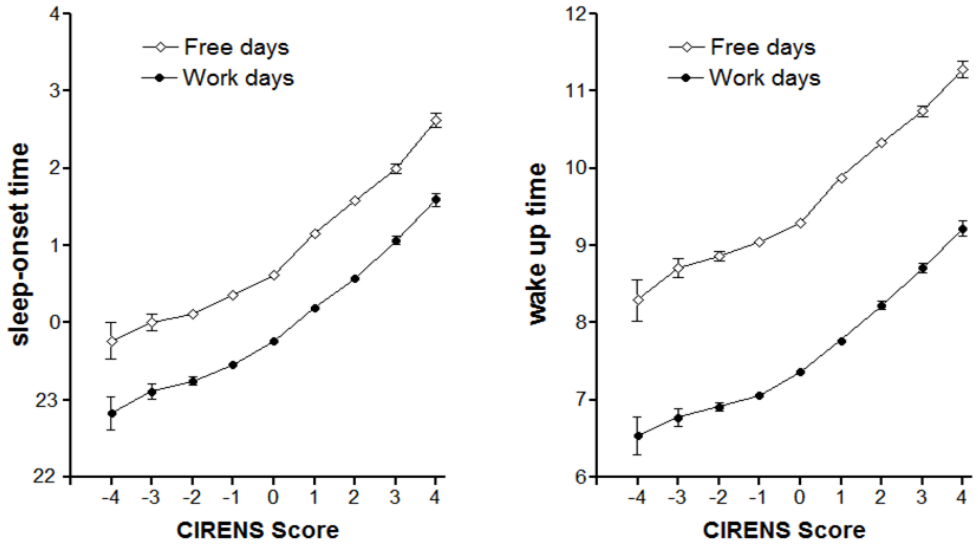


Figure 5

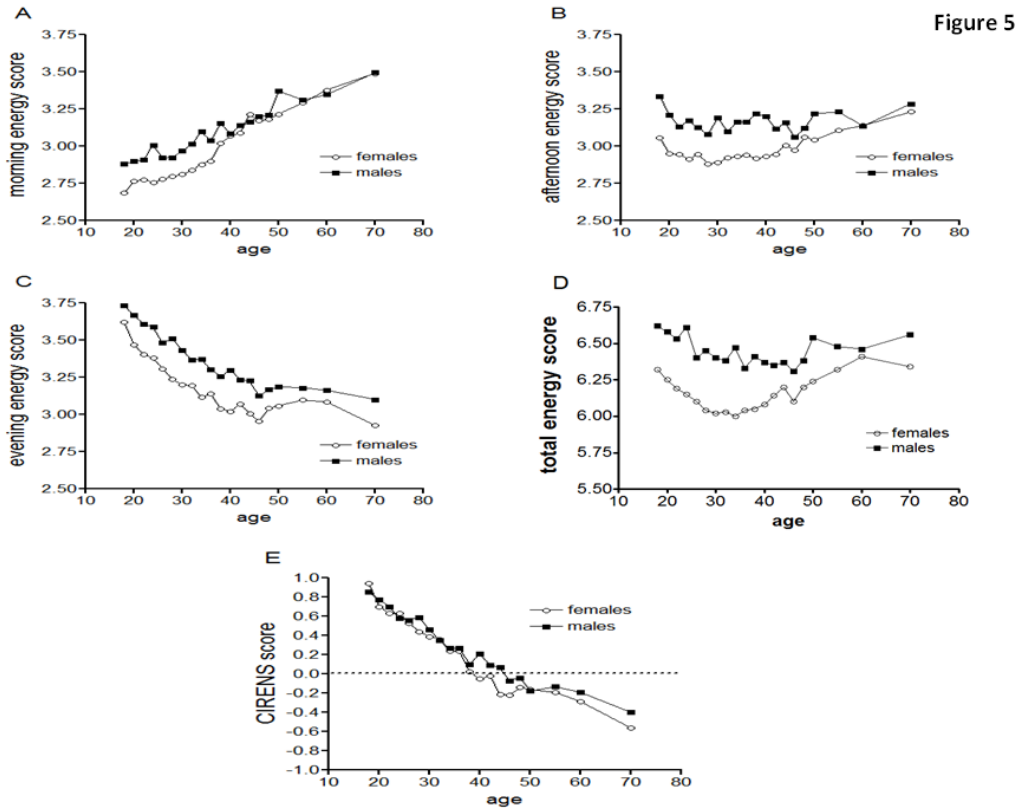
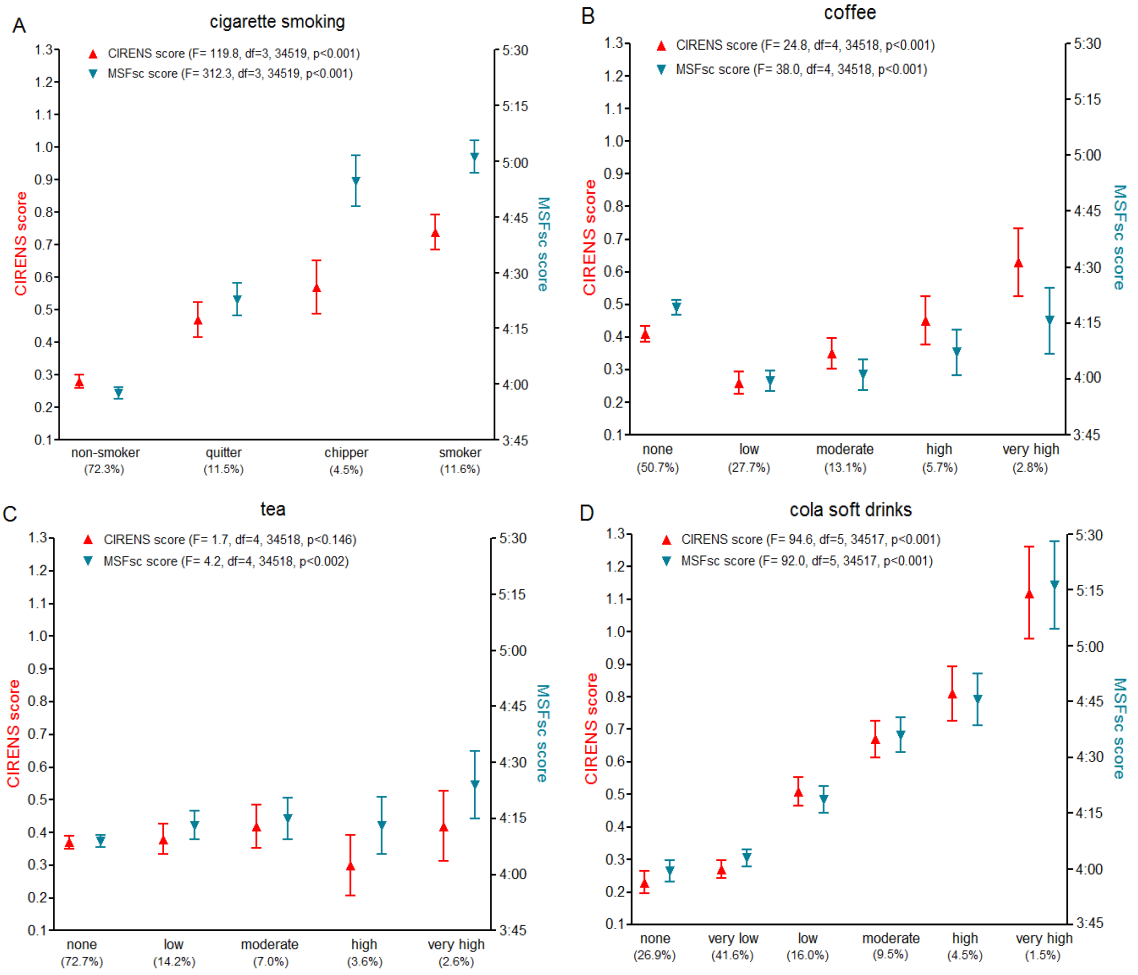


Figure 6


A
cigarette smoking
CIRENS score (F= 119.8, df=3, 34519, p<0.001)
MSFsc score (F= 312.3, df=3, 34519, p<0.001)
CIRENS score
MSFsc score
non-smoker (72.3%)
quitter (11.5%)
chipper (4.5%)
smoker (11.6%)
B
coffee
CIRENS score (F= 24.8, df=4, 34518, p<0.001)
MSFsc score (F= 38.0, df=4, 34518, p<0.001)
none (50.7%)
low (27.7%)
moderate (13.1%)
high (5.7%)
very high (2.8%)
C
tea
CIRENS score (F= 1.7, df=4, 34518, p<0.146)
MSFsc score (F= 4.2, df=4, 34518, p<0.002)
none (72.7%)
low (14.2%)
moderate (7.0%)
high (3.6%)
very high (2.6%)
D
cola soft drinks
CIRENS score (F= 94.6, df=5, 34517, p<0.001)
MSFsc score (F= 92.0, df=5, 34517, p<0.001)
none (26.9%)
very low (41.6%)
low (16.0%)
moderate (9.5%)
high (4.5%)
very high (1.5%)

Capítulo VI

Associação entre Temperamento Afetivo e Emocional e Parâmetros Subjetivos de Sono

(publicado no Journal of Affective Disorders)

Association of Temperament with Subjective Sleep Patterns

Gustavo L. Ottoni[1], Taise M. Lorenzi[2], Diogo R. Lara[2]

1. Departamento de Bioquímica, Instituto de Ciências Básicas da Saúde, Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil
2. Faculdade de Biociências, Pontifícia Universidade Católica do Rio Grande do Sul, Porto Alegre, Brazil

Corresponding author:

Diogo R. Lara

Faculdade de Biociências – PUCRS

Av. Ipiranga, 6681 – Pd12A

Porto Alegre, RS

Brazil

90619-900

Phone +55 51 81219187

Fax +55 51 33203612

diogorlara@gmail.com

ABSTRACT

Background: Emotional and cognitive functioning have been involved in insomnia etiology, and sleep disturbances are closely related to psychiatric disorders and personality traits. This study investigates the association of temperament with subjective sleep parameters.

Methods: In this web-survey, 5129 subjects (25.3% males) completed the Combined Emotional and Affective Temperament Scale (CEATS), which assesses emotional (fear, anger, drive and control) and affective (e.g. cyclothymic, hyperthymic) temperaments. Subjects also answered questions regarding subjective sleep parameters, psychiatric diagnosis, psychotropic medication intake and cigarette smoking.

Results: As control scores decreased, the later were the bed and the wake up time. Total sleep time was weakly associated with emotional temperaments. The higher the score of anger and the lower the score of control, the higher was the sleep-onset latency. As the anger score increased and the drive, fear and control scores decreased, the higher the number of nightly awakenings. The higher the drive and the control and the lower the anger scores, the better the sleep quality. For affective temperaments, depressives, labiles (related to ADHD) and cyclothymics (related to bipolar II disorders) go to bed and wake up later and have a worse profile regarding other sleep parameters. Hyperthymics and euthymics showed favorable sleep profiles.

Limitations: Sample included a significant number of subjects with psychiatric diseases and on psychotropic medication.

Conclusion: Dysregulated emotional activation (expressed as higher anger, and lower control and drive), as well as depressive, labile and cyclothymic affective temperaments were related to more dysfunctional sleep patterns.

Keywords: sleep, temperament, personality, CEATS, insomnia, mood disorders.

INTRODUCTION

Temperament relates to the emotional nature and the quality of the prevailing mood, being mostly inherited and relatively stable over time (Allport, 1961; Cloninger et al., 1993). In the psychiatric literature two models address what can be conceived as emotional and affective temperaments, proposed by Cloninger (Cloninger et al., 1993) and Akiskal (Akiskal et al., 1989), respectively. We have proposed a bidimensional model for the integration of emotional and affective temperament constructs (Lara and Akiskal, 2006; Lara et al., 2006). This model is based on the principle that activation (drive/pleasure and anger) and inhibition (fear and caution) are the two main *emotional* forces or 'vectors of the mind', as coined by Thurstone (Thurstone, 1934). We also included another factor that is related to regulation of activation and inhibition, called control. Their interaction would produce a resulting *affective* temperament or prevailing mood, which can be euthymic, cyclothymic, hyperthymic, irritable, depressive, anxious, dysphoric, labile, disinhibited or apathetic. Recently we developed and validated the Combined Emotional and Affective Temperament Scale (CEATS), a brief self-report scale for the simultaneous assessment of emotional and affective temperaments (Lara et al., 2008).

Sleep disturbances are very common and are related to impaired mood, subjective functioning and quality of life (Walsh, 2004). The prevalence of one or more symptoms of insomnia for at least a few nights a week is 64% in the USA adult working population, which is significantly higher than observed in other measurements over this decade (National Sleep Foundation, 2009). Insomnia related to psychiatric disorders has been shown to be the most

prevalent diagnosis among insomniac patients evaluated in sleep centers (Buysse et al., 1994), and more than half of these diagnoses are of a mood disorder (Tan et al., 1984). On the other hand, sleep disturbances are common complaints in psychiatric populations, with a stronger association among those presenting a mood disorder (Benca et al., 1992). Importantly, even in periods of remission, mood disorder patients exhibit higher rates of sleep disturbances than the general population (Peterson and Benca, 2006).

Compared to normal controls, most psychiatric diagnostic groups show reduction in sleep efficiency and total sleep time (Benca et al., 1992). The cardinal feature of chronic insomnia is hyperarousal, which is associated with an activation of the hypothalamic-pituitary-adrenal axis and the sympathetic nervous system, the major components of the stress system (Szelenberger and Soldatos, 2005). More specifically, psychiatric patients with Hamilton Depression (HAMD) scores of 18 or higher show less sleep quality than those with lower scores (Lemke et al., 1999). In polysomnographic studies, depressed and also dysthymic patients have decreased sleep efficiency, increased wakefulness within the total sleep period and reduced subjective sleep quality compared to normal controls (Saletu-Zyhlarz et al., 2002; Saletu-Zyhlarz et al., 2001). Major depressive patients, as well as borderline patients without concomitant major depression, have less total sleep time, more prolonged sleep-onset latency and greater percentage of wakefulness than control subjects in a sleep-EEG study (De la Fuente et al., 2001). Individuals at high behavioral risk of hypomania exhibit greater variability in duration, fragmentation and efficiency of sleep, shorter sleep duration and later bedtimes than controls (Ankers and Jones, 2009). Actigraphic sleep estimates show that attention-

deficit hyperactivity disorder (ADHD) adult subjects take longer to fall asleep, have lower sleep efficiency and shorter within-night periods of uninterrupted sleep than controls (Boonstra et al., 2007). A self-report study demonstrated that, comparing to controls, adults with ADHD go to bed later, have a wider range of bedtimes, are more likely to take over an hour to fall asleep, are more likely to experience difficulty going to bed, going to sleep, sleeping restfully, or waking in the morning, experience daytime sleepiness more often, and report more sleep problems (Surman et al., 2009). Patients with generalized anxiety disorder present significantly increased wake up time during the total sleep period, more early-morning awakening, decreased total sleep, decreased sleep efficiency, and deteriorated subjective sleep quality in a polysomnography based study (Saletu-Zyhlarz et al., 1997).

Concerning personality traits, trait anger has been associated with difficulty in initiating and maintaining sleep, early morning awakening, nonrestorative feelings in morning, and excessive daytime sleepiness (Shin et al., 2005). Waters et al. (1993) reported anger to be related to poor sleep quality and difficulty in falling asleep. Sleep disturbances have also been associated with fear of cognitive dyscontrol (Vincent and Walker, 2001), internalization of psychological disturbances (Kales et al., 1976), self-criticism (Vincent et al., 2008), neuroticism (Morgan et al., 1989), perfectionism (Jansson-Fröjmark and Linton, 2007) and emotional reliance on another person (Vincent et al., 2008). LeBlanc et al. (2009) found that cases with insomnia syndrome presented a premorbid psychological vulnerability to insomnia, characterized by higher depressive and anxiety symptoms, lower extraversion, higher arousal, and poorer self-rated mental health at baseline.

Cognitive and behavioral patterns have also been related to sleep dysfunction. Excessive cognitive activity at bedtime constitutes an important impediment to the process of falling asleep (Harvey et al., 2005). Also, higher impulsivity predicted shorter sleep duration and more nightly awakenings in men (Granö et al., 2007). Schmidt et al. (in press) found that two facets of impulsivity (urgency and lack of perseverance) and two strategies of thought-control (aggressive suppression and worry) were positively associated with insomnia severity, and concluded that specific personality traits may incline individuals to respond with dysfunctional thought-control strategies to unwanted mental activity at night.

Temperamental affective predispositions are present in individuals who develop mood disorders, as well as in their relatives, with different distributions according to the subtype of mood disorder (e.g. more hyperthymic traits in bipolar I disorder, cyclothymic traits in bipolar II disorder and depressive traits in unipolar depression) (Evans et al., 2005; Kesebir et al., 2005; Akiskal et al., 2005). Lara and Akiskal (2006) have also expanded the role of temperament to most psychiatric disorders. Since sleep disturbances are closely related to many psychiatric disorders and personality traits, and emotional and cognitive functioning are involved in the etiology of insomnia, the aim of this study was to investigate the relationship of emotional and affective temperaments, measured by the CEATS, with six subjective sleep parameters: bed time, wake up time, total sleep time, sleep-onset latency, sleep period awakenings and sleep quality.

METHODS

Participants

All participants gave their electronic informed consent before completing the scale. This form was elaborated to fulfill the requirements of the National Health Council of Brazil (Resolution 196/1996). Their participation was voluntary and they could cancel their participation at any moment without justification. The study was approved by the Institutional Review Board of Hospital São Lucas from Pontifícia Universidade Católica do Rio Grande do Sul.

Volunteers answered by internet the CEATS, questions on specific sleep characteristics, and general questions on psychiatric diagnosis and psychotropic medication intake in a website about bipolar spectrum disorders (n=4381) (www.bipolaridade.com.br) or in another website for the general population (n=748). These websites were broadcasted on TV and radio talk-shows.

The sample consisted of 5129 subjects, with mean age of 31.0 ± 10.22 years (18-73), being 1298 (25.3%) males (31.8 ± 10.79 years) and 3831 (74.7%) females (30.7 ± 10.0 years). A total of 2841 subjects (55.4% of the sample) had been diagnosed with a psychiatric disorder, and 2815 (54.9%) were on psychotropic medication.

CEATS

The CEATS (see Lara et al., 2008 for the complete scale) consists of three sections: 1) Emotional section: 27 five-item multiple choice questions arranged in the following order: fear (7 items), drive (8 items), control (6 items) and anger (6 items). Each question is scored from 1 to 5 and the total score of each

dimension is the sum of the scores of their respective questions; 2) Affective section: short descriptions of the ten affective temperaments (depressive, anxious, cyclothymic, dysphoric, apathetic, euthymic, irritable, labile, disinhibited, hyperthymic) are presented with a 5-item likert scale, from 'nothing like me' (rated as 1) to 'everything like me' (rated as 5). This is the *dimensional* assessment of affective temperaments. After these 10 descriptions, the subject has to select which of these profiles is the most suitable to represent his/her temperament. This allows for a *categorical* evaluation of affective temperament.

Sleep evaluation

The following subjective sleep parameters were assessed with the respective questions from the Basic Nordic Sleep Questionnaire (Partinen and Gislason, 1995): 1) bed time during work days, 2) wake up time during work days, 3) sleep-onset latency, 4) number of awakenings, 5) hours of total sleep, 6) use of hypnotic medication and 7) sleep quality (rated 0 for poor; 1 for quite bad; 2 for neither bad nor good; 3 for quite good; 4 for good).

Subjects were also questioned about having already received a psychiatric diagnosis by a mental health professional, about current intake of psychotropic medicines and cigarette smoking, since these are also potential risk factors for sleep patterns changes.

Statistical analysis

When applicable, all analyses were controlled for age, gender, smoking status, psychiatric diagnosis and psychotropic drug intake (yes or no). All results of each emotional temperament were controlled for the other three emotional temperaments. The relations between emotional temperaments and sleep

parameters were analyzed with linear regression. Comparisons of sleep parameters among categorical affective temperaments were performed with univariate analysis of variance with Bonferroni confidence interval adjustment. Frequencies of sleep medication intake among categorical affective temperaments were calculated with the chi-square test.

Subjects with sleep quality score quite bad or poor (0 or 1) were classified as having Poor Sleep Quality. The risk ratios for Poor Sleep Quality were calculated using logistic regression for each dimensional affective temperament, taking “nothing like me” as reference.

Statistical significance was considered if $p<0.05$. The SPSS 15.0 software was used for all analyses.

RESULTS

Emotional temperaments and sleep patterns

Figure 1 shows the relationship of emotional temperaments with each individual sleep parameter. Bed and wake up times correlated mostly with control (B = -0.049; 95%CI: -0.060, -0.037 and B = -0.048; 95%CI: -0.061, -0.035, respectively). As control decreased, the later were the bed and the wake up times. Not so strongly, bed time was also related to fear (B = -0.015; 95%CI: -0.027, -0.003) and anger (B = 0.015; 95%CI: 0.005, 0.025), but not to drive (B = -0.005; 95%CI: -0.015, 0.005), while wake up time was related to drive (B = -0.026; 95%CI: -0.038, -0.014) and fear (B = -0.020; 95%CI: -0.034, -0.006), but not to anger (B = 0.001; 95%CI: -0.011, 0.013). Total sleep time was weakly related to drive (B = -0.021; 95%CI: -0.031, -0.011) and anger (B = -0.014;

95%CI: -0.024, -0.005), and not related to fear (B = -0.005; 95%CI: -0.016, 0.006) and control (B = 0.001; 95%CI: -0.010, 0.011). The higher the anger score (B = 0.564; 95%CI: 0.446, 0.683) and the lower the control score (B = -0.381; 95%CI: -0.514, -0.249), the higher was the sleep-onset latency. This parameter was weakly related to drive (B = -0.210; 95%CI: -0.330, -0.090) and was not related to fear score (B = 0.116; 95%CI: -0.026, 0.258). As the anger score increased (B = 0.041; 95%CI: 0.031, 0.051), the number of nightly awakenings increased. This number decreased along with drive (B = -0.036; 95%CI: -0.046, -0.026), fear (B = -0.022; 95%CI: -0.034, -0.009) and control (B = -0.012; 95%CI: -0.023, -0.001) scores. Regarding sleep quality, the higher the drive (B = 0.037; 95%CI: 0.030, 0.044) and the control (B = 0.029; 95%CI: 0.022, 0.037) and the lower the anger score (B = -0.049; 95%CI: -0.055, -0.042), the better the sleep quality. This parameter was not correlated with fear level (B = 0.004; 95%CI: -0.004, 0.012).

Categorical affective temperaments and sleep patterns

Sleep profiles of *categorical* affective temperaments are shown in Figure 2 as mean ± 95% confidence intervals. Except for total sleep time, significant differences were observed in all parameters. In general, subjects who chose the cyclothymic, labile or depressive as their best temperament description tended to go to bed and wake up later and to have a worse profile regarding sleep-onset latency, number of awakenings during the total sleep period, and sleep quality. In contrast, those with hyperthymic or euthymic temperaments showed an inverse and favorable profile regarding these sleep parameters.

Concerning the use of sleep medication, more subjects with cyclothymic (13.9%) or dysphoric (13.9%) temperaments used medication every night

(p<0.01 and p<0.05, respectively). A lower proportion of subjects with hyperthymic (3.3%), euthymic (4.0%) or disinhibited (6.5%) temperaments reported such regular use (p<0.01, p<0.01 and p<0.05, respectively). Cyclothymics (23.9%) also reported occasional use of sleeping pills more often (p<0.01), whereas a lower proportion of hyperthymics (10.9%) and euthymics (12.2%) reported such sporadic use (p<0.01 for both).

Dimensional affective temperaments and sleep patterns

We also evaluated the relationship of *dimensional* affective temperaments scores with overall sleep quality. Subjects who reported having quite bad or poor sleep quality were classified as having Poor Sleep Quality. The risk ratios for poor sleep quality according to dimensional affective temperaments levels are shown in Table 1. The odds ratios changed in a gradual fashion as the intensity level of each affective temperament increased. The most negative associations with sleep quality were with dysphoric, cyclothymic and depressive temperaments. The odds ratios for poor quality of sleep comparing “nothing like me” (reference) and “exactly like me” answers for each of these affective temperaments were 4.77 for dysphoric, 4.52 for cyclothymic and 4.45 for depressive temperaments. In contrast, only euthymic and hyperthymic temperaments had lower risk of having poor quality of sleep (OR = 0.18 and 0.36, respectively). Thus, euthymic and hyperthymic dimensions were associated with better sleep quality, whereas all the other eight affective temperaments were associated with worse sleep quality, being irritable the least associated.

DISCUSSION

Our results revealed associations between the four CEATS emotional temperaments with subjective sleep parameters. In general, high anger was related to worse, whereas high control and drive to better sleep profile. Fear was weakly related to sleep variables.

Bed and wake up times depended mostly on control. Regarding bed time, the B = -0.049 for control indicates that the bed time varies 0.049 hours for every point variation on control score. This means that a decrease of 10 points on control (range 6-30) reflects a bed time 0.49 hours (~29 minutes) later. The relationship of control with wake up time showed a similar magnitude (B = -0.048).

Drive and anger, but not control and fear, were associated with total sleep time. A score increment of 20 points in drive and anger were associated with a reduction in sleep duration of 0.42 hours (~25 minutes) and 0.28 hours (~17 minutes), respectively. These results are in agreement with a previous finding of shorter total sleep duration related to transient hostility (Granö et al., 2008), which has shown convergent validity with the trait-anger scale (Spielberger et al., 1985; Romanov et al., 1994). Anger was the emotional temperament most strongly associated with dysfunctional sleep. Higher anger scores reflected increased sleep-onset latency, more nightly awakenings and poorer sleep quality. Accordinlgy, anger has been related to difficulty in falling asleep (Waters et al., 1993; Shin et al., 2005), nightly awakenings and subjective sleep quality (Shin et al. 2005). One possible mechanism is through the impact of the physiological arousals that accompany anger, as poor sleep could be caused by physiological activation (Bonnet and Arand, 2003).

Regarding affective temperaments, the CEATS has the advantage of identifying subjects with euthymic temperament, which can be considered as a healthy control group. Thus, compared to euthymics, all the other affective temperaments presented a worse sleep profile, except for hyperthymics. This is in line with sleep complaints frequently present in many different types of psychiatric illnesses, i.e., not only mood disorders. Indeed, sleep symptoms have been incorporated in the official diagnostic criteria for some mental disorders (Szelenberger and Soldatos, 2005), but may also be present in many other disorders.

Among all categories of psychiatric illnesses, findings on sleep abnormalities have been more robust for patients with affective disorders (Benca et al., 1992), particularly major depressive disorder. The results observed for the depressive affective temperament confirms previous findings of dysfunctional sleep parameters. However, our findings show that the cyclothymic temperament and labile temperaments are as problematic as the depressive temperament in all sleep parameters. Depressive, cyclothymic and labile temperaments tend to go to bed and wake up late, have a long latency to fall asleep, have more awakenings and low sleep quality, particularly in comparison with the euthymic temperament.

The reported sleep disturbances in the borderline personality disorder, also characterized by emotional instability, have been of less total sleep time, more prolonged sleep onset, and greater percentage of wakefulness than controls (De la Fuente et al., 2001). Except for that first parameter, the other two are in agreement with our findings for the emotionally unstable cyclothymic temperament, which probably underlies borderline personality disorders (Perugi

et al., 2003). Also, stable bipolar disorder patients have increased sleep-onset latency (Millar et al., 2004).

According to an actigraphic study, ADHD adult subjects take longer to fall asleep, have lower sleep efficiency, and shorter within-night periods of uninterrupted sleep (Boonstra et al., 2007), whereas a recent self-report study reports that adults with ADHD go to bed later and are more likely to take over an hour to fall asleep than controls (Surman et al., 2009). Compared to euthymics, our study showed that the labile temperament, which resembles ADHD features, is prone to going to bed later, having longer sleep-onset latency, having more nightly awakenings and worse sleep quality.

Our results demonstrated sleep problems among many affective temperaments even controlling for having already received a psychiatric diagnosis and for current psychiatric treatment. Accordingly, previous findings suggest that mood disorders patients exhibit higher rates of sleep disturbances than the general population even during periods of remission (Peterson and Benca, 2006), which could be least in part justified by the temperamental substrate of these patients.

Recent clinical (Röttig et al., 2007; Rihmer et al., 2009; Lazary et al., 2009) and genetic (Gonda et al., 2006) studies with different psychiatric phenotypes and mentally healthy subjects have pointed out a tendency of the hyperthymic temperament to distinguish itself from the other affective temperaments covered by the TEMPS-A. From an evaluation of remitting bipolar I patients, Perugi et al. (2010) extracted 2 factors regarding temperamental and psychopathological traits: the cyclothymic-sensitive that included, depressive, cyclothymic, irritable temperaments, and separation anxiety and interpersonal sensitivity traits; and the hyperthymic that included hyperthymic temperament as the only positive

component. In this study, dominant cyclothymic-sensitive and hyperthymic patients reported important differences in terms of both clinical and course characteristics of the bipolar disorder, family history and co-morbidities. Our findings with the temperaments as measured by CEATS corroborate these results, reinforcing the differentiation of hyperthymic temperament from the others. Further, since the CEATS introduced the euthymic temperament, unlike all the other affective temperaments, the hyperthymic is the only one that has a sleep pattern similar to the "normal" controls. However since the CEATS proposes five other affective temperaments than the TEMPS-A to be used in a broader spectrum of psychopathologies, further studies with different clinical and neurobiological parameters are necessary to confirm whether this dichotomy of affective temperaments will remain adequate.

This study has some limitations that should be taken into account. First, this is a cross-sectional investigation and thus cannot demonstrate the direction of the causality between temperament and sleep patterns. A second limitation is that our sample was mostly collected through an educational open-access website on bipolar disorders, which determined the inclusion of a significant number of subjects with psychiatric disorders and on psychotropic medication, and raises the question of whether our results may be generalized to the general population. However, our results were controlled for these factors and the overrepresentation of these subjects allows a better assessment of the relations between more extreme emotional traits and sleep. Thirdly, this was a self-report investigation on sleep patterns, and objective measures of sleep parameters are necessary to confirm these findings. Fourth, although our results were controlled for age, gender, psychiatric diagnosis, current psychotropic intake

and current smoking, other potential confounding factors were not considered, such as alcohol drinking, caffeine consumption, socioeconomic status and physical illnesses. Finally, data was collected using the internet, which may be liable to some degree of inaccuracy in responding. However, the large sample and the generally consistent responses to the instruments may counterbalance this limitation.

Supporting findings in which insomnia etiology is related to a physiological hyperarousal status, our results demonstrate that dysregulated emotional activation, expressed as high anger, and low control and drive, are independently related to specific sleep problems. Our study extends to the depressive temperament the sleep problems reported in major depression. Moreover, the cyclothymic and labile temperaments are similarly associated with highly dysfunctional sleep patterns. Further investigations of the relationship between temperament and sleep in different population groups and with objective sleep measures are warranted.

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Table 1 Risk Ratio for Poor Quality of Sleep According to Dimensional Affective Temperaments Levels

	Nothing like me	A little like me	Fairly like me	A lot like me	Exactly like me
Depressive	n=659 (12.8%)	n=868 (16.9%)	n=1835 (35.8%)	n=1031 (20.1%)	n=736 (14.3%)
Adjusted OR (95% CI)	1 (Reference)	1.35 (1.09-1.66)	2.25 (1.87-2.71)	3.32 (2.70-4.09)	4.45 (3.53-5.61)
Anxious	n=679 (13.2%)	n=1220 (23.8%)	n=1625 (31.7%)	n=954 (18.6%)	n=651 (12.7%)
Adjusted OR (95% CI)	1 (Reference)	1.19 (0.99-1.44)	1.61 (1.34-1.93)	2.29 (1.86-2.80)	2.86 (2.27-3.59)
Apathetic	n=1207 (23.5%)	n=1226 (23.9%)	n=1392 (27.1%)	n=735 (14.3%)	n=569 (11.1%)
Adjusted OR (95% CI)	1 (Reference)	1.26 (1.07-1.48)	2.11 (1.80-2.47)	2.87 (2.35-3.50)	2.74 (2.21-3.40)
Dysphoric	n=418 (8.1%)	n=667 (13.0%)	n=951 (18.5%)	n=1232 (24.0%)	n=1861 (36.3%)
Adjusted OR (95% CI)	1 (Reference)	1.42 (1.10-1.84)	1.87 (1.46-2.38)	2.78 (2.19-3.53)	4.77 (3.77-6.03)
Cyclothymic	n=470 (9.2%)	n=707 (13.8%)	n=862 (16.8%)	n=1076 (21.0%)	n=2014 (39.3%)
Adjusted OR (95% CI)	1 (Reference)	1.34 (1.05-1.71)	1.98 (1.56-2.51)	3.07 (2.43-3.87)	4.52 (3.62-5.65)
Euthymic	n=1435 (28.0%)	n=1385 (27.0%)	n=1137 (22.2%)	n=713 (13.9%)	n=459 (8.9%)
Adjusted OR (95% CI)	1 (Reference)	0.67 (0.57-0.79)	0.45 (0.38-0.53)	0.23 (0.19-0.28)	0.18 (0.14-0.23)
Irritable	n=208 (4.1%)	n=633 (12.3%)	n=1559 (30.4%)	n=1203 (23.5%)	n=1526 (29.8%)
Adjusted OR (95% CI)	1 (Reference)	0.84 (0.61-1.15)	0.88 (0.66-1.18)	1.21 (0.90-1.63)	1.48 (1.10-1.99)
Labile	n=855 (16.7%)	n=964 (18.8%)	n=1441 (28.1%)	n=986 (19.2%)	n=883 (17.2%)
Adjusted OR (95% CI)	1 (Reference)	1.47 (1.22-1.77)	1.81 (1.52-2.15)	2.26 (1.86-2.74)	2.88 (2.35-3.58)
Disinhibited	n=633 (12.3%)	n=1055 (20.6%)	n=1477 (28.8%)	n=1067 (20.8%)	n=897 (17.5%)
Adjusted OR (95% CI)	1 (Reference)	1.56 (1.27-1.90)	1.75 (1.44-2.11)	2.04 (1.66-2.50)	2.18 (1.76-2.69)
Hyperthymic	n=972 (19.0%)	n=1270 (24.8%)	n=1644 (32.1%)	n=827 (16.1%)	n=416 (8.1%)
Adjusted OR (95% CI)	1 (Reference)	0.80 (0.67-0.96)	0.56 (0.48-0.67)	0.42 (0.35-0.51)	0.36 (0.28-0.45)

Abbreviations: CI, confidence interval; OR, Odds Ratio.

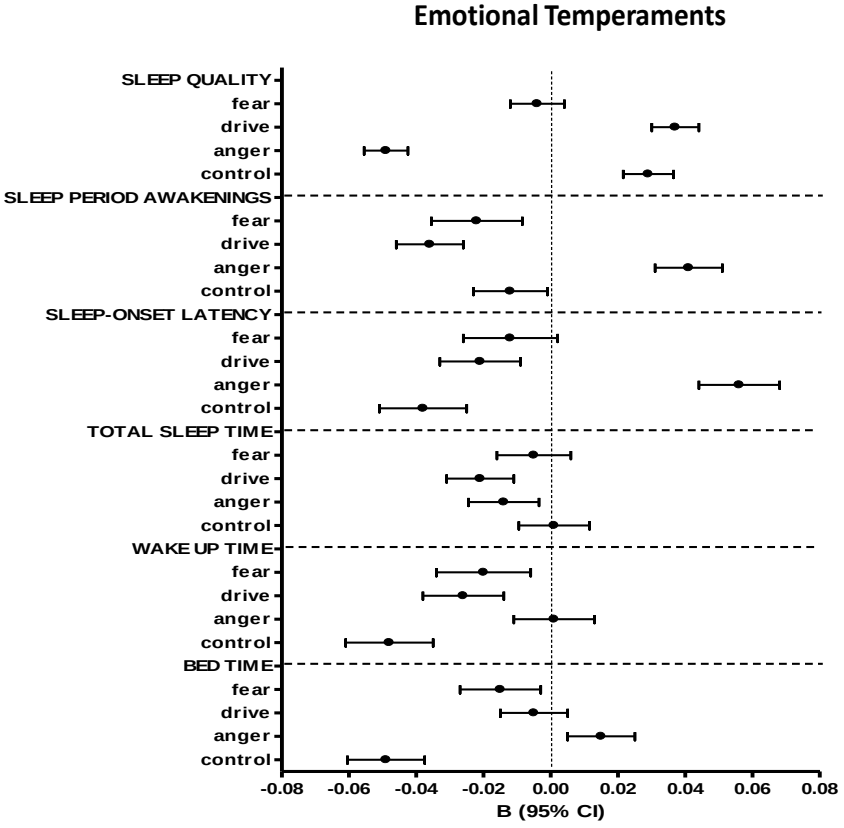
Odds Ratio Adjusted for age, gender, psychiatric diagnosis, psychotropic medication and cigarette smoking.

FIGURE LEGENDS:

Figure 1. Relationship between emotional temperaments and sleep parameters. “B” is the expected change in the sleep parameter, ±95% confidence interval, for a one–unit change in the emotional temperament, controlling for age, gender, psychiatric diagnosis, psychotropic medication intake, cigarette smoking, and the other emotional temperaments. The sleep parameters units are: bed time (hour), wake up time (hour), total sleep time (hour), sleep-onset latency (minutes), sleep period awakenings (number of awakenings), sleep quality (0 to 4). The range scores of the emotional temperaments are: fear (7-35), drive (8-40), control (6-30), anger (6-30).

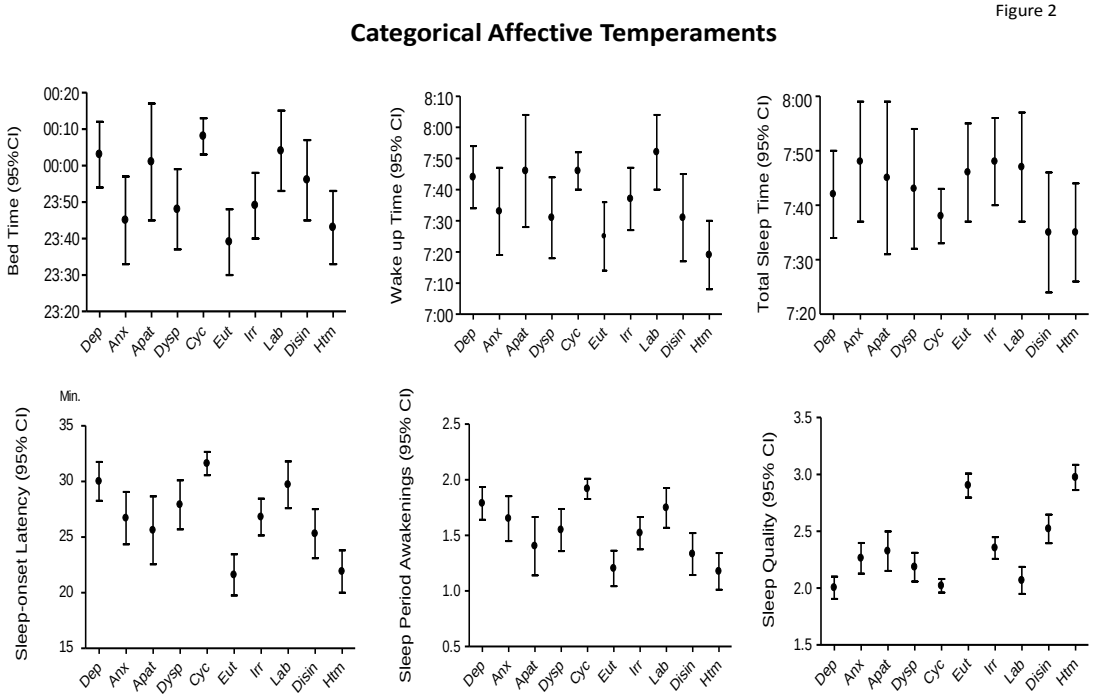
Figure 2. Sleep parameters profile of categorical affective temperaments. Scores of the sleep parameters are shown as mean ± 95% confidence interval, controlling for age, gender, psychiatric diagnosis, psychotropic medication intake, and cigarette smoking. Sleep quality scores are: 0 = poor, 1 = quite bad, 2 = neither bad nor good, 3 = quite good, 4 = good. Dep = depressive (n=552), Anx = anxious (n=297), Apat = apathetic (n=176), Dysp = dysphoric (n=336), Cyc = cyclothymic (n=1507), Eut = euthymic (n=449), Irr = irritable (n=573), Lab = labile (n=381), Disin = disinhibited (n=339), Htm = hyperthymic (n=448).

Figure 1



B values for Sleep-onset Latency are divided by 10.
B values adjusted for age, gender, psychiatric diagnosis, psychotropic medication, cigarette smoking and emotional temperaments.

Figure 2



Mean values adjusted for age, gender, psychiatric diagnosis, psychotropic medication and cigarette smoking .

Capítulo VII

Associação entre Temperamento Afetivo e Emocional e Preferência Circadiana

Circadian Preference is Associated with Emotional and Affective Temperaments

Gustavo L. Ottoni[1], Eduardo Antoniolli[1], Diogo R. Lara[2]

1. Departamento de Bioquímica, Instituto de Ciências Básicas da Saúde, Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil
2. Faculdade de Biociências, Pontifícia Universidade Católica do Rio Grande do Sul, Porto Alegre, Brazil

Corresponding author:

Diogo R. Lara

Faculdade de Biociências – PUCRS

Av. Ipiranga, 6681 – Pd12A

Porto Alegre, RS

Brazil

90619-900

Phone +55 51 81219187

Fax +55 51 33203612

diogorlara@gmail.com

ABSTRACT

Chronotype has been associated with mental disorders and temperamental features. This study aims to investigate the association of circadian preference with emotional and affective temperament. In this web-survey, 3,437 subjects (27.7% males) answered the Affective and Emotional Composite Temperament Scale (AFECTS), the Circadian Energy Scale (CIRENS), an energy-based chronotype scale, and questions on subjective sleep parameters for a sleep-based chronotype measure. Temperaments were more strongly correlated with daily energy scores than with chronotypes. For emotional dimensions, high Volition, Coping and Control correlated with high and stable daily energy, in contrast with Sensitivity. Evening types had lower scores of order and focus (the facets of Control), energy (facet of Volition), caution (facet of Inhibition), and ability (facet of Coping) than morning and neither types, which had similar emotional profiles. The euthymic and hyperthymic affective temperament scores showed the largest positive and the depressive, apathetic, cyclothymic, and volatile affective temperament scores had the greatest negative correlations with the CIRENS energy scores. Differences between affective temperaments were more pronounced for morning and afternoon than for evening scores. Cyclothymic and euphoric temperaments, which relate to bipolar disorders, and apathetic, volatile, and disinhibited temperaments, which relate to Attention Deficit Hyperactivity Disorders (ADHD) showed the latest chronotypes (i.e. evening preference). In conclusion, eveningness was associated with low emotional control, affective instability and externalization. The circadian daily energy profile can be an informative aspect of human temperament.

Keywords: chronotype, energy, sleep, CIRENS, AFECTS, personality

INTRODUCTION

Circadian typology (morningness-eveningness preference) is a continuum between two extremes from morning to evening chronotypes, and those without a pronounced circadian preference are called neither types. Morning types have earlier bed and rising times, greater morning energy, and preference for diurnal activities; evening types are characterized by later bed and rising times, more irregular sleep and wake up habits, more evening energy, and preference for nocturnal activities (Ishihara et al.,1987; Benedito-Silva et al., 1990; Ottoni et al., submitted). Chronotype is a stable trait (Klei et al., 2005; Paine et al., 2006) and results from a complex interaction between internal and external factors. Such as for all organisms, the internal circadian clock (Dijk and Edgar, 1999; Zlomanczuk and Schwartz, 1999) and light exposure (Czeisler et al., 2005) are mostly determinant for chronotyping, but the daily life of humans is under significant influence of social stimuli and work schedules (Monk, 2005).

The most widely used tool for chronotype assessment is the Horne and Östberg Morningness-Eveningness Scale (MEQ) (Horne and Ostberg, 1976), but the different cutoffs for chronotype classification according to age (Taillard et al., 2004) limit its application in samples with a wide age range. To enable a better understanding of the genetic basis of temporal organization in humans, Roenneberg et al (2003) developed the Munich Chronotype Questionnaire (MCTQ), a sleep-based chronotype instrument. The quantitative section of this questionnaire assesses the mid-sleep on free days adjusted for the sleep-debt accumulated during the workweek, a measure called MSFsc (Roenneberg et al., 2007). In contrast to this sleep-based measure, we have recently developed

and validated an exclusively energy-based chronotype measurement tool: the Circadian Energy Scale - CIRENS (Ottoni et al, submitted). Both the CIRENS and the MSFsc of MCTQ are significantly correlated to MEQ (r = -0.70 and r = -0.66, respectively) (Ottoni et al., submitted; Roenneberg et al., 2007). However, since the CIRENS and the MSFsc evaluate two different aspects of chronotype, their correlation is weaker (r = 0.32) (Ottoni et al., submitted).

Several studies have reported greater evening preference in different psychiatric disorders (Caci et al., 2009; Drennan et al., 1991; Hakkarainen et al., 2003; Wood et al., 2009; Adan, 1994; Kasof, 2001), and a breakdown in the organization of circadian rhythm has been suggested in mood disorders (Ashman et al., 1999). In this regard, an instrument interview for biological rhythms assessment has been recently validated to use in neuropsychiatric clinical setting (Giglio et al., 2009). Patients with major depression report greater eveningness than controls (Drennan et al., 1991), depressive symptoms are associated with an evening circadian preference (Hirata et al., 2007), and severity of depressive symptoms is higher among evening types, both in depressed (Gaspar-Barba et al., 2009) and healthy (Hidalgo et al., 2009) populations. Similarly, subjects with bipolar disorder show circadian delay and evening preference (Mansour et al., 2005; Ahn, et al., 2008; Wood et al., 2009; Giglio et al., 2010). Attention Deficit Hyperactivity Disorder (ADHD), mainly the inattention type, has also been related to eveningness (Rybak et al., 2007; Caci et al., 2009), and morning bright light therapy is useful to induce a circadian phase advance and improvement of core ADHD symptoms (Rybak et al., 2006)

Temperament relates to the emotional nature and the quality of the prevailing mood, being mostly inherited and relatively stable over time (Allport,

1961; Cloninger et al., 1993). Supported by several relevant theories on temperament, we have proposed the Affective and Emotional Composite Temperament (AFECT) model for the integration of what can be conceived as the emotional (Cloninger et al., 1993) and the affective (Akiskal et al., 1989) temperament constructs (Lara and Akiskal, 2006; Lara et al., 2006; Lara et al., submitted). The AFECT model proposes that human basic emotional dimensions work as a system composed of Activation, Inhibition, Sensitivity, Coping and Control (AIS2C). This system is based on the principle that *Activation* (Volition and Anger) and *Inhibition* (Fear and Caution) are the two main emotional forces or 'vectors of the mind', as coined by Thurstone (Thurstone, 1934). Three additional dimensions complete the system: *Sensitivity* and *Coping*, related to how the system reacts to the environment, particularly in stressful situations, and *Control*, related to monitoring the environment and making adequate adjustments in activation and inhibition. According to the interaction of the AIS2C independent emotional dimensions, an affective temperament or prevailing mood would result in a typology matrix. There are 12 affective temperament types: depressive, anxious, apathetic, obsessive, cyclothymic, dysphoric, volatile, euthymic, irritable, disinhibited, hyperthymic, and euphoric (for further details see Lara et al., submitted). We have recently developed and validated the Affective and Emotional Composite Temperament Scale (AFECTS), which is a brief self-report scale for simultaneous assessment of these emotional and affective temperaments (Lara et al., submitted).

Since temperamental affective predispositions are present in individuals who develop mood disorders, as well as in their relatives (Evans et al., 2005;

Kesebir et al., 2005; Akiskal et al., 2005), and the role of temperament has been expanded for most psychiatric disorders (Lara and Akiskal, 2006; Lara et al., submitted), the above reported associations between eveningness and psychiatric pathologies could be, at least in part, modulated by the individual underlying temperament.

Several studies have investigated the association of circadian preference with temperament and personality traits. Regarding temperament, evening-type subjects have been associated with high novelty seeking, and low harm avoidance, persistence and self-directedness (Adan et al., 2010), whereas the morning types have been positively correlated to persistence and negatively to novelty seeking (Caci et al., 2004) in the Temperament and Character Inventory - TCI (Cloninger, 1993). Eveningness has also been related to high impulsivity (Caci et al., 2005; Rybak et al., 2007), high sensation seeking behavior (Tonetti et al., 2010), low self-control and great procrastination (Digdon and Howell, 2008), and poor target discrimination (Rybak et al., 2007), whereas morningness has been inversely associated to high risk-taking propensity (Killgore, 2007). Regarding Eysenck's three factor model of personality (Eysenck, 1967), there are reports on positive associations of extraversion (Adan, 1992; Mecacci et al., 1986; Neubauer, 1992; Soehner et al., 2007), neuroticism (Mecacci & Rocchetti, 1998; Mura & Levy, 1986; Neubauer, 1992) and psychoticism (Mecacci & Rocchetti, 1998; Mecacci et al., 1986) with eveningness. However, neuroticism has also been related to morningness (Mecacci et al., 1986). Considering the Big Five model of personality (Costa & McCrae, 1992), there is a general agreement on the association of conscientiousness with morningness and on the absence of relation between

extraversion and circadian preference (Jackson & Gerard, 1996; Gray & Watson, 2002; DeYoung et al., 2007; Hogben et al., 2007; Randler, 2008; Tonetti et al., 2010). Despite some conflicting findings, there are reports suggesting the association of neuroticism (DeYoung et al., 2007; Randler, 2008; Tonetti et al., 2010), and openness (Hogben et al., 2007) with eveningness, and of agreeableness with morningness (DeYoung et al., 2007; Hogben et al., 2007; Randler, 2008).

Given the association of circadian typology with temperamental traits and psychiatric disorders, the aim of this study was to investigate the association of emotional and affective temperaments, as measured by the AFECTS, with both energy- and sleep-based circadian preference.

METHODS

Participants

All participants gave their electronic informed consent before completing the scale. This form was elaborated to fulfill the requirements of the National Health Council of Brazil (Resolution 196/1996) and the Code of Ethics of the World Medical Association (Declaration of Helsinki). Their participation was voluntary and they could cancel their participation at any moment without justification. The study was approved by the Institutional Review Board of Hospital São Lucas from Pontifícia Universidade Católica do Rio Grande do Sul.

The data presented is part of a large web-based survey to study temperament, psychiatric disorders and psychobiological measures. Volunteers

answered by internet (www.temperamento.com.br) the Affective and Emotional Composite Temperament Scale (AFECTS), the Circadian Energy Scale (CIRENS), and the respective questions from the Basic Nordic Sleep Questionnaire (Partinen and Gislason, 1995) for the following information: 1) bed time on workdays, 2) wake up time on workdays, 3) sleep-onset latency on workdays, 4) bed time on free days, 5) wake up time on free days, 6) sleep-onset latency on free days. To ensure reliability of the data, questions checking for attention were inserted within the instruments. Also, at the end of the system there were 2 specific questions on the degree of sincerity and seriousness of the volunteer while completing the instruments. Only those who stated being sincere and serious throughout the study and had correct answers in the attention validity items were included.

The sample consisted of 3,437 subjects, with mean age of 34.8 ± 11.4 years (18-77), being 952 (27.7%) males (35.6 ± 11.6 years) and 2485 (72.3%) females (34.5 ± 11.3 years).

Affective and Emotional Composite Temperament Scale (AFECTS)

The AFECTS (see Lara et al., submitted, for the complete scale) consists of the following sections: 1) Emotional section: 48 seven-item multiple choice questions, 8 for each emotional dimension: Volition, Anger (these two compose the Activation vector), Inhibition, Sensitivity, Coping, and Control. The questions are scored from 1 to 7 and the total score of each dimension is the sum of the scores of their respective questions. Each emotional dimension is composed by two facets of four questions as follows: Volition (positivity and energy), Anger (intensity and irritability), Inhibition (fear and caution), Sensitivity (interpersonal

and events), Coping (facing and ability), and Control (focus and order); 2) Affective section: short descriptions of the twelve affective temperaments (depressive, anxious, apathetic, obsessive, cyclothymic, dysphoric, volatile, euthymic, irritable, disinhibited, hyperthymic, and euphoric) are presented with a 5-item likert scale, from 'nothing like me' (rated as 1) to 'exactly like me' (rated as 5). This is the *quantitative* assessment of affective temperament. After these twelve descriptions, the subject has to select which of these profiles is the most suitable to represent his/her temperament. This allows for a *qualitative or categorical* evaluation of affective temperament; 3) Composite factors section: from combinations of emotional dimensions or of quantitative affective temperaments, the AFECTS provides the following composite factors: the Global Emotional Functioning (GEF) index (from -52 to 236 – the higher the index, the better the emotional functionality), the Internalization index (from 3 to 15 – the higher the index, the higher the internalization), the externalization index (from 3 to 15 – the higher the index, the higher the externalization), and the Instability index (from 3 to 19 – the higher the index, the higher the instability). The AFECTS also assesses the subjects perceived Problems and Advantages related to temperament. From this, the Adaptation score is provided (from 0 to 6 – the higher the score, the higher the adaptation).

Energy based chronotype

The energy based chronotype was assessed by the CIRENS (Ottoni et al., submitted). This scale rates the individual energy score in the morning, afternoon, and evening from 1 (very low) to 5 (very high). From the sum of these three scores results the Total Energy score, ranging from 3 to 15. The chronotype classification is determined by subtracting the morning from the

evening energy score. Therefore, the CIRENS' chronotype score ranges from -4 (most marked morning preference) to 4 (strongest evening preference) in the *quantitative* evaluation. In the *qualitative* classification, subjects are considered as morning-type (≤ -2), neither-type (≥ -1 and ≤ 1) or evening-type (≥ 2).

Sleep based chronotype

To assess a chronotype exclusively based on sleep, we used the data from the Basic Nordic Sleep Questionnaire (Partinen and Gislason, 1995). First, the sleep-onset time on free days was calculated through the addiction of the sleep-onset latency on free days to the bed time on free days. Then, from the sleep-onset time and the wake up time on free days, the mid-sleep time (midpoint between sleep onset and wake up times) on free days (MSF) was determined. Finally, the MSF was corrected for compensatory sleep on free days (MSFsc) as in the MCTQ (Roenneberg et al., 2003; Roenneberg et al 2004).

Statistical analysis

The correlation of the AFECTS with the CIRENS scores and the MSFsc chronotype were analyzed using Pearson's correlation test. The analysis of the AFECTS' emotional dimensions and composite factors mean score for the CIRENS' qualitative chronotypes, as the analyses of the CIRENS' measurements mean scores and of the MSFsc chronotype mean score for the AFECTS' categorical affective temperaments were performed with multivariate analysis of variance with Bonferroni confidence interval adjustment, considering age and gender as covariates. The SPSS 18.0 software was used for all analyses, and statistical significance was considered if $p<0.05$.

RESULTS

Table 1 shows all the correlations of the CIRENS and MSFsc data with the AFECTS. Regarding the AFECTS emotional dimensions, Volition, Coping and Control had the most positive correlations with the morning, afternoon and total energy scores. In contrast, Sensitivity was the emotional dimension most negatively correlated with the CIRENS energy scores. Inhibition and Anger showed small negative correlations with these scores. The AFECTS emotional dimensions were statistically but weakly correlated with the chronotypes scores. Correlation levels for the CIRENS and the MSFsc chronotypes were similar, but slightly higher with the CIRENS scores, except for Inhibition. Control was the emotional dimension most correlated with the chronotypes: the lower the Control, the higher the evening over morning preference.

The AFECTS affective temperament scores also had the greatest correlation with the whole day energy score. The euthymic and hyperthymic temperament scores showed the largest positive correlations, whereas depressive and apathetic temperament scores had the greatest negative correlations with the CIRENS energy scores. The unstable cyclothymic and volatile temperaments showed a negative correlation with morning, afternoon and total energy scores, but not with the evening energy score. In general, the correlations of the affective temperaments with the chronotypes were statistically significant, but also small, and slightly stronger for the CIRENS than for the MSFsc scores. The volatile temperament, followed by disinhibited, cyclothymic, euphoric and apathetic, were the temperaments most positively

correlated with the chronotype scores (the higher these temperaments scores, the higher the evening over morning preference). In contrast, only euthymic and hyperthymic temperaments showed negative correlations with eveningness.

The bottom of Table 1 shows that the GEF index and the Adaptation score had overall positive correlations, whereas the Internalization and the Instability index had negative correlations with the CIRENS energy scores. The Externalization index was not correlated at all with the total energy score because it was negatively correlated with morning and positively correlated with evening scores. Regarding chronotypes, GEF and Instability indexes showed the most positive and negative correlations with chronotypes scores, respectively.

Evening type showed a distinct global emotional profile compared to morning types and neither types, and these two types showed a relatively similar emotional pattern (Figure 1). Control, energy (facet of Volition) and caution (facet of Inhibition) were the most distinctive results, being particularly low in evening type. Evening type was also associated with lower scores in both facets of Coping (facing and ability) compared to morning type. Interestingly, neither type showed a low facing, but not ability score. There was also a trend for high Anger and Sensitivity scores in evening-type subjects.

Among AFECTS composite indexes, evening-type subjects showed significant differences from other chronotypes, whereas morning-type and neither-type subjects had similar results. Evening types showed lower GEF index score (mean = 91.1; 95%CI: 88.0, 94.2; F = 25.2) compared to morning type (mean = 106.4; 95%CI: 102.6, 110.1) and neither type (mean = 102.7;

95%CI; 100.8, 104.5). Instability score was higher in evening types (mean = 11.9; 95%CI: 6.6, 7.2; F = 26.2) than in morning (mean = 10.3; 95%CI: 4.9, 5.7), and neither types (mean = 10.8; 95%CI: 5.6, 5.9). Evening types also had higher Externalization score (mean = 9.8; 95%CI: 9.6, 10.0; F = 20.5) than morning (mean = 8.9; 95%CI: 8.6, 9.1) and neither types (mean = 9.0; 95%CI: 8.9, 9.1). The Internalization index showed the smallest difference between chronotypes (F = 5.8): morning type (mean = 8.5; 95%CI: 8.2, 8.7), neither type (mean = 8.5; 95%CI: 8.3, 8.6), and evening type (mean = 8.9; 95%CI: 8.7, 9.1).

The mean energy score in the different shifts of the day for the AFECTS categorical affective temperaments are shown in Figure 2. Six of the twelve affective temperaments showed an increase in energy throughout the day: depressive, apathetic, cyclothymic, volatile, disinhibited, and euphoric. The other six categorical affective temperaments showed a more evenly distributed energy profile, with a trend for higher afternoon energy in five of them. Differences in energy scores between the affective temperaments were most noticeable in the afternoon (F=26.5) and morning (F=16.4) than in the evening (F=9.7). Apathetics, euphorics and volatiles showed the greatest change in energy throughout the day.

Affective temperament categories also showed differences in the CIRENS (Figure 3A) and MSFsc (Figure 3B) chronotype scores. For both chronotype measures, anxious, obsessive and euthymic temperaments had an earlier circadian rhythm, whereas apathetic, cyclothymic, volatile, disinhibited and euphoric temperaments showed stronger evening preference. Interestingly, depressive and dysphoric temperaments showed contrasting profiles in CIRENS and MSFsc chronotype score: related to the other affective

temperaments, depressives had a later chronotype in the CIRENS than in the MSFsc, whereas an inverse change occurred in dysphorics (Figure 3).

DISCUSSION

This study revealed associations between AFECTS emotional dimensions, affective temperaments and composite indexes mostly with the CIRENS energy endpoints, but also with the CIRENS and MSFsc chronotypes. These general results indicate that assessing circadian energy profile may be meaningful to investigate human temperament. The diurnal and the whole day energy seem to be most informative in these regard, since nocturnal energy was less correlated with the investigated emotional and affective characteristics.

High Volition, Coping, and Control emotional scores, were associated with the propensity for maintaining a stable and high level of energy throughout the day, suggesting that these are the essential emotional requirements for good daily functioning. Not surprisingly, a high GEF index, which is essentially based on high levels of these three emotional dimensions, was also related with greater daily energy. Future investigations could elucidate the utility of this index as an easily available parameter of general mental health and pathology.

Control was the emotional dimension more strongly correlated to both energy- and sleep-based chronotype scores. These results suggest that Control has a general function of setting the pace of activity. Thus, Control is capable of adjusting the level of activation and inhibition according to the environment and context, i.e. promoting sleep and energy recovery when environmental stimuli reduce at night in order to be more energetic throughout the day.

Both focus and order facets of the Control dimension were low in evening types. This is in line with previous findings of low self-control and poor target discrimination (assessed by the focus facet) among evening-type individuals (Digdon and Howell, 2008; Rybak et al., 2007). Also consistent with our results on control and circadian rhythm, high conscientiousness (which includes Control elements as self-discipline and organization) is a predictor of diurnal preference (Hogben et al., 2007). The TCI dimensions most positively correlated with Control and Volition are the Persistence and the Self-directedness (unpublished observations), which are low among evening types (Adan et al., 2010). This is in agreement with our findings of low Control and Volition for this chronotype.

Besides lower Control and Volition, evening types presented lower Coping and Inhibition than morning and neither types. Since high procrastination behavior is associated with low Coping in AFECTS, our finding corroborates a previous report of higher procrastination as a feature of students with an evening preference (Digdon and Howell, 2008). As impulsivity has also been previously associated to evening preference (Caci et al., 2005; Rybak et al., 2007) and is the reverse of the caution facet of the Inhibition dimension, this is agreement with our result of low caution in evening types. Moreover, a study on TCI shows high novelty seeking and low harm avoidance, both correlated with low Inhibition (unpublished observations), as features of those with an evening preference (Adan et al., 2010). Of note, the only AFECTS emotional facet that had significantly different results among the three circadian types was the energy facet of Volition. This was not surprising, since the CIRENS chronotype is based on energy.

The composite indexes of AFECTS provide a broader view of the temperament. Results on the AFECTS composite factors and circadian preference can be compared with previous findings of two models of personality. Similarly to the extraversion factor of the Eysenck's three factor model, the AFECTS externalization index was higher for evening types (Adan, 1992; Mecacci et al., 1986; Neubauer, 1992; Soehner et al., 2007). This could be in part explained by impulsivity, a common feature of both Eysenck's extraversion factor and AFECTS externalization index. Interestingly, the extraversion factor of the Big Five model of personality does not include impulsivity, and is not associated with circadian preference (Jackson & Gerard, 1996; Gray & Watson, 2002; DeYoung et al., 2007; Hogben et al., 2007; Randler, 2008; Tonetti et al., 2010). The neuroticism trait of personality has been overrepresented among the evening circadian type (Mecacci & Rocchetti, 1998; Mura & Levy, 1986; Neubauer, 1992; DeYoung et al., 2007; Randler, 2008; Tonetti et al., 2010). In the AFECTS, the tendency to experience negative emotional states and to respond more poorly to environmental stress are represented by the Internalizaton and Instability indexes, which were also higher in the evening than in the morning and neither chronotypes.

Energy discrepancies between the categorical affective temperaments were pronounced in the morning and in the afternoon, but not in the evening. Unstable affective temperaments had an increasing energy pattern from morning to evening, whereas the most stable temperaments presented an even energy distribution throughout the day. This suggests that investigating the daily energy profile can be useful to distinguish unstable from stable and self-controlled temperaments (Lara et al., submitted). Interestingly, in contrast to the

cyclothymic temperament, dysphorics showed steady energy in the different shifts of the day. As cyclothymics and dysphorics share the same emotional temperament configuration (Lara et al, submitted), dysphorics seem to express more stable mixed mood pattern, whereas cyclothymics' trend for mood and energy swings.

Scores of the most unstable affective temperaments (volatile and cyclothymic) were positively correlated with eveningness, and the most stable affective temperament (euthymic) was positively correlated with morning preference. This is in line with a previous report of morning types presenting a more regular lifestyle (Monk et al., 2004).

Considering the temperamental predisposition for mood disorders (Evans et al., 2005; Kesebir et al., 2005; Akiskal et al., 2005) and the expansion of the temperament role for most of the psychiatric pathologies (Lara and Akiskal, 2006; Lara et al., submitted), our results of late chronotypes for cyclothymic and euphoric temperaments, which are related to bipolar disorders, expand to the temperamental level the previously suggested circadian delay in bipolar disorder patients (Mansour et al., 2005; Ahn, et al., 2008; Wood et al., 2009; Giglio et al., 2010). We also observed late chronotypes for apathetic, volatile and disinhibited temperaments, which correspond to inattentive, combined and hyperactive types of ADHD, respectively (for further details see Lara et al, submitted). This is in accordance with eveningness reported in ADHD, especially the inattention subtype (Rybak et al., 2007; Caci et al., 2009). Again, this circadian preference seems to be present also at the temperament level.

This study has some limitations that should be considered. First, this is a cross-sectional investigation and thus cannot evaluate if there is a causality relation between circadian preference and temperament. Second, we added age and gender as covariates when using ANCOVA, but other potential confounding factors were not considered. This was a choice to avoid effect overlaps that could obscure the results. Finally, data were collected by the internet, selecting more females and a wealthier and more motivated population to respond to this survey.

In conclusion, our results corroborate previous findings on the association of different temperamental features with circadian preference. The Control dimension seems to be particularly associated with human adaptation to environment, since low Control was the main feature of evening chronotype, which has been largely associated with psychiatric pathologies such as mood disorders and ADHD. In this regard, our findings extend to the temperament level the circadian characteristics reported in patients with bipolar disorders and ADHD. Finally, daily energy was more correlated with temperaments than chronotypes. Low Volition, Coping, and Control, and high Sensitivity were associated with a low and unstable daily energy profile, which probably impairs functionality and general well-being. Thus, the combined evaluation of temperament and circadian preference may provide valuable insights for a more global evaluation of psychiatric patients.

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Table 1. Correlations of emotional dimensions, affective temperaments and composite scores of AFECTS with energy and chronotype scores of CIRENS, and chronotype score of MSFsc.

	Morning score	Afternoon score	Evening score	Total score	CIRENS chronotype	MSFsc chronotype
Volition	**.32****	**.35****	.16**	**.46****	-.12**	-.04*
Anger	-.11**	-.07**	.00	-.10**	.07**	.05**
Inhibition	-.02	-.09**	-.18**	-.16**	-.10**	-.11**
Sensitivity	-.22**	-.25**	-.13**	**-.34****	.06**	.01
Coping	.27**	.28**	.09**	**.36****	-.13**	-.07**
Control	.27**	.25**	.00	**.30****	-.18**	-.16**
Depressive	-.22**	-.26**	-.13**	**-.34****	.07**	-.02
Anxious	-.08**	-.13**	-.11**	-.18**	-.01	-.03
Apathetic	-.22**	-.24**	-.07**	**-.30****	.10**	.08**
Obsessive	.01	.04*	.00	.03	-.01	-.01
Cyclothymic	-.20**	-.20**	-.02	-.24**	.12**	.10**
Dysphoric	-.16**	-.15**	-.03	-.19**	.09**	.05**
Volatile	-.22**	-.21**	.03	-.22**	.16**	.13**
Euthymic	.25**	.25**	.05**	**.31****	-.14**	-.08**
Irritable	-.03	-.02	-.01	-.03	.01	.01
Disinhibited	-.11**	-.08**	.10**	-.05**	.13**	.12**
Hyperthymic	.23**	.27**	.14**	**.36****	-.07**	-.02
Euphoric	-.04*	.05**	.15**	.09**	.12**	.10**
GEF	**.33****	**.34****	.11**	**.44****	-.16**	-.09**
Internalization	-.23**	-.28**	-.14**	**-.37****	.07**	.01
Externalization	-.08**	-.03	.12**	.00	.12**	.11**
Instability	-.28**	-.27**	-.02	**-.32****	.17**	.12**
Adaptation	.19**	.22**	.10**	.29**	-.07**	-.03

** Correlation is significant at the 0.01 level. * Correlation is significant at the 0.05 level.
Values ≥0.40 and ≤-0.40 are in **bold**.

FIGURE LEGENDS

Figure 1. Emotional profile of the CIRENS categorical chronotypes. Facet scores of AFECTS emotional dimensions range from 4 to 28. Data are shown as mean ± 95% confidence interval. The sum of the two facet scores provides the emotional dimensions scores (from 8 to 56).

Figure 2. Energy profile of the categorical affective temperaments in the morning, afternoon and evening. Energy scores range from 1 to 5 and are shown as mean ± 95% confidence interval.

Figure 3. CIRENS chronotype score (A) and MSFsc chronotype score (B) of the categorical affective temperaments. Chronotype scores are shown as mean ± 95% confidence interval. CIRENS chronotype score ranges from -4 to 4, and MSFsc chronotype score is represented as time (hh:mm).

Figure 1

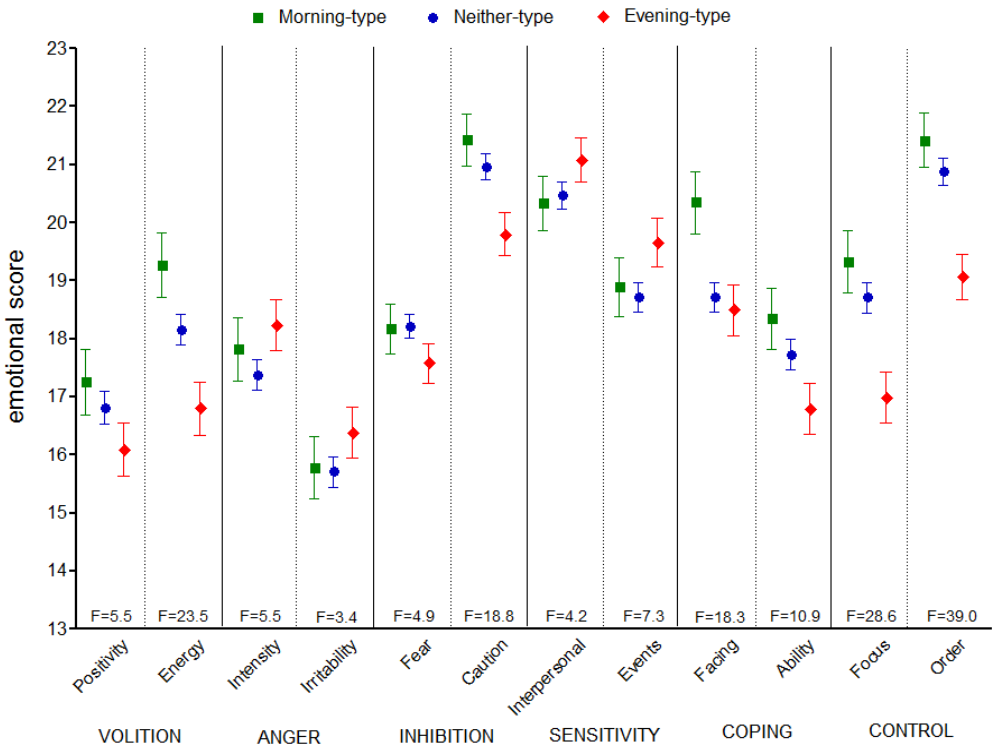


Figure 2

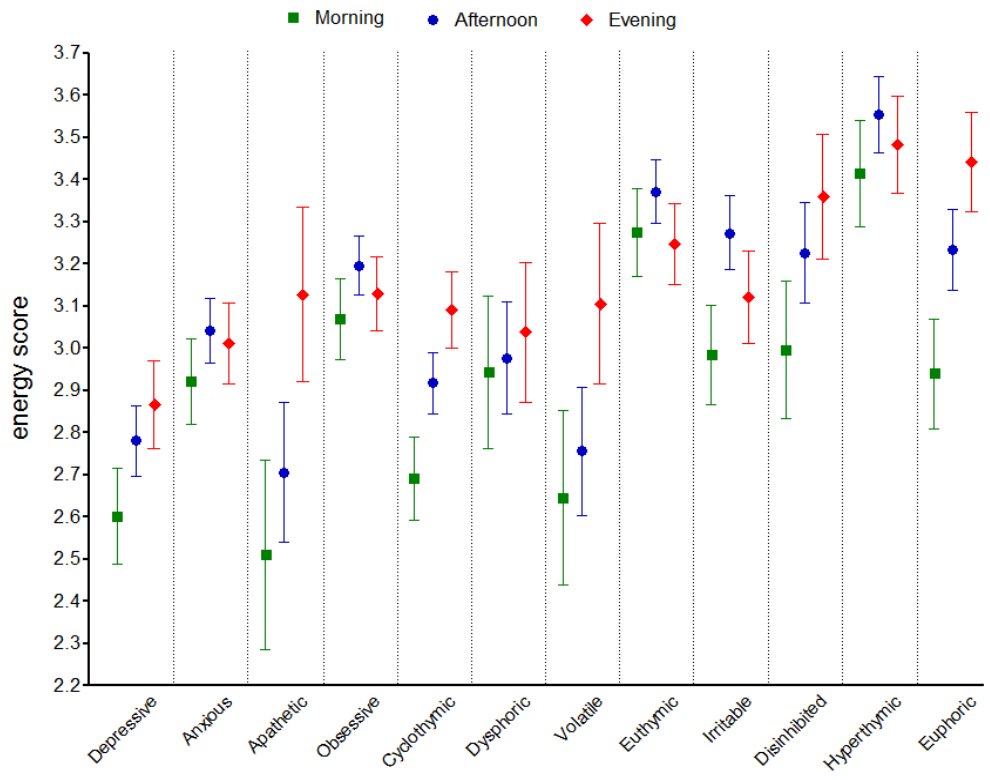
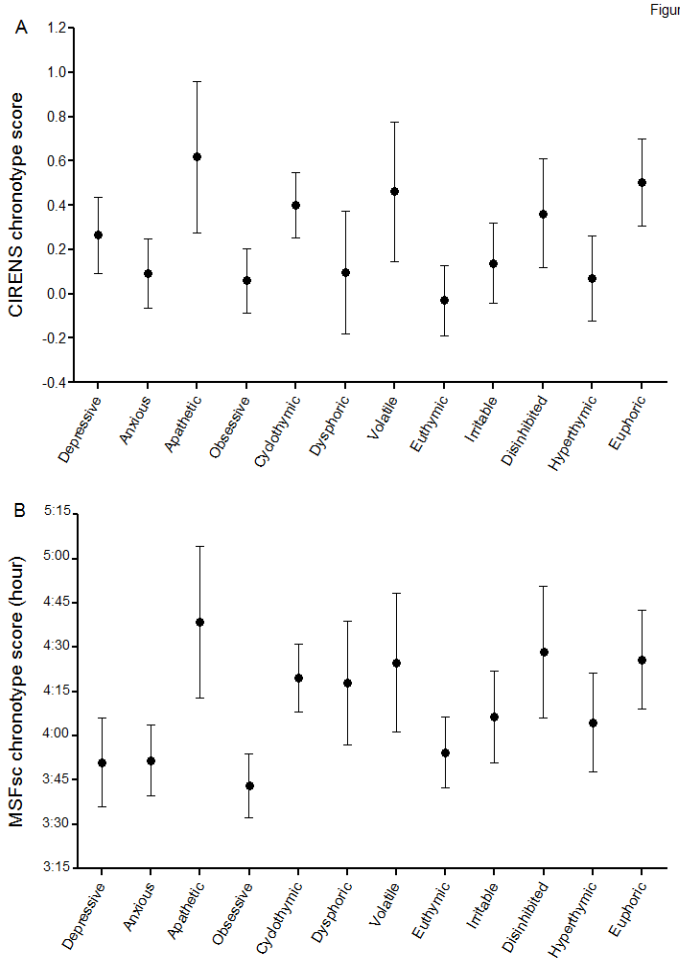


Figure 3


A
CIRENS chronotype score
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
Depressive
Anxious
Apathetic
Obsessive
Cyclothymic
Dysphoric
Volatile
Euthymic
Irritable
Disinhibited
Hyperthymic
Euphoric
B
MSFsc chronotype score (hour)
5:15
5:00
4:45
4:30
4:15
4:00
3:45
3:30
3:15
Depressive
Anxious
Apathetic
Obsessive
Cyclothymic
Dysphoric
Volatile
Euthymic
Irritable
Disinhibited
Hyperthymic
Euphoric

Capítulo VIII

Considerações Finais

Os sistemas classificatórios (CID e DSM) cumpriram um papel importante na sistematização diagnóstica em psiquiatria, visando uma melhor comunicação entre os diversos profissionais de saúde mental em diferentes continentes. Com isso, a psiquiatria atingiu um satisfatório nível de confiabilidade para comunicação interna. Porém, é necessária a ampliação desse poder de comunicação com áreas afins, como a psicologia e as neurociências. Se por um lado a psiquiatria e a psicologia ainda usam termos diferentes para descrever um mesmo fenômeno mental, de outro, apesar dos recentes avanços tecnológicos em neurociência, o estudo dos transtornos mentais por meio destas técnicas tem acrescido muito pouco à prática psiquiátrica. Sem negar a utilidade da categorização dos transtornos psiquiátricos, há a necessidade de uma melhor integração entre aspectos qualitativos e quantitativos do funcionamento cerebral.

Baseados nas crescentes evidências de que o temperamento e traços de personalidade determinam a fenomenologia dos distúrbios mentais, propomos o Modelo de Temperamento Afetivo e Emocional (AFECT), que sugere um papel central do temperamento no funcionamento mental sadio e patológico. Integrando conhecimentos da psiquiatria, psicologia, neurociências e psicofarmacologia, o modelo AFECT parte da premissa de que um sistema emocional básico, através da interação dinâmica entre as dimensões que o compõem e o ambiente externo, determinaria o temperamento afetivo de cada pessoa. Disfunções desse sistema emocional e afetivo, tanto induzidas por fatores endógenos quanto exógenos, levariam à manifestação dos transtornos psiquiátricos em alguns indivíduos.

Para testar este novo modelo de temperamento, desenvolvemos e validamos a AFECTS (nova versão da CEATS). Tanto a CEATS quanto a AFECTS apresentaram boa qualidade psicométrica, haja vista seu elevado índice de consistência interna e os perfis emocionais esperados para cada temperamento afetivo. Conforme as classificações atuais, os diagnósticos psiquiátricos têm como fator fundamental o nível de prejuízos que os sintomas determinam na vida da pessoa. Seguindo o raciocínio de predisposição temperamental para a manifestação de transtorno psiquiátrico, os eutímicos e hipertímicos foram os menos associados a problemas decorrentes do temperamento e com um melhor escore de adaptação ao ambiente. Isso sugere que estes sejam os temperamentos menos predispostos ao desenvolvimento de distúrbio mental, ou seja, além de patologias, o modelo AFECT também considera o funcionamento psíquico sadio.

Existem várias evidências de que alterações do sono e do ritmo circadiano estão associadas aos transtornos psiquiátricos, assim como a traços de personalidade e temperamento de diferentes modelos psicológicos consolidados. No entanto, pela inexistência de uma unidade de linguagem entre essas áreas tão próximas, existem dificuldades na integração desses conhecimentos e na compreensão mais ampla dos benefícios que essas informações podem gerar.

A medida de preferência circadiana a partir da energia individual subjetiva ao longo do dia demonstrou ser um método confiável e simples. Ao invés de substituir as formas de mensuração de cronotipo baseadas em outras características circadianas, propomos que a CIRENS seja utilizada como uma ferramenta adicional a estas. Os dados que fornece a respeito do nível de

energia nos diferentes períodos do dia podem ser tanto ou até mais informativos que a determinação do cronotipo, como ocorreu em relação ao temperamento.

Nossos resultados em relação à associação do modelo de Temperamento Afetivo e Emocional com parâmetros de sono e ritmo circadiano possibilitam entender, de uma maneira integrada, a relação dessas características circadianas com o funcionamento mental em vários níveis, desde o sistema emocional básico, passando pelo temperamento afetivo, até as manifestações patológicas de humor, cognição e comportamento. Esses resultados são um indício inicial de que o nosso modelo de temperamento possa servir à proposta de integração entre fenômenos psicológicos básicos, síndromes psiquiátricas e processos biológicos.

Concluindo, o modelo AFECT oferece um referencial teórico comum que se aplica à psiquiatria, psicologia e neurociências, visando facilitar a comunicação e a interação entre essas áreas. Futuros estudos clínicos, genéticos e bioquímicos são necessários para testar o modelo. Devido a sua simplicidade, é possível sua adoção na prática diária psiquiátrica, psicológica e de pesquisa em neurociência das emoções, cognições e comportamento.

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ANEXO 1

COMBINED EMOTIONAL AND AFFECTIVE TEMPERAMENT SCALE (CEATS)

INSTRUCTIONS:
1) For each of the questions below, please mark the alternative that best matches the way <u>you usually are and behave</u>.
2) Read all the alternatives for each question before marking the one that most closely represents your profile. Answer all the questions and tick only one alternative.
3) Please answer carefully, but do not take too long to answer the questions.
4) Remember that there are no right or wrong answers. You must answer according to how you are, not how you wish you were.

1.
A) I am fearful
B) I am slightly more fearful than most people
C) I am slightly more daring than fearful
D) I am daring
E) I am very daring

2.
A) I am very shy
B) I am shier than most people
C) I am slightly more outgoing than shy
D) I am outgoing
E) I am very outgoing

3.
A) I am very careful and cautious; I rarely take risks
B) I am careful and cautious, I take few risks
C) In some situations I am careful and cautious, but in others I take risks
D) In general, I take more risks than most people
E) I am not careful and cautious; I often take risks

4.
A) I have great difficulty to feel at ease; I am very inhibited
B) I am inhibited, I have difficulty to feel at ease
C) Sometimes I feel a little awkward, but in general I feel at ease
D) I am spontaneous easygoing
E) I am very spontaneous, sometimes even too much

5.
A) I think too much before I do things; I take longer than others to make decisions
B) I think a lot before I do things; I rarely make decisions impulsively
C) I think before I do things, but I don't take long to make decisions
D) Sometimes I do things without having thought enough; I make decisions quickly
E) I often do things without thinking, I make decisions impulsively

6.
A) I worry too much
B) I worry more than most people
C) I worry as much as most people
D) I worry less than other people
E) I practically don't worry

7. In dangerous situations, my natural reaction is:
A) to freeze and remain tense even after the danger passes
B) to freeze until the danger is gone
C) to freeze at the beginning, but I soon manage to loosen up and act
D) to have some kind of quick reaction, I usually do not freeze
E) to react quickly, I never freeze

8.
A) I am pessimistic
B) I am more pessimistic than optimistic
C) I am a little more optimistic than pessimistic
D) I am optimistic
E) I am very optimistic

9.
A) I rarely get excited and lively about new activities
B) Sometimes I get excited and lively about new activities
C) It is fairly common for me to get excited and lively with new activities
D) It is common for me to get excited and lively with new activities
E) It is very common for me to get very excited and very lively with new activities

10.
A) I feel little pleasure and joy
B) I feel less pleasure and joy than most people
C) I feel as much pleasure and joy as most people do
D) I feel more pleasure and joy than most people
E) I feel pleasure and joy intensely

11.
A) I often get sad and miserable
B) I often get a little sad and miserable
C) I am fairly happy and content
D) I am happy and cheerful
E) I am very happy and very cheerful

12.
A) My plans are modest, and I think small
B) My plans are more modest than those of others
C) I have some ambitious plans
D) My plans are usually ambitious
E) My plans are very ambitious, I think big

13.
A) Any problem I have is enough to discourage me and to make me give up
B) I often get discouraged and give up when I face difficulties
C) I feel a bit discouraged when the situation is difficult or complicated
D) It is quite rare for me to feel discouraged and give up on things
E) I rarely feel discouraged and I almost never give up

14.
A) I am very insecure
B) I am less confident than most people
C) I feel reasonably confident
D) I am more confident than others
E) I am very self-confident

15.
A) I have few goals and it is hard for me to go after them
B) I have some goals and go after some of them
C) I have some goals and go after most of them
D) I have many goals and go after them
E) I have many goals, including difficult ones, and I go after all of them with vigor

16.
A) I have little discipline
B) I have less discipline than most people
C) I am reasonably disciplined
D) I have more discipline than most people
E) I have a lot of discipline

17.
A) I am disorganized and it sometimes brings me problems
B) I am less organized than most people
C) I organized in some things
D) I am more organized than most people
E) I am very organized, sometimes too much

18.
A) I easily get distracted and it often brings me problems
B) I often get distracted and sometimes it brings me problems
C) Sometimes I get distracted but it is not enough to disturb me
D) I get distracted less often than most people
E) I hardly get distracted

19.
A) I often fail to conclude that the tasks I start
B) I have some difficulty in completing the tasks I start
C) I conclude many of the tasks I start, but I usually give up the hard ones
D) I often complete the tasks I start, including some hard ones
E) I always conclude the tasks I start, even long or difficult ones

20.
A) It is difficult for me to keep my concentration and interest
B) I can only keep my concentration if I am interested
C) I can keep my concentration if I am fairly interested
D) I can keep my concentration even if I am not interested
E) I can keep my concentration *well* even I am not interested

21.
A) I am fairly irresponsible
B) I am less responsible than most people
C) I am reasonably responsible
D) I am more responsible than most people
E) I am very responsible

22.
A) It is rare for me to get irritated with something
B) I usually don`t get irritated
C) Sometimes I get irritated, but it rarely brings me problems
D) I get irritated more often than most people
E) I often get very irritated, and it often brings me problems

23.
A) I am not at all aggressive and sometimes it is a problem for me
B) I am not aggressive
C) I am a little less aggressive than most people
D) I am a little more aggressive than most people
E) I am quite aggressive in various situations

24. When I get angry, my anger lasts:
A) for a short time and I rarely get angry
B) shortly, I quickly calm down
C) slightly less than other people
D) longer than other people
E) a long time (‘it ruins my day’)

25.
A) I am not explosive at all
B) I am less explosive than others
C) Sometimes I am explosive
D) I am more explosive than others
E) I am very explosive

26. I …… feel I am being betrayed or someone is planning to do something against me:
A) Never
B) Almost never
C) Hardly ever
D) Sometimes
E) Often

27.
A) I am very patient
B) I am patient
C) I am a little impatient
D) I am impatient
E) I am very impatient

28. For each description below check the alternative that best corresponds to you (check only one alternative).
A) I have a tendency towards melancholy and sadness, I see little fun and joy in things; I tend to put myself down; I don't like changes; I prefer to listen than to talk.
a) nothing to do with me
b) little to do with me
c) some things to do with me
d) a lot to do with me
e) everything to do with me

B) I am very cautious and careful; I often feel insecure and apprehensive; I keep imagining that bad things are about to happen, I try to avoid high-risk situations; I am always alert and vigilant.
a) nothing to do with me
b) little to do with me
c) some things to do with me
d) a lot to do with me
e) everything to do with me

C) My mood is unpredictable and unstable (ups and downs or mood swings); my mood changes very quickly or out of proportion to the facts; I have periods of great energy, enthusiasm and energy that alternate with other phases of sluggishness, loss of interest and discouragement.
a) nothing to do with me
b) little to do with me
c) some things to do with me
d) a lot to do with me
e) everything to do with me

D) I have a strong tendency to feel agitated, anxious and angry at the same time.
a) nothing to do with me
b) little to do with me
c) some things to do with me
d) a lot to do with me
e) everything to do with me

E) I have little initiative; I often drift away from what others are saying or doing; I often fail to finish what I have started; I tend to be passive and a bit slow.
a) nothing to do with me
b) little to do with me
c) some things to do with me
d) a lot to do with me
e) everything to do with me

F) My mood is balanced and predictable, I usually have mood changes only when there is a clear reason, I have good spirits and, in general, I feel good about myself.
a) nothing to do with me
b) little to do with me
c) some things to do with me
d) a lot to do with me
e) everything to do with me

G) I am very frank, direct and determined, but also angry, suspicious and explosive.
a) nothing to do with me
b) little to do with me
c) some things to do with me
d) a lot to do with me
e) everything to do with me

H) I am restless and easily distracted; often I switch off or drift away from what others are saying or doing, I often do things without thinking about the consequences, and sometimes I am inconvenient and only realize it when it is too late; I quickly loose interest, and I often fail to finish what I have started; when I loose my temper, I soon calm down.
a) nothing to do with me
b) little to do with me
c) some things to do with me
d) a lot to do with me
e) everything to do with me

I) I am restless, active, spontaneous and distracted; I often rush and do careless things; I often leave things for the last minute; when I loose my temper, I soon get well again.
a) nothing to do with me
b) little to do with me
c) some things to do with me
d) a lot to do with me
e) everything to do with me

J) I am always in good spirits, I feel very confident and I have fun easily; I love novelty and I am always ready for new activities; I do many things without getting tired; when I want something, I go after and get it; I have a strong tendency for leadership.
a) nothing to do with me
b) little to do with me
c) some things to do with me
d) a lot to do with me
e) everything to do with me

29. Choose the description (from A to J) from the question 28 above that is closest to your profile (only ONE alternative). Please read all the 10 descriptions before choosing the alternative.

[ ] A)
[ ] B)
[ ] C)
[ ] D)
[ ] E)
[ ] F)
[ ] G)
[ ] H)
[ ] I)
[ ] J)

30. To what extent have you had problems or personal losses due to your usual mood and the way you are and behave?

A) no problem / no losses
B) few problems / small losses
C) some problems / moderate losses
D) marked problems/ serious losses

31. To what extent have you gained benefits and had personal advantages due to your usual mood and the way you are and behave?

A) almost no advantage / minimal benefits
B) few advantages / small benefits
C) some advantages / moderate benefits
D) many advantages / marked benefits