Telemetrics: Measuring Personality at a Distance

William Revelle Joshua Wilt and David Condon

Presented as a symposium at the Biennial Meeting of the International Society for the Study of Individual Differences
London, U.K.

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July 28, 2011

Outline

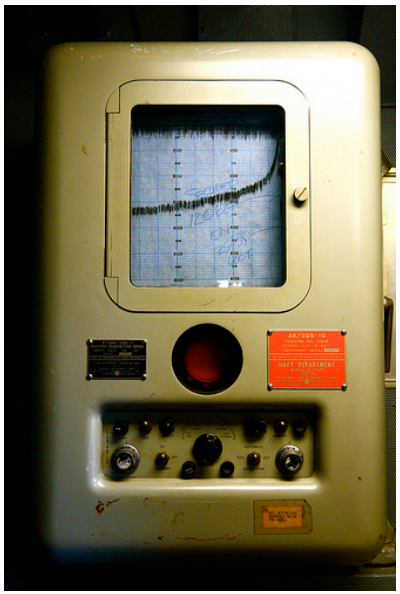
1. Part I: an introduction to telemetrics
   - A short history of telemetrics
   - Various telemetric techniques
   - An overview of Synthetic Aperture Personality Assessment
2. Part II: web based telemetrics
   - Conventional web based techniques
   - advantages of SAPA techniques
   - Using SAPA to measure Temperament, Ability, Interests, and Character
3. Part III: cell phone based telemetrics
   - Personality and emotional states
   - Traditional means of measuring states within subjects
   - Cell phones and text messaging
   - Example data and findings
4. Part IV: Telemetrics of personality
   - Open source software and items for telemetrics
   - Analyzing telemetric data

Telemetrics: Measuring personality at a distance

History of science is a history of measurement

1. The telescope and tests of Copernican theory (1609-)
   - Galileo
   - Kepler
2. The voyages of biological discovery (1831 -)
   - Darwin
   - Wallace
   - Hooker
   - Huxley

Measurement at a distance in the 20th century

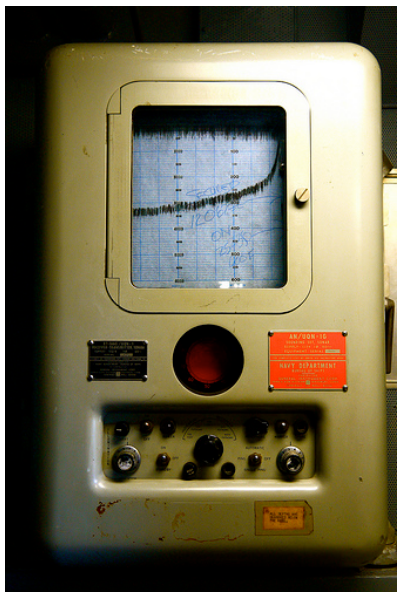


1. The echo sounder and oceanography (1923-
   - Discovery of seamounts and trenches
   - Theory of plate techtonics
2. Radio Astronomy (1930-
   - Background radiation, quasars, black holes
   - Theories of astrophysics and the formation of the universe

Scientific impact of instruments that measure at a distance

Telescopes and Astronomy

Biological field research and evolutionary theory



Echo sounders and oceanography

Radio telescopes and Astronomy

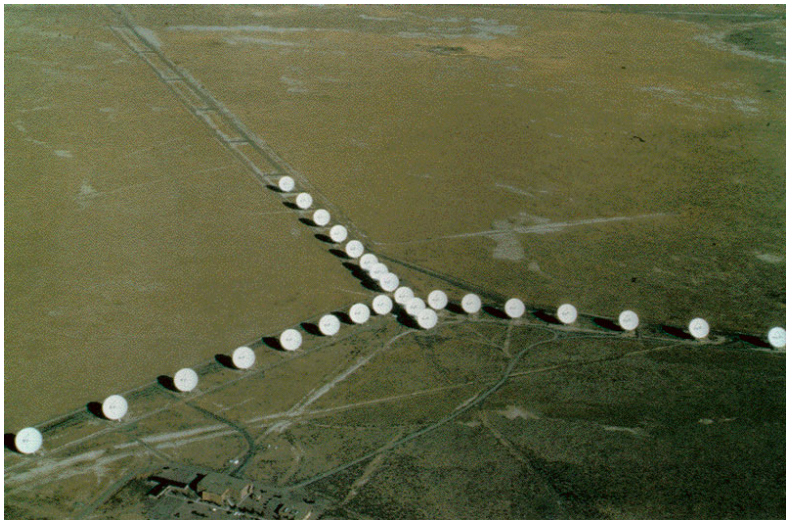
Telemetrics in psychology

1. The telephone and the population survey
   - Standard problems of sampling validity
   - Requires large survey research group
2. Web based data collection
   - Problems of validity
   - Easy to do
3. Ambulatory assessment
   - Expensive equipment
   - Mainly for psychophysical measures
4. Cell phone assessment
   - Easy to implement

Currently used telemetric techniques

1. Phone based surveys
   - National surveys (NORC)
2. Diary Studies
   - Paper and Pencil
   - Personal Digital Assistants (Green, Rafaeli, Bolger, Shrout & Reis, 2006; Rafaeli & Revelle, 2006)
   - Cell phone – text messaging (Wilt, Funkhouser & Revelle, 2011)
3. Web based surveys
   - `outoforder.com` (Gosling, Vazire, Srivastava & John, 2004)
   - John Johnson (`www.personal.psu.edu/j5j/IPIP/`)
   - Synthetic Aperture Personality Assessment (`test.personality-project.org`)

Synthetic Aperture Personality Assessment

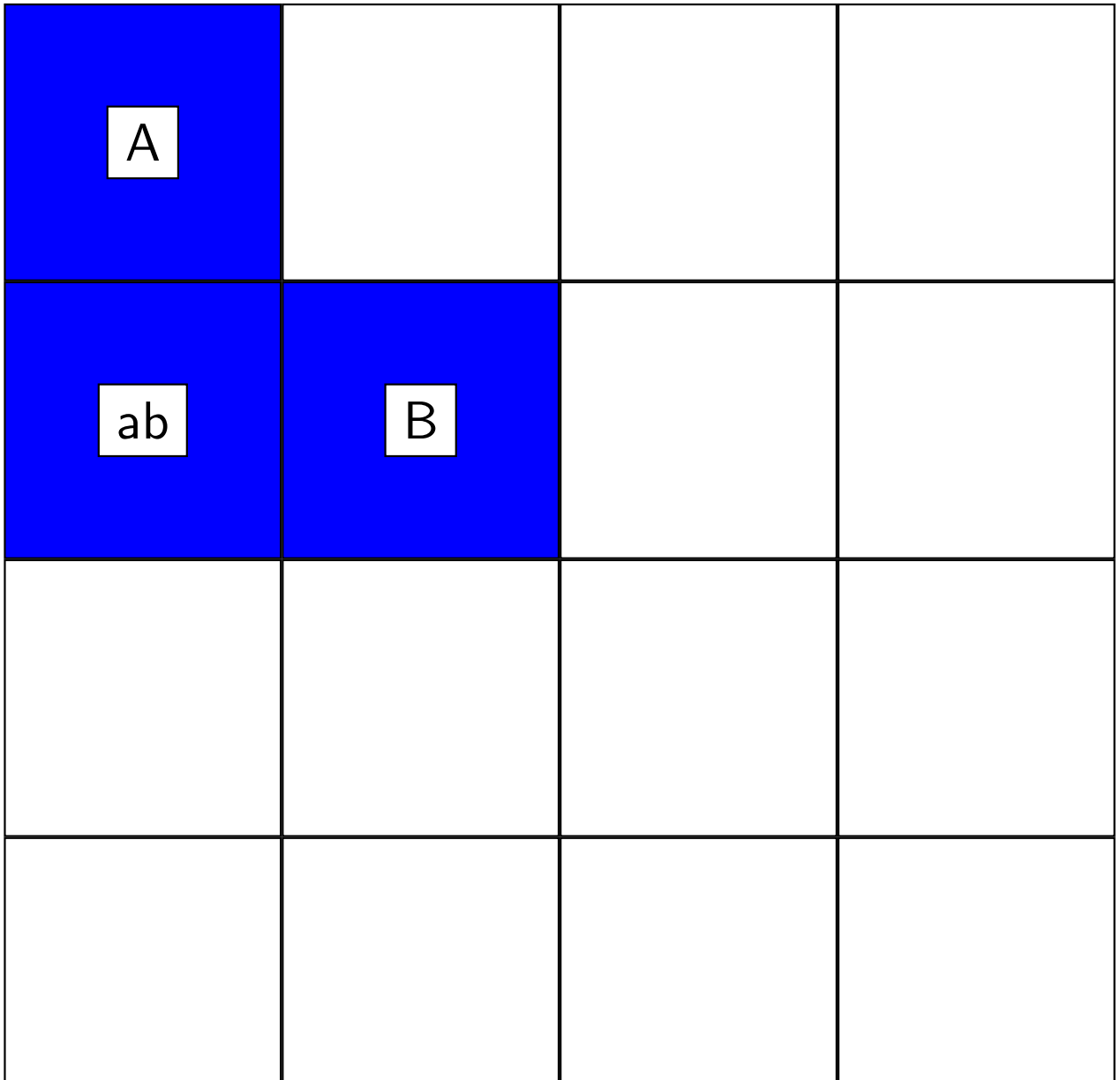


1. Analogous to Synthetic Aperture Radio Astronomy
   - Radio telescopes are measured by their circumference
   - Can increase the effective size of a telescope by arranging an array of telescopses
2. We can do the same thing in personality measurement
   - Can synthetically form large correlation matrices by building up smaller, overlapping data sets.
3. Not a new idea – used by ETS for years

SAPA: conceptual overview

1. Each participant takes a small number of items
   - These represent a pseudo random sample from a larger pool.
   - Participants are happy to have a short questionnaire.
   - Personality feedback is given to encourage participation.
2. Item variances and covariances from each sub sample may be synthetically combined into a larger matrix.
   - Researchers are happy with large covariance matrices.
3. Data collection is automated on a web server (5-10 subjects will be collected during this symposium).
4. Feedback is given to the participant to increase their motivation to take the inventory.

SAPA: what the subject sees



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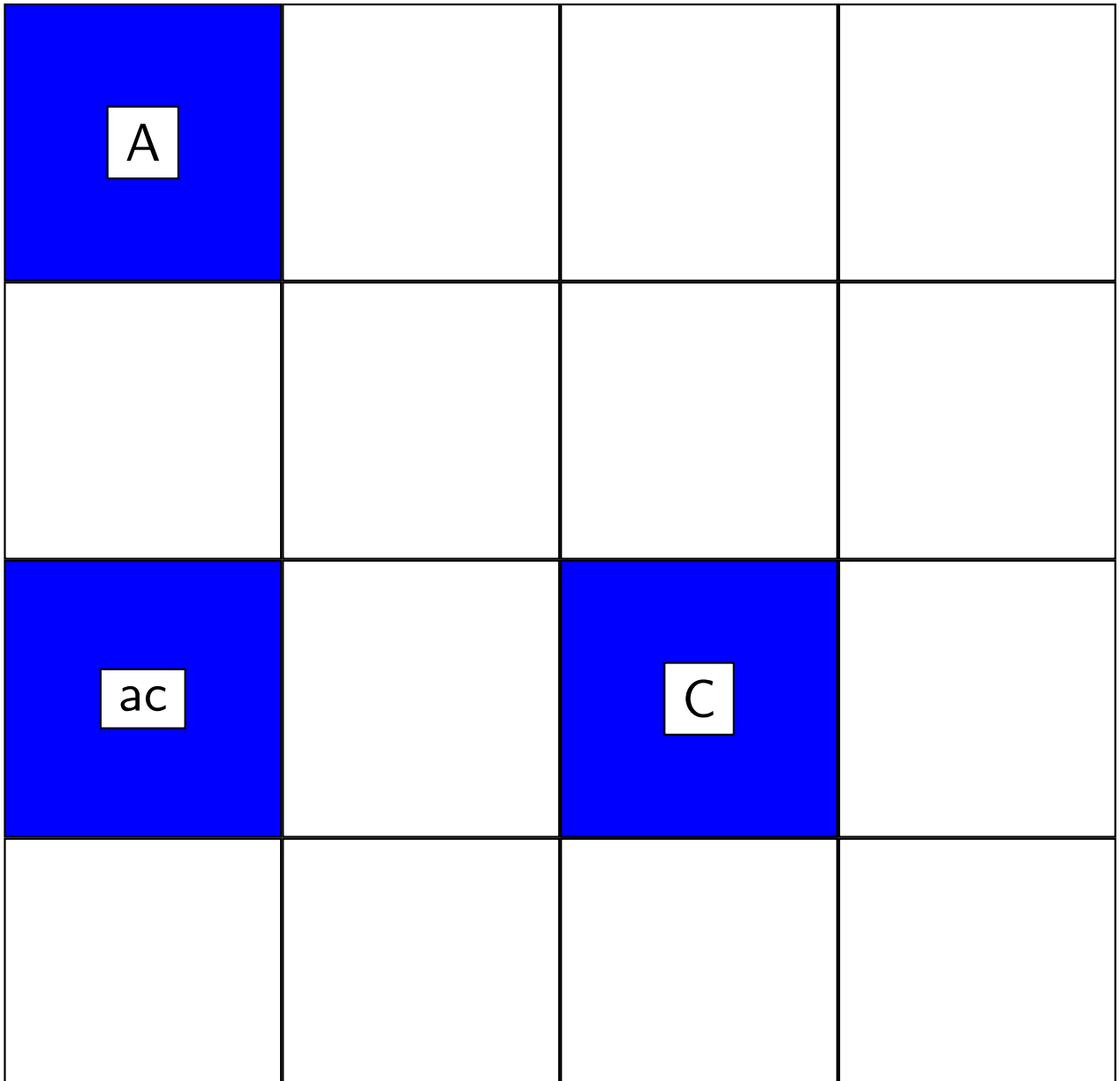

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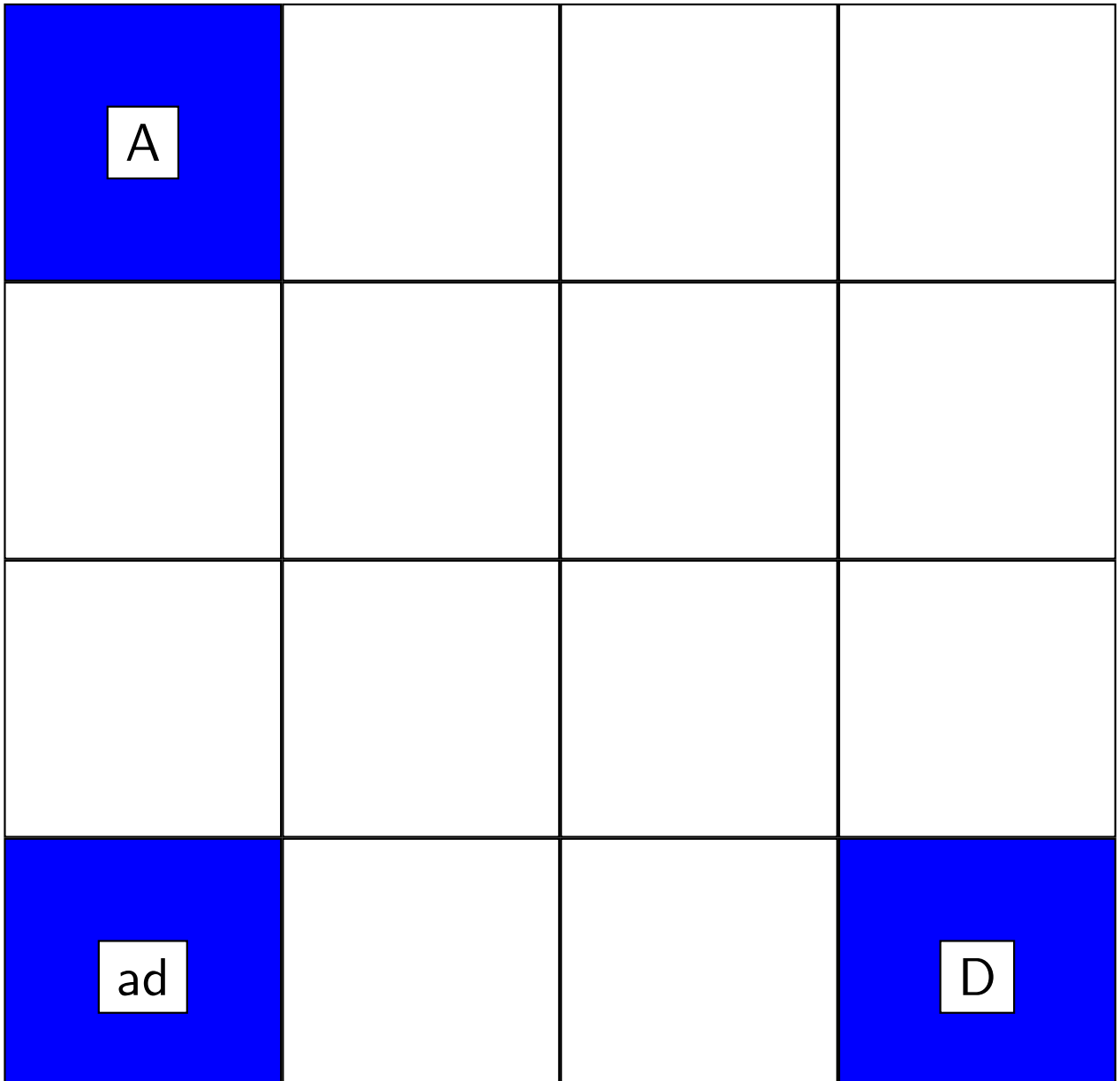

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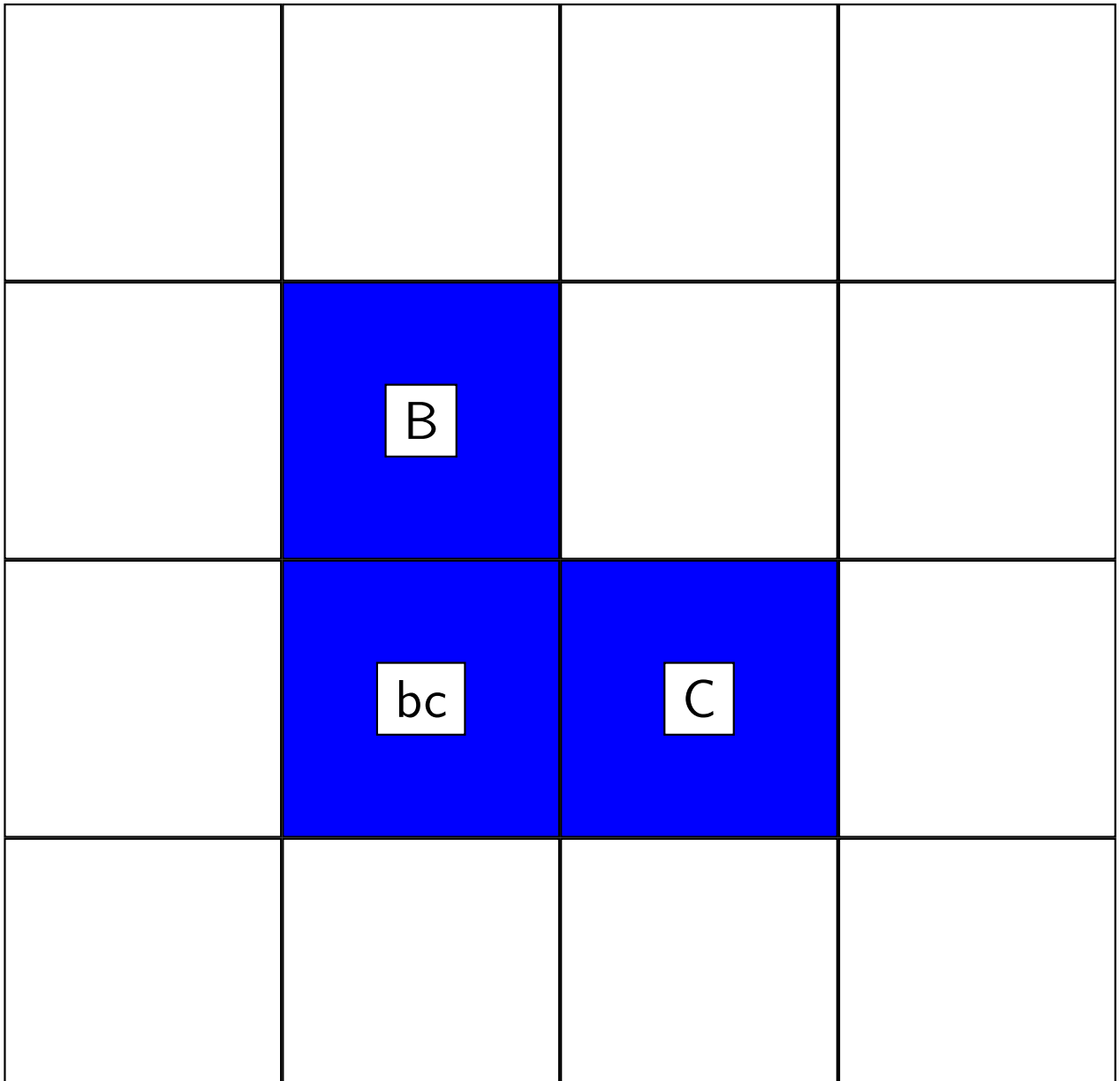

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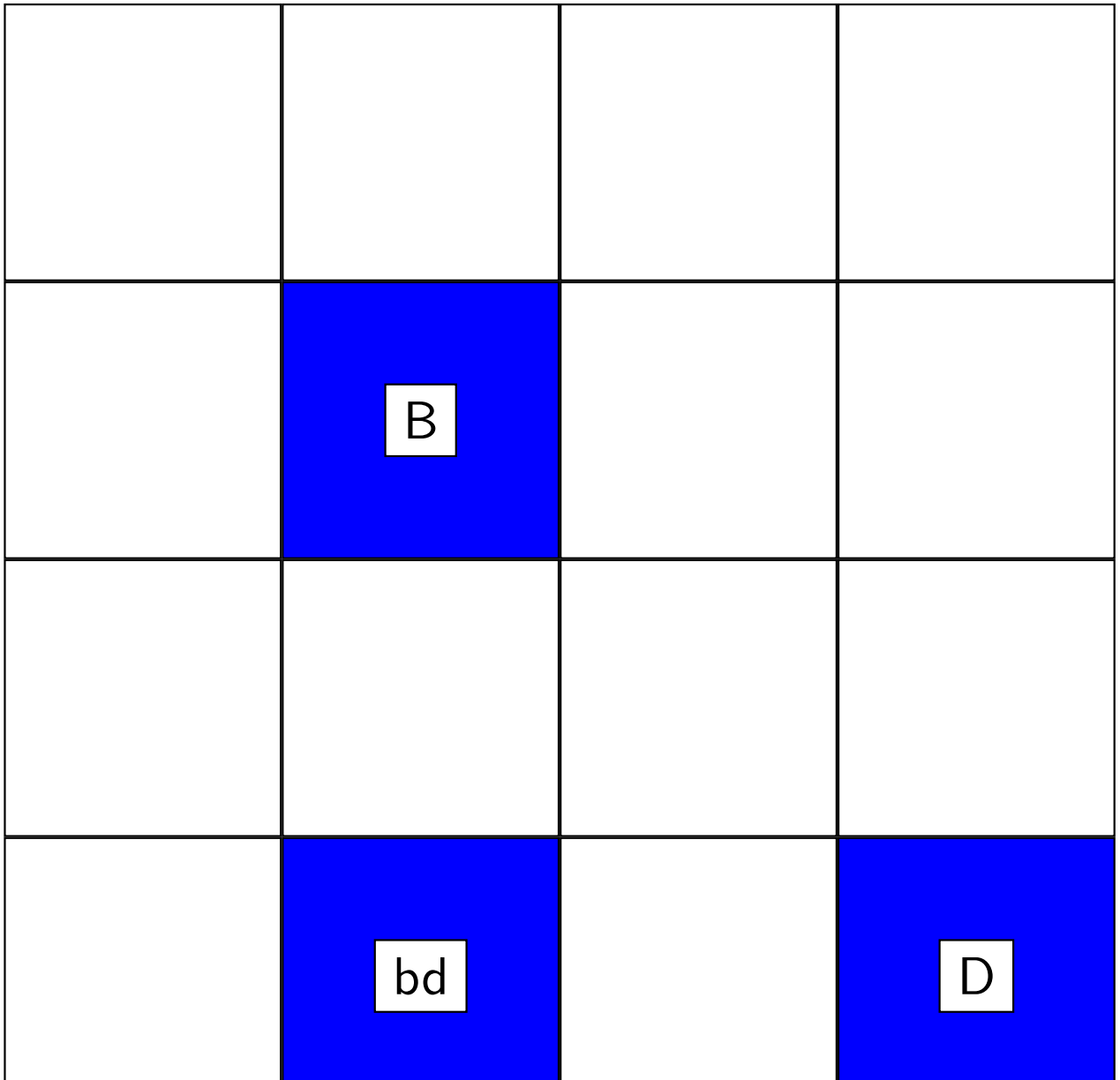

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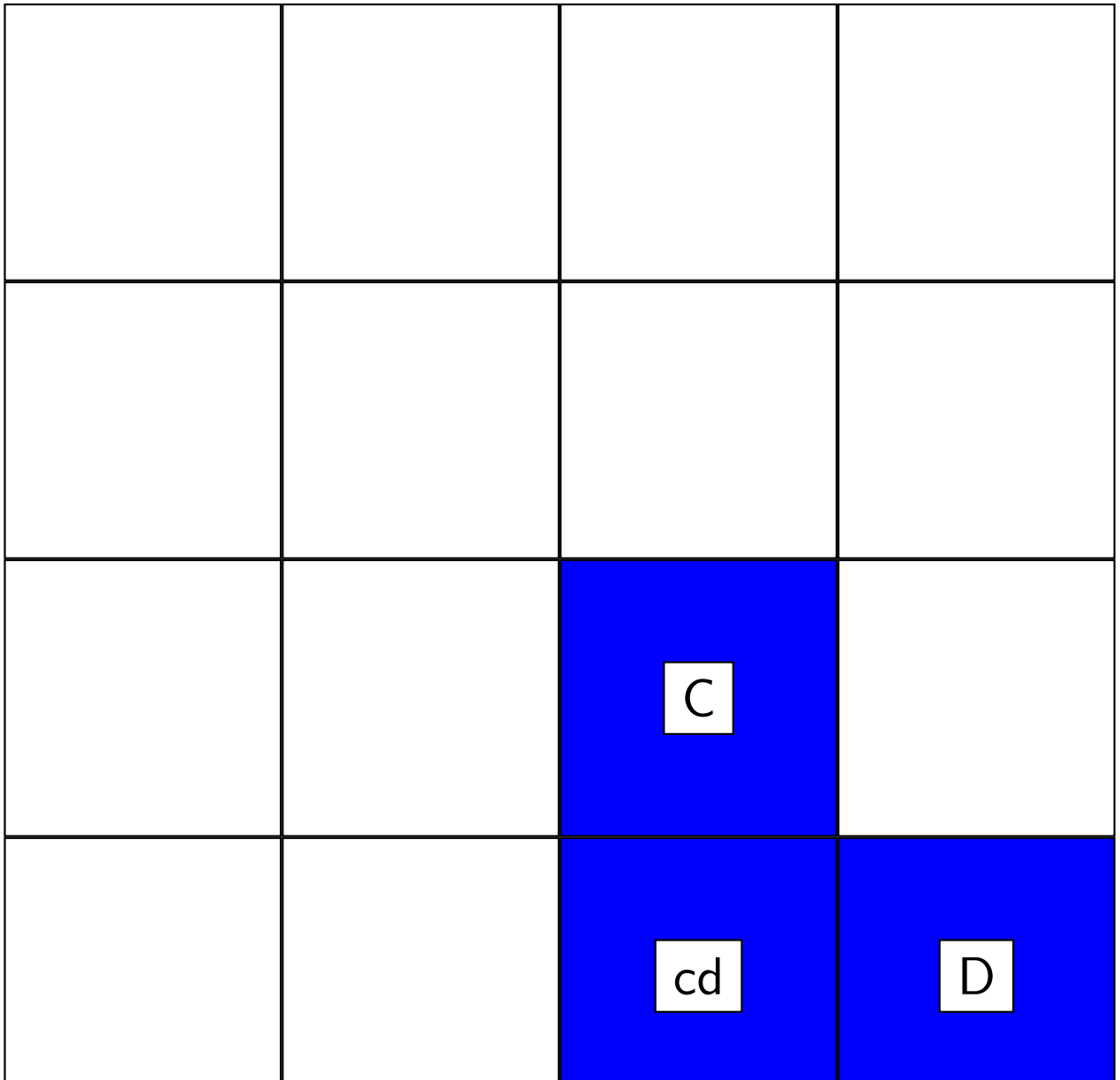

SAPA: what the experimenter sees: A Synthetic matrix

A			
ab	B		
ac	bc	C	
ad	bd	cd	D

SAPA: Technical overview

1. n x n synthetic covariance matrices are formed by giving p items to Np subjects
   - N Total number of subjects
   - n Total number of items in synthetic matrix
   - p Probability of any item being given
   - pN Number of subjects taking any one item
   - p^2N Number of subjects for any pair of items
2. Basic statistics
   - Data are Massively Missing at Random
   - Means and Variances are based upon pN subjects
   - Covariances are based upon p^2N subjects
3. Power of large samples and sampling of items
   - 100-150 people per day => 40,000 subjects per year
   - 700-1000 subjects/week
   - By varying p, one can prototype items rapidly.

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Telemetric Assessment: Using SAPA to Measure Temperament, Abilities and Interests

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Outline

1. Telemetric Assessment of Individual Differences
   - Basic Online Assessment
   - Concerns with Basic Online Assessment
   - Synthetic Aperture Personality Assessment
2. The SAPA Methodology in Practice
   - The Context for TAIC
   - Temperament
   - Vocational Interests
   - Cognitive Abilities
   - Demographics
3. Findings and Future Directions

Basic Online Assessment

- Amazing variety of web-based methods
  - Informal surveys: Google Forms, Survey Monkey, Qualtrics
  - 3rd party interfaces: Facebook apps, MTurk
  - Stand-alone Internet surveys
    - Offers maximum flexibility
    - Requires in-house server(s) and independent database mgmt
- Well-known benefits of "Basic Online Assessment"
  - Rapid data collection from large diverse samples
  - Ability to sample attitudes on time-sensitive topics
  - Highly efficient way to prototype items and construct scales

Concerns About Basic Online Assessment

- Concerns specific to online data collection
  - Sample characteristics
  - Multiple-responders
    - Various methods for dealing with this but none are perfect
  - Database security
    - Less of a concern than it may seem if precautions are taken
  - Not well-suited for all types of items
    - Self-report, peer-report, multiple-choice vs open-ended/free-response
    - Challenges with timed items and some types of stimuli
- General Concerns Related to Self-Reports
  - Social desirability
  - Participant fatigue
- Potential for massive proliferation of items
  - Ease of scale construction is not adequate justification
  - Oft-overlooked benefit of IPIP

Synthetic Aperture Personality Assessment

- Each participant is administered a subset of the items being studied
  - Small enough to be palatable for participants.
  - Broad and reliable enough to provide meaningful feedback (on the individual level)
  - Any two subsets will have overlapping items
  - Each subset can include items that are unrelated to participant feedback (1/6th of items are "exploratory")
- Enhances the benefits of "Basic Online Assessment"
  - Facilitates assessment of covariance between measures
    - Attitudes about current events can be correlated with broad array of individual difference.
    - Increases ability to evaluate items and scales across constructs
- Particularly well-suited for assessment across broad domains

The Context for TAIC

- Phillip Ackerman
  - *Cognitive, Affective, and Conative Individual Differences: Communalities, Uniquenesses, and Prospects for Integration*
- William Revelle
  - *Temperament, Abilities, Interests and Character*
- The methodological challenge of measuring personality across domains
  - Big Five Measures:
    - NEO-FFI: 60 items
    - NEO-PI-R: 300 items
    - IPIP Big-Five Factor Markers: 100 items
  - Vocational Interest Scales:
    - Various RIASEC measures: 90 to 400+ items
    - Oregon Vocational Interest Scales: 92 items
  - Cognitive Ability measures: tremendous variety

The SAPA Method for TAI

Create synthetic correlation matrix by administering a subset of items to each participant.

- Assessing Temperament:
  - 100-Item Set of IPIP Big-Five Factor Markers
    - Public-domain items validated against various other measures
  - Each participant gets 50 items
    - 2 of 6 possible pairings of 25 items

The SAPA Method for TAI

- Assessing Vocational Interests:
  - Oregon Vocational Interest Scales (8 scales / 92 items)
  - Each participant gets 10 items at random interspersed among the Big Five items
- This same procedure can be used for additional constructs
- Individual researchers granted access to "time on the machine"
- Constructs studied to date include:
  - Subjective Well-Being (Diener, Emmons, Larsen & Griffin, 1985)
  - Trait Emotional Intelligence (Petrides, 2009)
  - Internet Addiction
  - dozens more

The SAPA Method for TAI

- Assessing Abilities
  - "Home-brewed" IQ test
  - 56 item power test (speed tests possible but difficult)
  - Each participant receives 14 general factor items

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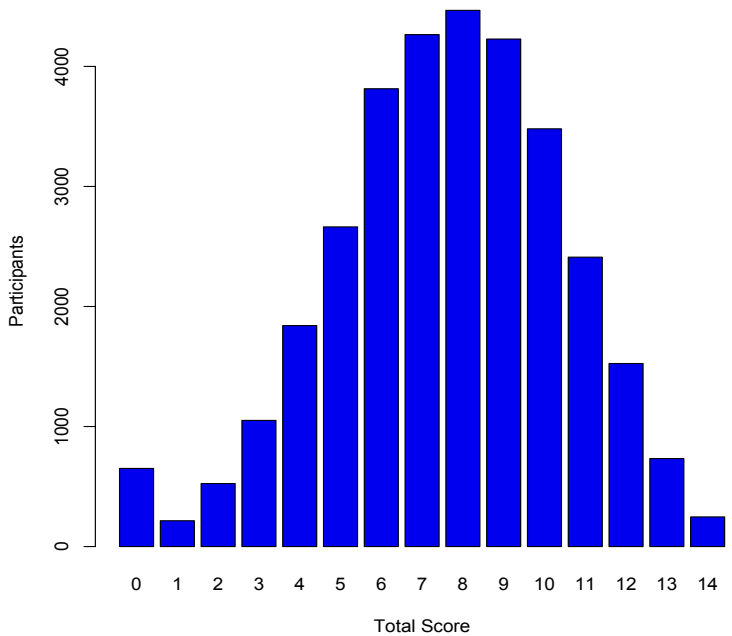

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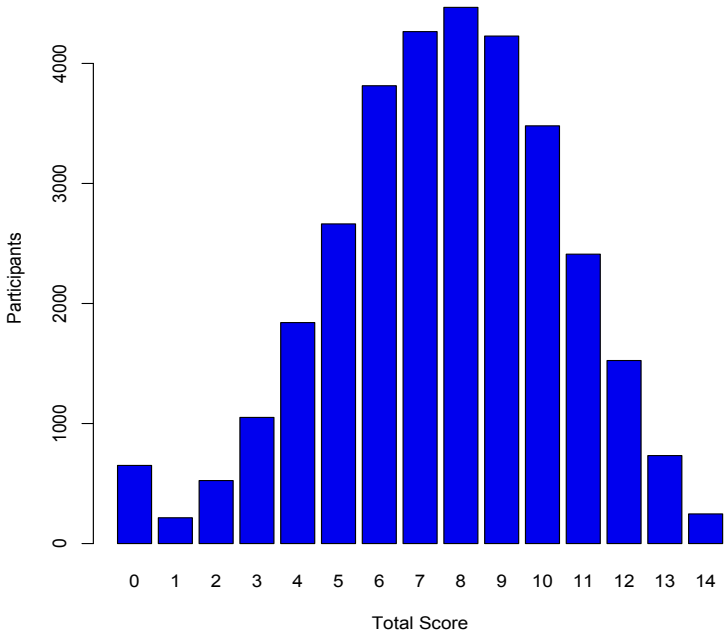

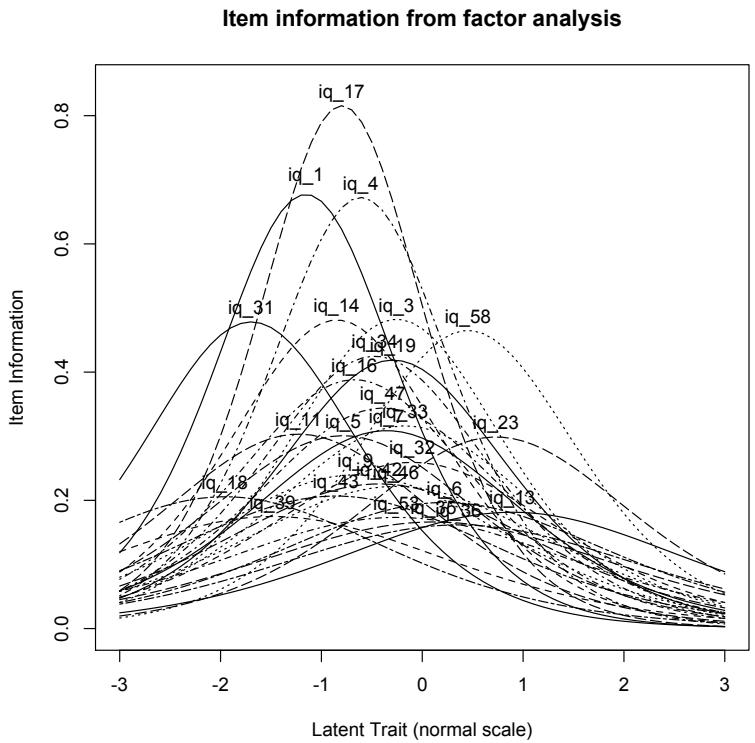

The SAPA Method for TAI

- Assessing Abilities
  - Initiative to develop items for second-order factors.
  - Tentative strategy based on V-P-R model (Johnson & Bouchard, 2005)
  - Intend to develop public-domain IQ tests
    - Compatible with automatic, adaptive item generation
    - Rely on algorithmic mechanisms for adjusting item difficulties
- Rotational items under testing.

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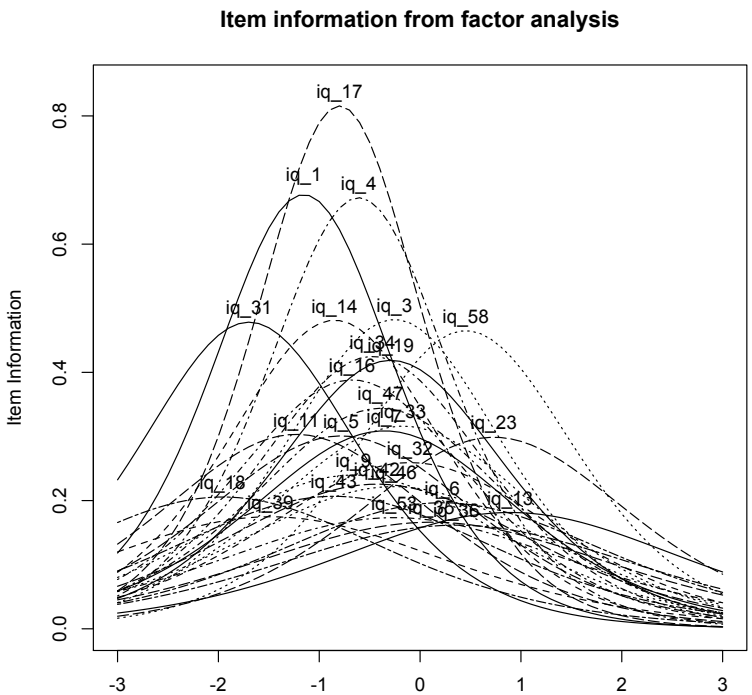

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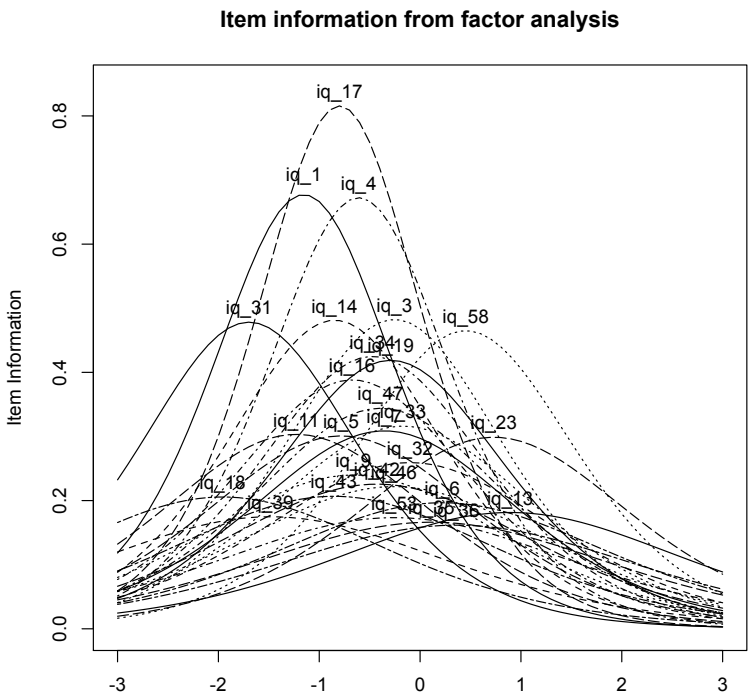
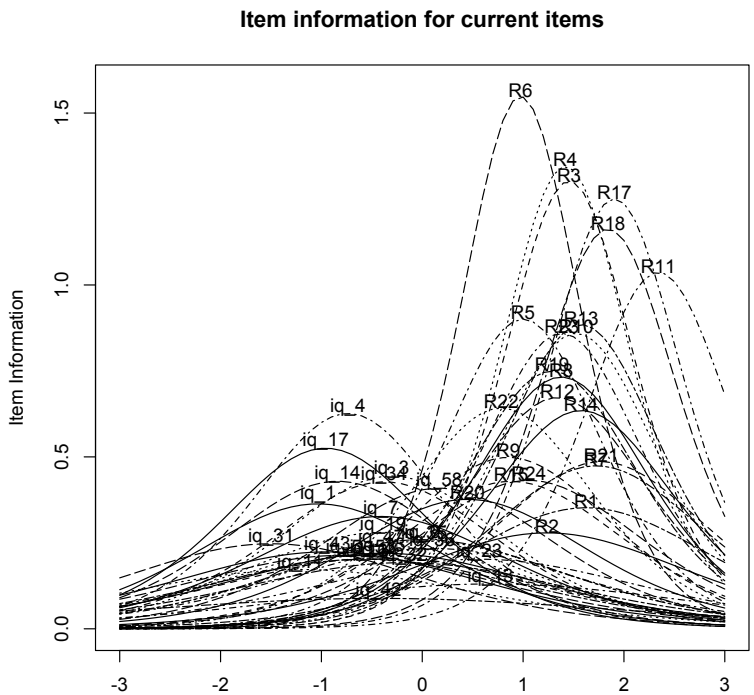
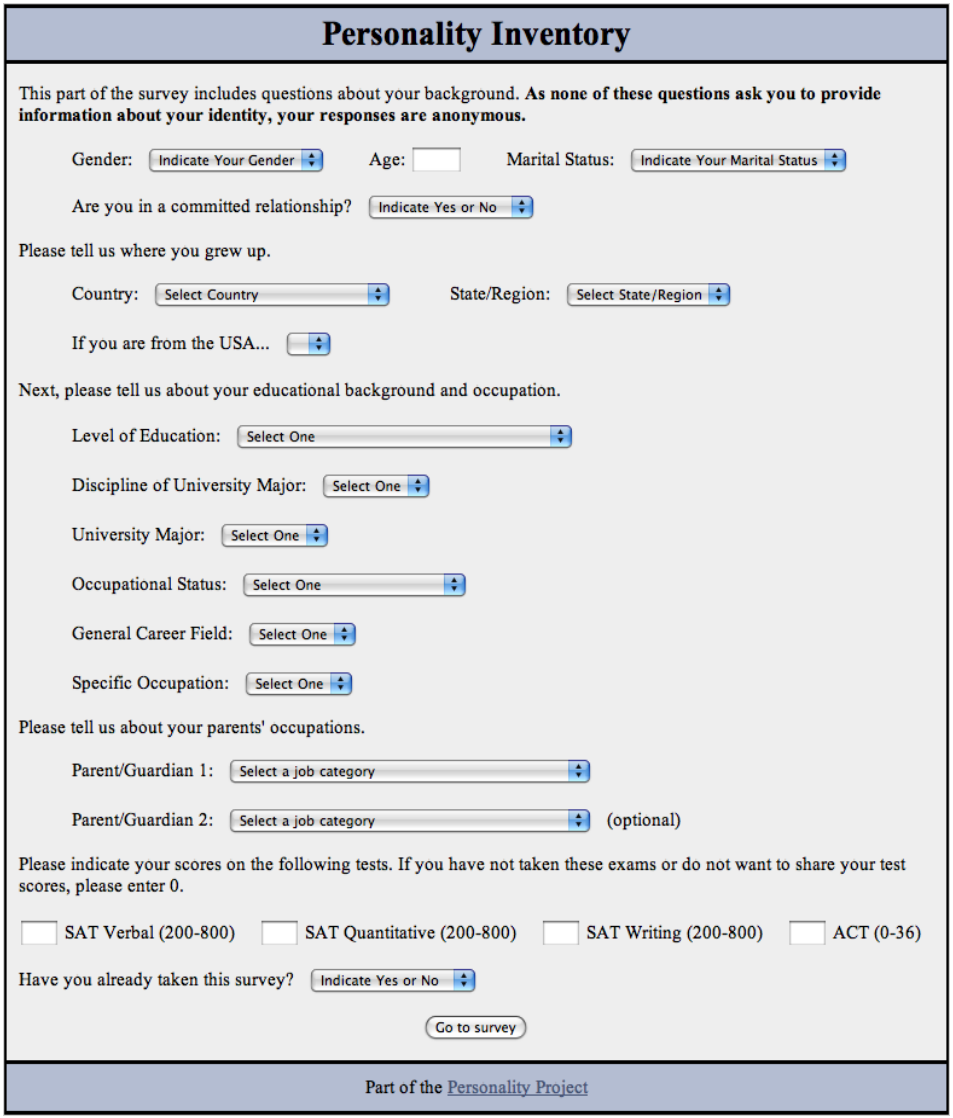




Demographics

from: <http://test.personality-project.org/>



Personality Inventory

This part of the survey includes questions about your background. **As none of these questions ask you to provide information about your identity, your responses are anonymous.**

Gender: Indicate Your Gender Age: Marital Status: Indicate Your Marital Status

Are you in a committed relationship? Indicate Yes or No

Please tell us where you grew up.

Country: Select Country State/Region: Select State/Region

If you are from the USA...

Next, please tell us about your educational background and occupation.

Level of Education: Select One

Discipline of University Major: Select One

University Major: Select One

Occupational Status: Select One

General Career Field: Select One

Specific Occupation: Select One

Please tell us about your parents' occupations.

Parent/Guardian 1: Select a job category

Parent/Guardian 2: Select a job category (optional)

Please indicate your scores on the following tests. If you have not taken these exams or do not want to share your test scores, please enter 0.

SAT Verbal (200-800) SAT Quantitative (200-800) SAT Writing (200-800) ACT (0-36)

Have you already taken this survey? Indicate Yes or No

Go to survey

Part of the Personality Project

Sample of Demographics:

Marital / Relationship Status

Level of Educational Attainment

University Major (if applicable)

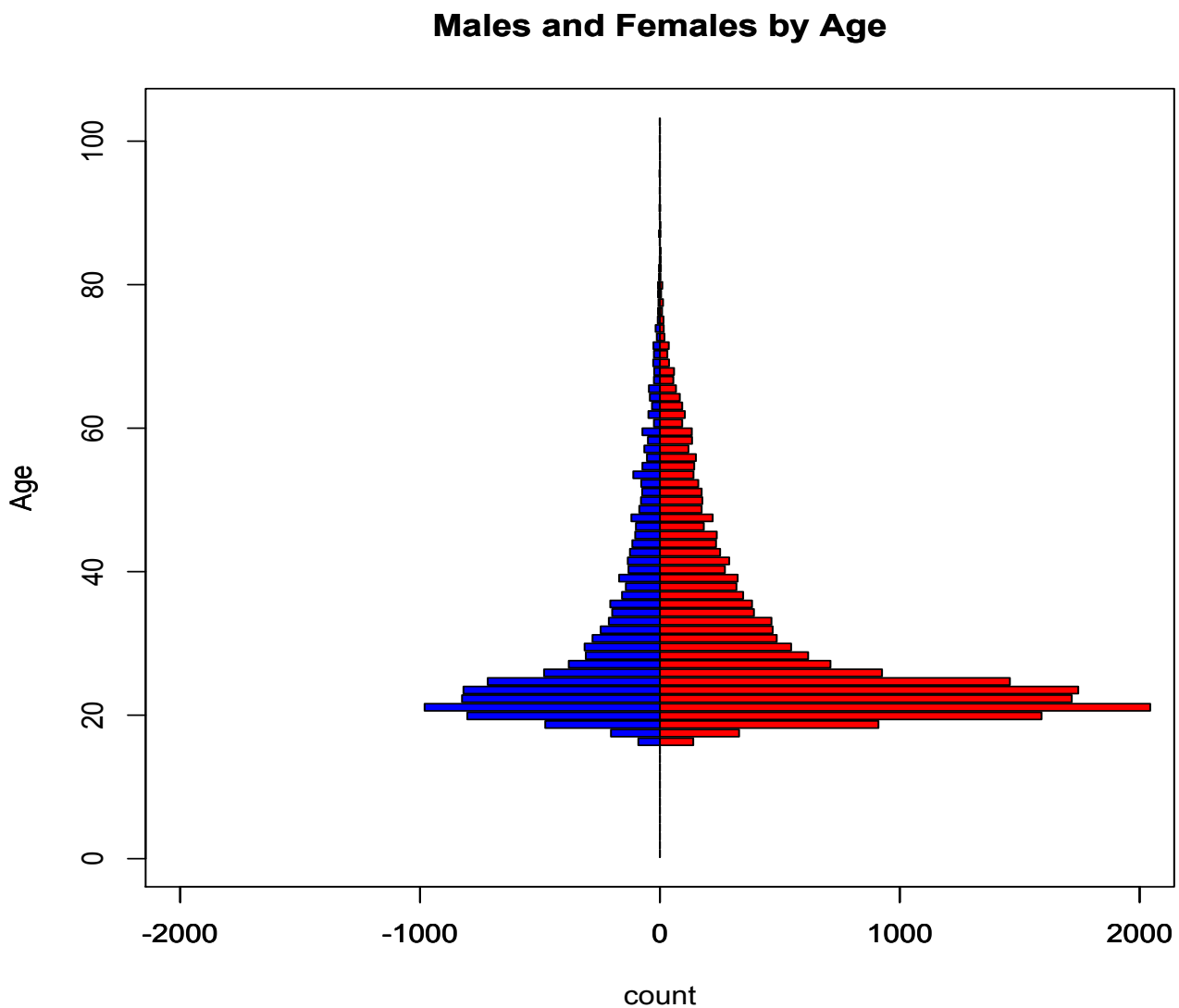
Career Status & Occupation

Parents' Occupations

Standardized Test Scores

Ethnicity (U.S. Only)

Recent Findings



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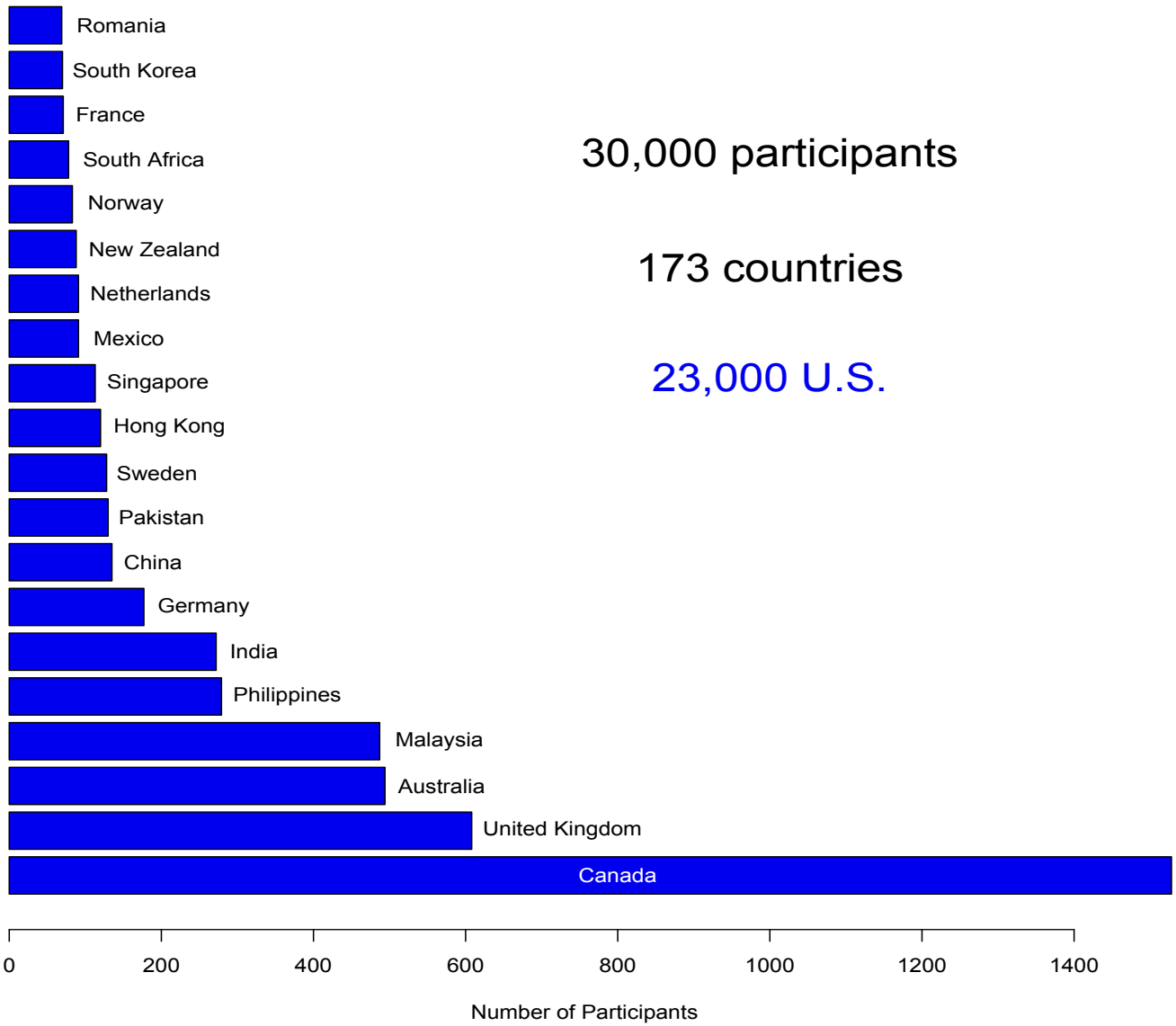
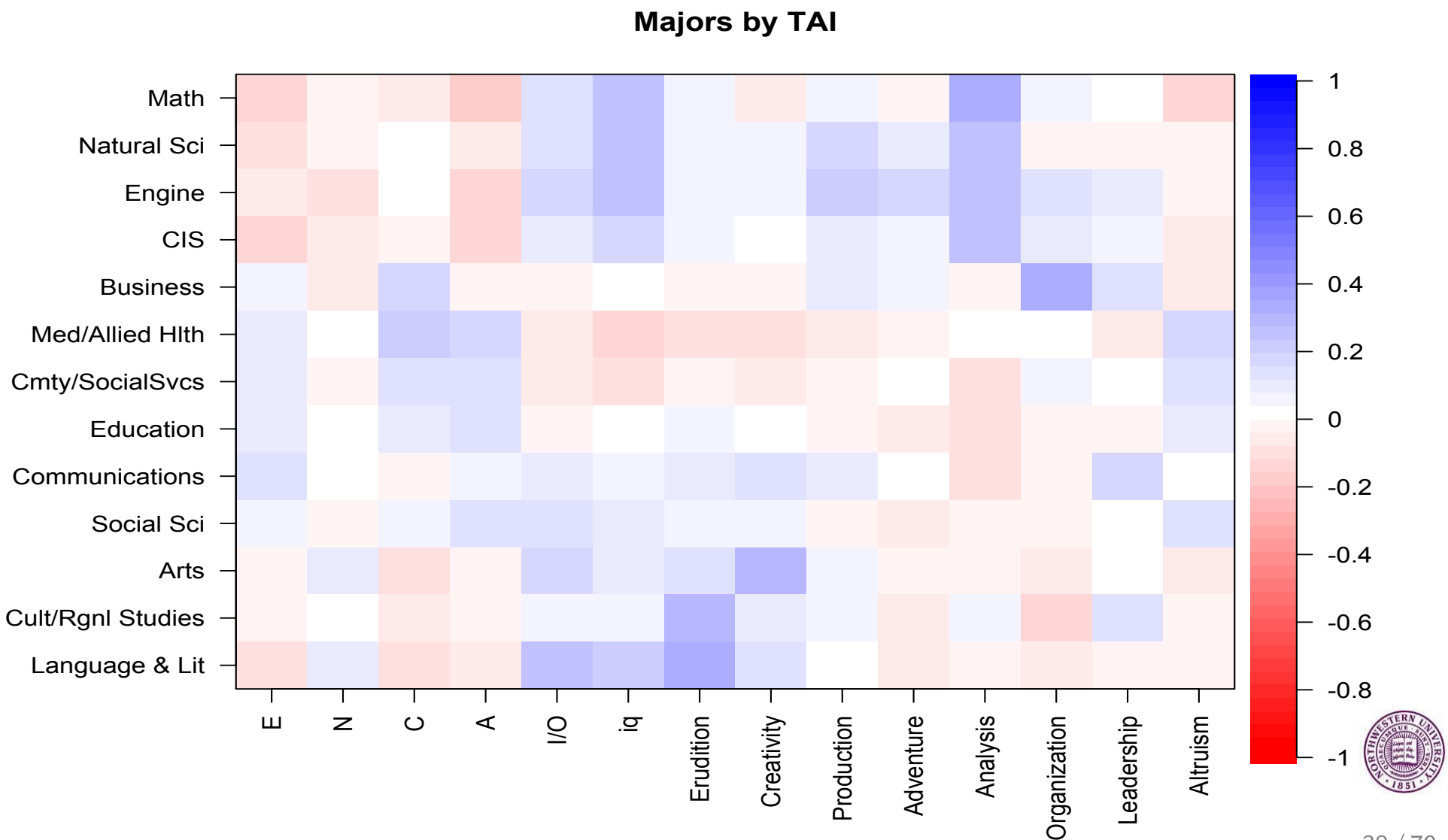


30,000 participants

173 countries

23,000 U.S.

Recent Findings



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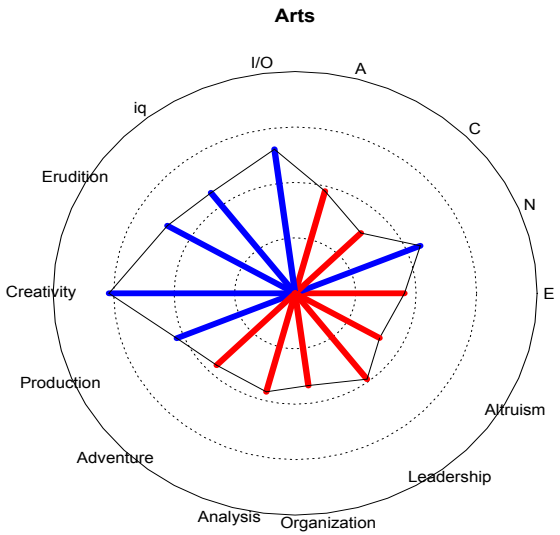

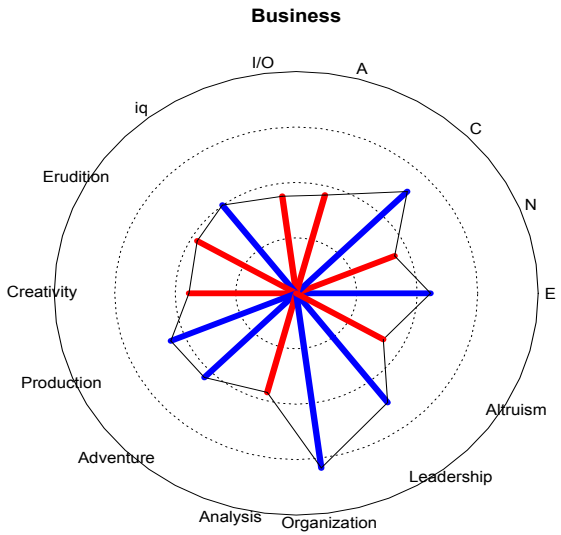

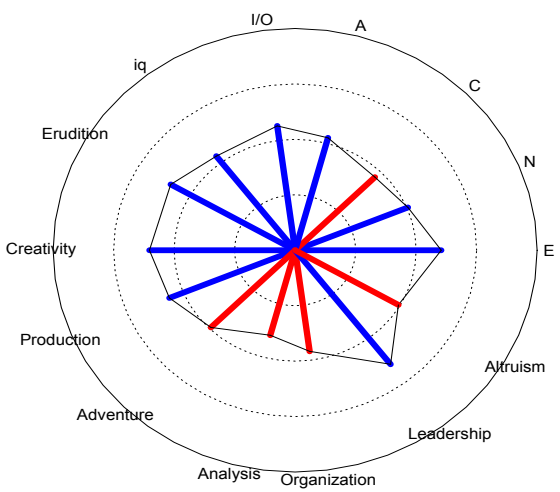

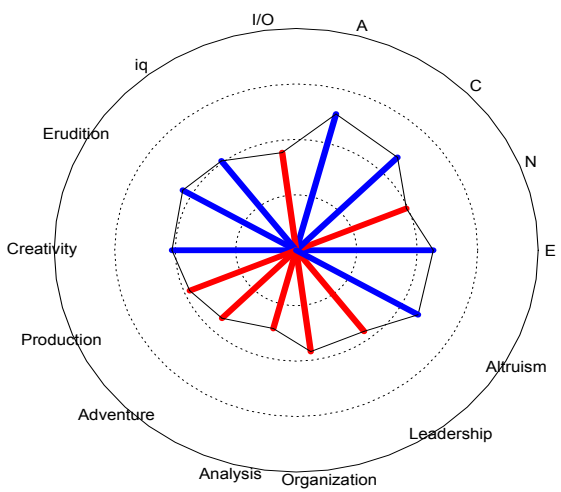

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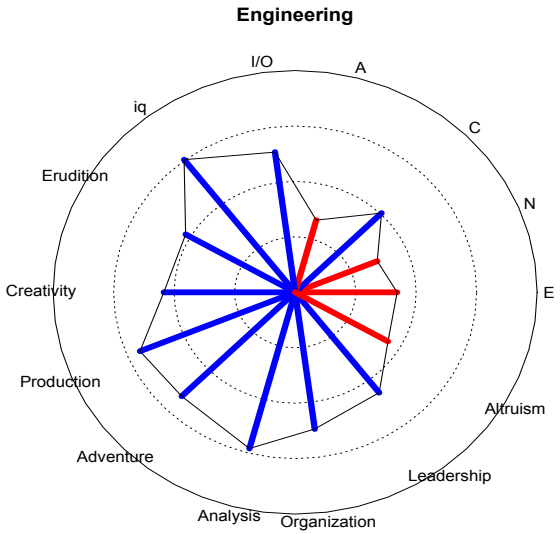

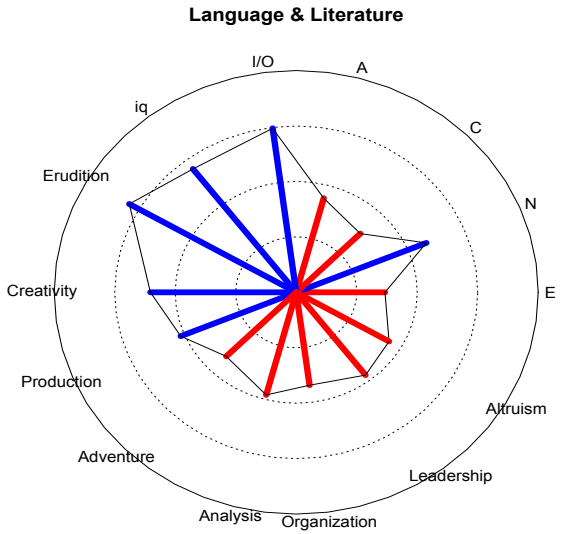

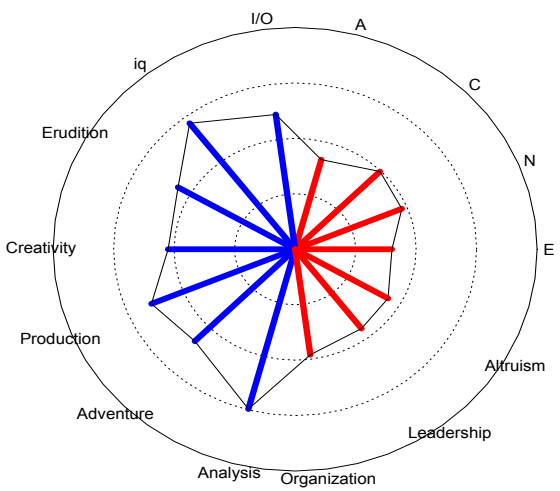

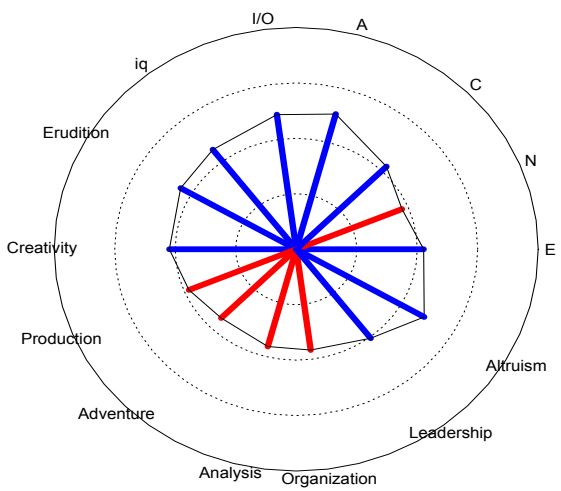

Future Directions

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1. Peer ratings of temperament

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2. Validation of cognitive ability items

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2. Validation of cognitive ability items
3. Development of additional cognitive measures

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Cell-Phone Text-Messaging as a Means of Remote Data Collection

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Call for methods to capture life-as-lived

- "Novel and somewhat daring methods will be required..." (p. 20, Allport, 1937)

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  - A new science of "personology"; the aim of this science would be to understand the complex personality of a given individual
  - Idiographic methods aim to identify patterns of affect, behavior, cognition, and desire ("ABCDs" of personality, Revelle et al., 2011) over time and space

Retrospective accounts of actual behavior may not be optimal

- People are usually not very accurate in recalling past events that have occurred years, weeks, days, or even just hours ago (Tourangeau, 2000)
  - Event salience
  - Implicit theories of stability and change
  - Evaluation of one's current situation
  - Emotional state during the encoding and retrieval of information

Experience Sampling Methodology and Ecological Momentary Assessment

- Methods for assessing self-report data in natural settings, in real-time, and on repeated time occasions

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- Ecological momentary assessment (EMA; Stone & Shiffman, 1994)
  - "Recent" computer technology such as palm-top computers (Personal Digital Assistiants; PDAs) prompts participants to fill out electronic forms

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- Paper or Plastic? (Bolger et al., 2003; Green et al., 2006)

Biggest Disadvantage of Both Methods: Potential for Data Loss!

Paper and Pencil Methods: A More Balanced Consideration (Bolger et al., 2003; Green et al., 2006)

Advantages

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Disadvantages

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Advantages

- Cheap
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Disadvantages

- No contemporaneous reminder, forgetting to keep diaries on-hand

Paper and Pencil Methods: A More Balanced Consideration (Bolger et al., 2003; Green et al., 2006)

Advantages

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Disadvantages

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- Reconstructing and deliberately fabricating entries

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- Data entry is time-consuming and prone to error
- Participants may fear loss of confidentiality

PDA Methods: A More Balanced Consideration (Bolger et al., 2003; Green et al., 2006)

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- Inappropriate for certain populations

ESM/EMA Methods may be Underutilized (Conner, Tennen, Fleeson & Barrett, 2009)

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  - Appear complex and demanding
  - Usefulness for the fundamental questions of differential psychology has not fully been appreciated

A New Method for Capturing Life-As-Lived

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Cell-Phone Text-Messasging

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- Researchers send SMTP message that can be received as SMS by SMS-enabled phones
- Participants respond to questions/items by sending SMS reply to a secure e-mail address
  - SMS Text Messaging
    - Brief (up to 160 characters)
    - Low-cost (e.g., <$0.01 USD, .04-.23 Euros, .05-.12 Pounds per message)

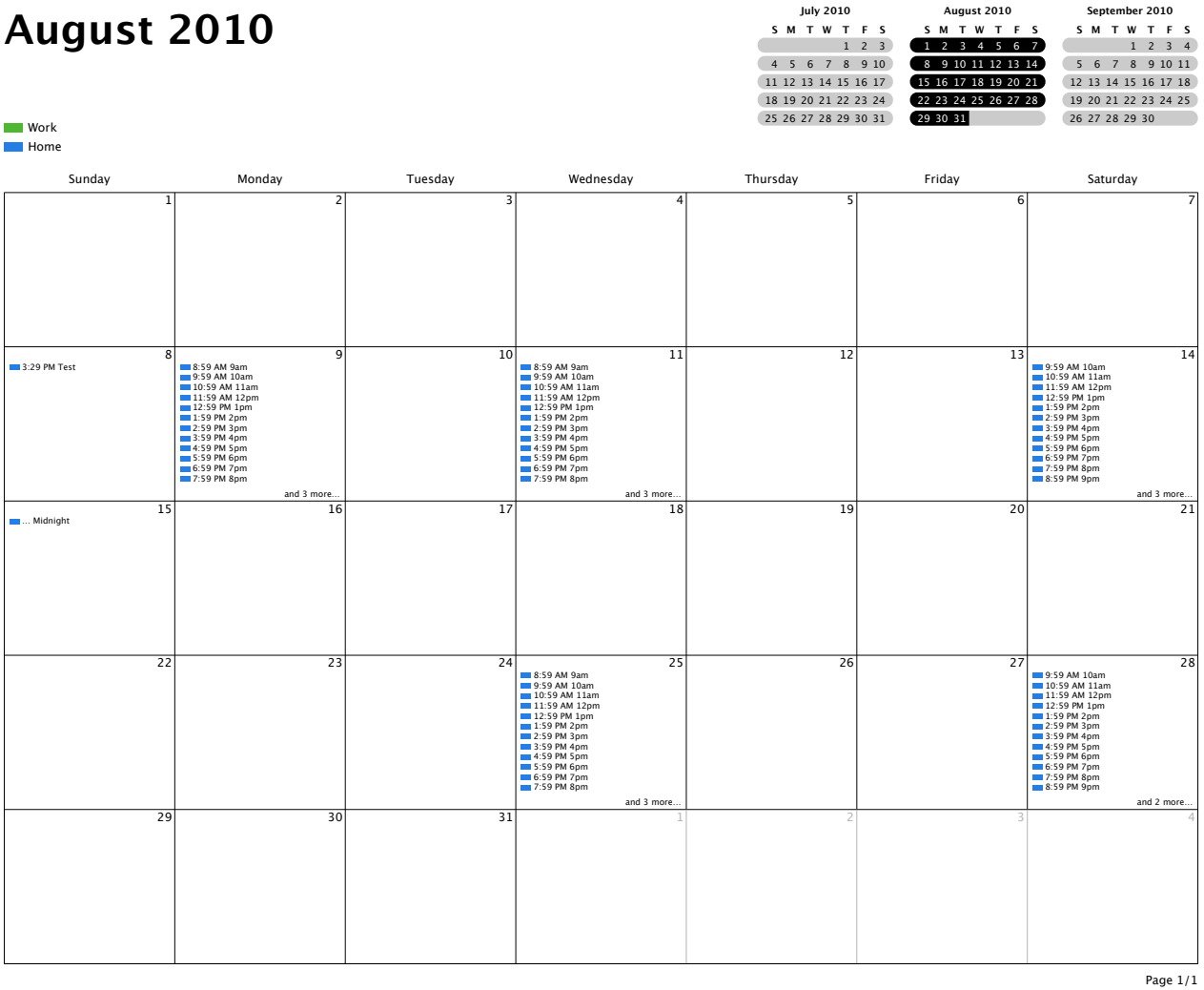
Conduct a text-messaging study in 4 easy steps

1. Create a script that sends text requests to participant phones (AppleScript)
2. Create "events" in calendar (iCal) that tell e-mail client (AppleMail) when to send text requests
3. Participants espond to items on their text-messaging cards
4. Save responses to a text-editor (BBEdit) and parse

1. Create a script that sends text requests to participant phones

```
tell application "Mail"
    set theMessage to make new outgoing message with properties {visible:true,
            subject:"Text Request", content:"Please respond to your card!", reply
            to:"pmclab@northwestern.edu"}
    tell theMessage
        make new recipient at end of bcc recipients with properties
                {address:"8475551212@txt.att.net"}
        make new recipient at end of bcc recipients with properties
                {address:"8475551213@vtext.com"}
        make new recipient at end of bcc recipients with properties
                {address:"8475551214@messaging.sprintpcs.com"}
        make new recipient at end of bcc recipients with properties
                {address:"8475551215@tmomail.net"}
        make new recipient at end of bcc recipients with properties
                {address:"8475551216@email.uscc.net"}
        make new recipient at end of bcc recipients with properties
                {address:"jaw729@northwestern.edu"}
        send theMessage
    end tell
end tell
```

2. Create "events" in iCal that tell AppleMail when to send text requests



3. Participant receives request, hits "Reply" on phone, and answers items on text-messaging card

How are you feeling?

For each of the following adjectives, please indicate how well the adjective describe the way you are feeing at the following times. Please use the scale below:

1 2 3 4 5 6

Not at all — Very much

How are you feeling right now?	*How were you over the last 30 minutes?*	*Over the past thirty minutes, the situation I was in was*
1. Calm		
2. Confident	16. Withdrawn	23. Challenging
3. Grouchy	17. Steady	24. Rewarding
4. Energetic	18. Assertive	25. Risky
5. Irritable	19. Anxious	26. Positive
6. Alert	20. *	27. Threatening
7. Happy	21.Unrestrained	28. Stressful
8. Relaxed	*22.* Emotional	29. Negative
9. Gloomy		30. *
10. *		
11. Cheerful		
12. Tense		
13. Sluggish		
14. Pleased		
15. Sad		

31. Please choose the goal you were trying to achieve most over the past 30 minutes…

1. Sleep 2. Good student 3. Friends 4. Exercise 5. Succeed in lab 6. Get a raise 7. Homework

32. How close were you to achieving the goal?

1 2 3 4 5 6

Far away or gave up — Extremely close /Achieved

33. What was your rate of goal achievement?

1 2 3 4 5 6

Slower than expected — Faster than expected

34. How important was the goal?

1 2 3 4 5 6

Unimportant — Very important

35. Would the goal be best described as pursuing a positive outcome or avoiding a negative outcome?

1. Positive 2. Negative

Over the past thirty minutes I…

1 2 3 4 5 6

Strongly Disagree — Strongly Agree

36. Felt like a failure
37. Had a positive attitude toward myself
38. Felt like my head was uncluttered, and I could think about what I needed to think about.
39. Felt like my head was so full of thoughts I could not think at all
40. *
41. Felt like I had no time to think about myself but only about what needed to be done

3. Participant receives request, hits "Reply" on phone, and answers items on text-messaging card

42. Are you:

a) Alone?
b) With a group of friends?
c) With one friend?
d) With family?
e) With a crowd of people

43. Which activity best describes what you are doing right now?

a) Studying
b) Eating
c) Reading
d) Watching TV or listening to music
e) Hanging out
f) Cooking
g) Walking to get somewhere
h) Exercising
i) Working
j) Drinking alcohol
k) Taking drugs or being high
l) Talking on the phone
m) Communicating with others on the internet
n) Surfing the internet
o) Playing a game
p) Dancing
q) Playing a sport
r) Prepping for a standardized test
s) Planning something
t) In lecture or lab
u) Seeing a doctor
v) Personalized
w) Personalized
x) Personalized
y) Personalized
z) Other

44. Where are you?

a) In my dorm room or apartment
b) In a dorm room that is mine
c) In a common area
d) In an apartment that is not mine
e) In Norris
f) In a library
g) In a cafeteria
h) Outside on campus
i) Outside off campus
j) In a car
k) In a bus or train
l) In a restaurant
m) In a bar
n) At a large party
o) At a small party
p) In a gym
q) In an office
r) Personalized
s) Personalized
t) Personalized
u) Other

4. Download responses from e-mail as to a .txt file and parse the responses

email_response.txt **Page 1 of 1**
Printed: 7/21/11 10:52:54 AM **Printed For: Personality Lab**

```
==========================================================================
This mobile text message is brought to you by AT&T

From: <8475551212@txt.att.net>
Date: June 16, 2011 10:02:53 AM CDT
To: <pmclab@northwestern.edu>
Subject: RE: Text Request

424454555#534344355#222244344#422211222#



From: <8475551213@email.uscc.net>
Date: June 16, 2011 10:03:12 AM CDT
To: <pmclab@northwestern.edu>

111135111#313134215#131151144#322222222#

From: <8475551214@VTEXT.COM>
Date: June 16, 2011 10:01:54 AM CDT
To: <pmclab@northwestern.edu>
Subject: 132221324#224312112#152141111#222212222#

132221324#224312112#152141111#222212222#

From: <8475551215@VTEXT.COM>
Date: June 16, 2011 10:01:21 AM CDT
To: <pmclab@northwestern.edu>
Subject: 1311111313#113113522#113132412#211221221#

1311111313#113113522#113132412#211221221#
```

Before conducting a text-messaging study

Information/training session

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- Download and parse practice data

Text-Messaging Studies Increase Access to Participants

- **It is possible to gather experiential data people from all over the globe without leaving your own lab**

Text-Messaging Studies Increase Access to Participants

- **It is possible to gather experiential data people from all over the globe without leaving your own lab**
  - Accessibility of SMS-enabled devices (International Telecommunication Union, 2010)
    - In 2009, more than two-thirds of the world's population owned a mobile phone and 4.2 trillion text messages were sent
    - In countries with established economies, greater than 70% of households own at least one mobile phone
    - In Europe, where individuals increasingly use two or more different mobile phones, the average penetration rate for mobile phone subscriptions now exceeds 100%

Increased Access to Participants

- Accessibility of SMS-enabled devices (continued)
  - A recent survey found that 86% of people in the United States have a mobile device and that 91% of those devices are SMS-enabled (more than 240 million individuals with SMS-enabled phones; Nielsen Mobile,2010)
  - In the UK, there are about 120 mobile phone subscriptions per 100 population, with ownership greater than 80% in all socioeconomic groups (The Consumer Experience, 2009)
  - Ownership rates have been estimated at 83% of Australian teenagers, more than 85% of Finnish teenagers, 73% of Hungarian teenagers, and over 90% of British teenagers (c.f., Reid, Kauer, Dudgeon, Sanci, Shrier & Patton, 2008)

Advantages: Familiar, Comfortable, Cost-Efficient, and High-Quality Data

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- Data are time-stamped and transmitted to the experimenter as they are entered, allowing for online quality checking of data

Text Messaging: Limitations

- Limitations
  - Paper recording procedures may be superior for open-ended questions
  - No confirmed receipt of data delivery
  - More complicated procedures may also not be suitable for participants with cognitive disabilities
  - Visually impaired participants may also experience difficulty

Text-Messaging Studies may address fundamental Questions of Individual Differences Research

- "[Intensive repeated measurements in naturalistic settings] provide for novel theory development by permitting the concurrent and reliable assessment of trait constructs, state constructs, situationally specific constructs, thus permitting nomothetic or between-subjects analyses,idiographic or within-person analyses, and the examination of individual differences in within-person processes" (p.138, Moskowitz, Russell, Sadikaj & Sutton, 2009)

Description of Studies and Participant Response Rates (Wilt et al., 2011)

Variable	Study 1	Study 2
Length of Study	2 weeks	2 weeks
Number of Participants	50 (Northwestern undergraduates)	49 (NU undergrads and adults from Chicago, IL area)
Number of Items	44	50
Times Assessed	9am, 12pm, 3pm, 6pm, 9pm, 12am	9am, 12pm, 3pm, 6pm, 9pm, 12am
Response rate (*M, SD*)	83% (69.7, 24.4)	66% (55.7, 23.7)
Min/Max Response Rate (time)	84% (12pm), 68% (12am)	71% (3pm), 54% (12am)
Median Latency to Respond	33 minutes	39 minutes
Maximum compensation	$60	$50

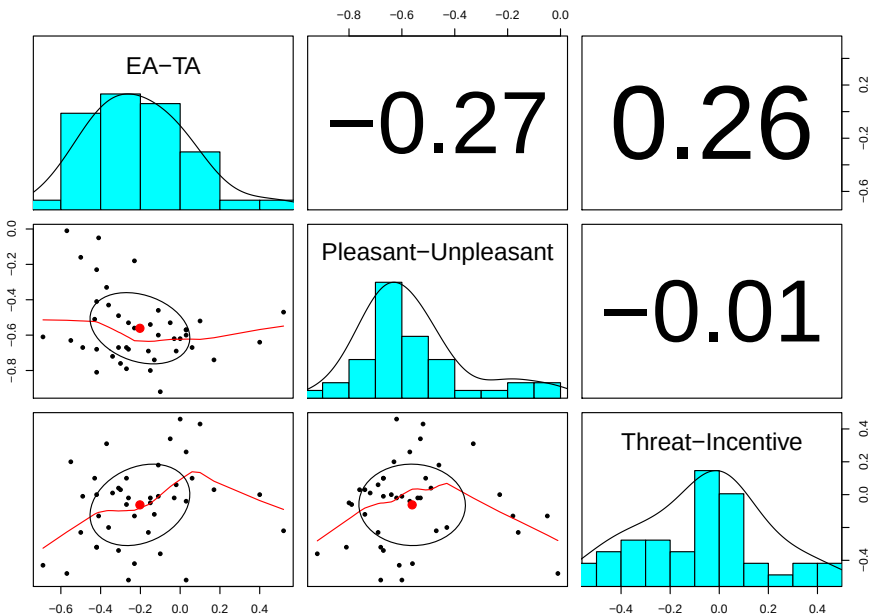
- Participants were excluded from analyses if they provided fewer than 2 texts per day, had 0 variability in responses, or consistently provided incomplete responses
- Each study assessed affect (A), personality states (B), perceptions of situations (C), and goals (D)

"...permitting reliable assessment of trait constructs, state constructs..."

	All Reports		By Participant			ICCs	
Variable	*M*	*SD*	*M*	BP *SD*	WP *SD*	*ICC1*	*ICC2*
Energetic Arousal	3.99	1.08	3.96	0.51	0.98	.19	.94
Tense Arousal	2.55	1.04	2.62	0.66	0.82	.38	.98
Pleasant Affect	3.91	1.09	3.86	0.68	0.87	.37	.98
Unpleasant Affect	1.85	0.98	1.88	0.59	0.81	.32	.97
Threat Appraisals	1.49	0.69	1.52	0.43	0.57	.32	.97
Incentive Appraisals	3.20	1.04	3.18	0.53	0.93	.21	.95

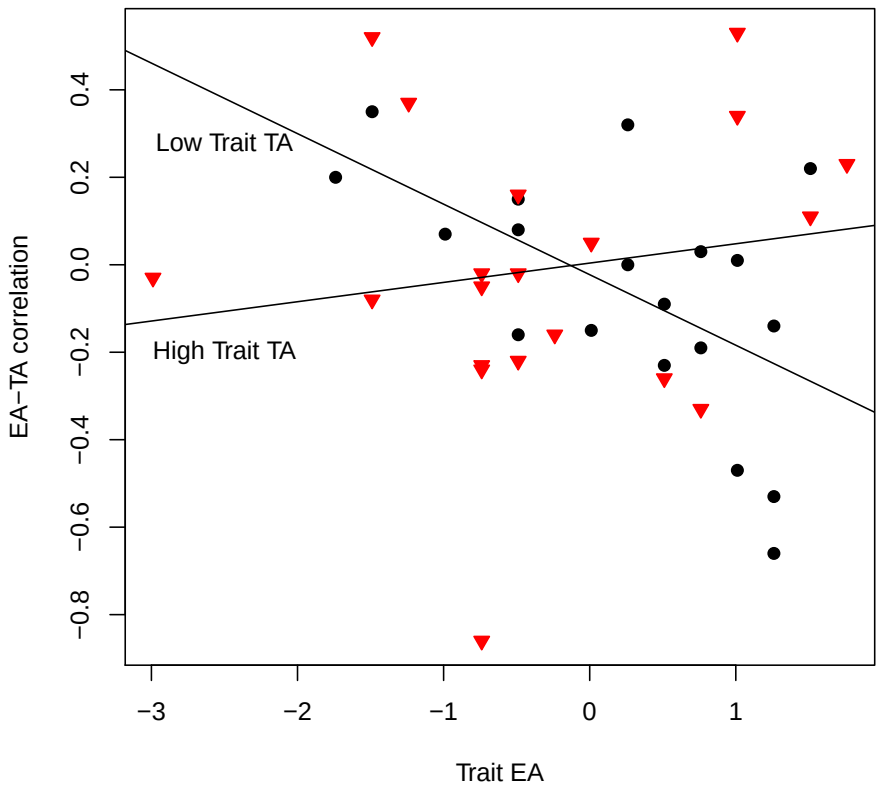
- There was substantial between-person and within-person variation
- *ICC1* indicates the amount of total variance attributable to between person variance
- *ICC2* indicates the reliability of the participant means

"...permitting nomothetic or between-subjects analyses,idiographic or within-person analyses..."



- Histograms show *between-person* distributions of *within-person* associations
- Scatterplots and correlations show *between-person* associations of *within-person* associations

"...and the examination of individual differences in within-person processes."



- Individuals with lower levels of trait TA (black circles) have more positive relationships between state EA and TA at lower levels of trait EA, whereas individuals with higher levels of trait TA (red triangles) experience have more positive relationships between state EA and TA at higher levels of trait EA.

Studying Mixed Emotions during Graduation

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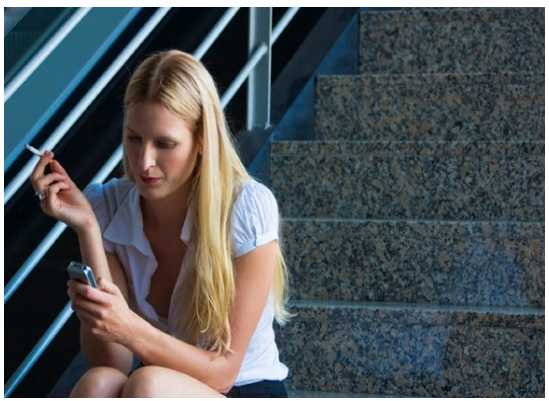
- Northwestern University graduating students responded to text messages in the days leading up to and following commencement

Studying Mixed Emotions during Graduation

- Northwestern University graduating students responded to text messages in the days leading up to and following commencement
- **A graduating research assistant alerted researchers about when to send messages to students on the day of commencement**

Text-messaging studies are becoming more prevalent in health/medical studies



Future directions

Increasingly flexible designs

- Event contingency, Free-response, Classroom surveys, Mass-testing, Long-distance studies
- Smartphones (Woods, Dumbleton, Jones & Fonn, 2011)
- Combine with other methods
  - Electronically Activated Recorder (EAR; Mehl & Pennebaker, 2003)
  - Ambulatory assessment, physiological data (Ebner-Priemer & Kubiak, 2007)
- Personality and text-messaging (Holtgraves, 2011)

Conclusions

- As called for by Allport and Cattell, methods for assessing experience over time continue to evolve
- Cell-phone Text-Messaging offers a new way to study individual differences that combines the advantages of paper-and-pencil methods with those of PDAs
- The far-reaching applications of Cell-Phone Text-Messaging studies are just beginning to be realized

- Part I: an introduction to telemetrics
- Part II: Web based telemetrics
- Part III: Phone based telemetrics
- Part IV: Telemetrics of personality

Telemetrics of Personality

The benefits

1. Ease of data collection
   - Possible to use new subject pools
   - No longer limited to undergraduates or well paid subjects
2. With cell phone technology, possible to collect data in the wild
   - Participants can be anywhere

Programs and equipment used

1. Data collection
   - iMac running Apache, PHP, MySQL
   - Software is open source and public domain
2. Data analysis
   - All analyses are done in R (R Development Core Team, 2011)
   - Most analyses done in the *psych* package.
     - Factor analysis
     - Item Response Theory analyses
     - Graphics
   - Multilevel modeling of text messaging study done using the *multilevel* package.
3. Code and instructions available from the `personality-project.org`

For more information

1. `personality-project.org/telemetrics`
   - A. M. Evans and W. Revelle. Survey and behavioral measurements of interpersonal trust. *Journal of Research in Personality*, 42(6):1585–1593, 2008.
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2. or email:
   - revelle@northwestern.edu
   - joshuawilt2008@u.northwestern.edu
   - emailcondon@gmail.com

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The traditional study of individual differences

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