

Automatic Analysis of Personality Dimensions: Vision, Achievements and Challenges

Prof. Yair Neuman

<https://bgu.academia.edu/YairNeuman>

CLEF 2019

Lugano

Books

- Neuman, Y. (2014). *Introduction to computational cultural psychology*. Cambridge: Cambridge University Press.
- Neuman, Y. (2016). *Shakespeare for the intelligence agent: Toward understanding real personalities*. N.Y.: Rowman and Littlefield.
- Neuman, Y. (2016). *Computational personality analysis: Introduction, practical applications and future directions*. N.Y.: Springer.

Book chapters

- Neuman, Y. (2015). AI in public health surveillance and research. In D. Luxton (Ed.). ***Artificial intelligence in mental health practices***. N.Y.: Elsevier
- Neuman, Y. Assaf, D & Cohen, Y. (2016). Automatic identification of the splitting defense mechanism in texts. In M. Arntfield & M. Danesi (Eds.), ***The criminal humanities: An introduction***. N.Y.: Peter Lang
- Neuman, Y. (in press). Automatic diagnosis and screening of personality dimensions and mental health problems. In M. Lenca, M. Liang & F. Jotter (Eds.), ***Ethics of artificial intelligence in brain and mental health***. N.Y.: Springer

Journal papers

- Neuman, Y. et al., (2012). Proactive screening for **depression** through automatic and metaphorical text analysis. ***Artificial Intelligence in Medicine***, 56, 19-25
- Neuman Y, Cohen Y. (2014). A vectorial semantics approach to **personality** assessment. ***Scientific Reports***, 4
- Neuman, Y. (2014). Personality from a **cognitive-biological** perspective. ***Physics of Life Reviews***, 11(4), 650-686
- Neuman et al., (2015). Automatic profiling and screening for **school shooters**. ***Frontiers in Psychiatry***. doi: 10.3389/fpsy.2015.00086
- Neuman, Y. et al., (2016). The personality of **music** genres. ***Psychology of Music***, 44(5), 1044-1057
- Neuman, Y. et al., (2019). How to (better) identify a **perpetrator** in a haystack. ***Journal of Big Data*** (BIGD-D-18-00148R1)

Computational Personality Analysis in the Age of the Individual

My Opening Thesis

Understanding human personality is important than ever

The Changing *Zeitgeist*

In the past, and until quite recently in historical terms, it was more important to know **What** you are (e.g. a Noblemen or a peasant) than **Who** you are

Today the **Who** you are is THE central issue

Why?

The combination of two major threads:

1. The rise of the **individual** as a major socio-cultural unit of analysis
2. The emergence of powerful technological platforms supporting **individuation** and its expression

Let's see some examples illustrating the grand challenge that we are facing

Consumers Research

“Profiling” the client for high resolution tasks (e.g. marketing, advertising, prioritization)

Similarly to “**Personalized Medicine**”, we would like to find the best match for a **specific individual**

The idea of the average man (**l'homme moyen**) is not enough ...

e-Health

Think for example about the importance of automatically screening for [depression among certain professionals](#)

The murderous pilot of Germanwings who commit suicide at 2015 by crashing the plane (150 fatalities!)

This depressed pilot could have been screened in advance

Highly important for HR companies in general and the screening of pilots in particular...

Forensic and Intelligence Analysis

The threat from individuals

Can we screen for potential offenders such as civilian mass murderers, lone wolf terrorists, the “insider threat”?

The lone wolf phenomenon is an unsolved problem ...

We also Observe a New Era of Psychological Influence

Persuasion

Manipulation

Propaganda

Edward Bernays and the “Torches of Freedom” Campaign (1929)



“Torches of Freedom”

Women have been manipulated to start smoking cigarettes

The cigarettes have been presented as signs of women liberation

“Torches of Freedom”

Today, addressing a specific sector (e.g.
Women) is not enough

Individuality in the New Era of Influence and Psychological Warfare

The Russian Bots Campaign

Think about Bots, combined with tools of personality profiling and AI

Hybrid Bots + AI + Computational Personality Analysis =

The Unprecedented Potential of Targeting and Influencing the Individual

Personality and its Representation in Human Language

Personality refers to the subject's **consistent patterns** of

- Thought
- Emotion
- Behavior

Consistent = **Relatively** stable across time and contexts

Thoughts

Thoughts concern the cognitive aspect of personality

Mainly the **schemes/patterns** through which we represent our inner and outer world

Beliefs about self and others (I am ..., They are ...)

Emotions

Basically, a positive vs. a negative approach i.e. sentiment

1. Valence (positive or negative)
2. Arousal (the strength of the affect)
3. Social aspect (e.g. jealousy)

Behavior

Behavior concerns the **actions** taken by the individual

Not necessarily actual actions but **fantasies** and **intentions** too

Can we use language to analyze
personality?

What can we learn, for instance, from a singer who sings:

“I’m a fool to want you”

This statement implies deep mistrust in self

Mistrust in Self → Depression?

Billie Holiday – “I’m a Fool to Want You”



Another Song

Beliefs about self:

- “I been **swallowed** by the **darkness**”
- “I said we're in this to the **death**”

Behavior:

- “I could've **killed** a cop or two”
- “**Violate** my brothers and I'm fillin' you with **lead**”

- Lessons from this song?
- Signs of depressivity + violent thoughts
- If I would tell you that the guy who wrote these lines has been undergone a process of Islamic radicalization, would you increase his risk factor?

The Source

- “The Beginning” – A Rap Song
- Written by the British rapper “L. Jinny”
- He turned to be the murderous ISIS Jihadist: Abdel-Majed Abdel Barry

Kurt Cobain (Nirvana) – Letter of Suicide

- “I feel guilty beyond words”
- “I’ve become **hateful** towards all human in general”
- “I don’t feel **passion** anymore”

BTW If you try to analyze the letter using simple tools such as LIWC then you fail to identify the depressivity and even the dominant negative emotion ...

In sum

Personality involves consistent patterns of thought, emotion and behavior

Language, despite its complexity and ambivalence, can be highly informative for the analysis of personality

Major Theories of Personality

The Five Factor Model of Personality (FFM) - The “Big Five”

The dominant model in the current personality research and the computational personality venture

- John, O. P. & Srivastava, S. (1999). The Big Five trait taxonomy: History, measurement, and theoretical perspectives. In L. A. Pervin & O. P. John (Eds.), *Handbook of Personality: Theory and Research* (pp. 102–138). New York: Guilford Press.
- McCrae, R. R. & John, O.P. (1992). An introduction to the five-factor model and its applications. *Journal of Personality*, 60(2), 175-215.

Based on the Lexical Approach to Personality

- Assumption: The naïve use of language is informative
- Methodology: Through subjects' self-reports, we examine whether certain linguistic tags/adjectives used to describe self/others, **cluster together**
- The result: If you identify clusters then conclude that there are underlying personality factors explaining these clusters

The Five Factors of Personality

AGREEABLENESS

EXTRAVERSION

CONSCIOUSNESS

NEUROTICISM

OPENNESS

Extraversion

Being energetic, assertive, sociable

vs.

Introversion

In music

The difference between Rap and Jazz

See: Neuman, Y. et al., (2016). The personality of music genres. *Psychology of Music*, 44(5), 1044-1057

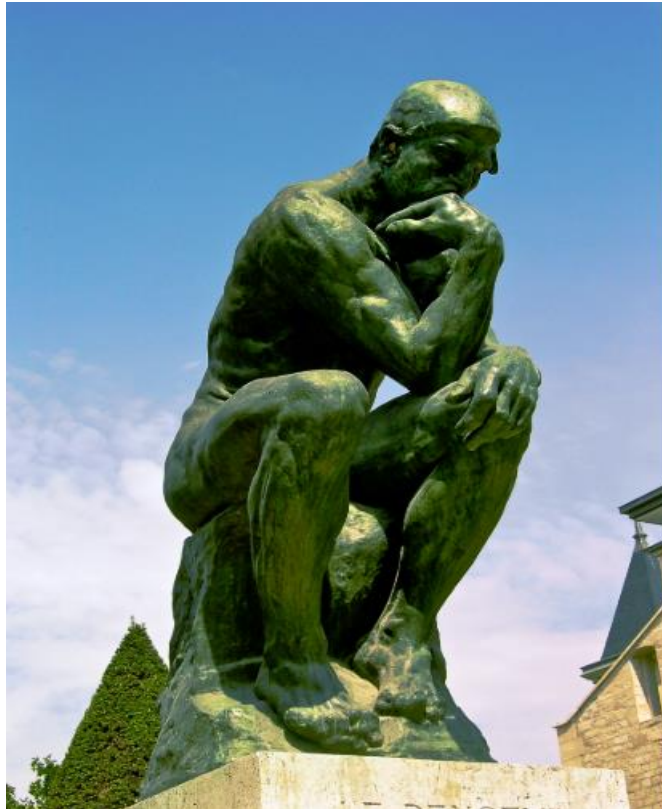
“Feel Right” by Mystikal



versus Bill Evans...



The Thinker by Rodin is an Introvert



Neuroticism

Negative reaction to stress, anxious, insecure

vs.

Calm and stable

Woody Allen vs. Clint Eastwood



Agreeableness

Friendliness and cooperative behavior

vs.

Selfishness and antagonism

The Joker is low on Agreeableness



Conscientiousness:
Organized, Ordered, Responsible vs.



In Music: Monk vs. Chopin



Openness (Exploration)

Openness to experience, creativity and imagination

vs.

Closeness and rigidity

Closed to
experience



Open to
experience

Problems with the Big-5

The Big-5 is a dogma with many theoretical and empirical problems ...

See the shocking findings of:

Molenaar, P. C., & Campbell, C. G. (2009). The new person-specific paradigm in psychology. *Current directions in psychological science*, 18(2), 112-117.

Pros and Cons

- The three basic dimensions (ext., con., agr.) seem to be valid
- Appealing in its simplicity
- Extremely limited as it is too simple
- For example, the Insider Threat may be associated with an Extravert or an Introvert personality...

The Modern Psychodynamic Approach

The General Idea

- As complex social animals, human beings are motivated by deep, unconscious conflicts and desires, mediated by a variety of mental mechanisms
- Human personality is organized around conflicts
- Human personality is evident through our mental defense functions

Conflicts

The axis of personality. Points of instability, areas of occupation

The obsessive personality has a conflict over **control**

Understanding Personality through Conflicts: The Implications

- Think about the power of unconsciously targeting an individual according to his major conflict ...
- Recall Bernays and his Torches of Freedom ...
- Imagine bots that target individuals according to their unique conflicts and adjust their message accordingly
- If a customer looking for a flight has a conflict with control then I can send him a targeted advertisement touching his Achilles Hill:
- **With Neuman's Airlines, you are the Captain!**

Defensive Functioning

- The mechanisms we use to defend ourselves from threatening thoughts and emotions
- For example, the defense mechanism of **splitting**, where positive and negative qualities of the self and others are separated
- It is evident when a religious fundamentalist is threatened by the complexity of modern women and splits women into two different types

The Logic of “either or”

The Woman is represented as

Saint or Whore

The Splitting Mind has no Grey Areas

The World in Black or White

Identifying Splitting

- Highly relevant for diagnosis
- Identification of potential offenders (e.g. shooters, political extremists etc.)

Neuman, Y. Assaf, D & Cohen, Y. (2016). Automatic identification of the splitting defense mechanism in texts. In M. Arntfield & M. Danesi (Eds.), *The Criminal Humanities: An Introduction*. N.Y.: Peter Lang.

The Spectrum of Personality Dimensions

Personality dimensions range from:

Adaptive, flexible and normal

to

Non-adaptive, rigid and pathological

The Obsessive Personality

Positive Aspects

- Perfectionists, hard-workers, believe in work ethics, task-oriented and put their emotions aside when the work has to be done
- Such a prototypical personality may be a highly successful software engineer ...

The Obsessive Personality

Negative Aspects

- Nothing is ever good enough and therefore no task can be finished
- Rigid thinking
- Rigid ethics

For instance



When Ed Snowden worked for the government, he was known as “Popish than the Pope”

I'm always explaining to people that the greatest threat to the organization comes from the best employee ...

I would like to Emphasize the Importance of
Understanding Human Personality as
Constructed around Conflicts

For instance: The Paranoid Personality



The Paranoid

- **Main conflict:** The conflict over attacking/being attacked by humiliating others
- **Central affect:** Fear, rage
- **Beliefs about others:** The world is full of potential attackers and users
- **Central ways of defense:** Projection. The aggression that exists in the paranoid's mind is attributed to others

Suspicion as a Marker?

- The major conflict of the paranoid is the one of trust/suspicion
- The paranoid invests energy in **trust** issues
- Believes no one
- **On the other hand fully and uncritically trusts and adopts ungrounded Beliefs!**
- Conspiracy theories

For example

- September 11
- They don't trust the official/scientific theories but fully and uncritically accept "alternative" theories
- Conflict over trust
- They are not just skeptical ...
- The conclusion: There is no point in tagging the paranoid as untrustworthy. **He has a conflict over trust**

Think about a Challenge

Automatically

- Identifying people with a deep conflict over trust
- Targeting these people for implanting conspiracy theories and creating chaos

Can you imagine a regime that may initiate such a venture?

Personalities and their Conflicts

- Antisocial-Psychopathic
- Narcissist

The Antisocial-Psychopathic

A Conflict over Victimhood

- Exploits others
- Experiences little remorse and empathy
- Manipulative
- Lacks fear
- Enjoys playing the role of the predator

Famous Psychopaths

“Hannibal the Cannibal”

Hannibal the Cannibal is a Caricature

Many CEOs Show Similar Traits

The Narcissistic Personality

A Conflict over Status and Self-Worth

- Grandiose self
- Dismissive of others
- Vulnerability beneath a grandiose façade

Muhammad Ali – The Boxer

“I’m the greatest. I said that even before
I knew I was”

Kanye West, the singer, said:

“My greatest pain in life is that I will never be able to see myself perform alive”

In sum

- The psychodynamic approach is theoretically grounded and rich in insights
- Mostly applied to individual and clinical cases
- Difficult to apply in practice, specifically in the context of computational personality analysis
- We have done it ...

Personality Profiling, Diagnosis and Screening

- The analysis of personality is mainly “manual”
- Experts and questionnaires
- Moving to the automatic analysis of personality is a must
- But first let me use a single case-study for illustrating some difficulties with personality analysis

How Dangerous are the Mentally Ill?

Two researchers* have built a “A unique dataset of 119 lone-actor terrorists and a matched sample of group-based terrorists”

They compared the prevalence of mental-illness (yes/no) among lone wolf terrorists and group terrorists

*Corner, E., & Gill, P. (2015). A false dichotomy? Mental illness and lone-actor terrorism. *Law and Human Behavior*, 39(1), 23

The Major Finding

An association between **mental illness** and **lone-actor terrorism**

The prevalence of mental illness among lone wolves: **32%**

The prevalence of mental illness among “usual” terrorists: **3%**

The Conclusions

“...mental health professionals may have a role in preventing lone-actor terrorist attacks”

“...screening processes can be carried out by security agencies on patients that present similar antecedents and behaviors in medical evaluations”

Impressive! Isn't it? Well...

- The real issue is NOT the difference between the two groups
- The real issue is **mental illness as a risk factor**
- The real issue: What are the chances of being a lone wolf terrorist **given** mental illness?
- The answer is ... almost 0!

We don't learn the Bayesian lesson ...

See:

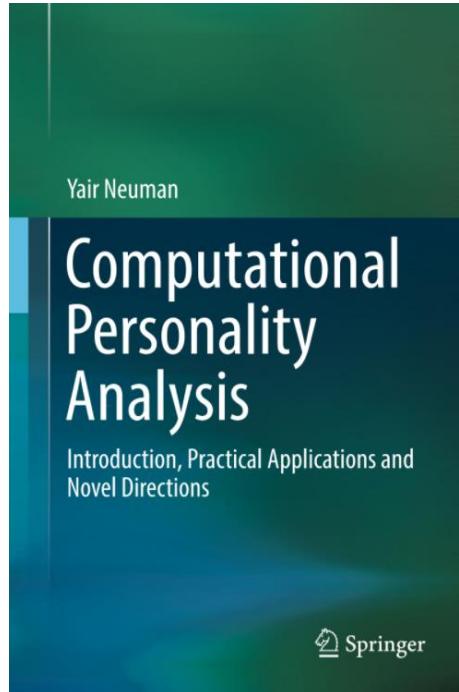
Neuman, Y., Cohen, Y., & Neuman, Y. (2019). How to (better) find a perpetrator in a haystack. *Journal of Big Data*, 6(1), 9.

Lessons from this Case?

- Personality profiling/diagnosis/screening should serve a mission
- A pragmatic, evidence-based approach
- “Name calling”, and “personality tags” cannot substitute an evidence-based and a mission-oriented approach

Can we apply these lessons to the automatic analysis of personality?

Computational Personality Analysis



- Automatic analysis of the subject's personality based on his documents
- You can use non-textual features for the analysis (e.g. voice) but let's focus on documents only
- Texts, whether written or spoken, are the richest source of information

How to do it?

The Dominant Approach

The Recipe:

1. Use a tagged corpus (e.g. Facebook pages + personality tags)
2. Apply NLP & Features extraction tools
3. Build a model using Machine Learning

This is the basis of Cambridge Analytica that worked for Steve Bannon

See the Famous Facebook Study

Kosinski, M., et al. (2013). Private traits and attributes are predictable from digital records of human behavior. *Proceedings of the National Academy of Sciences*, 110(15), 5802-5805.

- Facebook users tagged with the Big-5 scores
- They have analyzed the users' **topical preferences** (e.g. sport)
- Built a “predictive” model
- Please read this paper critically ...
- Steve Bannon didn't pay a lot but I'm not sure he got the best technology ...

Problems with the Common Approach

The Example of IBM - Watson Personality Insights

Analyzing Cho's Manifesto

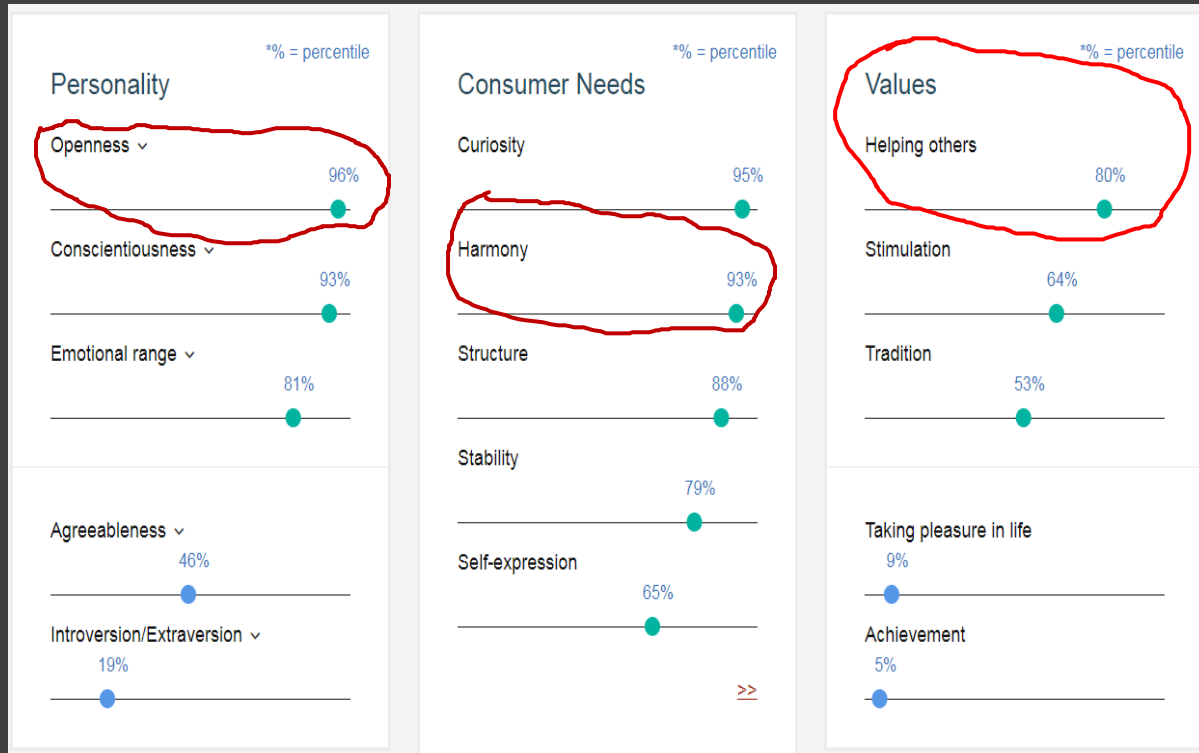
Seung-Hui Cho was responsible for the Virginia Tech massacre (2007)

Before launching his attack, he produced a 'manifesto' explaining his motivation

What happens if we analyze this text using IBM's Personality Insights tool?



Watson's Diagnosis



Problems in Launching a Computational Personality Analysis Project

- There are difficulties in gaining access to a tagged corpus of a high-quality
- Low level features might be insufficient
- The ML model is not always interpretable
- Language is dynamic and contextual
- However, the general approach may work nicely in several well-defined contexts

Identifying School Shooters

Neuman, Y. et al. (2015). Profiling school shooters: Automatic text-based analysis. *Frontiers in Psychiatry*
[<http://journal.frontiersin.org/article/129117/abstract>]

School Shooters



- School shooters receive extensive media coverage and create social anxiety
- Interestingly, there is **no consistent/agreed scientific diagnosis (i.e. signature)** of school shooters
- Can we profile school shooters?
- Can we use the profile for future screening? Ranking of potential suspects for an in-depth inspection?

- We selected **six texts** written by school shooters
- For gaining comparative insights, we used the Blogs Authorship Corpus (Schler et al., 2006) and selected blogs written by *males*, age of 15 to 25
- Overall, we've analyzed the blogs written by **6056** subjects
- How did we measure personality dimensions in a text?

We have measured the **semantic similarity** between each of the texts and word vectors representing four personality dimensions (Paranoid, Narcissistic etc.)

The vectors have been defined by identifying the words used by experts to describe/diagnose these personality dimensions

A very naïve approach. I have significantly advanced since this study

...

In Addition,

Dimensions such as [revenue](#)

Vendetta is a highly important
motivational force ...

See: Neuman, Y. (2012). On revenge. *Psychoanalysis, Culture & Society*, 17(1), 1-15.

Following the automatic identification of sexual predators (Inches & Crestani, 2012) can we produce a **ranked list** of suspects to prioritize the investigation?

Applying ML classifiers, we were able to **identify all the shooters' documents among the top 210 ranked documents**: approximately *3% of our corpus*

Enormous reduction in work load for the human analyst

*We don't pretend to find the needle in the haystack but to **reduce the size of the haystack** ...*

How to Get Better?

Some Lessons

(Mainly from some Real-World Projects)

- Most of the approaches to the automatic analysis of personality rely on low-level features (e.g. words) or their simple categorization
- The analysis should combine the words' level of analysis with a deep syntactic semantic analysis that aims to expose the **relations** between the screened individuals and others
- After all, personality is all about relations ... When one relies on a shallow linguistic analysis only, results are limited

See

Neuman, Y. (2019). Language mediated mentalization: A proposed model. *Semiotica*, 227, 261-272.

- Most approaches rely on a tagged corpus where texts are produced by individuals who are tagged according to their personality dimensions
- Such corpora are extremely difficult to get and their “shelf life” is limited as a result of the dynamic and changing nature of language

- Personality is a dynamic phenomenon
- It “lives” in time and sometimes the most important information is identified by analyzing the behavior of personality dimensions along the time line
- See the approaching tipping-points of emotion in:

Neuman, Y., Marwan, N., & Cohen, Y. (2014). Change in the Embedding Dimension as an Indicator of an Approaching Transition. *PloS one*, 9(6), e101014.

The Industry's Perspective

- Most Machine Learning approaches to computational personality analysis adopt an academic **ready-to-wear** approach where ML classifiers are trained, validated and tested on a tagged corpus
- Like any ready-to-wear approach this approach is limited in providing the customer with the best fit

Summary and Conclusions

Automatic personality analysis may have enormous benefits in better understanding individuals in contexts ranging from screening for mental health problems to the effective recruitment of men-power

Diverse Theoretical Approaches should be Adopted

The Big-5 is not enough ...

Deeper Personality Analysis is Required

There is a need for more sophisticated methods that use a deep syntactic-semantic analysis and infer personality dimensions through higher and more abstract features extracted from the text

The Corpus Challenge

A solution to the problem of a big tagged corpus

Analyze the Dynamic of Personality

A Pragmatic Engineering Approach

There is no single key to all of the locks in the world ...

Find the specific key to your problem

Thank you for Attending
my Talk

Please ask some Challenging Questions ...

It is my personal recipe for anti-aging ...