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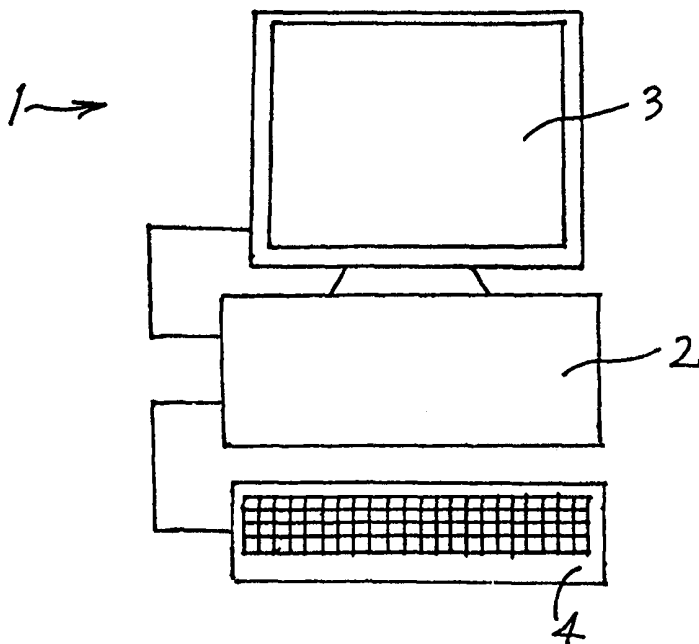
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(54) Title: AN APPARATUS FOR CONDUCTING A TEST

(57) Abstract

There is disclosed an apparatus in the form of a personal computer (1) for conducting a test on a candidate. The computer includes a desktop unit (2) which houses a motherboard, one or more CPU's and any necessary peripheral drivers and/or network cards, none of which are explicitly shown. Computer (1) also includes first means in the form of a screen (3) for presenting a series of questions to the candidate. Also provided are second means in the form of a keyboard (4) for obtaining from the candidate an answer to each of the questions. The CPU included within computer (1) includes timer means which, in this case, is utilised for determining the time taken for the candidate to answer each of the questions.

TITLE: **AN APPARATUS FOR CONDUCTING A TEST**

FIELD OF INVENTION

The present invention relates to testing and in particular to an apparatus for conducting a test.

5   The invention has been developed primarily for testing the suitability of a candidate to work in a predetermined position within an organisation and will be described hereinafter with reference to that application. However, the invention is not limited to that particular field of use and is also suitable for conducting other tests.

BACKGROUND OF THE INVENTION

10   Hitherto, it has been known to subject candidates applying for a position within an organisation to a written test. This testing is intended to provide the potential employer with an indication of the relative strengths and weaknesses of the candidates and whether any are well suited to the position or positions on offer.

Testing of this kind is usually in the form of one or more sets of multiple choice

15   questions although other forms of questions are used in some tests. The questions are generally set out on a question paper which is provided to the candidates for a predetermined time. During this time the candidates must mark respective separate answer sheets with a pencil or pen to signify their choice of answer to the questions. At the end of the predetermined time the answer sheets are collected and collated for

20   subsequent analysis. Is also known to utilise tests which are not timed.

Such testing is labour intensive and time consuming. Another major disadvantage is that the results from such tests are highly susceptible to error due to scoring mistakes by the tester. Additionally, error susceptibility easily arises should the candidate guess

the answers.

DISCLOSURE OF THE INVENTION

It is an object of the present invention, at least in the preferred embodiment, to

overcome or substantially ameliorate at least one of the disadvantages of the prior art, or

5   at least to provide a useful choice.

According to a first aspect of the invention there is provided an apparatus for

conducting a test on a candidate, the apparatus including:

first means for presenting a series of questions to the candidate;

second means for obtaining from the candidate an answer to each of the questions;

10   and

timer means for determining the time taken for the candidate to answer each of the

questions.

Preferably, the apparatus includes third means for obtaining from the candidate an

indication of their confidence that any one or more of the answers were correct.

15   According to a second aspect of the invention there is provided an apparatus for

conducting a test on a candidate, the apparatus including:

first means for presenting a series of questions to the candidate;

second means for obtaining from the candidate an answer to each of the questions;

third means for obtaining from the candidate an indication of their confidence that

20   any one or more of the answers were correct; and

timer means for determining the time taken for the candidate to answer the

questions.

Preferably, the timer means determines the time taken for the candidate to answer

each question.

Preferably also, the first means sequentially presents the series of questions. Even more preferably, the answers to the questions, once provided by the candidate, can not be changed.

5   In a preferred form, the third means allows the candidate to nominate one of a plurality of confidence bands which best corresponds with their confidence that an answer was correct. More preferably, at least some of the questions are multiple choice, wherein the number of choices being available corresponds to the number of confidence bands. In other embodiments the third means prompts the candidate to provide a number

10   within a predetermined range to indicate their degree of confidence.

Preferably, the apparatus includes fourth means responsive to the first means, the second means and the timer means for indicating the results of the test.

According to a third aspect of the invention there is provided a method for conducting a test on a candidate, the method including the steps of:

15   presenting a series of questions to the candidate;

obtaining from the candidate an answer to each of the questions; and

determining the time taken for the candidate to answer each of the questions.

Preferably, the method includes the additional step of obtaining from the candidate an indication of their confidence that any one or more of the answers were correct.

20   According to a fourth aspect of the invention there is provided a method for conducting a test on a candidate, the method including the steps of:

presenting a series of questions to the candidate;

obtaining from the candidate an answer to each of the questions;

- 4 -

obtaining from the candidate an indication of their confidence that any one or more

of the answers were correct; and

determining the time taken for the candidate to answer the questions.

Preferably, the method includes the step of determining the time taken for the

5   candidate to answer each question.

Preferably also, the series of questions is sequentially presented. Even more

preferably, the answers to the questions, once provided by the candidate, can not be

changed.

In a preferred form, the candidate must nominate one of a plurality of confidence

10   bands which best corresponds with their confidence that an answer was correct. More

preferably, at least some of the questions are multiple choice, wherein the number of

choices being available corresponds to the number of confidence bands. In other

embodiments the candidate is prompted to provide a number within a predetermined

range to indicate their degree of confidence.

15   Preferably, the method includes the step of indicating the results of the test.

BRIEF DESCRIPTION OF THE DRAWINGS

A preferred embodiment of the invention will now be described, by way of

example only, with reference to the accompanying drawings and Tables, in which:

Figure 1 is a schematic representation of an apparatus according to the invention;

20   Figure 2 is a schematic representation of a number of like apparatus interconnected

to allow simultaneous testing of a number of candidates;

Tables 1, 2, and 3 illustrate scores achieved by candidates for Fluid Intelligence,

Crystallised Intelligence and Quantitative Knowledge respectively;

- 5 -

Table 4 provides summary statistics for the data provided in Table 1, 2 and 3; and

Table 5 provides a summary of the indicative results provided by the various tests.

PREFERRED EMBODIMENTS OF THE INVENTION

Referring to Figure 1, there is shown an apparatus in the form of a personal

5   computer 1 for conducting a test on a candidate. The computer includes a desktop unit 2

which houses a motherboard, one or more CPU's and any necessary peripheral drivers

and/or network cards, none of which are explicitly shown. Computer 1 also includes

first means in the form of a screen 3 for presenting a series of questions to the candidate.

Also provided are second means in the form of a keyboard 4 for obtaining from the

10   candidate an answer to each of the questions. As would be appreciated by those skilled

in the computing art, the CPU included within computer 1 includes timer means which,

in this case, is utilised for determining the time taken for the candidate to answer each of

the questions.

More particularly, computer 1, once initialised, sequentially displays on screen 3 a

15   series of questions. By way of illustration these questions will be designated as q_1, q_2,

..., q_n. As a question is displayed the candidate is prompted to choose one of a plurality

of answers, only one of which is correct. By way of illustration these answers will be

designated as a_1, a_2, ..., a_n. The candidate effects their choice, in this embodiment, by

using keyboard 4 to type a number which corresponds to the number displayed on the

20   screen as designating the answer selected by the candidate. In other embodiments the

candidate effects the choice by moving a cursor across screen 3 in response to

manipulation of either keyboard 4 or a mouse (not shown). In still further embodiments

use is made of a specialised input device for allowing the candidate to enter their choice.

- 6 -

For example, a numeric keypad or a joystick.

As each question q_1, q_2, ..., q_n is displayed and the respective answer a_1, a_2, ..., a_n sequentially given, computer 1 calculates the respective time periods t_1, t_2, ..., t_n which elapse. Accordingly, it is possible to determine both the total time the candidate takes to

5   answer all questions q_1, q_2, ..., q_n, and the time taken for the candidate to answer each of those questions.

For at least some of the questions the candidate is prompted to indicate their confidence that the answer given was correct. Preferably, computer 1 prompts for such an indication for at least half of questions q_1, q_2, ..., q_n. However, in tests where there

10   are a large number of questions computer 1 prompts for the indication of confidence less often. Preferably, the confidence indications are sought in respect of the hardest of each type of test. In this embodiment computer 1 prompts for an indication of confidence for each question q_1, q_2, ..., q_n. This leads to a plurality of confidence indicators which, for convenience, will be designated as c_1, c_2, ..., c_n. Once the candidate has answered the

15   questions q_1, q_2, ..., q_n, computer 1 stores answers a_1, a_2, ..., a_n, time periods t_1, t_2, ..., t_n and confidence indicators c_1, c_2, ..., c_n in a predetermined file for subsequent processing.

More particularly, each answer is allocated a score which is weighted in accordance with a predetermined scale. In the present embodiment all the weightings are equal. In the event the answer chosen by the candidate is the correct one, then the

20   score is allocated to the candidate. The value of all the scores allocated to the candidate are then added together to provide a total score T_s. In this embodiment T_s is expressed as a percentage and lies within the range of 0 to 100%.

Separately, indicators c_1, c_2, ..., c_n are processed to provide an overall indicator for

confidence for that particular candidate, which will be referred to as T_c. In this embodiment the confidence indicators correspond to each answer and are allocated the same respective scores, in that they weighted the same as the corresponding answer. The resulting overall confidence indicator T_c is expressed as a percentage and falls within the

5   range of 0 to 100%. In other embodiments where a confidence indicator is not obtained for each answer, the overall confidence indicator T_c is derived from a weighted average of the separate confidence indicators that are obtained.

In this embodiment, when obtaining an indication of the confidence of the candidate that an answer is correct, the candidate must select from one of at least three

10   discrete confidence bands. In more preferred embodiments the candidate must select from one of at least five confidence bands. These bands are quantified in percentage terms. For example, one particular multiple choice question presents two alternatives from which to choose the answer. In this case the lowest confidence band has a lower limit of 50%, which corresponds to a guess. However, in other questions there are five

15   alternatives from which to choose an answer, and the lowest confidence band has a lower limit of 20%, which also corresponds to a guess. In all cases the upper limit of the upper confidence band is 100%.

The total score T_s for the candidate is adjusted in accordance with the overall confidence indicator T_c to provide a final result or a self monitoring score T_{sm} for the

20   test. Accordingly, the T_{sm} provides an indication of the level of self monitoring achieved by the candidate.

In some tests T_{sm} is calculated in the following manner. First, the total score T_s is expressed as a percentage of the maximum possible total score. Second, the confidence

or self monitoring T_c is expressed as an average percentage for each of the indications provided, whether that occurred after each question or only a selected number of questions. The final result T_{sm} is then calculated in accordance with the formula:

$$T_{sm} = | T_c - T_s |$$

5   which lies within the range of 0 to 100%.

T_{sm} is indicative of the extent to which the candidate has insight into what he or she does or does not know with respect to the questions in the test. This indication is used, in combination with T_c and T_s in isolation, to assist in the assessment of the candidate for either certain tasks or, if the position in question is well defined, for that

10   position. In some circumstances it is known to predefine a range of suitable T_{sm} that is appropriate for a position based upon the tasks that are needed to be carried out. In the event the test yields a T_{sm} in that range the candidate is considered suitable.

Generally, a low T_{sm} is favourable, although different positions have different sensitivities and acceptable ranges. For some tests and positions T_{sm} in the range of 0 to

15   7 is considered ideal, while a T_{sm} in the range of 8 to 12 is acceptable. This effect is, however, modulated by the acceptable levels specified by the organisation offering the position in question.

The apparatus and method according to the invention have been developed in conjunction with, and are particularly suited, although not limited, to carrying out tests

20   which have been recently developed by Dr Lazar Stankov. These test are referred to as Stankov's Tests of Cognitive Abilities. The tests are designed to be short, cover a reasonably broad range of cognitive abilities and provide a maximum amount of information to the personnel selection professionals. The questions and techniques used

are intended to assist in obtaining an indication of the candidate's ability to make

decisions under conditions of uncertainty, their mental speed, and their mental capacity.

More particularly, Stankov's Tests of Cognitive Abilities are based upon the

theory of fluid and crystallised intelligence (G_f/G_c theory). This widely accepted theory

5   states that intelligence is multi-faceted and is made up of a number of abilities which

affect our performance educationally, socially and in the "world of work". The theory

enunciates a number of distinct types of broad abilities and that these involve different

cognitive processes, share different predictive validities and are differentially sensitive to

intervention. These abilities also appear subject to different sets of learning and genetic

10   influences. The eight broadly identified abilities are:

      1. fluid ability (G_f);

      2. crystallised ability (G_c);

      3. broad visualisation (G_v);

      4. broad auditory function (G_a);

15   5. short term acquisition and retrieval (SAR);

      6. tertiary storage and retrieval (TSR);

      7. broad speediness function (G_s); and

      8. broad quantitative ability (G_q).

Stankov's Tests of Cognitive Abilities are mostly concerned with G_f, G_c and G_q.

20   From a statistical point of view each ability is equally important. However, most

work has focused on the fluid and crystallised abilities, which share important common

features. For example, both are characterised by processes of perceiving relationships,

logical reasoning, abstraction, concept formation, problem solving and the like.

Moreover, both can be measured by timed tests or power, that is untimed, tests. The

testing can take the form of material presented in any of the following: pictorial-spatial;

verbal-symbolic; or verbal-semantic.

The main distinguishing feature between G_f and G_c is the amount of formal

5   education and acculturation that is present either in the content of, or operations required

during, the tests used to measure these abilities. It is well established that G_f depends to

a much smaller extent on formal education experiences than does G_c.

G_f and G_c also show distinct developmental trends during adulthood. Thus, while

G_c remains constant or show slight increment over the course of an individual's life

10   span, G_f generally declines as a function of age. This may largely be accounted for by

the proposed mechanisms underlying the G_f/G_c distinction. While G_f is thought to

depend on the capacity of working memory, G_c is thought to depend on the long-term

memory store and the organisation of information within that store. Working memory

deteriorates with age as a function of neurological decay, while long term store is less

15   prone to such effects.

According to G_f/G_c theory, the presence of broad abilities other than G_f and G_c

indicates that performance on all cognitive tasks depends not only on "higher" mental

processes, but also on processes that have been viewed as "lower" level functions in

more traditional theories of intelligence. For example, the existence of G_a and G_v

20   indicates that some people are more efficient at processing information that is auditory in

nature, whilst others are more efficient at processing information acquired through the

visual medium.

The theory is discussed in more detail in the following references, the disclosure of

which is incorporated herein by way of cross reference:

Carroll, J.B. (1913). Human Cognitive Abilities: A Survey of Factor-Analytic

Studies. New York: Cambridge University Press; and

Horn, J.L., & Noll, J. (1994). A system for understanding cognitive capabilities:

5   A theory and the evidence on which it is based. In D.K. Detterman, (Ed), Current Topics

in Human Intelligence: Volume IV: Theories of Intelligence. Norwood, NJ: Ablex

Publishing Corporation.

Stankov's Tests of Cognitive Abilities include a battery of tests for measuring

three broad ability factors that are deemed essential for successful performance in a wide

10   variety of contemporary working environments. These are:

1.   Fluid intelligence (Gf). This is measured by two tests:

a. Swaps test;

b. Triplets test;

Both these tests have good psychometric properties and embody sound principles

15   from experimental cognitive psychology. They will be described in more detail below.

2.   Crystallised intelligence (Gc). This is measured by two tests:

c. Vocabulary test;

d. Proverbs Matching test;

The Vocabulary test is a common synonyms vocabulary test. The Proverbs test

20   requires the examinee to match two proverbs according to their meaning or their relevant

message.

3.   Broad quantitative ability (Gq). This is measured by two tests:

e. Numerical Operations;

- 12 -

f. Financial Reasoning.

The Numerical Operations test is a common measure of the facility to carry out

elementary arithmetic operations. The Financial Reasoning test is developed for and is

most suitable to part of a selection battery for the entry-level jobs in financial

5   institutions.

It is possible to classify the above six tests with respect to subjective difficulty. In

the listing, the first test in each group is usually seen as somewhat easier than the second.

Stankov's Tests of Cognitive Abilities contain three features that have not been a

part of most previous selection batteries. These are:

10   1.   Systematic measurement of complexity and difficulty in tests of fluid

                   abilities.

An important aspect of good tests of fluid abilities is the existence of items that

systematically vary in difficulty. This allows for a fine discrimination among

individuals along the relevant dimension. In the past, this gradation was accomplished

15   by selecting items in the post-hoc way, that is, after piloting the test and during the

process of item analysis. The tests of the present battery consist of items that are

selected a priory after the analysis of cognitive processes that are called upon during the

solution process. This increase in difficulty is directly related to demands placed on

important capacity constructs like working memory and attentional resources. Thus, the

20   Swap items that require one swap are easier than items that require more than one swap

and a similar increase in difficulty is present in the Triplets test. Laboratory studies have

shown that systematic increase in difficulty is supported by the data.

Furthermore, the increased item difficulty is also characterised by an increase in

- 13 -

the tests' correlations with traditional tests of intelligence. In other words, they also

increase in complexity. This increase in correlation is not a necessary feature of the

increase in difficulty - in most tests of intelligence easy items have the same correlation

with the IQ scores as do the difficult items. For that reason, the present tests have an

5   advantage over the older tests - they can measure a wide range of difficulty and, at the

hardest level, the items are improved measures of fluid abilities for theoretically

important reasons. On the applied side, we now know that these two tests are useful

assessment devices during the different stages of recovery from brain injury.

2.   Measurement of speed of test-taking.

10   Much of the recent work on intelligence is directed at establishing the empirical

link between fluid intelligence and speed of mental operations. It is important to keep in

mind the fact that speed is not a unitary construct - there are several types of mental

speed and each one of these may have different relationship to intelligence. While the

measurement of mental speed is important from both theoretical and practical points of

15 view, it is wrong to see mental speed as the basic process of intelligence. The present

battery measures one of the mental speed constructs - the speed of test-taking.

From the practical viewpoint, the information on the speed of test-taking may be

useful for the selection of personnel for jobs requiring a quick decision under time

pressure. It is also useful to compare people with respect to speed-accuracy trade-off

20 that is, are those who are quick also prone to committing more errors. Finally, it is also

known that speed of mental processing is closely linked to the age-related cognitive

changes in the human organism. Older people are considerably slower than young.

However, there are significant individual differences in the aging process. The

- 14 -

information about the speed of test taking may be useful in selecting older people who

have retained the speed characteristic of the younger members of the population.

3.   Measurement of self-confidence and self-monitoring.

Three tests in this battery provide information about the self-confidence in the

5   answers provided to test items. This work derives from research on decision making

under conditions of uncertainty. Confidence rating scores on their own provide an

indication about the ego-related personality trait of self-confidence which is located

somewhere on the borderline between personality and intelligence. In many situations,

the accuracy of one's assessment of the situation is not the only or even the most

10   important information that directs action. Confidence in that judgement may be the

critical feature. Furthermore, the difference between accuracy scores and confidence that

are provided in the report section tell us how good we are in knowing what we know and

what we do not know. This difference or bias is the information about self-monitoring.

Some people have good insight into their own performance while others show a

15   pronounced bias.

It can be expected that people with high self-confidence tend to be "managerial

material" in organisations. They should show more initiative and, in general, provide

leadership in team work.

The design of this battery of tests was guided by the following considerations:

20   a.   Relatively quick assessment of cognitive abilities. On average a

respondent should be able to complete each test within ten minutes.

b.   Reliable for a wide range of jobs.

Overall, the tests of this battery represent a sample of abilities that are captured by

the general factor and contain considerably more information than what can be easily obtained from known tests.

Each of the individual tests in Stankov's Tests of Cognitive Abilities are performed through use of the invention. That is, the tests are embodied in a computer program which, once initialised, runs on computer 1. The candidate is sequentially presented with a series of questions from one or more of the Stankov's Tests and prompted to select an answer. The Swaps test involves displaying on screen 3 an array of at least three linearly spaced apart visually distinct figures or pictures, as well as a set of instructions. The instructions ask the candidate to carry out a mental swap of the figures and to prompt the computer once they wish to provide and answer. Once so prompted, the instructions and array are no longer displayed, but rather a number of alternative arrays are shown with different relative positioning of the pictures. The candidate must them select one of the alternative provided. Once this answer is provided computer 1 displays the next question. Generally, one or both of the number of pictures and the complexity of the instructions progressively increases for subsequent questions.

In this particular embodiment each array in the different questions includes three pictures.

The time taken for the candidate to review and answer each question is measured by computer 1. Moreover, in this embodiment computer 1, after each question, asks the candidate to indicate their level of confidence that the answer was correct. In other embodiment the level of confidence is not measured for the Swaps test.

Once the Swaps test is completed, computer 1 automatically progresses to the Triplets test. The input provided by the candidate to computer 1 during the Swaps and

- 16 -

Triplets test are compiled and processed to give the following:

- Swaps Accuracy (%) = the number of correct answers divided by the total

    number of questions;

- Swaps Reaction Time (seconds) = the sum of the time taken to answer each

    question, divided by the total number of questions;

- Triplets Accuracy (%) = the number of correct answers divided by the number

    of questions;

- Triplets Reaction Time (seconds) = the sum of the time taken to answer each of

    the questions, divided by the total number of questions;

- Triplets Self Confidence (%) = the sum of the confidence ratings for each

    question attempted divided by the total number of questions; and

- Triplets Self Monitoring (%) = Triplets Self Confidence minus Triplets

    Accuracy.

Once the Triplets test is completed computer 1 progresses to the additional tests to

gain indicators to Crystallised Intelligence. The input provided by the candidate to

during these tests are compiled and processed to give the following:

- Vocabulary Accuracy (%) = the number of correct answers divided by the total

    number of questions in the test;

- Vocabulary Reaction Time (seconds) = the sum of the time taken to answer

    each of the questions, divided by the total number of questions;

- Proverbs Matching Accuracy (%) = the number of correct answers divided by

    the total number of questions in the test;

- Proverbs Matching Reaction Time (seconds) = the sum of the time taken to

answer each question, divided by the total number of questions;

- Proverbs Matching Self Confidence (%) = the sum of the confidence ratings for each question attempted divided by the number of questions attempted; and

- Proverbs Matching Self Monitoring (%) = Proverbs Matching self confidence minus Proverbs Matching Accuracy.

Computer 1 then progresses to the final tests to gain indicators to Quantitative Knowledge. The input provided by the candidate during these tests are compiled and processed to give the following:

- Numerical Operations Accuracy (%) = the number of correct answers divided by the total number of questions in the test;

- Numerical Operations Reaction Time (seconds) = the sum of the time taken to answer each question, divided by the total number of questions;

- Financial Reasoning Accuracy (%) = the number of correct answers divided by the total number of questions in the test;

- Financial Reasoning Reaction Time (seconds) = the sum of the time taken to answer each question, divided by the total number of questions;

- Financial Reasoning Self Confidence (%) = the sum of the confidence ratings for each answer divided by the number of questions; and

- Financial Reasoning Self Monitoring (%) = Financial Reasoning Self Confidence minus Financial Reasoning Accuracy.

Once all the tests are completed computer 1 produces summary statistics for the candidate which, in this embodiment, include the following:

- Fluid Intelligence (percentage correct) = the sum of the accuracy scores for

- 18 -

Swaps and Triplets, divided by two (2);

- Crystallised Intelligence (percentage correct) = the sum of the accuracy scores for Vocabulary and Proverb Matching, divided by two (2);

- Quantitative Knowledge (percentage correct) = the sum of the accuracy scores for Numerical Operations and Financial Reasoning, divided by two (2);

- Speed (seconds) = the sum of the speed scores for all tests divided by six (6);

- Overall Self Confidence (%) = the sum of all Confidence Ratings for Triplets, Proverbs Matching and Financial Reasoning, divided by three (3); and

- Overall Self Monitoring (%) = overall self confidence for Triplets, Proverbs Matching and Financial Reasoning minus the overall accuracy for the same three tests.

The results provided by computer 1 can be represented in tabular, graphical or other forms. Examples of such results for candidates c, d, e and f are provided in Tables 1, 2, 3 and 4. In this embodiment the tabulated results are not displayed to the candidate. In other embodiments some or all of the data is so displayed.

Reference is also made to Table 5 which sets provides a brief explanation of the indications provided by the various tests outlined above.

The invention, through the use of time measurement, self confidence ratings and a derivation of a measure of self monitoring, allows the assessor to gain a greater insight into cognitive ability of the candidate. Unlike the prior art systems, reliance need not be placed only upon the number of correct answers and the total time taken to conduct a test.

In some embodiments, and as illustrated in Figure 2, a plurality of like computers 1

- 19 -

are interconnected in a LAN to allow simultaneous testing of a plurality of candidates.

In the configuration shown, computers 1 are interconnected by cabling 6 and centrally

controlled by a server 7.

Although the invention has been described with reference to a specific example, it

5   will be appreciated by those skilled in the art that it may be embodied in many other

forms. For example, the results, in some embodiments, are expressed both in relative

and absolute terms. That is, not only are the actual results of the test for each candidate

provided, but how that candidate performed relative to other candidates who underwent

the same test.

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- 20 -

Table 1

FLUID INTELLIGENCE					
Name	Swaps Accuracy	Swaps Reaction	Triplets Accuracy	Triplets Reaction	Triplets Self-Confidence	Triplets Self-Monitoring
c	56%	17.66 sec	89%	2.95 sec	95%	6%
d	28%	15.84 sec	94%	3.36 sec	67%	-27%
b	18%	24.24 sec	83%	6.67 sec	66%	-17%
e	18%	10.66 sec	87%	3.74 sec	99%	-12%
a	62%	16.30 sec	90%	3.40 sec	67%	-23%
f	15%	17.07 sec	25%	5.43 sec	72%	47%
Norm Average	38%	16.9 sec	4.0 sec	4.0 sec	95%	8%

Table 2

CRYSTALLISED INTELLIGENCE					
Name	Vocabulary Accuracy	Vocabulary Reaction	Proverbs Accuracy	Proverbs Reaction	Proverbs Self-Confidence	Proverbs Self-Monitoring
c	80%	5.92 sec	60%	23.66 sec	60%	0%
d	90%	7.26 sec	20%	29.53 sec	43%	23%
b	60%	18.32 sec	25%	30.53 sec	42%	17%
e	93%	4.20 sec	65%		98%	33%
a	73%	9.51 sec	45%	27.53 sec	81%	36%
f	23%	7.32 sec	25%	10.77 sec	70%	45%
Norm Average	69%	9.7 sec	39%	22.1 sec	55%	10%

Table 3

QUANTITATIVE KNOWLEDGE					
Name	Numerical Accuracy	Numerical Reaction	Financial Accuracy	Financial Reaction	Financial Self-Confidence	Financial Self-Monitoring
c	82%	11.01 sec	25%	41.24 sec		
d	36%	11.48 sec	16%	53.54 sec		
b	62%	11.33 sec	0%	61.65 sec	7%	7%
e	70%	11.11 sec	25%	51.38 sec	42%	17%
a	82%	11.07 sec	58%	48.98 sec	83%	25%
f	14%	11.75 sec	8%	35.16 sec	68%	60%
Norm Average	57%	15.3 sec	29%	45.8 sec	53%	30%

Table 4

SUMMARY STATISTICS						
Name	Fluid Gf	Crystallised Gc	Quantitative Gq	Speed Gs	Overall Self-Confidence	Overall Self-Monitoring
c	73%	70%	54%	17.07 sec		
d	61%	55%	26%	20.17 sec		
b	51%	43%	31%	25.46 sec	38%	2%
e	53%	79%	48%		80%	21%
a	76%	59%	70%	19.47 sec	77%	13%
f	20%	24%	11%	14.58 sec	70%	51%
Norm Average	59%	54%	43%	18.7 sec	67%	9%

Table 5

TEST NAME	SCORE	EXPLANATION/COMMENTS
SWAPS ACCURACY	HIGH 80%	Indicates above average ability to hold in mind several bits of information and manipulate elements of the task in working memory
	AVERAGE	
	LOW 20%	Indicates below average ability to hold in mind several bits of information and manipulate elements of the task in working memory
SWAPS REACTION TIME	HIGH 80%+	Fast thinker - above average speed of manipulating elements while holding several bits of information in working memory
	AVERAGE	
	LOW 20%-	Slow thinker - below average speed of manipulating elements while holding several bits of information in working memory.
TRIPLETS ACCURACY	HIGH 80%	Indicates above average ability to keep in mind a rule for doing a particular mental operation and examine the problem in order to establish if the rule is satisfied.
	AVERAGE	
	LOW 20%	Indicates below average ability to keep in mind a rule for doing a particular mental operation and examine the problem in order to establish if the rule is satisfied.
TRIPLETS REACTION TIME	HIGH	Fast thinker - above average speed when there is a need to keep in mind a rule for doing a particular mental operation and examine the problem in order to establish if the rule is satisfied.
	AVERAGE	

Table 5 Cont.

TEST NAME	SCORE	EXPLANATION/COMMENTS
	LOW	Slow thinker - below average speed when there is a need to keep in mind a rule for doing a particular mental operation and examine the problem in order to establish if the rule is satisfied.
TRIPLETS SELF CONFIDENCE	HIGH 80%	Above average belief in one's ability to keep in mind a rule for doing a particular mental operation and examine the problem in order to establish if the rule is satisfied
	AVERAGE	
	LOW 20%	Above average belief in one's ability to keep in mind a rule for doing a particular mental operation and examine the problem in order to establish if the rule is satisfied.
TRIPLETS SELF MONITORING	HIGHER THAN 10%	Relatively poor ability to monitor one's performance in tasks requiring the ability to keep in mind a rule for doing a particular mental operation and examine the problem in order to establish if the rule is satisfied
	10%	Satisfactory ability to monitor one's performance in tasks requiring the ability to keep in mind a rule for doing a particular mental operation and examine the problem in order to establish if the rule is satisfied.
VOCABULARY ACCURACY	HIGH 80%+	Indicates a good understanding of word meanings
	AVERAGE	
	LOW 20%-	Indicates poor understanding of word meanings
VOCABULARY REACTION TIME	HIGH 80%+	Indicates speed of retrieving and applying acquired (stored) knowledge.
	AVERAGE	
	LOW 20%-	Indicates slow speed of retrieving and applying acquired (stored) knowledge
PROVERBS MATCHING ACCURACY	HIGH 80%	Strong ability to understand word meanings at an advanced level, to understand the meanings conveyed by proverbs, and match two proverbs according to their meaning
	AVERAGE	
	LOW 20%	Poor ability to understand word meanings at an advanced level, to understand the meanings conveyed by proverbs, and match two proverbs according to their meaning.
PROVERBS MATCHING REACTION TIME	HIGH 80%	Fast thinker - quick to understand word meanings at an advanced level, to understand the meanings conveyed by proverbs, and match two proverbs according to their meaning.

Table 5 Cont.

TEST NAME	SCORE	EXPLANATION/COMMENTS
	AVERAGE	
	LOW 20%-	Slow thinker - slow to understand word meanings at an advanced level, to understand the meanings conveyed by proverbs, and match two proverbs according to their meaning.
PROVERBS MATCHING SELF CONFIDENCE	HIGH 80%+	Above average belief in one's ability to know that the decisions regarding the meanings of proverbs are correct or incorrect
	AVERAGE	
	LOW 20%-	Below average belief in one's ability to know that the decisions regarding the meanings of proverbs are correct or incorrect
PROVERBS MATCHING SELF MONITORING	HIGHER THAN 10%	Relatively poor ability to monitor one's performance regarding the meanings of proverbs
	AVERAGE	
	0-10%	Indicates an accurate perception of the quality of answers given. A realistic awareness of the ability to monitor one's performance regarding the meanings of proverbs
NUMERICAL OPERATIONS ACCURACY	HIGH 80%	Indicates strong ability to solve basic mathematical problems
	AVERAGE	
	LOW 20%	Indicates poor ability to solve basic mathematical problems.
NUMERICAL OPERATIONS ACCURACY REACTION TIME	HIGH 80%	Fast thinker - high speed of solving basic mathematical problems.
	AVERAGE	
	LOW 20%	Slow thinker - slow speed of solving basic mathematical problems
FINANCIAL REASONING ACCURACY	HIGH 80%	Indicates strong ability to reason with problems of financial and mathematical nature
	AVERAGE	
	LOW 20%	Indicates poor ability to reason with problems of financial and mathematical nature
FINANCIAL	HIGH	Fast thinker - above average speed of reasoning with

Table 5 Cont.

TEST NAME	SCORE	EXPLANATION/COMMENTS
REASONING REACTION TIME	80%+	problems of financial and mathematical nature.
	AVERAGE	
	LOW 20%-	Slow thinker - below average speed of reasoning with problems of financial and mathematical nature
FINANCIAL REASONING SELF CONFIDENCE	HIGH 80%	Above average belief in one's ability reason with problems of financial and mathematical nature
	AVERAGE	
	LOW 20%	Below average belief in one's ability reason with problems of financial and mathematical nature
FINANCIAL REASONING SELF MONITORING	HIGHER THAN 10%	Relatively high ability to monitor one's performance in tasks that require reasoning with financial and mathematical problems.
	0-10%	Relatively poor ability to monitor one's performance in tasks that require reasoning with financial and mathematical problems
FLUID INTELLIGENCE	HIGH 80%	Indicates above average learning potential. Strong ability to solve novel problems. Strong ability to solve problems which are predominantly unrelated to past education. Suggests that the individual is highly competent at carrying out such processes as perceiving relationships, logical reasoning and problem solving with nonverbal material. Indicate advanced working memory capacity (ability to mentally hold and organise information to solve problems), and the amount of attentional resources (focus mental energy to solve tasks).
	AVERAGE	
	LOW 20%	Indicates difficulty in learning new tasks. Relatively poor ability to solve novel problems and difficulty in solving problems which are unrelated to past education. Suggests that the individual struggles at carrying out such processes as perceiving relationships, logical reasoning and problem solving with nonverbal material. Indicates below average working memory capacity (ability to mentally gather and organise information to solve problems) and the amount of attentional resources (focusing mental energy to solve tasks).

- 25 -

CLAIMS

1.   An apparatus for conducting a test on a candidate, the apparatus including:

      first means for presenting a series of questions to the candidate;

5   second means for obtaining from the candidate an answer to each of the questions;

and

      timer means for determining the time taken for the candidate to answer each of the

questions.

2.   An apparatus according to claim 1 including third means for obtaining from the

10 candidate an indication of their confidence that any one or more of the answers were

correct.

3.   An apparatus for conducting a test on a candidate, the apparatus including:

      first means for presenting a series of questions to the candidate;

      second means for obtaining from the candidate an answer to each of the questions;

15   third means for obtaining from the candidate an indication of their confidence that

any one or more of the answers were correct; and

      timer means for determining the time taken for the candidate to answer the

questions.

4.   An apparatus according to claim 2 or claim 3 wherein the third means obtains a

20 confidence indication for each of the questions.

5.   An apparatus according to claim 2 or claim 3 wherein, once all the answers have

been obtained from the candidate, the third means provides an overall confidence

indicator for that candidate.

6.   An apparatus according to claim 5 wherein the third means derives the confidence

25 indicator from the indications of confidence provided by the candidate.

7. An apparatus according to claim 6 wherein the third means derives the confidence indicator from selected ones of the indications of confidence provided by the candidate.

8. An apparatus according to claim 6 wherein the third means obtains from the candidate an indication of their confidence that selected ones of the answers were correct, where that selected number is less than the number of questions presented to the candidate.

9. An apparatus according to claim 3 wherein the timer means determines the time taken for the candidate to answer each question.

10. An apparatus according to claim 3 wherein the first means sequentially presents the series of questions.

11. An apparatus according to claim 3 wherein the answers to the questions, once provided by the candidate, can not be changed.

12. An apparatus according to claim 2 or claim 3 wherein the third means allows the candidate to nominate one of a plurality of confidence bands which best corresponds with their confidence that an answer was correct.

13. An apparatus according to claim 12 wherein at least some of the questions are multiple choice and the number of choices being available corresponds to the number of confidence bands.

14. An apparatus according to claim 2 or claim 3 wherein the third means prompts the candidate to provide a number within a predetermined range to indicate their degree of confidence.

15. An apparatus according to claim 2 or claim 3 including fourth means responsive to the first means, the second means and the timer means for indicating the results of the test.

- 27 -

16. A method for conducting a test on a candidate, the method including the steps of:

presenting a series of questions to the candidate;

obtaining from the candidate an answer to each of the questions; and

determining the time taken for the candidate to answer each of the questions.

17. A method according to claim 16 including the additional step of obtaining from the candidate an indication of their confidence that any one or more of the answers were correct.

18. A method for conducting a test on a candidate, the method including the steps of:

presenting a series of questions to the candidate;

obtaining from the candidate an answer to each of the questions;

obtaining from the candidate an indication of their confidence that any one or more of the answers were correct; and

determining the time taken for the candidate to answer the questions.

19 A method according to claim 17 or claim 18 including the step of determining the time taken for the candidate to answer each question.

20. A method according to claim 17 or claim 18 wherein the series of questions is sequentially presented.

21. A method according to claim 17 or claim 18 wherein the answers to the questions, once provided by the candidate, can not be changed.

22. A method according to claim 17 or claim 18 wherein the candidate must nominate one of a plurality of confidence bands which best corresponds with their confidence that an answer was correct.

23. A method according to claim 22 wherein at least some of the questions are multiple choice, wherein the number of choices being available corresponds to the

number of confidence bands.

24.   A method according to claim 17 or claim 18 wherein the candidate is prompted to

provide a number within a predetermined range to indicate their degree of confidence.

25.   A method according to claim 17 or claim 18 including the step of indicating the

5   results of the test.
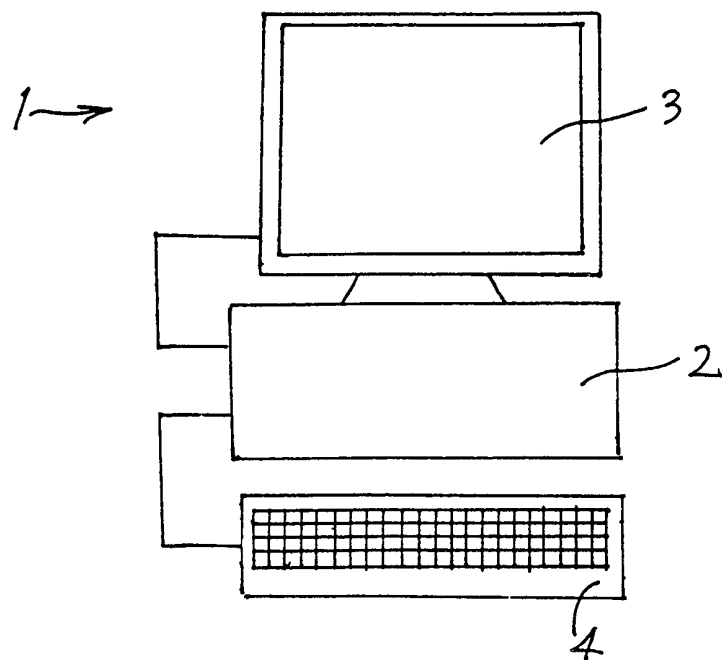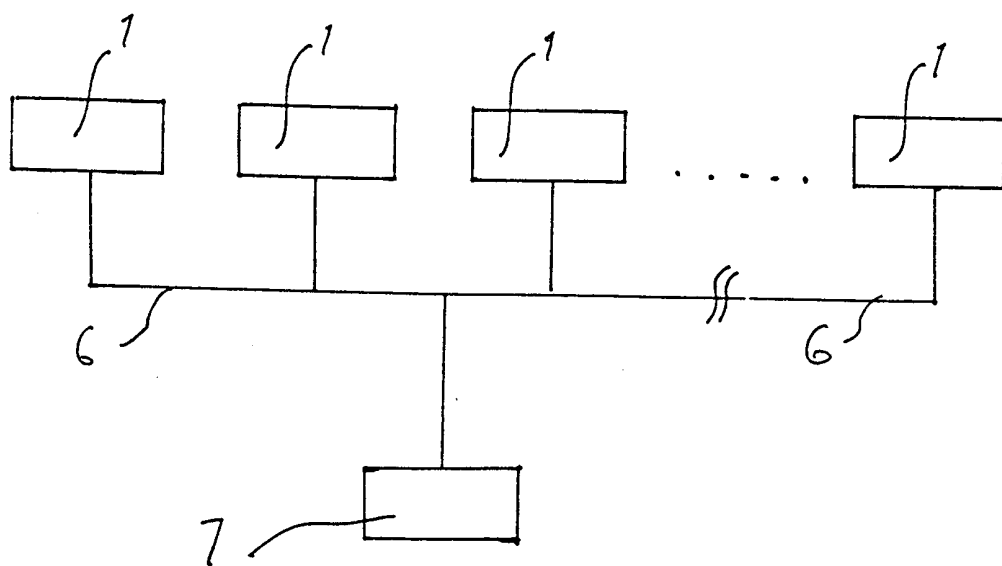
Figure 1

Figure 2

INTERNATIONAL SEARCH REPORT

A.	CLASSIFICATION OF SUBJECT MATTER

Int Cl^6:   G09B 7/06

According to International Patent Classification (IPC) or to both national classification and IPC

B.	FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC: G09B 7/06

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
wpat: ("QUESTION" OR "ANSWER") AND ("TIME" OR "TIMING")

C.	DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 2242557 A (GALLAGHER) 2 October 1991	1, 16
X	US 5274610 A (TONOMURA et al) 28 December 1993	1, 16
A	US 5180309 A (EGNOR) 19 January 1993	

☐ Further documents are listed in the continuation of Box C   ☒ See patent family annex

*	Special categories of cited documents:		
		"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be of particular relevance		
"E"	earlier application or patent but published on or after the international filing date	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed	"&"	document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
5 October 1999	1 2 OCT 1999

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INTERNATIONAL SEARCH REPORT
Information on patent family members

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member					
US	5274610	CN	1065537	JP	4301789	KR	9510298

END OF ANNEX