Report of the Research Department

Johnson O'Connor Research Foundation, Inc.
Human Engineering Laboratory, Inc.
Johnson O'Connor Research Support Corporation

2014

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.

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Three musical ability tests as they relate to cognitive measures and musical experience

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Johnson O'Connor Research Foundation
Chicago, Illinois

Poster presented to the Association for Psychological Science 26th Annual Convention in San Francisco, May 22-25, 2014

Johnson O'Connor Research Foundation

Introduction

Musical and cognitive abilities and musicianship were explored with three tests (Pitch Discrimination, Tonal Memory, and Rhythm Memory) from the Johnson O'Connor Research Foundation (JOCRF) and based on the Seashore Tests of Musical Ability.

We take previous research a step further by measuring musical abilities instead of relying on self-report of musical experience or expertise. We looked at the musical abilities in relation to cognitive abilities. Then we demonstrated criterion-related validity by predicting occupations in music. We also looked at musical abilities for people with occupations in fields other than music.

Previous research has associated musical abilities with verbal memory and reading ability (Miendlarzweska & Trost, 2014; Ho, Cheung, & Chan, 2003) and spatial reasoning (Hetland 2000), though the working definition of musical abilities has varied. Others have found an association between pitch perception and language pronunciation (Posedel, Emery, Souza, & Fountain, 2012).

Method

Sample

Participants were a sample of clients who came to JOCRF to learn about their abilities in order to help with academic and career decisions.

- ranged in age from 22 to 60 years old
- had complete scores on the JOCRF testing battery
- tested between 2004 and 2010
- 13,095 individuals met these criteria

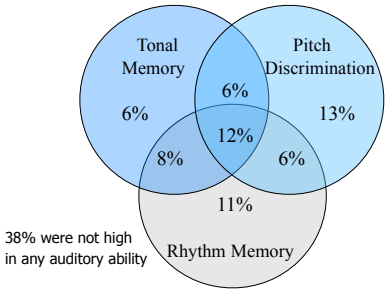
Measures

Tonal Memory: a test of memory for patterns of tones.
Rhythm Memory: a test of memory for patterns of rhythms.
Pitch Discrimination: a test of perception of pitch.
Numerical ability: a number series test.
Spatial ability: a combined score of two spatial tests (paper folding and wiggly block).
Verbal ability: a test of vocabulary knowledge.

Results

Scores for the musical tests were correlated amongst themselves: Tonal Memory and Pitch Discrimination (r= .48), Tonal Memory and Rhythm Memory (r = .55), and Pitch Discrimination and Rhythm Memory (r = .32).

Percentages with High Scores



38% were not high in any auditory ability

Considering the three musical abilities together, 12% of the sample were high (70th percentile or greater) in all three, 20% were high in two, 30% were high in only one, and 38% of the sample were not high in any of the three auditory tests.

	Number	Spatial ability	Memory for Design	Vocabulary	Clerical ability
Tonal Memory	.27	.24	.21	.23	.08
Pitch Discrimination	.26	.29	.23	.24	.07
Rhythm Memory	.26	.23	.22	.25	.09

The musical abilities tests had correlation of .20 or higher with scores for numerical ability, spatial ability, memory for design, and vocabulary knowledge.

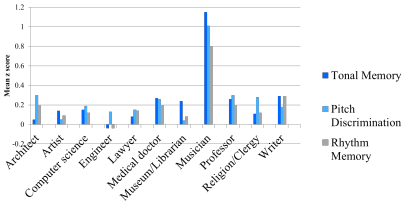
Music Majors and Musicians

The musical abilities tests significantly predicted having majored in music in college, as expected. Numerical ability, spatial ability, memory for design, and vocabulary did not contribute over and above the musical abilities tests in the logistic regression model, below.

	B	S.E. B	Exp(B)
Tonal Memory	.83**	.10	2.30
Pitch Discrimination	.76**	.11	2.14
Rhythm Memory	.44**	.11	1.55

The occupations in the figure below had higher proportions of clients who had had higher scores in all three musical abilities tests. (Occupations were classified using the Dictionary of Occupational Titles system). Mean z scores are shown below.

z scores for musical abilities tests for select occupations



Summary of Results

The three musical abilities tests predicted experience about equally, and better than cognitive abilities, validating the measures. The tests were correlated with numerical, spatial, and verbal abilities.

Conclusion

Our study has shown that musical abilities can be measured and people who are higher in musical abilities tend toward certain occupations. Understanding more of the cognitive components of musical abilities should be a goal for future research.

Letter from the Research Chairman

Johnson O'Connor's training was largely in mathematics, and his work throughout his career was primarily statistical in nature. He also evidenced, though, a life-long fascination with the discoveries of the physical and biological sciences. In his first book, *Born That Way* (1928), the opening sentence is: "Science has drawn man's physical characteristics into its domain; not only measuring their extent, but formulating a portion of the laws which govern their passage from one generation to the next."

A discussion of the then-nascent science of genetics follows, leading to O'Connor's exploration of the idea that mental characteristics, as well, might be inherited (thus the book's title).

A few years later, in *Psychometrics* (1934), he wrote:

> "There are two approaches to the study of the human being: one, a physiological study of the brain and the nervous system, the other such a psychological study of man's activities as has been given in this volume. The physical approach is probably the ultimate one. Each mental element which has been discussed in Chapter XXI probably depends upon a definite physical structure and will not be thoroughly understood until its physical cause is known. On the other hand, it seems to me that the psychological isolation of mental elements must precede the search for their physical basis....(T)he ultimate goal must always be an understanding of the physical basis."

By "mental elements," of course, Mr. O'Connor meant what we refer to as "aptitudes," the types of specific cognitive abilities we measure. He understood that our "psychological" measures are only indirect indicators of aptitude, samples of behavior at a particular time.

Given continual work to improve the reliability and validity of the tests, these indicators are, we believe, very accurate indications of a person's abilities, but O'Connor hoped that some day an understanding of the relationship of abilities to physical structures within the brain would move us closer to a real understanding of individuals and their differences.

How delighted he would be, then, to see the directions our research is taking. In the Research Department, Dr. David Schroeder, with help from Dr. Linda Houser-Marko, is building a large database of twins and triplets who have been tested in our laboratories over the past forty years, and has made analysis of their results an ongoing project.

He first looked at heritability of aptitudes in the 1990s, in collaboration with Dr. William G. Johnson and Dr. Ronald P. Cody of UMDNJ-Robert Wood Johnson Medical School, using results primarily from siblings tested at JOCRF. Some of the results of that work were presented at annual meetings of the American Psychological Association, and were summarized last year by Schroeder in Statistical Bulletin 2014-6, *Heritability/ Familiality Studies of the Foundation's Aptitude Tests*. Now, with more data on twins to work with, he plans to update and expand upon many of those analyses, as discussed on page 3.

As for the physiological approach, we have the work of Dr. Rex Jung of the University of New Mexico, partially supported by the Johnson O'Connor Research Support Corporation, which includes working with tests from our standard aptitude battery. Dr. Jung and his associates last year published *Subcortical Correlates of Individual Differences in Aptitude* in the online journal PLoS ONE, as reported on page 2.

Following on studies that examined the relationships between abilities and gray matter (i.e., regions of the brain's cortex), this study found significant relationships between abilities and structures within the mid-brain, results which "conformed, generally, to well-established findings within the cognitive neurosciences showing lateralization of structure-function relationships (e.g., Vocabulary-left hippocampus; Paper Folding-right thalamus)."

In discussing the limitations of the study, Jung wrote: "Future research will be necessary to disentangle the genetic versus environmental contribution of such structure-function relationships...." An important step in that direction was finally taken in 2014, as Dr. Jung and his associate, Ranee Flores, began the scheduling and testing of twins for another project with Support Corporation funding, "Brain Correlates of Aptitude: A Twin Study."

Sets of twins (and triplets) tested at JOCRF within the past ten years and meeting certain other criteria are traveling to Albuquerque, where they take other tests (personality, creativity, and so on) and undergo brain imaging.

Recruiting of twins in the New Mexico region is also underway, with the ultimate goal being the testing of 75 twin (or triplet) pairs, and analysis of the relationships between their measured abilities and brain structures. We are delighted to be able to assist in this project and others which seek to continue our advancement along the roads Mr. O'Connor envisioned over eighty years ago.

Rusty Burke

April 16, 2015

Aptitudes and Brain Imaging Update

Dr. Rex E. Jung, of Univ. of New Mexico, has been funded by JOCRSC for several research projects since 2010, to bring sophisticated brain imaging study to the aptitudes we measure in a way Johnson O'Connor would have been thrilled to envision had the science of his day only allowed. The abstract of this paper published in 2014 is presented here to bring us up-to-date on research funded — but not directed — by us. Our aptitude tests have been modified for use with brain imaging technology. The reference below will lead those interested to the full article.

Mark Holm for The New York Times

PLoS ONE 9(2): e89425. doi:10.1371/journal.pone.0089425 (2014)
Rex E. Jung , Sephira G. Ryman, Andrei A. Vakhtin, Jessica Carrasco, Chris Wertz, Ranee A. Flores

Subcortical Correlates of Individual Differences in Aptitude

Abstract.

The study of individual differences encompasses broad constructs including intelligence, creativity, and personality. However, substantially less research is devoted to the study of specific aptitudes in spite of their importance to educational, occupational, and avocational success. We sought to determine subcortical brain structural correlates of several broad aptitudes including Math,Vocabulary, Foresight, Paper Folding, and Inductive Reasoning in a large (N = 107), healthy, young (age range = 16–29) cohort.

Subcortical volumes were measured using an automated technique (FreeSurfer) across structures including bilateral caudate, putamen, globus pallidus, thalamus, nucleus accumbens, hippocampus, amygdala, and five equal regions of the corpus callosum. We found that performance on measures of each aptitude was predicted by different subcortical structures: Math – higher right nucleus accumbens volume; Vocabulary – higher left hippocampus volume; Paper Folding – higher right thalamus volume; Foresight – lower right thalamus and higher mid anterior corpus callosum volume; Inductive Reasoning – higher mid anterior corpus callosum volume. Our results support general findings, within the cognitive neurosciences, showing lateralization of structure-function relationships, as well as more specific relationships between individual structures (e.g., left hippocampus) and functions relevant to particular aptitudes (e.g., Vocabulary).

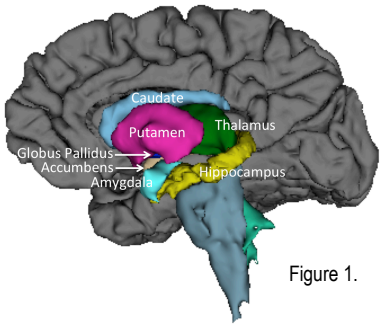


Figure 1.

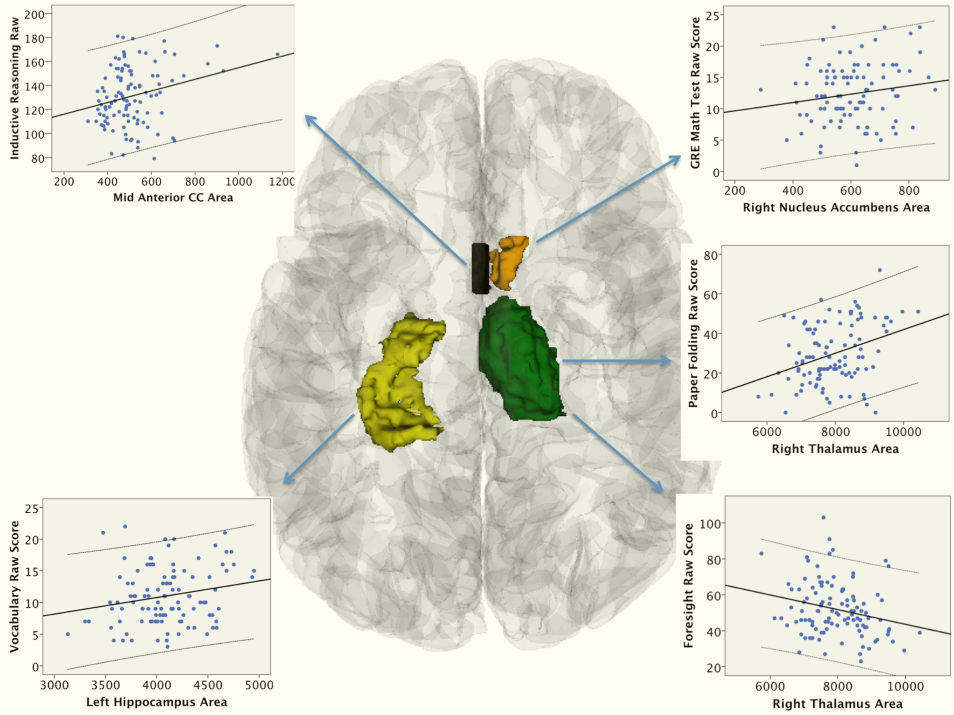


Figure 2. Axial view of subcortical structures related to aptitude measures, with scatter plots displaying linear relationships (solid line) and 95% confidence intervals (dashed lines) for all subjects.
Four structures are shown: Hippocampus (yellow), Mid Anterior Corpus Callosum (black), Nucleus Accumbens (brown), Thalamus (green).

Twins coming to Albuquerque

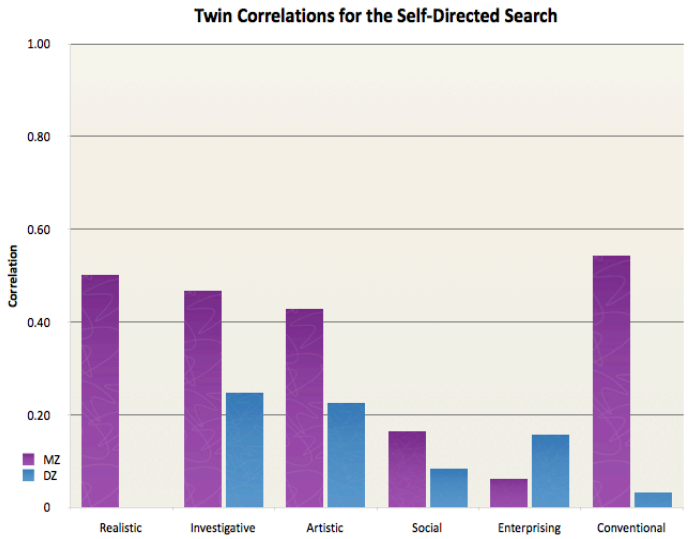
As first announced in our 2012 Research Report, Dr. Rex Jung is conducting a study of twins using MRI scans in relation to creativity, personality, intelligence and aptitudes. 2014 saw 25 subjects tested but more are being measured this spring as well. We are partially funding this project and several of our tests are incorporated into the study.

The study is planned to include 150 subjects, twins (or triplets), right-handed, from 16-29, without brain injury. Cortical thickness, white matter fidelity, and default mode network analyses will be undertaken of the MRI data. Identity of subjects is strictly confidential. From our testing files, some 50 twin pairs will be recruited to participate. The rest will be recruited locally in New Mexico. Dr. Richard Haier will also participate in publishing papers using the data.

David Ransom, *President*

Heritability

At the Foundation, we have had a continuing interest in genetic influences on aptitudes, which has been passed on from our founder, Johnson O'Connor. In 2014 David Schroeder, Research Manager, continued our work from recent years, and our collaborator Dr. Rex Jung initiated a study involving neuroimaging of twins (see earlier section). Schroeder followed up his earlier analyses of twin scores on our standard aptitude battery with an analysis of scores on the Self-Directed Search, the vocational-interest test that we give. The results of the analysis are shown in the accompanying figure.



In general, the values are somewhat lower than what we have seen for aptitude scores, but it does appear as though there is a heritable component to scores for the Realistic, Investigative, Artistic, and Conventional themes and not much of an effect for the Social and Enterprising themes.

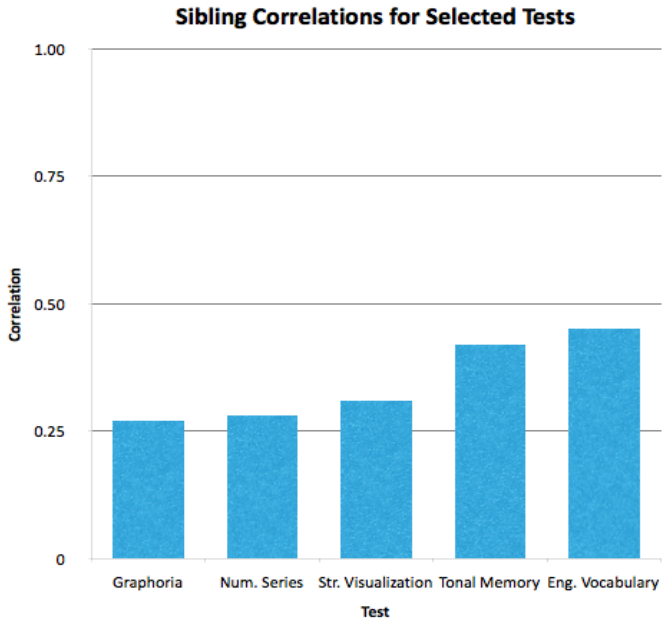
Schroeder also re-analyzed the data on test scores of siblings that we originally examined in the 1990s, and selected results are shown in the second figure on this page. With data from siblings, one can estimate *familiality*, which is the extent to which differences tend to be reproduced in families, but one can't explicitly distinguish how much of the familiality is due to genetic factors and how much is due to the shared environment. The values from this analysis support our earlier analysis of twin data in finding substantial familialities for many of our aptitude tests and particularly high values for Tonal Memory and, interestingly, English Vocabulary.

Schroeder also investigated two variables that outside research indicates may moderate the degree of genetic influence on aptitudes: age and socioeconomic status. The outside research suggests that heritabilities of some abilities tend to increase across childhood and adolescence (which may be counter to one's intuitions). Schroeder compared examinees of different ages in our sibling data file and found only very slight effects for teen-agers versus adults. If we had test data for examinees younger than 14, we likely would have seen more of an effect here.

Regarding socioeconomic status, outside research shows that for some abilities, heritabilities tend to be lower for persons from lower socioeconomic groups. In our data, we do not have information on the financial status of our examinees or their families, but we do have examinees' reports of their parents' educational levels. When Schroeder compared siblings who differed in terms of parents' educations, he did find a trend toward higher correlations (that is, higher familialities) corresponding to higher parental education levels. We hypothesize that the explanation for this is that the genetic influences are actually similar across educational groups, but the environmental variation may be greater for lower educational levels, and therefore the proportion of variation attributed to genetics is smaller.

Schroeder made a presentation on these findings, "Resemblance for Twins on a Battery of Ability Tests," at the annual meeting of the Behavior Genetics Association in June 2014 and also published his presentation as Statistical Bulletin 2014-9, *Poster Presentation at Behavioral-Genetics Conference*. In addition, he reported our sibling analyses in Statistical Bulletin 2014-6, *Heritability/Familiality Studies of the Foundation's Aptitude Tests*.

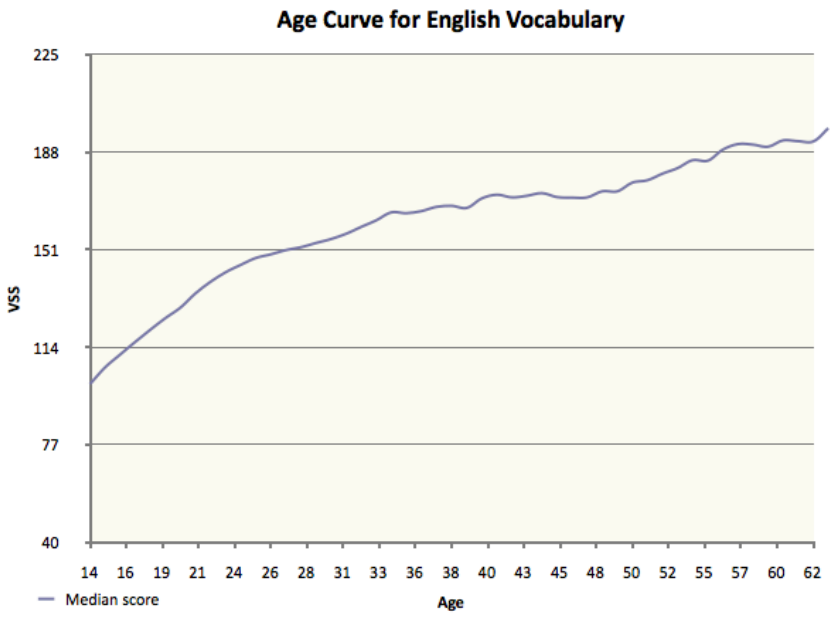
Finally, in late 2014 Schroeder and Linda Houser-Marko, Researcher, initiated an effort to expand our samples of identical and fraternal twins to roughly double their previous size. With the additional data, Schroeder plans to repeat his twin analyses in 2015.



Long-Term Stability

For a number of years, we have been investigating the stability of scores on our tests across time. In 2014, David Schroeder analyzed data we have collected on our English Vocabulary test. We view English Vocabulary knowledge, unlike aptitudes, as a feature that persons can improve through conscious study, and so one might expect that scores on vocabulary tests would show lower degrees of stability than would scores on aptitude tests.

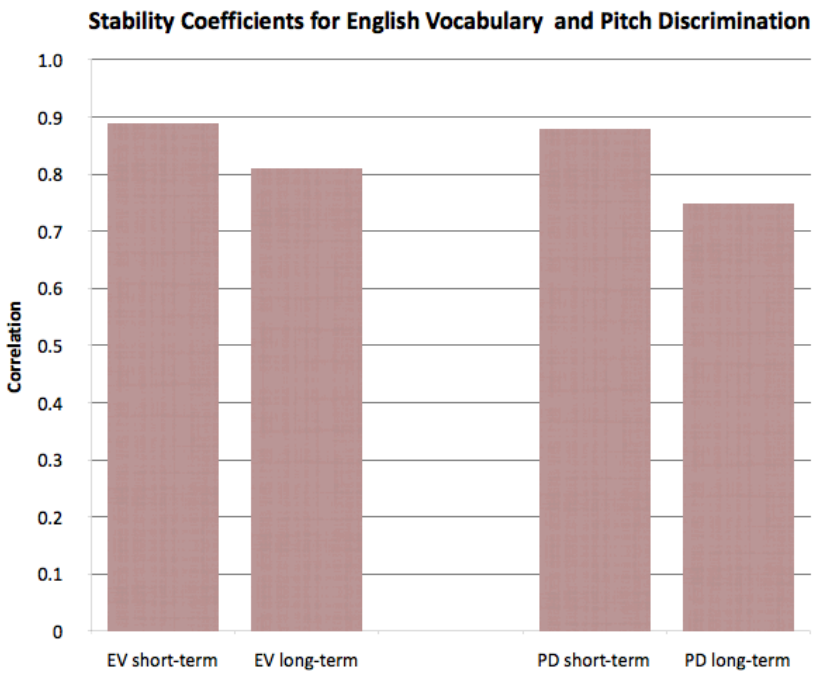
To provide context for this study, the age curve for Foundation examinees on English Vocabulary is shown in the accompanying figure. As can be seen, examinees tend to gain in vocabulary across most of the lifespan, with somewhat greater gains in the teen years and more-modest gains in adulthood.



Thus, one could anticipate that examinees would show gains in vocabulary as they get older, and the question for the present study was whether they would maintain their rank order relative to their age as they moved across time.

The data for this study came from the administration of English Vocabulary retests to 395 former examinees from our testing program. Of these examinees, 52 had been tested less than one year prior to taking the retest, and these were termed the "short-term sample," while 343 were tested one year or more after their original testing, and we referred to them as the "long-term sample." The test-retest interval for the long-term sample ranged from 1 to 21 years with a mean of 7.5 years.

For the long-term sample, examinees showed an average Vocabulary Scale Score (VSS) of 143.2 on their original testing and an average of 159.6 on their retests, and so they gained a mean of 16.4 VSS points between testings. When one adjusts for age effects, however, the examinees showed essentially the same rank order on the retest as they did on the original testing:



As shown in the second accompanying figure, for the long-term sample, examinees' scores on the retest correlated .81 with their scores on their original testing, while for the short-term sample, the corresponding correlation was .89.

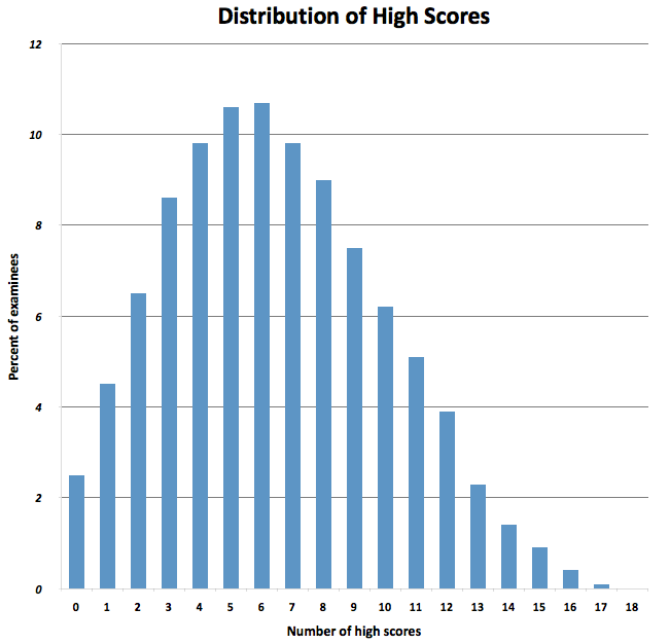
When one compares these values with the corresponding values for Pitch Discrimination, one can see that the correlations for Vocabulary are even a little higher than the correlations for Pitch.

Thus, it appears that in general, English Vocabulary knowledge is relatively stable over time. In other words, although people in general gain knowledge as they get older, they tend to maintain their ranking within the larger group.

Schroeder reported this study in Statistical Bulletin 2014-10, *Long-Term Stability for English Vocabulary*.

Number of Aptitudes

Examinees frequently ask us how many high scores people typically receive on our tests. In 2014, David Schroeder examined this question for clients of our testing service. The figure on this page shows the distribution of high scores (percentile > 70) on our standard battery of aptitude tests (not counting Word Association and Color Perception), which do not provide percentiles). The median number of high scores for our examinees is 6, and 73% of examinees had between three and nine high scores. One implication of these findings is that most examinees have a substantial spread of scores across our various tests, and an IQ-type test that yields a single overall score would be likely to overlook this.



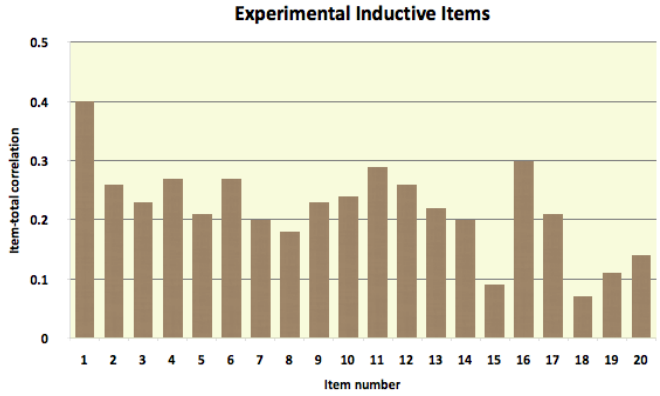
Schroeder reported these results in Statistical Bulletin 2014-12, *Number of Aptitudes Per Examinee*.

Inductive Reasoning

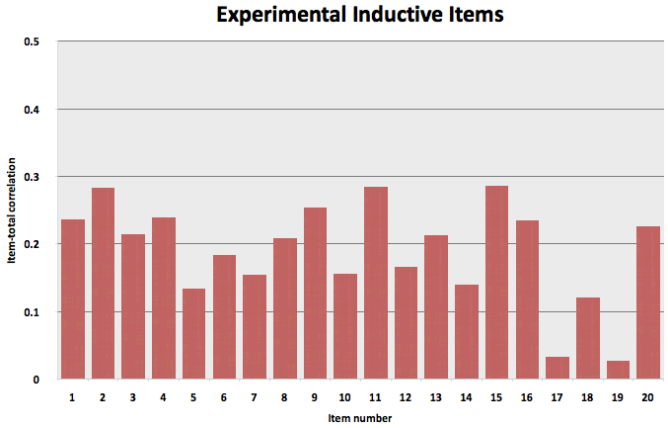
In 2014 we continued our research on Inductive Reasoning items, both on our standard test and on sets of experimental items. David Schroeder performed an item analysis on the standard test with a particular focus on the five items that were modified in 2013. In general, the test performance was very similar to its performance before the latest changes (reported in Statistical Bulletin 2013-3). Of the five revised items, two showed discernible improvement, but all five are continuing to function more poorly than we would like to see.

We continued to work on the development of new items that could be used in an alternate form or to replace items on the standard test. From mid-2013 into 2014, the labs gave a set of 20 experimental items, of which 11 were new items devised by David Ransom, President of the Foundation, and other staff. The remaining nine items had been administered previously, and several of them were modified to improve their performance.

Schroeder analyzed the results of the experimental administration, and the correlations of the items with the total score on the standard Inductive Reasoning test are shown in the first accompanying figure. Fifteen of the items appear to be reasonably well-functioning items.



Ransom assembled another set of experimental items that were administered from April to July 2014. Schroeder performed an item analysis on this set, and the results for this set are shown in the second accompanying figure. Of the 20 items, 11 were judged to be functioning reasonably well, and several of the other items are likely to improve with some modifications.



Schroeder reported these various analyses in three Statistical Bulletins: 2014-4, *Analysis of Standard Inductive Reasoning Items, Wks. 164 OA*; 2014-5, *Analysis of Latest Set of Experimental Inductive Reasoning Items, Wks. 164 X* (2013-14)*; and 2014-11, *Analysis of Experimental Inductive Reasoning Items, Wks. 164 X9 (2014)*.

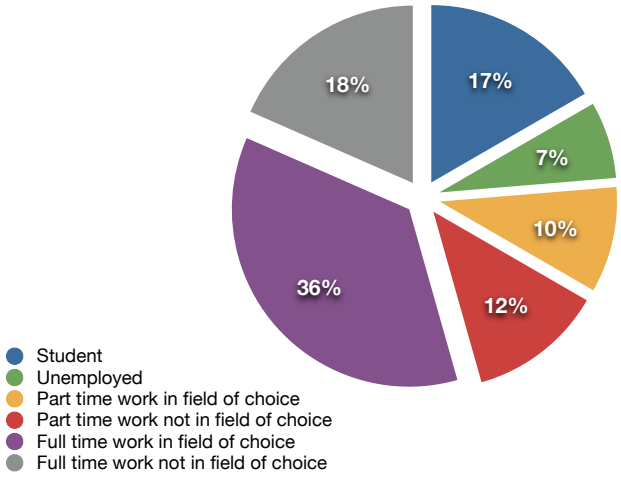
Early-career adult study

As we are interested in one of our larger client-examinee age groups, namely early career adults, we continue in our efforts to study this population. We want to better understand the impact of aptitude testing on their employment and lives. In particular, we have been looking at young adults who have tested with us, and their outcomes as far as their schooling, employment, and aptitudes. As part of this, we did a study of young adults three years after testing with the Foundation, under the direction of Dr. Linda Houser-Marko, Researcher.

The respondents were between the ages of 17 and 28 at the time of testing, with a median age of 21 years old. They were pre-selected for not having a full time job at the time of testing. About half of the sample was selected for being high in Structural Visualization, and the other half was selected for being not high. Of the respondents, 69 were high in Structural Visualization and 49 were not high in SV.

What did we learn about their aptitudes? Two-thirds of respondents endorsed the statement that, since testing, they now understand their aptitudes "quite a bit" or "very much" better than before. Forty-six percent of respondents endorsed the statement that, since testing, they understand themselves "quite a bit" or "very much" better than before. It seems that self-understanding is the more difficult endeavor, and that clients are indeed gaining knowledge about their aptitudes.

We asked about their current employment status. The pie chart shows that more than one-third of the respondents were employed full time in the field of their choice. Almost three-quarters of those who were employed were moderately to very much satisfied with their current employment.



Creativity Project

As part of our collaboration with Dr. Rex Jung, we have started some projects that will investigate associations between creative achievements and divergent thinking measures. Throughout 2014, selected offices have given the Creative Achievement Questionnaire to client-examinees. We have collected more than 1,000 CAQ questionnaires and will be able to look at creative achievement along with the Johnson O'Connor battery of aptitude tests.

Dr. Jung has found that the Foundation's measure of Foresight is related to a measure of divergent thinking (or creative thinking). In our research, Linda Houser-Marko has found similar results—specifically, that the measure of Foresight correlates with creative achievement at a level of .22 (which is small but significant, in this case). This study will also allow us to look at how other cognitive abilities relate to creative achievement. Past research has proposed a relationship between intelligence and creative achievement, and our project will add the concept of divergent thinking and the measure of Foresight to the mix.

Research Collaborations with JOCRF Aptitude Consultants

We have been working with Crystal Brown, New York, in developing a research project that will look at Ideaphoria, Foresight, "many aptitudes," and their effects on employment and job satisfaction.

Further, Linda Houser-Marko has been working with Amanda Summers, Chicago, on a research project that will continue to examine Foresight to a greater degree. This will be the second stage of this project, and we hope to complete a second version of a self-report questionnaire soon in order to look at the concepts related to our measure of Foresight.

We have been working with Megan Terrazas and Deborah Streahle, Houston, on a recruiting plan for a study of physical therapists that they are organizing. We hope that this type of occupational validation study will continue to be an important part of our research efforts in conjunction with the testing offices.

Linda Houser-Marko has continued working on the study of theatre artists with Scott Barsotti, Chicago. We are now in the second phase in which we will take a closer look at the aptitude patterns for each type of role in theatre.

Our Examinees in 2014

After a review of data from examinees tested in 2010 to 2014, we found that the characteristics of people who have been tested at the Foundation are generally similar to those of examinees from prior years of the past decade. In other words, in 2014, the Foundation tested slightly more males than females, mostly teenagers and young adults, and their parents most often both had a bachelor's degree or higher. Twenty-three percent of clients were referred to Johnson O'Connor by a family member, and fourteen percent were referred by a friend.

Dissemination of Research Findings

In recent years we have made it a practice to present some of our findings in scholarly outlets such as professional conferences and journals. In 2014 Dr. Linda Houser-Marko and Dr. David Schroeder made a presentation titled "Three Musical Ability Tests as They Relate to Cognitive Measures and Musical Experience" at the annual meeting of the Association for Psychological Science in San Francisco. Later in the year Schroeder presented "Resemblance for Twins on a Battery of Ability Tests" at the annual meeting of the Behavior Genetics Association in Charlottesville, Virginia.

Also in 2014, Dr. Rex Jung and his associates, the team of scholars whose work on neuroimaging research we are supporting through the Johnson O'Connor Research Support Corporation, published a journal article titled "Subcortical Correlates of Individual Differences in Aptitude" in the journal *PLoS ONE*. See page 2 for more information on this article.

This online journal article has been viewed 1,662 times, shared 8 times, and Figure 1 (see page 2) has been shared 548 times. According to Altimetric, it stands in the 85th%ile for viewing compared to other articles of the same age and journal. Blog post, tweets and Google+ mentions have also been noted.
This provides an indirect mention of Johnson O'Connor's aptitude study and an expansion of his vision to a new era and new modes of research.

Our previous scholarly work continued to receive attention in 2014. Our 2010 article with Dr. Richard Haier and his associates in *BMC Research Notes* has now been viewed by 11,383 persons, while our 2012 article by Dr. David Schroeder and others in *BMC* has been viewed by 1,196 persons.

According to Google Scholar, the 2010 Haier et al. article has been cited in 10 scholarly journal articles and books, and our 2009 article with Haier and others in *Intelligence* has been cited 44 times. In addition, our 2010 article with Dr. Cheuk Tang and others in *Intelligence* has been cited in 34 articles and books.

With regard to earlier publications, Schroeder's 2004 article with Drs. Timothy Salthouse and Emilio Ferrer in *Developmental Psychology* has now been cited in 87 scholarly journal articles and books, and his article with Salthouse in *Personality and Individual Differences* has been cited 45 times. Our 2001 *Intelligence* article by Dr. Scott Acton, former research assistant in the Research Department, and Schroeder has been cited 41 times.

In 2015 Jung will host the annual meeting of the International Society for Intelligence Research in Albuquerque, New Mexico, and we anticipate that we will have several presentations on the Foundation's work.

Research Department Staff

Russell E. Burke, Director of Research, serves in Washington, D.C. as senior summarizer and writer interpreting research information to the staff. An autodidact by inclination following a degree in Religious Studies at the University of Tennessee, he joined the Foundation in 1983 in New Orleans and served as Director in Houston before moving to the nation's capital, living on Capitol Hill.

David H. Schroeder, Research Manager, 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.

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Rusty, Dave & Linda in Chicago

Recent Technical Reports

2013-1	Sex Differences in Variability	*D. Schroeder*
2012-1	Aptitudes, Vocabulary, and Educational Attainment	*D. Schroeder*
2012-2	The Aptitudes of Engineering Students	*C. Condon, D. Schroeder*
2012-3	Four Studies of the Self-Directed Search	*D. Schroeder*
2008-1	Is the Flynn Effect Primarily a Rise in Structural Visualization?	*C. Condon, D. Schroeder*
2008-2	Memory for Design: Internal Characteristics and Validation Data	*D. Schroeder, C. Condon*
2007-1	Analyses of Fixed-Piece and Standard Administrations and Alternative Scoring Methods on the Wiggly Block Test	*D. Schroeder, C. Condon*
2005-1	The Aptitudes of Attorneys	*S. Goldman, D. Schroeder, K. M. Jang*
2003-1	The Aptitudes of Software Engineers	*R. Burke, T. Fitzgerald*

Recent Statistical Bulletins

2014-1	Inter-Trial Improvement in Scores on Silograms, Wks. 376 AL	Rusty Burke
2014-2	Sex Differences in Variability for Non-Cognitive Foundation Tests and SDS Scales	David Schroeder
2014-3	Mean Sex Differences for Foundation Tests and SDS Scales	David Schroeder
2014-4	Analysis of Standard Inductive Reasoning Items, Wks. 164 OA	David Schroeder
2014-5	Analysis of Latest Set of Inductive Reasoning Items, Wks. 164 X*	David Schroeder
2014-6	Heritability/Familiality of the Foundation's Aptitude Tests	David Schroeder, Mikako Nakajima
2014-7	Mean Percentiles for Individual Tests by Lab and Test Administrator	Linda Houser-Marko
2014-8	Sensory Discrimination in Relation to a General Factor of Cognitive Ability	David Schroeder, G. Scott Acton
2014-9	Poster Presentation at Behavioral-Genetics Conference	David Schroeder
2014-10	Long-Term Stability of English Vocabulary	David Schroeder
2014-11	Analysis of Experimental Inductive Reasoning Items, Wks. 164 X9 (2014)	David Schroeder
2014-12	Number of Aptitudes Per Examinee	David Schroeder
2014-13	The Distributions of Times for Color Discrimination	David Schroeder

Recent Publications

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.

Schroeder, D. H., & Salthouse, T. A. (2004). Age-related effects on cognition between 20 and 50 years of age. *Personality and Individual Differences*, *36*, 393-404.

Salthouse, T. A., Schroeder, D. H., & Ferrer, E. (2004). Estimating retest effects in longitudinal assessments of cognitive functioning in adults between 18 and 60 years of age. *Developmental Psychology*, *40*, 813-822.

Recent Presentations

Schroeder, D. H. (2014, June). *Resemblance for twins on a battery of ability tests*. Poster session presented at the annual meeting of the Behavior Genetics Association, Charlottesville, VA.

Houser-Marko, L. S., & Schroeder, D. H. (2014, May). *Three musical ability tests as they relate to cognitive measures and musical experience*. Poster session presented at the annual meeting of the Association for Psychological Science, San Francisco.

Haier, R. J., Jung, R. E., Ryman, S. G., Frantz, J. A., Carrasco, J., Burke, R. E., & Weisend, M. (2012, December). *Sequence and speed of information flow among brain areas during problem solving in high and average intelligence individuals*. Paper presented at the annual meeting of the International Society for Intelligence Research, San Antonio.

Houser-Marko, L. S., & Schroeder, D. H. (2012, December). *Cognitive abilities of engineers and computer scientists*. Poster session presented at the annual meeting of the International Society for Intelligence Research, San Antonio.

Jung, R. E., Frantz, J., Ryman, S., Carrasco, J., Shamiloglu, S., Vakhtin, A., Burke, R. E., Schroeder, D. H., & Haier, R. J. (2012, December). *Subcortical correlates of aptitude*. Poster session presented at the annual meeting of the International Society for Intelligence Research, San Antonio.

Jung, R. E., Ryman, S., Frantz, J., Carrasco, J., Shamiloglu, S., Vakhtin, A., Burke, R. E., Schroeder, D. H., & Haier, R. J. (2012, December). *Differentiation of intelligence, creativity, and aptitude via brain-behavior imaging*. Paper presented at the annual meeting of the International Society for Intelligence Research, San Antonio.

Schroeder, D. H. (2012, December). *Gender differences in variability in ability factors over time*. Paper presented at the annual meeting of the International Society for Intelligence Research, San Antonio.

Houser-Marko, L. S., & Schroeder, D. H. (2012, May). *Cognitive abilities of males and females who work in STEM fields*. Poster session presented at the annual meeting of the Association for Psychological Science, Chicago.

Schroeder, D. H. (2012, May). *Gender differences in variability of specific cognitive abilities*. Poster session presented at the annual meeting of the Association for Psychological Science, Chicago.

Houser-Marko, L. S., & Schroeder, D. H. (2011, June). *The association between objectively-measured and self-perceived abilities and educational achievement in adults*. Paper presented at the biannual meeting of the Association for Research in Personality, Riverside, CA.

Schroeder, D. H., Haier, R. J., & Tang, C. Y. (2010, December). *A comparison of the gray-matter correlates of vocational-interest and cognitive-ability scales*. Paper presented at the annual meeting of the International Society for Intelligence Research, Alexandria, VA.

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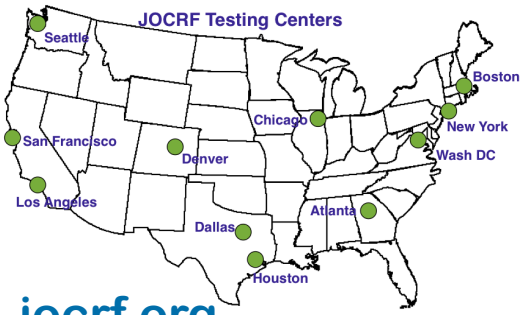

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