Individual differences beyond temperament: Expanding the boundaries of personality

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Presented to the British Society for the Psychology of Individual Differences

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The traditional study of individual differences

Thanks to British Individual Differences Psychologists

1. Temperament
   - Temperament: What we normally do
   - Validity studies of Temperament
2. Ability
   - Ability: What we can do
   - Validity studies of Ability
3. Interests
   - Interests: What we want to do
   - Validity studies of Interest
4. Character
   - Character: Doing what we should do
   - An ignored part of individual differences

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   - Gray (1970, 1981, 1982); Gray & McNaughton (2000)
4. For continuing in the grand tradition
   - Corr (2002, 2008b); Corr & Matthews (2009)
   - Deary et al. (2004, 2007, 2010)
   - Chamorro-Premuzic et al. (2011)

Personality and Temperament

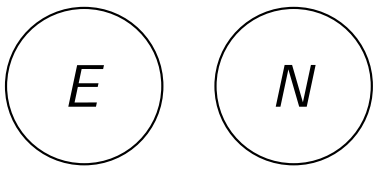
Hogan (1982) distinguishes between personality as identity and personality as reputation. To this we would add actions.

1. Identity
   - How we see ourselves
   - Studies of the structure of self report
2. Reputation
   - How others see us
   - Studies of the structure of peer report
3. Actions
   - What we actually do
   - Studies of the residues of our choices and our actions.

Two broad approaches to temperament

1. The European (particularly British) emphasis upon theory
   - Ray Cattell
   - Hans Eysenck
   - Jeffrey Gray
2. The American emphasis upon description
   - Gordon Allport
   - Warren Norman
   - Lew Goldberg
3. Perhaps a reconciliation with more Americans discussing theory
   - Colin deYoung

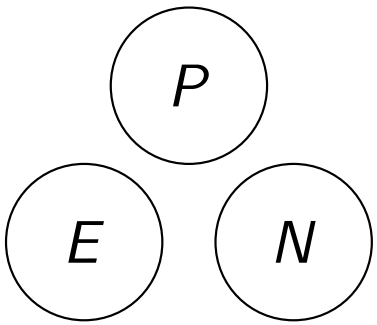
The contributions of Hans Eysenck



Early Eysenck model of temperament

1. Early theory of I/E was speed of conditioning
2. Later theory of I/E was arousal based Eysenck (1967b)
3. Original E was a mix of Impulsivity and Sociability (Eysenck & Eysenck, 1964; Rocklin & Revelle, 1981)
4. Systematic time of day by caffeine interactions for impulsivity but not sociability (Revelle, Humphreys, Simon & Gilliland, 1980)

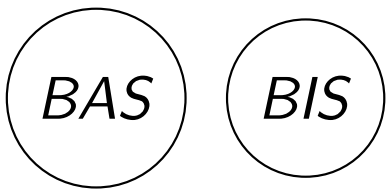
The contributions of Hans Eysenck



Later Eysenck model of temperament

1. Develop of Psychoticism scale and the EPQ (Eysenck, Eysenck & Barrett, 1985)
2. Some migration of impulsivity over to P, change of I/E to be primarily Sociability
3. Synthesis of correlational and experimental research (Eysenck & Eysenck, 1985b)
4. Growing evidence for heritability of all dimensions

Gray's revisions to Eysenck model

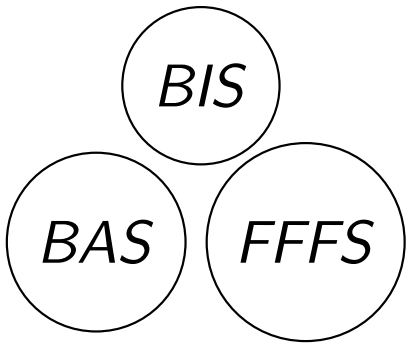


Original "Gray model"

Jeffrey Gray explored the biological mechanisms behind a conceptual rotation of Hans Eysenck's of two dimensions of E and N to Impulsivity and Anxiety (Gray, 1970, 1981)

1. Emphasis upon sensitivity to cues for reward and punishment
2. Anxiety and the Behavioral Inhibition System (BIS)
3. Impulsivity and the Behavioral Activation System (BAS)

Gray and Reinforcement Sensitivity Theory

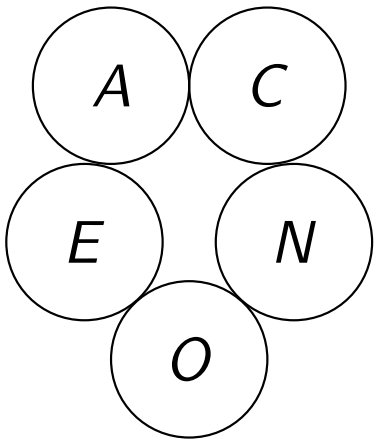


Subsequent revision now known as Reinforcement Sensitivity Theory (Gray & McNaughton, 2000; Corr, 2008a)

1. Continued emphasis upon sensitivity to cues for reward and punishment
2. Fear $\neq$ Anxiety
3. Sensitivity of Fight Freeze Flight System (FFFS) to cues for punishment
4. Sensitivity of Behavioral Activation System for cues for reward
5. Behavioral Inhibition System resolves FFFS/BAS conflict.

Current "Consensus model" of Temperament – The "Big 5"

Temperament

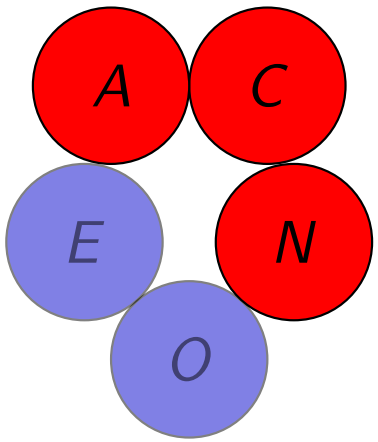


Dimensions of Peer and self report

1. Originally developed as structure of peer reports (Tupes & Christal, 1961; Norman, 1963; Digman, 1990; Goldberg, 1990)
2. With elaboration of Galton's "lexical hypothesis" came also to be a structure of self report.
3. Now being extended into the dimensional approach to the DSMV.

Perhaps not so much consensus

Temperament



Alternatives to the Big 5

1. The HEXACO: a 6 factor model Ashton, Lee & Son (2000); Ashton & Lee (2005)
2. Two higher order factors: α and β (or stability and plasticity) (Digman, 1997; DeYoung, Peterson & Higgins, 2002; DeYoung, 2010)
3. A proposed General Factor of Personality Musek (Musek, 2007; Rushton & Irwing, 2008, 2009)

Heritability of Temperament

1. Turkheimer's laws (Turkheimer, 2000)
   - First Law. All human behavioral traits are heritable.
   - Second Law. The effect of being raised in the same family is smaller than the effect of genes.
   - Third Law. A substantial portion of the variation in complex human behavioral traits is not accounted for by the effects of genes or families.
2. Johnson's laws (Johnson, 2010)
   - Many small genes
   - Heritability does not imply immutability
3. Heritable does not imply evolutionary importance.
   - Heritability of watching TV is roughly the same as that of Extraversion.
   - Are heritable personality traits just genetic junk?
   - Heritability does not imply simple biological system

The conventional US model: with some behavioral correlates

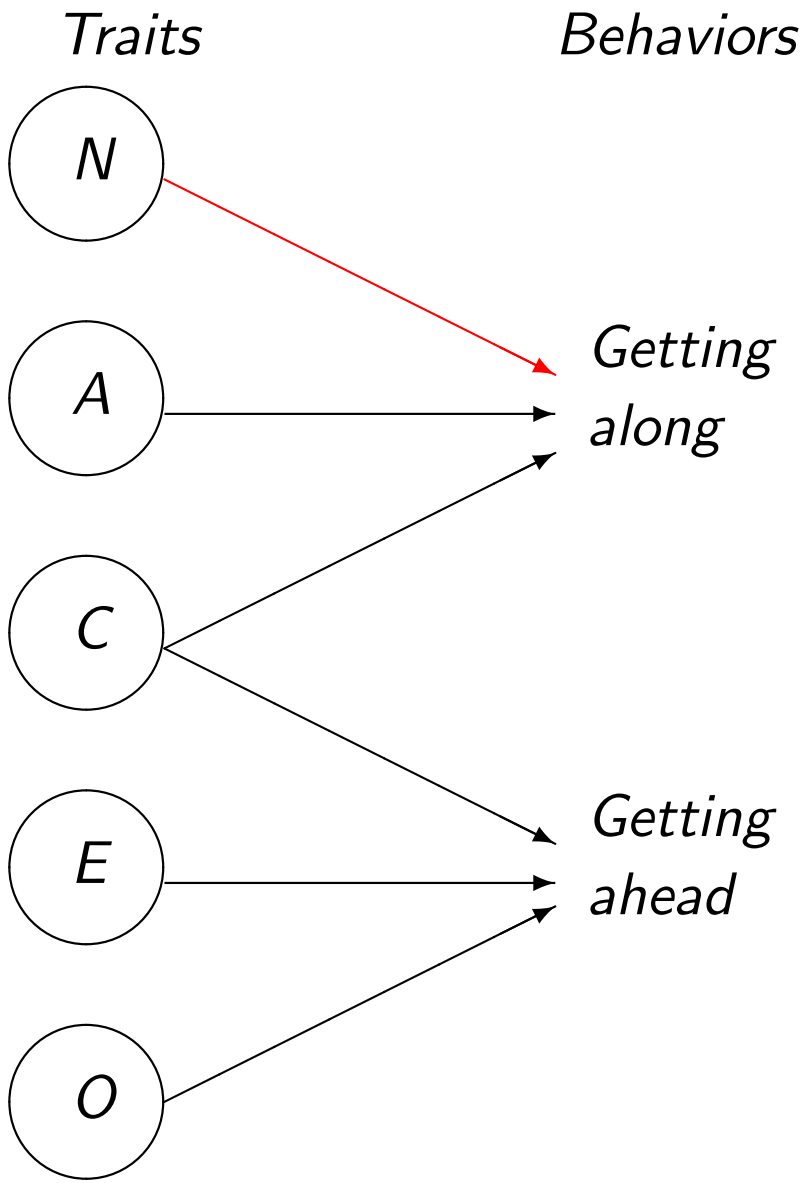
	Traits	*Behaviors*
	Neuroticism	
Traits are stable and have predictive power over the lifespan	Agreeableness	*Getting along*
	Conscientiousness	
Roberts and DelVecchio (2000)	Extraversion	*Getting ahead*
Caspi, Roberts and Shiner (2005)		
	Openness	

The conventional model: with some predictive powers

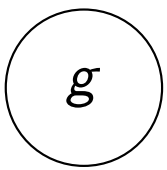
Traits are stable and have predictive power over lifespan

Mortality
Divorce
Employment

Roberts, Kuncel, Shiner, Caspi and Goldberg, (2007)



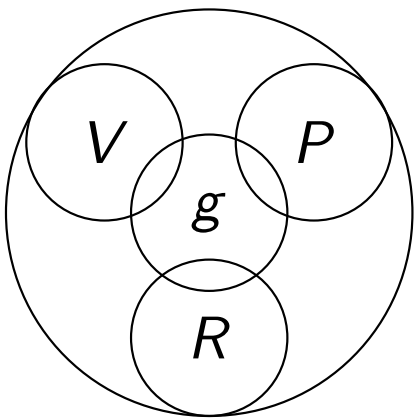
General factor model of Ability



A general factor of ability

1. Spearman (1904a, 1946) proposed a single factor to account for the positive manifold of ability tests.
2. Thomson (1935, 1951) argued that the positive manifold did not imply a general factor
3. Bartholomew, Deary & Lawn (2009) and Van Der Maas, Dolan, Grasman, Wicherts, Huizenga & Raijmakers (2006) have continued the critique of a general factor as an explanatory concept.

Traditional model of Abilities



Hierarchical models of intelligence

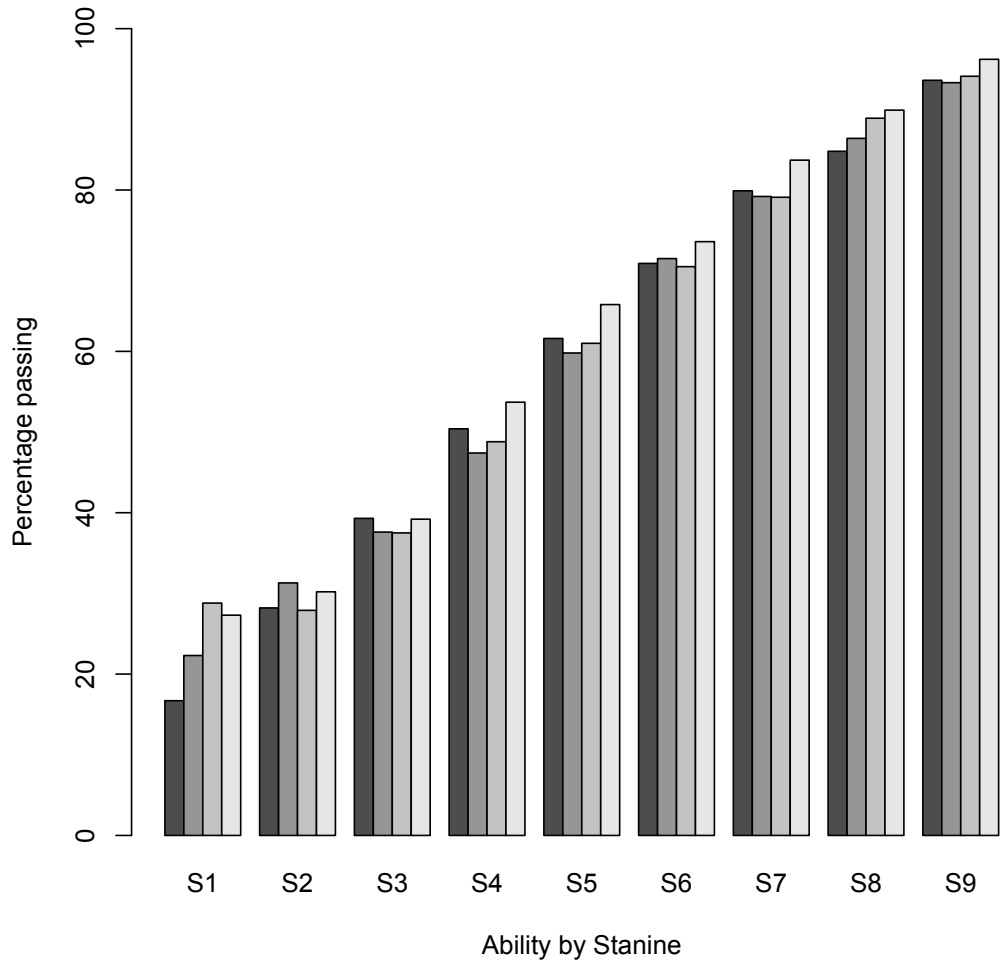
1. Horn & Cattell (1966, 1982) $g_f - -g_c$ model
2. Carroll (1993, 2005) three stratum model
3. McGrew (2009) as an integrative model
4. Johnson & Bouchard Jr. (2005) VPR model as alternative to $g_f - -g_c$

Predictive power of ability

1. Life as an intelligence test (Gottfredson, 1997)
   - life tasks differ in difficulty
   - the harder the task, the more g required
2. IQ predicts even at the very high end (Lubinski, Webb, Morelock & Benbow, 2001; Lubinski & Benbow, 2006)
   - It is not that ability does not predict the performance of the very high, it is just that the tests need to be given early enough.
3. Intelligence, health, and mortality:
   - Cognitive epidemiology (Deary & Batty, 2007; Deary, 2009)
   - Is "health literacy" anything more than "g"?

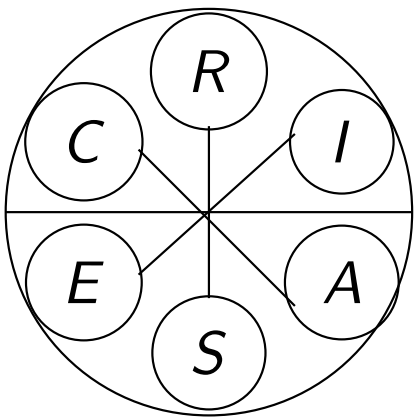
The power of ability: Army Airforce Selection

Army airforce selection study: predicting passing training based upon stanine of screening battery. Multiple R $\approx$ .42



Interests as an aspect of vocational counseling

Interests



1. Early work by Strong (1927)
2. Holland (1959, 1996) and the RIASEC model
   - Realistic
   - Investigative
   - Artistic
   - Social
   - Enterprising
   - Conventional

Character: Doing what we should do

"John Adams and his wife Abigail through character and personality did much to create understanding between the two English speaking countries" (Colonial Dames of America, 1983, plaque on Adams House, Duke Street and Grovener Square)

An integrative proposal

5. Previous integrative work
   - Integrating temperament, ability and interests
   - Temperament and Ability
   - Ability and Interests
   - Temperament and interests

6. A new organization
   - Prior demonstrations of the power of temperament, abilities and interest
   - A need for integrative studies
   - SAPA: A new methodology

Integrating temperament, ability and interests

- Personality theorists from the 1920s to late 1940s included ability and interests in personality formulations (e.g., Kelly & Fiske, 1950).
- Perhaps in a desire to be theoretical rather than applied, and not to discuss the socially dangerous idea of intelligence, American personality psychologists from the 1950s until the present have avoided or ignored the study of ability and interests.
  - Exceptions include Lubinski & Benbow (2000); Lubinski et al. (2001); Lubinski & Benbow (2006)
  - Ackerman (1997), Ackerman & Heggestad (1997)
  - Kuncel, Campbell & Ones (1998); Kuncel, Hezlett & Ones (2001); Kuncel, Crede & Thomas (2005)
- Ability was left to school psychologists, interests to counseling psychology. However, both were included in I/O psychology.
- It is time to rectify that oversight. What follows is a tentative proposal.

Ackerman: Integrating temperament, ability and interests

1. Looking for common threads in temperament, ability and interests
   - Ackerman & Heggestad (1997); Ackerman (1997) examined the commonality of the three domains
2. Emphasis upon what they have in common

Integrating Ability and Interests

- Camilla Benbow and David Lubinski's Study of Mathematically Precious Youth (SMPY) has yielded important results about the effect of the "tilt" between Verbal and Quantitative reasoning.
  - High Q and V leads to success
  - Quant $>$ Verbal leads to patents and success in science
  - Verbal $>$ Quant leads to novels and a career in the arts

Integrating Temperament and Interests

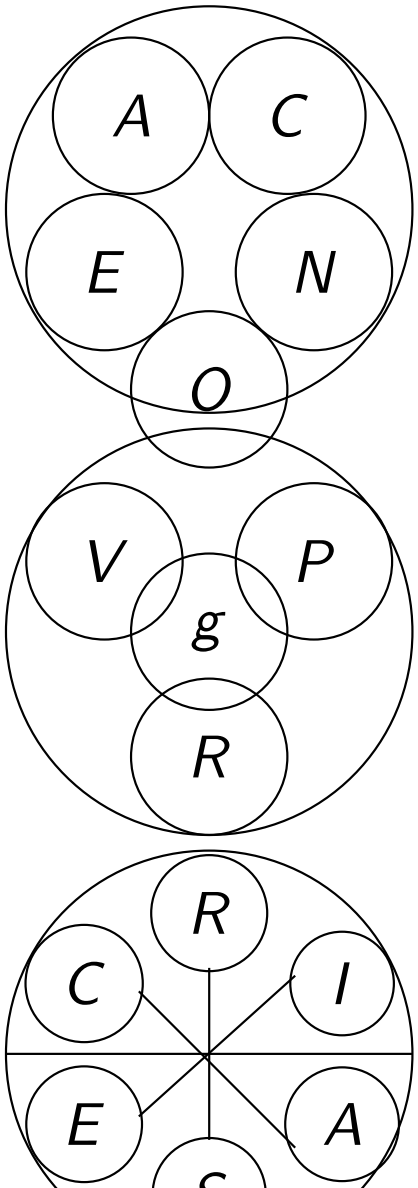
- Primary analysis has been to examine the correlations between domains of interest and those of the Big 5
  - Metanalsysis of RIASEC and NEO Larson, Rottinghaus & Borgen (2002)
- Some have looked at facet level correlations
  - Armstrong & Anthoney (2009) examined facet level correlations between RIASEC and NEO facets

Traditional model of Temperament, Abilities, and Interests

Temperament

Abilities

Interests



Temperament

2- 5 dimensions reflecting individual differences in Affect, Behavior, Cognition, Desire

Ability

1. g
2. g_f g_c

Interests

2 broad dimensions organizing 6-8 specific interests

1. People vs. Things
2. Facts vs Ideas

Temperament, ability, interests: Kelly and Fiske (1950)

- A classic study of graduate school success showed how temperament, ability, and interests all predicted performance equally well (Kelly & Fiske, 1950).
- Graduate students enrolled in 40 different clinical psychology programs in 1946 were evaluated by $\approx$ 75 psychologists at UM
- Criteria included ratings of clinical diagnosis, skill at individual therapy, research skills, preference for hiring
- Predictive measures that worked included
  - Ability: Millers analogy test
  - Temperament: Measures of neuroticism
  - Interests: Measures of psychological mindedness in interests
- "The most efficient clinical predictions, in terms of both validity and economy of data, are those based only on the materials contained in the credentials file and in the objective test profiles. The addition of autobiographical and projective test data appears to have contributed little or nothing to the validities of the assessment ratings."

A need for integrative studies

- Prior work has shown that there is a need to integrate Temperament, Abilities and Interests.
- But how to do it?
- To integrate the areas requires large sample sizes, ease of data collection, and a diverse subject population.
- Some do this through meta analysis, some use broad based national samples.
- Is it possible for single labs to do integrative studies?

How to do integrative studies?

- Problem of small samples sizes based upon college undergraduates. Typical subject pools are neither large enough nor diverse enough.
- Expensive to get access to large and diverse populations
  - Exceptions include national and international survey samples using preselected items:
    - National Longitudinal Study of Youth (NLSY)
    - Program for International Student Assessment (PISA)
    - German Socio-Economic Panel
- Is it possible to do large based sampling with tailored items?
- Yes, use the web.

Synthetic Aperture Personality Assessment (SAPA)

- Using the web to collect data on temperament, ability and interests
  - Synthetically form large covariance matrices from smaller subsets of items
  - Each subject given ≈ 50 personality, 10 interest, and 14 ability items sampled from the larger pool.
  - Total pool of items > 500
    - ≈ 400 personality items primarily from International Personality Item Pool Goldberg (1999)
    - 92 interest items for Oregon Vocational Interest Scales (Pozzebon, Visser, Ashton, Lee & Goldberg, 2010)
    - 56 ability items (home brewed at NU)
    - Demographic items include age, sex, education, race, country, college major, occupation (if appropriate)
    - Resulting sample sizes $> 50,000 - 100,000$
- College major, occupational status and interest items added in 9/10
- Data to be summarized include $\approx 30,000$ participants

Preliminary results

Method

1. Synthetic Aperture Personality Assessment (Revelle, Wilt & Rosenthal, 2010) forms large covariance matrices by sampling items across people
   - $\approx 120/day$ particpants are recruited to `test.personality-project.org`
   - Each participant is given 60-70 items
   - Total set of items being analyzed > 400
2. Item content being sampled
   - 100 "IPIP" Big 5 items
   - ≈ 200 other temperamental items
   - 54-75 home brewed ability items
   - 92 Oregon Vocational Interest items (ORVIS)
3. Although $> 200,000$ participants have been run in all, we will report only those data from the last 30,000
4. Demographic information included
   - Age, Gender
   - Level of education
   - College major and broad field (if appropriate)
   - Occupation (if appropriate)

Oregon Vocational Interest Scales: sample items

Adventure	Would like to be a professional athlete.
Altruism	Like to care for sick people.
Analytic	Would like to be a chemist.
Artistic	Create works of art.
Erudition	Would like to be a translator or interpreter.
Leadership	Like to make important things happen.
Organization	Would like to be the financial officer for a company.
Practical	Would like to care for cattle or horses.

Analytical approach: All analyses done in R

1. R: An international collaboration `http://R-cran.org`
2. R: The open source - public domain version of S+
3. R: Written by statistician (and all of us) for statisticians (and the rest of us)
4. R: Not just a statistics system, also an extensible language.
   - This means that as new statistics are developed they tend to appear in R far sooner than elsewhere.
   - For example, a recent issue of *Pschological Methods* had at least three articles with examples or supplementary work done in R
   - R facilitates asking questions that have not already been asked.
5. Special functions for SAPA have been written in R and are included in the **psych** package.

Analytical reporting

1. Given the sample sizes, statistical significance is not an issue, but rather the size of the effects.
2. Correlation is an appropriate effect size measure
   - Correlations between continuous variables are reported as Pearson r
   - Correlations between dichotomous variables are reported as tetrachoric correlations
   - Correlations between continuous and dichotomous are reported as biserial
   - These last two correlations make assumptions of normal distributions of latent traits
3. Data displays are graphical techniques for showing the complex, multivariate structure of the data
   - Correlation strength reported as a "heat map" with positive correlations shaded as progressively darker shades of blue, negative correlations as darker shades of red.
   - Patterns of correlations will be shown as "spider" or "radar" images, with line length reflecting the correlation.

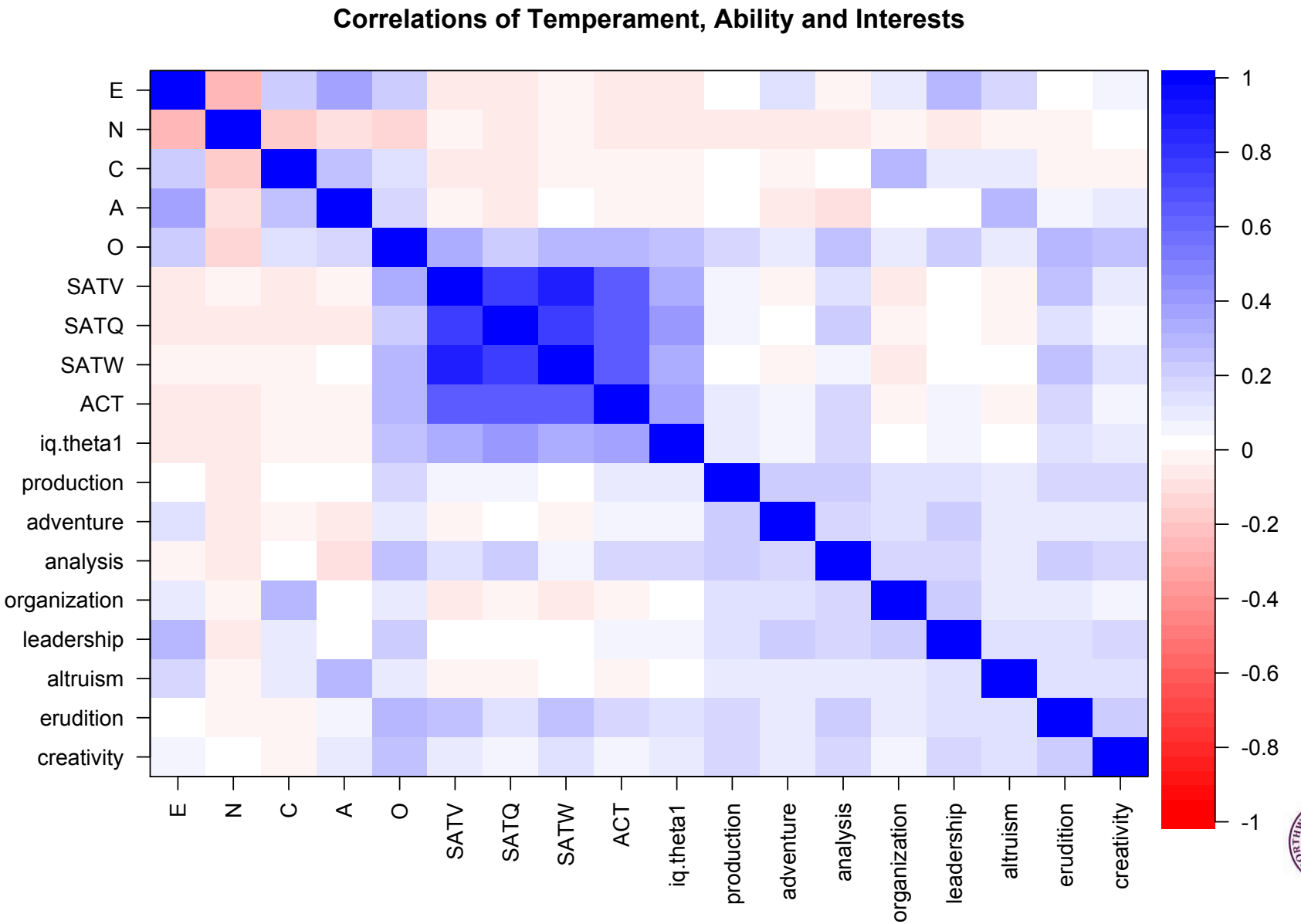
Analysis of Temperament, Ability, Interests

1. Big 5 scale scores used an Item Response Theory (IRT) algorithm
   - With complete data, IRT and simple sum scores are almost identical.
   - SAPA data are Massively Missing at Random and are better estimated using IRT techniques.
     - Two parameter model: item difficulty, item location
     - One parameter model: item difficulty
2. Ability measures
   - SATV, SATQ, SATW and ACT were self reported
   - iq measure was based upon IRT analysis and scoring

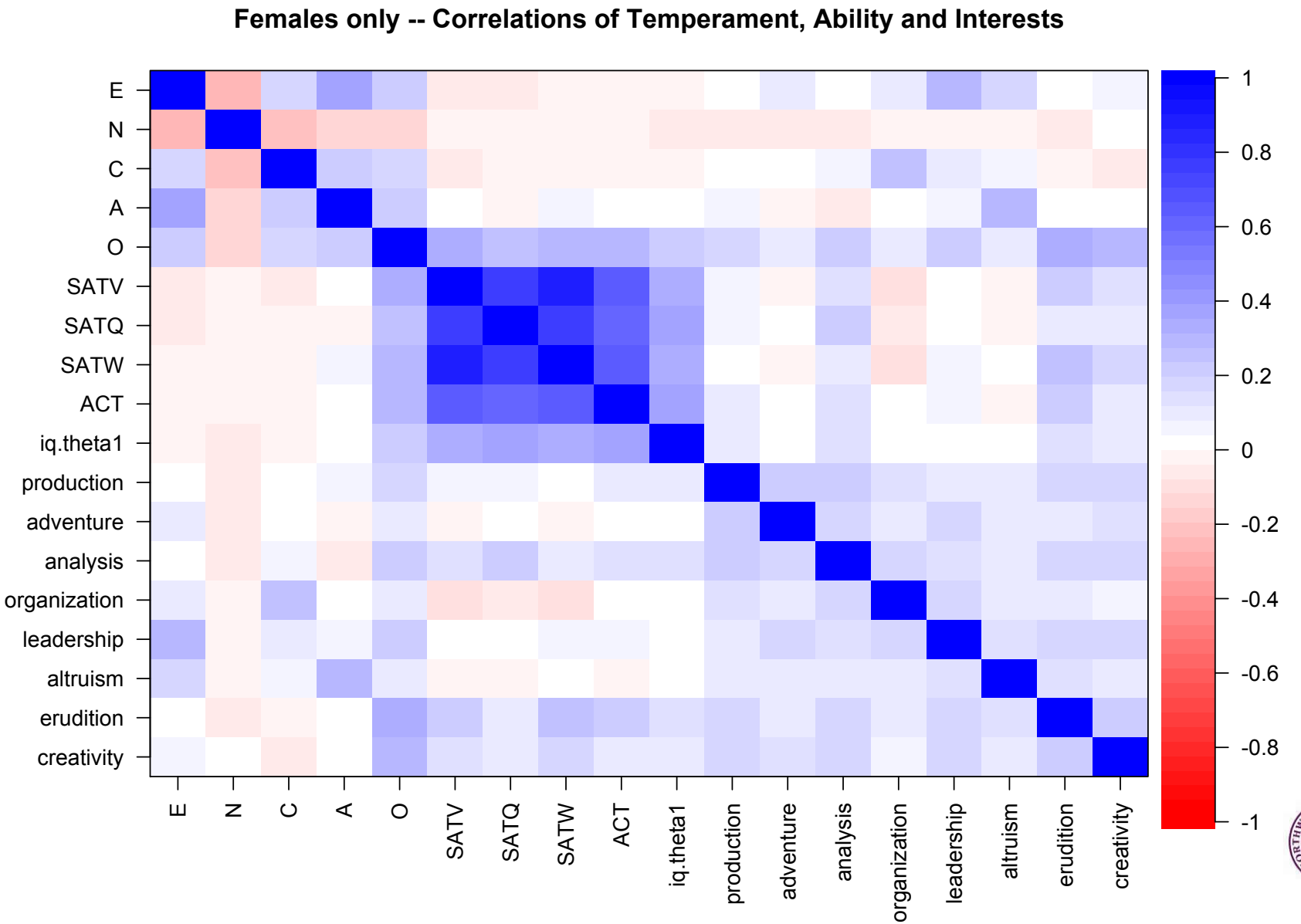
4 sets of results

1. Intercorrelation of Temperament, Ability and Interests
   - Reported for all subjects
   - Broken down by gender
2. Temperament, Ability and Interests: correlations with college major
   - Reported for all subjects
   - Broken down by gender
3. Temperament, Ability and Interests: correlation with occupation
   - Reported for all subjects
   - Broken down by gender
4. "Spider plots" of various college majors

Three domains: Temperament, Ability and Interests



Three domains: Temperament, Ability and Interests – Females only



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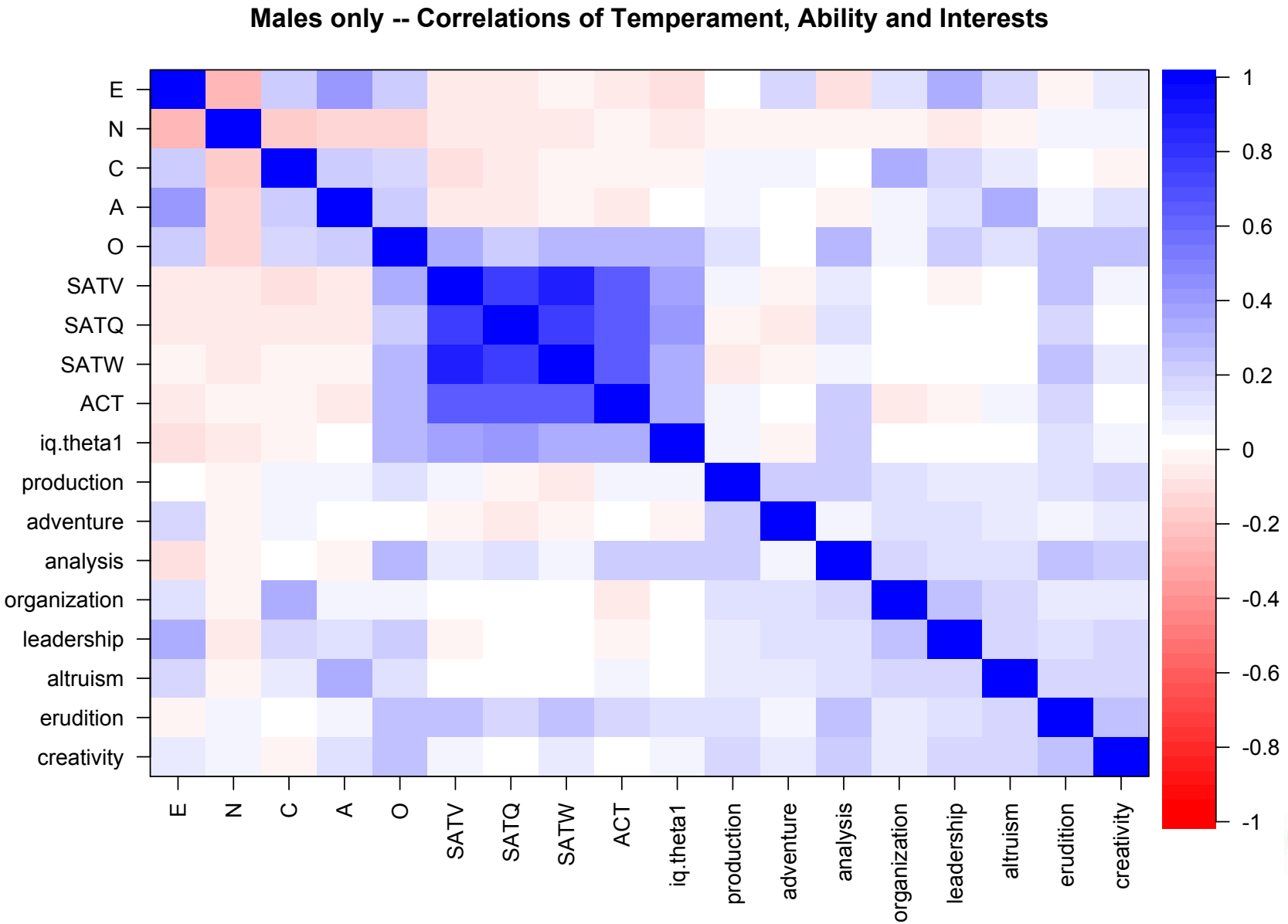
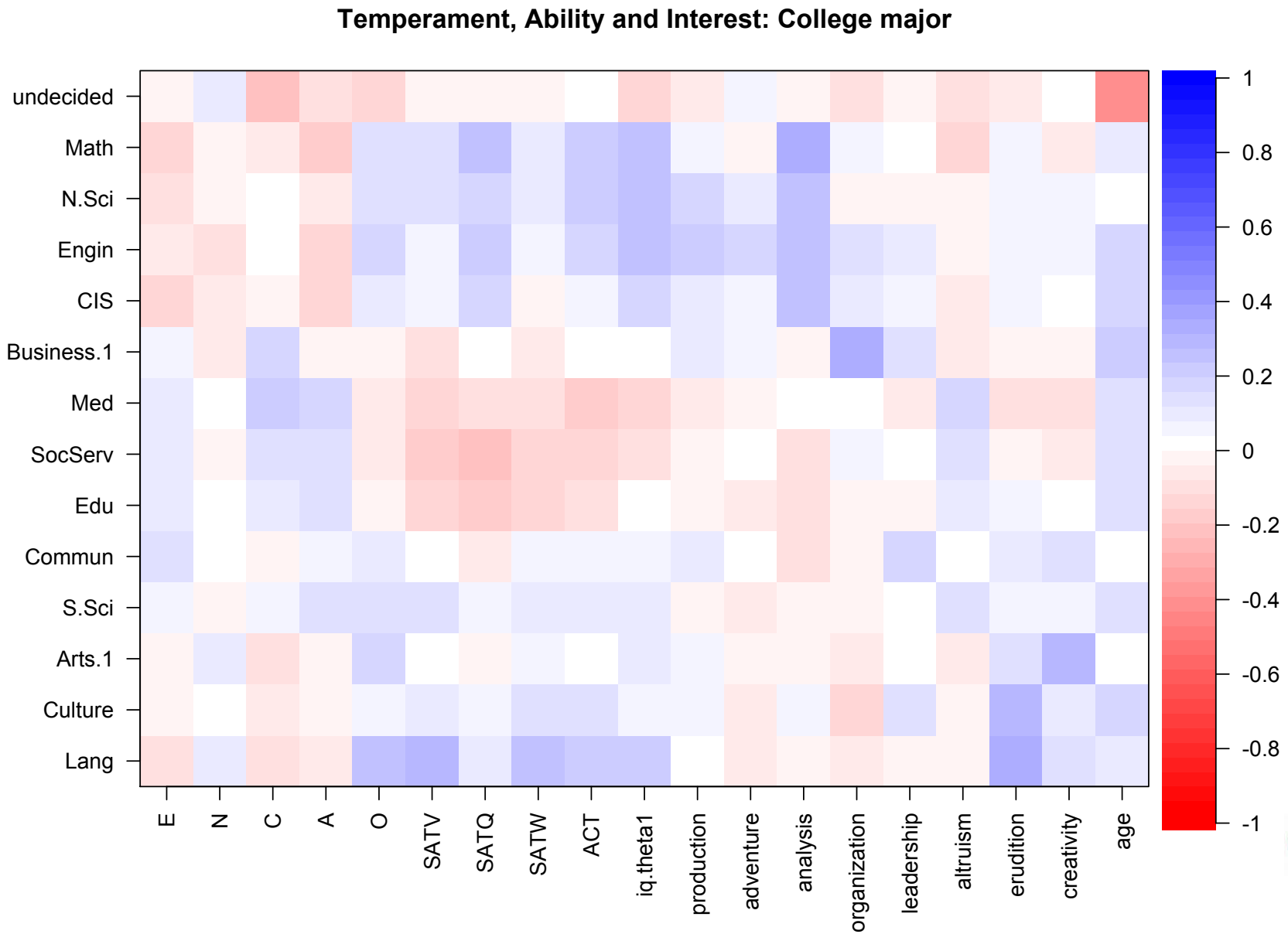
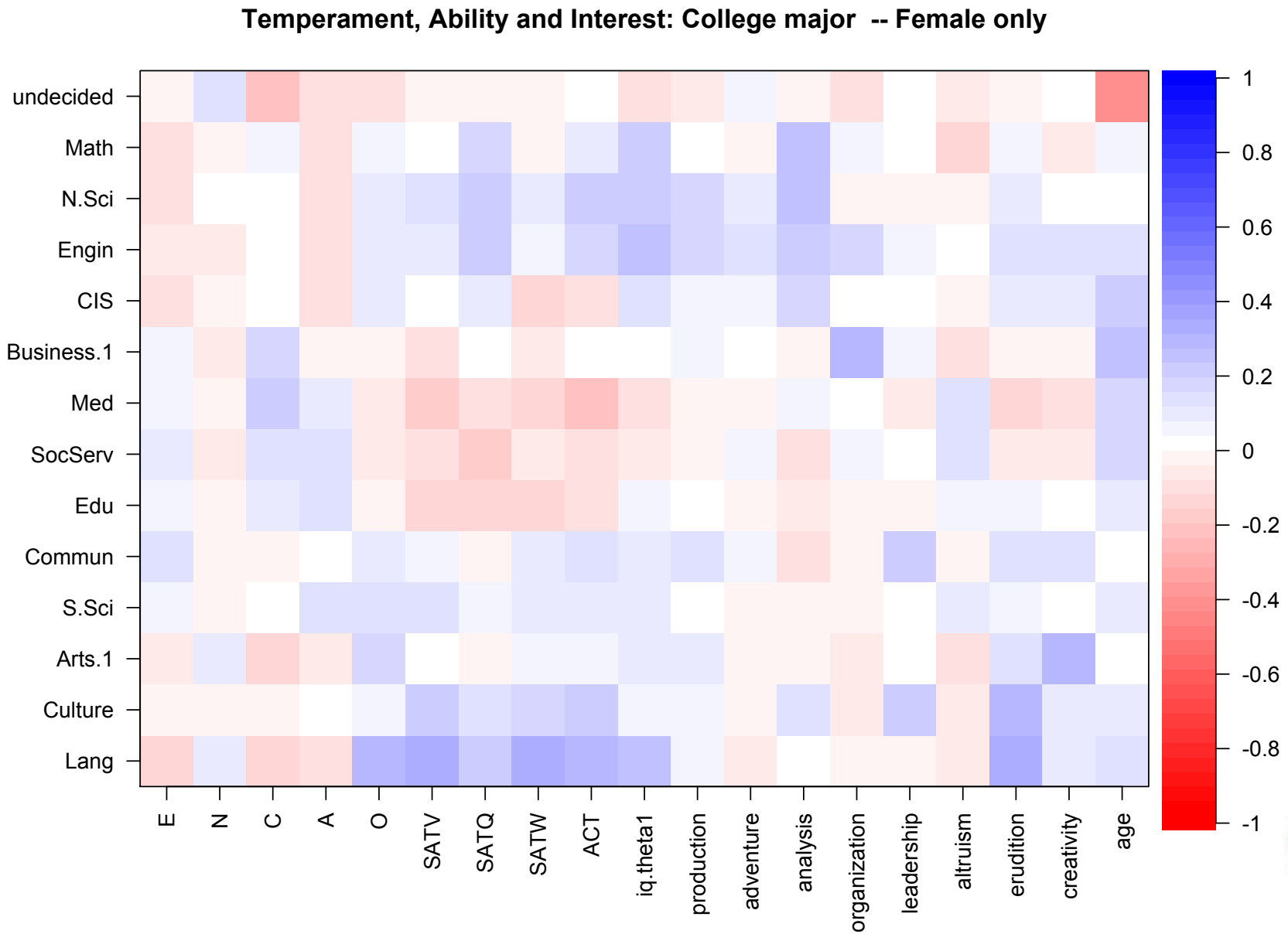


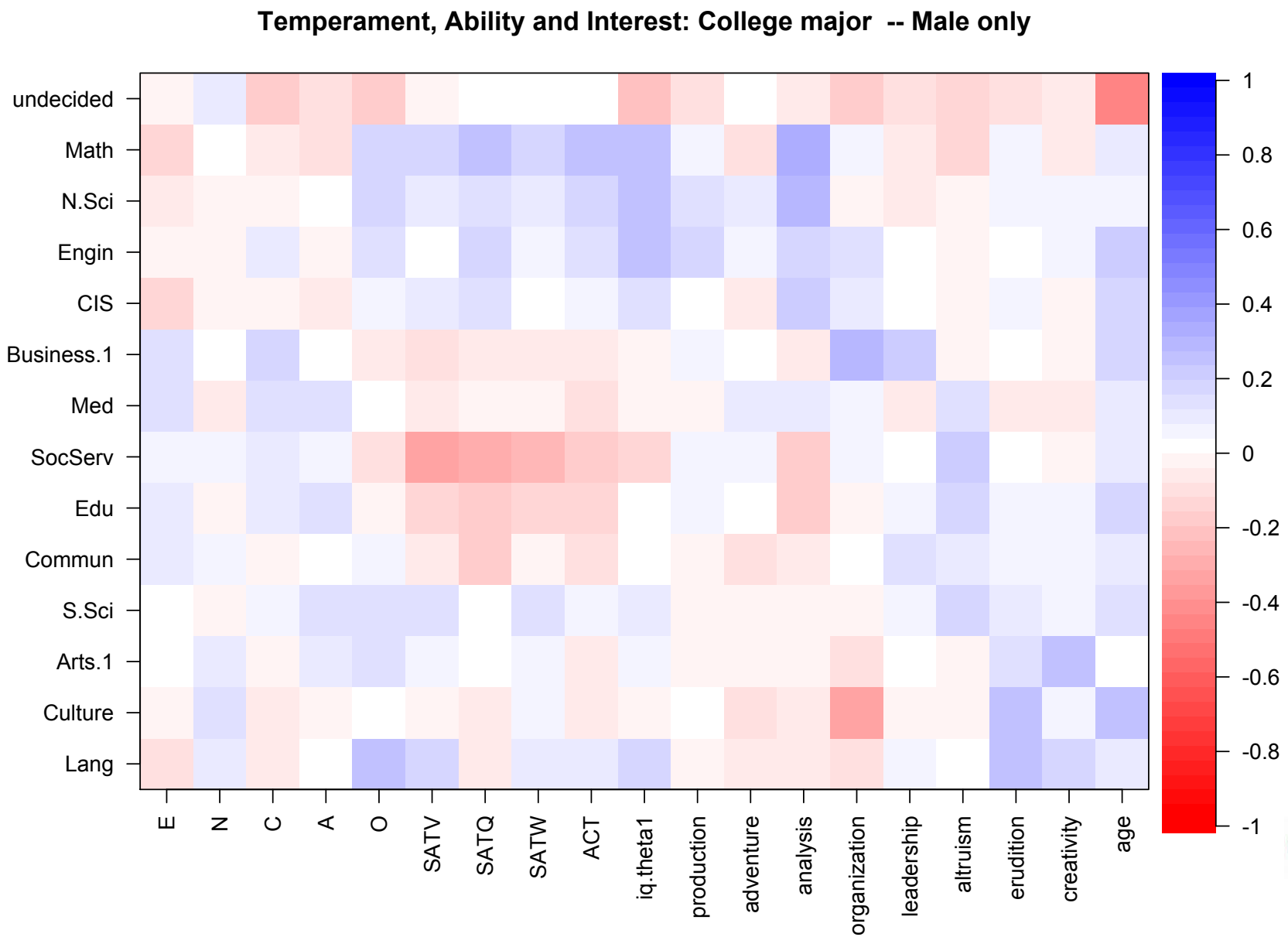
College major by Temperament, Ability and Interests



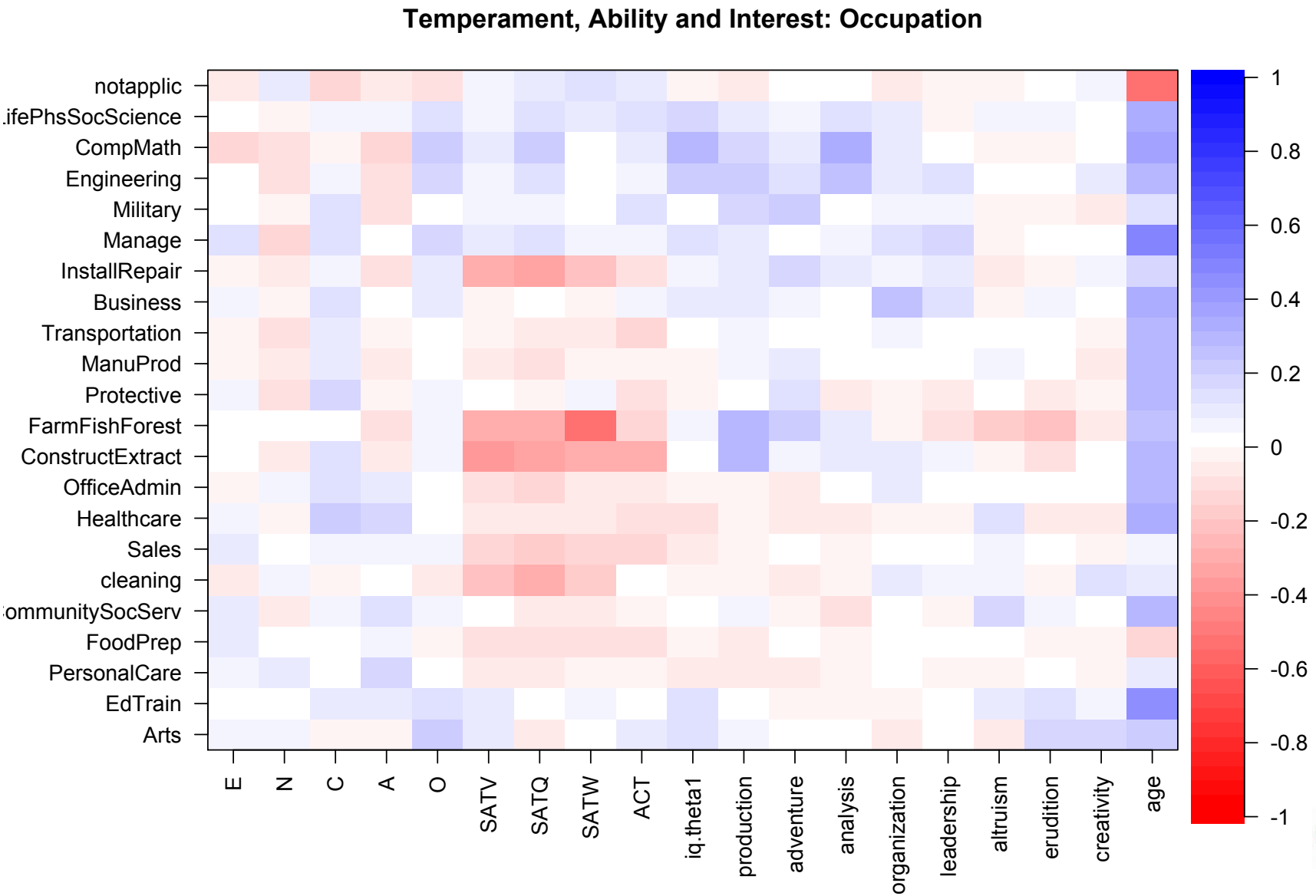
College major by Temperament, Ability and Interests- Females only



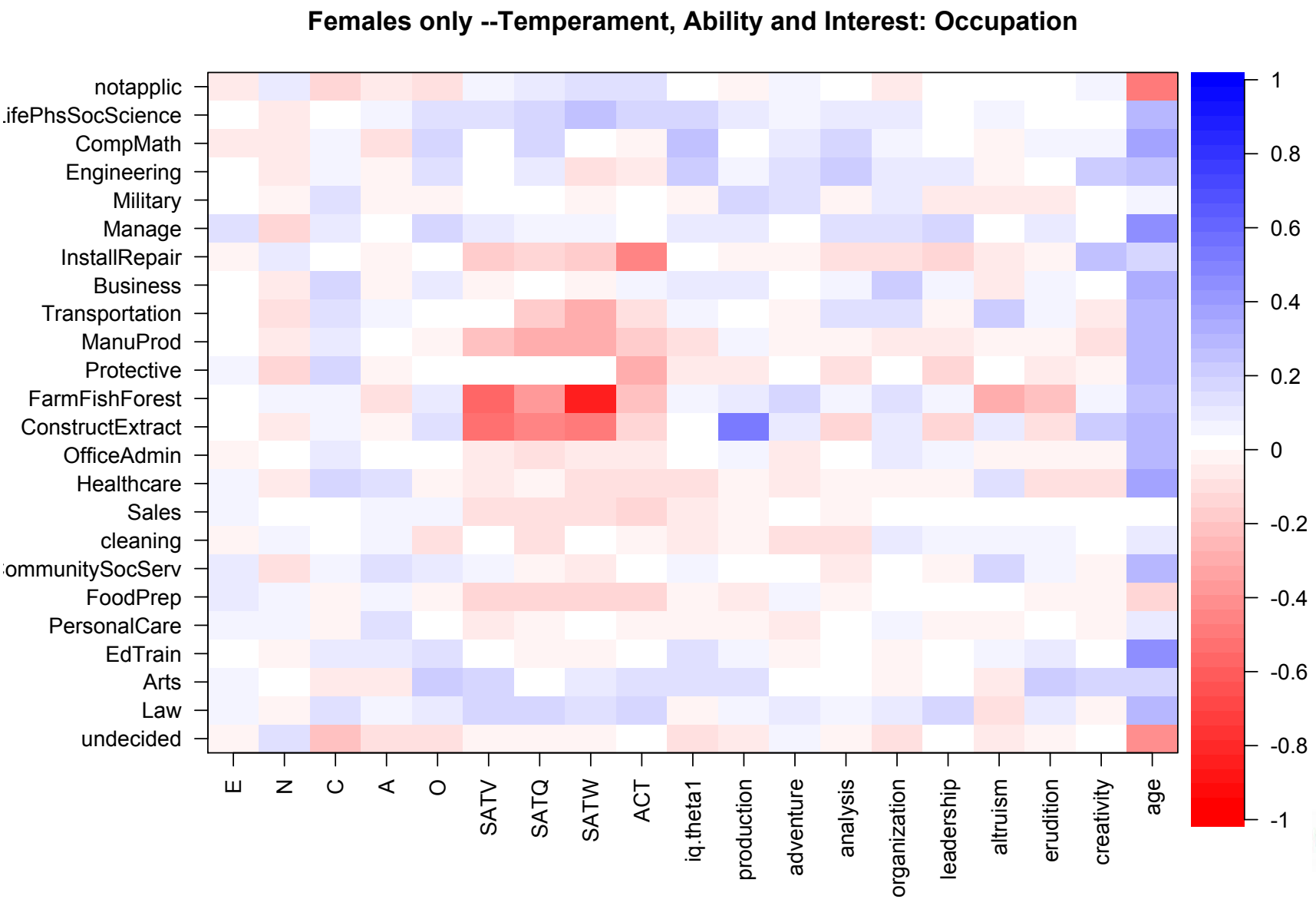
College major by Temperament, Ability and Interests- Females only



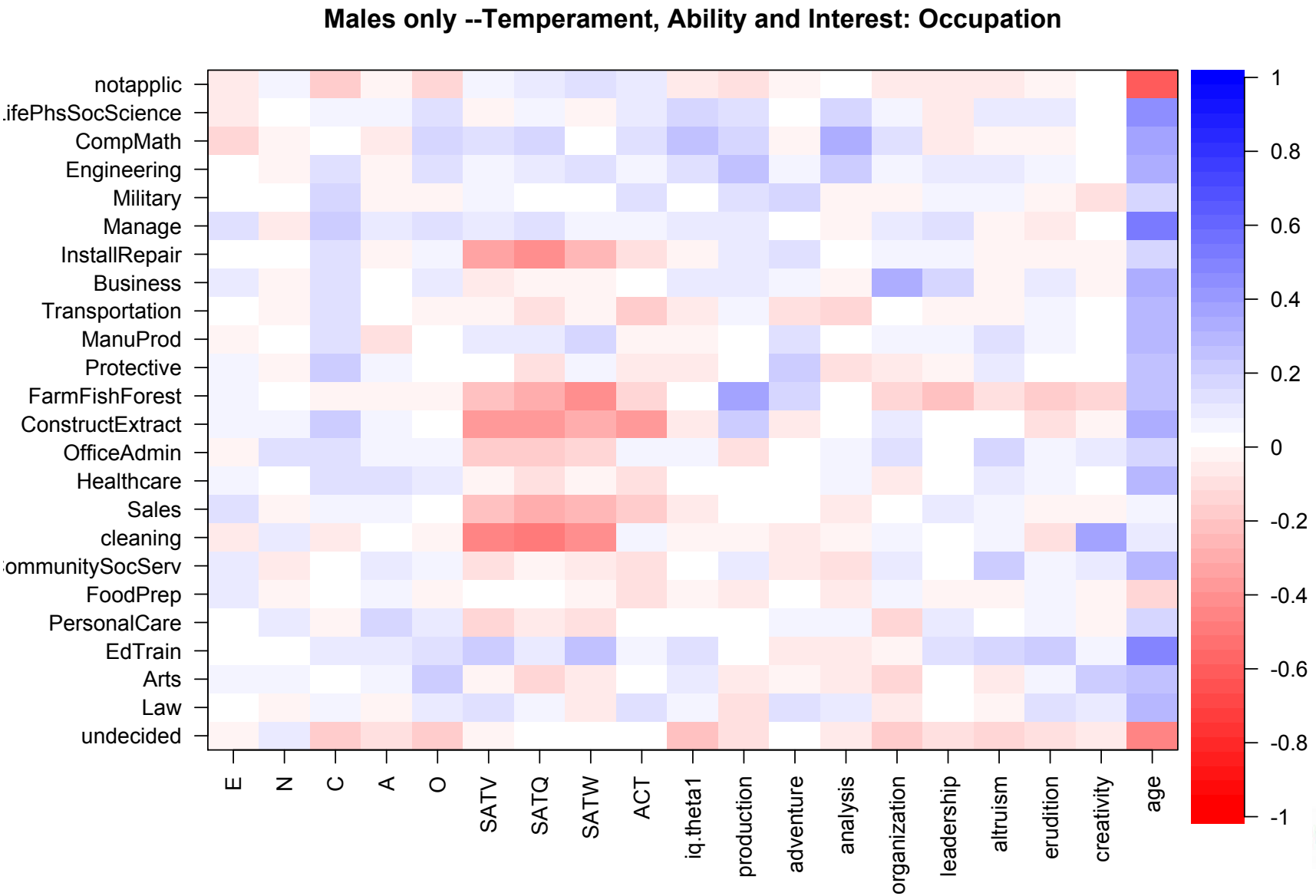
Occupation by Temperament, Ability and Interests – All participants



Occupation by Temperament, Ability and Interests- Females only



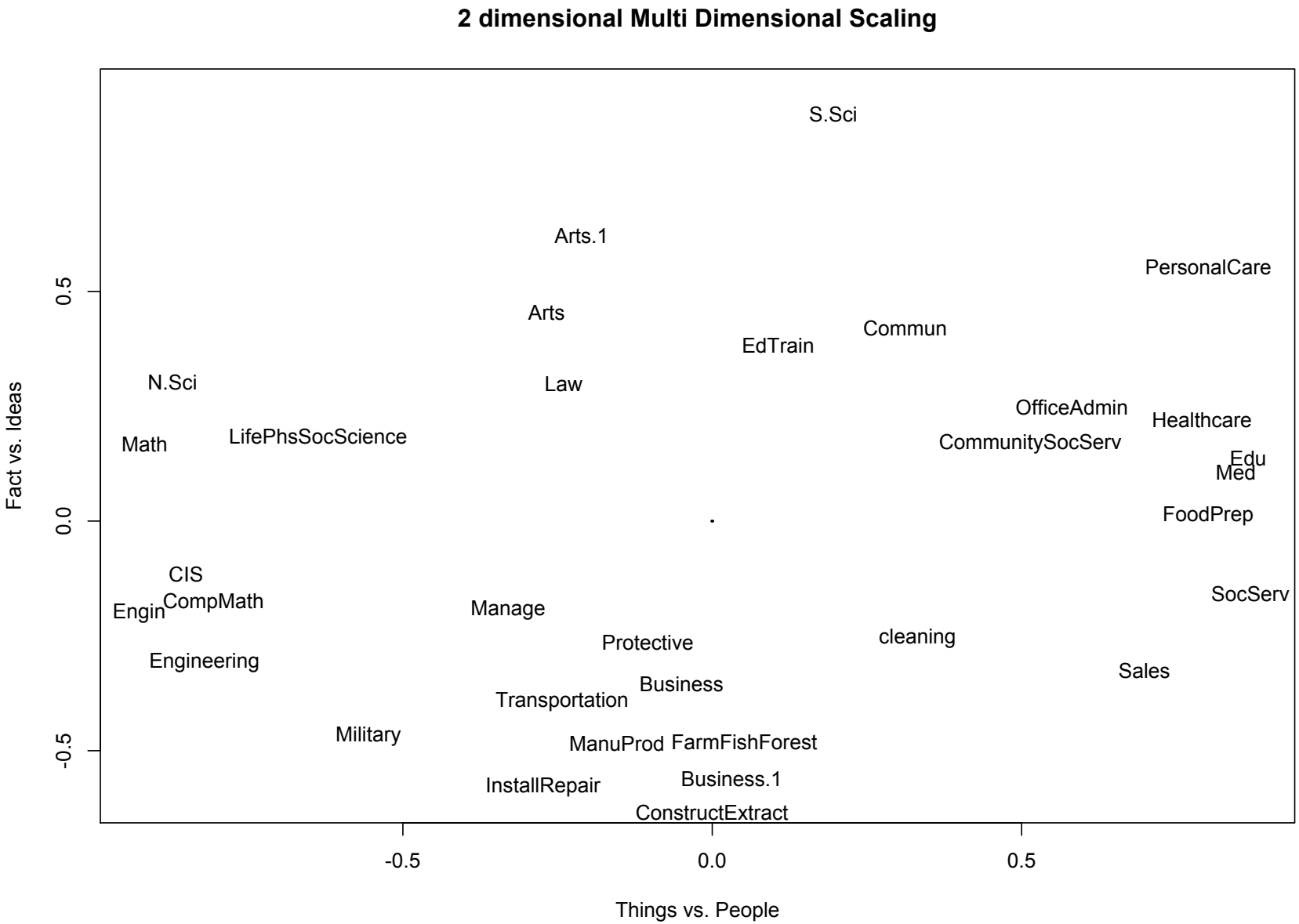
Occupation by Temperament, Ability and Interests- Males only



Converting variable oriented data to person oriented data

1. The correlations between Temperament, Ability and Interests are taken over all occupations
   - This is the conventional way of analyzing data
2. Can compare occupations and majors in terms of their pattern over the TAI varibles
   - Less frequently done, this amounts to a Q analysis (Cattell, 1966a)
   - This correlation of majors and occupations across TAI measures is a 34 x 13 Q analysis
   - Convert the correlations to distances and then do a multidimensional scaling of the resulting matrix
   - Varimax rotation of the resulting dimensions.

A multi dimensional scaling of majors and occupations.

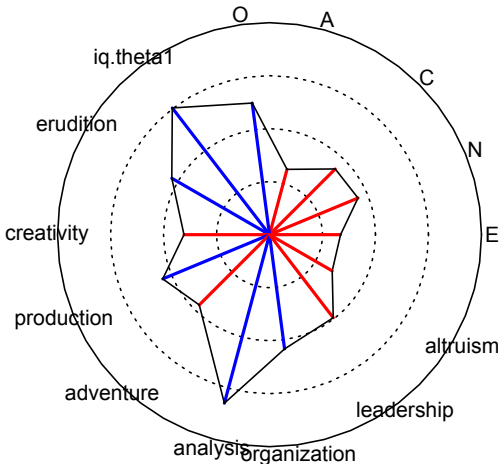


"Spider plots" show patterns within groups across TAI variables

1. This is simply a way of showing correlations for multiple variables for different groups.
    - Just another way of showing correlational strength
2. Spider plots are particularly useful for showing structural differences across groups.

Temperament, Ability and Interests – Science orientation

Math



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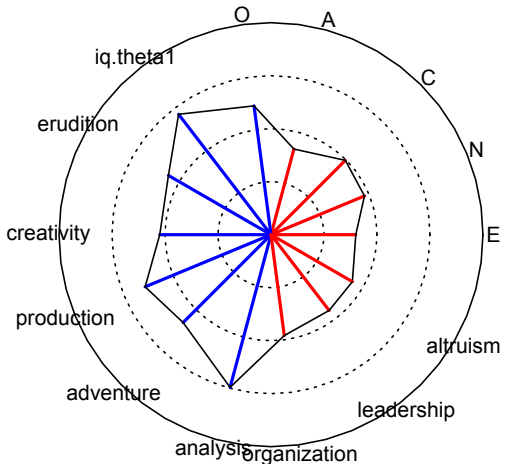

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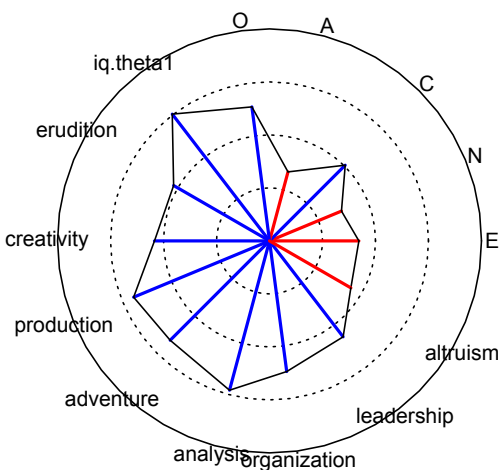

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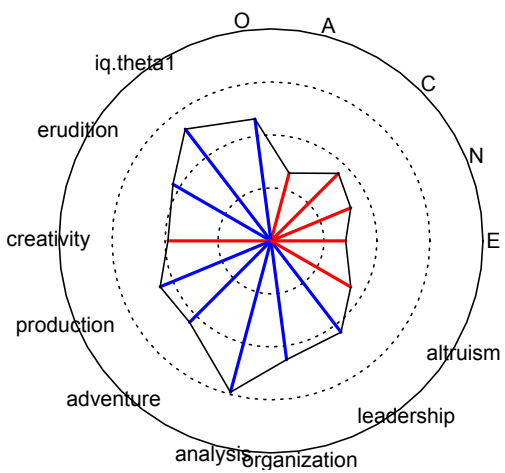
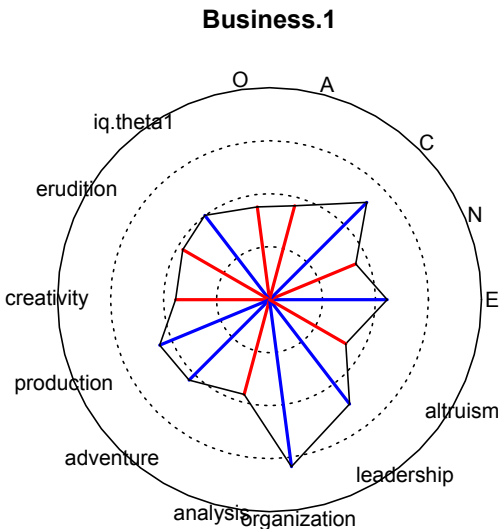
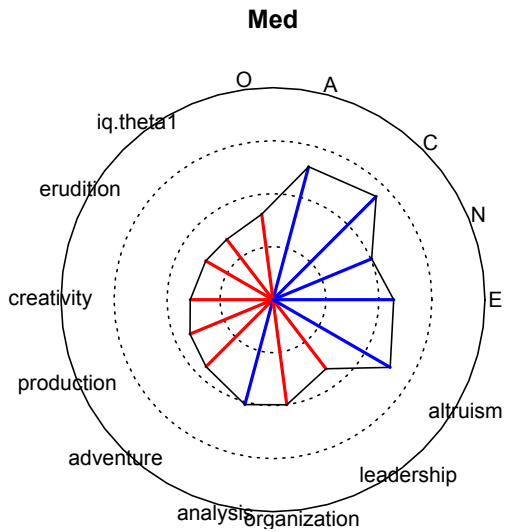
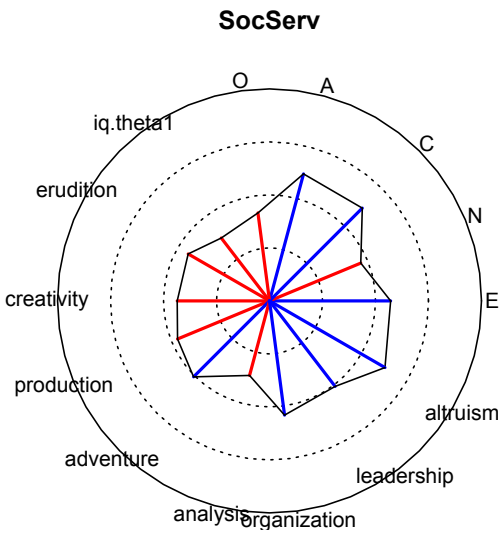
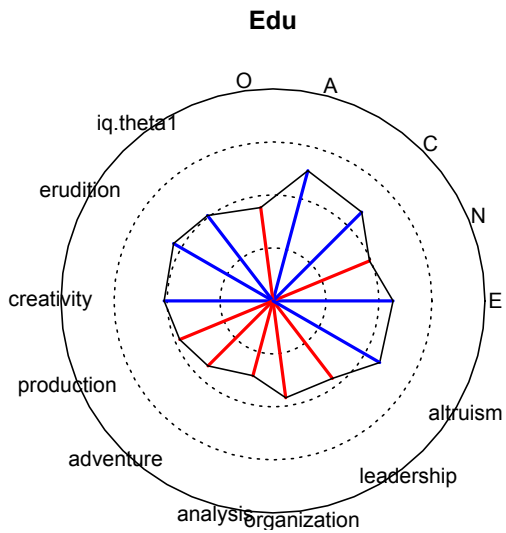


Temperament, Ability and Interests- Business orientation

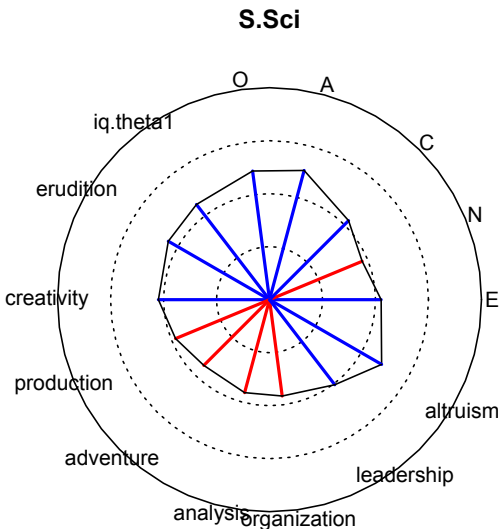


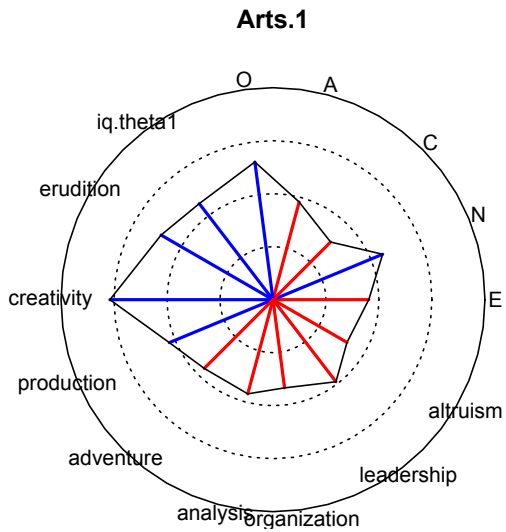


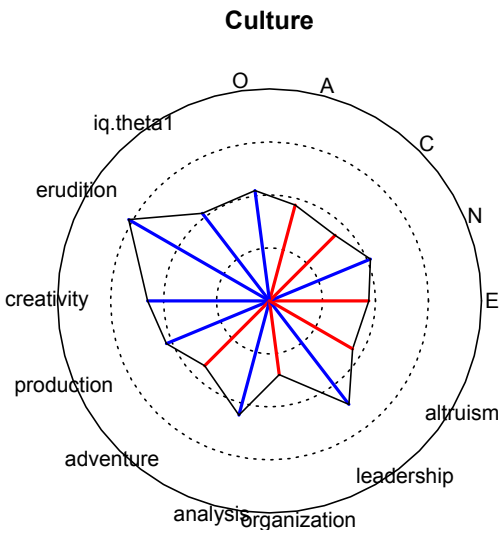


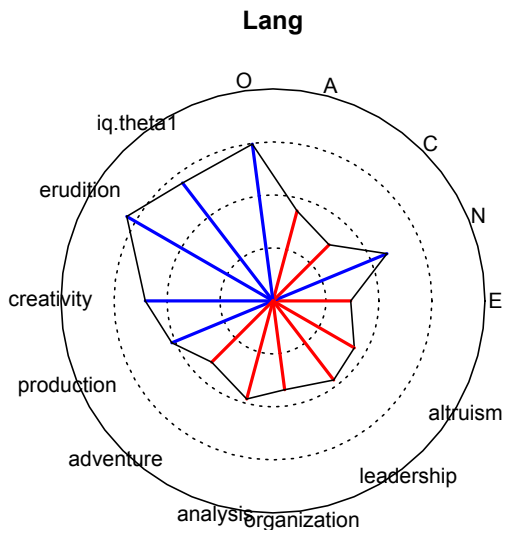


Temperament, Ability and Interests- Arts orientation









Tentative conclusion

1. Temperament, Ability and Interests are important sources of individual differences
   - Share some but not much common variance
   - Openness/Intellect and cognitive skills
   - Interests reflect some temperamental differences
2. Better to use all three domains as predictors of real world consequences
   - More to be gained by using all three domains rather than forcing into artificial synthesis
3. The study of individual differences is alive and well

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