

Report of the Research Department  
Johnson O'Connor Research Foundation / Human Engineering Laboratory  
Johnson O'Connor Research Support Corporation

**2020-2021**



## 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.
4. The evaluation of age and sex differences and the effect of practice on test performance.
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

It has been one hundred years since Johnson O'Connor started developing aptitude tests in Lynn, Massachusetts. Did he know what he was creating when he made those first pegboards to measure the dexterity of General Electric employees for the electrical assembly line? I suspect the potential and possibilities were buzzing in his head even then. He was always a dreamer and an innovator.

The hundred years since then have seen one major world war, multiple economic upheavals, society-transforming technological change, and the upending of the social status quo. Through all that time, Johnson O'Connor's central, simple, timeless idea—that people thrive when they are able to use their natural pattern of abilities—has endured.

Speaking of major historical events, I can confidently say the last two years have shown us what it is like to live through one. It has been a wild ride, navigating uncharted waters as the world turned itself upside down again and again. I owe a huge thank you to our staff for their efforts, working through closures and re-openings and new safety protocols, a new way of doing summaries, and the rollout of a completely new database system. Everyone stepped up in a major way to soldier on through a difficult and ever-evolving situation.

For our researchers, work went remote, psychology conferences were canceled or transitioned to online, and testing for research purposes was sidelined. Our partnership with Rex Jung was unfortunately ended when his lab was shut down. The pandemic also put a temporary halt to our hiring search for a new researcher. We put the process on hold for a year, and Dave Schroeder graciously delayed his retirement, agreeing to stay on half-time to provide guidance and continuity.

Then, in the summer of 2021, we were able resume our search and successfully hire a new researcher. We are delighted to welcome Susan Park to our research team. Her background in psychometrics brings a unique testing and data-focused perspective to the department, and her natural curiosity, energy and drive have galvanized us all.

Despite the conference cancellations, Ashley Brown was still able to present a poster at one conference (held remotely), analyzing the relationship between aptitudes and personality measures. Also, Holly Wilhelm and the research committee team coordinated TA participation in research, organized webinars, improved documentation of our archives, and generally served as a bridge between the research and testing departments. Dave and Ashley did some further analysis of client occupational data, which is presented later in this report.

Looking ahead, we are contemplating big changes to our testing model, specifically digitalizing our tests. We are very excited about the potential for capturing item-level data that our researchers can use and analyze almost as soon as it happens. Digitalization would also allow for the expansion of our testing services to a broader audience, which would diversify the demographics of our data pool and allow more people to benefit from knowledge of themselves and their aptitudes.

Our research department will be crucial as we contemplate changing the model that has served so many people over the last one hundred years. While we feel that innovation and risk-taking is very much in keeping with Johnson O'Connor's legacy, we also feel our responsibility as stewards of an assessment tool that has stood the test of time. We want to grow and change and improve while maintaining our reputation as a leader in the field of aptitude testing and research on human abilities.



All in all, times of turmoil lead to opportunities for innovation and renewal, and I'm very excited about the future.

Anne Steiner  
President

## Research Department Staff

**David H. Schroeder, Research Manager**



David Schroeder joined the Research Department in August 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.

**Ashley D. Brown, Researcher**



Ashley Brown joined the Research Department in September 2018. She earned her B.S. in psychology from the University of Kentucky and her Ph.D. in personality and health psychology from Northwestern University. She has published research on psychometric trends and individual differences.

**Susan Park, Researcher**



Susan Park received her Ph.D. in psychometrics and quantitative psychology from Fordham University. She joined the Research Department in 2021 after working in research institutions that focused on education and career development as well as the intersection of technology and learning. Research topics in her past work have included psychometrics and the interplay among motivation, emotions, and goal pursuits, especially in career development. Prior to her career in psychology, Park worked as a vocational rehabilitation counselor.

**Holly Wilhelm, Research Committee Chair**

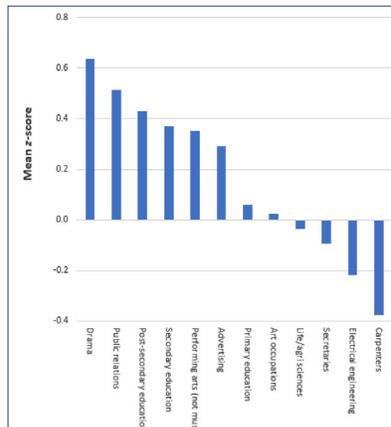


Holly Wilhelm joined the Foundation staff as a test administrator in the Atlanta office in 2005, and has since contributed to multiple writing, research, and training endeavors. She became the chair of the research committee when it was first established in 2019 to form a stronger link between the research and the testing arms of the Foundation.

## Occupational Plots

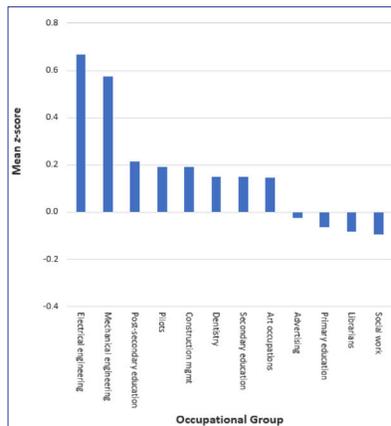
In 2018 David Schroeder, Research Manager, and Ashley Brown, Senior Researcher, initiated a research project in which they used the Foundation’s database to analyze how examinees from various occupations score on the Foundation’s battery of tests. In 2019 they wrote a series of reports on this line of research, including a report on how 27 occupational groups scored on each of the tests in the Foundation’s standard battery. In 2020-21 they extended this work with a study of how 47 additional groups performed, again on a test-by-test basis.

Mean Z-scores for Ideaphoria



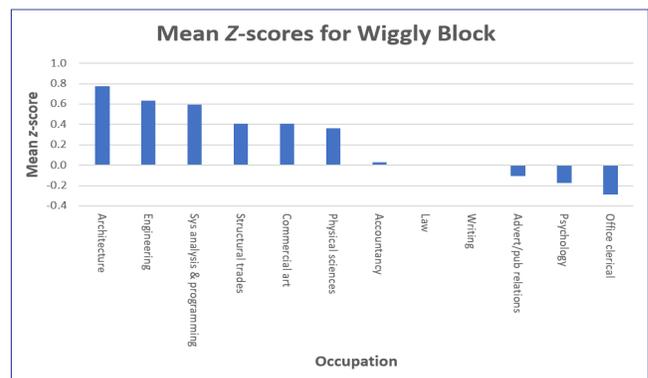
The accompanying figure shows how a subset of these groups scored on the Ideaphoria test. Examinees working in the fields of drama (theater), public relations, and postsecondary education tended to score higher than examinees in other occupations. More broadly, examinees scoring high on Ideaphoria showed a trend toward being in occupations that involve idea production, especially verbal production, and were often in the arts, education, and fields involving verbal persuasion, such as advertising.

Mean Z-scores for Memory for Design



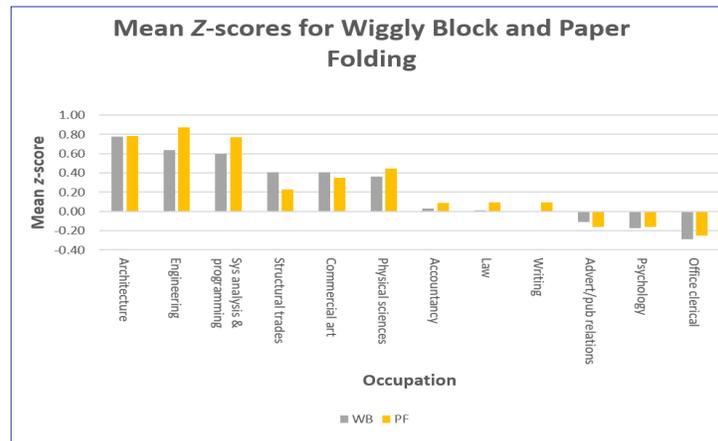
A second figure shows mean scores for a set of occupations on Memory for Design. As illustrated in the figure, examinees in many STEM fields, including engineering, as well as non-STEM visual fields such as pilots tended to score above the mean on Memory for Design.

Schroeder and Brown also constructed occupational plots for the Wiggly Block test. The accompanying figure shows the mean z-scores for 12 of the 74 occupational groups that we studied. As shown in the figure, the pattern of mean scores was pretty much what one would expect for a structural visualization test, with high values for architects, engineers, and systems analysts and programmers.



## Occupational Plots, continued

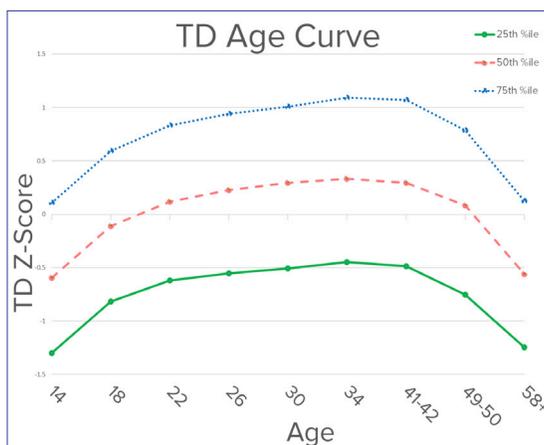
Schroeder and Brown also compared the results for Wiggly Block with the results for the Paper Folding test (see the next figure). This analysis showed a striking similarity in the patterns of means for the two tests—that is, the values were consistently in the same direction and relatively close in size. The largest difference in the figure is for Engineering (.63 and .87 for the two tests), and even in that instance, both values are relatively pretty high. Although the other differences were generally not statistically significant when tested individually, there did appear to be a small pattern to the differences, with the professional-level occupations tending to score a little higher on Paper Folding and the skilled trades a little higher on Wiggly Block.



Schroeder expects to publish two Statistical Bulletins in 2022 on this recent occupational plot research.

## Age Curve for Tweezer Dexterity

Susan Park and David Schroeder constructed new norms and age curves based on the performance of clients who have used the new test equipment introduced in 2017 for the Tweezer Dexterity (TD) test. A total of 12,629 client scores collected from 2017 to 2020 was used to construct the norms. Clients whose data were analyzed ranged in age from 14 to 70 years, and 55% of them reported as male. Sample sizes for the younger age ranges were substantially larger than for the older age ranges. As a result, Park and Schroeder combined some of the older age groups to reduce sampling error.



In the accompanying figure, the 25th, 50th, and 75th percentiles from the normed TD z-scores are shown across age groups. Age curves for all percentiles (5th to 99th) showed similar patterns. Moreover, the slight inverted U-curve indicates a nonlinear relationship between age and scores from the TD test. That is, small-instrument dexterity, as measured by the TD test, shows only modest gains in the 20s and 30s but substantial gains in the teen years and declines after age 40.

## “Broad” and “Narrow” Aptitudes versus Personality Traits

In a poster entitled "Big 5 Personality Traits and Broad Versus Narrow Cognitive Abilities," presented at the APS Virtual Conference in May of 2021, senior researcher Ashley Brown examined the relationships among personality traits and aptitude measures with high loadings ("broad" abilities) or low loadings ("narrow" abilities) on a general aptitude factor (g).

Participants (ages 14 – 65, 63% female) were 329 clients of the JOCRF testing program who completed its ability battery and the online Synthetic Aperture Personality Assessment (SAPA) questionnaire, hosted by JOCRF collaborators David Condon (University of Oregon) and William Revelle (Northwestern University). Participants completed the SAPA battery independently, in environments of their own choosing, after completing the JOCRF battery.

Revelle, Condon, and Brown have demonstrated that SAPA’s unique online item administration method (in which each participant receives a random sample of items drawn from each trait or aptitude scale) produces valid statistics when sample sizes are relatively large. Individual scores on each of the Big 5 traits (Intellect/Openness, Conscientiousness, Extraversion, Agreeableness, and Emotional Stability) are the mean scores across the items administered for that scale. Scores on the four SAPA cognitive ability measures used in these analyses (listed in the table below) are the proportions of items given that are answered correctly.

A set of six JOCRF aptitude tests (listed in the table below) were selected as representative based on previous research (Haier et al., 2009) and presumed similarity to corresponding measures in the SAPA ability battery. An exploratory factor analysis of JOCRF and SAPA ability data yielded the following classifications:

SAPA and JOCRF Measures Used in Analyses			
Class	Narrow	Intermediate	Broad
<i>g-loading</i>	< .40	.40 to .60	> .60
<i>SAPA</i>		Letter/Number Series (LN) Matrix Reasoning (MR) 3D Rotation (RD)	Verbal Reasoning (VR)
<i>JOCRF</i>	Graphoria (GR) Inductive Reasoning (IR)	English Vocabulary (EV) Number Facility (NF)	Analytical Reasoning (AR) Number Series (NS)
<i>Note.</i> All tests will be referred to by their abbreviations (in parentheses) in the text.			

Correlation analyses sought to (a) determine whether commonly observed relationships between traits and broad abilities could be replicated and (b) identify the differences in magnitude and direction among correlations between personality and broad versus narrow aptitudes.

The correlations replicated most previous findings regarding broad abilities (these were, i.e., positively related to Intellect/Openness and unrelated to Agreeableness and Extraversion), only departing from expectation inasmuch as abilities were unrelated to Emotional Stability. All aptitudes save for SAPA VR were unrelated to Conscientiousness (VR’s relationship was slightly negative, which is consistent with previous research). Abilities with “narrow” or “intermediate” g-loadings were only moderately related to personality traits (correlations ranged from  $r = -.12$  to  $r = .23$ ); most of the few significant relationships were unsurprising (e.g., Intellect was a significant positive predictor of all JOCRF measures save GR).

Interestingly, however, and with only one exception, JOCRF tests slightly favored extraverts (ranging from  $r = .08$  to  $.23$ ) whereas SAPA ability tests did not (ranging from  $r = -.12$  to  $.04$ ). To that end, Brown used regression analyses to look at Extraversion and Intellect/Openness in predicting scores on the three JOCRF tests most strongly related to extraversion (AR, NF, and NS). Results (tabulated below) indicated that shared variance with intellect likely accounted for the effect of extraversion on AR and NS, but not on NF. In other words, extraversion remained a significant predictor of Number Facility, a speeded test.

Regression Models of Selected Abilities Predicted by Extraversion and Intellect						
	Analytical Reasoning		Number Facility		Number Series	
<i>Linear Regressions</i>	$\beta$	$p$	$\beta$	$p$	$\beta$	$p$
Extraversion	<b>0.173</b>	<b>0.049</b>	<b>0.225</b>	<b>0.012</b>	<b>0.199</b>	<b>0.024</b>
Intellect	<b>0.447</b>	<b>&lt; .001</b>	<i>0.177</i>	<i>0.053</i>	<b>0.270</b>	<b>0.002</b>
<i>Multiple Regression</i>						
Extraversion (E)	0.031	0.719	<b>0.194</b>	<b>0.045</b>	0.127	0.168
Intellect (I)	<b>0.459</b>	<b>&lt; .001</b>	0.152	0.129	<b>0.230</b>	<b>0.018</b>
E-by-I Interaction	0.052	0.472	0.102	0.209	0.003	0.966
<i>Note</i> . Analytical Reasoning and Number Facility are speeded tests; all three are JOCRF aptitude measures. All regression models partialled for the effects of age. Data for predictors that were significant at the $p < .05$ level are given in bold for each model. Marginally significant results ( $p = .050$ to $.100$ ) are italicized.						

On the whole, scores on the three tests of “broad” cognitive abilities (VR, AR, NS) were no more strongly related to personality traits than were scores on the seven tests of “narrower” aptitudes. The SAPA battery’s aptitude measures were more likely overall to be independent of personality, which stands to reason, given that SAPA aptitude measures were designed with divergent validity from its personality measures in mind. Emotional stability’s normally positive relationship to broad aptitudes was absent in this study, but this makes more sense for SAPA’s online, un-speeded tests of ability than it does for JOCRF’s in-person ones, which are often speeded as well as timed. Client/test administrator rapport may have ameliorated such effects. Finally, the findings regarding extraversion and Number Facility were intriguing, but caution is advised in attributing this difference to differences in the speed with which participants gave answers, particularly since other speeded JOCRF tests failed to favor extraverts (accounting for Intellect or otherwise).

## Activities of the Research Committee

At the writing of the last annual report, which covered 2019, the Research Committee was just getting off the ground. In the ensuing two years, the group has made notable progress toward some of its goals. With the closure of the testing centers for several months during the pandemic, staff had an opportunity to devote more time to research and communication work.

One of our first objectives was the creation of a single database to store all research reports and make them easy to search by subject. Thanks to an effort led by committee member Michele Ledbetter, staff members can now log in to a JOCRF account in Airtable and find a database including all Statistical Bulletins, Technical Reports, and Test Information Bulletins published after 2000. Each report now begins with a one-paragraph summary of its content, written by a test administrator, and is tagged with any aptitudes, career fields, or other topics covered. The committee is still in the process of uploading and tagging the older reports.

Another goal was to make research data more digestible for testing staff and to make it easier for them to include up-to-date information in discussions with clients. Several years ago, Rusty Burke led a group of test administrators in creating a compilation of research information for each aptitude. Committee member Alex Bureau updated this compilation with the latest occupational validation information from the 2019 occupational plots, and streamlined the formatting to make the information easier to take in. The committee also continued to publish a quarterly research newsletter to keep staff abreast of ongoing work in the research department.

Committee chair Holly Wilhelm helped to update the summary manual used in training to be more in keeping with current research. She was also tasked with incorporating current research information, including occupational plots, in the creation of the new book, *Choosing Intelligently*, that is now shared with clients.

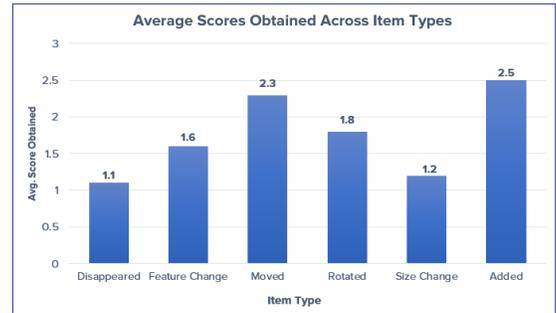


Sample Page of *Choosing Intelligently* with Analytical Reasoning Occupational Plot Incorporated

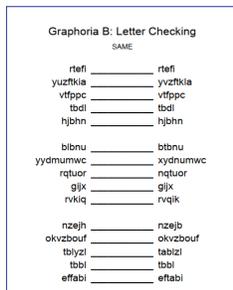
The research committee, led by chair Holly Wilhelm, led an effort to update the college major and occupation coding systems used by the department in validation research. The new system, adopted in the summer of 2021, is loosely based on the O\*NET and the SOC codes. It employs a nesting system that groups related fields and should make it fairly easy to study specific fields of interest and to group related occupations together to create larger samples.

Testing staff found time to be active in TA-led research projects, which reflected their individual interests in learning more about specific tests and abilities.

Committee member Alex Bureau conducted an item analysis of the Observation test, which showed distinct differences in the difficulty of various item types. Dr. Ashley Brown built on this work with an analysis of possible alternate scoring methods, examining whether it might be worthwhile to adapt the time ranges currently used. In the long term, the research team hopes to create a new version of the Observation test that would be both more reliable and easier to translate to an online version.

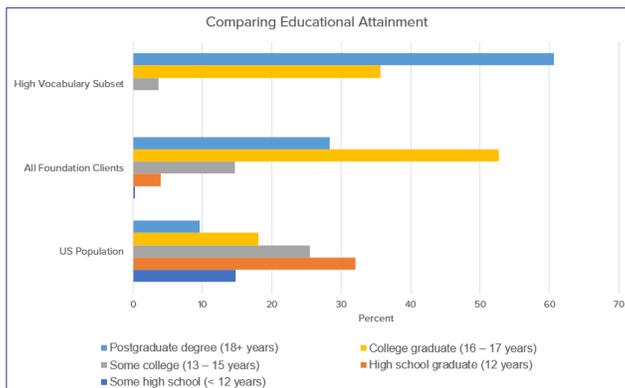


TA Luke Robbins led an item analysis of the Memory for Design test, and was able to verify his hypothesis that the last and most difficult item on the test contributes very little to the scores of most examinees. Based on this finding, the department plans to discontinue the tenth item on this test, and instead provide examinees with a new experimental item. Testing multiple experimental items could eventually produce a bank of alternate items that could replace the tenth item, or could comprise a new alternate version of the test.



TA Chris Weimer created a new test that he gave experimentally in the New York office for several months. It closely replicated the Graphoria test, but had examinees compare sets of letters instead of sets of numbers. Early data showed correlations with the Graphoria test, but not an exact overlap. Chris hopes to continue to explore visual processing with similar tests.

The committee and several other volunteers, led by Holly Wilhelm, compiled data from a set of adult clients with notably high vocabulary scores to see whether this sample showed any interesting trends. The group had achieved considerably more education, on average, than the average of the testing population, which already tends to have more education than the average American. There was a preponderance of lawyers and college professors in the group, which is consistent with findings in the 2019 Occupational Plots. The high vocabulary group tended to express interest in both reading and writing in their hobbies and their occupational daydreams.



*\*\*Table expanded from SB 2006 -1; US data came from US Census Bureau 2004 and includes individuals 25 and older; Foundation data came from Foundation's bargraph database for 1997-2001 and includes individuals 25 and older.*

## Dissemination of Research Findings

In recent years we have continued to present findings from our research in scholarly outlets such as professional conferences and journals. In 2020-21, several conferences at which we might have made presentations were canceled because of the COVID pandemic. However, the Association for Psychological Science did meet virtually in 2021, and Dr. Ashley Brown made a presentation at that conference titled “Big 5 Personality Traits and Broad Versus Narrow Cognitive Abilities.” In that presentation, she used correlation and regression analyses to examine how relationships between personality traits and aptitude measures varied by their loadings on a general aptitude factor (g); she also investigated the effect of extraversion on several JOCRF tests.

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 2020-21. The Jung et al. article in *Frontiers in Psychology* in 2015 has now been viewed 16,439 times and cited in 43 other scholarly articles. The 2014 *PLoS ONE* article by Dr. Jung and his team has been viewed by 4,437 persons and cited 15 times.

Other scholarly work sponsored by us continued to have impact in 2021. Our 2010 article with Dr. Richard Haier, with whom we collaborated on earlier neuroimaging research, and his associates in *BMC Research Notes* has now been viewed by over 13,000 persons and cited 24 times in other articles, while our 2012 *BMC* article by Dr. Schroeder and others has been viewed by 2,406 persons and cited 6 times. In addition, our 2009 article with Dr. Haier and others in *Intelligence* has been cited 113 times, and our 2010 article with Dr. Cheuk Tang and others in *Intelligence* has been cited 87 times.

With regard to earlier publications, Dr. Schroeder’s 2004 article with Drs. Timothy Salthouse and Emilio Ferrer in *Developmental Psychology* has now been cited in 192 scholarly publications, and his article with Salthouse in *Personality and Individual Differences* has been cited 112 times. Our 2001 *Intelligence* article by Dr. Scott Acton, a former research assistant in the Research Department, and Dr. Schroeder has been cited 99 times.

## Recent Statistical Bulletins

2020-1	Scoring Analysis of Memory for Design	Luke Robbins
2019-1	Updated Occupational Plots for the Foundation’s Standard Test Battery	David Schroeder Ashley Brown
2019-2	The Foresight Aptitude And Creative Achievement	Linda Houser-Marko Rusty Burke
2019-3	Research Proposal: Video Game Designer Study	Alex Bureau
2019-4	Occupational Plots for the Self-Directed Search Scales	David Schroeder Ashley Brown
2019-5	Occupational Plots for Satisfied Versus Dissatisfied Examinees	David Schroeder Ashley Brown
2019-6	Age Curves for the Graphoria, Number Memory, and Color Discrimination Tests	Ashley Brown Linda Houser-Marko
2019-7	Occupational Plots for Art-Related Occupations	David Schroeder Ashley Brown

2019-8	Occupational Plots for the Grip Test	David Schroeder Ashley Brown
2019-9	How to Write a Statistical Bulletin	Amanda Summers Linda Houser-Marko Michele Ledbetter
2018-1	Long-Term Stability for Number Facility	David Schroeder
2018-2	Summary of Long-Term Stability Findings	David Schroeder
2018-3	Writing Speed: A Series of Analyses	David Schroeder
2018-4	Information about Norms for Each Test	Linda Houser-Marko
2018-5	Research Proposal: The Aptitudes of Translators and Interpreters	Will Eells
2017-1	Poster Presentation for the 29th Annual Association for Psychological Science Convention	Linda Houser-Marko
2017-2	A Neuroimaging Study of the Visual Designs Test	David Schroeder
2017-3	Tweezer Dexterity Test Changes and New Norms for Worksample 18KA	Linda Houser-Marko David Schroeder
2016-1	Preliminary Results for the Cognitive Ability Scales from the Revelle/Condon Project Collaboration	Linda Houser-Marko
2016-2	Frequency and Creativity Scores for Foresight, Wks. 307AQ	Rusty Burke Kelsey Bakas
2016-3	Age Curve for the Analytical Reasoning Test	David Schroeder Linda Houser-Marko
2016-4	Age Curve for the Number Facility Test	David Schroeder Linda Houser-Marko
2016-5	Results from the Decade Study of Examinees from 2005	Linda Houser-Marko
2016-6	Poster Presentation for Association for Psychological Science Convention	Linda Houser-Marko
2016-7	Internal Analysis of Number Memory	David Schroeder

## Recent Technical Reports

2019-1	Occupational Plots for the Foundation's Standard Battery Displayed by Occupation	David Schroeder Ashley Brown
2017-1	Occupations in Education	Christopher Condon David Schroeder
2013-1	Sex Differences in Variability	David Schroeder
2012-1	Aptitudes, Vocabulary, and Educational Attainment	David Schroeder
2012-2	The Aptitudes of Engineering Students	Christopher Condon David Schroeder
2012-3	Four Studies of the Self-Directed Search	David Schroeder

## 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.

Houser-Marko, L. S., & Brown, A. D. (2019, July). *Cognitive abilities, divergent thinking, and the aspects of Openness*. Poster session presented at the annual meeting of the International Society for Intelligence Research, Minneapolis, Minnesota.

Schroeder, D. H. (2019, July). *A negative Flynn Effect in recent cognitive-ability scores*. Paper presented at the annual meeting of the International Society for Intelligence Research, Minneapolis, Minnesota.

Houser-Marko, L. S., & Brown, A. D. (2019, June). *Aging and the aspects of Openness: Unpacking cross-sectional patterns*. Poster session presented at the biennial meeting of the Association for Research in Personality, Grand Rapids, Michigan.

Houser-Marko, L. S. (2018, July). *Person-environment fit as seen in college majors and group-factor cognitive ability patterns*. Poster session presented at the annual meeting of the International Society for Intelligence Research, Edinburgh.

Houser-Marko, L. S. (2018, May). *Perceived person-job fit and relative abilities and interests for popular occupational fields*. Poster session presented at the annual meeting of the Association for Psychological Science, San Francisco.

Schroeder, D. H. (2018, May). *Declines in cognitive-ability scores: A negative Flynn Effect?* Poster session presented at the annual meeting of the Association for Psychological Science, San Francisco.

Houser-Marko, L. S., & Schroeder, D. H. (2017, May). *A longitudinal study of abilities and interests in STEM- and people-oriented fields*. Poster session presented at the annual meeting of the Association for Psychological Science, Chicago.

Schroeder, D. H. (2017, May). *Secular trends in specific abilities: Understanding the Flynn Effect*. Poster session presented at the annual meeting of the Association for Psychological Science, Chicago.

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.

Houser-Marko, L. S. (2016, May). *Spatial ability and the STEM majors: Where do females with high spatial ability go?* Poster session presented at the annual meeting of the Association for Psychological Science, Chicago.

Schroeder, D. H. (2016, May). *The Flynn Effect: Is it continuing in the United States?* Poster session presented at the annual meeting of the Association for Psychological Science, Chicago.

## Recent Publications

Bezruczko, N., Manderscheid, E., & Schroeder, D. H. (2016). MRI of an artistic judgment aptitude construct derived from Eysenck's K factor. *Psychology & Neuroscience*, 9, 293-325. doi: <http://dx.doi.org/10.1037/pne0000064>

Ryman, S. G., Yeo, R. A., Witkiewitz, K., Vakhtin, A. A., van den Heuvel, M. P., de Reus, M., Flores, R. A., Wertz, C. R., & Jung, R. E. (2016). Fronto-parietal gray matter and white matter efficiency differentially predict intelligence in males and females. *Human Brain Mapping*, 37, 4006-4016. doi: 10.1002/hbm.23291

Yeo, R. A., Ryman, S. G., Thompson, M. E., van den Heuvel, M. P., de Reus, M. A., Pommy, F., Seaman, B., & Jung, R. E. (2016). Cognitive specialization for verbal vs. spatial ability in men and women: Neural and behavioral correlates, *Personality and Individual Differences*, 102, 60-67. doi: 10.1016/j.paid.2016.06.037

Jung, R. E., Wertz, C. J., Meadows, C. A., Ryman, S. G., Vakhtin, A. A., & Flores, R. A. (2015). Quantity yields quality when it comes to creativity: A brain and behavioral test of the equal-odds rule. *Frontiers in Psychology*, 6:864. doi: 10.3389/fpsyg.2015.00864

Jung, R. E., Ryman, S. G., Vakhtin, A. A., Carrasco, J., Wertz, C., & Flores, R. A. (2014). Subcortical correlates of individual differences in aptitude. *PLoS ONE*, 9(2): e89425. doi: 10.1371/journal.pone.0089425

Schroeder, D. H., Haier, R. J., & Tang, C. Y. (2012). Regional gray matter correlates of vocational interests. *BMC Research Notes*, 5(1), 242. doi: 10.1186/1756-0500-5-242

Haier, R. J., Schroeder, D. H., Tang, C. Y., Head, K., & Colom, R. (2010). Gray matter correlates of cognitive ability tests used for vocational guidance. *BMC Research Notes*, 3(1), 206. doi: 10.1186/1756-0500-3-206

Tang, C. Y., Eaves, E. L., Ng, J. C., Carpenter, D. M., Kanellopoulou, I., Mai, X., Schroeder, D. H., Condon, C. A., Colom, R., & Haier, R. J. (2010). Brain networks for working memory and factors of intelligence assessed in males and females with fMRI and DTI. *Intelligence*, 38, 293-303.

Haier, R. J., Colom, R., Schroeder, D. H., Condon, C. A., Tang, C. Y., Eaves, E., & Head, K. (2009). Gray matter and intelligence factors: Is there a neuro-g? *Intelligence*, 37, 136-144.



## **Trustees**

Wendy Bigelow  
Richard Bowker  
Alice Campbell  
Timothy Fitzgerald  
Thomas Jensen  
Ellen Leifer  
David Ransom  
Anne Steiner  
Frank Stowell  
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Thomas Jensen, Vice President  
Timothy Fitzgerald, Treasurer and Assistant Secretary  
Holly Wilhelm, Secretary  
Alice Campbell, Assistant Treasurer

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David Schroeder, Ph.D., Manager  
Ashley Brown, Ph.D., Researcher  
Susan Park, Ph.D., Researcher

## **Research Committee**

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Alex Bureau (2020)  
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