Goals of the Research Department

1. The isolation of aptitudes and the study of their role in various occupations.
2. The development of accurate measures of aptitudes.
3. The investigation of the role of aptitudes in education.
5. The study of the processes involved in the acquisition of knowledge.
6. The development of accurate measures of knowledge.
7. The communication of research findings to the public.
From the President  ~ Anne Steiner

As a nonprofit foundation, we are driven by our mission, which is to help as many people as we can by providing them with knowledge of their aptitudes. We are proud to have served hundreds of thousands of clients over the last century, and we continue to look for ways to bring testing to a broader range of people. It was with our mission in mind that we embarked on the project to create a digitalized version of our aptitude testing battery.

However, there have always been two aspects of our mission: providing aptitude testing to our clients, and also continually augmenting our understanding of human abilities and human potential. Our research undergirds the insights we provide to our clients, and the data from testing our clients forms the basis for most of our research. The two sides of our mission support and reinforce each other, and digitalization of our tests will facilitate and enhance both efforts.

We are now more than halfway through the process of building digital versions of 19 of our tests. When the digital tests are fully complete, clients who come in to one of our testing centers will take a combination of interactive digital tests and hands-on tests with a test administrator. The digital tests translate the analog test content into an updated and more technologically sophisticated format. Our researchers will benefit from the greater standardization, item level data, and a robust database that will come along with the digitalized tests.

In the midst of our work on digitalization, along with database and test improvements, there were some personnel changes in the research department in 2023. Dr. Ryan Barry was promoted from Associate Researcher to Researcher. Then, in October, we welcomed Dr. Zara Wright to the research department. She is a graduate of Northwestern University and of the University of Minnesota, where she earned her M.A. and Ph.D. in Clinical Psychology with a special concentration in measurement and psychometrics. We’re very excited to have her join us!

(Once again, I’d like to thank Dr. Dave Schroeder, who “retired” at the end of 2019 but is still here providing guidance and expertise. Whenever he thinks he’s out, we pull him back in!)

All three researchers have all been an integral part of the digital test-building process, working hand-in-hand with the developers to ensure the tests are as sound as they can be from a research perspective. Going through this process has led us to take a fresh look at all of our assessments, digging up old test manuals and other dusty files from the archives to explore why certain choices were made regarding the nuts and bolts of each test. Dave Schroeder and his prodigious memory have been invaluable throughout, as have Zara Wright’s and Ryan Barry’s firsthand knowledge of research outside of the Foundation. We are excited to be able to incorporate two new measures into the battery: the Big Four Personality test, which is discussed later in this report, and a version of the Mental Rotations Test, which should expand our understanding of the Structural Visualization aptitude.
Working on the digitalization project has been very much a group effort. Holly Wilhelm has continued her excellent work as Research Coordinator. Thomas Jensen, VP and Director of Development, has served as the project manager of the digitalization process, and he and Holly have been the liaison between the research department, the programmers, and anyone else at the Foundation with opinions about the tests (that is, everyone). Barry Joseph Consulting and the developers at Cloudberry Creative have been true partners in this endeavor, developing a meaningful understanding of our tests but also looking at them through a new lens as they brainstorm improvements and creative approaches to test interaction.

None of this work would be possible without the contributions of our research department and our wonderful team of researchers. The work of our testing arm is more visible, but at our core we remain a research organization devoted to the study of human potential and the world of work.

We’d like to share our sincere thanks for two generous donors, whose belief in the benefits of aptitude testing and desire to help us make it available to a wider audience has led to their financial support of our digitalization work. Our gratitude goes out to:

The Endless Network  
https://www.endlessnetwork.com  
New York, NY

The Endeavor Foundation  
New York, NY
Dr. Ryan Barry, Researcher, joined the research department in October of 2022. He earned a dual M.S. degree in industrial/organizational and quantitative psychology from Illinois State University and completed his Ph.D. in industrial/organizational psychology from the University of Tulsa. His research interests include personnel selection, psychometrics, and personality.

Dr. Zara Wright, Researcher, became a part of the research department in the fall of 2023. She earned her M.A. and Ph.D. in clinical psychology, with a special concentration in measurement and psychometrics, from the University of Minnesota. Her dissertation explored the relationship between personality traits and mental, physical, and social functioning.

Dr. David H. Schroeder, Research Consultant, has been working with the research department since 1984. He has a B.S. from the University of Illinois and an M.S. from Colorado State University, as well as an M.A. and a Ph.D. in personality psychology from The Johns Hopkins University. He retired as full-time Research Manager in 2020 but continues to support the Foundation with his extensive institutional knowledge.

Kathleen Voss, Research Assistant, joined the Foundation as a test administrator in Dallas in 2019, and was brought on as a contributor to the research department in 2022. She has a B.S. in psychology and child development and an M.S. in psychological sciences from the University of Texas at Dallas.

Holly Wilhelm, Research Coordinator, began working as a test administrator at the Foundation’s Atlanta office in 2005. After being involved with various research, writing, and training projects, she is now tasked with organizing the details of the digitalization project and other research initiatives.
In the spring of 2023, the Foundation decided to revise Inductive Reasoning Form 164 OA to create Form 164 PA. The main goals of implementing changes to Form 164 OA were to improve the psychometric quality of the test and replace culturally outdated items.

Items were replaced if their item-total correlation was below .20 or if fewer than 75% of examinees responded with the correct answer. Seven items on Form 164 OA fit these criteria and were selected for replacement. Three other items that were replaced were selected because they were deemed to be culturally outdated. The ten items that replaced the old items were chosen from an item set that had been constructed and administered experimentally between 2006 and 2015. Similarly to the criteria for item removal, to be selected as a replacement item it needed to have an item-total correlation above .20 and 80% of clients needed to have answered correctly.

**Implementation and Analysis**

In July of 2023, the Foundation began to administer Form PA as part of its standard test battery. Ryan Barry, Researcher, analyzed item-level data from 808 clients in order to examine how the replacement items were functioning on the new form and corroborate prior results showing that the items selected for inclusion would improve the psychometric quality of the test.

Overall, the results showed that the items selected to replace the old items did have higher item-total correlations, ranging from .29 to .47. Additionally, the proportion of examinees who answered correctly for the seven new items were all notably higher than for the items selected for removal.

Barry, along with David Schroeder, Research Consultant, reported these findings in Statistical Bulletin 2024-1, Item Analysis of the New Items on Inductive Reasoning Form PA.
Creating digital versions of tests that have been in use for many years in an analog format has been a bit like threading a needle. We have sought to achieve a balance between making the most attractive and user-friendly versions possible and maintaining fidelity to the source material to ensure that the tests’ psychometric properties would remain stable.

**Test Design – Solving Problems**

Through working with the user experience experts at Cloudberry Creative, we have learned that user experience design is generally driven by user preferences and seeks the most streamlined path to achieve a task. In some cases, however, what would be easiest and most comfortable for test takers might not yield the most accurate test results. Project lead Tommy Jensen and Research Coordinator Holly Wilhelm used their knowledge of the tests and drew on the expertise of the Foundation’s researchers to determine how and when to effectively take advantage of the digital format.

In some cases, interactive digital testing offers an elegant solution to a problem in the analog format. For example, on the auditory tests, clients sometimes lose their place on the answer sheets. With the digital format we can eliminate this issue by limiting the number of visible items and highlighting one item at a time. Changes like this, we believe, should lead to a purer assessment of the client’s true ability due to a reduction in measurement error that might otherwise cloud the picture.

We have remained in close contact with the researchers throughout the design process, posing innumerable questions to guide the process of test development. Examples of such questions have included:

- When should test items be forced choice, instead of allowing clients to skip items?
- How much information should we provide about how much time is allowed or how much time remains for our timed tests?
- How can we accurately account for misspellings on a test with typed entries?
- What kind of practice or sample item can be given to illustrate a test’s interaction model without giving the user too much foreknowledge of test content?
Sourcing Test Content

Rather than exactly reproduce the content used in the analog tests, we have been making judicious use of available technology to make improvements where possible. The digital auditory tests will use the technical specifications documented in our test manuals to produce the tones in real time for each test administration, which allows for much purer sound quality than relying on an audio recording that was first produced in the 1990s.

For Inductive Reasoning, we have employed the talents of Research Assistant Kathleen Voss to reproduce the artwork from all sixty items in a format that looks more uniform and reduces the distractions of unclear images. While it was tempting to consider replacing all the images with new artwork that looks more modern, we recognize the importance of staying closer to the material that has been used by thousands of clients over the years and that formed the basis for the norms currently in use. The new artwork is very similar to the older images, but is now clearer, cleaner, and more streamlined.

Scoring and Interpreting Digital Tests

As we learned in the preliminary equating study of the Analytical Reasoning test last year, the raw scores of the analog and the digital forms of a test will not always be equal. In some cases, a different interaction model may affect client response times, leading to differences in scores. In these cases, the researchers will perform equating between the analog and digital versions so that we will be able to derive meaningful percentile scores. During the equating period, clients will receive scores based on the analog administration, while a second digital version, given using an alternate test form, will provide data for the researchers to compare results from the two interaction models.

These examples demonstrate the value of working closely with our knowledgeable, creative, and diligent researchers as we work to create instruments that will yield more comprehensive and accurate data for our future work.
New Personality Measure  ~ Dr. Ryan Barry and Kathleen Voss

The Foundation currently uses the Word Association test as a measure of personality. In 2023, we decided to incorporate measures of personality beyond the objective-subjective trait captured by Word Association. The process of implementing additional personality measures began with a review of the literature to determine which traits to include in our test battery and how to measure them. Since we needed measures that were valid through self-reports, predictive of numerous life outcomes, and suitable for a diverse population, it was decided to use the Big 4 traits – extraversion, openness, agreeableness, and conscientiousness.

<table>
<thead>
<tr>
<th>Low Scorers</th>
<th>High Scorers</th>
</tr>
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<tbody>
<tr>
<td>Openness to Experience</td>
<td></td>
</tr>
<tr>
<td>• Resistant to change</td>
<td>• Very creative</td>
</tr>
<tr>
<td>• Prefer routine</td>
<td>• Eager to try new things</td>
</tr>
<tr>
<td>• Less imaginative</td>
<td>• Entertain abstract concepts</td>
</tr>
<tr>
<td>Conscientiousness</td>
<td></td>
</tr>
<tr>
<td>• Not bothered by messes</td>
<td>• Always meets deadlines</td>
</tr>
<tr>
<td>• Procrastinate</td>
<td>• Very organized and clean</td>
</tr>
<tr>
<td>• Not punctual</td>
<td>• Schedule-oriented</td>
</tr>
<tr>
<td>Extraversion</td>
<td></td>
</tr>
<tr>
<td>• Prefer solitude or small groups</td>
<td>• Socially engaging</td>
</tr>
<tr>
<td>• Exhausted by social interactions</td>
<td>• Enjoy attention</td>
</tr>
<tr>
<td>• Think carefully before speaking</td>
<td>• Energized by social stimuli</td>
</tr>
<tr>
<td>Agreeableness</td>
<td></td>
</tr>
<tr>
<td>• Skeptical of others</td>
<td>• Empathy and concern for others</td>
</tr>
<tr>
<td>• Motivated by self-interest</td>
<td>• Take time to help others</td>
</tr>
<tr>
<td>• Not afraid to speak the truth</td>
<td>• Try to keep everyone happy</td>
</tr>
</tbody>
</table>

Test Creation and Experimental Administration

In the summer of 2023, we initiated experimental administration of a revised 92-item version of an existing measure of the Big 4 traits. In February 2024, we concluded this phase after testing nearly 1,000 clients. The data are being used to construct preliminary norms and investigate relationships between the Big 4, the standard JOCR test battery, and client data such as major and occupation. These analyses will provide insight on how the traits can be incorporated into client summaries.
Incorporating Big 4 Results with Client Aptitude Patterns

The new Big 4 Personality measure is expected to provide valuable information to help summarizers craft a more complete pattern for an individual client. For example, the difference between the current objective/subjective classifications and introversion/extraversion is a frequently asked question in summaries. Knowing a client’s Big 4 scores will allow for a more nuanced approach to discussing personality: an objective introvert or a subjective extravert is likely to have different workplace needs than an objective extravert or subjective introvert.

Openness to experience, agreeableness, and conscientiousness are additional areas of personality not currently measured by the other tests in the battery. Having information on these will add more depth to the client’s summary, particularly in cases with few moderate or high scores. The data we collect from the Big 4 Personality measure could also act as an explanation or qualifier when clients find that the typical explanation of a given aptitude sounds unlike what they know about themselves.

Resumption of Client Follow-Up Surveys  ~ Dr. Ryan Barry

The Foundation has previously administered client follow up surveys at 1, 5, and 10 years after clients have been tested. After a brief hiatus, we are resuming this program. Client surveys provide the Research Department with data that can be used for test validation such as the congruence between the clients’ occupations and majors and their aptitude scores.

We have also added peer-reviewed and validated measures of job satisfaction, work engagement, and person-job fit to the surveys.

- The measure for job satisfaction focuses on satisfaction with the nature of the work itself.
- Work engagement, as it is measured here, is a positive state of mind characterized by high levels of energy while working (i.e., vigor); a strong sense of pride and involvement in one’s work (i.e., dedication); and being focused and engrossed in one’s work (i.e., absorption).
- Lastly, the person-job fit measure captures an individual’s perceived fit between their personality, skills, knowledge, interests, and ideal job characteristics (e.g., autonomy, skill variety, and importance) with those required by their job.

These measures were included with the intent that they will help generate research that can be used for validation studies, publications, and research conferences.
Database Reorganization ~ Dr. Zara Wright

In 2023, the research staff began the ambitious project to overhaul our data infrastructure and consolidate all the Foundation’s data into one centralized data frame. The Foundation last built a consolidated data frame in 2015, merging all data from 1988 up to that point. Now, we must take the next step to integrate the results of this effort with the data which predate it (1984 to 1987) and the data since (2016 to now).

This endeavor is particularly timely as we make the transition to a new digital platform and database software, which will lay the scaffolding for our data structure and storage for years to come. This enterprise involves two concurrent steps, as described in further detail below, and represents a substantial undertaking that will likely be a multi-year effort.

As part of this project, the Foundation is working to clean, systematize, and merge all digital client and test data on record. This data spans 40 years (1984 – 2024) and several database software programs with various data structures. A standardized data frame will streamline Research Department operations and maximize project efficiency by reducing resources spent sourcing, managing, and preparing data.

Perhaps most exciting of all, merging the data from tens of thousands of individuals over the course of several decades will open doors for potential new research opportunities, such as longitudinal studies (e.g., predicting outcomes), "Big Data" Analyses (e.g., structural equation modeling), and large norming samples (e.g., developing more specific age-based norms).

Digital Tests - Expanded Possibilities

In addition to restructuring past and present data, the Research Department is collaborating closely with Cloudberry Creative (consulting on research processes, data management, and test properties) to design a new database that not only can be seamlessly integrated with past data, but also meets the evolving research needs of our organization. By collecting more specific data, standardizing measurement, and reducing anomalous data, this automated database will maximize data quality and usability, improve our psychometric tools and empirical standards, and grow our research program.

We are particularly excited to implement the ongoing collection of item-level data for all tests, data which (up to this point) has been cumbersome to source. Having consistent access to such data will facilitate our understanding of the aptitudes and how to best measure them, as well as provide opportunities for more advanced assessment techniques such as computerized adaptive testing.

Finally, by building a comprehensive digital data infrastructure that can serve our needs for many years, the Research Department is laying the foundation to semi-automate some of the department’s perennial operations (e.g., re-norming, test validation, item pruning).

Taken all together, this venture to create a main data frame that integrates past, present, and future data will optimize the operational functioning of the Research Department.
**Dissemination of Research**

Over the years we have strived to present findings from our research in scholarly outlets such as professional conferences and journals. More specifically, in the 2010s, we collaborated with Dr. Rex Jung on a series of neuroimaging studies of aptitudes. Articles from this work continued to receive attention in scholarly circles in 2023. The Jung et al. article in *Frontiers in Psychology* in 2015 has now been viewed 27,946 times and cited in 61 other scholarly articles. The 2014 *PLoS ONE* article by Dr. Jung and his team has been viewed by 4,126 persons and cited 18 times.

Other scholarly work sponsored by the Johnson O’Connor Research Foundation continued to have impact in 2023. Our 2010 article with Dr. Richard Haier, with whom we collaborated on earlier neuroimaging research, and his associates in *BMC Research Notes* has been viewed by over 14,000 persons and cited 28 times in other articles, while our 2012 *BMC* article by Dr. Schroeder and others has been viewed by 2,635 persons and cited 8 times. In addition, our 2009 article with Dr. Haier and others in *Intelligence* has been cited 126 times, and our 2010 article with Dr. Cheuk Tang and others in *Intelligence* has been cited 99 times.

Regarding earlier publications, Dr. Schroeder’s 2004 article with Drs. Timothy Salthouse and Emilio Ferrer in *Developmental Psychology* has now been cited in 208 scholarly publications, and his article with Salthouse in *Personality and Individual Differences* has been cited 122 times. Our 2001 *Intelligence* article by Dr. Scott Acton, a former research assistant in the Research Department, and Dr. Schroeder has been cited 117 times.

**Recent Statistical Bulletins**

**2024-1**  
Item Analysis of New Items on Inductive Reasoning  
Form 164 PA  
*Ryan Barry*  
*David Schroeder*

**2023-1**  
Changes in Inductive Reasoning Leading to Form PA  
*Holly Wilhelm*  
*David Schroeder*

**2023-2**  
Scoring for New Inductive Reasoning Items  
*David Schroeder*

**2023-3**  
Equating Scores on Analytical Reasoning Wks.  
244 IC with Scores on Wks. 244 JC  
*Susan Park*  
*David Schroeder*  
*Ryan Barry*

**2023-4**  
Item Analysis of Analytical Reasoning Wks. 244 JC  
*Ryan Barry*  
*David Schroeder*

**2022-1**  
Norm-Construction Procedures and Age Curve for Tweezer Dexterity  
*David Schroeder*  
*Susan Park*

**2020-1**  
Scoring Analysis of Memory for Design  
*Luke Robbins*
### Recent Statistical Bulletins, continued

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<td>Updated Occupational Plots for the Foundation’s Standard Test Battery</td>
<td>David Schroeder, Ashley Brown</td>
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<td>2019-2</td>
<td>The Foresight Aptitude and Creative Achievement</td>
<td>Linda Houser-Marko, Rusty Burke</td>
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<td>2019-3</td>
<td>Research Proposal: Video Game Designer Study</td>
<td>Alex Bureau</td>
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<td>2019-4</td>
<td>Occupational Plots for the Self-Directed Search Scales</td>
<td>David Schroeder, Ashley Brown</td>
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<td>2019-5</td>
<td>Occupational Plots for Satisfied Versus Dissatisfied Examinees</td>
<td>David Schroeder, Ashley Brown</td>
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<td>2019-6</td>
<td>Age Curves for the Graphoria, Number Memory, and Color Discrimination Tests</td>
<td>Ashley Brown, Linda Houser-Marko</td>
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<td>2019-7</td>
<td>Occupational Plots for Art-Related Occupations</td>
<td>David Schroeder, Ashley Brown</td>
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<td>2019-8</td>
<td>Occupational Plots for the Grip Test</td>
<td>David Schroeder, Ashley Brown</td>
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<td>2019-9</td>
<td>How to Write a Statistical Bulletin</td>
<td>Amanda Summers, Linda Houser-Marko, Michele Ledbetter</td>
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### Recent Technical Reports

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<td>2019-1</td>
<td>Occupational Plots for the Foundation’s Standard Battery Displayed by Occupation</td>
<td>David Schroeder, Ashley Brown</td>
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<td>2019-1</td>
<td>Occupations in Education</td>
<td>Christopher Condon, David Schroeder</td>
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Recent Presentations

Brown, A. D. (2021, May). *Big 5 personality traits and broad versus narrow cognitive abilities.* Poster session presented at the virtual meeting of the Association for Psychological Science.


Bezruczko, N., & Schroeder, D. H. (2017, February). *Artistic-judgment aptitude factors correlate significantly with increased gray matter.* Poster session presented at the annual meeting of the American Association for the Advancement of Science, Boston, MA.
**Recent Publications**


Trustees 2023
Richard Bowker
Alice Campbell
Chris Condon
Timothy Fitzgerald
Thomas Jensen
Ellen Leifer
David Ransom
Anne Steiner
Robert Townes
Jeffrey Wyatt

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David Schroeder, Ph.D., Research Consultant
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