

Enhanced CALCAP Reports

INTERPRETATION OF REACTION TIME RESULTS

Overview

At the completion of testing, the CALCAP program displays a summary of all of the exam results on a single screen, showing those tests, if any, on which the subject performed abnormally (see Figure 1).

An additional five screens of detailed test results are available by pressing the space bar to cycle through a graphical summary of the reaction times and true positive responses; a detailed summary of mean and median reaction times; difference scores; accuracy indices including true and false positive responses; and signal detection parameters.

The exam results can be sent to your printer and disk (press 'P') or to disk only (press 'D'). Additional information about test interpretation is included when you send the results to the printer. A sample printout is shown in Appendix B.

A disk image of the printed output is created whenever you send information to the printer (by pressing 'P') as well as when you explicitly request disk output by pressing 'D'. The disk images consist of two ASCII files, one named REVIEW.TXT (suitable for any generic word processor) and one named REVIEW.PRN (suitable for word processors that can read the PC-8 ASCII character set, such as WordPerfect). If you connect your computer to a printer at some later time, you can still print the most recent test results by typing 'PRINTIT' at the DOS command prompt in the CALCAP subdirectory.

How the CALCAP Selects Normative Comparison Samples

The CALCAP program compares each subject's responses with normative data matched (when possible) by age and education. The original normative sample consisted of over 600 men between the ages of 21 to 59, with a mean educational level of a college degree. Additional normative data are available, and most of these data are summarized in Appendix A. For

the purposes of the CalCAP printouts, however, only the original normative sample is used to compute z-scores and percentile ranks. Normative data are stratified by both age (20-34, 35-44, 45+) and education (< 16 years, 16 years, > 16 years).

Subjects who are not within the age groupings of the normative sample are evaluated based on means and standard deviations for all subjects within their educational stratum. If years of education are missing, subjects are evaluated using means and standard deviations for all subjects within their age stratum. If age and education data are missing or out of range, subjects are evaluated using means and standard deviations for all subjects within the normative sample.

Sociodemographic Factors That May Influence Reaction Time

Reaction time correlates most highly with age, and, to a lesser extent, with years of education. A study of the effects of age, education and ethnicity is reprinted in Appendix F. Two small studies of gender effects on CalCAP reaction time have shown no differences between men and women on any of the CalCAP indices. Normative data from one of these studies, stratified by gender, are included in Appendix A.

Understanding the Results: A Page by Page Interpretation Guide

Each of the six pages of the CalCAP printout is described in detail below and are illustrated in the accompanying figures. A complete sample printout is shown in Appendix B. For all printouts, results that are outside of normal limits are tagged with one, two or three asterisks to represent performance 1.5, 2.0 or 3.0 SDs below the mean of the normative sample. The notation "Skipped" indicates that some or all of the subtest was skipped by the user. "Custom" indicates that the subtest is Custom-designed and cannot be compared with the original CalCAP normative data set.

Figure 1. Summary of Exam Results (Page 1 of standard printout)

CALIFORNIA COMPUTERIZED ASSESSMENT PACKAGE (CalCAP)

ID#: 40000
Date of Exam: 25 Aug 1998
Gender: Male
Age: 47
Yrs Education: 16
Handedness: Right
Vision: Corrected
Race: White (not Hispanic)
Occupation: CLERICAL

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SUMMARY OF ABNORMAL CALCAP EXAM RESULTS
(only results 1.5 SDs below norms are marked)

## Description	Reaction Time	Accuracy	Signal Detection	Normative Data
1 Simple RT 1 - Dominant Hand				Std (a)
2 Simple RT - Nondominant Hand				Std (a)
3 Choice Reaction Time - Digits				Std (a)
4 Sequential Reaction Time 1	*	***	***	Std (a)
5 Language Discrimination				Std (a)
6 Simple RT 2 - Dominant Hand				Std (a)
7 Degraded Words with Distract				Std (a)
8 Response Reversal - Words				Std (a)
9 Form Discrimination		**		Std (a)
10 Simple RT 3 - Dominant Hand				Std (a)

*One or more indices are more than 1.5 SDs outside of normal range
**One or more indices are more than 2.0 SDs outside of normal range
***One or more indices are more than 3.0 SDs outside of normal range

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Normative Sample(s)
(a) Norms are based on 25 U.S. males ages 45 - 54 with education level
= 16 years. Normative Sample = NORM0292/509.

Page 1 - Summary of Results
(see Figure 1)

Results that are outside of normal limits are tagged with one, two or three asterisks to represent performance 1.5, 2.0 or 3.0 SDs below the mean of the normative sample. The notation "Skipped" indicates that some or all of the subtest was skipped by the user. "Custom" indicates that the subtest is Custom-designed and cannot be compared with the original CalCAP normative data set.

Reaction Time: Indicates whether mean computed reaction time falls outside of normal limits. Additional information on mean reaction times is included on Page 3 of the printout, which also includes information about the Range of reaction times and Median reaction times. Only Mean reaction time is used to evaluate whether or not a score was within normal limits.

Accuracy: Indicates whether True Positive and/or False Positive indices of response accuracy all outside of normal limits. For a more detailed breakdown of raw scores, z-scores and percentile

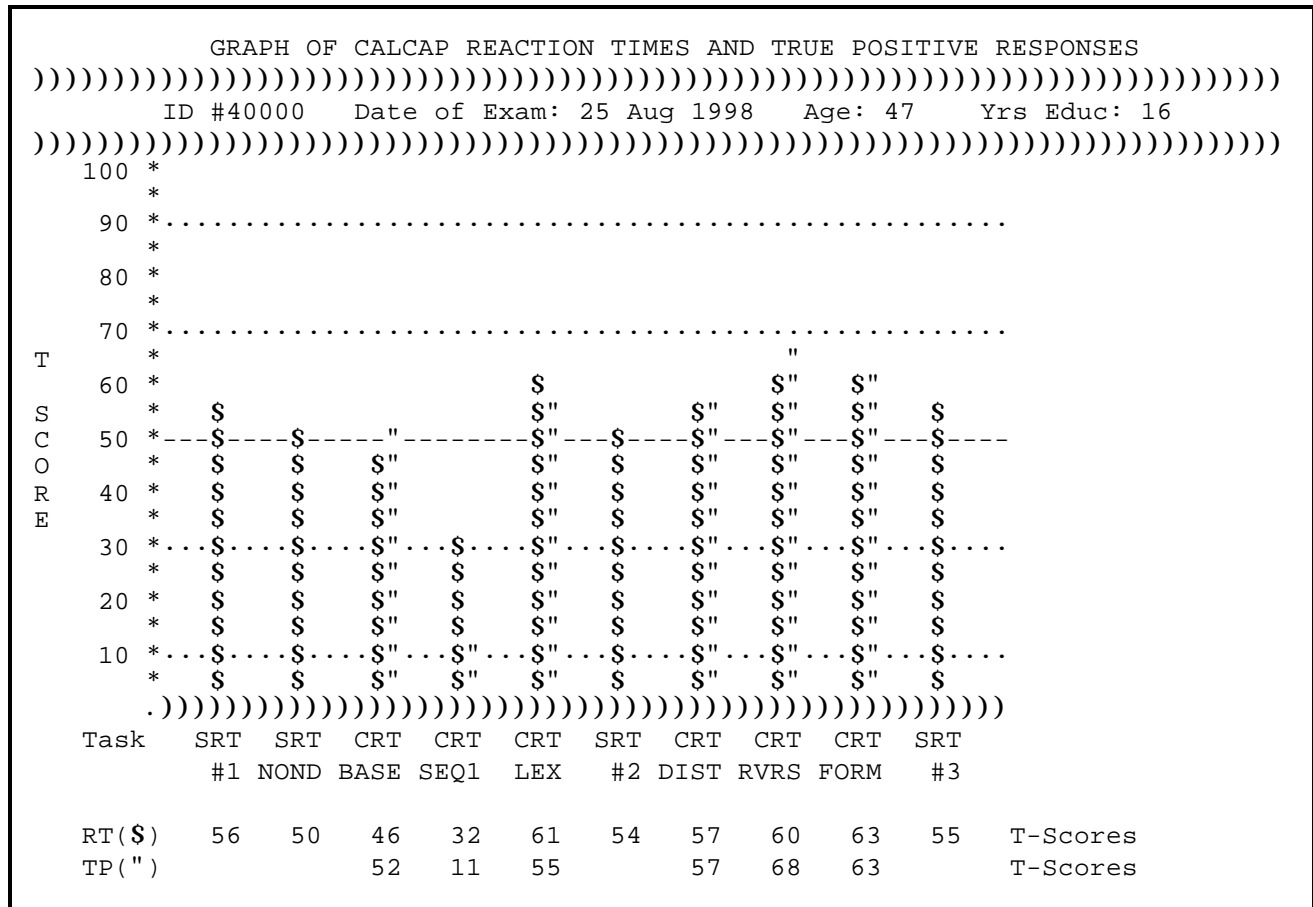
ranks for these indices, see Page 4 of the printouts (Figure 4 in this Interpretation Guide).

Signal Detection: Indicates whether the signal detection parameter A' (a population estimate of d') falls outside of normal limits. Additional information about this signal detection parameter is shown on Page 6 of the printout (Figure 6 in this Interpretation Guide).

Normative Data: Std Norms or Std (a) indicates that the original CalCAP normative data set was used as a comparison group for this test protocol. "Skipped" indicates that some or all of the subtest was skipped by the user. "Custom" indicates that the subtest is Custom-designed and cannot be compared with the original CalCAP normative data set.

The "Normative Sample(s)" footer provides additional information about the age and education range of the normal control subjects that were used as a comparison group for this test protocol.

Figure 2. Graphical Printout (Page 2 of standard printout)



Page 2 - Graphical Printout
(see Figure 2)

The graphical representation of exam results is presented using T-score (standard score) values where a score of 50 is average. The standard deviation for a T-score is 10. Higher T-scores correspond to better performance, lower T-scores correspond to poorer performance.

The CALCAP program displays the age- and education-adjusted reaction time T-scores for all of the simple and choice measures. In addition, the program displays the age- and education-adjusted T-scores for the number of true positive responses on each choice reaction time measure.

The following codes are used:

- RT = Age & education adjusted T-score for Mean Computed Reaction Time
- TP = Age & education adjusted T-score for # of True Positive responses

Task Codes:

- SRT #1 = Simple RT, Dominant Hand (1st iteration)
- SRT NOND = Simple RT, Nondominant Hand
- SRT #2 = Simple RT, Dominant Hand (2nd iteration)
- SRT #3 = Simple RT, Dominant Hand (3rd iteration)
- CRT BASE = Choice RT, Basic Go-No Go Paradigm
- CRT SEQ1 = Choice RT, Serial Pattern Matching (Repetition of Numbers)
- CRT LEX = Choice RT, Word Discrimination
- CRT DIST = Choice RT, Go-No Go Paradigm with Distraction
- CRT RVRS = Choice RT, Rapid Visual Scanning/Response Reversal
- CRT FORM = Choice RT, Form Discrimination
- CRT SEQ2 = Choice RT, Serial Pattern Matching (Numbers in Sequence)
- MEMORY = Recognition Memory

Figure 5. Accuracy Indices (Page 5 of standard printout).

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          CALCAP ACCURACY INDICES
          (not computed for Simple RT tasks)
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  ID #40000  Date of Exam: 25 Aug 1998  Age: 47  Yrs Educ: 16
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          True Positives                False Positives
## Description                        Score  z-score %ile      Score  z-score %ile
-----
  3 Choice Reaction Time - Digits      15/15    0.20  58%       0/85    0.52  70%

  4 Sequential Reaction Time 1         9/20***  -3.89   1%        1/80    0.14  56%
  5 Language Discrimination             24/24    0.52  70%       0/96    1.17  88%

  7 Degraded Words with Distract      15/15    0.72  76%       1/85    0.50  69%
  8 Response Reversal - Words         15/15    1.76  96%       1/85    0.28  61%
  9 Form Discrimination                 19/20    1.27  90%       7/80**   -2.37  1%

  *Score is more than 1.5 SDs outside of normal range
  **Score is more than 2.0 SDs outside of normal range
  ***Score is more than 3.0 SDs outside of normal range
    
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Page 5 - Accuracy Indices
(see Figure 5)

This page summarizes the accuracy indices of True and False Positive responses (Choice Reaction Time measures only). One, two or three asterisks are used to indicate scores that are 1.5, 2.0 or 3.0 SDs below the mean of the normative sample. Percentile ranks and z-scores are included separately for True Positive and False Positive responses.

True Positives: True Positive responses are responses where the individual correctly identifies a target stimulus. Abnormal True Positive scores may indicate inattention, random responding, visual problems, or a true inability to identify and respond to the target stimulus in the amount of time available. Note that abnormal performance on the Language Discrimination task only may suggest that the individual is not a native speaker. True Positive responses are only computed for Choice Reaction Time measures.

False Positives: False Positive responses are responses where the individual incorrectly identifies a distractor as being a target stimulus. Abnormal False Positive scores may indicate inattention, random responding, visual problems, a response bias toward excessive button pressing, or a true difficulty with separating distractor stimuli from target stimuli, due either to slowed cognitive processing or an inability to remember the task instructions. False Positive responses are only computed for Choice Reaction Time measures.

Figure 6. Signal Detection Parameters (Page 6 of standard printout).

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                                     CALCAP REACTION TIMES
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                                     ID #40000   Date of Exam: 25 Aug 1998   Age: 47   Yrs Educ: 16
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                                     Mean Reaction Time (RT)
##  Description                               Range      Median      RT        z-score    %ile
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1  Simple RT 1 - Dominant Hand                283- 352     333        332         0.64      74%
2  Simple RT - Nondominant Hand              295- 428     343        351         0.03      51%
3  Choice Reaction Time - Digits              375- 502     427        426        -0.36     36%

4  Sequential Reaction Time 1                 437- 853     853        712*        -1.78      4%
5  Language Discrimination                     382- 552     482        488         1.15     87%
6  Simple RT 2 - Dominant Hand                 338- 868**    354        385         0.40     65%

7  Degraded Words with Distract               431- 669     515        503         0.68     75%
8  Response Reversal - Words                  407- 757     613        601         1.05     85%
9  Form Discrimination                         435-1133     607        613         1.27     90%

10 Simple RT 3 - Dominant Hand                 298- 458     328        335         0.48     69%

*Score is more than 1.5 SDs outside of normal range
**Score is more than 2.0 SDs outside of normal range
***Score is more than 3.0 SDs outside of normal range
  
```

Page 6 - Signal Detection Parameters
(see Figure 6)

Signal detection parameters provide an index of an individual's ability to accurately discriminate target stimuli from distractor stimuli. A' is a population estimate of the signal detection parameter d'. An abnormal value in A' indicates that the individual had greater than average difficulty with differentiating the target stimuli from the distractor stimuli. This type of error might be due to inattention, visual problems, random responding, visual processing deficits, or an inability to process the stimuli at the rate they are presented by the CalCAP program.

The signal detection parameter beta is also collected and can be used for research studies (consult Appendices D and E for instructions on how to use CalCAP data files). Beta is not included in the clinical printouts since it is not normally distributed, has a very restricted range, and does not seem to be particularly predictive of clinical abnormalities.

General Tips for Interpretation

In general, you should consider the first simple and choice reaction time tasks to be practice trials. Even though each individual task has a practice component, many subject's scores do not stabilize until after the first tasks.

The reaction time tasks measure cognitive functioning that is not ordinarily assessed using standard neuropsychological procedures. Although the tasks correlate modestly (.2 - .4) with other neuropsychological measures (especially Symbol Digit Substitution and Trails B), based on factor analyses the reaction time measures form two factors (Simple reaction time and Choice reaction time) that are different from standard NP tasks.

The cognitive functions assessed by the CALCAP program are best described as timed psychomotor skills requiring focused or sustained attention. Impaired reaction time across multiple measures is usually indicative of generalized motor slowing. Impaired reaction time on specific measures, particularly when coupled with scores outside of normal bounds on true positive responding, is suggestive of a more specific functional deficit, usually in the area of fluctuating attention.

In general, poor performance on a single measure is not indicative of a specific type of cognitive impairment. Certain tasks, however, do seem to be related to specific skills.

Serial Pattern Matching (Sequential Reaction Time) is largely a measure of divided attention skills (similar to Trails B, Consonant Trigrams, etc.)

Lexical Discrimination is frequently impaired in non-native English speakers.

A large discrepancy in reaction time between tasks 1 (simple reaction time–dominant hand) and 2 (simple reaction time–non-dominant hand) may be suggestive of a lateralizing finding.

An isolated finding of impaired performance on Form Discrimination may be suggestive of focal impairment in visuo-perceptual skills.

APPENDIX B

SAMPLE REPORT

The following pages show a sample 6-page printout from a standard CalCAP test battery. See “Interpretation of Reaction Time Results” in the manual for additional information about test interpretation.

Sample Printed Report

Page 3 - Reaction Times

CALCAP REACTION TIMES

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ID #40000 Date of Exam: 25 Aug 1998 Age: 47 Yrs Educ: 16
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		Mean Reaction Time (RT)				
##	Description	Range	Median	RT	z-score	%ile
1	Simple RT 1 - Dominant Hand	283- 352	333	332	0.64	74%
2	Simple RT - Nondominant Hand	295- 428	343	351	0.03	51%
3	Choice Reaction Time - Digits	375- 502	427	426	-0.36	36%
4	Sequential Reaction Time 1	437- 853	853	712*	-1.78	4%
5	Language Discrimination	382- 552	482	488	1.15	87%
6	Simple RT 2 - Dominant Hand	338- 868**	354	385	0.40	65%
7	Degraded Words with Distract	431- 669	515	503	0.68	75%
8	Response Reversal - Words	407- 757	613	601	1.05	85%
9	Form Discrimination	435-1133	607	613	1.27	90%
10	Simple RT 3 - Dominant Hand	298- 458	328	335	0.48	69%

*Score is more than 1.5 SDs outside of normal range
**Score is more than 2.0 SDs outside of normal range
***Score is more than 3.0 SDs outside of normal range

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Notes

Reaction times indicate the average speed with which the individual was able to respond to target stimuli. Norms displayed above are based on mean reaction times. Norms are not currently available for median reaction times. Abnormal reaction times on multiple tasks suggest generalized slowing in cognitive processing or artifacts such as inattention, visual problems, or random responding. Selective slowing on certain tasks may indicate a passing distraction during the test procedure or may indicate a focal deficit in the cognitive ability measured by that subtest. Note that abnormal performance on the Language Discrimination task only may suggest that the individual is not a native speaker. Consult the CalCAP manual for additional discussion of the skills measured by the individual subtests.

The range of reaction times shown represents the best and worst performances during this testing session. Unusually large ranges suggest inconsistent responding across the trial. This may be due to transient distractions during the testing, difficulties keeping up with the pace of the testing, or losing track of the task instructions. Abnormal ranges across multiple tests suggest poor motivation, malingering, or significant fluctuations in attention due to psychoactive drugs or neurologic injury.

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Sample Printed Report

Page 4 - Difference Scores

CALCAP DIFFERENCE SCORES

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ID #40000 Date of Exam: 25 Aug 1998 Age: 47 Yrs Educ: 16

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#	Description	Diff. from Baseline Simple RT (332 ms)	Diff. from Baseline Choice RT (426 ms)
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1	Simple RT 1 - Dominant Hand	---Baseline---	
2	Simple RT - Nondominant Hand	19 ms slower	
3	Choice Reaction Time - Digits		---Baseline---
4	Sequential Reaction Time 1		287 ms slower
5	Language Discrimination		62 ms slower
6	Simple RT 2 - Dominant Hand	53 ms slower	
7	Degraded Words with Distract		77 ms slower
8	Response Reversal - Words		175 ms slower
9	Form Discrimination		187 ms slower
10	Simple RT 3 - Dominant Hand	3 ms slower	

Notes

Normative data are not available for Difference Scores.
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Sample Printed Report

Page 5 - True Positive and False Positive Responses

CALCAP ACCURACY INDICES

(not computed for Simple RT tasks)

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ID #40000 Date of Exam: 25 Aug 1998 Age: 47 Yrs Educ: 16

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## Description	True Positives			False Positives		
	Score	z-score	%ile	Score	z-score	%ile
3 Choice Reaction Time - Digits	15/15	0.20	58%	0/85	0.52	70%
4 Sequential Reaction Time 1	9/20***	-3.89	1%	1/80	0.14	56%
5 Language Discrimination	24/24	0.52	70%	0/96	1.17	88%
7 Degraded Words with Distract	15/15	0.72	76%	1/85	0.50	69%
8 Response Reversal - Words	15/15	1.76	96%	1/85	0.28	61%
9 Form Discrimination	19/20	1.27	90%	7/80**	-2.37	1%

*Score is more than 1.5 SDs outside of normal range

**Score is more than 2.0 SDs outside of normal range

***Score is more than 3.0 SDs outside of normal range

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Notes

True Positive responses are responses where the individual correctly identifies a target stimulus. Abnormal True Positive scores may indicate inattention, random responding, visual problems, or a true inability to identify and respond to the target stimulus in the amount of time available. Note that abnormal performance on the Language Discrimination task only may suggest that the individual is not a native speaker. See the CalCAP manual for additional discussion of the relevance of each individual subtest.

False Positive responses are responses where the individual incorrectly identifies a distractor as being a target stimulus. Abnormal False Positive scores may indicate inattention, random responding, visual problems, a response bias toward excessive button pressing, or a true difficulty with separating distractor stimuli from target stimuli, due either to slowed cognitive processing or an inability to remember the task instructions.

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Sample Printed Report

Page 6 - Signal Detection Parameters

CALCAP SIGNAL DETECTION PARAMETERS

(not computed for Simple RT tasks)

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 ID #40000 Date of Exam: 25 Aug 1998 Age: 47 Yrs Educ: 16
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A' estimate of d'

## Description	Score	z-score	%ile
-- -----	-----	-----	-----
3 Choice Reaction Time - Digits	1.00	0.42	66%
4 Sequential Reaction Time 1	0.85***	-3.50	1%
5 Language Discrimination	1.00	0.93	82%
7 Degraded Words with Distract	1.00	0.80	79%
8 Response Reversal - Words	1.00	1.76	96%
9 Form Discrimination	0.96	1.10	86%

*Score is more than 1.5 SDs outside of normal range
 **Score is more than 2.0 SDs outside of normal range
 ***Score is more than 3.0 SDs outside of normal range

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 Notes

Signal detection parameters provide an index of an individual's ability to accurately discriminate target stimuli from distractor stimuli. A' is a population estimate of the signal detection parameter d'. An abnormal value in A' indicates that the individual had greater than average difficulty with differentiating the target stimuli from the distractor stimuli. This type of error might be due to inattention, visual problems, random responding, visual processing deficits, or an inability to process the stimuli at the rate they are presented by the CalCAP program.

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