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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample and a personnel evaluation form are also included. (AG)

S-402

Development of USES Aptitude Test Battery

for

Painter, Automobile

(auto. ser.) 845.781

U.S. DEPARTMENT OF LABOR
MANPOWER ADMINISTRATION

Technical Report on Development of USES Aptitude Test Batteries

For . . .

Painter, Automobile (auto serv.) 845.781

S-402

(Developed in Cooperation with the
California State Employment Service)

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November 1967

FOREWORD

The United States Employment Service General Aptitude Test Battery (GATB) was first published in 1947. Since that time the GATB has been included in a continuing program of research to validate the tests against success in many different occupations. Because of its extensive research base the GATB has come to be recognized as the best validated multiple aptitude test battery in existence for use in vocational guidance.

The GATB consists of 12 tests which measure 9 aptitudes: General Learning Ability, Verbal Aptitude, Numerical Aptitude, Spatial Aptitude, Form Perception, Clerical Perception, Motor Coordination, Finger Dexterity, and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, with a standard deviation of 20.

Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, in combination, predict job performance. For any given occupation, cutting scores are set only for those aptitudes which contribute to the prediction of performance of the job duties of the experimental sample. It is important to recognize that another job might have the same job title but the job content might not be similar. The GATB norms described in this report are appropriate for use only for jobs with content similar to that shown in the job description included in this report.

Charles E. Odell, Director
U.S. Employment Service

DEVELOPMENT OF USES APTITUDE TEST BATTERY

FOR

PAINTER, AUTOMOBILE (auto ser.) 845.781-018

S-402

This report describes research undertaken for the purpose of developing General Aptitude Test Battery (GATB) norms for the occupation of Painter, Automobile 845.781. The following norms were established:

GATB Aptitudes	Minimum Acceptable GATB Scores
S - Spatial Aptitude	80
K - Motor Coordination	90
M - Manual Desterity	80

RESEARCH SUMMARY

Sample:

55 male workers employed by various employers in the San Francisco Bay Area, California.

Criterion:

Supervisory Ratings

Design:

Concurrent (test and criterion data were collected at approximately the same time).

Minimum aptitude requirements were determined on the basis of a job analysis and statistical analyses of aptitude mean scores, standard deviations, aptitude-criterion correlations, and selective efficiencies.

Concurrent Validity:

Phi Coefficient = .46 ($P/2 < .0005$)

Effectiveness of Norms:

Only 60% of the non-test-selected workers used for this study were good workers; if the workers had been test-selected with the above norms, 82% would have been good workers. 40% of the non-test-selected workers used for this study were poor workers; if the workers had been test-selected with the above norms, only 18% would have been poor workers. The effectiveness of the norms is shown graphically in Table 1.

TABLE 1

Effectiveness of Norms

	Without Tests	With Tests
Good Workers	60%	82%
Poor Workers	40%	18%

SAMPLE DESCRIPTION

Size:

N = 55

Occupational Status:

Employed workers.

Work Setting:

Workers were employed in various auto repair shops in the San Francisco Bay Area of California. (Employees are listed in the Appendix)

Employer Selection Requirements:

Education: None

Previous Experience: Journeymen auto painters.

Tests: None

Principal Activities:

The job duties of each worker are comparable to those shown on the job description in the Appendix.

Minimum Experience:

All workers in the sample had at least five years total job experience.

TABLE 2

Means, Standard Deviations (SD), Ranges, and Pearson Product-Moment Correlations with the Criterion (r) for Age, Education, and Experience

	Mean	SD	Range	r
Age (Years)	38.9	9.2	21 - 56	.296*
Education (Years)	11.7	1.6	6 - 16	.058
Experience (Months)	197.2	100.1	60 - 462	.358**

* Significant at the .05 level
** Significant at the .01 level

EXPERIMENTAL TEST BATTERY

All 12 tests of the GATB, B-1002B were administered between July 1966 and March 1967.

CRITERION

The criterion data consisted of supervisory ratings of job proficiency made at approximately the same time as the test data were collected. Two ratings were made by the worker's immediate supervisor with a time interval of at least two weeks between ratings.

Rating Scale:

Using Form SP-21, "Descriptive Rating Scale" was used. This scale (see Appendix) consists of nine items covering different aspects of job performance. Each item has five alternatives corresponding to different degrees of job proficiency.

Reliability:

The correlation between the two ratings is .944 indicating satisfactory reliability. The final criterion consisted of the combined score of the two sets of ratings.

Criterion Score Distribution:

Possible Range:	18 - 90
Actual Range:	35 - 90
Mean:	70.9
Standard Deviation:	12.7

Criterion Dichotomy:

The criterion distribution was dichotomized into low and high groups by placing 40% of the sample in the low group to correspond with the percentage of workers considered unsatisfactory or marginal. Workers in the high criterion group were considered "good workers" and those in the low group as "poor workers". The critical score is 71.

APTITUDES CONSIDERED FOR INCLUSION IN THE NORMS

Aptitudes were selected for tryout in the norms on the basis of a qualitative analysis of job duties involved and a statistical analysis of test and criterion data. Aptitudes S, P, and K, which do not have a significant correlation with the criterion, were considered for inclusion in the norms because the qualitative analysis indicated that they were important for the job duties; the sample had relatively high mean scores for S and K and relatively low standard deviations for P and K. With employed workers, a relatively low standard deviation indicates that some sample preselection may have taken place. Tables 3, 4, and 5 show the results of the qualitative and statistical analyses.

TABLE 3

QUALITATIVE ANALYSIS
(Based on the job analysis, the aptitudes listed appear to be important to the work performed.)

Aptitude	Rationale
S - Spatial Aptitude	Must continually visualize the general smooth contour of vehicle part to the whole during sanding and painting processes.
P - Form Perception	Ability to make visual comparisons and discriminations to see differences in color and shades.
K - Motor Coordination	Ability to coordinate eyes and hands accurately and smoothly while operating spray gun at proper distance from surface.
M - Manual Dexterity	Must be able to move hands skillfully and easily while operating spray gun and power sander.

TABLE 4

Means, Standard Deviations (SD), Ranges, and Pearson Product-Moment Correlations with the Criterion (r) for the Aptitudes of the GATB

Aptitude	Mean	SD	Range	r
G - General Learning Ability	91.0	16.5	59-125	.154
V - Verbal Aptitude	91.6	15.2	63-125	.277*
N - Numerical Aptitude	85.9	16.2	48-122	.040
S - Spatial Aptitude	96.9	19.1	58-137	.105
P - Form Perception	89.1	14.7	55-177	.160
Q - Clerical Perception	93.1	12.8	67-132	.240
K - Motor Coordination	97.7	14.7	56-132	.221
F - Finger Dexterity	87.0	16.0	60-125	.030
M - Manual Dexterity	95.9	17.6	49-129	.386**

*Significant at the .05 level
**Significant at the .01 level

TABLE 5

SUMMARY OF QUALITATIVE AND QUANTITATIVE DATA

Type of Evidence	Aptitudes								
	G	V	N	S	P	Q	K	F	M
Job Analysis Data									
Important				X	X		X		X
Irrelevant									
Relatively High Mean				X			X		X
Relatively Low Standard Dev.					X	X	X		
Significant Correlation with Criterion		X							X
Aptitudes to be Considered for Trial Norms		V		S	P		K		M

DERIVATION AND VALIDITY OF NORMS

Final norms were derived on the basis of a comparison of the degree to which trial norms consisting of various combinations of Aptitudes V, S, P, K, and M at trial cutting scores were able to differentiate between the 60% of the sample considered good workers and the 40% of the sample considered poor workers. Trial cutting scores at 5 point intervals approximately one standard deviation below the mean are tried because this will eliminate about one-third of the sample with three aptitude norms. For two aptitude trial norms, minimum cutting scores of slightly more than one standard deviation below the mean will eliminate about one-third of the sample. For four aptitude trial norms, cutting scores of slightly less than one standard deviation below the mean will eliminate about one-third of the sample. The phi coefficient was used as a basis for comparing trial norms. Three sets of norms provided the highest degree of differentiation with identical phi coefficients of .460 and had the same statistical and selective efficiency:

1.	S - 75	K - 90	M - 85
2.	S - 80	K - 85	M - 85
3.	S - 80	K - 90	M - 80

None of the three sets of norms qualified for inclusion into the existing OAP structure. Number 1 was eliminated because it had only one cutting score equal to one standard deviation below the mean while each of the other two sets (#2 and #3) had two cutting scores equal to one standard deviation below the mean. Since all three analysts considered K and M important in their qualitative analyses and, in addition, felt that K was more significant than M in job performance and, since K had the highest mean of all the aptitudes, Number 3 (S - 80, K - 90, and M - 80) was selected as the final set of norms. The validity of these norms is shown in TABle 6 and is indicated by a Phi Coefficient of .46 (statistically significant at the .0005 level).

TABLE 6

Concurrent Validity of Test Norms
S - 80, K - 90, and M - 80

	Nonqualifying Test Scores	Qualifying Test Scores	Total
Good Workers	10	23	33
Poor Workers	17	5	22
Total	27	28	55

Phi Coefficient = .46
Significance Level = $P/2 < .0005$

Chi Square (X^2) = 11.7

DETERMINATION OF OCCUPATIONAL APTITUDE PATTERN

The data for this study did not meet the requirements for incorporating the occupation studied into any of the 36 OAP's included in Section II of the Manual for the General Aptitude Test Battery. The data for this sample will be considered for future groupings of occupations in the development of new occupational aptitude patterns.

A-P-P-E-N-D-I-X

Workers were employed by the following: San Pablo Body, Shepard Cadillac, Fidelity Oldsmobile, Maggini Chevrolet and Hustead's Auto Repairing in Berkeley, California. Pacific Radiator, Lloyd Wise Oldsmobile, Phillipi, Inc., Jackson Goldie Ford, Hanzel Body Shop, F. H. Dailey Chevrolet, W. H. Strehle Co., Kleinman Cole Body Shop, Doten Pontiac, Cochran and Celli, and City of Oakland in Oakland, California. Carl's Body Shop, Perry & Key, and Auto Body Hospital in Hayward, California. Richmond Motors and Claar Chevrolet in Richmond, California. Dailey Chevrolet and San Leandro Body in San Leandro, California. Central Chevrolet and Di Giulio Pontiac in Fremont, California. Carlsen-Klemm Body Shop, Alioto's Body-Fender, Gough Auto Repair, Cecil Whitebone Ford, Kenneth Larkins Co., Les Vogel Chevrolet, British Motor Car Distributors, European Motors Body Shop, J. Killeen Auto Painting Co., R & J Auto Body, H & S Auto Reconstruction, in San Francisco, California. Concourse Body Shop in San Carlos, California. Dick Foster Auto Body Repair, Santa Clara, California. San Jose Ford, Motor Body Co., Pierce Arrow Body Shop, Tiernan's, Bob Olinger Auto Body, Courtesy Chevrolet, and City Body Repair in San Jose, California. Kaiser Cement Co., Permanente, California. Moore Motor Co., Los Gatos, California.

SP-21
Rev. 2/61

A-P-P-E-N-D-I-X

DESCRIPTIVE RATING SCALE
(For Aptitude Test Development Studies)

Score___

RATING SCALE FOR _____
D. O. T. Title and Code

Directions: Please read Form SP-20, "Suggestions to Raters", and then fill in the items listed below. In making your ratings, only one box should be checked for each question.

Name of Worker (print) _____
(Last) (First)

Sex: Male_____ Female_____

Company Job Title: _____

How often do you see this worker in a work situation?

☐ See him at work all the time.

☐ See him at work several times a day.

☐ See him at work several times a week.

☐ Seldom see him in work situation.

How long have you worked with him?

☐ Under one month.

☐ One to two months.

☐ Three to five months.

☐ Six months or more.

RATER_____TITLE_____DATE_____

A. How much work can he get done? (Worker's ability to make efficient use of his time and to work at high speed.)

☐ 1. Capable of very low work output. Can perform only at an unsatisfactory pace.

☐ 2. Capable of low work output. Can perform at a slow pace.

☐ 3. Capable of fair work output. Can perform at an acceptable but not a fast pace.

☐ 4. Capable of high work output. Can perform at a fast pace.

☐ 5. Capable of very high work output. Can perform at an unusually fast pace.

B. How good is the quality of his work? (Worker's ability to do high-grade work which meets quality standards.)

☐ 1. Performance is inferior and almost never meets minimum quality standards.

☐ 2. The grade of his work could stand improvement. Performance is usually acceptable but somewhat inferior in quality.

☐ 3. Performance is acceptable but usually not superior in quality.

☐ 4. Performance is usually superior in quality.

☐ 5. Performance is almost always of the highest quality.

C. How accurate is he in his work? (Worker's ability to avoid making mistakes.)

☐ 1. Makes very many mistakes. Work needs constant checking.

☐ 2. Makes frequent mistakes. Work needs more checking than is desirable.

☐ 3. Makes mistakes occasionally. Work needs only normal checking.

☐ 4. Makes few mistakes. Work seldom needs checking.

☐ 5. Rarely makes a mistake. Work almost never needs checking.

D. How much does he know about his job? (Worker's understanding of the principles, equipment, materials and methods that have to do directly or indirectly with his work.)

☐ 1. Has very limited knowledge. Does not know enough to do his job adequately.

☐ 2. Has little knowledge. Knows enough to "get by."

☐ 3. Has moderate amount of knowledge. Knows enough to do fair work.

☐ 4. Has broad knowledge. Knows enough to do good work.

☐ 5. Has complete knowledge. Knows his job thoroughly.

E. How much aptitude or facility does he have for this kind of work? (Worker's adeptness or knack for performing his job easily and well.)

☐ 1. Has great difficulty doing his job. Not at all suited to this kind of work.

☐ 2. Usually has some difficulty doing his job. Not too well suited to this kind of work.

☐ 3. Does his job without too much difficulty. Fairly well suited to this kind of work.

☐ 4. Usually does his job without difficulty. Well suited to this kind of work.

☐ 5. Does his job with great ease. Exceptionally well suited for this kind of work.

F. How large a variety of job duties can he perform efficiently? (Worker's ability to handle several different operations in his work.)

☐ 1. Cannot perform different operations adequately.

☐ 2. Can perform a limited number of different operations efficiently.

☐ 3. Can perform several different operations with reasonable efficiency.

☐ 4. Can perform many different operations efficiently.

☐ 5. Can perform an unusually large variety of different operations efficiently.

G. How resourceful is he when something different comes up or something out of the ordinary occurs? (Worker's ability to apply what he already knows to a new situation.)

☐ 1. Almost never is able to figure out what to do. Needs help on even minor problems.

☐ 2. Often has difficulty handling new situations. Needs help on all but simple problems.

☐ 3. Sometimes knows what to do, sometimes doesn't. Can deal with problems that are not too complex.

☐ 4. Usually able to handle new situations. Needs help on only complex problems.

☐ 5. Practically always figures out what to do himself. Rarely needs help, even on complex problems.

H. How many practical suggestions does he make for doing things in better ways? (Worker's ability to improve work methods.)

☐ 1. Sticks strictly with the routine. Contributes nothing in the way of practical suggestions.

☐ 2. Slow to see new ways to improve methods. Contributes few practical suggestions.

☐ 3. Neither quick nor slow to see new ways to improve methods. Contributes some practical suggestions.

☐ 4. Quick to see new ways to improve methods. Contributes more than his share of practical suggestions.

☐ 5. Extremely alert to see new ways to improve methods. Contributes an unusually large number of practical suggestions.

I. Considering all the factors already rated, and only these factors, how acceptable is his work? (Worker's "all-around" ability to do his job.)

☐ 1. Would be better off without him. Performance usually not acceptable.

☐ 2. Of limited value to the organization. Performance somewhat inferior.

☐ 3. A fairly proficient worker. Performance generally acceptable.

☐ 4. A valuable worker. Performance usually superior.

☐ 5. An unusually competent worker. Performance almost always top notch.

FACT SHEET

Job Title: Painter, Automobile (auto ser.) 845.781-018

Job Summary: Repaints automotive vehicles such as buses, trucks, and automobiles: Feather-edges surface by power and hand sanding. Protects areas not to be painted with masking tape and paper. Sprays surface with primer and/or sealer using Spray Gun. Selects paints to match vehicle color and sprays on finish coat.

Work Performed: Prepares for painting: Drives vehicle to work area. Reads job order and instructions attached to windshield. Feather-edges surface area to be painted using portable electric or pneumatic powered Sander. Hand sands using finer grade sandpaper, checking smoothness by sight and feel to attain desired surface texture. Hand sands only when area to be painted is small. Washes surface with solvent-saturated rag to remove wax and grease. Attaches paper and masking tape to protect surface areas not to be painted. Selects primer and thinner at supply bench and pours appropriate amounts into clean spray gun cup for desired viscosity. Blends primer and thinner mixture by stirring with clean putty knife or stirring paddle. Attaches cup to spray gun; locks into position by turning cup clockwise. Attaches spray gun to air hose by pushing male coupling of gun into female coupling of air hose. Directs gun away from surface and squeezes trigger for one or two seconds to bleed line. When necessary, turns valves located on spray gun to adjust fan (width) and/or pressure (quantity) of spray. Holds gun 6 - 8 inches perpendicular to surface, squeezes trigger, and directs spray by moving gun slowly in a side to side motion, covering entire surface to be painted. Hand rubs primed surface, when dry, to desired smoothness with one or more of the following: (a) fine grade sandpaper (b) fine grade sandpaper dipped in solvent or water (c) rag saturated with solvent or rubbing compound. Checks smoothness by sight and feel. Cleans surface by wiping with dry cloth. Occasionally, pushes male coupling of dusting gun into female coupling of air hose and cleans surface with jets of air produced by squeezing trigger of dusting gun. Occasionally sprays sealer or additional coat of primer to dry surface.

Spray paints prepared surface: Disassembles spray gun at work bench using small wrench and screwdriver. Places disassembled parts in solvent and cleans with tube brush and rag. Dries parts with clean cloth and reassembles gun. Cleans spray-gun cup by thoroughly rinsing with solvent and scrubbing interior surface with rag. Dries cup with dry clean cloth. Selects proper paint by matching manufacturer's color code number, located on frame of vehicle, with paint code number in catalog. Occasionally selects and hand mixes paints following directions in paint catalog or by visual comparison to match vehicle color. Pours appropriate amount(s) of selected paint(s) through cone-shaped filter into clean sprayer cup. Adds appropriate amount of thinner for desired viscosity and blends mixture using putty knife or stirring paddle. Locks cup onto gun, connects gun to air hose, and sprays paint onto surface as described above. Touches up areas inaccessible to spray gun using small paint brush. Sprays surface with as many coats of paint as required. Removes masking tape and paper from vehicle when final coat is dry. Drives vehicle to designated parking area for customer pick up.

Related tasks: When necessary, removes accessories such as license plates, insignias, and ornaments. Repairs minor damages to spray gun. Directs heat lamps on surface to shorten drying time. Occasionally sprinkles water on floor of work area to keep dust at a minimum. Replaces worn sandpaper on sanders using hand tools and glue. Occasionally paints stripes and lettering on vehicles. Polishes surface as required: Applies polishing compound onto surface from plastic squeeze bottle; buffs surface with portable electric buffer.

Effectiveness of Norms:

Only 60% of the non-test-selected workers used for this study were good workers; if the workers had been testeselected with the S-402 norms, 82% would have been good workers. 40% of the non-test-selected workers used for this study were poor workers; if these workers had been test-selected with the S-402 norms, only 18% would have been poor workers.

Applicability of S-402 Norms:

The aptitude test battery is applicable to jobs which include a majority of the job duties described above.


DEPARTMENT OF LABOR
UNITED STATES OF AMERICA


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