Individual differences in Cognition: the Personality-Cognition link

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"***Individual differences in cognition***"

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Błażej Szymura and Edward Nęcka

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Individual differences in cognition: the Personality-Cognition link

Traditional studies of cognitive ability have examined the component processes and factor structure of ability tests. Theoretical and empirical studies of non-cognitive dimensions of personality have examined how individual differences in personality interact with situational stressors to affect efficient cognitive performance. Previously reported results have emphasized motivational direction and intensity effects upon cognitive performance. Using a new technique of "synthetic aperture personality assessment" (SAPA) which takes advantage of the large subject populations available on the internet, it is possible to study how basic personality dimensions relate to dimensions of cognitive ability. The SAPA procedure presents to participants small subsets of items sampled from large pools of publicly available personality and ability items. Although each participant is given only a small subset of items, with the recognition that subjects (> 50,000) are randomly sampled and items are missing at random, it is possible to synthesize large (>300x300) interitem correlation matrices. Individual differences in complex pattern recognition, spatial reasoning, and (self reported) standardized ability tests are moderately associated ($.16 < R^2 < .23$) with Big 5 measures, particularly with openness and introversion. I will present the SAPA procedure in some detail and review findings relating dimensions of personality, ability, and interest.

Personality and Cognition

- Personality is the integration and patterning of Affect, Behavior, Cognition and Desire in the service of Effective Functioning.
- The typical distinction between cognition and personality is perhaps better called the distinction between cognitive and non-cognitive aspects of personality.
- These cognitive and non-cognitive aspects of personality are predictors of real world preferences and behaviors

Overview

- ABCDs of personality
- Synthetic Aperture Personality Assessment (SAPA) as a tool for exploring cognitive and non-cognitive aspects of personality
- Application of SAPA techniques to showing importance of both cognitive and non-cognitive aspects of personality in predicting real world criteria

Personality and the ABCDs

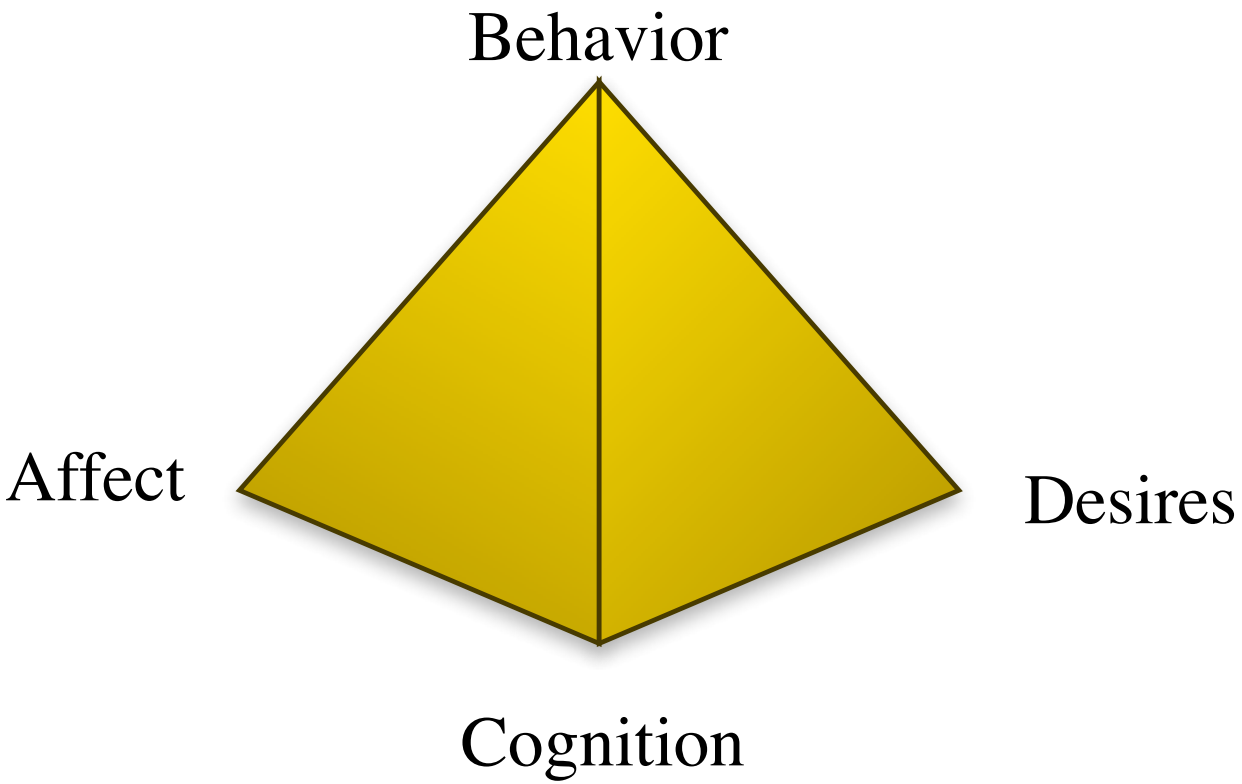
Personality is an abstraction used to explain consistency and coherency in an individual's pattern of Affects, Cognitions, Desires and Behaviors. What one feels, thinks, wants and does changes from moment to moment and from situation to situation but shows a patterning across situations and over time that may be used to recognize, describe and even to understand a person. The task of the personality researcher is to identify the consistencies and differences within and between individuals (what one feels, thinks, wants and does) and eventually to try to explain them in terms of set of testable hypotheses (why one feels, thinks, wants and does).

The ABCDs of Personality

- Affect (what we feel)
- Behavior (what we do)
- Cognition (what we think)
- Desire (what we want)
- Environment (where we are)

Ortony, A., Norman, D.A. & Revelle, W. (2005): Effective Functioning: A Three Level Model of Affect, Motivation, Cognition, and Behavior. in J. M. Fellous & M. A. Arbib (Eds.), *Who Needs Emotions? The Brain Meets the Machine*. New York: Oxford University Press.

The ABCDs of Personality



The ABCDs and the study of personality

- Four fundamental components
  - Affect, Cognition, Desire, Behavior
- Six pairwise "edges"
  - e.g., Affect x Cognition, Affect x Behavior, Cognition x Behavior, ...
- Four facets (Affect x Cognition x Behavior, ...
- Complete Integration requires ABCD

But, the ABCDs happen at three levels of processing

- Reactive
  - External Cues evoke fixed Action Patterns
- Routine
  - External Cues evoke Action Tendencies
  - Action Tendencies elicit Actions
  - Actions reduce Action Tendencies
- Reflective
  - Control Process monitors Reactive and Routine levels

See MacLean (1990), Ortony et al., (2005) Sloman & Logan(2005)

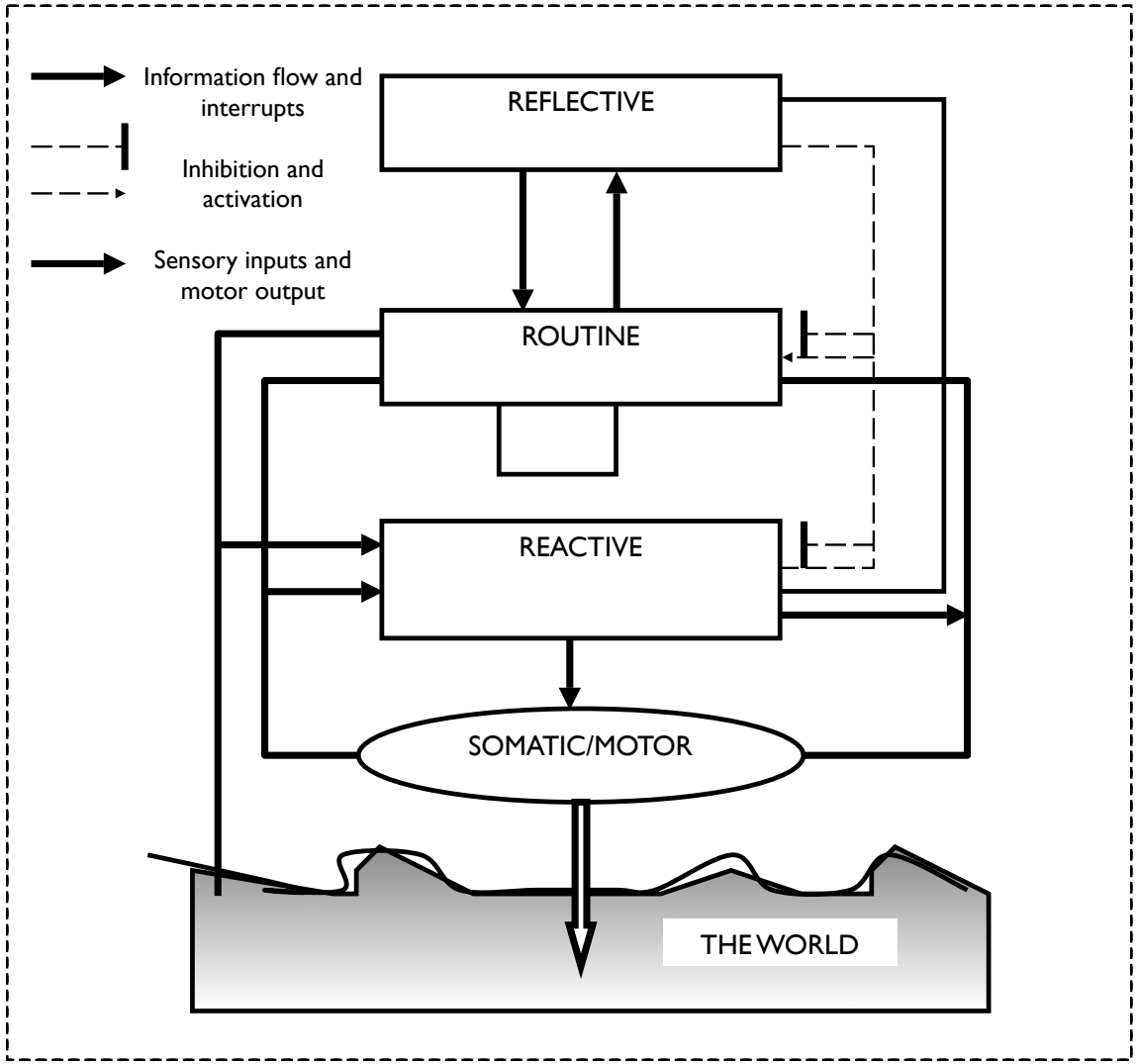
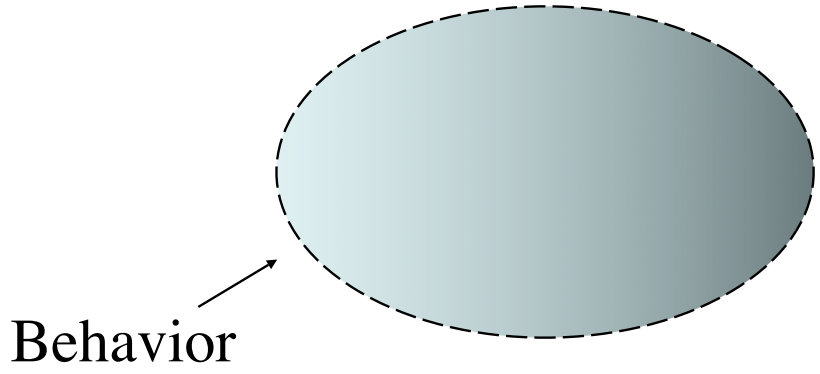


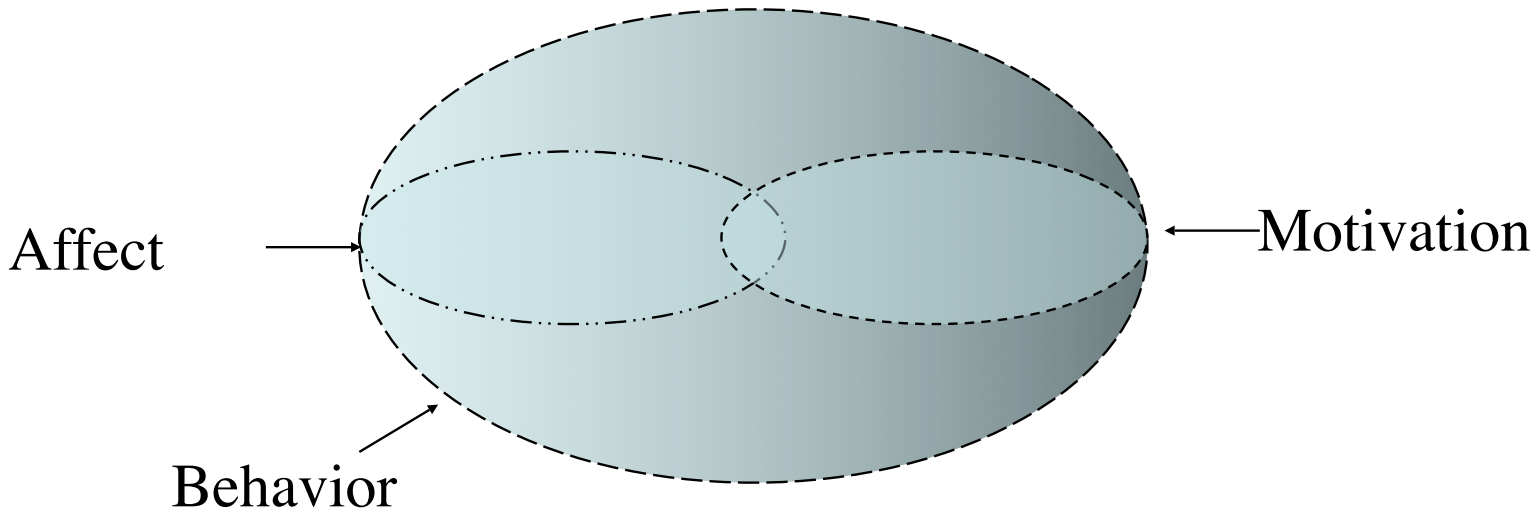
Figure 1. The three basic processing levels – Reactive, Routine, and Reflective, showing their interconnections and relationships both to one another, to somatic and motor states, and to the state of the world. Small solid lines indicate both information content and interrupt signals that serve to initiate activity. Broken lines indicate excitatory and inhibitory influences from the reflective level to those below. Thick solid lines indicate response initiation (downward flowing arrows) and sensory signals (upward arrows) from both internal (the somatic/motor systems) and external sensors (sensing the environment).

Behavior at the Reactive Level



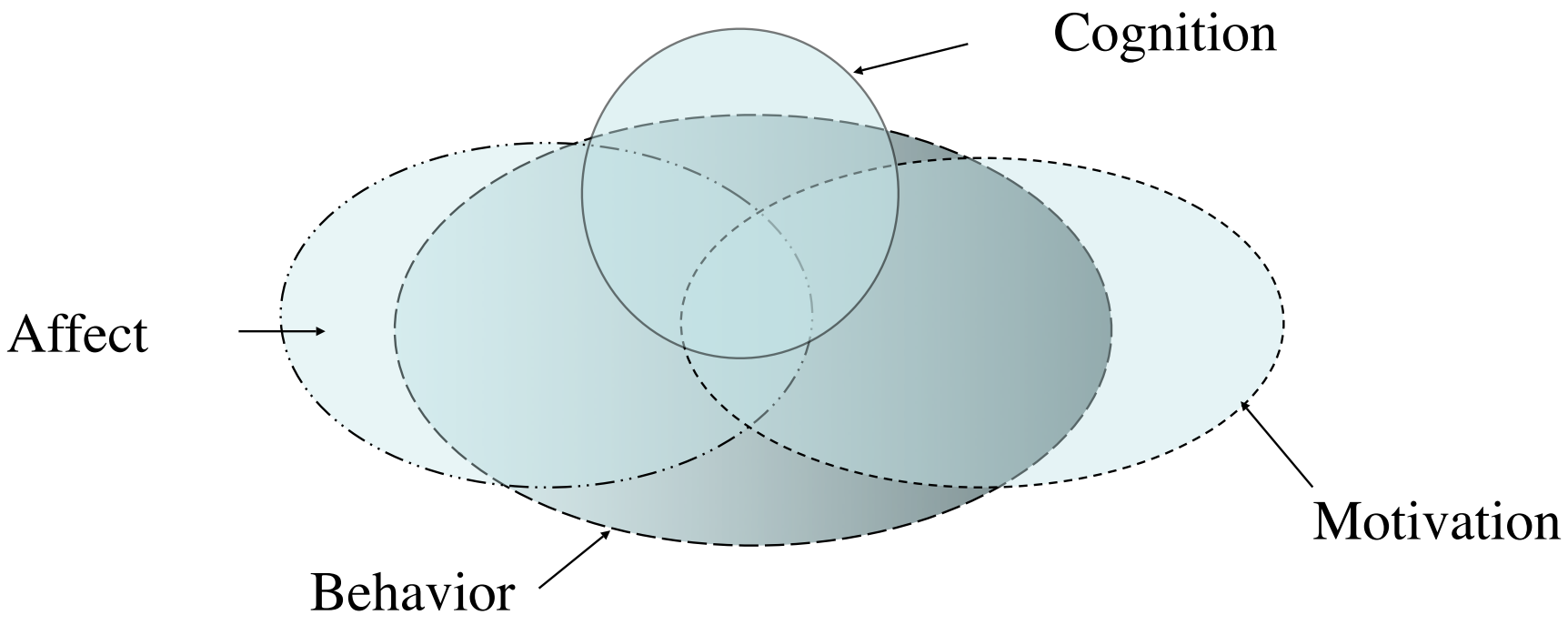
<-- Past Present Future -->

Affect, Motivation and Behavior at the Reactive Level

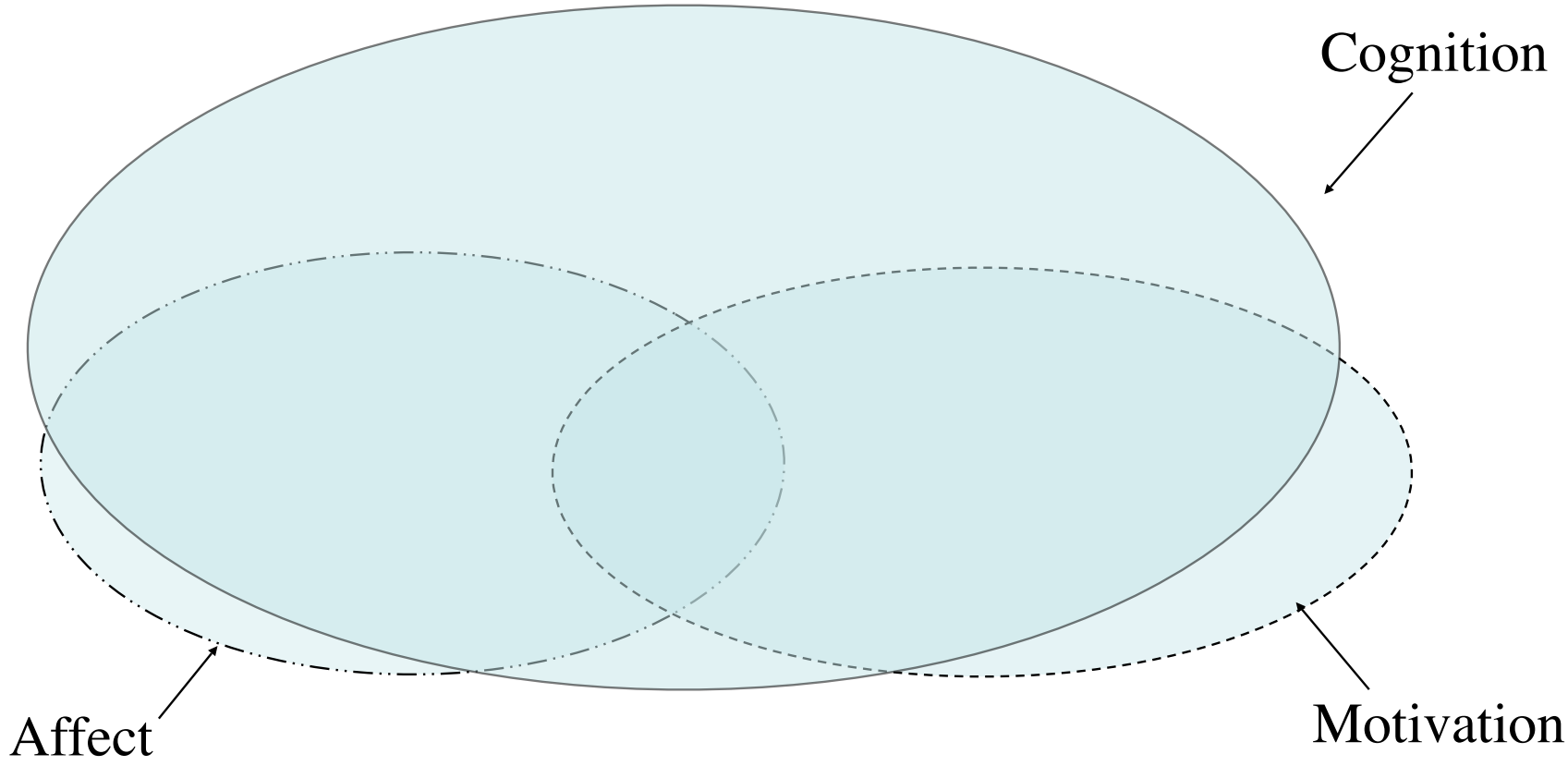


<-- Past Present Future -->

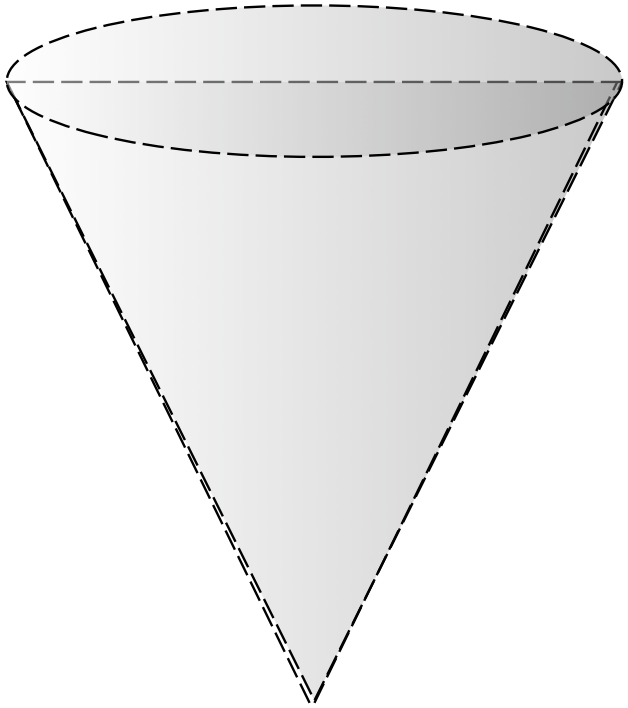
Affect, Motivation, Cognition and Behavior at the Routine Level



Affect, Motivation, and Cognition at the Reflective Level



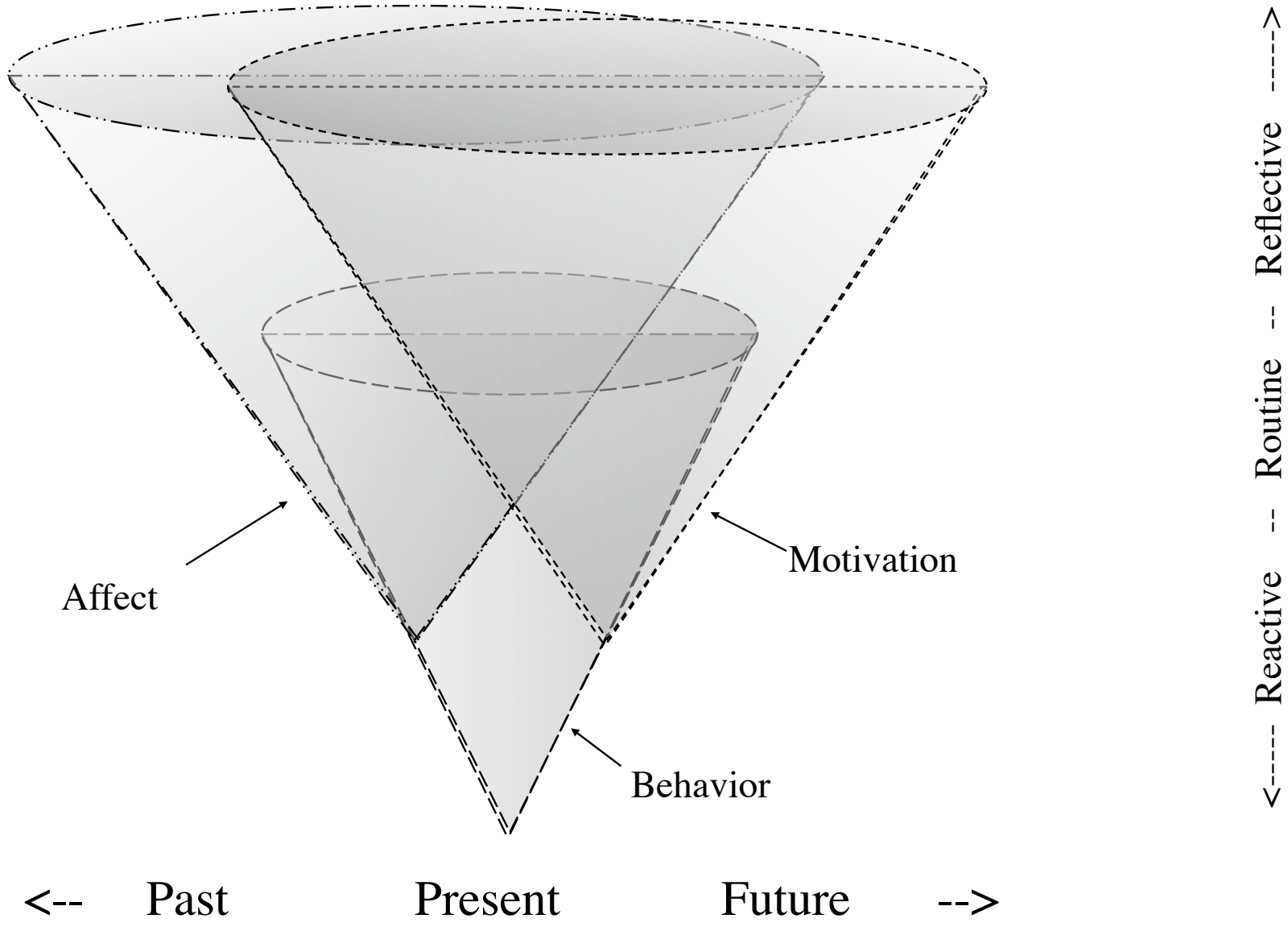
Behavior across levels of processing



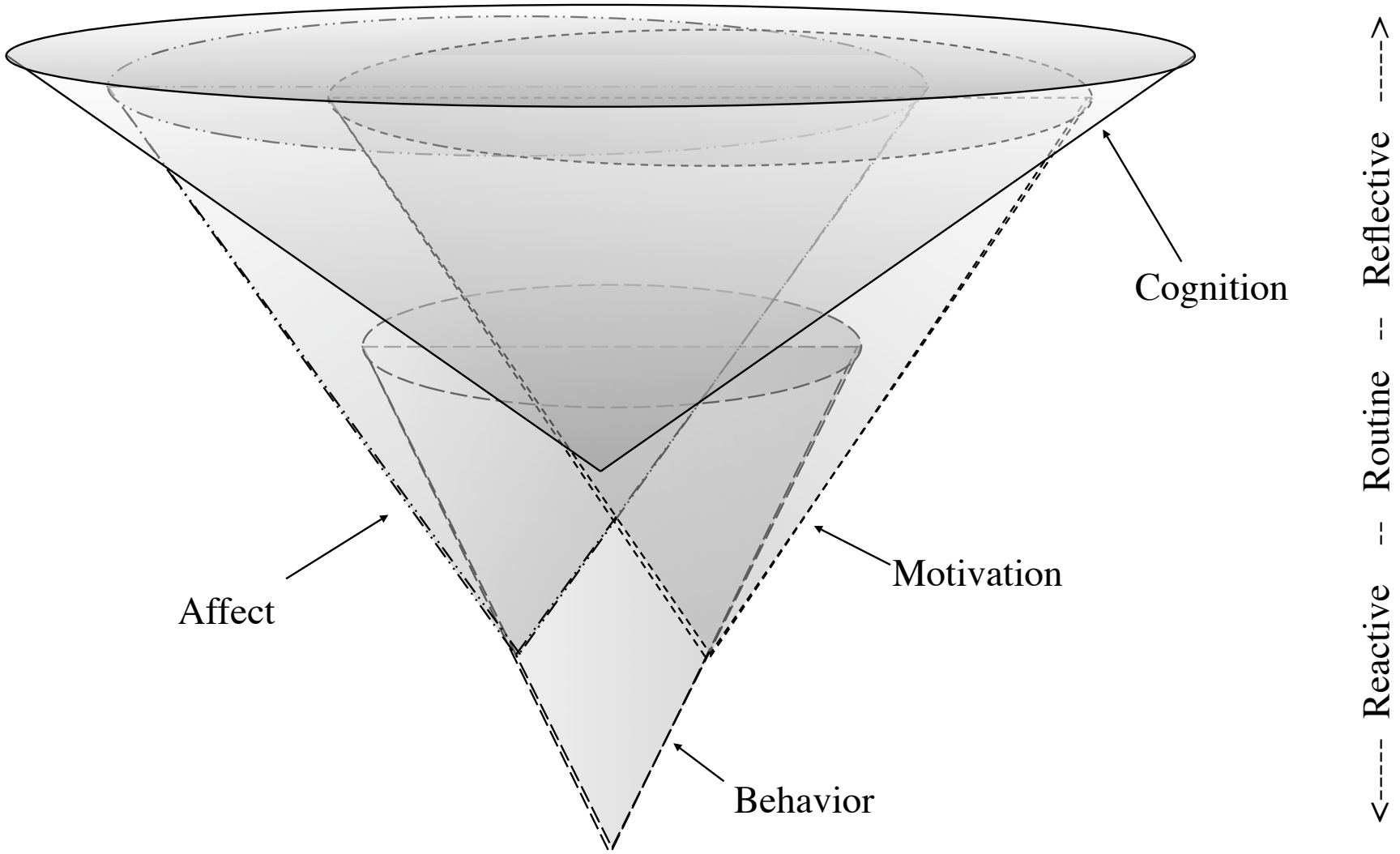
Immediate Past Present Immediate future

<----- Reactive -- Routine -- Reflective ----->

Affect, Motivation, and Behavior interact across levels of processing



Affect, Motivation, Cognition and Behavior as interacting domains across levels of processing



Application of ABCD analysis to personality and cognitive processing

Previously presented as part of a Symposium:
Categorisation, Decision-Making and Personality

(Luke D Smillie & William Revelle, organizers)
European Conference of Personality, Athens, 2006

available at
http://personality-project.org/revelle/publications/ecp.2006.pdf

Personality, Affect and Categorization: 5 examples

- **Trait and State Affect bias -> Cognitive Bias**: Weiler, M. A (1992) Sensitivity to affectively valenced stimuli. Unpublished doctoral dissertation, Northwestern University, Evanston, IL.
- **Trait & State Affect -> Cognitive Bias:** Rogers, G. and Revelle, W. (1998) Personality, mood, and the evaluation of affective and neutral word pairs. *Journal of Personality and Social Psychology, 74,* 1592-1605
- **Cognitive Representation -> Behavioral Variability** Klirs, E. G. & Revelle, W. (1986) Predicting variability from perceived situational similarity. *Journal of Research in Personality, 20*, 34-50.
- **Trait Cognitive -> Cognitive Bias**: Yovel, I., Revelle, W., Mineka, S. (2005). Who Sees Trees before Forest? The Obsessive-Compulsive Style of Visual Attention *Psychological Science 16,* 123-129.
- **Affect -> Cognitive Bias**: Gasper, K., & Clore, G. L. (2002). Attending to the big picture: Mood and global versus local processing of visual information, *Psychological Science, 13*, 34-40.

Overview

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- Synthetic Aperture Personality Assessment (SAPA) as a tool for exploring cognitive and non-cognitive aspects of personality
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Synthetic Aperture Measurement

- Synthetic Aperture Measurement is done in visual and radio astronomy by combining input from multiple, linked sites into one coherent image
- Classic example is radio astronomy at the Very Large Array (Socorro, New Mexico)
- Visual Astronomy uses similar techniques at Keck Observatory with “outriggers”

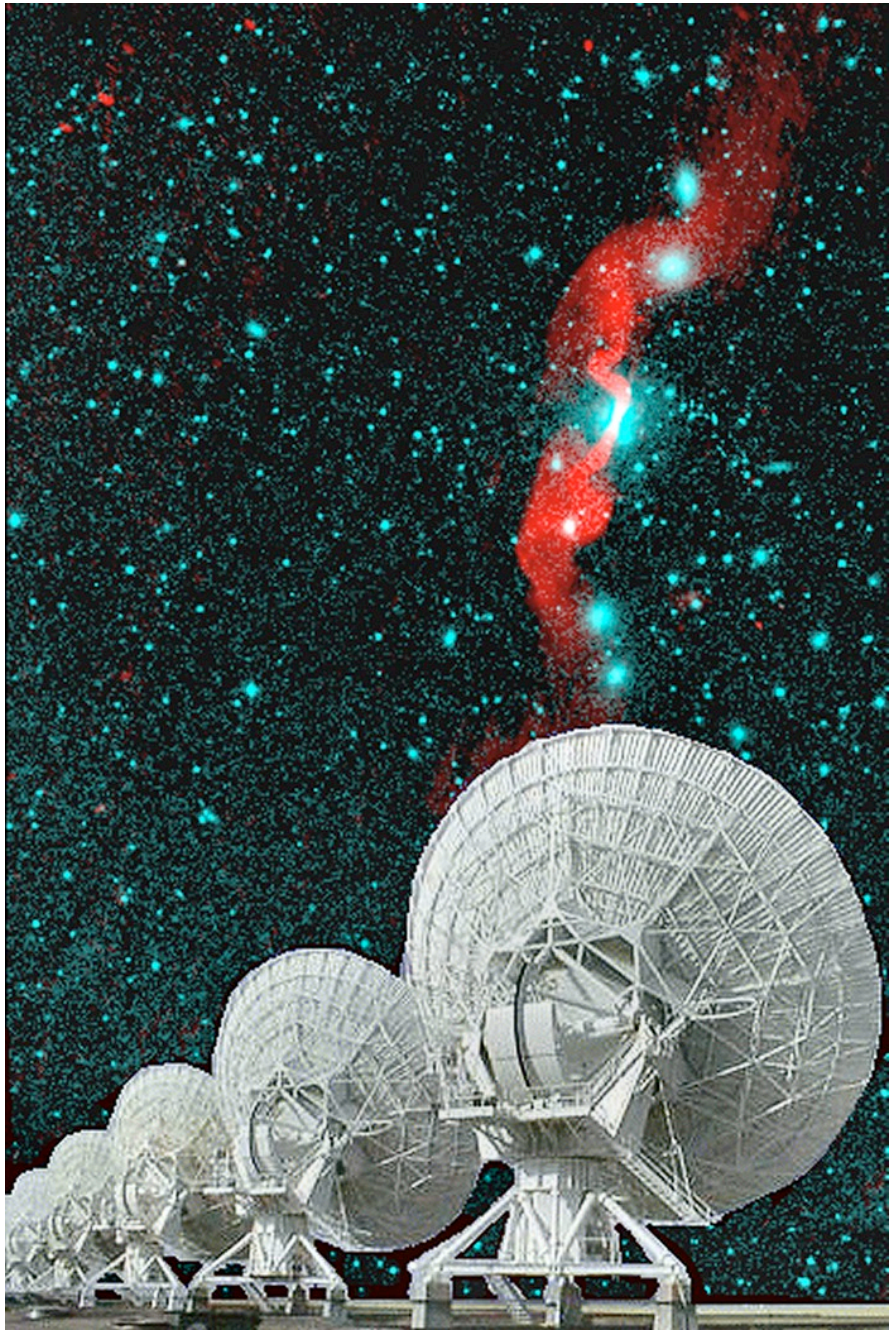
NRAO / AUI / NSF

Very Long Array

NRAO / AUI / NSF

Very Long Array

NRAO / AUI / NSF



NRAO / AUI / NSF

SAPA: Overview

- Develop item statistics and item-item covariances on large (N > 2000) item pools by randomly presenting small (N ≈ 60-80) subsets of items to different subjects taken from a very large (N > 56,000) and growing (≈100/day) subject population.
- Use open source and public domain software.

SAPA: Synthetic Aperture Personality Assessment

- Not particular new or original, early work was done (and is still being done) at ETS on the SAT and GRE
- Techniques are now available for SAPA for all of us
- The techniques use open source software and public domain personality and ability items available to any interested user

SAPA: Method

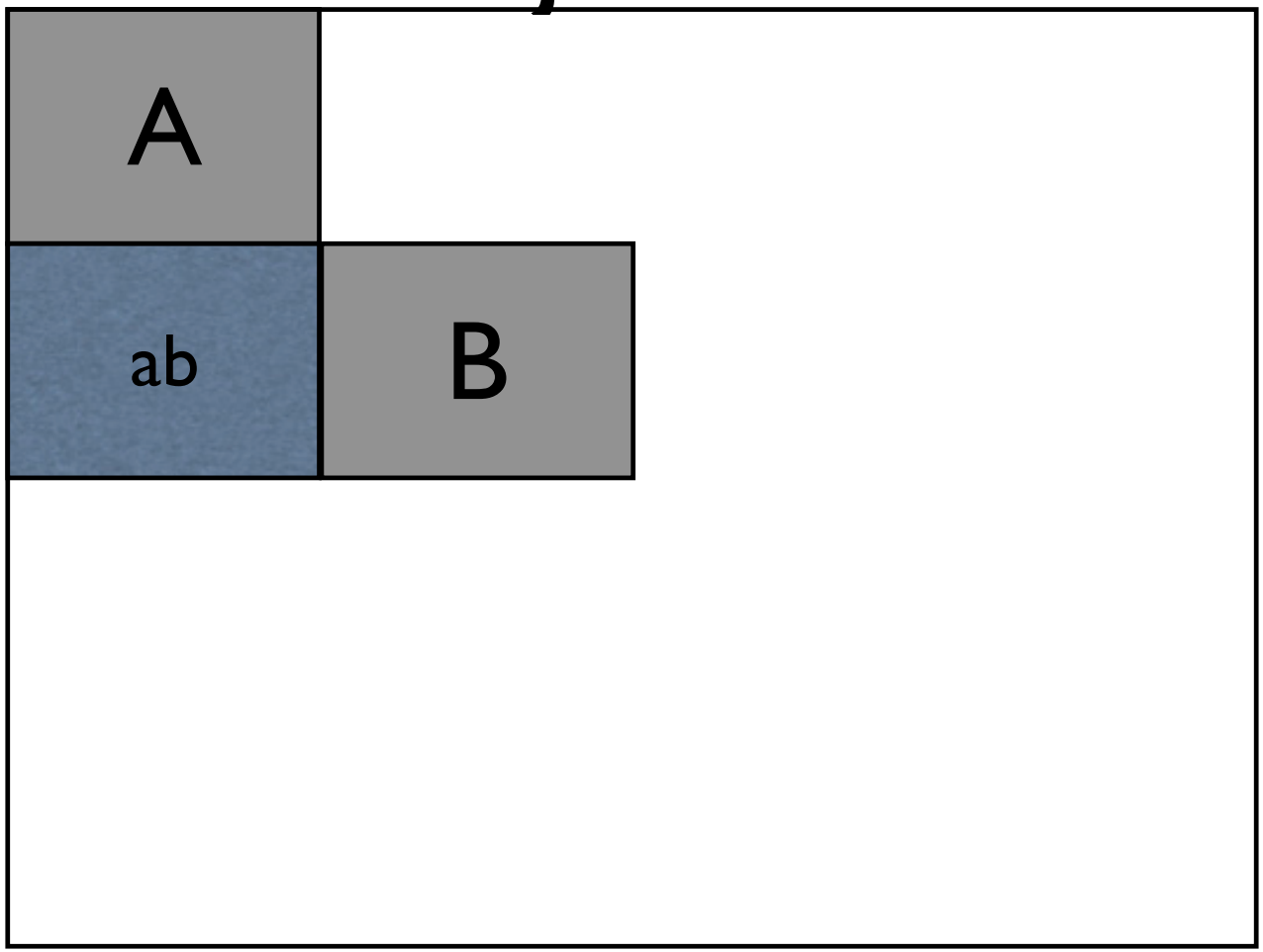
- Item Pool: International Personality Item Pool (Goldberg)
  - Particular emphasis upon marker sets of "Big 5"
- Ability items (created for SAPA project)
- Other items? (any we want, e.g. IQ, EI, etc.)
- Subjects: recruited from visitors to the Personality Project (roughly 1-2000/day visitors) -> ≈ 100 day participants
- Methods: public domain applications
  - HTML, PHP, Apache, mySQL, R

SAPA: basic concept

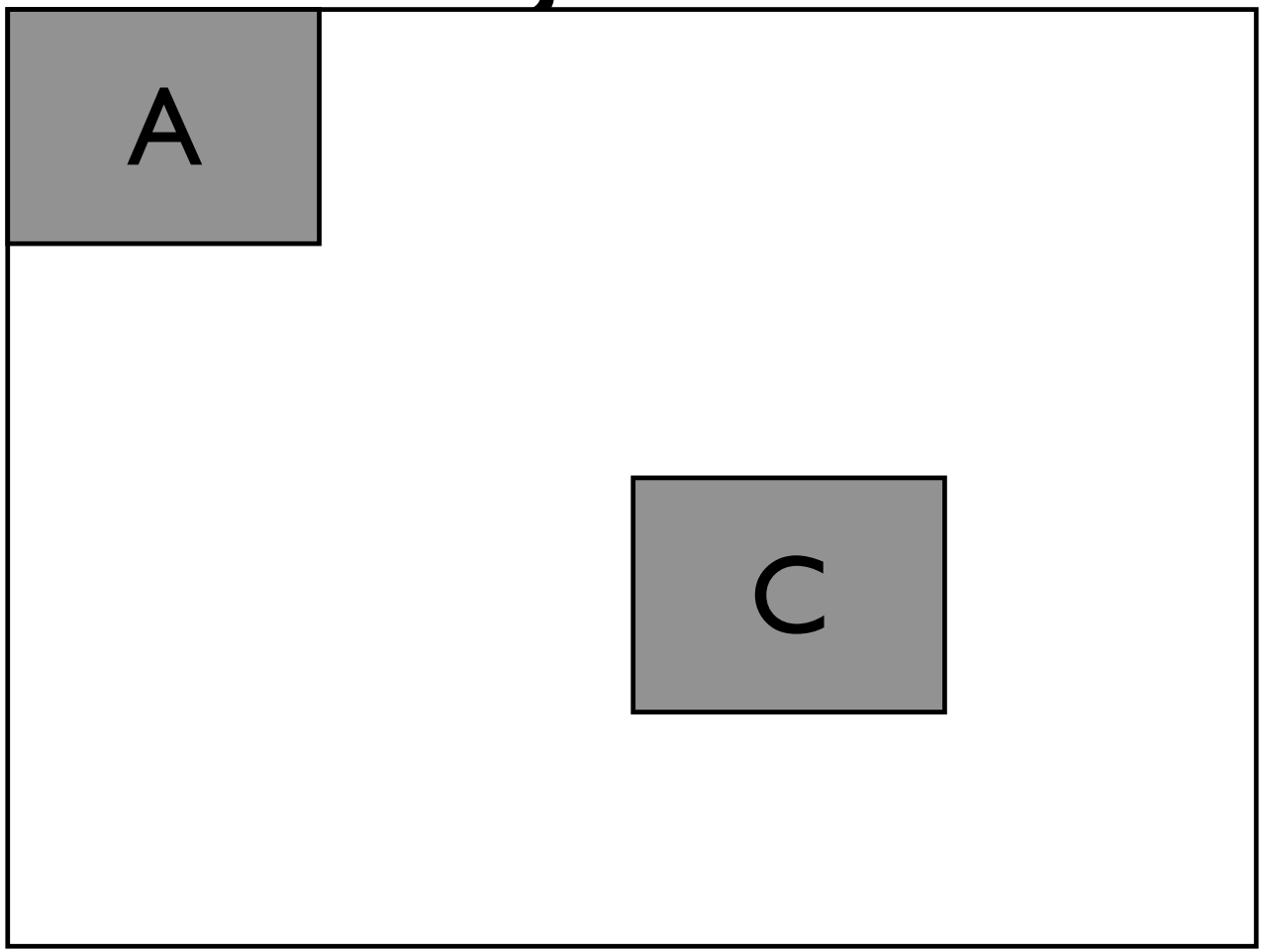
- Consider an item pool of P items divided into m sets e.g., P =120, m = 4 produces sets A, B, C, D of 30 items.
- Each subject (N >> 1000) is given 2 sets of items
  - E.g., (A+B, A+C, … C+D)
- Sample size n for basic set is 2N/m,
- Sample size n_{ij} for correlations between item subsets = 2N/(m*m-1)

SAPA: conceptual demonstration

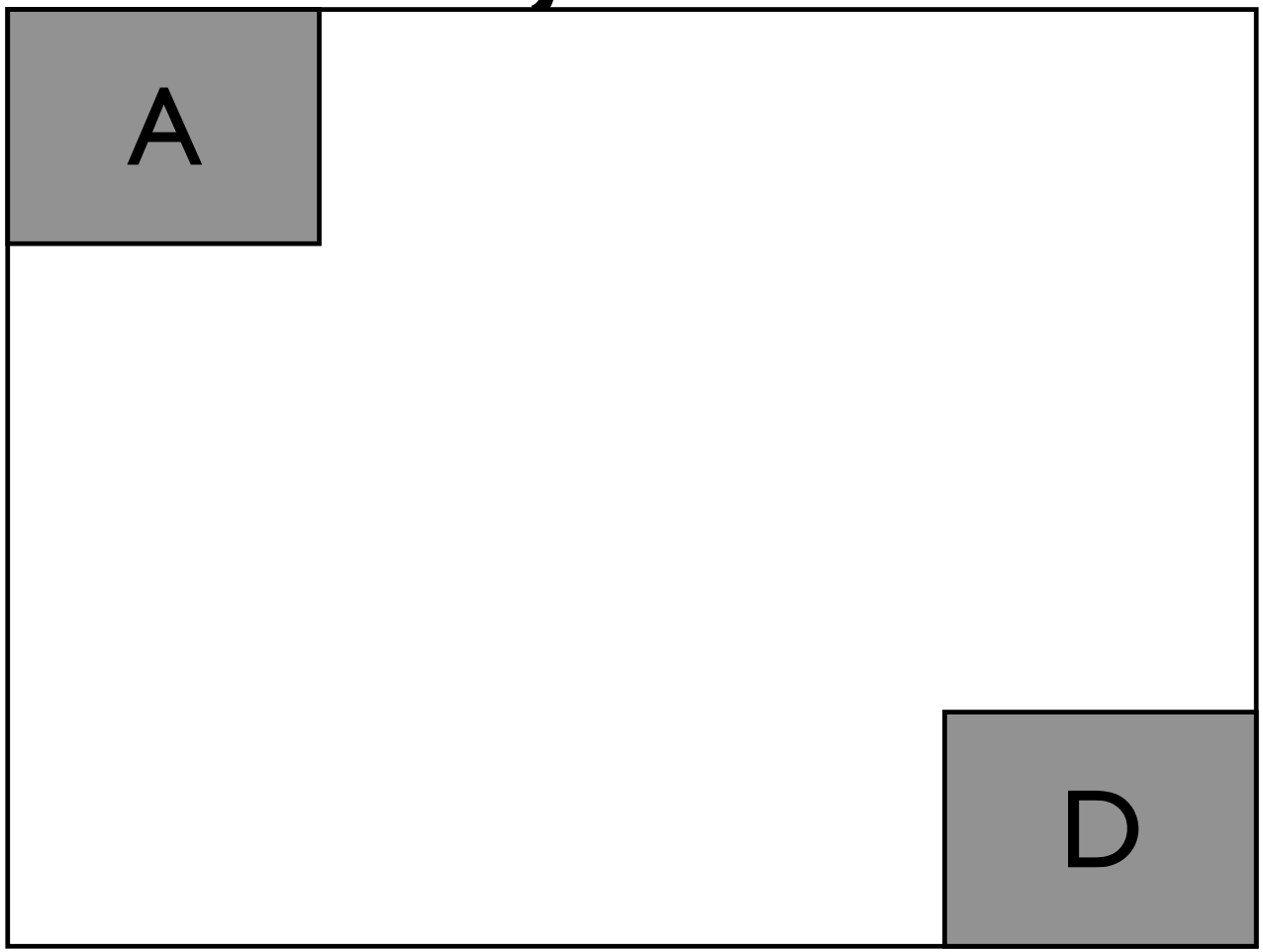
Basic Model
a subject sees



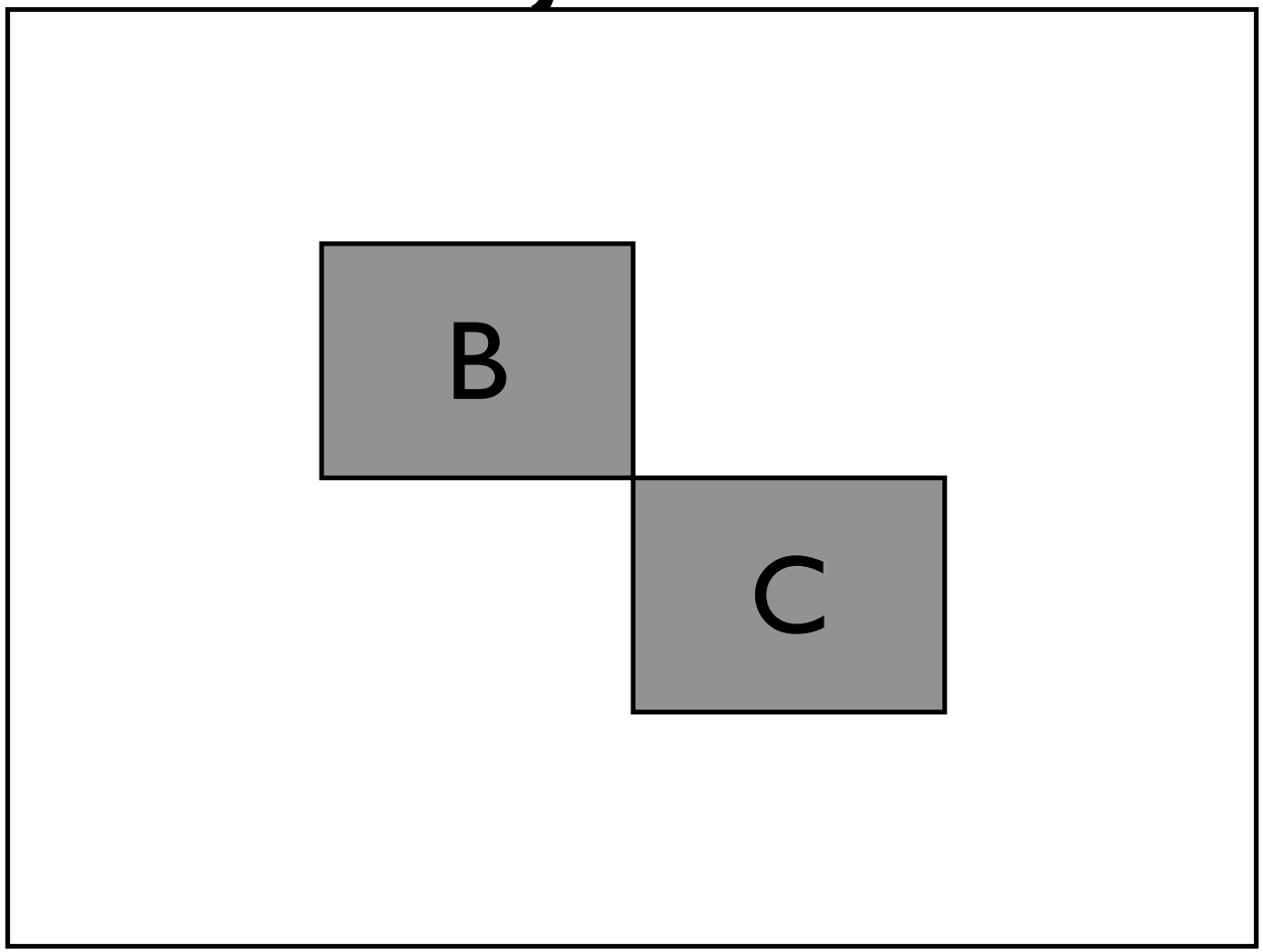
Basic Model
a subject sees



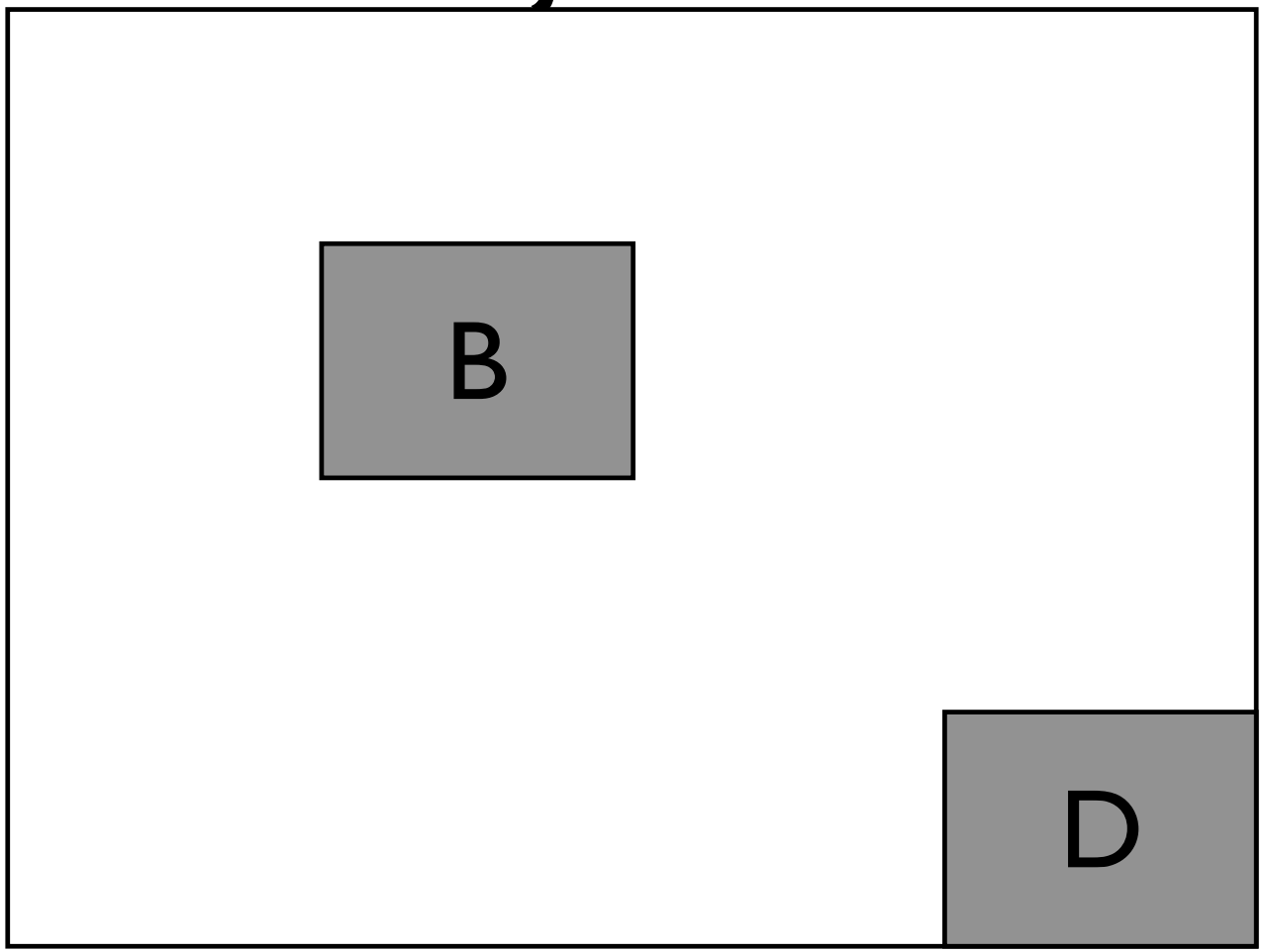
Basic Model
a subject sees



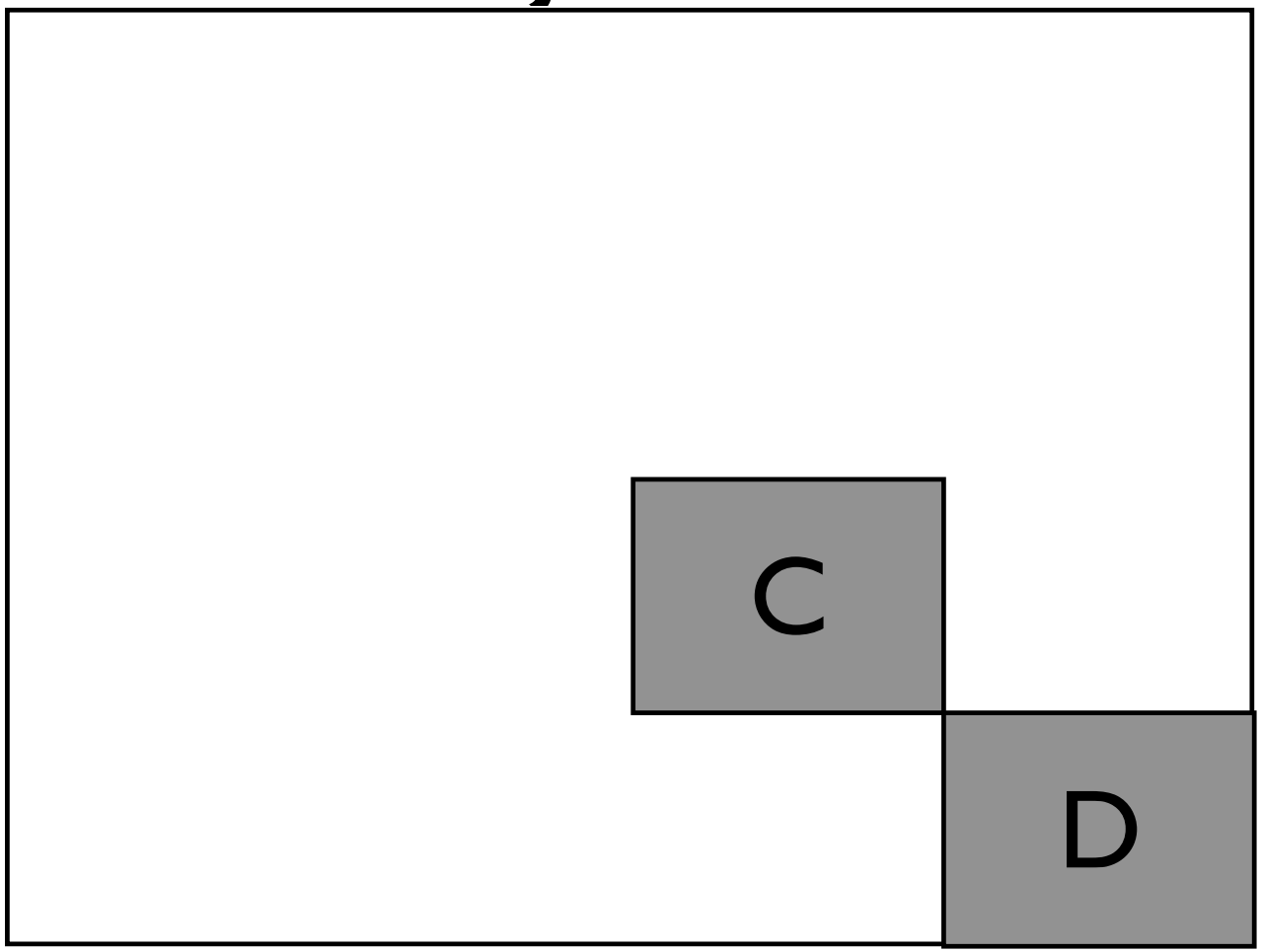
Basic Model
a subject sees



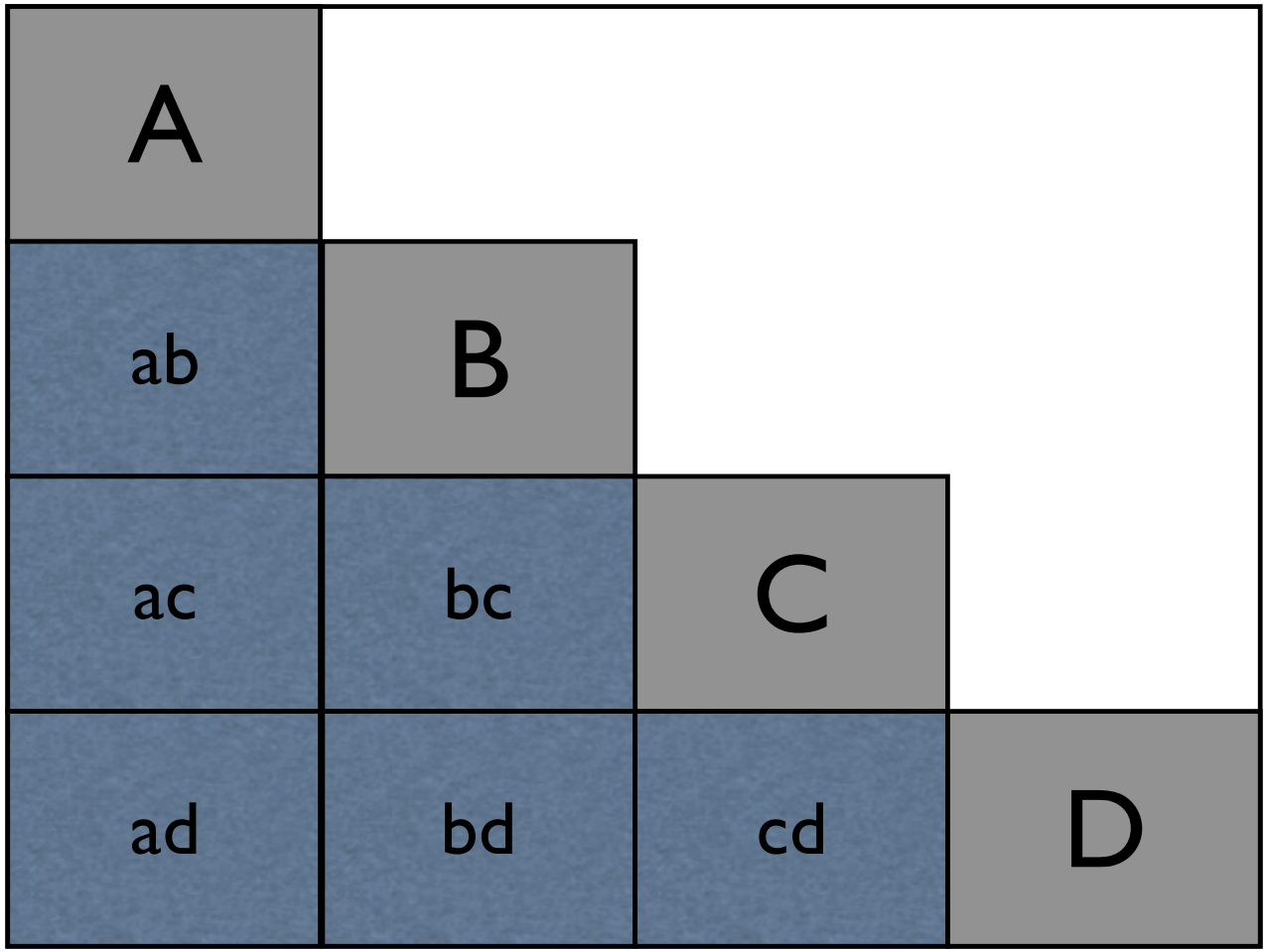
Basic Model
a subject sees



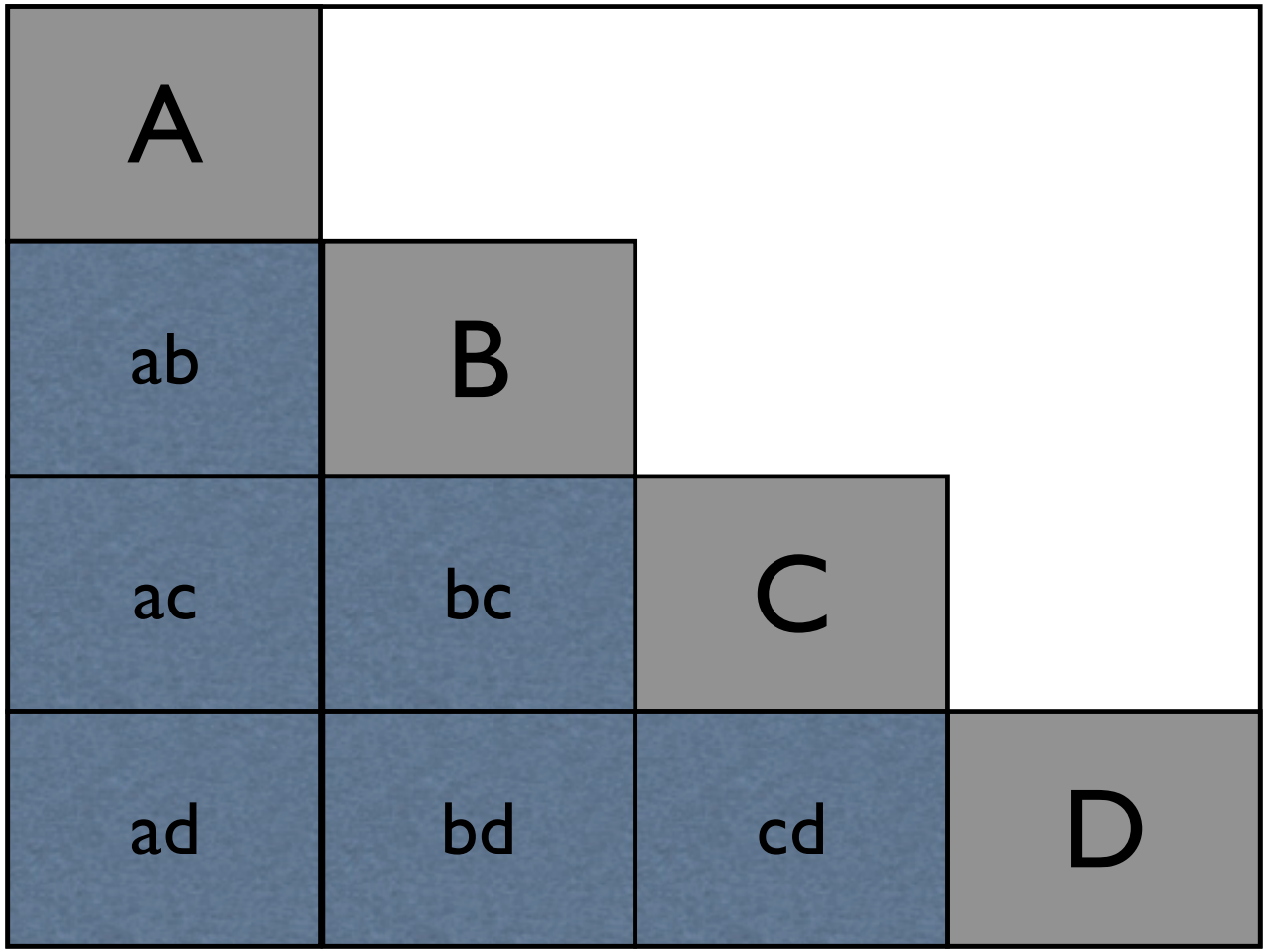
Basic Model
a subject sees



Basic Model experimenter collects



Variances and covariances can be formed synthetically



Applying SAPA to cognitive and personality items

- 170 items taken from International Personality Item Pool (IPIP)
- 56 Ability items created
- 60 Music preference items created

Analyzing SAPA data

- Classical and “New” (IRT) psychometrics applied to raw data
- Traditional psychometric data reduction and scale construction procedures based on synthetic correlation matrices

Online ability assessment

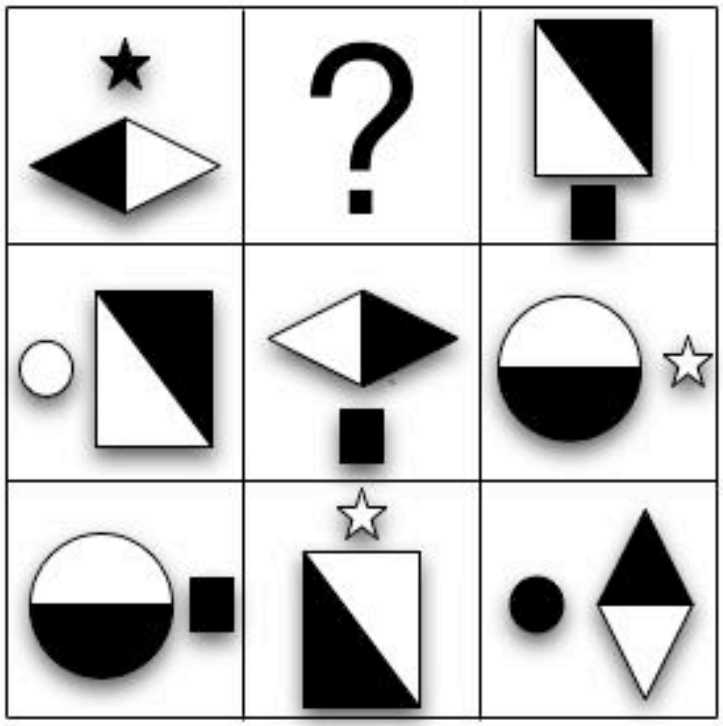
- Created 56 items
  - matrix like reasoning
  - number series
  - letter series
  - logic
  - vocabulary
  - basic math
  - general knowledge
- sampled 14 items/subject
- for subjects from US, asked for SAT/ACT

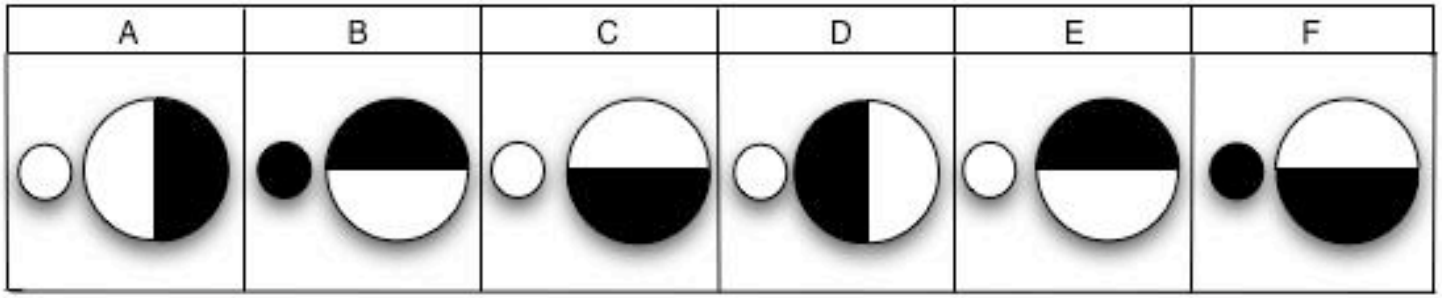
Ability items

Now we will ask a few reasoning and knowledge questions. This part is experimental. We hope to use this section to develop some norms that we will then be able to report to future visitors. We greatly appreciate your participation. Remember, your responses are anonymous. Please read each statement carefully, and then click the bubble that corresponds to the best answer. After these questions, we will give you the report on your Big 5 scores.

73.	What number is one fifth of one fourth of one ninth of 900?	2 ○	3 ○	4 ○	5 ○	6 ○	7 ○
74.	If you rearrange the letters COBILOCR you will have the name of a:	Planet ○	Fruit ○	River ○	Animal ○	Vegetable ○	Country ○
75.	Please mark the word that does not match the other words:	Buenos Aires ○	Melbourne ○	Seattle ○	Cairo ○	Morocco ○	Milan ○
76.	If some pineapples are oranges and all apples are oranges, then some	TRUE ○	FALSE ○	Neither ○	○	○	○

Please indicate which is the best answer to complete the figure.





78.	A	B	C	D	E	F
	○	○	○	○	○	○

SAPA: Users perspective

- Recruited from visitors to personality-project.org
- Basic demographic data
- 50 questions selected from Big 5 scales of IPIP
- 10 additional questions from IPIP are interlaced with the 50
- Music and ability items are given after IPIP items
- Personality feedback (adapted from John Johnson)

Subject Recruitment -

The Personality Project--Overview

The Personality Project

What's New?

"Big 5" personality test

Recommended Readings

Overviews
Personality Taxonomies

- Descriptive Taxonomies
- Theoretical Taxonomies
- Intelligence

Assessment and Applications

- Psychometrics
- Statistics

Personality theory

- Biological approaches
- Behavior genetics
- Psychoanalytic theory
- Evolutionary Psychology
- Other

Academic Webpages

Scientific Journals
Research Labs
Homepages of researchers
Course Syllabi .
Online research projects

Non academic Webpages

That people differ from each other is obvious. How and why they differ is less clear and is an important part of the study of personality. Personality psychology addresses the questions of shared human nature, dimensions of individual differences and unique patterns of individuals.

Research in personality ranges from analyses of genetic codes and studies of biological systems to the study of sexual, social, ethnic, and cultural bases of thought, feelings, and behavior. Personality research includes studies of cognitive abilities, interpersonal styles, and emotional reactivity. Methods range from laboratory experiments to longitudinal field studies and include data reduction techniques such as factor analysis and principal components analysis, as well as structural modeling and multi-level modeling procedures. Measurement issues of most importance are those of reliability and stability of individual differences.

Research in individual differences addresses three broad questions: 1) developing an adequate descriptive taxonomy of how people differ; 2) applying differences in one situation to predict differences in other situations; and 3) testing theoretical explanations of the structure and dynamics of individual differences.

These pages are meant to guide those interested in personality theory and research to the current personality research literature. Although some of the readings are available on-line, all should be available from most university libraries. Abstracts of many recent articles are available by using search engines such as Medline.

Introductory page

Internet Personality Inventory Survey

The following is an internet-based study of personality. Many of us have a good idea what it means to be extraverted or agreeable at an intuitive level, but we are interested in what form those descriptions take at the most basic level. One theory on this subject argues that there are five basic dimensions of personality -- Extraversion, Emotional Stability, Agreeableness, Conscientiousness, and Openness to Experience.

This study has two purposes. One is to find out more about these five dimensions of personality. Another is to take part in and further the use of the internet as a collaborative and data collection tool. To that end, our test is composed of freely available items from the International Personality Item Pool, and the descriptions we use for each trait were borrowed and adapted from work done by John Johnson.

When you take this test, you will receive a report summarizing your standing in the Big-5 dimensions. This report is generated dynamically and is different for everybody taking the test. If you want to learn more about the Big-5 model and want to know where you might stand in that model, you should take this test.

After completing the test, you are invited to leave feedback regarding your impressions of the test and the reports it generates.

In addition to helping you find out your "Big 5" score, we are also interested in relating those broad personality traits to experimental measures of musical preference and cognitive ability. We include a few items about musical preferences and a few cognitive ability items that we are developing.

Before taking the test you must proceed to the consent form.

Consent form

Northwestern University
Department of Psychology
Consent Form
Project Title: An Internet Study of the Basic Dimensions of Personality
Principal Investigator: William Revelle

Introduction/Purpose:

You are being asked to participate in a research study of the basic dimensions of personality. The purpose of this study is examine the correlational structure of items similar to those used in many personality inventories. In addition, by allowin the public to participate in this web based inventory we hope to increase public knowledge about science based models o personality. This inventory will compare your answers to those of others and give you an estimate of your level on each o five broad personality domains ("the big 5"). These domains represent normal differences in personality that are probably known by your friends and colleagues. This inventory will not reveal any secret information about you, nor will it assess any serious psychological problems. The report is designed to be objective, not necessarily pleasing or flattering. Becaus we are using a limited number of items, sampled from a broad domain of items, your scores will be sensitive to errors of measurement and will not necessarily agree with measures of the same traits using other items. If people who know you well disagree with the results of this inventory, then the inventory results are probably wrong. If you answer the items carelessly or intentionally try to distort the results, then the results will be incorrect.

For more information about personality theory and research, please consult the pages of the personality-project. Other online tests are discussed there, as well as links to reviews of current literature in personality assessment.

...

Demographics

Please Enter Your Demographic Data

These data are necessary because they will be used to calculate your score so as to give you the best results. No information will be collected that would identify you.

Please enter your gender.

Indicate Your Gender

Please indicate your level of formal education.

Indicate Your Level of Education

Please enter your age

Please select your country of origin.

Indicate Your Country

On the following pages, there are phrases describing people's behaviors. Please use the rating scale below to describe how accurately each statement describes you. Describe yourself as you generally are now, not as you wish to be in the future. Describe yourself as you honestly see yourself, in relation to other people you know of the same sex, and roughly your same age. So that you can describe yourself in an honest manner, your responses are anonymous. Please read each statement carefully, and then click the bubble that corresponds to the number on the scale.

1.	Am the life of the party.	Very Inaccurate	Moderately Inaccurate	Slightly Inaccurate	Slightly Accurate	Moderately Accurate	Very Accurate
2.	Insult people.	Very Inaccurate	Moderately Inaccurate	Slightly Inaccurate	Slightly Accurate	Moderately Accurate	Very Accurate
3.	Am always prepared.	Very Inaccurate	Moderately Inaccurate	Slightly Inaccurate	Slightly Accurate	Moderately Accurate	Very Accurate
4.	Get stressed out easily.	Very Inaccurate	Moderately Inaccurate	Slightly Inaccurate	Slightly Accurate	Moderately Accurate	Very Accurate
5.	Have a rich vocabulary.	Very Inaccurate	Moderately Inaccurate	Slightly Inaccurate	Slightly Accurate	Moderately Accurate	Very Accurate
6.	Get back at others.	Very Inaccurate	Moderately Inaccurate	Slightly Inaccurate	Slightly Accurate	Moderately Accurate	Very Accurate

Feedback based upon 5 scales

Personality Profile

What follows is the results of your survey responses. The results here are grouped into five categories: extraversion, agreeableness, conscientiousness, emotional stability, and openness. These categories represent the way that most people talk about personality and so they may reflect cultural or social biases.

While many or all of these categories may look like words you typically use (even ones that often are accompanied with a value judgment) it is important to understand that these five factors are really labels used by psychologists to describe differences between people.

This is not a psycho-analysis; the results presented here were created directly from your responses to the items. For that reason, it is unlikely that there should be a mis-match between our descriptions and how you or others view themselves. However, there is always room for error, and we would like to see your feedback on our inventory and descriptions. Feedback can be left here.

The descriptions used here are borrowed from John Johnson, who hosts a page of descriptions . If you would like to learn more about the model of personality presented here, you can find an overview and a short biblography on the personality project website. We also discuss how to estimate the realibility of these results and show the distributions of scores from the first 3,000 people who have taken the survey.

Feedback (continued)

SHARE YOUR SCORE!

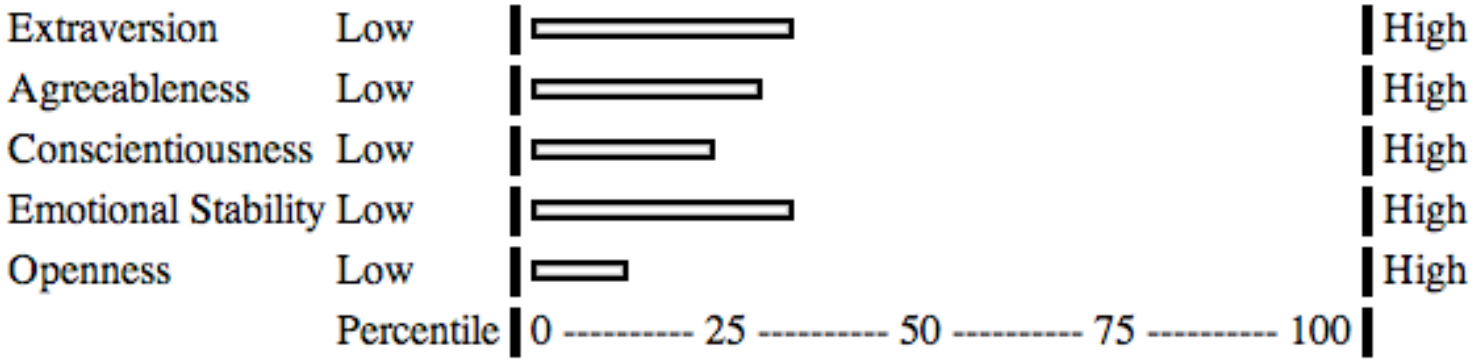
Copy the URL or hyperlink below to share your score with others, or use it to visit your score later.

Your score URL:

http://test.personality-project.org/survey/yourscores.php?
G=1&Y=123&A=3.5&O=3.5&E=3.5&S=3.5&C=3.5

Hyperlink to your score:

<a href='http://test.personality-project.org/survey/yourscores.php?
G=1&Y=123&A=3.5&O=3.5&E=3.5&S=3.5&C=3.5'>Check out my
personality profile!



Extraversion Report

Extraversion is marked by pronounced engagement with the external world. Extraverts enjoy being with people, are full of energy, and often experience positive emotions. They tend to be enthusiastic, action-oriented, individuals who are likely to say "Yes!" or "Let's go!" to opportunities for excitement. In groups they like to talk, assert themselves, and draw attention to themselves.

Introverts lack the exuberance, energy, and activity levels of extraverts. They tend to be quiet, low-key, deliberate, and disengaged from the social world. Their lack of social involvement should not be interpreted as shyness or depression; the introvert simply needs less stimulation than an extravert and prefers to be alone. The independence and reserve of the introvert is sometimes mistaken as unfriendliness or arrogance. In reality, an introvert who scores high on the agreeableness dimension will not seek others out but will be quite pleasant when approached.

Score at a Glance	
Total Score	31
Avg Response	3.5

Your average score on extraversion was 3.5, which is considered low. It is in approximately the 31st percentile for males over the age of 21.

Your score on Extraversion is low, indicating you are introverted, reserved, and quiet. You enjoy solitude and solitary activities. Your socializing tends to be restricted to a few close friends.

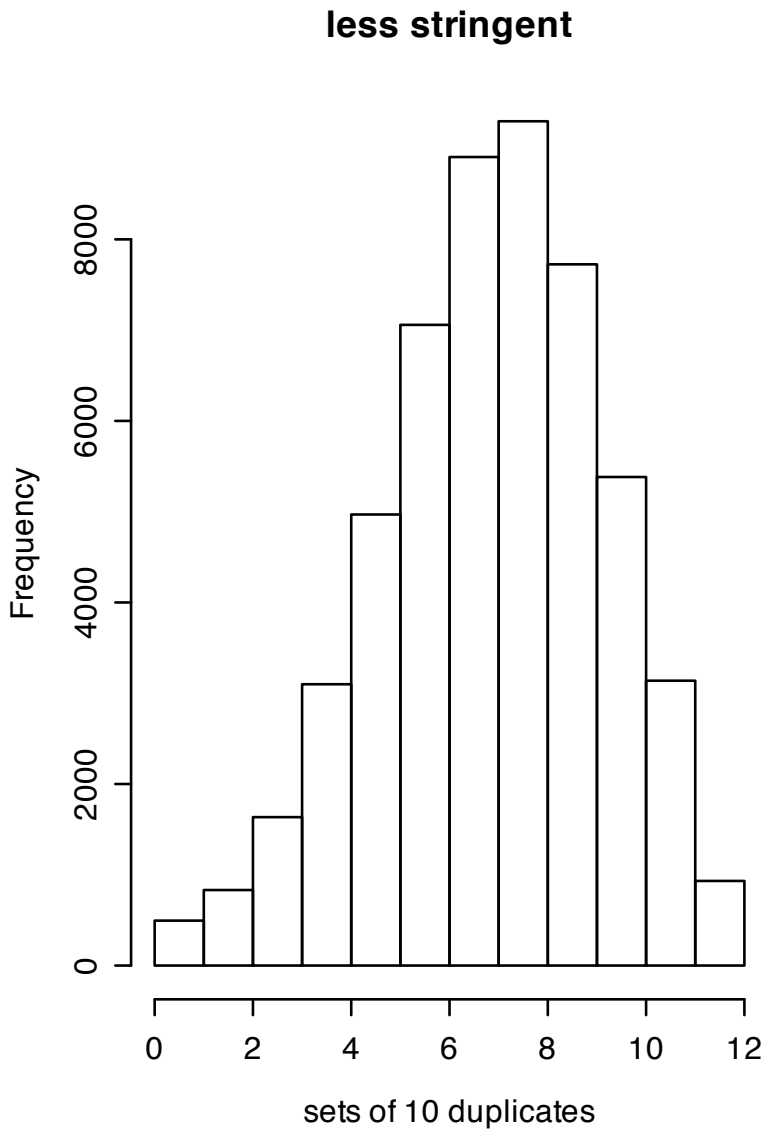
Sample characteristics

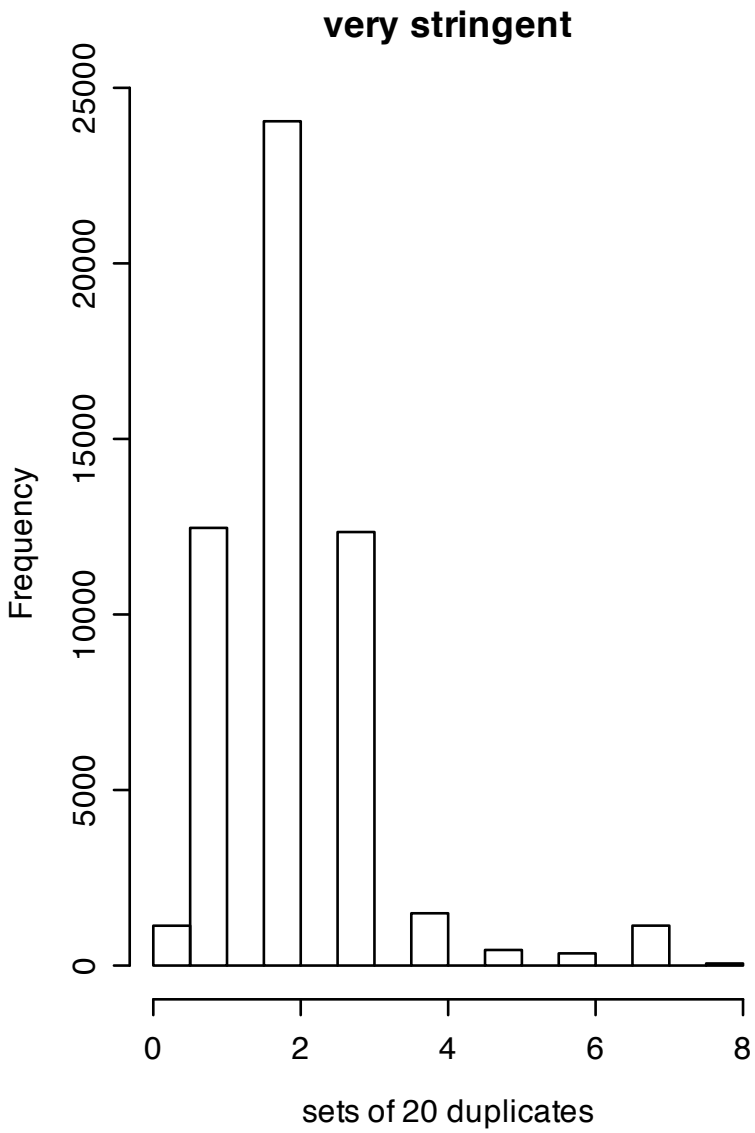
- Sample 1: 54,480 (From March 2004-March 2006)
  - 120 IPIP items
- Sample 2: 7,376 (From March 2006-Sept. 2006)
  - 170 IPIP
    - 100 IPIP: Big 5
    - 60 IPIP: NEO+
    - 10 Motivational Orientation
  - 56 ability
  - 60 music preference

First two years of operation

- N ≈ 54,480
- remove duplicated and near duplicated records
  - Some visitors were clearly trying out the system and change one or two items and then resubmit
  - Duplication measure as count of duplicate blocks of 20 items
- removed age < 10 or age > 100
- N = 51,410

Distribution of near duplicates



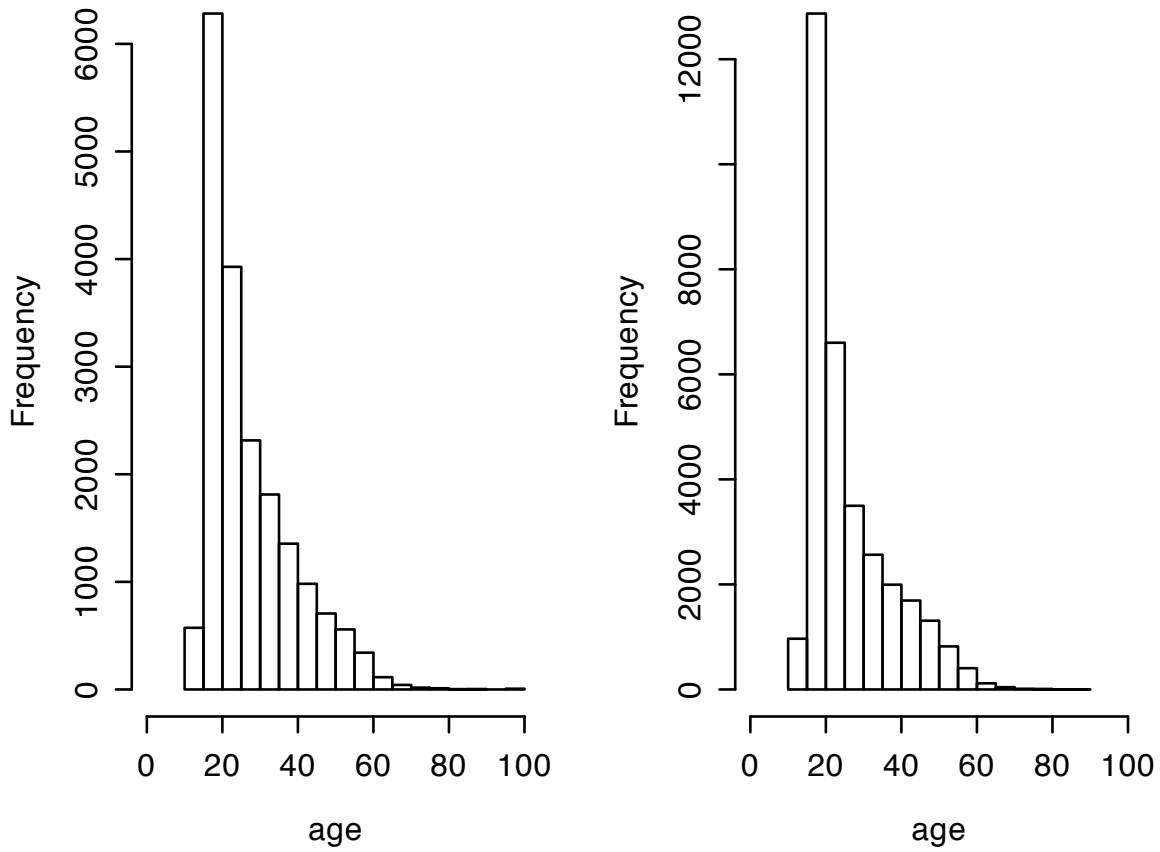


Basic demographics

	Male	Female
Min	11	11
25%	19	18
Med	23	22
75%	34	32
Max	99	90
Mean	27.59	26.38
N	19,051	32,907

Age by gender

M F



Countries > .5% of sample represent 90% of total

USA	36,071	36,071	70%	70%
Canada	3,115	39,186	6%	76%
UK	2,260	41,446	4%	81%
Australia	1,616	43,062	3%	84%
India	796	43,858	2%	85%
Philippines	526	44,384	1%	86%
Malaysia	357	44,741	1%	87%
Singapore	323	45,064	1%	88%
Germany	284	45,348	1%	88%
China	283	45,631	1%	89%
Norway	270	45,901	1%	89%
Ireland	269	46,170	1%	90%
Hong Kong	235	46,405	0%	90%
New Zealand	210	46,615	0%	91%
Netherlands	204	46,819	0%	91%
Mexico	203	47,022	0%	91%

Last 6 months

- N ≈ 7,376 (From March 2006-Sept. 2006)
- remove duplicated records (based upon random ID generated for every log in to system)
- removed age < 10 or age > 100
- N = 7,005

Most recent data

Survey.info as of Friday 08th of September 2006 10:19:29 PM

7434 subjects in ipip_repsonses

7376 subjects in music_responses;

2043 subjects in iq_responses with SAT scores

1441 subjects in iq_responses with ACT scores

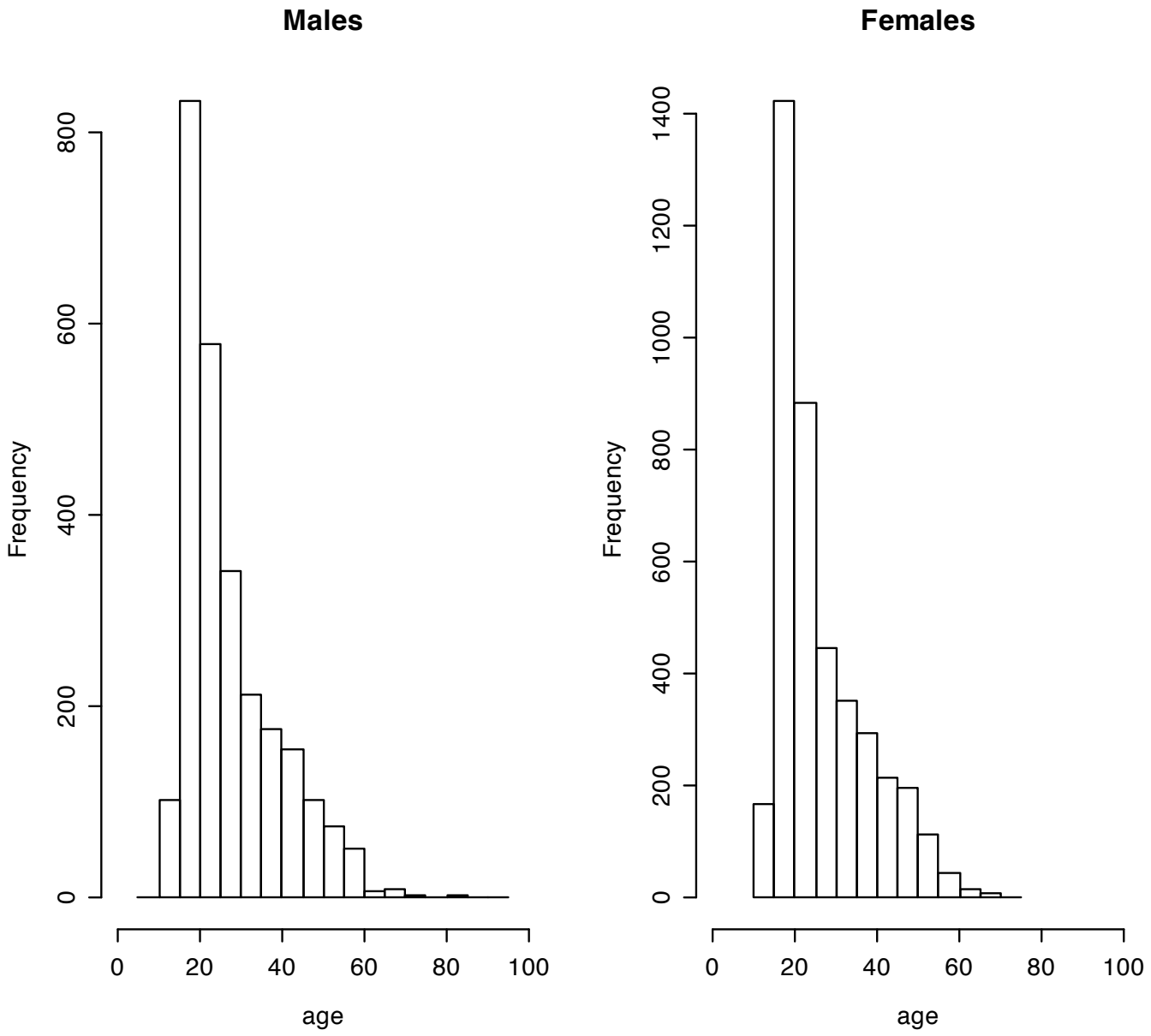
590 subjects in iq_responses with ACT and SAT scores

Basic demographics- study 2

not representative of population

Age	Male	Female
Min	12	12
25%	19	19
Med	23	23
75%	34	33
Max	95	75
Mean	27.52	26.96
N	2,890	4,486
%	39%	61%

Age by gender



Sample 2: 7,005

USA	4645	65.7%	66%
Canada	475	6.9%	73%
UK	358	5.3%	78%
Australia	330	4.9%	83%
India	145	2.1%	85%
China	58	0.9%	86%
Germany	53	0.8%	86%
South Africa	44	0.7%	87%
Philippines	39	0.6%	88%
Singapore	38	0.6%	88%
Malaysia	36	0.5%	89%
Netherlands	33	0.5%	89%
Romania	29	0.4%	90%
Ireland	28	0.4%	90%
New Zealand	26	0.4%	90%
Sweden	26	0.4%	91%
Mexico	25	0.4%	91%
Poland	23	0.3%	92%

SAPA measures of cognition

- 14 different IQ items (sampled from 56) presented to all participants.
- If participants said they came from US, they were asked to report SAT or ACT scores if they had them.
- IQ scale was validated against these self reported ability measures
- IQ measures for 14 items scored using IRT techniques
- IQ measures for 56 items grouped by clustering using ICLUST

Item Response Theory

- Given scores x_{ij} for i^{th} individual on j^{th} item
- Classical Test Theory ignores item difficulty and defines ability as expected score : $ability_i = ø_i = x_{i.}$
- Basic 1 parameter (Rasch) model considers item difficulties ($∂_j$):
  - $p(correct_{ij} | ø_i, ∂_j) = 1/(1+exp(∂_j - ø_i))$
- Two parameter model adds item sensitivity ($ß_j$):
  - $p(c_{ij} | ø_i, ∂_j, ß_j) = 1/(1+exp(ß_j *(∂_j - ø_i)))$
- Estimate $ø_i, ∂_j, ß_j$ to maximize fit of model to data

Personality and Ability scales as item composites

- The problem of how to form item composites
  - Factor analysis (FA)
  - Principal components analysis (PC)
  - Hierarchical Cluster analysis using the ICLUST algorithm
- All analyses done on correlation matrix using pairwise deletion
  - Synthetic correlations of composites based upon correlation matrix

Hierarchical Cluster Analysis of items

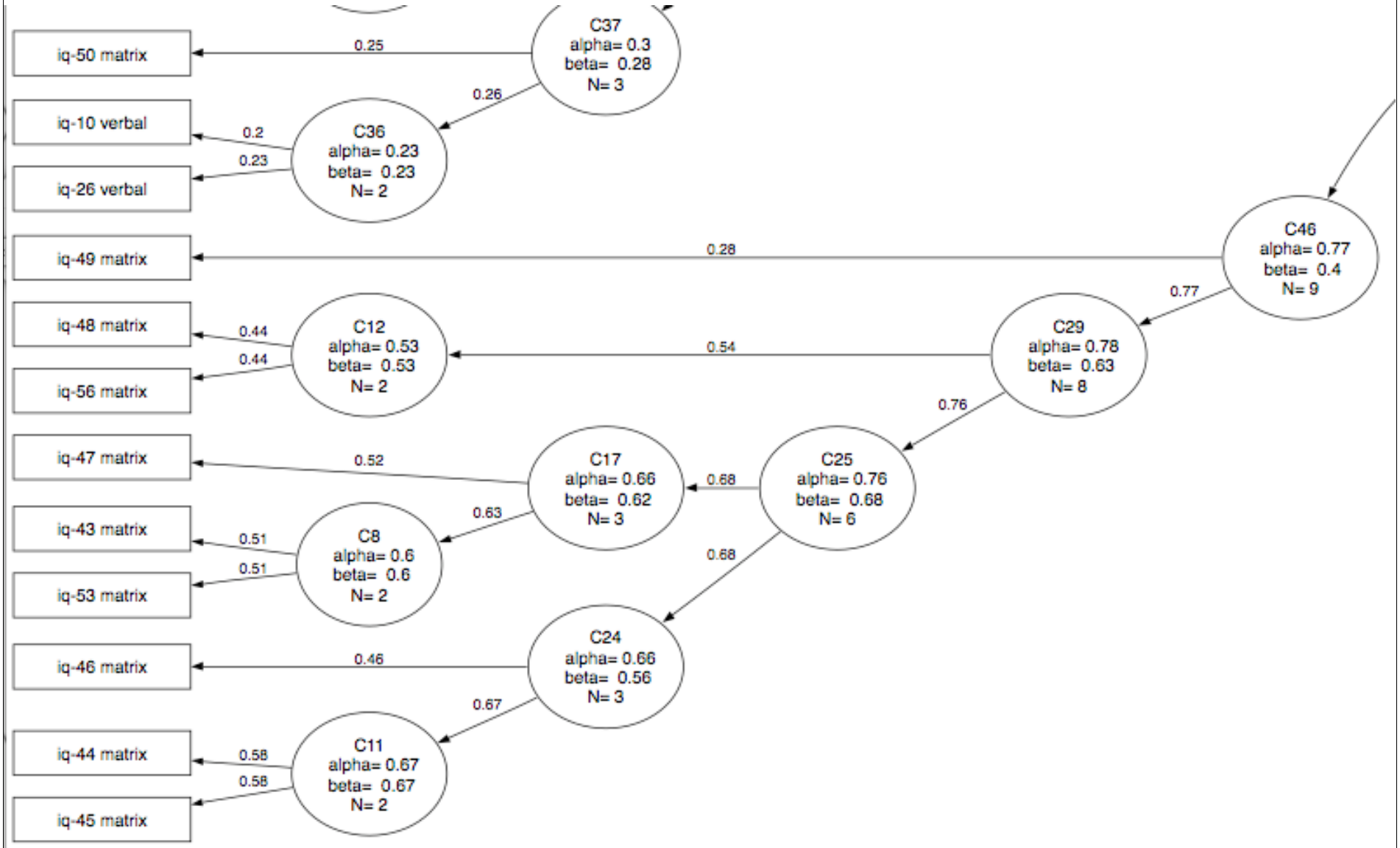
1) Form matrix of proximities (correlations)

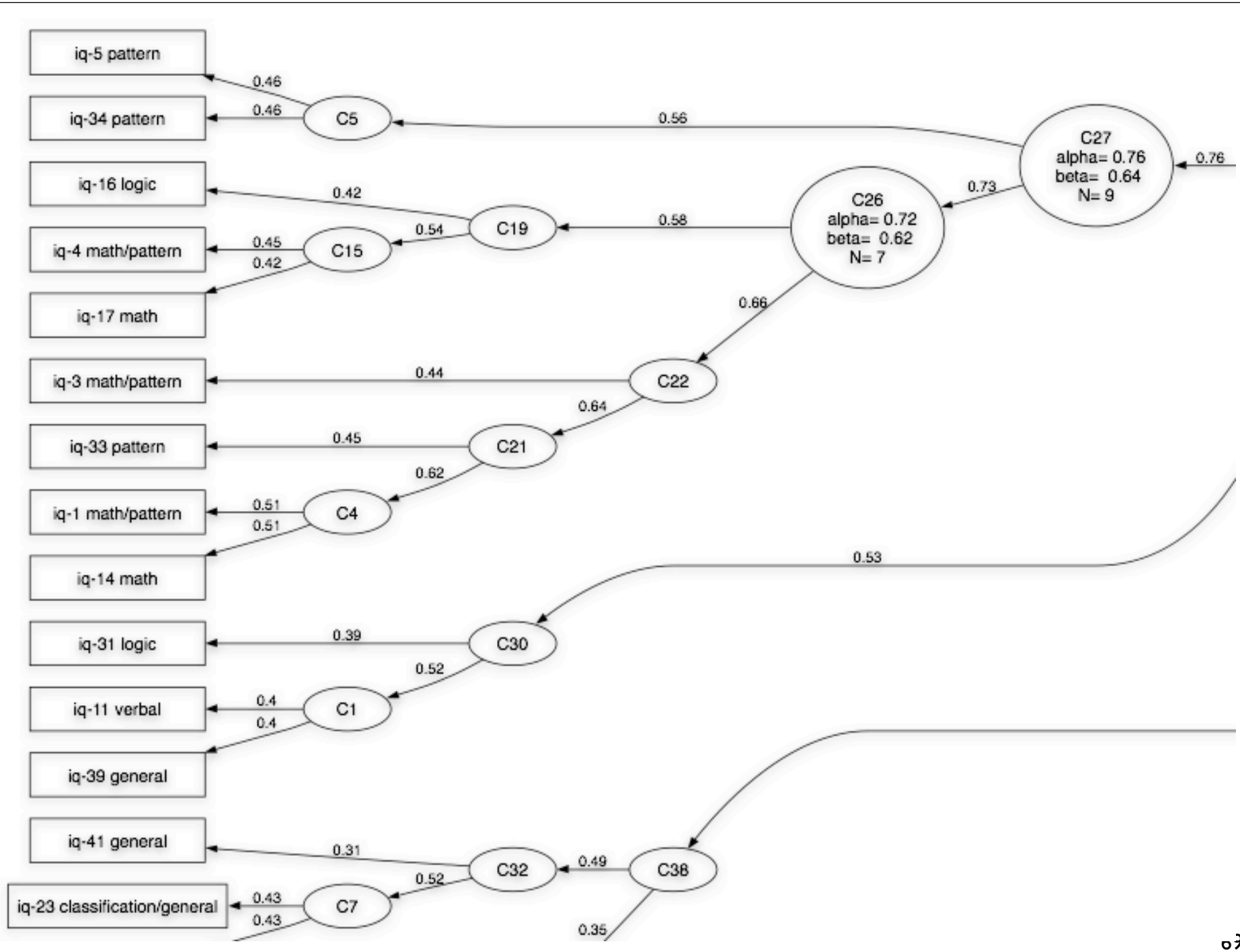
2) Find most similar pair

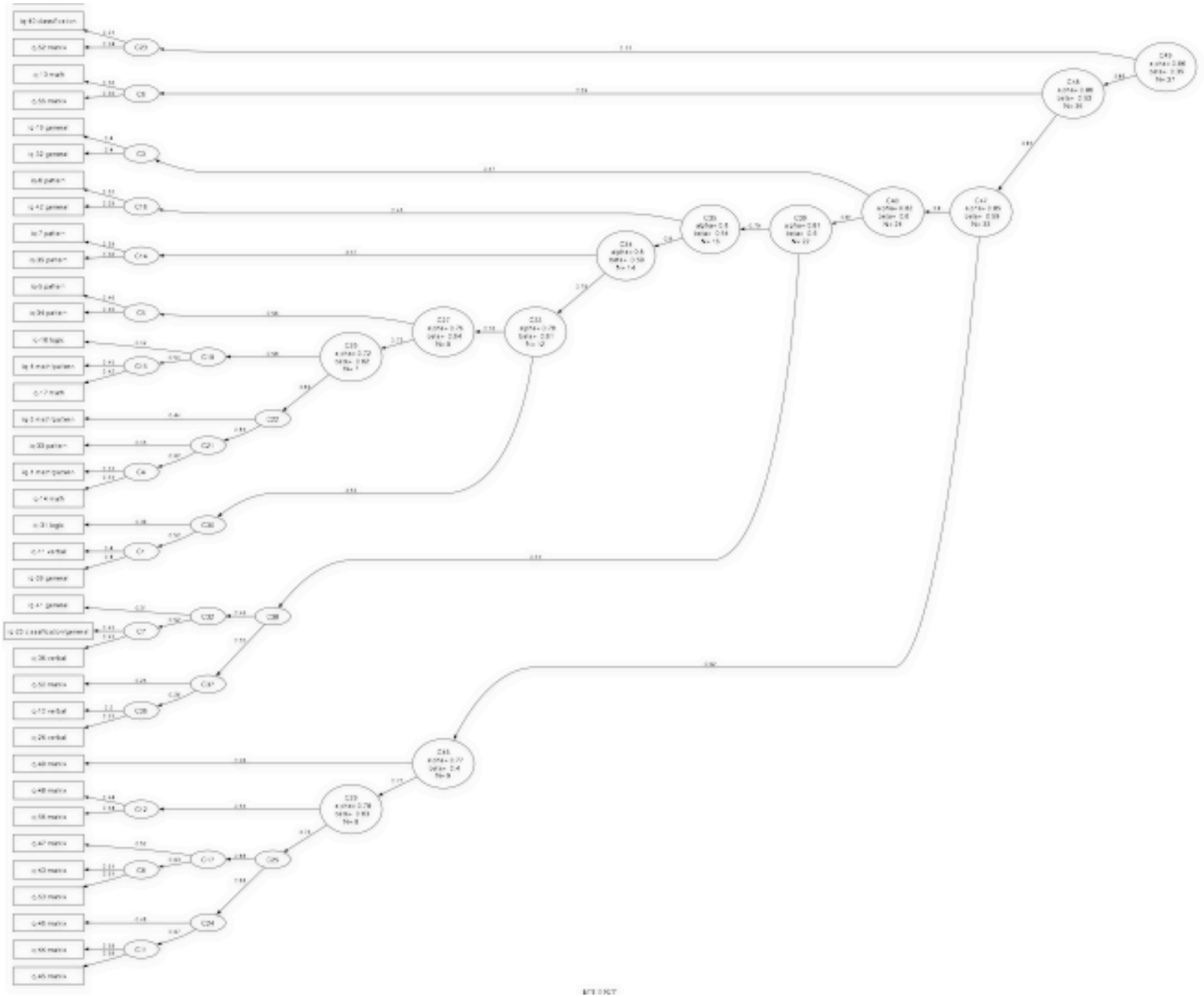
3) Combine this pair if pair would be better (in terms of alpha and beta) than each part

4) Repeat steps 2 & 3 until no pairs meet the criterion

5) Clusters show hierarchical structure of ability or personality items

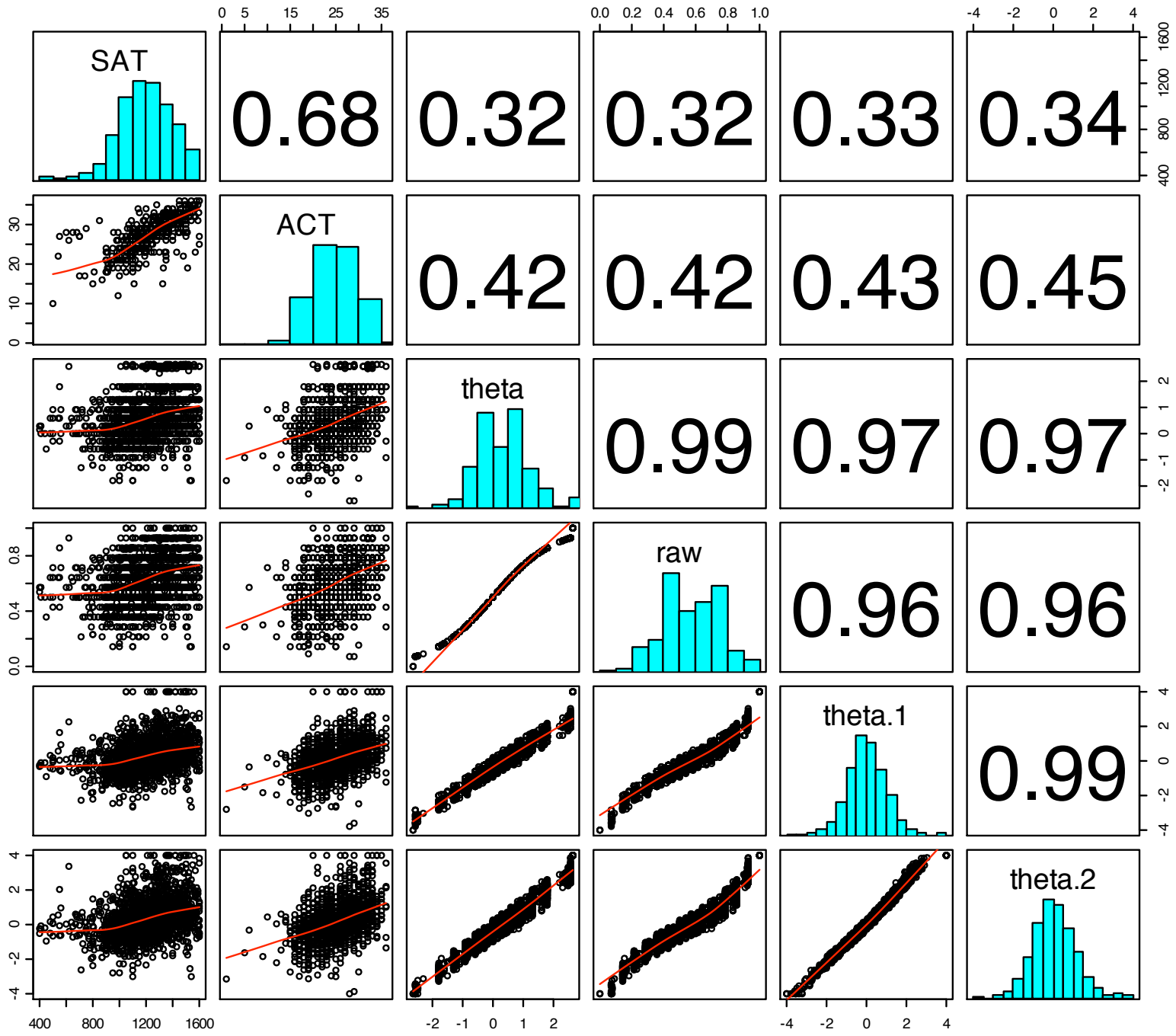

C37
alpha= 0.3
beta= 0.28
N= 3
C36
alpha= 0.23
beta= 0.23
N= 2
C46
alpha= 0.77
beta= 0.4
N= 9
C12
alpha= 0.53
beta= 0.53
N= 2
C29
alpha= 0.78
beta= 0.63
N= 8
C17
alpha= 0.66
beta= 0.62
N= 3
C25
alpha= 0.76
beta= 0.68
N= 6
C8
alpha= 0.6
beta= 0.6
N= 2
C24
alpha= 0.66
beta= 0.56
N= 3
C11
alpha= 0.67
beta= 0.67
N= 2
iq-50 matrix
iq-10 verbal
iq-26 verbal
iq-49 matrix
iq-48 matrix
iq-56 matrix
iq-47 matrix
iq-43 matrix
iq-53 matrix
iq-46 matrix
iq-44 matrix
iq-45 matrix
0.25
0.26
0.2
0.23
0.28
0.77
0.44
0.44
0.54
0.76
0.52
0.68
0.63
0.51
0.51
0.68
0.46
0.67
0.58
0.58


iq-5 pattern
iq-34 pattern
iq-16 logic
iq-4 math/pattern
iq-17 math
iq-3 math/pattern
iq-33 pattern
iq-1 math/pattern
iq-14 math
iq-31 logic
iq-11 verbal
iq-39 general
iq-41 general
iq-23 classification/general
C5
C19
C15
C22
C21
C4
C30
C1
C32
C7
C38
C26
alpha= 0.72
beta= 0.62
N= 7
C27
alpha= 0.76
beta= 0.64
N= 9
0.46
0.46
0.42
0.54
0.45
0.42
0.58
0.56
0.73
0.76
0.66
0.44
0.64
0.45
0.62
0.51
0.51
0.53
0.39
0.52
0.4
0.4
0.31
0.52
0.49
0.43
0.43
0.35



SAPA IQ - Validity

- multiple measures of validity
  - Raw data scored using classical test theory
  - Raw data using 1 parameter IRT
  - Raw data using 2 parameter IRT
  - synthetic correlations of total (56) items
  - synthetic correlations of cluster analytic derived scales and subscales


SAT
ACT
theta
raw
theta.1
theta.2
0.68
0.32
0.32
0.33
0.34
0.42
0.42
0.43
0.45
0.99
0.97
0.97
0.96
0.96
0.99

Reliabilities and Validities of composite and short scales

	n	alpha	SAT	ACT	Education	Age
composite-g	35	.85	.40	.55	.28	.15
composite-reasoning	25	.83	.40	.56	.28	.17
composite matrix	10	.76	.21	.29	.16	.06
composite all	56	.83	.40	.54	.27	.14
raw	14	.65	.30	.41	.22	.11
theta.1	14	-	.31	.41	.22	.11
theta.2	14	-	.32	.43	.22	.11
SAT		-	1.00	.68	.02	-.04

SAPA measures of non-cognitive personality

- 5 "Big 5" scales from 100 IPIP
- Extended "Big 5" (140 items grouped by loadings on Big 5-100 scales)
- 6 cluster scales derived from 140 item pool
  - (political orientation + clusters matching Big 5 scale definitions)

140 IPIP items

6 clusters

- 5 "Big 5"
  - Agreeableness
  - Conscientiousness
  - Extraversion
  - Openness
  - Neuroticism
- Political conservatism

Cluster correlations

(alpha on diagonal - disattenuated above diagonal)

	Agree	Cons	Extra	Open	Neuro	cons
A	**0.92**	0.35	0.43	0.21	-0.31	-0.11
C	0.32	**0.93**	0.28	0.12	-0.32	0.12
E	0.40	0.27	**0.94**	0.23	-0.38	-0.03
Open	0.19	0.11	0.21	**0.92**	-0.17	-0.32
N	-0.28	-0.30	-0.36	-0.16	**0.94**	-0.04
conser	-0.09	0.09	-0.02	-0.26	-0.03	**0.71**

Agreeableness (selected)

Am concerned about others.
Love to help others.
Sympathize with others' feelings.
Take time out for others.
Think of others first.
Inquire about others' well-being.
Feel little concern for others. (R)
Have a good word for everyone.
Feel others' emotions.
Am not really interested in others. (R)
Cut others to pieces. (R)
Have a soft heart.

Conscientious (selected)

Neglect my duties. (R)
Do things in a half-way manner. (R)
Leave things unfinished. (R)
Make plans and stick to them.
Waste my time. (R)
Do things according to a plan.
Find it difficult to get down to work. (R)
Get chores done right away.
Make a mess of things. (R)
Shirk my duties. (R)
Am always prepared.
Carry out my plans.

Extraversion (selected)

Don't talk a lot. (R)
Find it difficult to approach others. (R)
Keep in the background. (R)
Feel comfortable around people.
Am skilled in handling social situations.
Often feel uncomfortable around others. (R)
Start conversations.
Talk to a lot of different people at parties.
Am quiet around strangers. (R)
Feel at ease with people.
Make friends easily.
Am the life of the party.

Openness (selected)

Am not interested in abstract ideas. (R)
Have difficulty understanding abstract ideas. (R)
Am full of ideas.
Am not interested in theoretical discussions. (R)
Avoid philosophical discussions. (R)
Have excellent ideas.
Love to read challenging material.
Carry the conversation to a higher level.
Enjoy thinking about things.
Have a rich vocabulary.
Have difficulty imagining things. (R)
Am quick to understand things.
Believe in the importance of art.
Get excited by new ideas.
Use difficult words.
Rarely look for a deeper meaning in things. (R)

Neuroticism

Am often down in the dumps.
Get stressed out easily.
Change my mood a lot.
Get irritated easily.
Have frequent mood swings.
Often feel blue.
Get angry easily.
Get caught up in my problems.
Panic easily.
Am not easily bothered by things. (R)

Political Conservatism

Tend to vote for conservative political candidates.
Believe that too much tax money goes to support artists.
Tend to vote for liberal political candidates. (R)

Overview

- ABCDs of personality
- Synthetic Aperture Personality Assessment (SAPA) as a tool for exploring cognitive and non-cognitive aspects of personality
- Application of SAPA techniques to showing importance of both cognitive and non-cognitive aspects of personality in predicting real world criteria

Do “cognitive” measures relate to “non-cognitive measures”

- Cognitive measures
  - Standardized ability tests (SAT, ACT)
  - SAPA ability measures (reasoning, matrix)
- Non-cognitive measures
  - Big 5 (A, C, E, O, N)
- Criteria measures
  - Education
  - Gender differences

Predicting cognitive from non cognitive (beta + R^2)

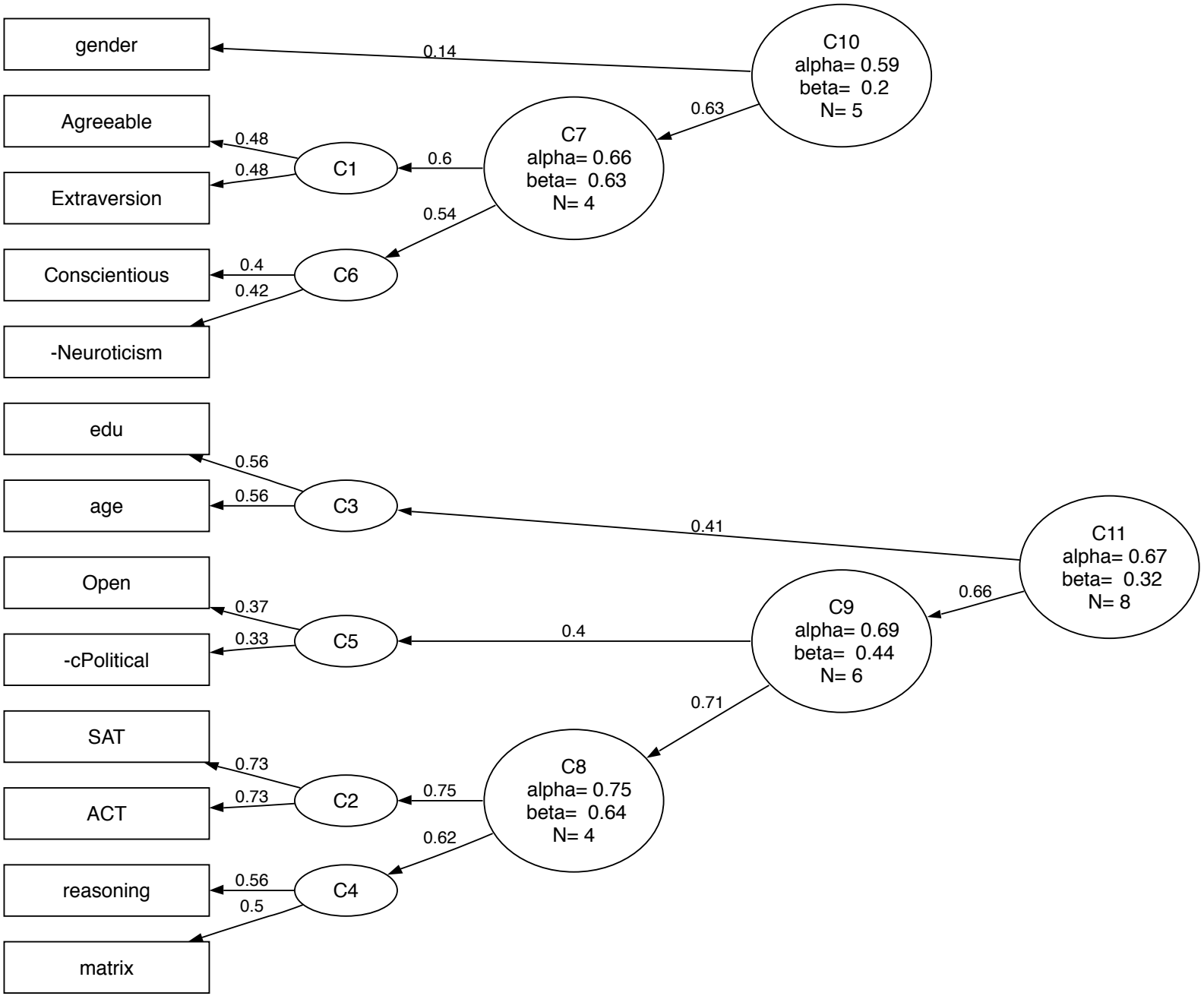
	reasoning	matrix	SAT	ACT
Agreeable	-0.02	-0.04	-0.16	-0.11
Consc	-0.02	-0.04	-0.06	-0.14
Extraversion	**-0.20**	-0.10	**-0.16**	**-0.18**
Open	**0.36**	**0.17**	**0.31**	**0.45**
Neuroticism	-0.10	-0.09	-0.10	-0.10
cPolitical	-0.05	-0.03	0.04	0.10
R^2	**0.16**	0.04	0.13	**0.23**
R	0.40	0.20	0.36	0.48

Predicting non-cognitive from cognitive (beta + R^2)

	Agree	Cons	Extrav	Open	Neuro	cons
reasoning	0.10	0.09	-0.03	**0.19**	-0.06	-0.19
matrix	-0.02	-0.03	-0.01	0.00	-0.04	-0.02
SAT	-0.15	-0.01	-0.09	-0.02	0.00	-0.02
ACT	-0.07	-0.17	-0.05	**0.28**	0.00	0.11
R^2	0.03	0.02	0.02	**0.16**	0.01	0.03
R	0.17	0.14	0.14	0.40	0.10	0.17

Cognitive and non-cognitive - a joint space

- Cluster analysis of composite scales
  - shown as hierarchical cluster
  - shown as factor (cluster) loadings


gender
Agreeable
Extraversion
Conscientious
-Neuroticism
edu
age
Open
-cPolitical
SAT
ACT
reasoning
matrix
C1
C2
C3
C4
C5
C6
C7
C8
C9
C10
C11
alpha= 0.59
beta= 0.2
N= 5
alpha= 0.66
beta= 0.63
N= 4
alpha= 0.75
beta= 0.64
N= 4
alpha= 0.69
beta= 0.44
N= 6
alpha= 0.67
beta= 0.32
N= 8
0.14
0.63
0.48
0.48
0.6
0.54
0.4
0.42
0.56
0.56
0.41
0.37
0.33
0.4
0.66
0.71
0.73
0.73
0.75
0.62
0.56
0.5

ICLUST

Scale	cognitive	non-cognitive
Reasoning	**0.59**	-0.06
ACT	**0.52**	-0.15
Open	**0.43**	0.18
SAT	**0.39**	-0.14
Matrix	**0.35**	-0.05
Education	**0.34**	0.11
Age	0.23	0.11
Political	-0.15	-0.02
Agreeable	0.04	**0.51**
Extraversion	-0.05	**0.46**
Conscientious	0.02	**0.41**
Neuroticism	-0.11	**-0.25**
Gender	-0.10	0.12

Predicting real world criteria (betas + R^2)

	SAT	ACT	gender	edu	age	conserv
reason	**0.31**	**0.44**	-0.06	**0.23**	0.14	-0.05
matrix	0.04	0.05	0.01	0.06	-0.01	-0.01
Agree	-0.16	-0.11	**0.29**	0.06	0.07	-0.11
Consc	-0.05	-0.11	0.12	0.16	0.17	0.13
Extrav	-0.09	-0.09	0.07	-0.06	-0.10	0.01
Open	**0.17**	**0.25**	-0.13	0.06	0.08	**-0.25**
Neuro	-0.07	-0.06	**0.29**	0.00	-0.03	-0.06
R^2	**0.22**	**0.39**	**0.16**	**0.12**	**0.08**	**0.09**
R	0.47	0.62	0.40	0.35	0.28	0.30

Summary

- ABCDs of personality - need to study all four aspects of personality
- Synthetic Aperture Personality Assessment (SAPA) as a tool for exploring cognitive and non-cognitive aspects of personality
- Application of SAPA techniques to showing importance of both cognitive and non-cognitive aspects of personality in predicting real world criteria

For more information

- example of web based personality and ability survey: http://test.personality-project.org
- for R code used in analysis: http://personality-project.org/r/
- for this and other papers: http://personality-project.org/revelle.html
- for HTML, PHP & MySQL code for presenting items, contact revelle@northwestern.edu