

The Big Five and HEXACO
questionnaires are full of affect and
so, probably, are your questionnaires

Michael D. Biderman, Ph.D.

The University of Tennessee at Chattanooga

pptx at www.utc.edu/faculty/michael-biderman

Key Reference

- Biderman, M. D., McAbee, S. T., Chen, Z., & Hendy, N. T. (In press). Assessing the evaluative content of personality questionnaires using bifactor models. *Journal of Personality Assessment*.

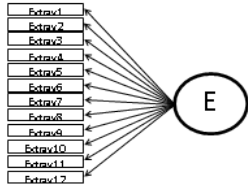
The Big Five

- Five general traits believed to be foundation characteristics of normal personality
- Extraversion
- Agreeableness
- Conscientiousness
- Emotional Stability (Rev of Neuroticism)
- Openness to Experience

Place of the Big Five

- “After decades of research, the field has now achieved an initial consensus on a general taxonomy of personality traits, the “Big Five” personality dimensions.” (John, O. P. (2008) in John, Robins, & Pervin, Handbook of Personality: Theory and Research, 3rd Ed.)

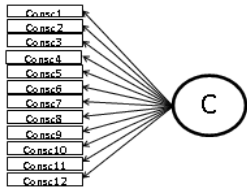
Path Diagram of the Big 5



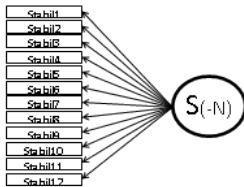
Each specific **domain** is indicated by 2 – 20+ items, usually about 10.



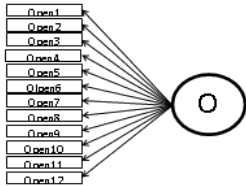
The **content** of each item is supposed to be **specific to the domain**.



For example, the **Extraversion items** are supposed to **reference only extraversion**, nothing else.



Same for each of the other domains



HEXACO

- Six general traits believed to be foundation characteristics of normal personality
- Extraversion
- Agreeableness
- Conscientiousness
- Emotional Stability (rev of Emotionality)
- Openness to Experience
- Honesty/Humility

Key B5/HEX Assumptions

- Applies to everyone – each of us has a unique B5/HEX profile
- Dimensions are orthogonal – independent – being high on one does not mean you're high or low on any other

Two Issues

- 1. Summated scales of the Big Five and HEXACO Dimensions are positively correlated
- Block 1995, “...the empirical research findings indicate that the five factors are frequently and importantly correlated with each other”

Examples of Issue 1 from UTC data. . .

- N=1195 NEO-FFI-3
- Negative correlations are in **red**

	Ext	Agr	Con	Sta	Opn
Ext	1	.17	.18	-.05	-.03
Agr		1	.18	.18	.12
Con			1	-.07	.04
Sta				1	.04
Opn					1

- Mean of correlations = **+.08**.

Issue 1 from UTC data . . .

- IPIP 50 Item Questionnaire; N=1140
- Negative correlations are in **red**

	Ext	Agr	Con	Sta	Opn
Ext	1	.28	.07	.21	.22
Agr		1	.18	.06	.24
Con			1	.09	.19
Sta				1	.21
Opn					1

Mean of correlations = **+.18.**

Issue 1 from UTC data. . .

- BFI-2 Questionnaire; N = 638
- Negative correlations are in **red**

	Ext	Agr	Con	Sta	Opn
Ext	1	.15	.28	.34	.20
Agr		1	.42	.24	.32
Con			1	.30	.24
Sta				1	.08
Opn					1

Mean of correlations = +.26.

Issue 1 from UTC data . . .

- HEXACO 100; N = 1195
- Negative correlations are in **red**

	Ext	Agr	Con	Sta	Opn	HH
Ext	1	.25	.25	.08	.05	.07
Agr		1	.18	.18	.12	.32
Con			1	-.07	.04	.28
Sta				1	.04	-.08
Opn					1	.14
HH						1

Mean of correlations = **+.12**

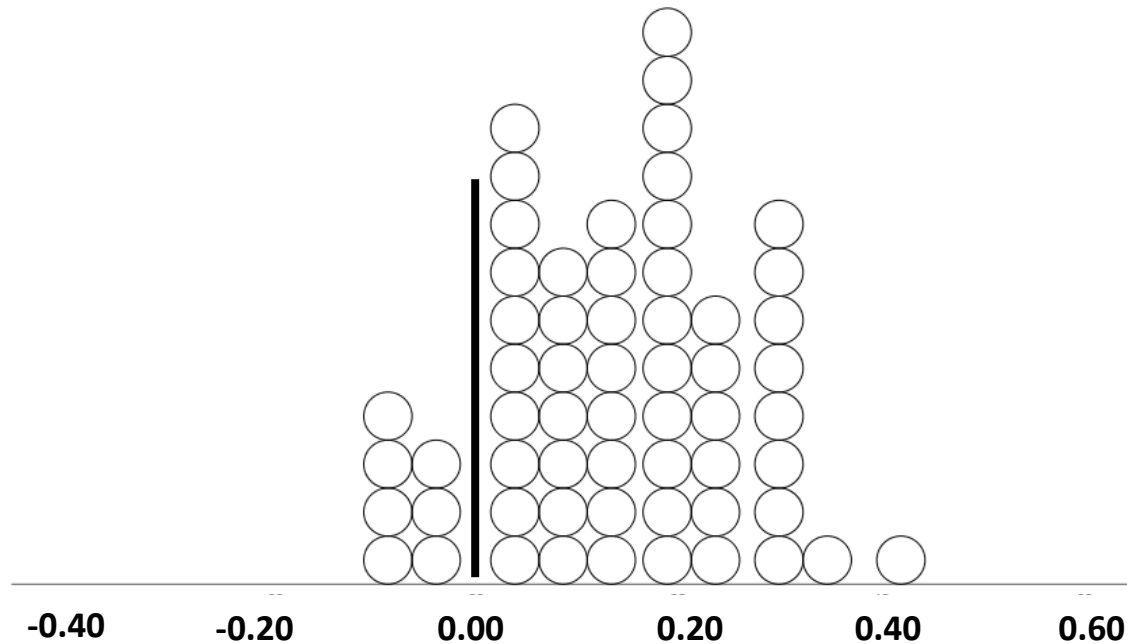
Last Example of Issue 1 . . .

- HEXACO 60; N = 1373
- Negative correlations are in red

	Ext	Agr	Con	Sta	Opn	HH
Ext	1	.14	.19	.14	.03	.04
Agr		1	.09	.02	.12	.31
Con			1	-.10	.12	.30
Sta				1	.05	-.04
Opn					1	.10
HH						1

Mean of correlations = $+.15$.

Issue 1: Dot-plot of B5 / HEX scale correlations



Two issues continued . . .

- 2. Big 5 and HEXACO summated scales except Openness are generally fairly highly correlated with measures of emotional/affective states . . .
- Rosenberg Self-esteem Scale
- Costello & Comrey Depression Scale
- PANAS PA and NA scales

UTC Scale Correlations with Self-esteem

	Ext scale	Agr Scale	Con Scale	Sta Scale	Opn Scale	H/H Scale
NEO- N=1195	.51	.28	.53	.66	.03	
IPIP 50 N = 531	.26	.12	.28	.30	.23	
BFI-2; N = 638	.44	.18	.41	.60	.18	
HEX 100 N=1195	.64	.20	.40	.12	-.01	.15
HEX 60 N=1373	.61	.11	.29	.18	-.04	.14

What does Extraversion have to do with Self-esteem?

What does Conscientiousness have to do with Self-esteem?

What does Emotional Stability have to do with Self-esteem?

UTC Correlations with Depression

	Ext scale	Agr Scale	Con Scale	Sta Scale	Opn Scale	H/H Scale
NEO N=1195	-.56	-.42	-.51	-.54	-.06	
IPIP 50 N = 531	-.22	-.17	-.19	-.29	-.11	
HEX 100 N=1195	-.61	-.25	-.42	.01	.01	-.25

What does Extraversion have to do with Depression?

What does Conscientiousness have to do with Depression?

What does Emotional Stability have to do with Depression?

UTC Correlations with PA and NA

PANAS PA	Ext scale	Agr Scale	Con Scale	Sta Scale	Opn Scale	H/Hu Scale
NEO- N=1195	.60	.29	.59	.46	.14	
HEX 100 N=1195	.61	.18	.48	.06	.10	.15

PANAS NA	Ext scale	Agr Scale	Con Scale	Sta Scale	Opn Scale	H/Hu Scale
NEO- N=1195	-.42	-.31	-.43	-.72	.00	
HEX 100 N=1195	-.52	-.35	-.32	-.29	.01	-.19

Summary of Issues

- 1. The scale scores of the Big 5 and the HEXACO are generally positively correlated with each other.
- 2. Most of the Big 5 and HEXACO scale scores correlate with measures of affect.

The Common Content Hypothesis

- We believe that ALL questionnaire items have some aspect of content in common.
- That content is **in addition to** the **domain** content
- It affects responses to all items
- Some respondents are more likely to agree with ALL items because of this content.
- Some respondents are more likely to disagree with ALL items because of this content.

The Common Content Explanation

- This certainly **accounts for Issue 1** – the positive correlations of Big 5 and HEXACO scale scores
- For example, if there is something in the Extraversion items that is also in the Agreeableness items, then that **common content will cause Extraversion scales and Agreeableness scales to be positively correlated**

Common Content and Affectivity

- Common content, if it's affective in nature, could also account for Issue 2- the correlations of ALL (but Openness) Big 5 and HEXACO scales with measures of affect
- If Extraversion, Agreeableness, Conscientiousness, and Stability items all have some content related to affective states, that would explain why they might all be correlated with affect scales

Measuring Common Content

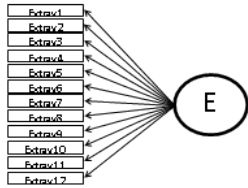
How do we measure the responses to content that cuts across all items and multiple domains in a questionnaire?

Recent advances in factor analysis give us a method

Bifactor FA models

- The advances have been in what are called bifactor models for factor analysis
- Bifactor models allow you to measure both specific domains, such as the Big 5 or HEXACO domains, and also **general characteristics common across all items** not specific to the domains
- Note: The study of models similar to bifactor models has been done under the heading of common method variance

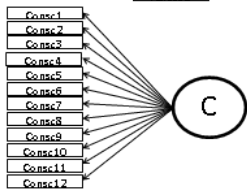
A “regular” Big 5 factor model



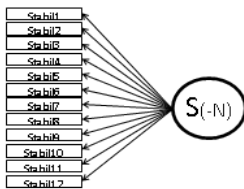
Each specific domain is represented by a factor.



Each factor represents a characteristic – Extraversion, Agreeableness, etc

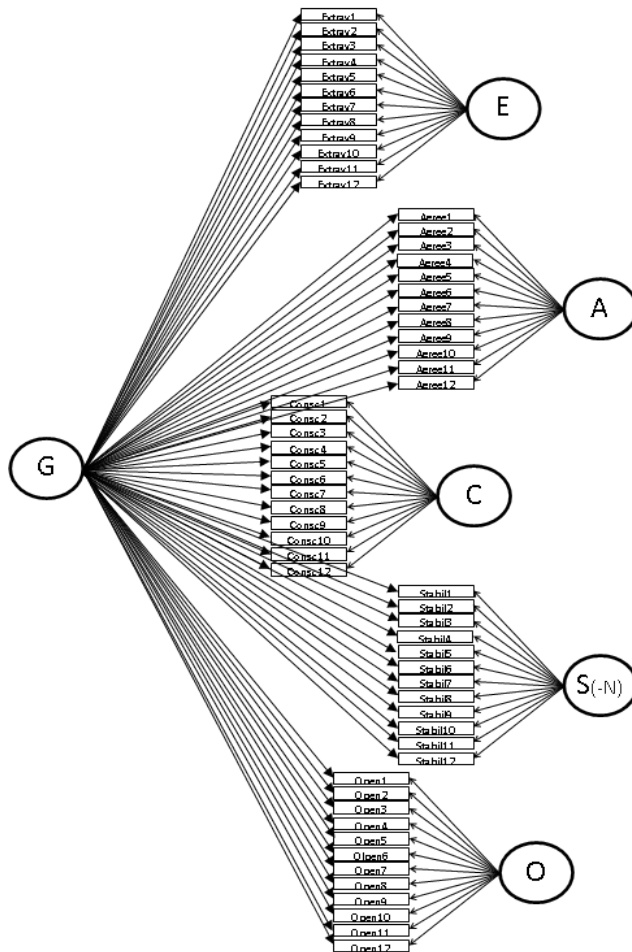


Each factor influence responses to a group of items. The amount of such influence for an item is the item’s **loading** on that factor.



Note that the factors are not correlated, nor is there a mechanism for them all being correlated with affect

A bifactor model



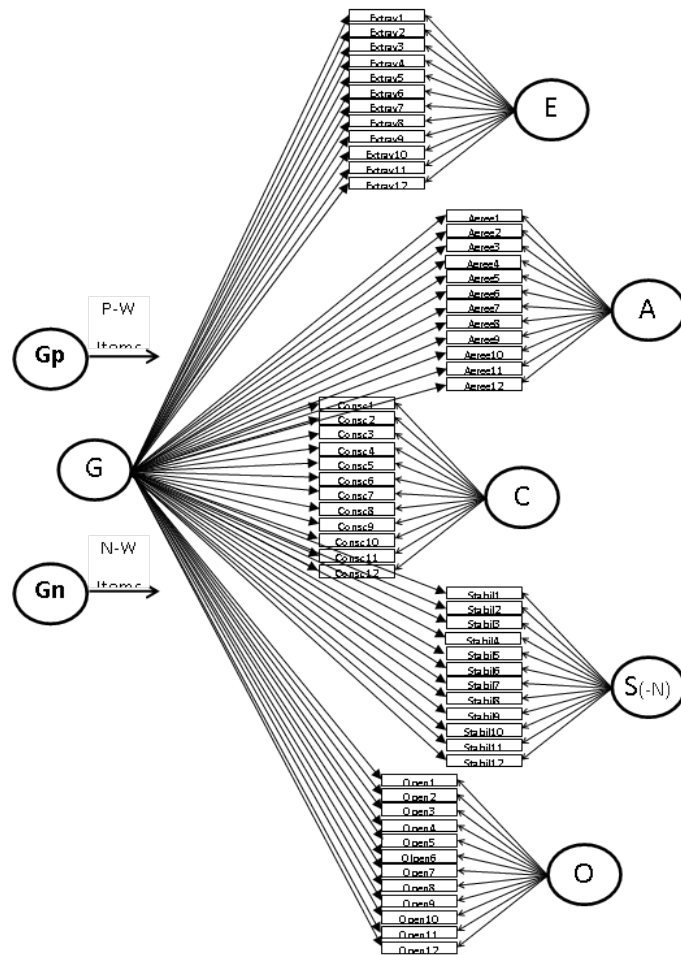
Each specific domain is represented by a factor as before

But, there is an added **general** factor.

The general factor represents a characteristic common to ALL items.

We believe that this common characteristic can account for the correlations between scale scores and the common correlation with affect measures

Full Disclosure



We actually applied a slightly more complicated model in which there were actually **THREE** general factors – one completely general, one general to positively-keyed items, and one general to negatively-keyed items.

For the sake of simplicity, I'll discuss the following as if there were only one general factor.

Is a General Factor Needed?

From the first application of bifactor models to Big 5 questionnaire data (Bäckström, 2007; Biderman, 2007) it has been found that including the general factor in analyses **significantly improves the ability of factor analytic models to represent the data**

So the answer is “Yes, a general factor seems to be needed.”

G is needed. But what is it?

- Adding the G factor significantly improves goodness-of-fit of model
- But what does G represent?
- What is the common content??
- What is it that is in Extraversion items and in Agreeableness items and in Conscientiousness items and in Stability items and in Openness items, and in Honesty/Humility items?

Item Valence

- We discovered in 2011, by chance, that G correlates positively with PANAS PA and negatively with PANAS NA (Biderman et al., 2011)
- This suggested that whatever the item characteristic is that distinguished PA from NA is the characteristic important for G

Item Valence . . .

- PA items are “positive” words – “interested,” “excited,” “strong,” “enthusiastic,” “proud” . . .
- NA items are “less positive” words – “distressed,” “upset,” “guilty,” “scared” . . .
- This suggested that the item characteristic that indicated G was item “positiveness” or **valence**

Is G a valence factor?

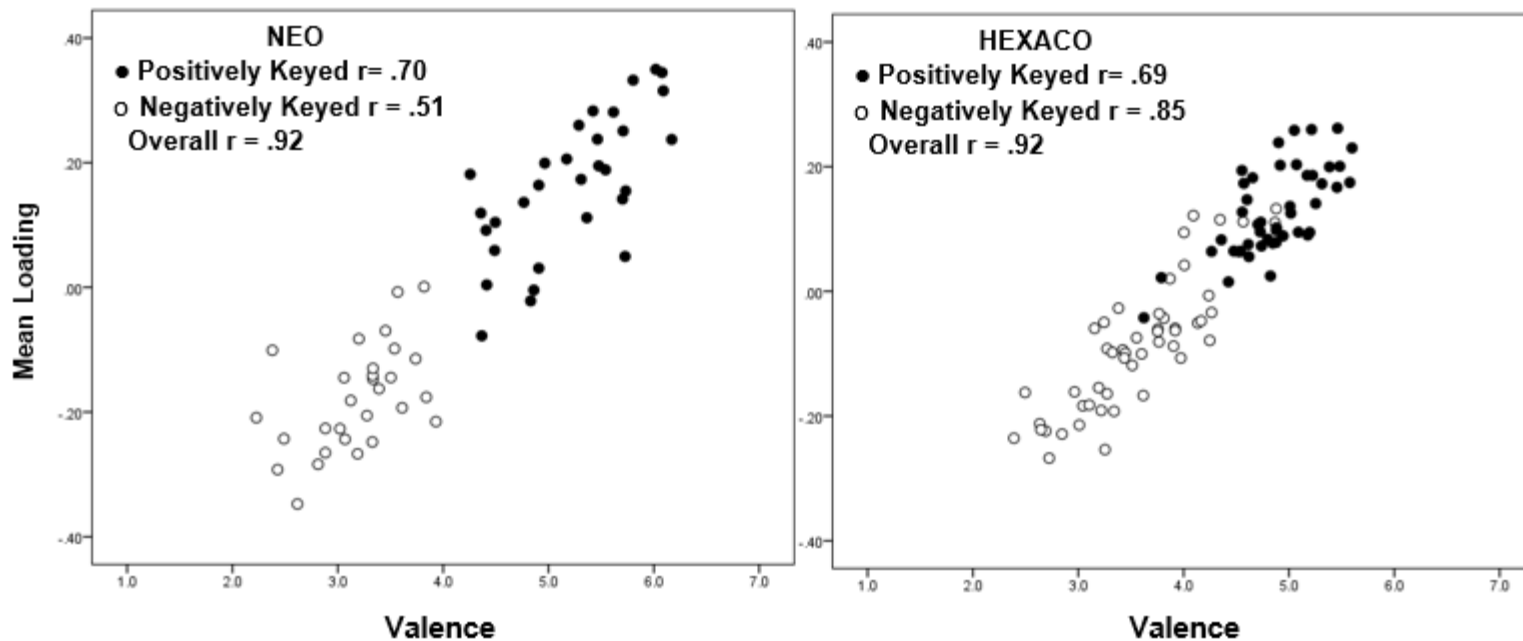
- Factor analysts know that the **loading** of an item on a factor shows us what the factor is about
- We look for items with high loadings to define factors – ask any factor analyst
- So we investigated the hypothesis that item valence determined the loadings of items on the G factor

The Valence study

- To explore the valence idea, we had UTC students rate the valence of Big 5 and HEXACO items.
- We asked, “If a person had this characteristic, it would make him or her look
- 1 = absolutely bad,
- 2 = very bad,
- 3 = bad,
- 4 = neither good nor bad,
- 5 = good,
- 6 = very good,
- 7 = absolutely good

Valence **does** determine G loadings

- Loadings on the G factor were very strongly positively correlated with Valence ratings



Explaining the two issues

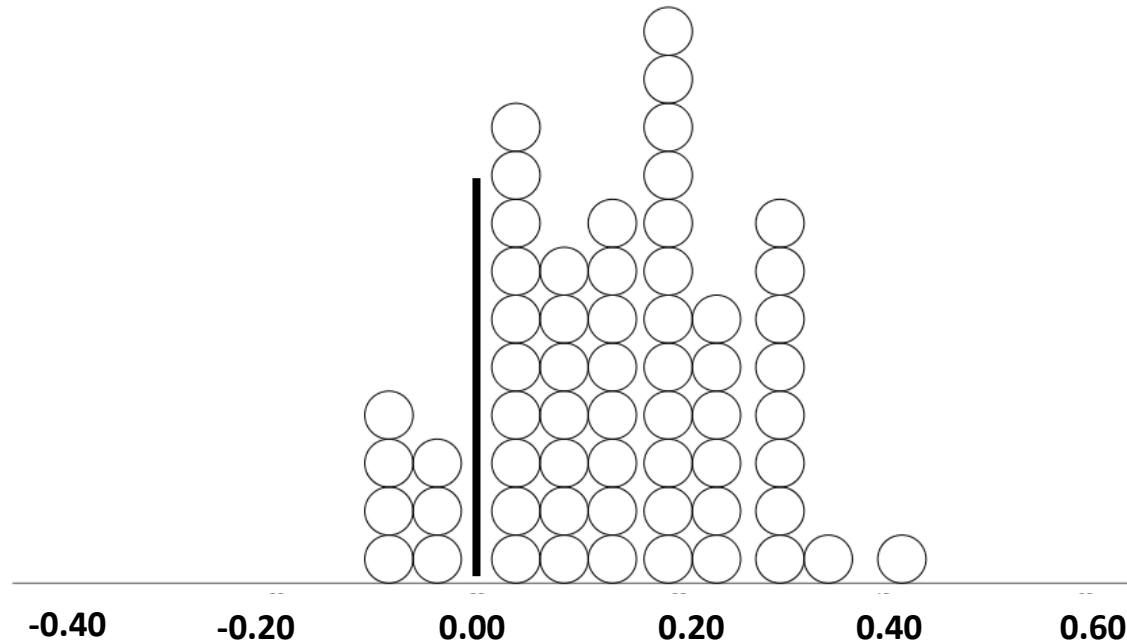
We measured the Big 5 and HEXACO domains using **factor scores from the bifactor model**.

Big 5 and HEXACO Factor scores from the bifactor model will have the contamination of the common content removed

We also computed factor scores for the G factor separately from the Big 5 and HEXACO domain factor scores.

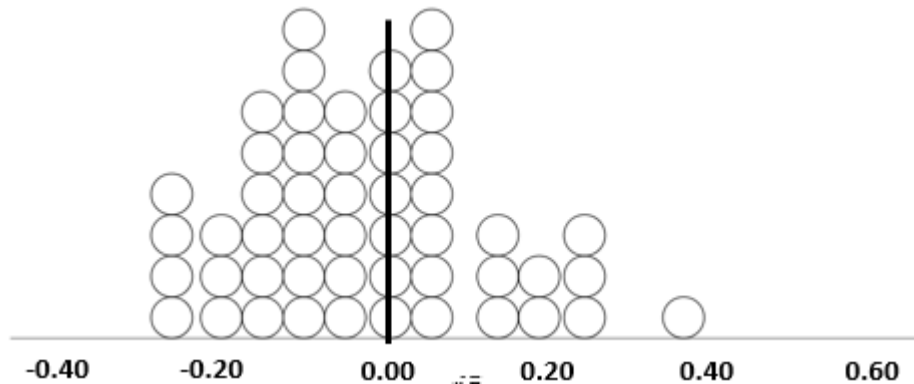
Results: Issue 1

Recall that the scale scores were almost all positively correlated with each other



Issue 1 resolved

Dot plot of **factor score** correlations . . .



Note that the distribution of correlations is nearly centered over zero.

So removing the effect of common content resulted in generally uncorrelated Big 5 and HEXACO domains

Issue 2 – Correlations with Self-esteem

N=1195	Ext	Agr	Con	Sta	Opn	H/Hu
NEO Scale	.51	.28	.53	.66	.03	
HEX Scale	.64	.20	.40	.12	-.01	.15
NEO FS	.14	.01	.11	.32	-.02	
HEX FS	.43	-.05	.19	.10	-.13	-.09

Note the large **d**ecreases in correlations for Extraversion Agreeableness, Conscientiousness and Stability.

Based on these analyses I would conclude that only Extraversion and perhaps Stability are importantly related to Self-esteem.

Similar results for Depression

N=1195	Ext	Agr	Con	Sta	Opn	H/H
NEO Scale	-.56	-.42	-.51	-.54	-.06	
HEX Scale	-.61	-.25	-.42	.01	.01	-.25
NEO Factor	-0.21	-.16	-.10	-.24	-.06	
HEX Factor	-.39	-.02	-.16	-.02	.14	.02

As was the case with Self-esteem, the correlations are much closer to zero.

And for PA and NA

PA N=1195	Ext	Agr	Con	Sta	Opn	H/Hu
NEO Scale	.60	.29	.59	.46	.14	
HEX Scale	.61	.18	.48	.06	.10	.15
NEO Factor	.24	.02	.19	.13	.09	
HEX Factor	.44	-.03	.30	.11	-.01	-.04
NA N=1195						
NEO Scale	-.42	-.31	-.43	-.72	.00	
HEX Scale	-.52	-.35	-.32	-.29	.01	-.19
NEO Factor	-.12	-.08	-.08	-.41	-.01	
HEX Factor	-.34	-.11	-.12	-.17	.12	.00

Conclusion regarding Issue 2

- Measurement of Big 5 and HEXACO domains with factor scores from a bifactor model yields measures that are not generally correlated with affect scales

What about G correlations?

N=1195	Self-esteem	Positive Affectivity	Depression	Negative Affectivity
NEO G	.72	.68	-.70	-.62
HEX G	.58	.54	-.63	-.51

G has absorbed all of the affective content of the Big 5 and HEXACO items.

It correlates very strongly with all of the affect measures.

Conclusion

- We believe Big 5 and HEXACO scale scores are contaminated with item affective content.
- We believe that measuring Big 5 and HEXACO domains with factor scores from a bifactor model removes the affect contamination from the domains and creates a separate measure of affect that is the G factor

Implications

- If you compute a summated scale, it very likely represents two things:
 - 1) the characteristic of interest, and
 - 2) the respondent's affective state

The Future

- I believe that we'll begin measuring psychological constructs using factor scores from models such as the bifactor model presented here.
- Summated scales will no longer be used in 2100.

References

- Anglim, J., Morse, G., De Vries, R., MacCann, C., & Marty, A. (2017). Comparing job applicants to non-applicants using an item-level bifactor model on the HEXACO Personality Inventory. *European Journal of Personality*, <http://dx.doi.org/10.1002/per.2120>
- Bäckström, M. (2007). Higher-order factors in a five-factor personality inventory and its relation to social desirability. *European Journal of Psychological Assessment*, *23*, 63-70. doi:10.1027/1015-5759.23.2.63
- Bäckström, M., Björklund, F., & Larsson, M. (2009). Five-factor inventories have a major general factor related to social desirability which can be reduced by framing items neutrally. *Journal of Research in Personality*, *43*, 335-344. doi:0.1016/j.jrp.2008.12.013
- Biderman, M. D. (2007). Method variance and Big Five correlatons. Paper presented at the 7th Annual Conference of the Association for Research in Personality, Memphis, TN, January 24, 2007.
- Biderman, M. D., Nguyen, N. T., Cunningham, C. J. L., & Ghorbani, N. (2011). The ubiquity of common method variance: The case of the Big Five. *Journal of Research in Personality*, *45*, 417-429. doi:10.1016/j.jrp.2011.05.001
- Biderman, M. D., McAbee, S. T., Chen, Z., & Hendy, N. T. (In press). Assessing the evaluative content of personality questionnaires using bifactor models. *Journal of Personality Assessment*.