

BRAIN EMOTIONAL SYSTEMS: THE ITALIAN VERSION OF THE ANPS-AFFECTIVE
NEUROSCIENCE PERSONALITY SCALES 2.4 (RELIABILITY AND VALIDITY)

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Abstract

Objective: The *Affective Neuroscience Personality Scales* (ANPS) 2.4 is a self-report questionnaire, based on neurobiological considerations relating to the activity in 6 core emotional systems (FEAR, ANGER, SADNESS, CARE, PLAY, SEEKING). These subcortical brain emotional systems are foundations of personality development in both humans and animals, having a great deal of individual variability related to them.

Method: We investigated the psychometric properties of ANPS 2.4 among 843 Adolescents and Adults of both non-clinical and clinical nature.

Results: Internal consistency was satisfactory and the factor structures were similar to the original version of ANPS. 703 participants out of the larger sample also completed the Big-Five Inventory (BFI: John et al. 1991, Italian version: Fossati et al. 2011) in order to study the external validity of ANPS. The inter-correlations between Italian version of ANPS and the BFI are largely congruent with the original ANPS findings. ANPS was applied to an extended age range that includes not only adulthood but also adolescence which could increase the heuristic value of the test.

Conclusions: ANPS scores and correlations were discussed in order to find out if they could be interpreted for the characterization of emotional endophenotypes involved in the personality and individual differences, including psychiatric disorders.

Key words: adolescence, affective neuroscience, affective neuroscience personality scales, comparative psychology, emotional systems, personality

Declaration of interest: none

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Introduction

The brain emotional systems are a privileged area for comparative psychology due to the homology of neuroanatomy, neurochemistry, behaviors and feelings among vertebrate and human species (Panksepp 1998, Panksepp and Biven 2012). The *neuro-evolutionary psychobiological* point of view has allowed us to understand the functional characteristics of motivational/emotional systems in the human phylogenesis (Darwin 1872, McLean 1990, Cory and Gardner 2002) and it can contribute significantly to the understanding and treatment of mental disease. Jaak Panksepp named this field of research affective neuroscience and he has made a central contribution to track down seven primary emotional systems, all originating in subcortical regions and all present in all mammals, through *electrical stimulation of the brain* (ESB). These emotional systems are: SEEKING, ANGER/RAGE, FEAR, LUST, maternal CARE, separation-distress

PANIC/SADNESS, and physical PLAY. Primary emotional systems are printed in capital letters intended to distinguish them from the vernacular emotional terms. All these emotional systems are characterized by specific subcortical brain networks (Panksepp 1998) and neurochemical activation (neurotransmitters, neuropeptides and hormones) both in animal and human species (Panksepp and Biven 2012). They are likely the neurobiological and subcortical roots of individual differences in human temperament and personality, and they are measured by the *Affective Neuroscience Personality Scales* (ANPS) (Davis et al. 2003, Davis and Panksepp 2011). The ANPS is a test of personality that was modeled on the Spielberger State-Trait Personality Inventory (STPI: Spielberger 1975). ANPS is a self-assessment instrument intended to measure individual personality differences as strengths and weaknesses in the foundational primary emotions. In ANPS (Davis et al. 2003) the SEEKING scale was defined as anticipating new positive experiences including being

curious, liking to strive for solutions to problems, and generally liking to explore. The ANGER scale included feeling hotheaded, being easily irritated and frustrated, and expressing anger verbally or physically. The FEAR scale incorporated experiencing anxiety, worrying, difficulty making decisions, ruminating, feeling tense, and losing sleep. The CARE scale centered on nurturing tendencies including liking to care for others, being drawn to young children and pets, and feeling softhearted towards animals and people in need. The PANIC/SADNESS scale was conceptualized as feeling social separation distress, feeling lonely, and thinking about loved ones and past relationships including crying. The PLAY scale focused on playing social games with physical contact plus laughter, humor, and generally having fun. There isn't a LUST scale in ANPS, because the authors believed that people would be less frank about this emotion. A construct called Spirituality is a scale added to the other six ANPS scales. It is believed to be clinically important in the treatment of alcoholism (Davis et al. 2003). Spirituality focuses largely on transcendent values, it is defined as "feeling connected to humanity and creation as a whole, feeling a sense of oneness with creation, striving for inner peace and harmony, searching for meaning in life" (cf. Davis et al. 2003).

The original ANPS validation study (Davis et al. 2003) was carried out on two samples: university students and adult job applicants. The exploratory factor analysis for ANPS (excluding the Spirituality subscale) revealed two higher order factors; with FEAR, SADNESS, ANGER loading on the first factor which represented overall "negative affect" and with PLAY, CARE, SEEKING loading on the second factor which represented global "positive affect". Davis et al. (2003) did not conduct a Confirmatory Factorial Analysis (CFA) to determine the goodness-of-fit of the two-factor model. The first CFA conducted on the scales was for the French validation (Pahlavan et al. 2008).

The new version of ANPS 2.4 (Davis and Panksepp 2011) differs from that of 2003 (Davis et al. 2003) for 33 items, and it is 2 items longer than the original. In ANPS 2.4 there are some filler items: 7 were designed as "Dominance", 6 were designed as "Social desirability" or "unlikely virtue" items, which can cautiously be used as an indication of deception, and 3 were written to measure "Social Anxiety". Social dominance is related to the behaviors and the feelings associated with social rank. Panksepp speculated that Dominance may represent the convergence of the two older primary emotional systems, ANGER and SEEKING (Panksepp and Biven 2012). A recent study (van der Westhuizen and Solms 2015) has suggested that while Dominance can be thought of as a personality variable related to distinct hormone patterns, stopped short of conceptualizing Dominance as a primary emotional system.

Two instruments: ANPS and TCI

ANPS is therefore a unique personality test based on neurobiological observation of behaviors activated by *electrical stimulation of the brain* (ESB) of specific subcortical neurological with focally functional neurotransmitters. There is another personality test, the Temperament and Character Inventory (TCI) (Cloninger et al. 1993), that is "a biogenic amine-based "biosocial" theory of personality" (Davis and Panksepp 2011). Cloninger stated that personality is combination of Temperament and Character. Temperament is hereditary viewed in four dimensions that are connected

to specific neurotransmitters. These four dimensions are listed as: 1) novelty seeking, characterized by the search for new stimulation. This dimension is related to the dopaminergic system. 2) harm avoidance characterized by the preoccupation of the consequences of one's actions. This dimension is related to serotonin system. 3) reward dependence reflects sensitivity to reward contingencies. This dimension is related to norepinephrine system. 4) persistence to reach an object despite any obstacle. The neurotransmitters are glutamate and serotonin. The TCI aims at describing the individual differences in innate temperament that are based on neurotransmitter systems, which are however, present in many various areas of the brain and so they function too broadly to be isolated as specific contributors. The Character dimensions -- Self-Directedness, Cooperativeness, and Self-Transcendence -- were hypothesized as more environmentally than genetically derived. The Character traits of TCI were thought to be acquired as a function of developmental experiences and can be conceptualized as "higher-order, tertiary-process type BrainMind functions" (Davis and Panksepp 2011).

So ANPS and TCI have different objective and different ways of considering the neurological bases of human behaviours. ANPS is a personality test based on neurobiological and subcortical emotional and motivational systems derived in large part from animal models, whereas TCI is derived from studies of human behaviours and clinical observations that are proposed to rely on broadly functioning amine neurotransmitters. "The ANPS and TCI differ both in proposed ontology and etiology" (Barrett 2013).

ANPS in the world and in Italy

The ANPS has been translated in many languages and proved to be reliable and valid in different cultural and linguistic contexts, e.g. Spanish version: Abella V., Panksepp J., Manga D., Barcena C., & Iglesias J. A. (2011); French version: Pahlavan F., Mouchiroud C., Zenasni F., Panksepp J. (2008), Pingault J.B., Pouga L., Grezes J., Berthoz S (2011); Turkish version: Özkarar-Gradwohl F G, Panksepp J, İcoz FJ, Cetinkaya H, Koskal F, Davis KL, Scherler N (2014); Italian version Pascasio et al. 2015.

The main first purpose of the present work was to provide a validation of the Italian translation of the new ANPS 2.4 that is different from the previous Italian ANPS 110 items version (Davis et al. 2003, Pascasio et al. 2015), by analyzing the psychometric properties of the scales, their factorial structure and their construct validity in Adolescents and Adults non-clinical and clinical samples. To provide evidence of construct validity of the ANPS scales, it was correlated with FFM (Five Factor Model, Davis et al. 2003, Davis and Panksepp 2011), the so-called "Big Five" personality dimensions (Goldberg 1990), for an age range of 14 to 78 years (see below), in the non-clinical as well as in the smaller clinical group. In addition, the Dominance and Social Anxiety sub-scale scores allowed us to study human competition. The motivational system of Dominance is also called inter-male aggression (see Darwin 1871), and Social Anxiety is a construct which highlights the FEAR system in a interpersonal dimension. We expected, in our study that "Social Anxiety" is positively correlated with FEAR in both non-clinical and clinical groups. Both "Social Anxiety" and therefore FEAR, are the complementary emotions of the Dominance motivational system in social competition (Gilbert et al. 2009, Giacolini et al.

2013). Our second aim was to investigate the gender and the age differences on both non-clinical and clinical groups, and analyze general group differences. In previous validations of ANPS (Pascasio et al. 2015, Özkarak-Gradwohl et al. 2014) it was noticed that as age increased, the intensities of scores of emotions scales decreased, which may imply a stronger affect regulation as one matures.

There were gender differences in the ANPS scales, with females adults scoring higher than males adults on CARE (F. G. Özkarak-Gradwohl et al. 2014), on CARE and SADNESS (Davis et al. 2003, Pahlavan et al. 2008); and on CARE, SADNESS, FEAR (Abella et al. 2011, Pascasio et al. 2015, Pingault et al. 2012); with males scoring higher on the SEEK factor (Davis et al. 2003), and on PLAY scale (Pahlavan et al. 2008). In the original study, women also scored higher on Spirituality, whereas in the French version they scored higher on FEAR scale. Spanish females showing higher scores than males on SEEK, and French females showing lower scores than males on PLAY (Abella et al. 2011, Pahlavan et al. 2008). These scores could reflect a genetically hard wired evolutionary trait in females not only towards caring for their offspring, but, it could also mean that women are more prone to FEAR and SADNESS than men due to the Dominance motivational system. In the present study, with a large sample and with an equilibrated sex ratio, we expected to replicate significant differences on all aforementioned scales, specifically for the two scales showing consistent results across studies (CARING and SADNESS).

The ANPS was utilized in a clinical study (Pedersen et al. 2014) that replicated earlier psychometric studies on ANPS in a sample of (546) personality disordered patients. The clinical sample was constituted by a majority of female patients (77%). Our present work is the first ANPS comparative study (to the best of our knowledge) between Adolescents and Adults non-clinical and clinical samples.

We also expected to replicate the intercorrelations patterns reported in previous studies, in particular the positive correlations between the three positive scores (PLAY, SEEK, CARE) and linking the three negative scores (FEAR, ANGER, SADNESS). Furthermore,

all studies found a positive correlation linking CARE, FEAR and SADNESS scores.

Method

Participants

The participants were Adolescents and Adults of both non-clinical and clinical nature.

Nine-hundred and thirteen questionnaires were returned, of which 15 had not answered all the ANPS items (with 10% or more missing values) and, in addition, a total of 55 univariate outliers were detected and removed from the dataset by using standard z-score (Tabachnick and Fidell 2007), leading to a final sample of 843 Adolescents ($n = 425$) and Adults ($n = 418$) (59% women; mean age of the women = 27.99, $SD = 14.59$; mean age of the men = 29.62 years, $SD = 15.51$).

The non-clinical group consisted of 625 participants, 219 males (mean age = 29.16; $SD = 16.39$) and 406 females (mean age = 28.67; $SD = 14.73$). Participants 14-19 of the non-clinical sample ($n = 326$) were recruited randomly from students of different high schools in Rome, that voluntarily participated in this study. They completed the ANPS and BFI in the classrooms. The non-clinical population 20-78 ($n = 299$) was made up of adult volunteers. The clinical group was a convenience sample of 218 psychiatric patients, 128 males and 90 females. The mean age was 30.41 years ($SD = 13.90$) and 24.96 years ($SD = 13.62$), respectively for males and females. The clinical adolescent population ($n = 99$) was recruited from inpatients and outpatients of *Specialist Public Child/Adolescent Neurology and Psychiatry Services*. The clinical adult population ($n = 119$) made up of volunteers from *Specialist Public Addiction and Mental Health Services*.

Clinical diagnoses were assigned by several staff psychiatrists, confirmed by clinical interviews and the subjects were diagnosed especially for personality disorders. The diagnoses of the clinical group are showed in **table 1**.

703 participants ($n = 523$ non-clinical group, age 14-19 $n = 261$ and age 20-78 $n = 262$; $n = 180$ clinical group, age 14-19 $n = 76$ and age 20-78 $n = 104$) out of the larger sample also completed the Big-Five

Table 1. Diagnoses of the clinical group

	<i>F</i>	%
DSM 5		
Personality Disorders		
Cluster A Personality Disorders	7	3,21
Cluster B Personality Disorders	24	11,01
Cluster C Personality Disorders	15	6,88
Unspecified Personality Disorders	5	2,29
Substance-Related and Addictive Disorders	74	33,94
Depressive Disorders	12	5,50
Bipolar and Related Disorders	6	2,75
Trauma and Stressor Related Disorders	7	3,21
Anxiety Disorders	40	18,35
Schizophrenia Spectrum and Other Psychotic Disorders	7	3,31
Feeding and Eating Disorders	5	2,29
Other Disorders	16	7,34

Inventory (BFI) for the construct validation of ANPS dimensions. This subsets of subjects were very similar to the larger sample.

Measure

Italian version of the Affective Neuroscience Personality Scales

The ANPS was translated from English into Italian by one of the authors (T. G.) and independently translated back to English by an English mother tongue professional translator.

The Affective Neuroscience Personality Scales (ANPS; Davis et al. 2003, Davis and Panksepp 2011) ANPS 2.4 (Davis and Panksepp 2011) is a 112 items self-report questionnaire. The items are rated on a four-point scale from 0 (strongly disagree) to 3 (strongly agree) to measure six basic affects and Spirituality (e.g. "Spiritual inspiration helps me transcend my limitations"); three sub-scales assess SEEK (e.g. "I really enjoy looking forward to new experiences"), PLAY (e.g. "I am known as one who keeps work fun") and CARE (e.g. "I often feel a strong need to take care of others") as positive emotions, while other three sub-scales assess FEAR (e.g. "I often worry about the future"), ANGER (e.g. "When I am frustrated, I usually get angry") and SADNESS (e.g. "I often feel sad") as negative emotions.

The Spirituality scale focused on feelings of connectedness with all of life and oneness with creation (Davis and Panksepp 2011).

The basic positive emotions conjointly constitute a measure of General Positive Affect and the basic negativistic emotions conjointly constitute a measure of General Negative Affect (Davis et al. 2003).

The first study of ANPS showed reliabilities by Cronbach's alpha with a ranging from .65 to .86 with the PLAY and SEEK scales below .70 and the FEAR, ANGER, and Spirituality scales above .80 (Davis et al. 2003).

In ANPS 2.4 each scale consists of 14 items formulated, except for the Spirituality scale which has 12.

For each emotional state, half of the items assess it directly and the other half inversely, in an alternating sequence.

Sixteen additional filler items are included with the intention of controlling for validity and to respond to questions of interest for the authors.

We calculated scale scores by computing the sum of each participant's responses to all items on the scale (according to the final factorial structure; see Davis et al. 2003, Davis and Panksepp 2011).

The Big Five Inventory

The Big Five Inventory (BFI; John et al. 1991, Italian version – Fossati et al. 2011) is a 44-item assessment of five primary personality traits – Openness, Extraversion, Agreeableness, Conscientiousness, and Neuroticism. The scale asks respondents the extent to which they agree that a particular characteristic applies to them, that is, "I see myself as someone who is...". Examples include "Is curious about a number of things" (Openness), "Is outgoing, sociable" (Extraversion), "Likes to cooperate with others" (Agreeableness), "Does a thorough job" (Conscientiousness), and "Worries a lot" (Neuroticism). The participants respond on a 5-point Likert-type scale (1 = strongly disagree, 5 = strongly agree). Approximately half the items were reverse coded.

Reliability for this study was good: $\alpha = 0.77$ (Openness), $\alpha = 0.84$ (Extraversion), $\alpha = 0.71$ (Agreeableness), $\alpha = 0.83$ (Conscientiousness), and $\alpha = 0.88$ (Neuroticism).

Data analysis

The items of the each ANPS scales were preliminarily submitted to analyses, using IBM SPSS Statistics for Windows, Version 19.0 (2010), to check the normal distribution by calculating mean, standard deviation, and indices of skewness and kurtosis. Inspection of skewness and kurtosis indices indicated that departures from normality were not severe, so no variable transformations were deemed necessary.

Descriptive statistics and general distributional properties of the each ANPS scales were also assessed, for the sample as a group and were run by sex and age (Adolescents vs. Adults) as well in both non-clinical and clinical sample.

From the non-clinical group, a split-sample technique was used for data analysis. The non-clinical sample was randomly divided into two samples of similar size. Random sample I ($N = 302$) was used to conduct exploratory factor analysis (EFA) and data from the second split sample ($N = 323$) were used to conduct confirmatory factor analysis (CFA). In this strategy, the first sample is used to develop a good-fitting solution, and the final model is then fitted in the second sample to determine its replicability with independent data.

The investigation of the factorial structure of the ANPS (EFA; excluding the Spirituality sub-scale) was performed through a Principal Axis Factoring (PAF), a method based on the variables' communality, with Varimax rotation. In PAF, the six basic affective systems were considered as variables (second order factor analysis), in a similar way to the original validation study of the questionnaire devised by Davis et al. (2003). This process was applied to the non-clinical (Random sample I) and the clinical samples.

Using Random sample II (non-clinical sample), Confirmatory factor analysis (CFA) was conducted with EQS 6.0, allowing for correlation among error terms. To evaluate the CFA models, goodness of fit were estimated by χ^2 , Root Mean Square Error of Approximation (RMSEA) (Steiger 1990), the Comparative Fit Index (CFI) (Bentler 1990), standardized Root Mean Square Residual (SRMR) (Hu and Bentler 1998) and the Non-Normed Fit Index (NNFI) (Bentler & Bonnet 1980).

A maximum likelihood (ML) method of estimation was applied to test the hypothesized model.

Internal consistency was estimated by Cronbach's alpha (Cronbach 1951) and mean total correlations corrected item; group (clinical vs. non-clinical), age (clinical vs. non-clinical adolescents/adults) and gender (clinical vs. non-clinical males/females) differences were analyzed by Independent Samples *t*-test (two-sided) and effect sizes of this differences were estimated by Cohen's *d*.

For the Italian BFI scale, used in the present study, non-clinical and clinical sample were compared. Linear relationships between variables were estimated by Pearson's *r* coefficients. This was followed by application of the Fisher *r*-to-*z* transformation (Cohen and Cohen 1983) to examine one-tailed differences in the magnitude of the correlation coefficients between the non-clinical and clinical populations.

Finally, we used the Feldt's test (see Feldt 1969, Feldt et al. 1987) for testing the similarity of Cronbach's

alpha from each sample (non-clinical and clinical) and compared to the Cronbach's alpha from Italian work (Pascasio et al. 2015) and original study (Davis et al. 2003).

Results

Factorial structure of the ANPS

The correlation matrix of ANPS scales of the Random sample I was subjected to an exploratory factor analysis (EFA).

To determine the appropriateness of factor analysis, we examined the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and the Bartlett's test of sphericity. According to Tabachnick and Fidell (2007), KMO should be > 0.5 , and the chi-square value of Bartlett's test should be significant. Both indices confirmed the adequacy of the sample: $KMO = 0.59$; χ^2 Bartlett (15) = 416.99, $p < 0.001$.

To select the numbers of factors, we used a criterion in which eigenvalues were greater than 1.0 (Kaiser 1960) and Cattell's (Cattell 1966) scree test. Two factors were extracted.

The two dimensions explained 47.29% of variance; they were substantively identical to the original structure (Davis et al. 2003) and were thus labeled accordingly: General Negative Affect and General Positive Affect, with all primary factor loadings greater than .39 and all secondary loadings less than .20; in the first, SADNESS, FEAR and ANGER had particularly high loadings, accounted for 28.96% of the variance; in the second, PLAY, SEEK and CARE, accounted for 18.33% of the variance. Factor loadings and communalities of each scale after the EFA are shown in **table 2**.

CFA was conducted on the second split sample (Random non-clinical sample II) to test the two-factor structure obtained with EFA.

The analyses were performed on covariance matrices, since SEM statistical theory relies on the distributional properties of the elements of a covariance matrix (Cudeck 1989). We used the maximum likelihood estimation method. The model examined was a two factor orthogonal model in which the scales were predicted to load onto the two factors derived from the EFA, where factors were not allowed to intercorrelate.

Results showed an acceptable fit and yielded an inferential test of χ^2 (7, $N = 323$) = 10.912, $p = .14$;

RMSEA = .042, 90% CI [.00-.08], CFI = .99; NNFI = .98; SRMR = .03. All factor loadings were statistically significant and ranged from .41-.86, with an average standardized factor loading of .64. Squared multiple correlations ranged from .34-.74, with an average SMC of .45 indicating that, on average, 45% of the variance in observed variables was accounted for by latent factors.

A similar analysis (EFA) using the data from the clinical sample equally gave a two factor solution (eigenvalues for the first three factors were 2.13, 1.71, 0.90) as did the analysis in the non-clinical sample. According to Tabachnick and Fidell (2007), both indices, KMO and chi-square value of Bartlett's test, confirmed the adequacy of the sample ($KMO = 0.60$; χ^2 Bartlett (15) = 321.93, $p < 0.001$).

All of the scales have strong primary loadings on the appropriate factor, and the secondary loadings are all acceptably low (see **table 2**).

The two higher-level affective dimensions explained 49.18% of variance: in the first, General Negative Affect, SADNESS, FEAR and ANGER had particularly high loadings, accounted for 27.57% of the variance; in the second, General Positive Affect, SEEK, PLAY and CARE, accounted for 21.62% of the variance.

In both samples, the exploratory factor analysis for ANPS (excluding the Spirituality sub-scale) revealed two higher order factors with FEAR, SADNESS, ANGER loading on the factor which represented overall "Negative Affect" and with PLAY, CARE, SEEK loading on the factor which represented global "Positive Affect".

The two factor solution in the clinical sample displays a high degree of congruence with the two component solution in the non-clinical sample (second split sample) (Tucker's Coefficient of Congruence Factor 1 = .97; Factor 2 = .96).

Comparisons between samples

In **table 3** the descriptive statistics, Cronbach's Alpha Coefficients and mean item's inter-correlation coefficients are displayed for the six basic Affective System scales, Spirituality, the two scales relating to the General Positive and Negative Affect, and the Dominance and Social Anxiety filler groups, broken down by group. Mean scores of the two groups were

Table 2. Factor structure extracted considering the six basic affective systems (second-order factor analysis)

ANPS SCALES	Extracted Factors and Loadings on first split non-clinical sample (n = 302)		h^2	Extracted Factors and Loadings on the clinical sample (n = 218)		h^2
	1	2		1	2	
SADNESS	0.895	-0.010	0.80	0.904	0.107	0.83
FEAR	0.805	0.048	0.65	0.764	-0.158	0.61
ANGER	0.500	0.131	0.27	0.402	-0.045	0.16
PLAY	0.020	0.863	0.75	-0.250	0.605	0.43
SEEK	-0.014	0.426	0.18	-0.085	0.742	0.32
CARE	0.195	0.392	0.19	0.144	0.585	0.36
% Variance explained	28.96	18.33		27.57	21.62	

Note: h^2 is communality.

Table 3. Comparisons between samples; descriptive statistics, reliability and univariate tests

Subscale	Range	Mean	SD	Cronbach's α coeffi- cients	mean corrected item-total correla- tions	Skew- ness	Kurtosis	Range	Mean	SD	Cronbach's α coeffi- cients	mean corrected item-total correlations	Skew- ness	Kurtosis	t test	df	Co- hen's d	mean differ- ence	Feldt's test
PLAY	9-41	27.05	5.54	.790	.42	-.154	-.322	7-39	25.21	5.84	.785	.41	-.212	.175	4,15***	841	.33	1.84	0.967
SEEK	2-41	27.70	5.12	.745	.37	-.182	.821	6-40	26.11	5.96	.777	.40	-.244	-.056	3,78***	841	.30	1.59	1.1435
CARE	12-41	29.71	5.15	.717	.34	-.402	.083	13-42	28.47	5.41	.717	.34	.130	-.263	3,02***	841	.24	1.24	1
FEAR	5-42	26.13	6.24	.826	.46	-.124	-.069	12-41	26.42	6.11	.789	.41	.219	-.381	-.060	841	-.05	-.29	0.8246*
ANGER	4-38	21.77	6.58	.807	.43	.038	-.331	7-40	22.97	6.28	.770	.39	.268	.029	2,34*	841	-.18	-.120	0.8391
SADNESS	5-41	24.96	5.68	.756	.37	.045	-.025	12-42	25.28	6.00	.749	.36	.314	-.228	-.070	841	-.06	-.32	0.9721
Spirituality	0-35	17.21	5.75	.791	.43	-.175	.270	3-35	17.26	5.69	.758	.39	.102	.444	-.011	841	-.01	-.05	0.8636
General Positive Affect	31-114	84.45	11.67	.835	.31	-.363	.581	28-112	79.79	13.38	.859	.34	.004	.418	4,89***	841	.38	4.66	1.1702
General Negative Affect	28-111	72.86	15.04	.891	.38	-.087	-.168	42- 116.90	74.66	14.69	.872	.35	.329	.018	-1,53	841	-.12	-1.80	0.8516
DOMI- NANCE	0-21	9.12	3.33	.705	.41	.268	.268	1-21	9.28	3.24	.571	.29	.503	.898	-.063	841	-.05	-.16	0.6860***
SOCIAL ANXIETY	0-9	4.56	2.07	.608	.42	.040	-.469	0-9	4.84	2.17	.674	.49	-.099	-.568	-1,65	841	-.13	-.28	1.2025

note: * $p < .05$; ** $p < .01$; *** $p < .001$

compared using the *t*-test for independent samples.

In line with recommendations by West et al. (1995), all ANPS variables, showed an acceptable distribution, in both samples (non-clinical and clinical); skewness and kurtosis, as reported in **table 3**, showed no non-normal distributed variables.

Group differences were observed on the PLAY, SEEK, CARE, and on the scale relating to the General Positive Affect, in which the clinical sample scored significantly lower than non-clinical group. A slight difference between the two groups was found for ANGER in which non-clinical sample scored significantly lower than clinical group. Based on the effect sizes (Cohen's *d*) differences were small (Cohen 1988).

With respect to the individual subscales, Cronbach's alpha coefficients ranged from .72 (CARE) to .83 (FEAR) and from .72 (CARE) to .79 (FEAR), respectively in the non-clinical and clinical sample. The mean inter-correlations of items within each scale ranged from 0.34 (CARE) to 0.46 (FEAR) and from 0.34 (CARE) to 0.41 (FEAR and PLAY), respectively in the non-clinical and clinical sample.

Analysis using Feldt's test (see Feldt 1969, Feldt et al. 1987) indicates that Cronbach's alpha does not significantly differ between the clinical and non-clinical sample (see **table 3**) with the exception, to a slighter degree, of FEAR ($p < 0.05$) and Dominance ($p < 0.001$) and that Cronbach's alpha significantly differ between our non-clinical sample ($n=625$) and sample from Italian study ($n=418$; Pascasio et al. 2015) in SEEK ($p < 0.001$), PLAY ($p < 0.01$) and SADNESS ($p < 0.001$), in which the our non-clinical sample scored higher reliabilities values.

These findings were similar to the findings of the original ANPS study, where the Cronbach's Alphas ranged between .65 and .86 ($n=171$; Davis et al. 2003), with the FEAR and ANGER scales above .80, but with

the exception of PLAY ($p < 0.001$) and SEEK ($p < 0.01$) original scales which are below .70 and, with a slighter degree, of SADNESS ($p < 0.05$) that is lower than our value.

Table 4 presents the intercorrelations between the scores of the ANPS sub-scales, including Dominance and Social Anxiety, for clinical and non-clinical samples.

In both groups, negative sub-scales (FEAR, ANGER and SADNESS) were found to be positively and significantly correlated with each other. Similarly, positive sub-scales (PLAY, SEEK and CARE) were found to be positively and significantly correlated with each other.

All the negative ANPS scale correlated highly with each other, suggesting how the coherent general concept of "negative affect" may emerge as a superordinate personality factor (Davis et al. 2003).

Significant positive correlations were observed between CARE and FEAR, PLAY and ANGER, in the non-clinical sample, whereas PLAY was found to be significantly and negatively correlated with FEAR and SADNESS, in the clinical sample. CARE score was positively related to the SADNESS score, for both samples. The CARE score was also positively related to the FEAR score, but for non-clinical sample only. Finally, the SEEK score was positively related to the FEAR score, for clinical sample only.

Spirituality was significantly and positively correlated with CARE, in both non-clinical and clinical groups, with FEAR and SADNESS, in the non-clinical sample and significantly and positively correlated with SEEK in the clinical sample only. ANGER was found to be negatively correlated with Spirituality in the clinical sample.

Dominance was significantly and positively correlated with ANGER, in both non-clinical and clinical groups, with PLAY and FEAR in the non-

Table 4.

Intercorrelations of the Affective Neuroscience Personality Scales (n = 625 - non-clinical group)									
	PLAY	SEEK	CARE	FEAR	ANGER	SADNESS	SPIRITUALITY	DOMINANCE	SOCIAL ANXIETY
PLAY	1								
SEEK	.378***	1							
CARE	.323***	.242***	1						
FEAR	-.001	-.006	.213***	1					
ANGER	.198***	.028	-.013	.400***	1				
SADNESS	-.027	-.055	.233***	.702***	.395***	1			
SPIRITUALITY	-.036	.077	.153***	.143***	-.046	.187***	1		
DOMINANCE	.170***	.146***	-.194***	.072	.334***	.051	.017	1	
SOCIAL ANXIETY	-.231***	-.223***	-.049	.343***	.113**	.400***	.069	-.061	1
Intercorrelations of the Affective Neuroscience Personality Scales (n = 218 - clinical group)									
	PLAY	SEEK	CARE	FEAR	ANGER	SADNESS	SPIRITUALITY	DOMINANCE	SOCIAL ANXIETY
PLAY	1								
SEEK	.483***	1							
CARE	.300***	.424***	1						
FEAR	-.337***	.135*	.018	1					
ANGER	.007	-.092	-.071	.349***	1				
SADNESS	-.175*	-.023	.234***	.649***	.381***	1			
SPIRITUALITY	.071	.295***	.301***	-.033	-.137*	.093	1		
DOMINANCE	.011	-.005	-.090	.047	.172*	.100	-.076	1	
SOCIAL ANXIETY	-.397***	-.259***	-.174*	.419***	.123	.266***	-.036	.020	1

* $p < .05$, two-tailed; ** $p < .01$, two-tailed; *** $p < .001$, two-tailed.

clinical sample and significantly and negatively correlated with CARE in the non-clinical sample only.

Social Anxiety was significantly and positively correlated with FEAR and SADNESS, in both non-clinical and clinical groups, with ANGER, in the non-clinical sample and significantly and negatively correlated with PLAY and SEEK in both non-clinical and clinical groups, with CARE, in the clinical sample only.

The Fisher r -to- z transformation procedure for testing equality of correlation matrices (Cohen and Cohen 1983) was used to compare the correlation matrix structure between the clinical and the non-clinical population.

Compared with those correlations of SEEK and CARE, PLAY and FEAR, PLAY and SADNESS, SEEK and Spirituality, Social Anxiety and PLAY were statistically higher in size in clinical sample, while the correlations between ANGER and PLAY, CARE and FEAR, SEEK and FEAR, FEAR and Spirituality, Dominance and PLAY, Dominance and SEEK, Dominance and ANGER, Social Anxiety and SADNESS were statistically higher in size in the non-clinical sample (see **table 4**).

Descriptive scale scores of ANPS

Table 5 gives the descriptive statistics for all subscales of ANPS by sex and age as well as significant sex and age differences and effect sizes in both non-clinical and clinical samples.

Gender and age differences were examined using t tests. Among non-clinical sample men scored significantly lower than women on CARE ($t(623) = -7,937$, $p < 0.001$, $d = -0,67$), FEAR ($t(623) = -7,550$, $p < 0.001$, $d = -0,63$), SADNESS ($t(623) = -8,127$, $p < 0.001$, $d = -0,68$), Spirituality (slight difference) ($t(623) = -2,479$, $p < 0.05$, $d = -0,21$), Social Anxiety ($t(623) = -2,946$, $p < 0.01$, $d = -0,25$), General Positive (slight difference) ($t(623) = -2,180$, $p < 0.05$, $d = -0,18$) and Negative Affect ($t(623) = -5,776$, $p < 0.001$, $d = -0,49$), whereas women scored significantly lower than men on the Dominance ($t(623) = 4,467$, $p < 0.001$, $d = 0,38$) and PLAY ($t(623) = 2,239$, $p < 0.05$, $d = 0,19$) (slight difference) scale. Among clinical sample, female exhibited significantly higher scores than male on the FEAR ($t(216) = -6,040$, $p < 0.001$, $d = -0,83$), ANGER ($t(216) = -3,207$, $p < 0.01$, $d = -0,44$), SADNESS ($t(216) = -3,207$, $p < 0.01$, $d = -0,44$), Social Anxiety ($t(216) = -3,247$, $p < 0.01$, $d = -0,45$) and General Negative Affective ($t(216) = -6,682$, $p < 0.001$, $d = -0,92$).

Comparison of adolescents and adult participants among non clinical group revealed that Adults scored significantly lower than Adolescents in the subscales of SEEK ($t(623) = 4,329$, $p < 0.001$, $d = 0,35$), FEAR ($t(623) = 5,727$, $p < 0.001$, $d = 0,46$), ANGER ($t(623) = 8,487$, $p < 0.001$, $d = 0,68$), PLAY ($t(623) = 10,985$, $p < 0.001$, $d = 0,88$), SADNESS ($t(623) = 4,725$, $p < 0.001$, $d = 0,38$), Dominance ($t(623) = 7,270$, $p < 0.001$, $d = 0,58$), Social Anxiety ($t(623) = 3,010$, $p < 0.01$, $d = 0,24$), General Positive ($t(623) = 7,649$, $p < 0.001$, $d = 0,61$) and Negative Affect ($t(623) = 7,954$, $p < 0.001$,

Table 5. Descriptive data (means and standard deviations) and cronbach's α coefficients of the Italian version of the affective neuroscience personality scales with reference to the non-clinical and clinical sample and separated by sex and age

	Non-clinical Sample (n = 625)				Clinical Sample (n = 218)			
	Male (n = 219)		Female (n = 406)		Male (n = 128)		Female (n = 90)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Play	27,72	5,70	26,68	5,43	25,53	5,28	24,77	6,57
Seek	27,77	5,44	27,66	4,95	26,15	5,74	26,05	6,30
Care	27,59	5,18	30,85	4,76	27,90	5,00	29,27	5,88
Fear	23,67	5,86	27,45	6,03	24,48	5,35	29,18	6,09
Anger	22,01	6,61	21,65	6,57	21,85	6,16	24,56	6,14
Sadness	22,57	5,52	26,25	5,34	23,25	4,95	28,15	6,21
Spirituality	16,44	6,03	17,63	5,56	17,51	5,42	16,92	6,06
General Positive Affect	83,07	12,24	85,20	11,29	79,58	11,88	80,09	15,33
General Negative Affect	68,25	14,49	75,35	14,76	69,58	12,81	81,90	14,22
DOMINANCE	9,92	3,29	8,69	3,27	9,47	3,10	9,02	3,42
SOCIAL ANXIETY	4,23	2,06	4,74	2,05	4,45	2,00	5,39	2,28
	Adolescents (14-19; n = 326)		Adults (20-78; n = 299)		Adolescents (14-19; n = 99)		Adults (20-78; n = 119)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Play	29,18	5,09	24,72	5,07	26,35	6,49	24,27	5,08
Seek	28,54	4,82	26,79	5,29	26,17	6,44	26,06	5,56
Care	30,00	5,16	29,38	5,12	28,28	5,50	28,62	5,35
Fear	27,46	6,00	24,67	6,17	26,99	6,38	25,94	5,86
Anger	23,80	6,65	19,57	5,74	24,78	6,30	21,46	5,88
Sadness	25,97	5,74	23,86	5,40	26,37	6,65	24,37	5,26
Spirituality	17,14	5,68	17,29	5,84	16,05	6,02	18,27	5,21
General Positive Affect	87,73	10,67	80,89	11,68	80,79	14,22	78,96	12,63
General Negative Affect	77,23	14,36	68,09	14,33	78,14	15,48	71,77	13,40
DOMINANCE	10,01	3,50	8,15	2,83	9,59	3,91	9,03	2,53
SOCIAL ANXIETY	4,80	2,18	4,31	1,90	5,16	2,29	4,56	2,03

$d = 0,64$).

Among all clinical participants, Adolescents scored significantly higher than adult participants on ANGER ($t(216) = 4,017$, $p < 0.001$, $d = 0,55$), PLAY ($t(216) = 4,017$, $p < 0.001$, $d = 0,55$), SADNESS ($t(216) = 2,479$, $p < 0.05$, $d = 0,34$) (slight difference), Social Anxiety ($t(216) = 2,057$, $p < 0.05$, $d = 0,28$) (slight difference), General Negative Affect ($t(216) = 3,255$, $p < 0.01$, $d = 0,44$), whereas adult participants scored significantly higher than adolescent participants in Spirituality ($t(216) = -2,924$, $p < 0.01$, $d = -0,40$).

Based on the effect sizes (Cohen's d) differences were small to large effect (Cohen 1988).

ANPS scales correlations with Big-Five personality dimensions

The external validity of the ANPS was highlighted by focusing on the interrelations of the sub-scales of ANPS and Big-Five markers namely: Extraversion, Agreeableness, Conscientiousness, Neuroticism, and Openness to Experience, in both samples (non-clinical and clinical).

Detailed coefficients and significance levels of correlations between sub-scales of ANPS and BFI scales are given in **table 6**.

The main results are that PLAY was most positively strongly associated with Extraversion, in both samples and had significant negative correlation with Neuroticism in clinical sample. SEEK was most positive strongly associated with Openness to Experience and with Extraversion in both samples and was found to be negatively and significantly correlated with Neuroticism in clinical sample. CARE was most positive strongly associated with Agreeableness, in both sample and had significant positive correlations with Openness to Experience in clinical sample. FEAR, ANGER, and SADNESS were all most positive strongly

associated with Neuroticism. However, ANGER was also related highly negative to Agreeableness and Conscientiousness, in both sample.

Spirituality non yield a high correlation coefficient with an BFI scale. There was lower but statistically significant correlations for Spirituality with Agreeableness in both sample.

Dominance was most negative associated with Agreeableness in both sample and social anxiety was most negatively strongly associated with Extraversion and also positive correlated with Neuroticism in both sample.

In the original version of ANPS (Davis et al. 2003) the FFM Conscientiousness scale was the only scale that did not yield a high correlation coefficient with an ANPS scale. There were lower but statistically significant correlations for Conscientiousness with FEAR, ANGER, and SADNESS. These negative correlations suggest a possible role for Conscientiousness in suppressing negative affect.

Discussion

As previously mentioned, two higher-level affective dimensions emerge, General Positive Affect and General Negative Affect underlying the ANPS scales. These two affective factors shape the subjective experience of the primary emotional systems and are the roots of the secondary learning function, through the "reward" (Positive Affect) and "punishment" (Negative Affect) (see above Panksepp 2011).

The comparison between the descriptive data (means and standard deviations) of Adolescents and Adults, shows that the non-clinical sample of Adolescents scored significantly higher than the non-clinical sample of Adults in five emotional systems, whereas, CARE and Spirituality scores are almost the same. The most significant difference between Adolescent and Adult

Table 6. ANPS sub-scales correlated with BFI subscales, in both non-clinical and clinical group

n = 523 - non-clinical group					
	EXTRAVERSION	AGREEABLENESS	CONSCIENTIOUSNESS	NEUROTICISM	OPENESS TO EXPERIENCE
PLAY	.49***	.08	-.17***	-.08	.14**
SEEK	.38***	.07	.17***	-.09*	.47**
CARE	.24***	.37***	.07	.11*	.27***
FEAR	-.20***	-.21***	-.26***	.76***	-.04
ANGER	.02	-.43***	-.31***	.48***	-.13**
SADNESS	-.23***	-.15***	-.26***	.67***	-.07
SPIRITUALITY	.00	.16***	.16***	.06	.13**
DOMINANCE	.15***	-.39***	-.12**	.08	.03
SOCIALANXIETY	-.55***	-.15**	-.27***	.36***	-.16***
n = 180 - clinical group					
	EXTRAVERSION	AGREEABLENESS	CONSCIENTIOUSNESS	NEUROTICISM	OPENESS TO EXPERIENCE
PLAY	.56***	.18*	.00	-.41***	.22**
SEEK	.48***	.18*	.26***	-.32***	.52***
CARE	.26**	.34***	.16*	-.12	.35***
FEAR	-.37***	-.24**	-.19**	.76***	-.03
ANGER	-.16*	-.42***	-.34***	.47***	-.01
SADNESS	-.27***	-.10	-.11	.60***	.07
SPIRITUALITY	.20**	.28***	.18*	-.04	.27***
DOMINANCE	-.01	-.25**	-.05	.07	-.14
SOCIALANXIETY	-.51***	-.23**	-.28***	.45***	-.17*

* $p < .05$, two-tailed; ** $p < .01$, two-tailed; *** $p < .001$, two-tailed.

scores are in the PLAY values (10,985 t), followed by ANGER (8,487 t), FEAR (5,727 t), SADNESS (4,725 t), SEEKING (4,329 t) and Dominance (7,270 t). This data confirms that the emotional systems became less active with age. The clinical sample shows data a bit different in the comparison of the scores between Adolescents and Adults. Adolescents of the clinical group have significantly higher scores in ANGER (4,017 t), PLAY (2,643 t) and SADNESS (2,479 t) scales. The differences among the other scales are not significant except for Spirituality (-2.924 t), that showed a significant difference with a negative value between Adolescents and Adults of clinical group. The data is difficult to interpret because the two clinical samples (Adolescents/Adults clinical group see tab. 1) are inhomogeneous and would require a study of disaggregated data. Despite this limit, we can see that there are fewer differences between Adolescents and Adults clinical samples than between Adolescents and Adults non-clinical samples. The Adolescence is the age in which the mental suffering “modeled itself”, and it acquires the peculiar forms that will characterize the subject for the life. In this way the mental diseases reduce the range of possibilities by which the emotional systems drive the subjects in adapting to the real life.

Gender differences were observed on the CARE, FEAR, SADNESS, Social Anxiety sub-scales, on the two factors relating to the General Positive and Negative Affect, in which men scored significantly lower than women, and on the Dominance scale, in which women scored significantly lower than men. This result was also detected in the Spanish and French studies (Abella et al. 2011, Pahlavan et al. 2008, Pingault et al. 2011), pointing to a potential universal female “resonance” with attachment/CARE and separation/distress (Ozkarak-Gradwohl et al. 2014). On the other hand, differently from the findings of the Spanish and French studies, both Spanish and French females having higher scores than males on FEAR, Spanish females showing higher scores than males on SEEKING, and French females showing lower scores than males on PLAY (Abella et al. 2011, Pahlavan et al. 2008).

The comparison between our non-clinical sample and the sample of previous Italian ANPS validation (Pascasio et al. 2015) indicates that the reliability does not significantly differ between the two sample, even if our non-clinical sample scored higher reliability values in SEEK ($p < 0.001$), PLAY ($p < 0.01$) and SADNESS ($p < 0.001$). In both Italian studies Adult females scoring higher than Adult males on CARE, SADNESS, FEAR.

The ANPS scales have specific correlations among them. One question arises: are these significant correlations identifying specific “organizations” of emotional systems and specific personality patterns?, i.e. actual endophenotypes? (Panksepp 2006, Pederson et al. 2014, Pingault et al. 2011).

We'll consider below just a few of these correlations.

The positive correlation between CARE and SADNESS both in clinical and non-clinical samples confirms that the two systems, though different, are closely synergistic and complementary. This could indicate that the caring of another person is closely linked to the fear of separation from her/him.

The positive correlation between CARE and FEAR is present only in non-clinical group. This could mean that the caring of the relationships implies the possession (van der Westhuizen and Solms 2015), and then the possible dangers that could threaten such ownership. So the relationships are a source of fear, probably feeling

denied or dissociated in the clinical group.

In clinical group there is also a positive correlation between CARE and SEEK. This could indicate that when one establishes a relationship that activates the CARE system, this determines greater compulsion to continuously seek that bond. It's useful to recall that the social bond constitutes the prototype of all the addictions (Zellner et al. 2011).

The positive and significant correlations between SEEK and Spirituality in the clinical group and FEAR and Spirituality in the non-clinical group are particularly interesting. The first correlation could indicate that the SEEKING emotion is very active in the clinical individuals (our clinical samples were formed by adolescents and many adults addicted, in both of them the dopaminergic system is particularly activated) and pushes them towards the Spirituality. Can the Spirituality be a resilience factor to drug addiction and psychosis during the hyperactivation of dopaminergic system?

In the non-clinical group, where there is a significant correlation between FEAR and Spirituality, there is a different interpretation. In this case it is the FEAR that predisposes the subjects towards the spiritual dimension.

Until now we have not looked at two filler groups that aren't items that relate to the six primary emotional systems, the Dominance and the Social Anxiety. As shown above Social Anxiety is lower in female gender while Dominance is higher in the male. These are both expected values, considering that the Dominance is also called inter-male aggression, and Social Anxiety is a construction which highlights the FEAR system in a interpersonal dimension. In fact the Social Anxiety is positively correlated with the FEAR and SADNESS both in clinical and non-clinical groups. The FEAR system, and therefore the Social Anxiety, is the complementary emotion of Dominance emotional system (Giacolini et al. 2013).

Finally the interrelations of the sub-scales of ANPS and Big-Five markers have highlighted external validity of the former test, which potentially provides the biological underpinnings for the descriptive Five Factor Model of personality. These correlations were observed to be largely congruent with the original ANPS findings (Davis et al. 2003, Davis & Panksepp 2011).

The sub-scales of positive emotions such as SEEK, CARE, PLAY all correlate positively with the three Big Five scales such as Extraversion, Agreeableness, Openness to Experience whereas they correlated negatively with Neuroticism. The sub-scales of negative emotions such as FEAR, ANGER, SADNESS and General negative affect correlate positively with Neuroticism. There was a substantial polarization between positive and negative dimensions of the two tests.

The data supported significant relationships between primary emotions and the most widely accepted model of human personality, which was consistent with the hypothesis that these six brain emotion systems form a foundation for the Adult Five Factor Model of personality (Davis and Panksepp 2011) and for the Adolescent one too.

The primary emotional systems are likely the motivational basis of personality and their study and measurement can help to identify the particular characteristics of vulnerability and resilience in the subjects. This can be very useful in clinical work both to articulate the nosographic diagnosis and to provide

suitable treatments. Again, the extension of ANPS to an age range that includes both Adolescence and Adulthood could increase the heuristic value of the test. Indeed sexual maturity there is a deep reframing of mental functioning, which makes adolescence the test for the next adult psychic dynamics. Finally, a large age range could allow us to have a useful psychometric tool in order to study the individual variables related to family transgenerational emotional systems and the endophenotypes.

Aims, limitations and future directions

The main aim of the ANPS validation is to supply the Italian population with a instrument that interfaces the neurobiology functioning of the brain and the human psychological functions by a pen-and-paper test.

A very important problem is the heterogeneity of the adolescent and adult clinical sample that could highlight a *Selection bias*. In this article the results related to clinical sample were not sufficiently analyzed due to the length of the paper and therefore they will be included in a subsequent article.

The use of correlations of the ANPS sub-scales to identify functional structures like emotional endophenotypes certainly poses an important methodological problem which would require further study. At the same time, the ANPS could allow us to study psychiatric distress rooted in excesses or imbalances in the six primary emotional systems.

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