

**A REPORT**

**On**

**THE ORGANIZATION, FUNCTION,**

**RELIABILITY & VALIDITY**

**Of**

**THE HIGHLANDS ABILITY BATTERY**

**(tHAB)**



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## **The Highlands Ability Battery (tHAB) and the Highlands Process**

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### **DESCRIPTION**

An ability is an intrinsic human aptitude for planning or performing a task or function, or a group of tasks or functions. It represents an individual's approach to thought, study, social interaction and performance. The Highlands Ability Battery (tHAB) is an online performance-based, multiple-ability battery of worksamples. tHAB was developed primarily for use with students and adults in career planning and counseling, and in personal, team and leadership development. So far as I have been able to determine, the Battery is the only collection of tests offered online which incorporates and utilizes ability measures similar to those on the Johnson O'Connor Aptitude Battery (JOAB), the Ball Aptitude Battery (BAB), and the Aptitude Inventory Measurement Service (AIMS).

Since 1993, the test publisher, The Highlands Company, has been engaged in extensive research on the identification and development of human potential and abilities. Beginning with a paper and pencil battery drawn from measures devised by Johnson O'Connor, the Company has converted and adapted the Battery first to a CD and, then, in 2004, to a version which can be accessed and completed entirely online. The CD version is used in multiple-user environments in which a common firewall limits access to the Internet by individual computers.

The CD and online versions are essentially similar in the substance and timing of the worksamples. The only substantive difference is that in the worksample assessing the user's Vocabulary, the online version combines two different lists of words into one. Also, the online version permits registration online and, most important, provides a database which not only shows each user's responses and scores, but records all scores and results as soon as the Battery is completed. Also, data can be segregated and processed for any group of users that can be identified under various specific criteria (e.g., age, sex, educational level, work team, employer, profession or industry, etc.). The Highlands Company is designing and will soon introduce a pre-registration questionnaire which will permit further classification under other variables.

tHAB is a collection of 19 tests designed specifically to measure an individual's capacity to

perform worksamples which simulate the tasks required in a wide variety of educational and work settings. The tests are grouped into four broad categories suggested by their relationship to study and job requirements. The categories are: Personal Style Elements (personality), Driving Abilities (problem-solving, idea production, spatial relations), Specialized Abilities (learning channels, music abilities, observation, visual speed and accuracy) and Vocabulary.

The 19 worksamples included in tHAB are:

#### Personal Style Elements

- Generalist-Specialist Scale – a measure of the individual’s responses to a series of common words. Generalists – the majority of test takers – respond in a common pattern; Specialists respond in their own unique individual patterns. Generalists enjoy a variety of interests and projects. Specialists prefer to focus on their own projects and develop their own areas of knowledge.
- Introvert-Extrovert Scale – the work sample induces the individual’s responses to questions measuring introversion and extroversion; based on the work of Hans Eysenck (1916-97).
- Time Frame Orientation – a measure of the amount of time an individual takes into account when thinking about the future – the relationship between time and perspective.

#### The Driving Abilities:

- Classification (Inductive Reasoning) – the ability to see relationships among seemingly unrelated objects or data; the ability to find a common link among discrete facts or ideas.
- Concept Organization (Analytical Reasoning) – the ability to assess and arrange ideas and details in logical order.
- Idea Productivity – the ability to generate new ideas in response to a given set of new facts or challenges – a measure of the rate at which the user’s ideas flow, not a measure of the quality or creativity of the ideas.
- Spatial Relations Theory – the ability to “see” and manipulate items in space; the ability to work with, arrange and organize ideas, concepts and relationships.
- Spatial Relations Visualization – the ability to visualize and utilize three-dimensional objects; the ability to add structure and utility to the technological elements of our society.

#### The Specialized Abilities:

- Design Memory – the ability to see and remember a two-dimensional design or image;

facilitates learning through graphs, pictures, charts and other visual cues.

- Observation – the ability to perceive and recall details in one’s visual field and to note changes and irregularities in the field as they occur.
- Verbal Memory – the ability to remember data and material presented visually – books, articles, the Internet, etc.; facilitates learning by reading.
- Tonal Memory – the ability to acquire and remember data and material presented aurally – through tapes, lectures, classroom participation, meetings, discussions, etc.; facilitates learning by listening.
- Rhythm Memory – the ability to perceive and reproduce – mentally and physically – a series of patterns or actions governed by intervals of time (tempo); facilitates kinesthetic learning (learning by watching, interpreting, imitating and executing movement).
- Pitch Discrimination – the ability to distinguish fine shadings in the levels of sound (pitch) and differences in the vibrations of the human voice; facilitates response to changes by others in mood and emotions.
- Number Memory – the ability to remember and learn through association with numbers; facilitates the recollection of information and data (e.g., statistics, stock prices, industrial formulas etc.)
- Visual Speed and Accuracy – measures two abilities by means of a single worksample. Visual Speed measures the speed at which changes in numbers are recognized; Visual Accuracy measures the degree to which that recognition is accurate over a fixed period of time.
- Keyboard Speed – the speed at which a user enters words on a computer keyboard; the user’s score in Idea Productivity is adjusted for this factor.
- Vocabulary – although not an ability in the same sense as the others, it is nevertheless an important factor in suggesting occupations, careers and professions. The worksample requires the selection of the closest synonym to a given word from four choices.

tHAB online is provided to users individually. The time required for completion of the Battery, including time for registration and instructions, varies among users, but averages about 2 hours and 30 minutes, or approximately ten minutes per worksample. Variations in completion time are the result of variations in the speed with which users complete the worksamples. The tests are timed to permit completion of all items by the average user. Except for the worksamples in Idea Productivity and Visual Speed and Accuracy, however, the results are not intended to correlate

speed directly to performance, although a user's score on each of the worksamples is affected if he fails to respond to all the prompts within the time allotted.

Completion of tHAB triggers an immediate online report which shows and explains the user's results. The report – at least 32 pages in all – includes a display of the user's score on each worksample in a line-by-line bar chart; a narrative explaining the significance of each score; a section relating groups of abilities to jobs or functions in the workplace (Work Types); and a section relating abilities to such important functions as Learning, Personal Style, Problem Solving, and Communication. Students and Adults receive different versions of the report.

The tHAB report is transmitted both to the individual user and, at the same time, to a trained and certified consultant who is either an employee of The Highlands Company or one of its two-hundred-odd Affiliates. The consultant meets with the user either individually or in a small group and conducts a feedback conference in which the tHAB results are interpreted. The bar chart which begins each report enables the user and the consultant to assemble a profile of abilities and to utilize the profile in delineating the tasks and functions which the user can perform most easily. This enables the user to identify jobs and professions which are ideal for him or her. In this way, the student is guided in curriculum and career choices, and the adult either in work-place adjustments or in a career or role change.

### **USES IN COUNSELING**

The Highlands Company believes that a user's ability profile is only as meaningful as the quality of its interpretation by a competent analyst. Over the years, the Company has trained almost two hundred Affiliates in the administration of tHAB and feedback. The Affiliates are dispersed throughout the fifty states and in Australia, Canada, China, France, Germany, Great Britain, Japan and Singapore. The Affiliates are trained to explain each ability and its relationship to the user's overall Ability Profile.

The training of Affiliates consists of 1) completion of the Battery by the trainee; 2) a two-hour individual feedback with the trainee conducted by the Company's Training Director; 3) two full days of participatory training, usually live and on-site; 4) administration by the trainee of not less than two individual training feedbacks with users; and 5) review, discussion and approval of the feedbacks by the Company's Training Director.

Training is conducted in accordance with the Company's training manual, which includes sample tests, exercises, group activities, presentations, reports, and other interpretive material. (The

Highlands Training Manual, 2005).

Peter Drucker and other commentators on the work-world have concluded that success and satisfaction come most readily to those people who are able to use their natural abilities in their work. If we accept this intuitive reality, logic dictates that we pursue it to identify those abilities which are most related to specific jobs and professions – e.g., medicine, dentistry, engineering, accounting, architecture, software programming, carpentry, teaching, writing, law, business, industrial or commercial management, etc. And within each job or profession, logic also dictates that we identify the ability profile most related to each area of specialization in that job or profession (for example, in medicine –the specialties of surgery and diagnostics; in law – the specialties of trial advocacy and intellectual property). And, as another step in our pursuit of logic, we are compelled to relate a user’s ability profile to his studies and work in order to guide him to the career which will suit him best and give him the greatest sense of fulfillment. While a user’s score in one ability has some significance in itself, the combination and range of scores reflected in his or her profile are the most critical factors in the choice of curriculum and career.

tHAB, in the same way as several other ability batteries, is designed to measure those abilities which are most related to successful performance in studies and at work. But only tHAB is presented online and only tHAB includes measures of personal style (*see*, Personal Style Elements, *supra*). Several reported studies have confirmed the thesis that the results of a given task performed by the user over a prescribed number of minutes can accurately predict successful performance by the same user of a task or function required regularly in studies or at work. [Dawis, R.V., Goldman, S.H, and Sung, Y.H., (1992); Dong, H.K., Sung, Y.H., Goldman S.H. & Dohm, T.E. (1986); O’Connor, J. (1947)].

As a valid and reliable measure of abilities, tHAB can be used effectively for a variety of purposes related to learning and work. Starting with grade 11, it is effective as a tool in school-based career guidance programs dedicated to career exploration or to the design of study programs and courses. Its most significant contribution to the student’s education may well be the knowledge it supplies about the student’s learning channels – i.e., how does the student learn best – by reading, listening, acting-out, or through graphics or numbers?

tHAB has also been used successfully among business organizations in a variety of ways – from personal development, to team building, to leadership, to employee retention, to mentoring, to employee relocation.

The tHAB Technical Manual is concise and well written, and provides detailed information

on the technical elements which support the Battery. The Administration and Feedback Training Manual (2005) is presented clearly and enables Affiliates to find and utilize everything they need for individual and group feedback. The Highlands Company has also published two books for general distribution which describe the tHAB process and relate it to the experiences of students and adults who have been helped by it: *Don't Waste Your Talent* (revised, 2005) and *Highlands: The Right Choice* (2004).

## TECHNICAL CONSIDERATIONS

In 1993, Highlands undertook a factor analysis using data from 2,101 protocols. A Varimax rotation was used to identify the principal factors of tHAB. The data drew upon 2,101 individuals ranging in age from 14 to 66 and consisting of 1,207 females and 894 males. Norms were established for males and females, and for the following age groups-15-22, 22-30, 30-39, 39 and over.

The study identified ten factors measured by tHAB:

1. Visual/Spatial Reasoning: Spatial Relations/Visualization, Spatial Relations/Theory, Design Memory, Concept Organization.
2. Visual Memory: Design Memory, Observation, Verbal Memory, Number Memory.
3. Cognitive Reasoning: Concept Organization, Classification, Time Frame.
4. Visual Speed: Visual Speed.
5. Visual Accuracy: Visual Accuracy.
6. Musical: Rhythm Memory, Tonal Memory, Pitch Discrimination.
7. Speed: Idea Productivity, Time Frame, Typing Speed.
8. Extrovert-Introvert: Extrovert-Introvert.
9. Specialist-Generalist: Specialist-Generalist.
10. Vocabulary: Vocabulary

These factors show that tHAB breaks into the same factor structure as other widely-used and well-researched and validated ability batteries, such as the Government Aptitude Test Battery (GATB), the Kit of Factor-Referenced Tests of Guilford, The Comprehensive Ability Battery (CAT), the Differential Aptitude Tests (DAT), and the Employee Aptitude Survey (EAS). In addition, tHAB shows the same factor structure as the Johnson O'Connor Aptitude Battery (JOAB), and the Ball Aptitude Battery (BAB), which are similarly constructed batteries of ability measures and have several tests in their respective batteries similar to the worksamples included in tHAB.

## RELIABILITY

Reliability is an estimate of the degree to which the score obtained by a person on any given measure is the 'true' score for that person on that measure, without influence by essentially extraneous factors. Reliability estimates are typically given as  $r$ .  $r$  typically ranges from 0.0 to 1.0, with 1.0 representing the perfect score.  $r = .7$  is generally held to be the minimum acceptable reliability in testing instruments similar to tHAB, although many tests in other batteries show reliability in the range of  $r = .6$ . The minimum standard of reliability for tHAB is  $r = .80$ . All instruments in tHAB are expected to maintain this standard.

The degree to which the results of a process are replicated, especially in different research centers utilizing different researchers, is an important piece of evidence leading to confidence in the obtained result. Reliability of tHAB through Parallel-Form Analysis has been established on many different occasions by comparing results with the separate but essentially similar instruments of the Ball Aptitude Battery (BAB), and the Johnson O'Connor Research Foundation (JOAB). Parallel-Forms Analysis is used to assess the consistency of the results of two tests constructed in the same way and with the same content. Because each of the worksamples comprising tHAB is different in form and function from all the other worksamples on the Battery – especially in the behavior being measured – the appropriate reliability measure differs from worksample to worksample. In other words, each worksample must be examined separately and each must conform separately to the same over-all standard.

In 1994, Highlands carried out a study of the reliability of the individual worksamples comprising tHAB. The study was conceived and conducted by C.L. Holland, Ph.D. The study showed that the reliability of the worksamples comprising tHAB ranged from .83 to .95. These reliability estimates showed the results to be highly reliable, allowing Highlands to make meaningful comparisons between scores. At that time of the study, Dr. Holland was director of the Graduate Program in Organizational Psychology at Georgia State University. Dr. Holland is an expert in test development and research, and has acted as consultant to many organizations on test validation and test construction.

The Holland study utilized 298 participants drawn from a random list of Highlands clients. They ranged in age from 15 to 66. The group consisted of 146 males and 152 females. Of the adults over 25, almost all were college graduates. Most of the participants who were younger

than 25 were either college students or former college students. Exhibit A to this Review shows the findings by Dr. Holland.

In the year 2002, Highlands contracted with the Chauncey Group, a subsidiary of ETS, to undertake the following:

...to perform a statistical audit of the 19 work assignments that contribute to a person's overall measurement in the Highlands Ability Battery. Each work assignment requires the person to perform a separate task. Our audit and evaluation were limited to the CD-Rom version of the Highlands Ability Battery, which is administered to examinees on the computer. All complete examinee records between the introduction of the CD-based test in March 2000 and September 2002 were included in the analysis. In all, 4,307 individual records were evaluated.

Of the 4,307 records, less than 200 were deleted for missing or correct information. In all, the Chauncey Group evaluated 19 different worksamples yielding 23 different scores per individual. The Report issued by the Group concludes as follow:

The 19 work assignments on the Highlands CD yield 23 separate scores. The Chauncey Group computed sample sizes, means, standard deviations and complete norms tables for each of the 23 CD-based scores for four groups of examinees ages 1) 15-21; 2) 22-30; 3) 31-39; and 4) 40 and older. Each norms table provided the percentile rank and the raw score for that age group at that percentile rank. Tables were provided that included the comparison of these data among each other and, where available, to the norms assigned by Highlands in the CD-Based Highlands Ability Battery.

An examination of the 23 different percentile norms tables across the different age groups reveals a substantial correspondence for most groups in many test scores. Also, many total group scores appear to be identical to norms assigned by Highlands, with the exception of the lower-bound 5<sup>th</sup> percentile score. In the Highlands norms, any score in this percentile is always assigned a zero, but in our

tables the score is usually greater than zero but below the minimum for the next percentile. Only two of the twenty-three tests, Visual Accuracy and Visual Speed, appear to present norms which are somewhat different from the norms presented on the Highlands norms sheets.

In general, the analysis of the score distributions revealed that many of the 23 scores appear to be identical to current norms... Also, two tests appear to have different norms than those presented on the norms sheets: Visual Accuracy and Visual Speed do not appear to agree with the norms provided by the Highlands Company to the extent that the other test scores do for the total group of candidates tested on the CD-based battery. The norms for most of these tests appear to be virtually perfect and have no need of change.

Overall, the data from the CD-based Highlands Ability Battery shows that each test score in the battery correlates sufficiently so as to provide indirect evidence that the tests in the Highlands Ability Battery are sufficiently reliable for their use in the test battery for feedback purposes, since the feedback report provides a combination of the scores for personal growth purposes.

Also, examination of the frequency distributions among the four age groups shows consistent similarities for scores at the different percentiles regardless of age group. Those differences in scores by age group that did exist were consistent across the different age groups.

In June 2004, Highlands introduced the online version of tHAB. The worksamples duplicate the functions of the CD-Rom except for the worksample in Vocabulary, in which the two lists of words on the CD have been merged into one in the online test. Also, the online version permits a seamless process beginning with registration and instructions and ends with the immediate receipt of the online report. The sound track for the online version was newly recorded, and the text on-screen was rewritten.

Since its introduction in 2004, a total of 5,088 users have completed tHAB online. In the same period, 2,114 users have completed the CD version. The answers, scores and percentiles of

all these 7,202 users have been captured and recorded in a carefully designed data base which separates the online results from the CD results and records the distribution of both sets of data as to male and female and for the following age groups 15-21, 22-30, 31-39, 40-55, 56+. In addition, the Company maintains a third set of data which is distributed among users in the same way as to sex and age, but which is limited to a group of users in the construction industry. This set (Group X) consists of 954 individual records and is maintained separately from the other data for the reason that one Highlands Affiliate who conducts many workshops in the construction industry has requested it and because it enables Highlands to compare people in a particular industry with the general population. This set also separates male from female, but because of the nature of the industry, there are many more males than females. Also, the age group 15-21 is not represented in this group.

Armed with these different data banks, Highlands has begun an intensive inquiry into the reliability and validity of tHAB online. The Company is satisfied that the initial findings show remarkable consistency in answers, scores and percentiles among the three sets of Highlands data (online, CD, and Group X). In three of the worksamples, which are used here to illustrate the consistency in percentiles, the median percentiles among all users were as follows:

	Online	CD	Group X
Classification	40	40	40
Concept Organization	55	55	55
Design Memory	50	50	55

The data being accumulated will enable Highlands to analyze results among high school students, college students and working adults. Also, it will provide comparative measurements for male and female users, and for people at different ages and stages in their careers. Further, as in the case of Group X, the Company will be able to separate data on the basis of profession and job function. This will in turn enable the Company to test which of the abilities are common to a particular profession. The Company has begun to isolate results for groups of lawyers, accountants, laboratory technicians and others. When a sufficient reserve of

data has been built for a particular profession (e.g., law), the Company will analyze and report the results.

## VALIDITY

The simplest measure of a test's validity is: does it measure what it purports to measure, i.e., are we satisfied that the measure is designed, constructed and presented so as to test the quality or factor we are intending to test. For example, in tHAB, the worksample called Classification is designed to test the factor we call inductive reasoning. Does the worksample function as a test of inductive reasoning? Years of research have established that it does.

Validity research has been an ongoing function of JOAB for over 55 years, of the Ball Foundation for over 25, and of tHAB since its introduction in paper and pencil. In all, the three organizations have conducted hundreds of studies demonstrating the validity of the individual worksamples shared by them. Many of the instruments on JOAB and BAB are similar to instruments on tHAB, and it is reasonable to relate these instruments to each other. Because of the similar factor structure of these test batteries, it is also possible to relate overall findings among them.

The following validity studies have been carried out on tHAB:

**Convergent Validity.** Results on individual worksamples have been compared to results obtained on other worksamples that measure abilities in the same ability domain. These correlations should show significant relationships between instruments that measure behavior in the same domain. The relationships should not be perfect, however, as that would indicate that the tests were measuring exactly the same ability. For instance, Pitch Discrimination should relate well to the other music worksamples – Rhythm Memory and Tonal Memory – because they are all measuring behavior in the same domain – music ability. Correlations should be in the range  $r = .30$  to  $r = .60$  to be meaningful. The obtained correlations were .32 and .49. In the study conducted by Dr. Holland, *supra*, among 2,100 participants over a six-year span, tHAB demonstrated strong evidence of Convergent Validity. This means that the tests of tHAB showed good evidence of relationship to each other and to other tests that are designed to measure abilities in the same domain.

**Divergent Validity.** Results on individual instruments are compared to results obtained on other instruments that measure abilities in different ability domains. Correlations should be very low – in the range  $r = .00$  to  $r = .29$ . Pitch Discrimination, for instance should show no relationship to Writing Speed. The correlation obtained was .09. The study by Dr. Holland also demonstrated that tHAB presents strong evidence of Divergent Validity. Tests that measure abilities in different domains showed very low correlations with each other

**Relationship of worksamples to other tests measuring the same ability.** The worksamples in tHAB are compared to instruments that have been designed to measure the same construct. This is more specific and criterion-related than Convergent Validity. Tests of tHAB (and similar tests of BAB and JOAB) were found to be related to and to show similar structure, and similar results, as:

1. Government Aptitude Test Battery (GATB). The GATB is universally recognized to be one of the best-constructed test batteries extant. There are literally tens of thousands of profiles in its database. Results from work on the GATB are used to establish profiles of occupational abilities for later studies.
2. Differential Aptitude Tests (DAT). The DAT has been shown to have similar factor structure and similar results to tests of tHAB.
3. Comprehensive Ability Battery (CAB). The CAB has been shown to have similar factor structure and similar results to tests of tHAB.
4. Employee Aptitude Survey (EAS). The EAS has been shown to have similar factor structure and similar results to tests of tHAB.
5. Kit of Factor-Referenced Tests. These tests, developed in a 20-year research program by Guilford, and long recognized as standard for criteria reference in the industry, were used to validate tHAB in 1995. Using a sample of over 200 clients, the tests of tHAB were shown to have very strong relationships to tests of the Kit of Factor-Referenced Tests ( $r = .36$  to  $.65$ ).

**Relationship of tHAB to other well-established ability batteries.** Results on tHAB should show factor structure and highly correlated pattern structure similar to results obtained on other batteries of ability tests.

**Relationship of results on tHAB to occupational choices.** If it is true that people tend to choose occupations for which they are suited by their abilities, and steer away from occupations for which they have very few natural abilities, there should be a significant relationship between occupational choice, and obtained ability profiles.

**Relationship of results on tHAB to success within an occupational field.** If people are relatively more successful in occupations for which they are naturally suited, then there should be a significant correlation between success within an occupational field and the obtained ability profiles. We would predict that the obtained relationship to success will be stronger than that obtained by considering occupational choice alone.

**Relationship of results on tHAB to satisfaction in occupation.** If people tend to be more satisfied in occupations for which they are naturally suited, then we should expect to see a significant relationship between satisfaction within an occupation and the ability profiles of its practitioners. We would predict that this relationship would also be stronger than the relationship obtained by considering occupational choice alone.

In general, research on tHAB has shown replicable evidence of the following:

- The individual's *pattern* of abilities is more stable and more predictive than any one particular score on an ability worksample.
- Abilities remain constant over time. Ability *patterns* are relatively more stable than individual ability scores.
- An individual's pattern of abilities is predictive of:
  1. Occupational choice.
  2. Success within an occupational field.
  3. Satisfaction with an occupational field.
- tHAB matches not only in factorial structure, but also in specific correlational study such well-known and researched ability measures as the CAB, DAT, GATB, Kit of Factor-Referenced Tests, and the Employee Aptitude Survey. This means that tHAB is measuring the same factors as these other well-researched and validated ability measures.

## **OVERALL CRITIQUE**

The Highlands Company continues to work on research establishing the integrity, reliability and validity of tHAB. By introducing the online version in 2004, and by developing its well-conceived and well-organized data base, the Company has taken the lead in establishing the reliability and validity of ability batteries such as tHAB, BAB and JOAB. The data being assembled by the Company is drawn from three different versions of the Battery – the online version, the CD version and the Group X version. Because of the similarity of some worksamples in tHAB with those in BAB and in JOAB, this data will enable Highlands to prove the value of hands-on worksamples which simulate tasks and functions in the school room and in the work place.

Based upon the Company's record of innovation and concern for the reliability of tHAB, there is every expectation that the Company will continue its work in psychometric research.

Both the Technical Manual and the Training Manual are very well written and appear to include all necessary and appropriate instructions. The instructions for administering the test are clear and precise. Although the online version of tHAB may be newer than such other ability batteries as DAT and GATB, it is a well-conceived series of tests that are being updated and improved continuously. tHAB is a good choice for ability assessment as part of a student's over-all career planning both in high school and college. And, increasingly, it has demonstrated its utility in corporate programs in self-development, team building and leadership training.

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