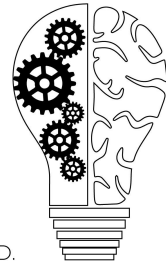


## Episode 092: The Big Five: Neuroticism Part 1

Alec Zane B.A., Alexis Carnduff B.S., David Puder M.D.

There are no conflicts of interest for this episode.

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DAVID PUDER, M.D.  
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In today’s podcast, we discuss the Big Five personality traits, focusing on neuroticism and how it fits into this set. We then explore each of the six domains of neuroticism and the research of how it manifests in other parts of one’s life, and affects relationships.

## The Big 5 Personality Traits

- The five factor model, or Big Five, originating from studies of trait-descriptive adjectives drawn from the lexicon, is the most widely used classification system for personality traits. This approach proposes that people naturally create terms for common traits so that they can describe and discuss them. The model identifies five broad domains of personality:
  - **Extraversion:** gregariousness, enthusiasm, assertiveness, and social ability.
  - **Neuroticism:** negative emotionality with proclivity to anxiety and emotional pain.
  - **Agreeableness:** compassion and politeness with maternal based orientation (cares about others more than themselves). Cooperative more than competitive. Warm. Likely to be taken advantage of and harbor resentment.
  - **Openness to experience:** combination of interest and ideas known as intellect. Proclivity to aesthetics. Discusses ideas and spends time in creative pursuits.
  - **Conscientiousness:** orderliness, responsibility, planning; focuses on industrialism.

## Neuroticism and its domains

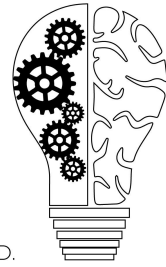
- Neuroticism “represents the individual’s tendency to experience psychological distress” ([McCrae and Costa, 1987](#)). Individuals who are more neurotic are more likely to experience negative emotions such as anxiety, fear, worry, embarrassment, anger,

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depressed mood, and loneliness. They typically respond much worse to stressors and are more likely to interpret ordinary situations as threatening.

- Neuroticism facets according to the NEO personality inventory (NEO PI 3)
  - The NEO inventories are concise measures of the five major dimensions (domains) of personality and the most important traits or facets that define them. Together, the five broad-domain scales and the 30 specific-facet scales allow a comprehensive assessment and rating of adolescent and adult personalities.



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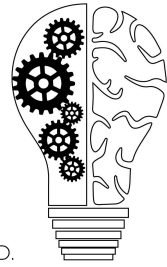
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| <b>N1: Anxiety</b> | Low   | High  |
|--------------------|---|---|
| Definition         | <ul style="list-style-type: none"> <li>● Does not worry</li> <li>● Rarely fearful or anxious</li> <li>● Seldomly nervous</li> </ul> | <ul style="list-style-type: none"> <li>● Frightened easily</li> <li>● Worries about things going wrong</li> <li>● Often tense and jittery</li> <li>● Struggles with frightening thoughts</li> </ul> |
| Strengths          | <ul style="list-style-type: none"> <li>● Few fears</li> </ul>   | <ul style="list-style-type: none"> <li>● May approach dangerous situations with caution</li> </ul>  |

| <b>N2: Angry Hostility</b> | Low   | High   |
|----------------------------|---|--|
| Definition                 | <ul style="list-style-type: none"> <li>● Slow to anger</li> <li>● Not considered touchy or temperamental</li> </ul> | <ul style="list-style-type: none"> <li>● Easily angered by mistreatment</li> <li>● Hot blooded</li> <li>● Disgusted easily by others</li> <li>● Prone to bitterness or resentment</li> <li>● Frustrated by minor inconveniences</li> </ul> |
| Strengths                  | <ul style="list-style-type: none"> <li>● Even-tempered</li> </ul>   | <ul style="list-style-type: none"> <li>● Passionate</li> </ul>   |

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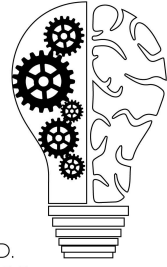
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| <b>N3: Depression</b> | Low   | High   |
|-----------------------|---|--|
| Definition            | <ul style="list-style-type: none"> <li>Rarely lonely or “blue”</li> </ul> | <ul style="list-style-type: none"> <li>Can feel worthless</li> <li>Easily discouraged and can give up when things go wrong</li> <li>Readily blames self</li> <li>Low opinion of self</li> <li>Life circumstances can feel bleak and hopeless</li> <li>Can experience deep guilt or sinfulness</li> </ul> |
| Strengths             | <ul style="list-style-type: none"> <li>Seldom depressed</li> </ul>        | <ul style="list-style-type: none"> <li>In touch with feelings</li> </ul>   |

| <b>N4: Self-Consciousness</b> | Low  | High   |
|-------------------------------|--|--|
| Definition                    | <ul style="list-style-type: none"> <li>Feels comfortable around bosses or teachers</li> <li>Seldom feels self conscious</li> </ul> | <ul style="list-style-type: none"> <li>Worries about making a fool of themselves in front of others</li> <li>Feels less than</li> <li>Can feel ashamed</li> <li>Avoids those they perceive to have done or said the wrong thing to</li> <li>Feels awkward around others</li> </ul> |
| Strengths                     | <ul style="list-style-type: none"> <li>Not easily embarrassed by being ridiculed or teased</li> </ul>                              | <ul style="list-style-type: none"> <li>Sensitive to the experience and feelings of others</li> </ul>   |

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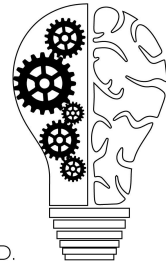
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| <b>N5: Impulsiveness</b> | Low   | High   |
|--------------------------|---|--|
| Definition               | <ul style="list-style-type: none"> <li>• Seldom gives into wants and needs</li> <li>• Always in control of self</li> <li>• Ok with not receiving all desires</li> </ul> | <ul style="list-style-type: none"> <li>• Trouble resisting cravings</li> <li>• Eats too much of favorite foods</li> <li>• Eats on impulse</li> </ul> |
| Strengths                | <ul style="list-style-type: none"> <li>• Often able to keep feelings under control</li> </ul>   | <ul style="list-style-type: none"> <li>• Does not miss out on spontaneous events</li> </ul>  |

| <b>N6: Vulnerability</b> | Low  | High   |
|--------------------------|--|--|
| Definition               | <ul style="list-style-type: none"> <li>• Emotionally stable</li> <li>• Handles themselves well in a crisis</li> <li>• Still makes good decisions, even when everything is going wrong</li> <li>• Strong coping skills</li> </ul> | <ul style="list-style-type: none"> <li>• Wants others to solve their problems</li> <li>• Does not manage themselves well under stress</li> <li>• Indecisive</li> </ul> |
| Strengths                | <ul style="list-style-type: none"> <li>• Cool head in emergencies</li> </ul>   | <ul style="list-style-type: none"> <li>• Does not take the world on their shoulders</li> <li>• Can ask others for help</li> </ul>                                      |

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### Neuroticism Over the Life Course

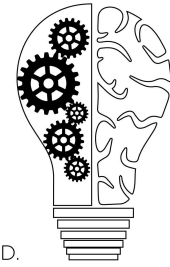
- Like most aspects of personality, neurotic traits are moderately stable across development ([Caspi, Harrington, Milne, et al., 2003](#)).
  - This [observational study](#) of 1,000 3-year-old children who exhibited five temperament types: undercontrolled, inhibited, confident, reserved, and well-adjusted were followed throughout their development.
  - 23 years later, the researchers re-examined children as adults. The 3-year-old behavioral styles identified as “under-controlled” (irritable, impulsive, emotionally labile, and impersistent on tasks) had an effect size with alienation (.34), stress reaction (.15), and negative emotionality (.27). These were linked by an effect size to neuroticism: (.27), (.41), and (.37) respectively. When looking directly at under-controlled 3 year olds and 26 year olds, the effect size was mild at 0.3.

**Table 3**  
Temperament Types Identified at Age 3 Have Distinct Personalities at Age 26 (Bottom Rows) as They Did at Age 18 (Top Rows), as Seen Through Self-Reports on the Multidimensional Personality Questionnaire (MPQ) Provided by the Children Grown Up

|                           | Temperament Groups at Age 3    |                            |                                 |                           |                          | F Ratio for Temperament | Age 18 to Age 26 Stability Correlation <sup>b</sup> |
|---------------------------|--------------------------------|----------------------------|---------------------------------|---------------------------|--------------------------|-------------------------|---|
|                           | Well-Adjusted<br>(n = 366-380) | Confident<br>(n = 263-270) | Under-controlled<br>(n = 92-97) | Reserved<br>(n = 137-142) | Inhibited<br>(n = 72-76) |                         |   |
| <b>MPQ Primary Traits</b> |                                |                            |                                 |                           |                          |                         |   |
| <b>Alienation</b>         |                                |                            |                                 |                           |                          |                         |   |
| Age 18                    | -.08 <sup>a</sup>              | -.02 <sup>a</sup>          | .38 <sup>b</sup>                | -.09 <sup>a</sup>         | .11 <sup>ab</sup>        | 3.65**                  | .59   |
| Age 26                    | -.07 <sup>a</sup>              | -.02 <sup>a</sup>          | .34 <sup>b</sup>                | -.10 <sup>a</sup>         | .12 <sup>ab</sup>        | 4.20**                  |   |
| <b>Stress Reaction</b>    |                                |                            |                                 |                           |                          |                         |   |
| Age 18                    | -.05                           | -.05                       | .17                             | .08                       | -.03                     | 1.24                    | .52   |
| Age 26                    | -.10 <sup>a</sup>              | .04 <sup>ab</sup>          | .15 <sup>b</sup>                | .03 <sup>ab</sup>         | .08 <sup>ab</sup>        | 1.90†                   |   |
| <b>Aggression</b>         |                                |                            |                                 |                           |                          |                         |   |
| Age 18                    | -.04 <sup>a</sup>              | .08 <sup>ab</sup>          | .22 <sup>b</sup>                | -.09 <sup>ac</sup>        | -.28 <sup>c</sup>        | 3.41*                   | .60   |
| Age 26                    | -.06                           | .05                        | .14                             | -.07                      | .02                      | 1.21                    |   |
| <b>Traditionalism</b>     |                                |                            |                                 |                           |                          |                         |   |
| Age 18                    | .06                            | -.09                       | -.02                            | .05                       | .08                      | .87                     | .55   |
| Age 26                    | .05 <sup>a</sup>               | -.17 <sup>b</sup>          | .15 <sup>a</sup>                | .05 <sup>a</sup>          | -.02 <sup>ab</sup>       | 2.97*                   |   |

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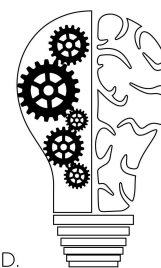
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|                              |                    |                    |                    |                    |                    |        |     |
|------------------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------|-----|
| <b>Harm Avoidance</b>        |                    |                    |                    |                    |                    |        |     |
| Age 18                       | -.06 <sup>ab</sup> | -.01 <sup>ac</sup> | -.22 <sup>bc</sup> | .08 <sup>a</sup>   | .40                | 4.73** | .62 |
| Age 26                       | -.01 <sup>ab</sup> | -.08 <sup>ab</sup> | -.18 <sup>a</sup>  | .07 <sup>b</sup>   | .42                | 4.81** |     |
| <b>Self-Control</b>          |                    |                    |                    |                    |                    |        |     |
| Age 18                       | .08 <sup>a</sup>   | -.14 <sup>b</sup>  | -.19 <sup>b</sup>  | .08 <sup>a</sup>   | .18 <sup>a</sup>   | 3.43** | .58 |
| Age 26                       | .08                | -.08               | -.13               | .02                | -.03               | 1.54   |     |
| <b>Social Potency</b>        |                    |                    |                    |                    |                    |        |     |
| Age 18                       | .08 <sup>a</sup>   | .07 <sup>a</sup>   | -.01 <sup>ab</sup> | -.15 <sup>bc</sup> | -.37 <sup>c</sup>  | 4.20** | .56 |
| Age 26                       | .01 <sup>a</sup>   | .16                | -.05 <sup>ab</sup> | -.13 <sup>ab</sup> | -.31 <sup>b</sup>  | 4.42** |     |
| <b>Achievement</b>           |                    |                    |                    |                    |                    |        |     |
| Age 18                       | .06                | -.05               | -.04               | -.06               | -.15               | .95    | .44 |
| Age 26                       | .05 <sup>a</sup>   | .06 <sup>a</sup>   | .01 <sup>ab</sup>  | -.20 <sup>b</sup>  | -.14 <sup>ab</sup> | 2.38*  |     |
| <b>Well-Being</b>            |                    |                    |                    |                    |                    |        |     |
| Age 18                       | -.02               | .07                | -.09               | .01                | -.06               | .65    | .43 |
| Age 26                       | -.01               | .06                | -.03               | .06                | -.27               | 1.87   |     |
| <b>Social Closeness</b>      |                    |                    |                    |                    |                    |        |     |
| Age 18                       | .05                | -.03               | -.03               | -.04               | -.02               | .40    | .51 |
| Age 26                       | .04                | -.01               | -.15               | .01                | .02                | .71    |     |
| <b>MFQ Superfactors</b>      |                    |                    |                    |                    |                    |        |     |
| <b>Negative Emotionality</b> |                    |                    |                    |                    |                    |        |     |
| Age 18                       | -.07 <sup>a</sup>  | .04 <sup>a</sup>   | .33                | -.03 <sup>a</sup>  | -.06 <sup>a</sup>  | 3.20*  | .60 |
| Age 26                       | -.11 <sup>a</sup>  | .03 <sup>a</sup>   | .27 <sup>b</sup>   | -.05 <sup>a</sup>  | .10 <sup>ab</sup>  | 3.46** |     |

- In youth, neuroticism represents a *major correlate* in internalizing problems. Higher levels increase a child's susceptibility to distress and negative emotions including fear, anxiety, feelings of insecurity, lack of self-confidence, shyness, feelings of guilt, and generally more fearful/sad events as compared to adults ([Zupančič, Podlesek, & Kavčič, 2018](#)).
  - A [longitudinal study](#) looked at children aged 5 and 6 for personality traits as predictors for social competence, internalizing problems, and externalizing problems. The study utilized different sources for observing and grading the children's behavior (teacher, parent, etc.).
  - "The children's extraversion, conscientiousness, and low neuroticism predicted subsequent social competence, but not vice versa."

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- Effect size between neuroticism and social competence was  $-0.328$  ( $p < .001$ )
  - Correlation from age 5 to age 6 was only  $.38$  (different informants, with different roles)
- A large meta analysis shows that overall neuroticism levels in the population *decrease* as individuals progress from *early to late adulthood* ([Roberts, Walton and Viechtbaeur, 2006](#)).
  - 92 studies were analyzed to determine patterns of change in personality traits across the life course.
  - The study showed *increases* in social dominance (facet of extraversion), conscientiousness, and emotional stability. Findings highlighting *decreases* in neuroticism, possibly due to differences in changing values and social context within a given culture.

ROBERTS, WALTON, AND VIECHTBAUER

Table 10  
*Moderators of Personality Trait Development Across the Life Course*

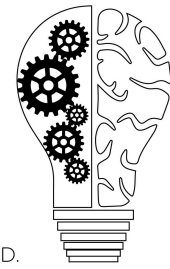
| Trait                   | K   | Gender   | Time          | Cohort   | Attrition | $Q_E$   |
|-------------------------|-----|----------|---------------|----------|-----------|---------|
| Social vitality         | 76  | .0308    | $-.0135^{**}$ | $-.0066$ | .0000     | 198.7** |
| Social <b>dominance</b> | 31  | .0470    | $-.0027$      | .1183**  | .0043     | 22.1    |
| Agreeableness           | 62  | $-.0736$ | .0204**       | .0676**  | .0002     | 127.3** |
| Conscientiousness       | 65  | $-.0147$ | .0183**       | .0420**  | .0028     | 169.5** |
| Emotional stability     | 102 | $-.0025$ | .0037         | .0164    | .0010     | 174.4** |
| Openness to experience  | 66  | .0506    | .0070         | .0527    | $-.0021$  | 371.7** |

*Note.* Coefficients are unstandardized beta weights in the metric of the standardized mean-level difference scores.  $K$  = number of samples;  $Q_E$  = test for residual heterogeneity after accounting the effect for moderators. \*\*  $p < .01$ .

- A study using longitudinal data from a US cohort study (Add Health) found an association between adverse childhood events (ACEs) and neuroticism scores later in life ([Fletcher and Shurer, 2017](#)).
  - The study explored the long-term impact of early-life maltreatment on personality.
  - Add Health was a nationally representative cohort study that followed health trajectories from early adolescence into young adulthood.
    - Surveys collected data from 1994-2008
    - Dataset included information on maltreatment and personality
  - Regression models showed significant correlation between *later-life neuroticism* and *previous sexual abuse* ( $r = 0.499$ ,  $p < .05$ ) and *neglect of needs* ( $r = 0.32$ ,  $p < 0.01$ ), whereas being slapped or left alone as a child proved insignificant.

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- Another study looking at data from the Midlife Development in the United States (MIDUS) also showed a *significant and positive association between ACE scores and neuroticism* ([Grusnick, Garacci, Eiler, et al., 2020](#)).
  - Study looking at three waves from the MIDUS study examined the relationship between ACEs and outcome variables that included generativity, personality traits, and affect.
    - MIDUS is a national longitudinal study of health and well-being that collected surveys from 1995-2014. The purpose was to investigate the role of behavioral, psychological and social factors in understanding age-related differences in physical and mental health.
  - Results showed that having any ACEs was *significantly associated with neuroticism* ( $\beta = 0.10$ ; 95% CI 0.07, 0.13) and *conscientiousness* ( $\beta = -0.03$ ; 95% CI  $-0.05$ ,  $-0.01$ ).
  - Also found was a dose-dependent relationship: higher ACE scores were positively associated with neuroticism (more adverse childhood events increased neuroticism):
    - $\beta = 0.24$ , 95% 0.15, 0.33 for 3 ACEs
    - $\beta = 0.16$ , 95% 0.11, 0.21 for 2 ACEs
    - $\beta = 0.07$ , 95% 0.04, 0.11 for 1 ACE
  - A smaller, negative association was seen with conscientiousness (more adverse childhood events decreased conscientiousness):
    - $\beta = -0.08$ , 95%  $-0.14$ ,  $-0.02$  for 3 ACEs
    - $\beta = -0.05$ , 95%  $-0.08$ ,  $-0.02$  for 2 ACEs
  - Neuroticism was also found to be associated with abuse:
    - $\beta = 0.20$ ; 95% CI 0.16, 0.24

These studies show significant correlations between ACE and adverse effects as adults, such as neuroticism.

## Neuroticism and Genetics

From the above studies, neuroticism tended to increase with environmental hardships early in life. Children labeled as irritable, impulsive, emotionally labile, and impersistent on tasks were later found to be mildly more neurotic. This piqued interest in the possibility of linked personality traits with genetics. Research currently shows a link of about 40% heritability.

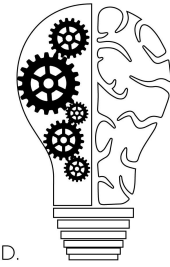
- A [study](#) looking at the correlation of personality traits between monozygotic and dizygotic twins:
  - Participants recruited were volunteer twin pairs:



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- 16 or older, raised together in the same home
- Completed the NEO-PI-R assessment
- The MZ and DZ twin correlations and estimates of additive and non-additive genetic and shared and nonshared environmental effects for the five dimensions and 30 facet traits:



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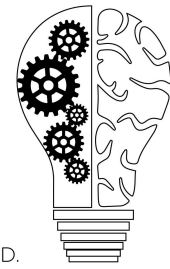
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**Table 2**  
Twin Correlations and Heritability Estimates of the Revised NEO Personality Inventory (NEO-PI-R) Dimensions and Facets

| Dimension and facets     | $r_{MZ}$ | $r_{DZ}$ | $h^2$ | $SE_A$ | $d^2$ | $SE_D$ | $c^2$ | $SE_C$ | $e^2$ | $SE_E$ |
|--------------------------|----------|----------|-------|--------|-------|--------|-------|--------|-------|--------|
| <i>Neuroticism</i>       | .41      | .18      | .41   | .06    |       |        |       |        | .59   | .04    |
| Anxiety                  | .26      | .13      | .26   | .08    |       |        |       |        | .74   | .05    |
| Angry Hostility          | .37      | -.01     |       |        | .33   | .07    |       |        | .67   | .05    |
| Depression               | .33      | .14      | .31   | .07    |       |        |       |        | .69   | .05    |
| Self-Consciousness       | .38      | .19      | .38   | .06    |       |        |       |        | .62   | .04    |
| Impulsiveness            | .36      | .21      | .36   | .07    |       |        |       |        | .64   | .04    |
| Vulnerability            | .45      | .17      | .44   | .06    |       |        |       |        | .56   | .04    |
| <i>Extraversion</i>      | .55      | .23      | .53   | .05    |       |        |       |        | .47   | .04    |
| Warmth                   | .43      | .14      |       |        | .43   | .06    |       |        | .57   | .05    |
| Gregariousness           | .56      | .19      | .52   | .05    |       |        |       |        | .48   | .04    |
| Assertiveness            | .42      | .10      |       |        | .42   | .06    |       |        | .58   | .05    |
| Activity                 | .29      | .14      | .29   | .07    |       |        |       |        | .71   | .05    |
| Excitement               |          |          |       |        |       |        |       |        |       |        |
| Seeking                  | .42      | .02      |       |        | .41   | .06    |       |        | .59   | .05    |
| Positive Emotions        | .38      | .24      | .39   | .06    |       |        |       |        | .61   | .04    |
| <i>Openness</i>          | .58      | .21      |       |        | .61   | .05    |       |        | .39   | .04    |
| Fantasy                  | .32      | .22      | .34   | .07    |       |        |       |        | .66   | .05    |
| Aesthetics               | .60      | .14      |       |        | .57   | .05    |       |        | .43   | .04    |
| Feelings                 | .44      | .35      |       |        |       |        | .39   | .05    | .61   | .03    |
| Actions                  | .42      | .21      | .44   | .06    |       |        |       |        | .56   | .04    |
| Ideas                    | .53      | .09      |       |        | .52   | .06    |       |        | .48   | .04    |
| Values                   | .49      | .27      | .51   | .06    |       |        |       |        | .49   | .04    |
| <i>Agreeableness</i>     | .41      | .26      | .41   | .06    |       |        |       |        | .59   | .04    |
| Trust                    | .27      | .21      | .30   | .07    |       |        |       |        | .70   | .05    |
| Straight-forwardness     | .47      | .17      | .47   | .06    |       |        |       |        | .53   | .04    |
| Altruism                 | .34      | .18      | .34   | .07    |       |        |       |        | .66   | .05    |
| Compliance               | .33      | .10      |       |        | .34   | .07    |       |        | .66   | .05    |
| Modesty                  | .30      | .36      |       |        |       |        | .33   | .06    | .67   | .04    |
| Tender-mindedness        | .41      | .15      |       |        | .45   | .06    |       |        | .55   | .04    |
| <i>Conscientiousness</i> | .37      | .27      | .44   | .06    |       |        |       |        | .56   | .04    |
| Competence               | .37      | .13      | .34   | .07    |       |        |       |        | .66   | .05    |

## Episode 092: The Big Five: Neuroticism Part 1

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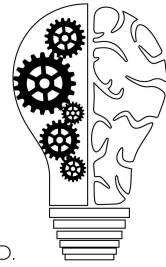
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- Pearson correlations for the MZ twins exceeded those for the DZ twins for all scales except modesty and self-discipline, suggesting a genetic influence on most NEO-PI-R scales. So, stats were correlated but not deterministic.
  - Early environments have a profound effect on neuroticism. The data in this study suggests that neuroticism is around 40% heritable.
- 
- A study of the Big Five personality traits amongst monozygotic and dizygotic twins in Vancouver, Canada found that Openness, Agreeableness, and Conscientiousness had significant changes in similarity of twins raised in different environments ([Bergeman, Chlpuer, Plomin, et al., 1993](#))
    - Used the NEO-PI to evaluate three dimensions: Openness, Conscientiousness, and Agree-ableness (Bergeman et al., 1993).
      - Two samples were examined: **twins reared apart and twins reared together.**
      - The monozygotic (MZ) and dizygotic (DZ) twins reared apart correlated .43 and .23, respectively, for Openness, **.15 and —.03 for Conscientiousness**, and .19 and .10 for Agreeableness.
      - For MZ and DZ twins reared together, the correlations were slightly higher: for Openness, .51 and .14, **for Conscientiousness, .41 and .23**, and for Agreeableness, .47 and .11, respectively.
      - Total genetic influences estimated using model fitting techniques accounted for **40%, 12%, and 29% of the variance for Openness, Agreeableness, and Conscientiousness, respectively.**
      - Although only Openness, Agreeableness, and Conscientiousness were examined in this study, neuroticism likely would also see a similar decrease in similarity of personality if the identical twins were raised apart
- 
- [Meta analysis](#) looked at the field of personality heritability and tested for possible moderator effects of heritability estimates
    - Total of 134 primary studies with 62 independent effect sizes, and more than 100,000 participants
    - First hypothesis was that there would be a statistically significant genetic effect on individual differences in personality
      - Meta analysis conducted for average personality heritability estimates and for each personality trait in three personality models (Eysenck's, Tellegens, FFM)
      - Looked at both twin and non-twin data, different from previous studies (Johnson et al., 2008) and (van den Berg et al., 2014)

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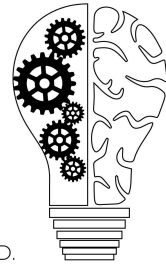
- *Average heritability estimate was 0.39, suggested that 39% of individual differences in personality were due to genetics while 61% could be due to environment*
- The Genomic-relatedness-matrix (GREML), a more recent study that looked at common genetic variants, is the first to point out additional heritability factors ([Power and Pluess, 2015](#)):
  - GREML used a sample of 5011 European adults with 527,000 single-nucleotide polymorphisms (SNPs) across the genome by looking at the proportion of shared SNPs to calculate an estimate of relatedness.
    - Significant heritability estimates for neuroticism (15% s.e.= 0.08, P=0.04) and openness (21% s.e.= 0.08, P<0.01)
      - Personalities are vastly complex and the effect of one's environment can't be overstated.

## Candidate gene studies of neuroticism

- A literature review of the genetics of affective and anxiety disorders revealed the *5-HTTLPR repeat polymorphism* of the serotonin transporter gene as a potential cause of anxiety-related traits ([Leonardo and Hen, 2006](#)).
  - This region in the gene codes for serotonin transport
  - Additionally, this polymorphism plays a major role of the serotonergic system in emotion processing by influencing transcription factors, and is often the target of psychopharmacological interventions for anxiety disorders
- Another meta analysis showed small but significant differences on N scores between individuals with at least one short 5-HTTLPR allele and individuals with all long alleles ([Munafò, Clark, Roberts, et al., 2006](#)):
  - The analysis is centralized around whether trait neuroticism mediates the association between 5-HTTLPR alleles and lifetime major depression.
  - 251 participants completed the Eysenck Personality Questionnaire and an adapted version of the depression section of the structured clinical interview for DSM-III diagnosis
  - The 5HTT-LPR genotype was significantly associated with both neuroticism ( $p=0.017$ ) and major depression ( $p<0.001$ )
    - Neuroticism accounted for 42.3% of the effect of the 5HTT-LPR gene on lifetime risk for major depression:

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|              | 5HTT-LPR genotype |               |              | p     |
|--------------|-------------------|---------------|--------------|-------|
|              | l/l (n = 76)      | l/s (n = 129) | s/s (n = 46) |       |
| Extraversion | 11.03 (5.08)      | 11.25 (5.28)  | 11.07 (4.72) | 0.949 |
| Neuroticism  | 12.59 (5.78)      | 11.71 (5.77)  | 14.59 (5.94) | 0.017 |
| Psychoticism | 1.74 (1.51)       | 1.77 (1.52)   | 1.76 (1.72)  | 0.991 |

|                | Log OR | SE    | OR   | 95% CI    | Z    | p      |
|----------------|--------|-------|------|-----------|------|--------|
| <b>Model 1</b> |        |       |      |           |      |        |
| Sex            | 1.019  | 0.293 | 2.77 | 1.56–4.92 | 3.48 | <0.001 |
| Age            | 0.003  | 0.003 | 1.00 | 1.00–1.01 | 1.08 | 0.28   |
| 5HTT (l/s)     | 0.161  | 0.316 | 1.17 | 0.63–2.18 | 0.51 | 0.61   |
| 5HTT (s/s)     | 0.957  | 0.395 | 2.60 | 1.20–5.65 | 2.42 | 0.02   |
| <b>Model 2</b> |        |       |      |           |      |        |
| Sex            | 0.678  | 0.329 | 1.97 | 1.03–3.76 | 2.06 | 0.04   |
| Age            | 0.004  | 0.003 | 1.00 | 0.99–1.01 | 1.24 | 0.21   |
| 5HTT (l/s)     | 0.260  | 0.355 | 1.30 | 0.65–2.60 | 0.73 | 0.46   |
| 5HTT (s/s)     | 0.653  | 0.448 | 1.92 | 0.80–4.62 | 1.46 | 0.14   |
| Neuroticism    | 0.213  | 0.033 | 1.24 | 1.16–1.32 | 6.48 | <0.001 |

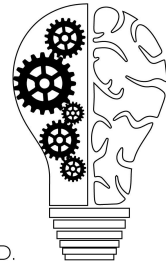
5HTT is compared with the l/l genotype group. OR = Odds ratio; SE = standard error.

## Psychopharmacological Treatment of Neuroticism by Targeting 5HTT-LPR Transporters

- Here's a [study](#) that looked at the possibility of treating major depression with quetiapine XR and citalopram using the role of 5-HTTLPR-S/Lg polymorphisms:
  - *SSRIs inhibit 5-HTT*; this theory comprises that citalopram-induced 5-HTT blockade in 5-HTTLPR-S/Lg carriers could *decrease availability of functional 5-HTT therefore decreasing amygdala response to negative emotions and increasing positive emotions*.
  - *However, there appeared to be no significant difference in the change of neuroticism scores between the quetiapine or citalopram treatment (t= .16, p= 0.87)*

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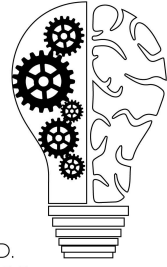
Table 2. Characteristics of MDD S/L<sub>G</sub> allele carriers in quetiapine XR and citalopram treatment groups

| Characteristics <sup>a</sup>         | MDD with S/L <sub>G</sub> allele |                     | Significance                      |
|--------------------------------------|----------------------------------|---------------------|-----------------------------------|
|                                      | Quetiapine XR (N = 13)           | Citalopram (N = 13) |                                   |
| Sex (F/M)                            | 7/6                              | 9/4                 | $\chi^2 = 0.65, df = 1, p = 0.42$ |
| Age                                  | 39.69 ± 10.03                    | 37.23 ± 10.83       | $t_{24} = 0.6, p = 0.55$          |
| Education (number of years)          | 15.62 ± 3.18                     | 14.54 ± 2.26        | $t_{24} = 0.92, p = 0.36$         |
| Number of previous episodes          | 2.15 ± 2.48                      | 1.85 ± 1.46         | $t_{24} = 0.38, p = 0.71$         |
| Age of onset (years)                 | 24.69 ± 10.13                    | 24.15 ± 9.54        | $t_{24} = 0.14, p = 0.89$         |
| Illness duration (months)            | 180 ± 102.2                      | 156 ± 117.8         | $t_{24} = 0.55, p = 0.58$         |
| Duration of current episode (months) | 36.15 ± 53.00                    | 42.62 ± 53.09       | $t_{24} = 0.31, p = 0.76$         |
| Average medication dose (mg)         | 219 mg/day                       | 20 mg/day           | –                                 |
| Neuroticism                          | 33.5 ± 5.13                      | 34.18 ± 10.79       | $t_{17} = 0.16, p = 0.87$         |

- A more recent [meta-analysis](#) of the Genome-wide Association Studies for Neuroticism found a novel locus for the personality trait:
  - 30 cohorts were examined from the Genetics of Personality Consortium to evaluate whether common genetic variants (SNPs) that predict neuroticism could also predict MDD.
  - Findings showed a genome-wide significant SNP found in 3p14 on the gene MAGI1 (rs35855737;  $P = 9.26 \times 10^{-9}$  in the discovery meta-analysis)
    - This was significant in the meta-analysis of all 30 cohorts ( $P = 2.38 \times 10^{-8}$ )
  - The MAGI1 gene is expressed in neuronal tissue, particularly the hippocampus, acting as a scaffolding protein in the neurite growth factor receptor-mediated signaling pathway.
    - Studies on this gene were previously associated with bipolar disorder, schizophrenia, and MDD.
      - This may be due to the potential role it plays in neuronal development, such as neurite outgrowth and synaptogenesis ([Ito, Morishita, Iwamoto, et al., 2013](#))
      - Also related to the *neurodevelopmental theory of mental illness*

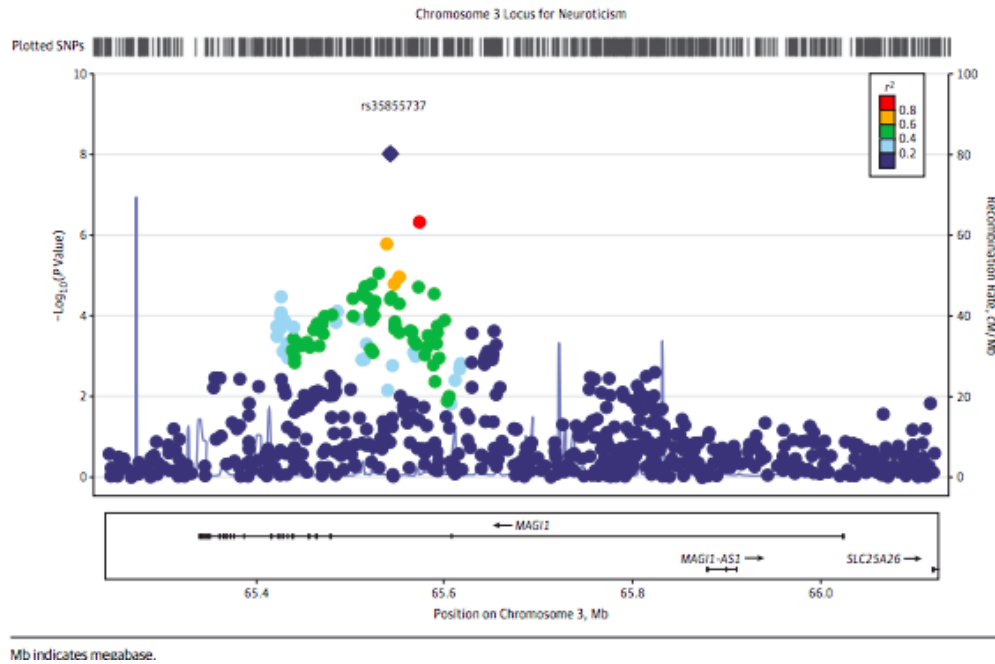
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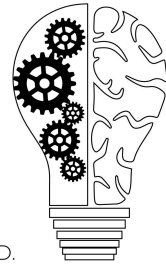


- Correlations between pain, phenotypes, and psychiatric traits such as depression and neuroticism ([Meng, Adams, Reel, et al., 2020](#)).
  - This study utilized the cross-trait linkage disequilibrium score regression (LDSC) to estimate genetic correlations of eight pain phenotypes with depressive symptoms, major depressive disorders, and neuroticism:
    - The eight described pain phenotypes were:
      - Headache
      - Facial pain
      - Neck/shoulder pain
      - Back pain
      - Stomach/abdominal pain
      - Hip pain
      - Knee pain
      - Generalized pain
    - “All pain phenotypes, except hip pain and knee pain, had significant and positive genetic correlations with depressive symptoms, major depressive disorders and

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neuroticism. All pain phenotypes were heritable, with pain all over the body showing the highest heritability ( $h^2 = 0.31$ , standard error = 0.072). Many pain phenotypes had positive and significant genetic correlations with each other indicating shared genetic mechanisms. Our results suggest that pain, neuroticism and depression share partially overlapping genetic risk factors.”



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| Pain phenotypes           | Heritability    |                       | Depressive symptoms    |                       | Major depressive disorder |                       | Neuroticism            |                       |
|---------------------------|-----------------|-----------------------|------------------------|-----------------------|---------------------------|-----------------------|------------------------|-----------------------|
|                           | $h^2$ (SE)      | $P$                   | rg                     | $P$                   | rg                        | $P$                   | rg                     | $P$                   |
| Headache                  | 0.21<br>(0.015) | $3.9 \times 10^{-45}$ | <b>0.52</b><br>(0.036) | $1.6 \times 10^{-46}$ | <b>0.39</b><br>(0.057)    | $1.6 \times 10^{-11}$ | <b>0.50</b><br>(0.028) | $2.2 \times 10^{-72}$ |
| Facial pain               | 0.24<br>(0.12)  | 0.036                 | <b>0.33</b><br>(0.091) | $2 \times 10^{-4}$    | 0.34<br>(0.137)           | 0.01                  | <b>0.30</b><br>(0.068) | $1.0 \times 10^{-5}$  |
| Neck or shoulder pain     | 0.11<br>(0.017) | $4.3 \times 10^{-11}$ | <b>0.55</b><br>(0.048) | $3.4 \times 10^{-30}$ | <b>0.40</b><br>(0.073)    | $5.8 \times 10^{-8}$  | <b>0.44</b><br>(0.039) | $5.3 \times 10^{-7}$  |
| Stomach or abdominal pain | 0.14<br>(0.050) | 0.004                 | <b>0.67</b><br>(0.134) | $5.7 \times 10^{-7}$  | <b>0.53</b><br>(0.15)     | $5 \times 10^{-4}$    | <b>0.70</b><br>(0.118) | $2.4 \times 10^{-9}$  |
| Back pain                 | 0.11<br>(0.020) | $8.4 \times 10^{-9}$  | <b>0.48</b><br>(0.063) | $1.5 \times 10^{-14}$ | <b>0.36</b><br>(0.086)    | $3 \times 10^{-5}$    | <b>0.40</b><br>(0.054) | $1.7 \times 10^{-13}$ |
| Hip pain                  | 0.12<br>(0.041) | 0.005                 | 0.34<br>(0.16)         | 0.03                  | 0.04<br>(0.167)           | 0.80                  | 0.27<br>(0.128)        | 0.04                  |
| Knee pain                 | 0.08<br>(0.029) | 0.007                 | 0.12<br>(0.083)        | 0.13                  | -0.07<br>(0.113)          | 0.53                  | 0.18<br>(0.057)        | 0.002                 |
| Pain all over body        | 0.31<br>(0.072) | $1.3 \times 10^{-5}$  | <b>0.69</b><br>(0.063) | $1.4 \times 10^{-27}$ | <b>0.43</b><br>(0.095)    | $5.6 \times 10^{-6}$  | <b>0.45</b><br>(0.054) | $3.4 \times 10^{-17}$ |

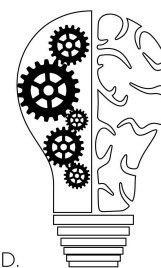
## Neuroticism and Psychopathology

There exists a consistent and robust association with mental disorders across the lifespan, with personality traits such as neuroticism holding weight as well.

- There is a very large effect size (Cohen's  $d > 1.0$ ) with Axis 1 disorders ([Kotov, Gamez, Schimdt and Watson, 2010](#)).
- Quantitative review of associations between higher order personality traits in the Big Three and Big Five models and specific depressive, anxiety, and substance-use disorders (SUD).

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- 66 meta-analyses and 175 studies published from 1980 to 2007 hypothesized that neuroticism would correlate with all disorders, but have the strongest links to the distress disorders (MDD, GAD, PTSD, and dysthymic disorders).
  - Second hypothesis- MDD, dysthymic disorder, phobias would have low extraversion scores.
  - Third hypothesis- Substance use disorder would be defined by high disinhibition, low conscientiousness, and low agreeableness.
  - Fourth hypothesis- openness would have weak associations with all disorders.

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Table 4  
Average Effect Sizes Corrected for Unreliability of Personality Scales

| Disorder           | Neuroticism              |         | Extraversion                |         | Disinhibition               |         | Conscientiousness           |         | Agreeableness               |         | Openness                    |         |
|--------------------|--------------------------|---------|-----------------------------|---------|-----------------------------|---------|-----------------------------|---------|-----------------------------|---------|-----------------------------|---------|
|                    | <i>d</i>                 | 80% CrI | <i>d</i>                    | 80% CrI | <i>d</i>                    | 80% CrI | <i>d</i>                    | 80% CrI | <i>d</i>                    | 80% CrI | <i>d</i>                    | 80% CrI |
| MDD                | <b>1.33</b> [0.44, 2.23] |         | -0.62 [-1.36, 0.13]         |         | 0.28 [-0.09, 0.65]          |         | <b>-0.90</b> [-1.42, -0.39] |         | -0.14 [-0.78, 0.49]         |         | -0.21 [-0.88, 0.47]         |         |
| Unipolar           | <b>1.54</b> [0.92, 2.17] |         | <b>-0.92</b> [-1.54, -0.30] |         | <b>0.25</b> [0.25, 0.25]    |         | <b>-1.13</b> [-1.88, -0.39] |         | -0.17 [-0.46, 0.11]         |         | -0.12 [-0.40, 0.17]         |         |
| Dysthymic disorder | <b>1.93</b> [1.01, 2.84] |         | <b>-1.47</b> [-2.47, -0.47] |         | <b>1.09</b> [0.39, 1.78]    |         | <b>-1.24</b> [-1.39, -1.09] |         | 0.26 [-0.69, 1.21]          |         | <b>-0.57</b> [-1.13, -0.01] |         |
| GAD                | <b>1.96</b> [1.33, 2.60] |         | <b>-1.02</b> [-1.86, -0.18] |         | <b>0.44</b> [0.22, 0.65]    |         | <b>-1.13</b> [-1.51, -0.76] |         | 0.18 [-0.67, 1.04]          |         | -0.40 [-1.04, 0.25]         |         |
| PTSD               | <b>2.25</b> [1.23, 3.27] |         | <b>-0.79</b> [-1.55, -0.03] |         | -0.02 [-0.68, 0.63]         |         | <b>-1.02</b> [-1.50, -0.54] |         | -0.70 [-2.38, 0.99]         |         | -0.30 [-0.99, 0.39]         |         |
| Panic disorder     | <b>1.92</b> [1.12, 2.72] |         | <b>-1.07</b> [-1.81, -0.34] |         | 0.05 [-0.54, 0.65]          |         | <b>-0.98</b> [-1.43, -0.53] |         | 0.08 [-0.64, 0.81]          |         | -0.41 [-1.09, 0.26]         |         |
| Agoraphobia        | <b>1.61</b> [0.86, 2.36] |         | <b>-0.98</b> [-1.82, -0.13] |         | 0.15 [-0.11, 0.41]          |         | <b>-0.96</b> [-1.20, -0.73] |         | 0.52 [-0.02, 1.05]          |         | <b>-0.70</b> [-1.32, -0.08] |         |
| Social phobia      | <b>1.63</b> [0.76, 2.49] |         | <b>-1.31</b> [-2.54, -0.08] |         | 0.19 [-0.16, 0.54]          |         | <b>-1.06</b> [-1.52, -0.61] |         | 0.32 [-0.50, 1.14]          |         | -0.47 [-1.09, 0.16]         |         |
| Specific phobia    | <b>0.92</b> [0.30, 1.53] |         | -0.20 [-0.65, 0.26]         |         | <b>-0.17</b> [-0.17, -0.17] |         | <b>-0.67</b> [-1.25, -0.08] |         | 0.00 [-0.25, 0.25]          |         | -0.10 [-0.44, 0.23]         |         |
| OCD                | <b>2.07</b> [1.25, 2.90] |         | <b>-1.12</b> [-1.85, -0.39] |         | <b>0.63</b> [0.04, 1.22]    |         | <b>-0.97</b> [-1.46, -0.47] |         | -0.06 [-0.69, 0.57]         |         | -0.14 [-0.87, 0.60]         |         |
| SUD                | <b>0.97</b> [0.13, 1.81] |         | -0.36 [-1.02, 0.29]         |         | <b>0.72</b> [0.36, 1.08]    |         | <b>-1.10</b> [-1.84, -0.36] |         | -0.60 [-1.30, 0.10]         |         | -0.16 [-0.72, 0.40]         |         |
| Alcohol            | <b>0.77</b> [0.02, 1.51] |         | -0.32 [-0.98, 0.35]         |         | <b>0.71</b> [0.32, 1.11]    |         | <b>-0.90</b> [-1.77, -0.03] |         | -0.44 [-1.33, 0.44]         |         | -0.04 [-0.62, 0.55]         |         |
| Mixed              | <b>1.14</b> [0.20, 2.09] |         | -0.39 [-0.93, 0.14]         |         | <b>0.71</b> [0.51, 0.92]    |         | <b>-1.34</b> [-1.79, -0.89] |         | <b>-0.74</b> [-1.18, -0.30] |         | -0.30 [-0.71, 0.10]         |         |
| Drugs              | <b>1.13</b> [0.63, 1.63] |         | <b>-0.33</b> [-0.61, -0.04] |         | <b>0.68</b> [0.40, 0.97]    |         | <b>-1.02</b> [-1.62, -0.42] |         | <b>-0.75</b> [-1.11, -0.39] |         | -0.38 [-0.98, 0.23]         |         |
| <i>M</i>           | 1.65                     |         | -0.90                       |         | 0.33                        |         | -1.01                       |         | -0.03                       |         | -0.32                       |         |

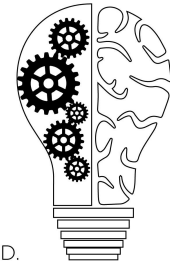
Note. Bold indicates that credibility interval (CrI) does not include zero. Mean excludes substance use disorders (SUD) subgroups (i.e., based only on the 11 diagnostic groups). MDD = major depressive disorder; unipolar = broad diagnosis of unipolar depression; GAD = generalized anxiety disorder; PTSD = posttraumatic stress disorder; OCD = obsessive-compulsive disorder.

- Common mental illnesses were strongly connected with personality, some effect sizes with a Cohen's *d* > 2.0.
  - All disorders were found to have a positive relationship with neuroticism and low conscientiousness
- Low specificity (all conditions were associated with high neuroticism and low conscientiousness) was to be expected given the high levels of comorbidity among mental illnesses
- Surprisingly, neuroticism had a relatively small effect on MDD, possibly suggesting that personality is less central to this disorder than what was previously thought.



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- However, there was a high association between GAD and neuroticism, often described as “an extreme form of neuroticism.”
- Small to medium effects for Axis II disorders ([Saulsman & Page, 2004](#))
  - This meta analysis examined the relationships between each of the Five Factor model personality dimensions and each of the 10 DSM-IV personality diagnostic categories:
    - Included paranoid, schizoid, schizotypal, antisocial, borderline, histrionic, narcissistic, avoidant, dependent, and obsessive-compulsive.

Table 5

Sample size weighted mean effect size estimates for each DSM-IV personality disorder and five-factor model personality dimension combination

| DSM-IV personality disorders | Five-factor model personality dimensions |                |          |          |                |
|------------------------------|--|----------------|----------|----------|----------------|
|                              | N  | E              | O        | A        | C              |
| Paranoid                     | <b>.28****</b>                           | -.12****       | -.04**   | -.34**** | -.07****       |
| Schizoid                     | <b>.13****</b>                           | <b>.23****</b> | -.12**** | -.17**** | -.03*          |
| Schizotypal                  | <b>.36****</b>                           | <b>.28****</b> | -.01     | -.21**** | -.13****       |
| Antisocial                   | <b>.09****</b>                           | .04            | .05**    | -.35**** | -.26****       |
| Borderline                   | <b>.49****</b>                           | -.09****       | .02      | -.23**** | -.23****       |
| Histrionic                   | .02                                      | <b>.42****</b> | .15****  | -.06**   | -.09***        |
| Narcissistic                 | .04                                      | <b>.20****</b> | .11****  | -.27**** | -.05*          |
| Avoidant                     | <b>.48****</b>                           | -.44****       | -.09**** | -.11**** | -.10****       |
| Dependent                    | <b>.41****</b>                           | -.13****       | -.11**** | .05**    | -.14****       |
| Obsessive-Compulsive         | <b>.08****</b>                           | -.12****       | -.07**** | -.04     | <b>.23****</b> |
| Mean                         | .24                                      | -.07           | -.01     | -.17     | -.09           |
| Median                       | .20                                      | -.12           | -.02     | -.19     | -.09           |

N = Neuroticism. E = Extraversion. O = Openness to experience. A = Agreeableness. C = Conscientiousness. Effect sizes  $\geq .20$  are in bold. The total number of participants on which sample size weighted mean effect sizes are based is 1158. The number of independent effect sizes on which means are based is 15.

\*  $P < .05$  (one-tailed).

\*\*  $P < .01$  (one-tailed).

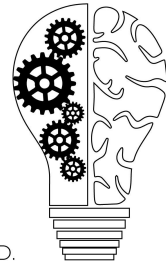
\*\*\*  $P < .001$  (one-tailed).

\*\*\*\*  $P < .0001$  (one-tailed).

- Disorders characterized by emotional distress had *positive associations with neuroticism* (paranoid ( $r = .28$ ,  $P < .01$ ), schizotypal ( $r = .36$ ,  $P < .01$ ), borderline ( $r = .49$ ,  $P < .01$ ), avoidant ( $r = .48$ ,  $P < .01$ ), and dependent ( $r = .41$ ,  $P < .01$ ))
  - Neuroticism and agreeableness were the most prominent and consistent with their effect sizes across all the disorders
- Disorders characterized with gregariousness (histrionic and narcissistic) had *positive associations* with extraversion.

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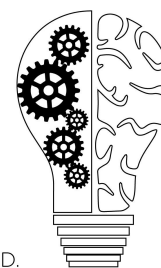
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- Disorders with interpersonal difficulties (paranoid, schizotypal, antisocial, borderline, and narcissistic) had *negative associations* with agreeableness.
  - Disorders with orderliness (obsessive-compulsive) had positive associations with conscientiousness while disorders with recklessness (borderline and antisocial) had *negative associations* with conscientiousness.
  - “This suggests that neurotic and disagreeable type traits are of primary importance as they are relevant to most personality disorders and that extraverted-introverted type traits are of next importance as they are relevant to some personality disorders.”
- 
- A more recent [study](#) that linked neuroticism with vulnerable narcissism found variable presentations of narcissism. Some emphasized grandiosity while others emphasize fragility and negative affectivity (narcissistic grandiosity vs narcissistic vulnerability)
    - Multiple measures have been developed for assessing both types of narcissism
    - Vulnerable narcissism is characterized by greater *internalizing symptoms and psychological distress*
    - Grandiose narcissism is characterized by *externalizing behaviors*. For example, anger and aggression following egocentric threats
      - Traditionally associated with high extraversion and low agreeableness
  - This study tested the extent to which vulnerable narcissism is characterized by elevated scores on neuroticism, thereby hypothesizing that neuroticism would account for the majority of variance in vulnerable narcissism compared to the other Big Five traits.
    - Narcissism was measured with the Hypersensitive Narcissism Scale (Hendin & Cheek, 1997), Five-Factor Narcissism Inventory (Glover et al., 2012), and Pathological Narcissism Inventory (Pincus et al., 2009) while the NEO-PI-R (Costa & McCrae, 1992) was used to evaluate facets of the Big Five

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**Table 2** General Dominance Weights for FFM Domains

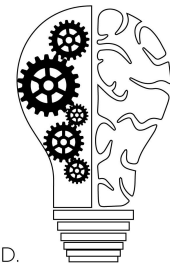
|                                     | Neuroticism            | Extraversion           | Openness              | Agreeableness          | Conscientiousness      | R <sup>2</sup> |
|-------------------------------------|------------------------|------------------------|-----------------------|------------------------|------------------------|----------------|
| S1: Vulnerable narcissism composite | .66**                  | -.25**                 | -.04                  | -.28**                 | -.16                   | .52            |
| GD weight                           | .41 (79%) <sup>a</sup> | .03 (6%) <sup>bc</sup> | .00 (0%) <sup>d</sup> | .07 (13%) <sup>b</sup> | .01 (2%) <sup>c</sup>  |                |
| S2: PNI Vulnerable                  | .64**                  | -.32**                 | .02*                  | -.51**                 | -.35*                  | .50            |
| GD weight                           | .28 (56%) <sup>a</sup> | .04 (8%) <sup>c</sup>  | .00 (0%) <sup>d</sup> | .14 (28%) <sup>b</sup> | .04 (8%) <sup>c</sup>  |                |
| S3: Vulnerable narcissism composite | .70**                  | -.30**                 | .02                   | -.41**                 | -.46**                 | .58            |
| GD weight                           | .36 (62%) <sup>a</sup> | .04 (7%) <sup>b</sup>  | .00 (0%) <sup>c</sup> | .10 (17%) <sup>d</sup> | .08 (14%) <sup>d</sup> |                |
| S4: Vulnerable narcissism composite | .80**                  | -.43**                 | -.28**                | -.50**                 | -.33**                 | .73            |
| GD weight                           | .46 (63%) <sup>a</sup> | .07 (10%) <sup>b</sup> | .04 (5%) <sup>b</sup> | .12 (16%) <sup>b</sup> | .04 (5%) <sup>b</sup>  |                |

Note. FFM = Five-Factor Model; S1 = Sample 1; S2 = Sample 2; S3 = Sample 3; S4 = Sample 4; GD weight = general dominance weight; PNI = Pathological Narcissism Inventory. The first row for each sample contains the zero-order correlation between the domain and VN. The proportion of R<sup>2</sup> accounted for is derived from the ratio of the general dominance weight to the total R<sup>2</sup>. Percentages with mismatching superscripts indicate that the general dominance weights are significantly different from one another based on bootstrapped 95% confidence intervals. Matching superscripts indicate no significant differences between general dominance weights. Sample 1 (N = 237); Sample 2 (N = 347); Sample 3 (N = 596); Sample 4 (N = 98). \*\*p < .01.

- Findings showed strong relationships between neuroticism and vulnerable narcissism in *all samples* (undergraduate students, online participants, and community participants).
- Overall, the Five-Factor Model accounted for 50-73% of the variance in vulnerable narcissism scores with neuroticism accounting for a large majority of variance (average 65%).
- Multiple mechanisms likely link neuroticism and various mood disorders in different individuals ([Widiger, 2017](#)).
- Vulnerability explanations hypothesize that personality traits increase the risk of later psychopathology
  - This could be due to the fact neurotic individuals do not manage themselves well under stress and look for others to solve their problems.
- On the other hand, the spectrum model states that personality traits and mental disorders lay on related spectra, transcending personality/psychopathology boundaries
  - For example, generalized anxiety disorder as an extreme version of neuroticism
- Neurotic individuals are more likely to use avoidance coping mechanisms, such as self-blame and wishful thinking ([Bolger, 1990](#))
  - A recent [study](#) looked to explore relationship between neuroticism, perfectionism and coping strategies among patients with depression and anxiety

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- Studies of psychiatric ward patients showed that neuroticism was positively linked with maladaptive perfectionism and avoidant coping strategies ( $r = .51, p < .01$ )
  - Furthermore, maladaptive perfectionism was found to be a predictor of depression ( $\beta = .39, p < .05$ )
  - Anxiety patients scored significantly higher on avoidant coping strategies ( $r = .41, p < .01$ )
- 
- More neurotic people have been shown to have lower *perceived* quality of social support ( $\beta = -.304, p < .01$ ) ([Swickert and Owens, 2010](#)) and decreased levels of marriage satisfaction ( $\beta = .220, t(80) = -2.30, p < .024$ ) ([Rogge, Bradbury, Hahlweg, et al., 2009](#)).

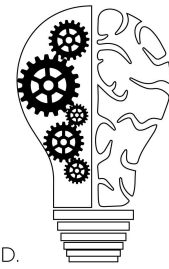
## Physical Health Effects of Neuroticism

A [longitudinal study](#) looked at the long-term effects of neuroticism on physical health in twins:

- 21,676 adult twins were studied. Neuroticism was assessed in 1973 and data on physical conditions was recorded 25 years later.
  - Neuroticism is related to stress and emotional stability which is correlated with physical symptoms and disease presence.
  - Chronic emotional instability creates physiological changes detrimental to health.
- 
- Results showed that likelihood of having a physical condition (Chronic fatigue syndrome (OR=1.56), ulcers (OR=1.30), coronary heart disease (OR=1.13)) is related to higher levels of prior neuroticism.
- 
- 21-year [prospective study](#) of 5,424 adults found that every 1 standard unit deviation difference in neuroticism was associated with 10% greater mortality from cardiovascular disease:
    - Each participant completed the Eysenck Personality Inventory in 1984 to 1985. Mortality was then tested 21 years after baseline.
    - There appeared to be a greater mortality from cardiovascular disease even after controlling for occupational social class, education, smoking, alcohol consumption, physical activity, and health.
    - Neuroticism was *not* found to be associated with deaths from stroke, respiratory disease, lung cancer, or other cancers

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TABLE 4. Hazard Ratios (95% Confidence Intervals) and *p* Values for Risk of Death From Cardiovascular Disease, Coronary Heart Disease, and Stroke Associated With 1-Standard Deviation Increase in Each of the Personality Measures for All Age Groups With ≥100 Events (*n* = 5424)

| Age Group                   | Cardiovascular Disease                 |  | Coronary Heart Disease                 |                                       | Stroke                                |                                       |
|-----------------------------|--|--|--|---------------------------------------|---------------------------------------|---------------------------------------|
|                             | Neuroticism                            | Extraversion                           | Neuroticism                            | Extraversion                          | Neuroticism                           | Extraversion                          |
| All ages                    |  |  |  |                                       |                                       |                                       |
| Baseline <sup>a</sup>       | 1.12<br>(1.03–1.21)<br><i>p</i> = .011 | 1.03<br>(0.94–1.13)<br><i>p</i> = .52  | 1.14<br>(1.02–1.28)<br><i>p</i> = .024 | 1.02<br>(0.90–1.15)<br><i>p</i> = .75 | 1.10<br>(0.93–1.30)<br><i>p</i> = .27 | 1.06<br>(0.89–1.27)<br><i>p</i> = .49 |
| Fully adjusted <sup>b</sup> | 1.10<br>(1.00–1.20)<br><i>p</i> = .039 | 1.04<br>(0.95–1.14)<br><i>p</i> = .41  | 1.10<br>(0.98–1.24)<br><i>p</i> = .099 | 1.03<br>(0.90–1.17)<br><i>p</i> = .69 | 1.10<br>(0.92–1.30)<br><i>p</i> = .29 | 1.07<br>(0.88–1.28)<br><i>p</i> = .50 |
| GHQ <sup>c</sup>            | 1.09<br>(0.98–1.21)<br><i>p</i> = .11  | —                                      | 1.08<br>(0.94–1.25)<br><i>p</i> = .28  | —                                     | 1.07<br>(0.87–1.33)<br><i>p</i> = .50 | —                                     |
| 40–59 years                 |  |  |  |                                       |                                       |                                       |
| Baseline <sup>a</sup>       | 1.13<br>(0.96–1.33)<br><i>p</i> = .13  | 1.20<br>(1.02–1.42)<br><i>p</i> = .032 | N/A                                    | N/A                                   | N/A                                   | N/A                                   |
| Fully adjusted <sup>b</sup> | 1.08<br>(0.92–1.28)<br><i>p</i> = .35  | 1.18<br>(0.99–1.42)<br><i>p</i> = .068 | N/A                                    | N/A                                   | N/A                                   | N/A                                   |
| GHQ <sup>c</sup>            | 1.04<br>(0.86–1.26)<br><i>p</i> = .69  | —                                      | N/A                                    | N/A                                   | N/A                                   | N/A                                   |
| 60+ years                   |  |  |  |                                       |                                       |                                       |
| Baseline <sup>a</sup>       | 1.10<br>(1.00–1.22)<br><i>p</i> = .05  | 0.97<br>(0.87–1.08)<br><i>p</i> = .59  | 1.12<br>(0.97–1.29)<br><i>p</i> = .11  | 0.95<br>(0.82–1.11)<br><i>p</i> = .52 | 1.11<br>(0.91–1.34)<br><i>p</i> = .31 | 1.00<br>(0.82–1.23)<br><i>p</i> = .97 |
| Fully adjusted <sup>b</sup> | 1.09<br>(0.98–1.21)<br><i>p</i> = .11  | 0.99<br>(0.88–1.10)<br><i>p</i> = .81  | 1.08<br>(0.94–1.25)<br><i>p</i> = .28  | 0.96<br>(0.82–1.13)<br><i>p</i> = .64 | 1.13<br>(0.92–1.38)<br><i>p</i> = .25 | 0.99<br>(0.80–1.23)<br><i>p</i> = .96 |
| GHQ <sup>c</sup>            | 1.12<br>(0.98–1.28)<br><i>p</i> = .10  | —                                      | 1.09<br>(0.91–1.30)<br><i>p</i> = .37  | —                                     | 1.17<br>(0.91–1.51)<br><i>p</i> = .21 | —                                     |

N/A = The cell size for this group was <100 events.  
<sup>a</sup> Adjusted for age and gender.  
<sup>b</sup> Adjusted for age, gender, occupational social class, education, smoking status, alcohol consumption, physical activity participation, forced expiratory volume, blood pressure and body mass index.  
<sup>c</sup> Adjusted for age, gender, and Gender Health Questionnaire (GHQ) score.

- [Study](#) that examined data from the National Comorbidity Survey showed that neuroticism was associated with increased odds of arthritis (OR=1.5), diabetes (OR=3.33), kidney/liver disease (OR=2.56), stomach/gallbladder problems (OR=2.27), and ulcers (OR=3.23) (Goodwin, Cox, and Clara, 2006):
  - Associations were still significant even when controlling for differences in demographic characteristics and comorbid mental disorders.
- Neuroticism is shown to affect the immune system. [Study](#) showed that pro-inflammatory cytokines IFN- $\gamma$ , IL-5, and IL-12 levels were associated with overall neuroticism score. Neuroticism caused an upregulation of inflammatory agents which are involved in the development of depression (Schmidt, Sander, Minkwitz, et al., 2018).
  - Participants were 37 depressed and 175 non-depressed subjects who completed both the Beck Depression Inventory II and the NEO-PIR-N

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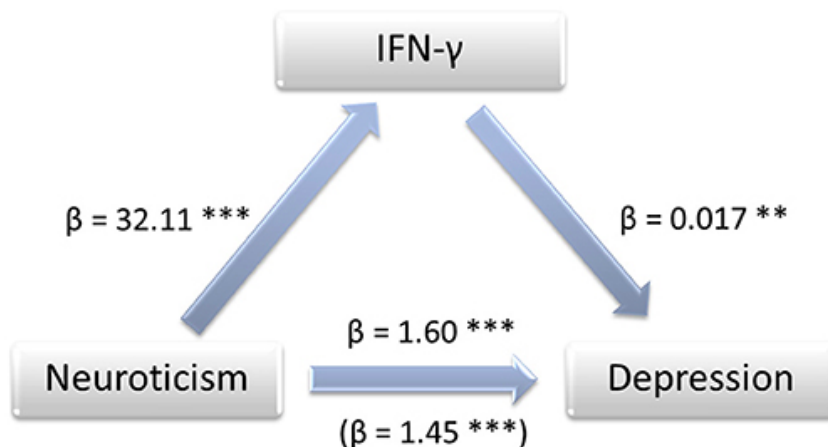
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- Cytokines were measured with blood draws and the Bio-Plex Pro human cytokine Th1/Th2 (assay that detects IL-2, IL-4, IL-5, IL-10, IL-12, IL-13, GM-CSF, IFN- $\gamma$ , and TNF- $\alpha$ )
- Multiple regression analyses were performed to determine the relationship between the dependent variable (scores) and each of the cytokine values



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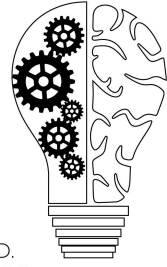


- The mediation model was also used to investigate whether the effect of neuroticism is mediated by cytokines.
  - Results showed that serum levels of IFN- $\gamma$ , IL-5, and IL-12 were positively associated with neuroticism scores. None of the anti-inflammatory cytokines were associated.
  - Markers of inflammation may be significant mediators for positive relationship between neuroticism and depressive symptoms.
- Neuroticism has been shown to be associated with lifetime asthma diagnosis ([Najjab, Palka, and Brown, 2020](#))
    - Examined association of personality traits and lifetime asthma diagnosis in a sample of almost 4000 participants. Personality was measured at a single point in time with the BFI-54 and asthma diagnoses were self-reported.
    - Binary logistic regression showed higher traits of neuroticism  $\beta = 0.024$ ,  $p = .03$ , OR = 1.025) and openness ( $\beta = 0.041$ ,  $p < .001$ , OR = 1.042) were associated with an increased lifetime risk of asthma diagnosis. Conscientiousness was found to be associated with decreased risk.
  - Neuroticism scores have also been shown to be significantly higher in diarrhea-predominant IBS patients when compared to patients with ulcerative colitis and general medical patients ([Muscatello, Bruno, Mento, et al., 2016](#)).

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- IBS patients were significantly more neurotic and less extroverted than the general population



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TABLE 2. EPI data Mean  $\pm$  S.S. Results for normal population taken from Eysenck and Eysenck

|                   | n    | Extroversion score | Neuroticism score | Lie score       |
|-------------------|------|--------------------|-------------------|-----------------|
| Sub-group of IBS  | 25   | 9.36 $\pm$ 3.12    | 11.64 $\pm$ 5.67  | 3.24 $\pm$ 1.76 |
| Matched PD        | 25   | 10.36 $\pm$ 4.30   | 15.89 $\pm$ 4.85  | 2.88 $\pm$ 1.96 |
| IBS vs PD         |      | n.s.               | $P < 0.01$        | n.s.            |
| IBS               | 41   | 10.66 $\pm$ 3.62   | 11.98 $\pm$ 5.62  | 4.02 $\pm$ 1.96 |
| Normal population | 2000 | 12.07 $\pm$ 4.37   | 9.06 $\pm$ 4.78   | 2.26 $\pm$ 1.57 |
| IBS vs Normal     |      | $P < 0.001$        | $P < 0.001$       | $P < 0.001$     |

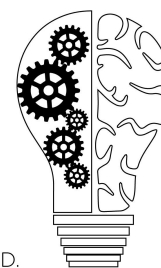
## Causal Pathways of Health Effects Due to Neuroticism

- More neurotic patients tend to report more somatic complaints, distorted cognition regarding symptoms, and greater use of medical services (Goubert, Crombez, and Van Damme, 2004).
  - [The study](#) examined the role of pain catastrophizing, pain-related fear and personality dimensions in vigilance to pain and pain severity
    - Pain catastrophizing: maladaptive cognitive-affective response to pain that involves negative thinking regarding the pain experience
  - Questionnaire survey was filled out by patients with chronic or recurrent lower back pain
    - Pain severity: Multidimensional Pain Inventory
    - Vigilance to pain: Pain Vigilance and Awareness Questionnaire
    - Catastrophic thinking about pain: Pain Catastrophizing Scale
    - Fear of reinjury: Tampa Scale for Kinesiophobia
    - Personality: NEO-FFI
  - Results showed that hypothesized structural model had a good fit  $\chi^2(40)=66.45$  ( $P=0.005$ ), RMSEA=0.07 (90% confidence interval: 0.04–0.10), CFI=0.96,

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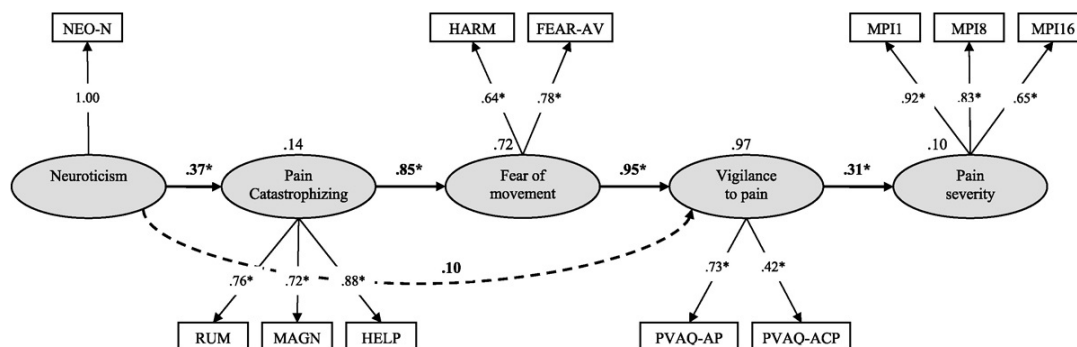
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GFI=0.91 and AGFI=0.85. Pain catastrophizing and fear of movement/reinjury mediated relationship between neuroticism and vigilance to pain.



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Structural equation model showing the role of neuroticism, pain catastrophizing and fear of movement/(re)injury in vigilance to pain. NEO-N, neuroticism subscale of the NEO-FFI; RUM, rumination subscale of the PCS; MAGN, magnification subscale of the PCS; HELP, helplessness subscale of the PCS; HARM, harm subscale of the TSK-AV; FEAR-AV, fear-avoidance subscale of the TSK-AV; PVAQ-AP, vigilance to pain subscale of the PVAQ; PVAQ-ACP, vigilance to changes in pain subscale of the PVAQ. \* $p < 0.05$ .

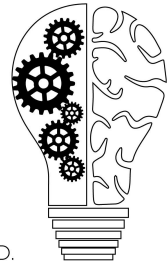
- Results summarized
  - Vigilance to pain was related to experience of more severe pain
  - Only neuroticism was found to be consistently related to vigilance to pain, catastrophizing, and fear of reinjury
  - Pain catastrophizing and fear of reinjury mediated the relationships between pain severity and pain catastrophizing
- Neurotic individuals may be more likely to engage in health-risk behaviors including alcohol or drug use, unsafe sexual practices, or violent/aggressive behavior.
  - [A study](#) of university students examined whether neuroticism, emotional regulation deficits, and/or their interactions increased engagement in risky behaviors
    - Participants filled out the Mood and Anxiety Symptom Questionnaire, FFI-N, Meta-Regulation Scale, and the Risky Behavior Questionnaire for University Students
    - Results showed that participants who had both high levels of neuroticism and low levels of emotional repair reported higher levels of risky behaviour only when experiencing high levels of anxiety symptoms ( $b=0.15$ ;  $t(666)=3.12$ ,  $p<0.01$ ).
  - [Study](#) examining data from the VA Normative Aging Study found that one health behavior, smoking, attenuated the effect of neuroticism on mortality by 40%



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- Conducted a survival analysis that drew upon measurements of neuroticism made in 1975 to predict time-to-death over 30 years in a sample of older men
- Hypothesized that health behaviors (smoking and drinking) would partially explain the mortality risk of high neuroticism
- Found positive correlations with neuroticism and drinking/smoking. 40% of the effect of neuroticism on mortality was mediated by smoking behavior. 60% remained unexplained, suggesting the effect of pathways other than health behaviors (biological).



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| Risk factor | Hazard ratio (95% C.I.) |                     |
|-------------|-------------------------|---------------------|
|             | Model 1                 | Model 2             |
| Age         | 1.10 (1.09–1.11)***     | 1.11 (1.10–1.12)*** |
| Smoking     | 2.15 (1.76–2.63)***     | 2.13 (1.73–2.61)*** |
| Neuroticism |                         | 1.04 (1.03–1.07)**  |
| AIC         | 8801                    | 8736                |
| -2LL        | 8805                    | 8742                |

\*\*

$p < 0.01$ .

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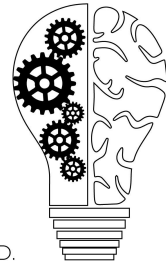
$p < 0.001$ .

## Neuroticism and Quality of Life

- Higher levels of neuroticism are associated with higher levels of burnout and emotional exhaustion ([Armon, Shirom, and Melamed, 2012](#)).
  - Study investigated the across-time effects of personality traits on burnout and its facets (physical fatigue, emotional exhaustion, cognitive weariness). Took data from one time period as a baseline and at a 24-month follow up.
    - Hypothesized neuroticism as a positive predictor of the base and follow-up levels of global burnout. Also expected it to positively predict the physical, emotional, and cognitive facets of burnout.

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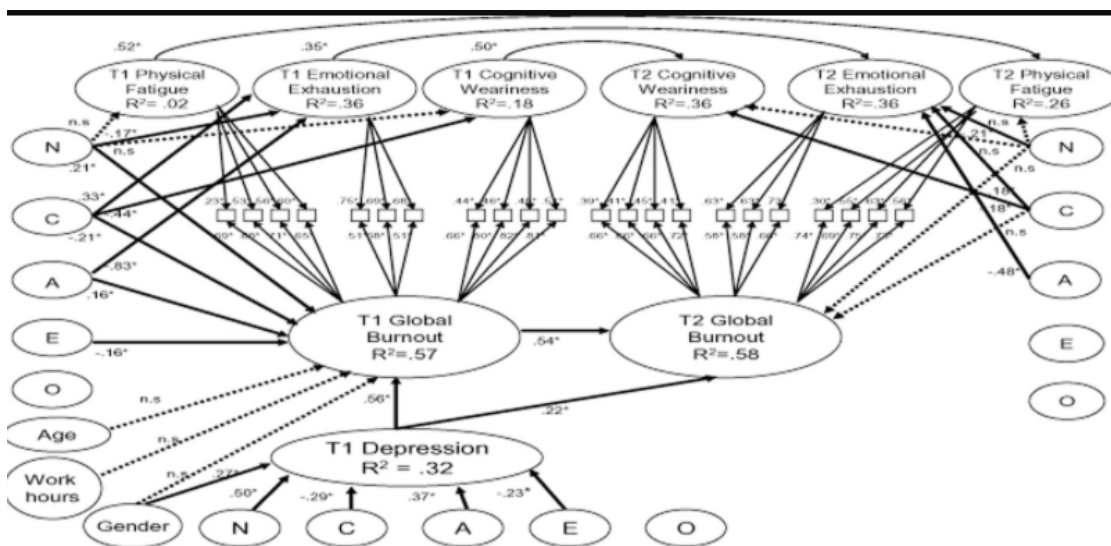
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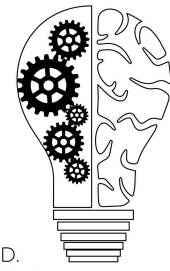
- Results showed that neuroticism was a positive predictor of global burnout as baseline ( $\beta = .21, p < .05$ ). Also found to significantly predict emotional exhaustion at both time periods (T1 and T2 ( $\beta = -.18, -.21$ , respectively;  $p < .05$ ))



- Neuroticism is also associated with decreased levels of marital satisfaction over time. ([O'Meara and South, 2019](#))
  - Study that used latent growth-curve modeling to estimate the initial levels and the rate of change in the Big Five Model domains and marital satisfaction to find any associations
  - Followed individuals for 18 years, one of the longest follow-up periods in relationship research
  - Results showed that neuroticism was significantly negatively associated with satisfaction at all 3 time points.
    - Extraversion and Openness demonstrated small, positive but significant associations with satisfaction
    - Conscientiousness and agreeableness were only significantly positive at two time points

# Episode 092: The Big Five: Neuroticism Part 1

Alec Zane B.A., Alexis Carnduff B.S., David Puder M.D.



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**TABLE 1** Bivariate correlations, means, and standard deviations for all study variables

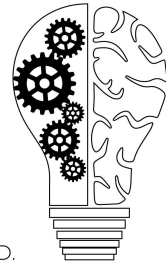
|      | T1 S    | T1 A   | T1 E    | T1 N    | T1 C    | T1 O    | T2 S    | T2 A    | T2 E    | T2 N    | T2 C   | T2 O    | T3 S    | T3 A   | T3 E   | T3 N    | T3 C   | T3 O |  |
|------|---------|--------|---------|---------|---------|---------|---------|---------|---------|---------|--------|---------|---------|--------|--------|---------|--------|------|--|
| T1 S | 1.00    |        |         |         |         |         |         |         |         |         |        |         |         |        |        |         |        |      |  |
| T1 A | 0.14**  | 1.00   |         |         |         |         |         |         |         |         |        |         |         |        |        |         |        |      |  |
| T1 E | 0.16**  | 0.55** | 1.00    |         |         |         |         |         |         |         |        |         |         |        |        |         |        |      |  |
| T1 N | -0.22** | -0.04  | -0.16** | 1.00    |         |         |         |         |         |         |        |         |         |        |        |         |        |      |  |
| T1 C | 0.18**  | 0.28** | 0.27**  | -0.16** | 1.00    |         |         |         |         |         |        |         |         |        |        |         |        |      |  |
| T1 O | 0.11**  | 0.37** | 0.51**  | -0.17** | 0.28**  | 1.00    |         |         |         |         |        |         |         |        |        |         |        |      |  |
| T2 S | 0.65**  | 0.11** | 0.14**  | -0.16** | 0.12**  | 0.10**  | 1.00    |         |         |         |        |         |         |        |        |         |        |      |  |
| T2 A | 0.15**  | 0.64** | 0.37**  | -0.03   | 0.22**  | 0.22**  | 0.19**  | 1.00    |         |         |        |         |         |        |        |         |        |      |  |
| T2 E | 0.17**  | 0.36** | 0.67**  | -0.11** | 0.20**  | 0.34**  | 0.19**  | 0.50**  | 1.00    |         |        |         |         |        |        |         |        |      |  |
| T2 N | -0.18** | -0.03  | -0.11** | 0.64**  | -0.09** | -0.13** | -0.22** | -0.13** | -0.19** | 1.00    |        |         |         |        |        |         |        |      |  |
| T2 C | 0.16**  | 0.18** | 0.16**  | -0.07*  | 0.62**  | 0.21**  | 0.15**  | 0.27**  | 0.26**  | -0.13** | 1.00   |         |         |        |        |         |        |      |  |
| T2 O | 0.12**  | 0.26** | 0.36**  | -0.15** | 0.26**  | 0.69**  | 0.14**  | 0.35**  | 0.50**  | -0.20** | 0.33** | 1.00    |         |        |        |         |        |      |  |
| T3 S | 0.53**  | 0.06   | 0.11*   | -0.15** | 0.05    | 0.06    | 0.64**  | 0.04    | 0.09*   | -0.21** | 0.02   | 0.09*   | 1.00    |        |        |         |        |      |  |
| T3 A | 0.09*   | 0.64** | 0.34**  | -0.04   | 0.22**  | 0.19**  | 0.05    | 0.64**  | 0.32**  | -0.10*  | 0.20** | 0.28**  | 0.05    | 1.00   |        |         |        |      |  |
| T3 E | 0.15**  | 0.32** | 0.67**  | -0.07   | 0.17**  | 0.32**  | 0.13**  | 0.33**  | 0.71**  | -0.13** | 0.16** | 0.39**  | 0.11**  | 0.50** | 1.00   |         |        |      |  |
| T3 N | -0.16** | -0.02  | -0.10*  | 0.57**  | -0.05   | -0.18** | -0.18** | -0.02   | -0.10*  | 0.66**  | -0.07  | -0.15** | -0.26** | -0.08* | -0.08  | 1.00    |        |      |  |
| T3 C | 0.07    | 0.16** | 0.15**  | -0.10*  | 0.57**  | 0.19**  | 0.06    | 0.15**  | 0.14**  | -0.11** | 0.65** | 0.25**  | 0.05    | 0.27** | 0.24** | -0.17** | 1.00   |      |  |
| T3 O | 0.11*   | 0.25** | 0.30**  | -0.11*  | 0.18**  | 0.59**  | 0.12**  | 0.23**  | 0.33**  | -0.16** | 0.18** | 0.71**  | 0.11**  | 0.39** | 0.49** | -0.17** | 0.31** | 1.00 |  |
| M    | 79.45   | 3.47   | 3.19    | 2.23    | 3.42    | 3.01    | 81.16   | 3.41    | 3.09    | 2.08    | 3.45   | 2.87    | 81.96   | 3.42   | 3.09   | 2.10    | 3.47   | 2.88 |  |
| SD   | 12.26   | 0.49   | 0.56    | 0.65    | 0.44    | 0.51    | 11.60   | 0.50    | 0.57    | 0.63    | 0.45   | 0.52    | 11.84   | 0.50   | 0.58   | 0.62    | 0.45   | 0.52 |  |

Note. T1 = Time 1, T2 = Time 2, T3 = Time 3, S = Satisfaction, A = Agreeableness, E = Extraversion, N = Neuroticism, C = Conscientiousness, O = Openness to Experience, M = mean, SD = standard deviation. \* $p < 0.05$ ; \*\* $p < 0.01$ .

- Measurements in changes of traits over time showed that increasing neuroticism was related to decreasing slopes of marital satisfaction. Overall “detrimental for the trajectory of marital satisfaction”
- Another [recent meta-analysis](#) found a negative relationship between neuroticism and marriage quality
  - Systematic review that resulted in 18 correlational studies examining the relationship between personality traits and marital satisfaction
  - Findings suggested that couples high in neuroticism experience significantly lower levels of marital satisfaction ( $r = -0.439$ , 95% Confidence Interval [CI]: 0.27–0.60) while couples high in conscientiousness have high levels of marital satisfaction ( $r = 0.90$ , 95% CI: 0.84–0.95).

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### Top 10 Takeaway Points:

1. Neuroticism is defined as the individual's tendency to experience psychological distress
2. The different facets (domains) of neuroticism are anxiety, angry hostility, depression, self-consciousness, impulsiveness, and vulnerability
3. The gold standard measurement of neuroticism is the NEO PI-3
4. Neuroticism has been shown to be relatively stable throughout the lifetime and can have an impact on development
5. Neuroticism has been found to have moderate genetic heritability and several possible candidate genes have been identified
6. Studies show that neuroticism has moderate to strong associations with all major forms of psychopathology
7. Various mechanisms such as vulnerability explanations or the spectrum model can potentially explain the link between neuroticism and psychopathology
8. Longitudinal studies have found associations between neuroticism and physical health problems including chronic fatigue syndrome, ulcers, and coronary heart disease
9. Various mechanisms such as increased health risk behaviors and impaired immune function have been theorized to explain the negative effects secondary to neuroticism on physical health
10. Neuroticism has been found to have a negative effect on quality of life and marital satisfaction

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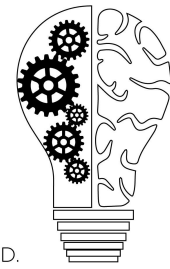
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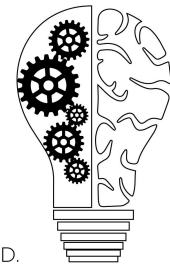
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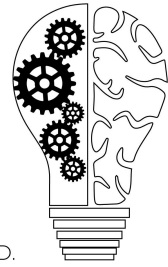
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