

Items

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Profile correlations

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Try this with majors and occupations

oooooooooooo

Conclusions

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References

# Structure of personality profiles using PWAS

## International Society for the Study of Individual Differences

### Florence, Italy

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Slides available at [personality-project.org/sapa](http://personality-project.org/sapa)

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## C.P. Snow and the two cultures: an underestimate

1. Snow (1959) proposed that there were two cultures of intellectual inquiry: the scientific and the humanistic.

*I was moving among two groups – comparable in intelligence, identical in race, not grossly different in social origin, earning about the same incomes, who had almost ceased to communicate at all, who in intellectual, moral and psychological climate had so little in common that instead of going from Burlington House or South Kensington to Chelsea, one might have crossed an ocean.*

2. Snow was an optimist. We will show that the academy and professions is not just two, but perhaps 4-5 different cultures (or at least dimensions).
3. We do this by borrowing techniques from genetics. We argue analogically that the Genome Wide Association Studies of genetics (GWAS) can be applied to personality by using Personome Wide Association Studies (PWAS) of personality and ability.



## How useful are items?

1. Common observation is that items have low correlations with other items.
2. From a classical reliability perspective: Item variance = general + group + specific + error.
3. The “gospel” is that items are mainly error variance.
4. This is true from a latent variable perspective, but less true if we actually examine item variance.
5. Perhaps 20% of an item is general factor variance, another 10-20% group variance but about 40% is specific and reliable variance.
6. We can see this by doing a variance decomposition of items that are repeated across time.
7. So what?
8. Lets look at the correlates of items.



## Items as analogous to SNPs in GWAS studies

1. In Genome Wide Association Studies one examines phenotypic variation as it correlates with differences in SNP frequencies across the genome.
2. We can do the same by examining phenotypic variation and correlation across the persome ([Möttus, Sinick, A.Terracciano, Hřebíckova, Kandler & Jang, 2018](#))
3. A typical approach is to show the correlations and their probability values (corrected for multiple tests)
  - Typically displayed in “Manhattan Plots” across the genome.  
We do this across the “Persome”.
4. First show plots for an open source data set (spi) available in the *psych* package.
  - This is a set of 135 temperament items ([Condon, 2017](#)), with 10 criteria for 4,000 subjects.
5. Then do the same for items from the Big 5, then an extended set (the little 27) then for a bigger data set with even more items.
6. Finally, we can do the same for personality traits.

Items

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Profile correlations

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Try this with majors and occupations

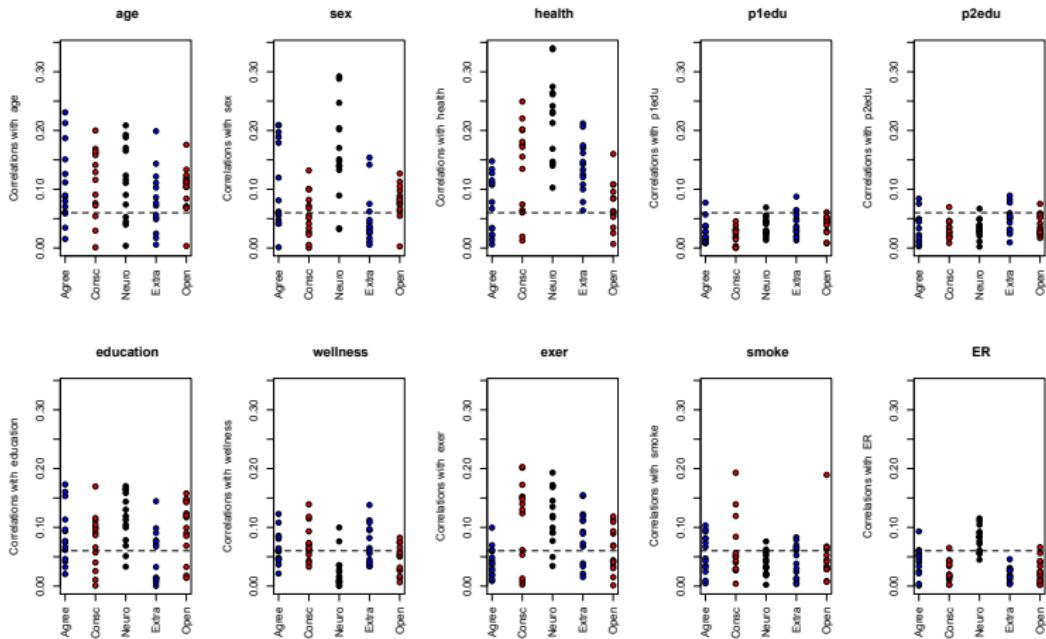
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Conclusions

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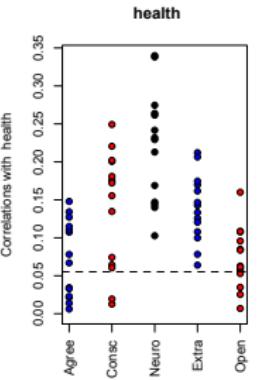
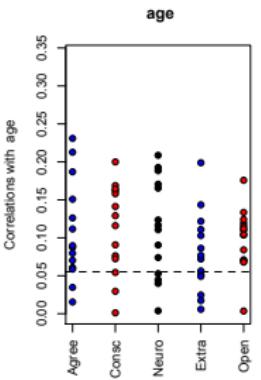
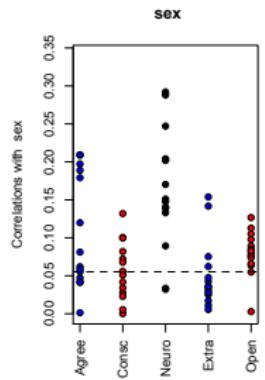
References

## A “Manhattan plot” of the spi items on the big 5 for 10 criteria

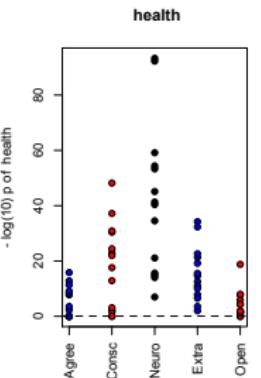
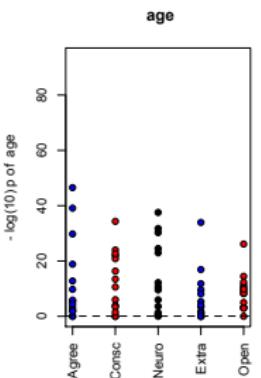
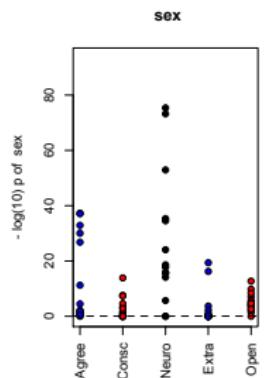


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## A “Manhattan plot” of the spi items for 3 criteria big 5

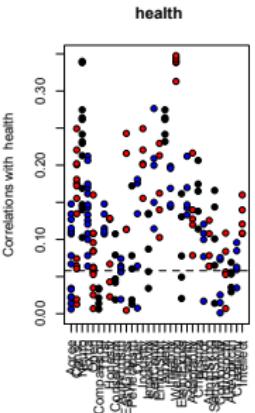
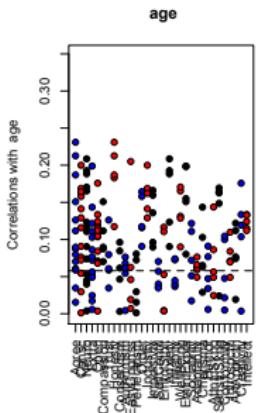
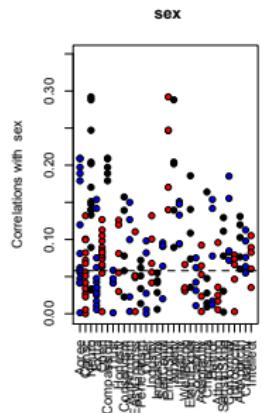


Correlations  
(absolute  
values)

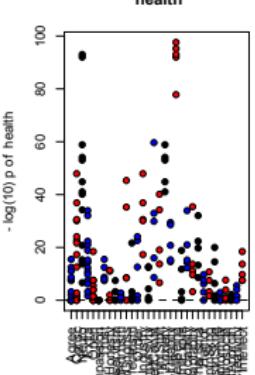
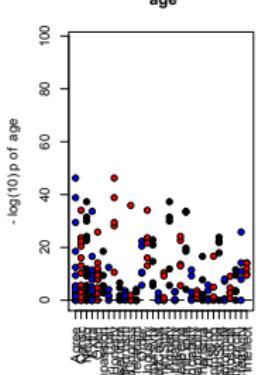
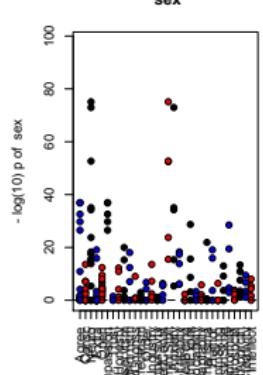


Log p values  
(Holm  
corrected for  
multiple  
tests)

## More predictors: 3 criteria big 5 + spi 27, N =4000



Correlations  
(absolute  
values)

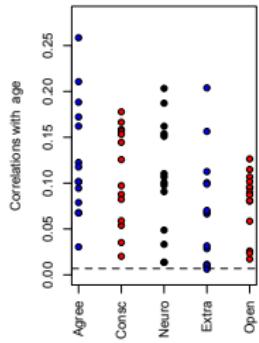


Log p values  
(Holm  
corrected for  
multiple  
tests)

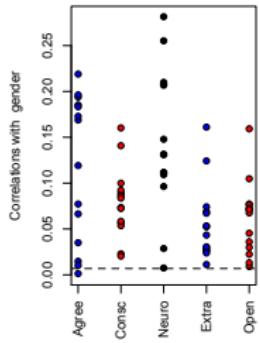


## More subjects: 3 criteria big 5, N = 255,000

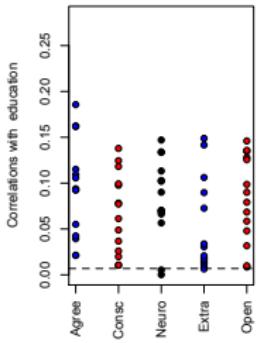
age



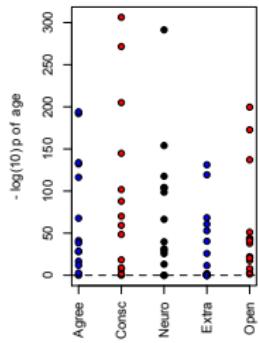
gender



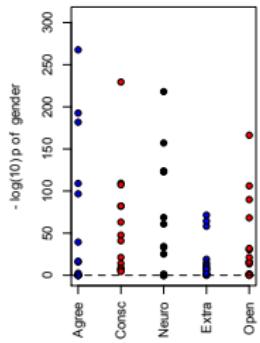
education



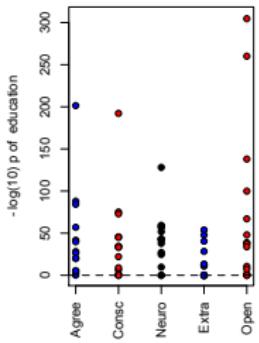
age



gender



education



Items

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Profile correlations

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Try this with majors and occupations

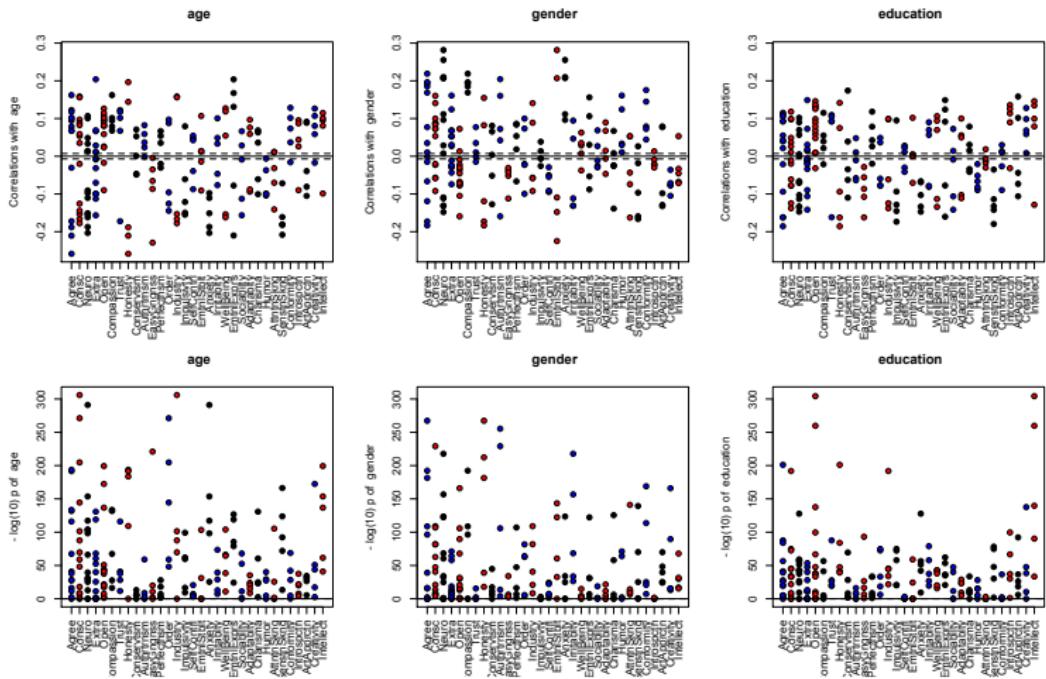
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Conclusions

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References

## More subjects: 3 criteria - Big 5 + little 27 items, N = 255,000



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Items

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Profile correlations

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Try this with majors and occupations

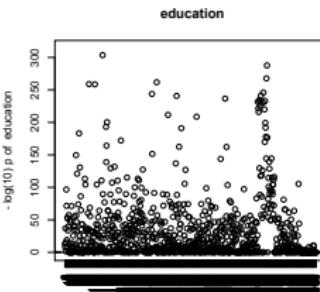
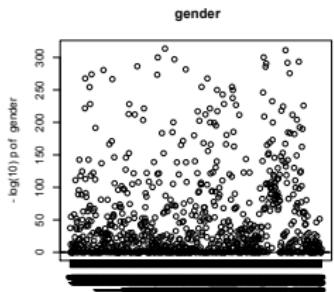
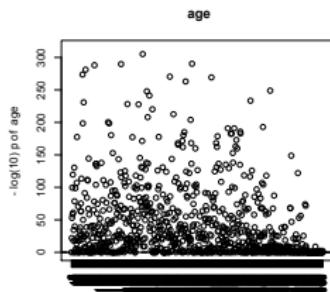
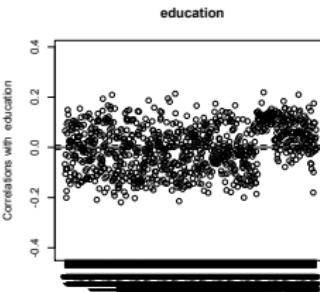
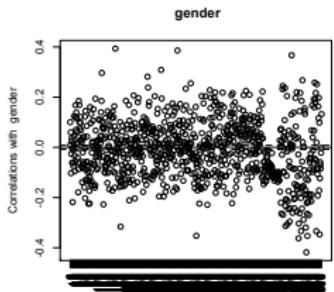
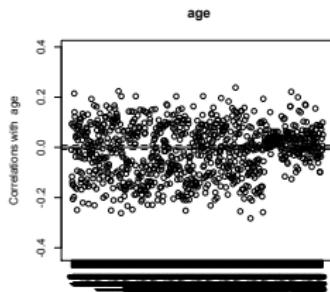
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Conclusions

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References

## More subjects: 3 criteria - 904 items (temperament, abilities, interests)



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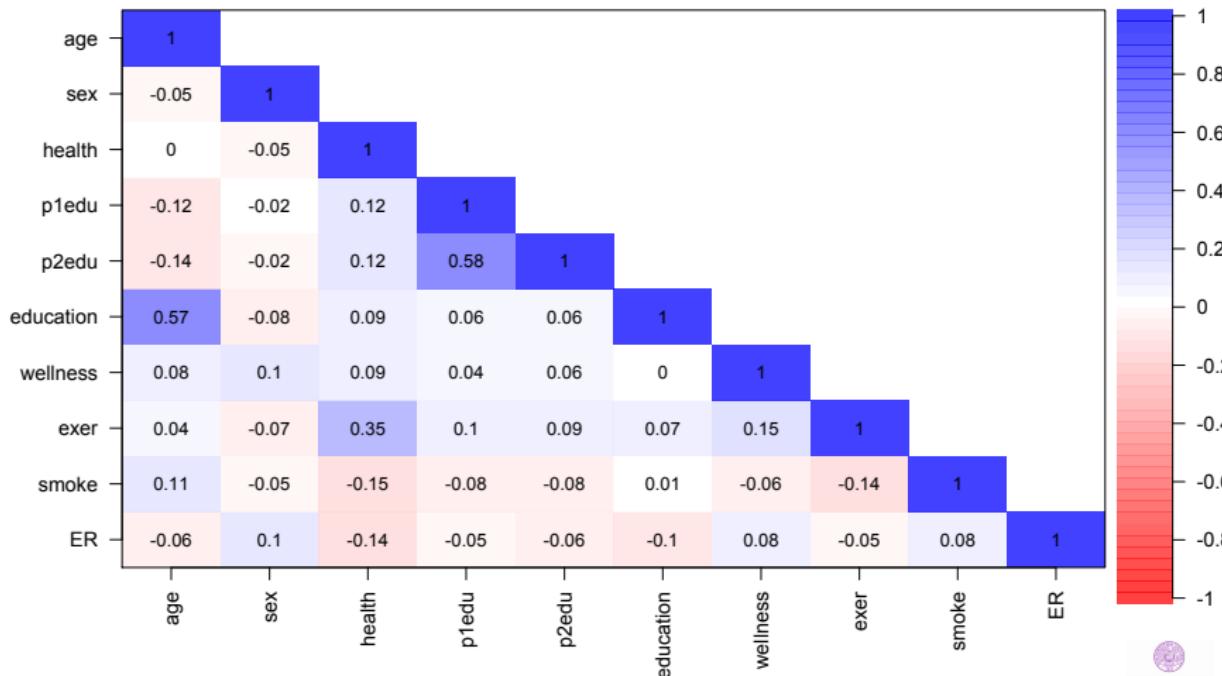
## Profile correlations are analogous to the “genetic correlation”

1. For any set of criteria or grouping variables we can find a vector of validity correlations across our predictor set.
2. We can then correlate these vectors. This is analogous to the genetic correlation across SNPs.
3. Basically, we are correlating the profiles of the Manhattan plots
4. I show this using the 10 criteria in the `spi` data set
5. First the raw correlations, then the profile correlations



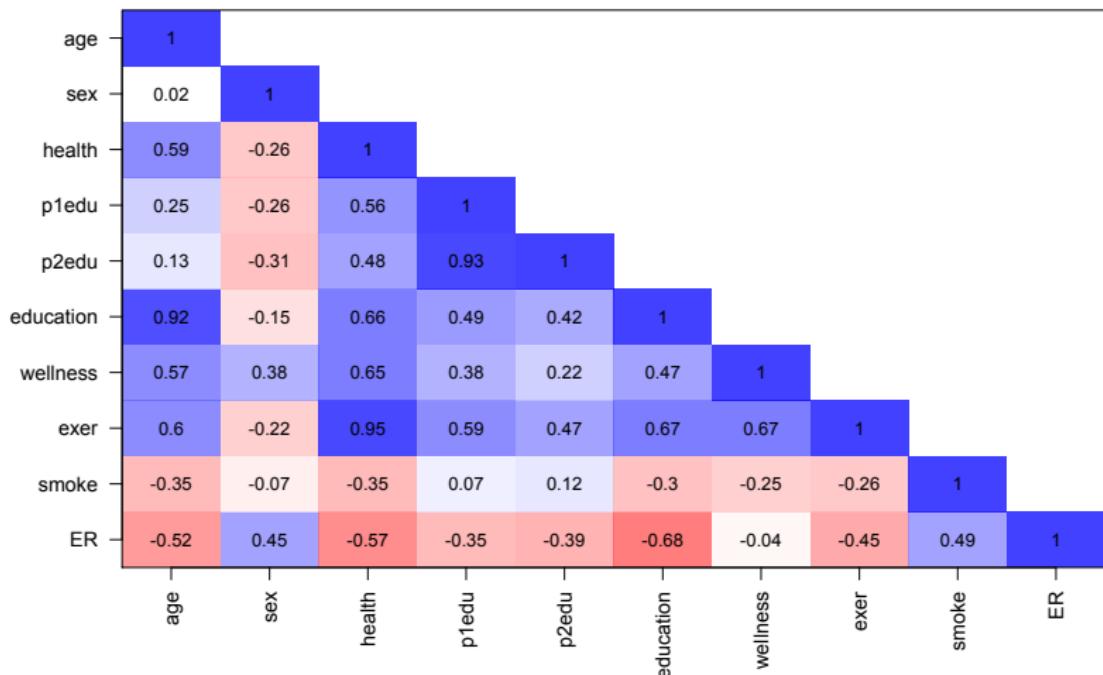
## 10 criteria from the SPI data set, raw correlations

Correlations of 10 SPI criteria



## 10 criteria from the SPI data set, profile correlations

Profile correlations of 10 SPI criteria across 135 items



Items  
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Profile correlations  
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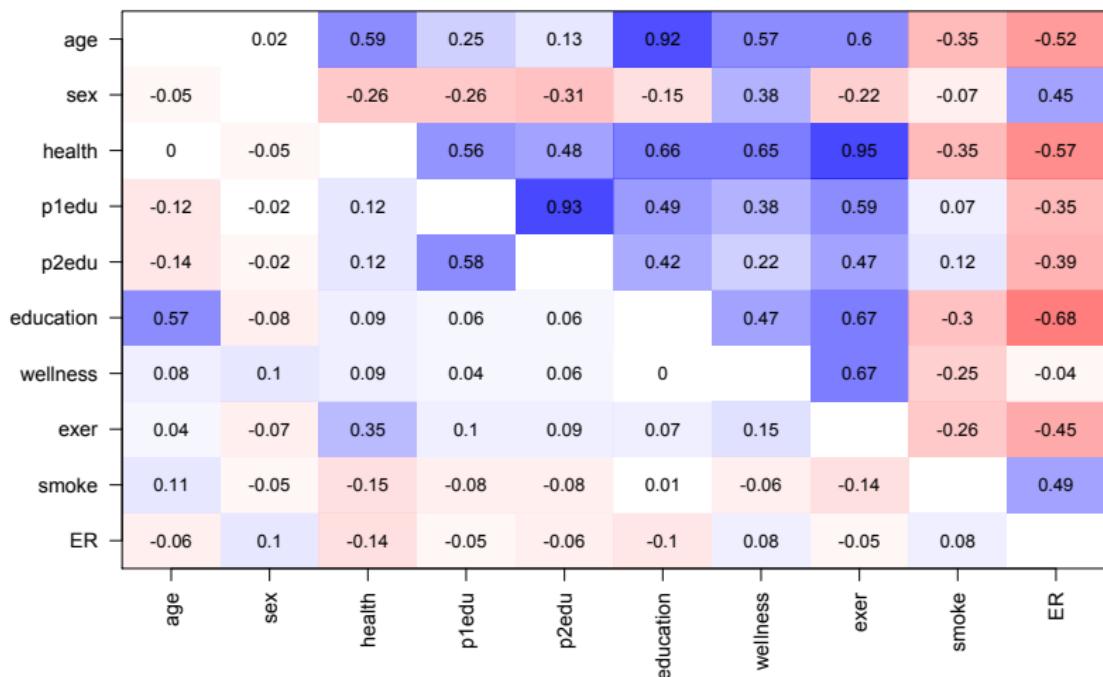
Try this with majors and occupations  
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## Comparing raw and profile correlations from the SPI dataset

Comparing raw to profile correlations

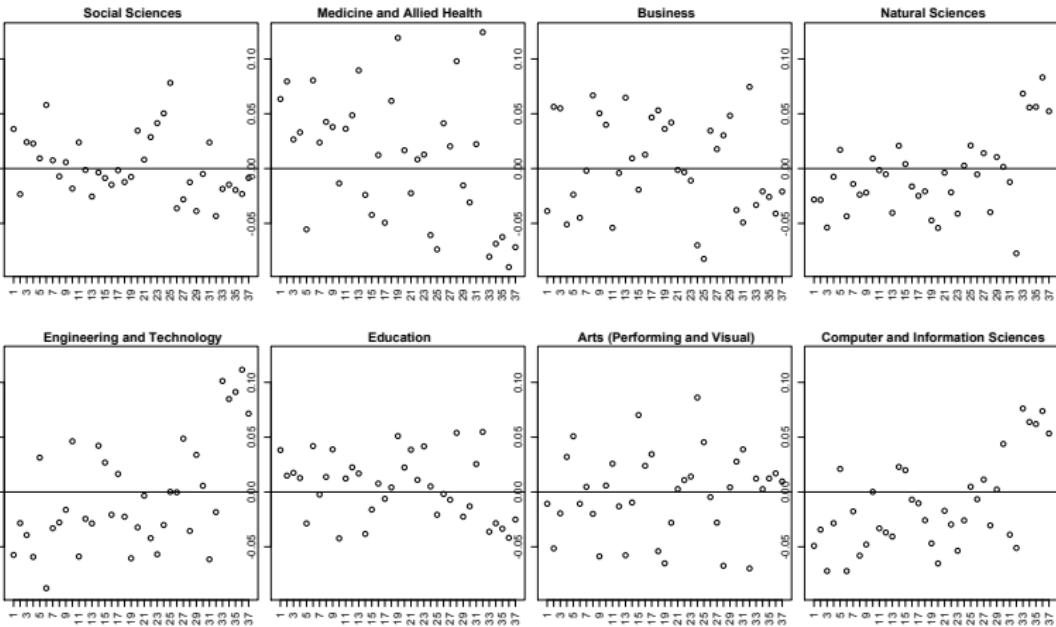


## Do people group themselves? Yes, college majors and occupations

1. People differ in their Temperament, Abilities and Interests (TAI)
2. Interests probably result from individual differences in Temperament and Ability
3. Tom [Bouchard \(2016\)](#) has suggested that we follow our interests based upon our skills
4. Lets examine this for college majors and for occupations using the SAPA 2010-2017 data set N= 255K
5. First we look at the correlation of majors field (13 superset of 146) and occupational field (22 of 991).
6. We show just the manhattan plots of the 8 largest majors or fields
7. Then we examine the PWAS correlations for 37 scales and 990 items-scales



## Manhattan plots of 37 scales items for 8 disciplines



Items  
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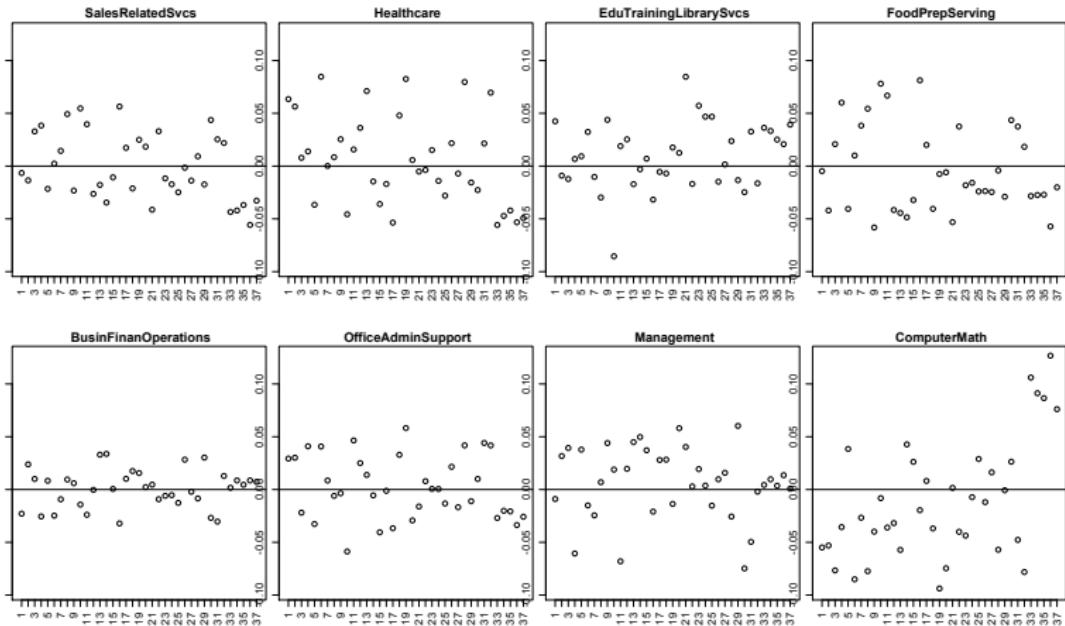
Profile correlations  
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Try this with majors and occupations  
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Conclusions  
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References

## Manhattan plots of 37 scale items for 8 job fields



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Items

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Profile correlations

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Try this with majors and occupations

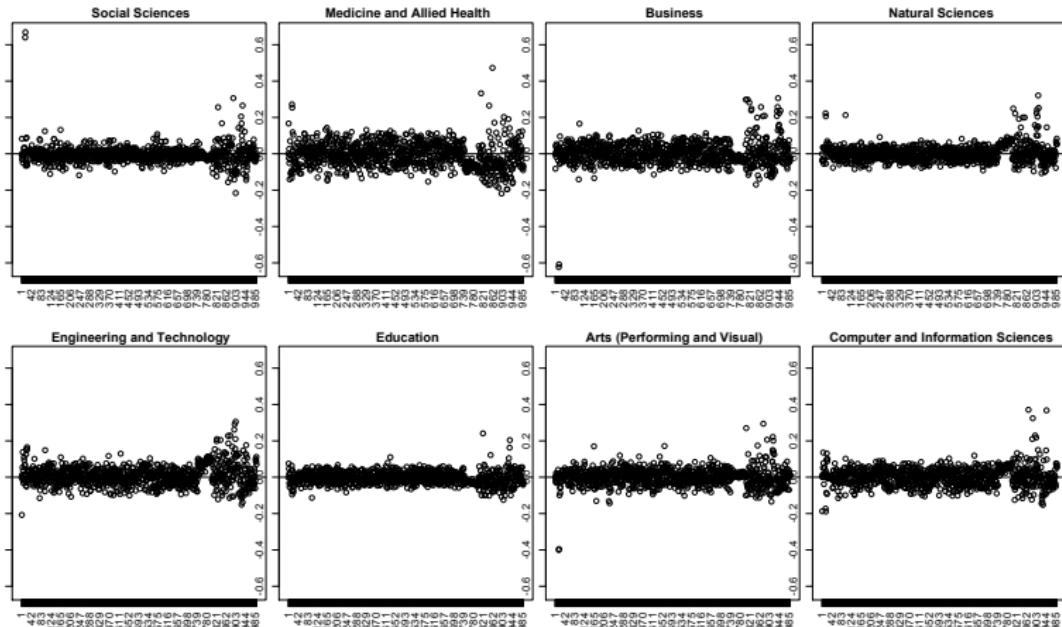
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Conclusions

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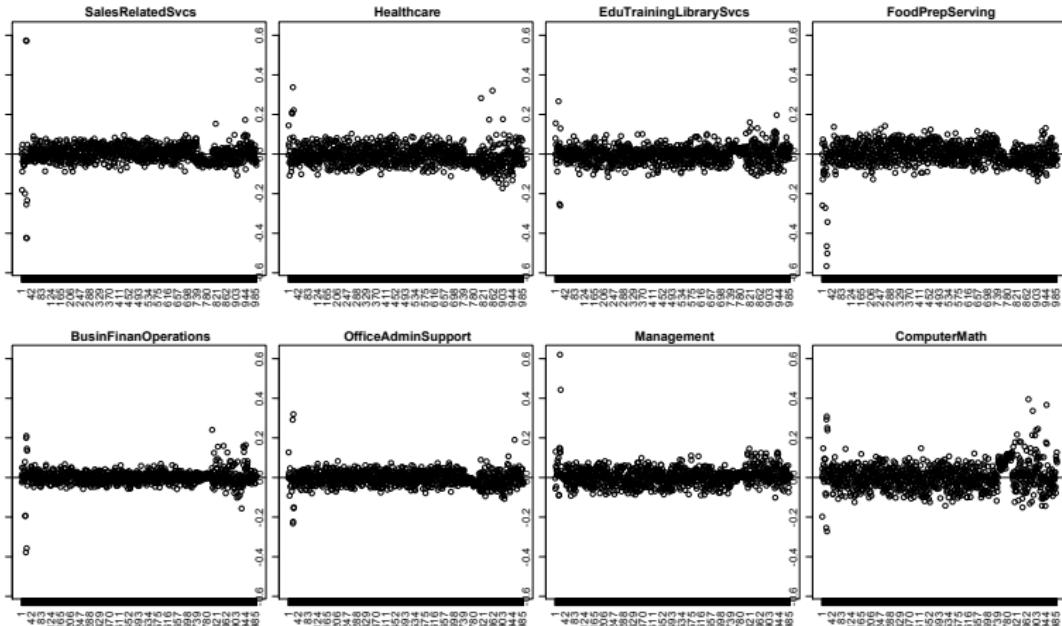
References

## Manhattan plots of 990 items for 8 disciplines



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# Manhattan plots of 990 items for 8 job fields



## Comparing majors or job fields by their profiles

1. We can correlate the manhattan plots (profiles) of the majors
2. This is a measure of similarity of pattern across the items
3. Yields a relatively clear 3 factor structure which may be hierarchically organized
4. Do the same for the job fields



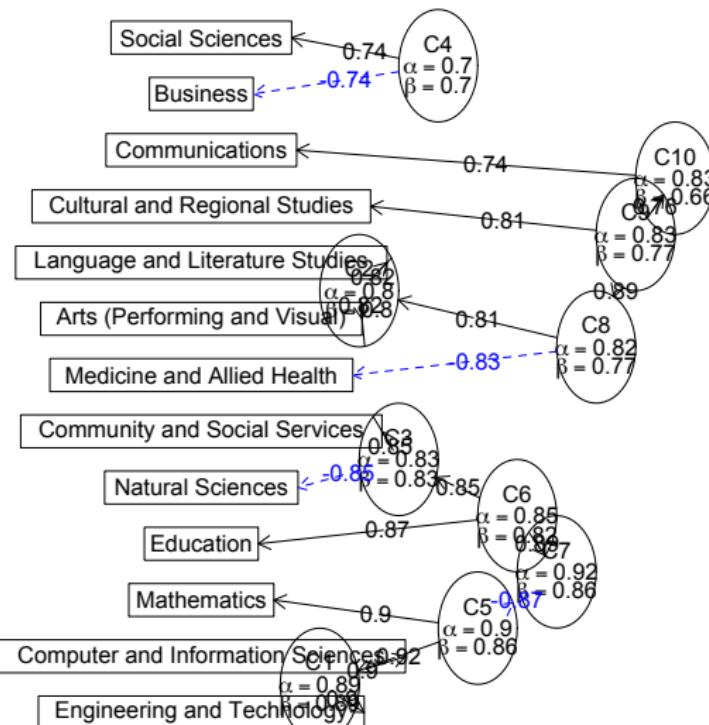
## 3 dimensions of college discipline profiles

	Standardized loadings (pattern matrix) based upon correlation matrix					
	MR1	MR2	MR3	h <sup>2</sup>	u <sup>2</sup>	com
Engineering and Technology	0.96	-0.11	-0.22	0.92	0.079	1.1
Computer and Information Sciences	0.87	0.13	-0.15	0.79	0.213	1.1
Mathematics	0.80	-0.02	0.09	0.67	0.335	1.0
Community and Social Services	-0.76	-0.13	-0.28	0.74	0.255	1.3
Education	-0.72	0.01	-0.06	0.53	0.473	1.0
Natural Sciences	0.68	-0.16	0.49	0.75	0.248	2.0
Arts (Performing and Visual)	0.04	0.81	0.05	0.67	0.327	1.0
Communications	-0.34	0.77	-0.21	0.67	0.327	1.5
Language and Literature Studies	0.11	0.68	0.48	0.82	0.179	1.9
Medicine and Allied Health	-0.59	-0.62	0.04	0.79	0.209	2.0
Cultural and Regional Studies	0.10	0.58	0.12	0.39	0.606	1.1
Business	0.00	-0.07	-0.89	0.82	0.183	1.0
Social Sciences	-0.46	0.00	0.64	0.57	0.434	1.8



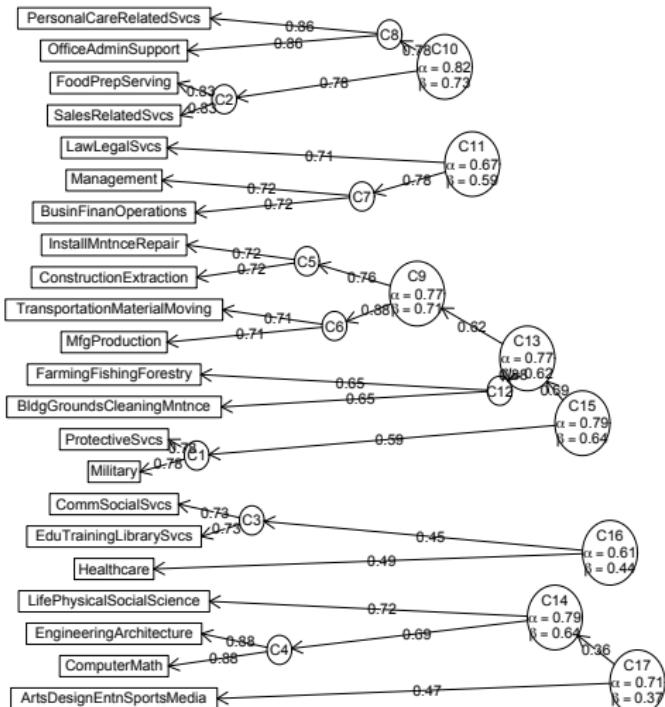
# The hierarchical structure of college discipline profile correlations

## 3 cluster solution to college major profiles



# The hierarchical structure of occupational fields

## ICLUST of Occupation Profile Correlations



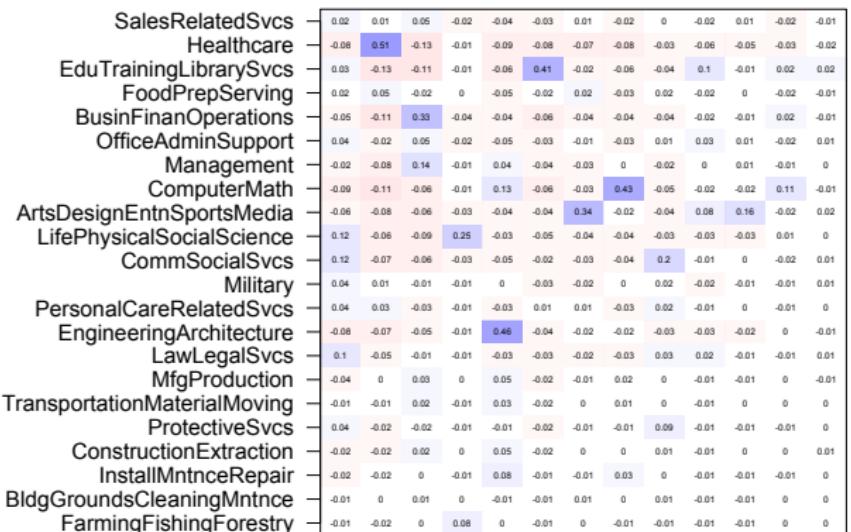
## Find the profile correlations between majors and job fields

1. The nice thing about profiles is they can be compared across domains
2. Thus, just as we examine the clustering of job fields or college majors so can we examine how the profile of majors relates to the profiles of job fields
3. We compare this to what happens if we naively examine which major goes onto which field



# The naive approach: majors and disciplines

Raw correlations of major field by occupation

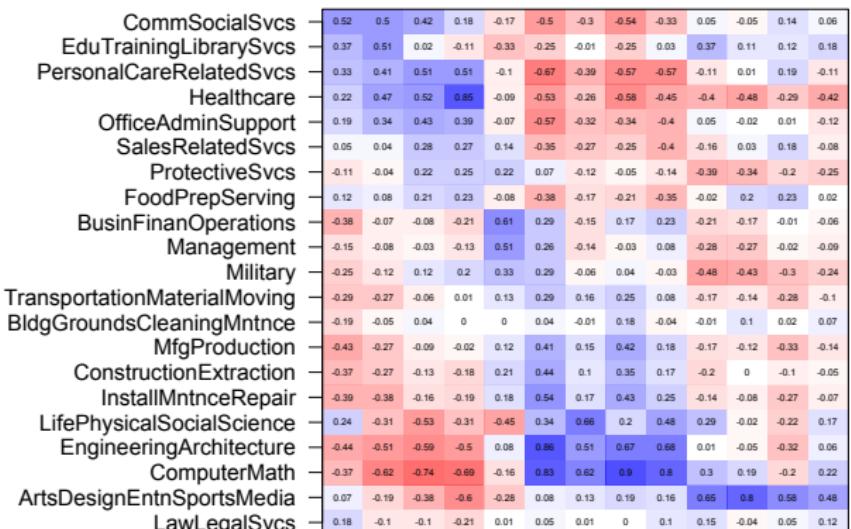


Items  
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ooooTry this with majors and occupations  
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References

# The PWAS profile approach

## Profile correlations of major field by occupation



## The advantage of items and profiles

1. There is more information in items than normally seen
2. By examining the profiles within and across areas, we can examine how individual differences in temperament, ability and interests unfold in the choice of college major and occupational field
3. There is evidence for sorting by TAI:
  - People (health care, social services),
  - Things (manufacturing, science)
  - Communication (law, history)
4. Are these discrete types?
  - Discrete: No
  - Increase in density: Yes



## Open Science

1. As with everything we do, our data and methods are open
2. The `spi` data set is available as part of the *psych* package (?) in R
3. All of the analyses are done using open source software (*psych*)
4. The larger data set has been released to dataverse
5. The slides for this presentation at at  
<https://personality-project.org/sapa>



Bouchard, T. J. (2016). Experience producing drive theory: Personality “writ large”. *Personality and Individual Differences*, 90, 302 – 314.

Condon, D. M. (2017). The SAPA Personality Inventory: An empirically-derived, hierarchically-organized self-report personality assessment model. Technical report, Northwestern University.

Möttus, R., Sinick, J., A. Terracciano, Hřebíckova, M., Kandler, C., & Jang, J. A. . . . K. L. (2018). Personality characteristics below facets: A replication and meta-analysis of cross-rater agreement, rank-order stability, heritability, and utility of personality nuances. *Journal of Personality and Social Psychology*.

Snow, C. P. (1959). "the Rede Lecture, 1959". In *The Two Cultures: and a Second Look* (pp. 1–21). Cambridge University Press.

