
Test of Variables of Attention®

# CLINICAL MANUAL

Lawrence M. Greenberg, MD
Chris Holder, MA, LMHC
Carol L. Kindschi, RN, MSN
Tammy R. Dupuy, MS

The TOVA Company
August 29, 2024

# T.O.V.A.® 9 Clinical Manual

Test Of Variables of Attention

Lawrence M. Greenberg, MD
Chris Holder, MA, LMHC
Carol L. Kindschi, RN, MSN
Tammy Dupuy, MS

**The TOVA Company**
222 Anthes Ave Ste 101
Langley, WA 98260 USA

Phone: 800.PAY.ATTN or 800.729.2886 or 562.594.7700
Fax: 800.452.6919 or 562.594.7770
Email: info@tovatest.com
Web: http://www.tovatest.com/

Edition Number 9.1-103-ge45444f (August 29, 2024) L19 B

T.O.V.A. release 9.1-391-gcea519a

Orders of this manual should be directed to:

The TOVA Company
222 Anthes Ave Ste 101
Langley, WA 98260 USA
800.PAY.ATTN 800.729.2886 +1. 562.594.7700
Fax: 800.452.6919 +1. 562.594.7770
http://www.tovatest.com/

Printed in the United States of America.

# Table of Contents Page

# Part I

# Important Information

## 1 T.O.V.A. Description

The Test of Variables of Attention (T.O.V.A.) provides healthcare professionals with objective measurements of attention and inhibitory control. The visual T.O.V.A. aids in the assessment of, and evaluation of treatment for, attention deficits, including attention-deficit/hyperactivity disorder (ADHD). The auditory T.O.V.A. aids in the assessment of attention deficits, including ADHD. T.O.V.A. results should only be interpreted by qualified professionals.

The T.O.V.A. is a culture- and language-free, sufficiently long computerized test that requires no left/right discrimination or sequencing. Responses to visual or auditory stimuli are recorded with a specially designed, highly accurate ($\pm 1$ ms) microswitch. The T.O.V.A. calculates response time variability (consistency), response time (speed), commissions (impulsivity), and omissions (focus and vigilance). These calculations are then compared to a large age- and gender-matched normative sample (over 1,700 individuals for the visual test, and over 2,600 individuals for the auditory test), as well as to a sample population of individuals independently diagnosed with ADHD. These comparison results are used to create an immediately available, easy-to-read report.

The T.O.V.A. is a stand-alone software application with USB-based hardware that is installed on Windows or Mac computers. The T.O.V.A. does not require internet access to operate, although access to the internet will be beneficial for many features, including software updates and access to technical support and interpretation support.

The T.O.V.A. System includes:

- USB flash drive with software installers for Mac and Windows PCs.
- T.O.V.A. USB device
- T.O.V.A. microswitch
- Installation Guide
- User's Manual (in electronic form)
- Clinical Manual (in electronic form)
- Accessory cables (USB, VGA, and audio cables)

# 2 Indications

The Test of Variables of Attention (T.O.V.A.) provides healthcare professionals with objective measurements of attention and inhibitory control. The visual T.O.V.A. aids in the assessment of, and evaluation of treatment for, attention deficits, including attention-deficit/hyperactivity disorder (ADHD). The auditory T.O.V.A. aids in the assessment of attention deficits, including ADHD. T.O.V.A. results should only be interpreted by qualified professionals.

**CAUTION:** Federal law restricts this device to sale by or on the order of a qualified professional.

# 3 Contraindications

The T.O.V.A. microswitch and USB device should not be used in conjunction with magnetic resonance imaging (MRI) equipment.

# 4 Warnings and Precautions

The T.O.V.A. provides objective measures of attention and inhibitory control. The T.O.V.A. does not diagnose any disease or disorder or make a recommendation of treatment. T.O.V.A. performance should always be considered in the context of all available clinical information and should only be interpreted by a qualified professional.

T.O.V.A. results should be interpreted only by qualified professionals.

**WARNING:** Repetitive flashing of display may cause eye strain, headaches, or seizures. Please seek medical help if you experience any eye strain, headaches, or seizures.

**WARNING:** The surface of the T.O.V.A. microswitch may become hot (41 °C / 106 °F) during use. Discontinue use if holding the switch becomes uncomfortable.

Do not interrupt the T.O.V.A. test while it's being administered. Pressing the Esc key will result in the test being Interrupted.

# 5 Compliance Information

## 5.1 Australia

The Test of Variables of Attention (T.O.V.A.) is a Class I medical device registered with the Australian Government's Therapeutic Goods Administration (TGA) under Australian Register of Therapeutic Goods (ARTG) Identifier 315322.

**Australian Sponsor**

Emergo Australia
Level 20, Tower II
Darling Park
201 Sussex Street
Sydney, NSW 2000
Australia

## 5.2 Canada

The Test of Variables of Attention (T.O.V.A.) is licensed by Health Canada as a Class I medical device manufactured under Medical Device Establishment License (MDEL) Number 9655.

## 5.3 European Union

The Test of Variables of Attention (T.O.V.A.) is a Class I medical device manufactured in accordance with the European Union's Medical Device Directive (MDD 93/42/EEC).

CE

**European Authorized Representative Information**

EC REP

**EMERGO EUROPE**
Westervoortsedijk 60,
6827 AT Arnhem
The Netherlands

For vigilance inquiries, use EmergoVigilance@ul.com

### 5.4 United States

The Test of Variables of Attention (T.O.V.A.) has been cleared for sale in the United States by the U.S. Food and Drug Administration (FDA).

## 6 Quality Standards

The TOVA Company is a medical device manufacturer that is certified under ISO 13485:2016 and the Medical Device Single Audit Program (MDSAP). Please see http://www.tovatest.com/iso for our certificate.

# 7 Symbols

| | |
|---|---|
| SN | Serial Number |
| | Production Date |
| | Consult instructions for use |
| | Caution, consult accompanying documents |
| | Keep dry |
| | Do not used if damaged |
| | Not for general waste |
| CE | European Union (EU) CE Mark |
| FC | FCC compliance |
| | Type B Applied Part |
| EC REP | Authorized representative in Europe |

Figure 1: International Symbols applicable to the T.O.V.A.

# Part II

# Introduction

## 8 About This Manual

This manual is the T.O.V.A. Clinical Manual. It is meant to help you understand the use of the T.O.V.A. in clinical practice. This manual will review:

- Attention-Deficit/Hyperactivity Disorder (ADHD)
- Construction of the T.O.V.A.
- T.O.V.A. variables
- Interpretation of T.O.V.A. reports

The examples shown represent a few of the many possible ways a person may perform on the T.O.V.A. The clinical application of the T.O.V.A. is best understood through experience, consultation with the T.O.V.A. interpretation support team, and ongoing education in the use of the T.O.V.A. in conjunction with other sources of information used in the assessment of, and evaluation of treatment for, attention deficits, including ADHD.

There are other manuals that may be helpful to you:

- The **User's Manual** can help you with all things technological about the T.O.V.A.
- The **Installation Guide** can help you set up the T.O.V.A. hardware and software.

## 9 Terms and Concepts Used in This Manual

**Attention,** according to Merriam-Webster's dictionary is 1. a) the act or state of applying the mind to something, and b) a condition of readiness for such attention involving especially a selective narrowing or focusing of consciousness or receptivity 2. Observation 3. sympathetic consideration to the needs and wants of others.

Attention is a mainstay of life, and the ability to appropriately focus one's attention affects one's self image and success in school, at work, and in relationships.

**Inhibitory control** is defined as the capacity to voluntarily inhibit or regulate prepotent (strong or automatic) attentional or behavioral responses.

**Attention deficit** is a general term for symptoms of impaired attention and inhibitory control that are the result of many causes (e.g., ADHD, head injuries, toxic exposure, sleep apnea, and other conditions.)

**Attention-Deficit/Hyperactivity Disorder** (ADHD) refers to a specific diagnosis in the *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.; *DSM-5*; American Psychiatric Association, 2013).

# 10 Attention-Deficit/Hyperactivity Disorder (ADHD)

## 10.1 ADHD and the *DSM-5*

To gain a full understanding of attention-deficit/hyperactivity disorder (ADHD) please read and understand the description, criteria, and related disorders and comorbidities in the *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.; *DSM-5*; American Psychiatric Association, 2013).

In summary, there are currently five different diagnoses under ADHD in the *DSM-5*. These are:

- 314.00 (F90.0) Predominantly inattentive presentation
- 314.01 (F90.1) Predominantly hyperactive/impulsive presentation
- 314.01 (F90.2) Combined presentation
- 314.01 (F90.8) Other Specified Attention-Deficit/Hyperactivity Disorder
- 314.01 (F90.9) Unspecified Attention-Deficit/Hyperactivity Disorder

## 10.2 Considerations

After a thorough review and complete understanding of the *DSM-5* criteria for ADHD, please take the following into consideration:

- The symptoms are subjective, unreliable, and culture-bound.
- ADHD is a symptom complex, not a disorder (that, by definition, must have a single, common etiology and a predictable natural history and response to treatment).
- The assumption that hyperactivity and attention deficits are necessarily linked is misleading and an artifact of equating symptom complexes with disorders. (This isn't the only example in psychiatry and psychology of a hypothetical construct being treated as though it had an independent existence in the real world.)
- The requirement that the onset be by twelve years of age ignores some critical factors. As examples, non-hyperactive, inattentive children and children with strong external support systems are may not be symptomatic until later in life.
- Since behavior is situationally specific, attention deficits may not be apparent in more than one setting. Differences in setting (school, classroom, teacher, peers) may affect the presence of symptoms.
- Although the emphasis is on inattention, individuals with ADHD are highly variable in their attention over time, and can hyperfocus.

- Executive functions are not included.
- Symptoms manifest differently in girls and boys.

## 10.3 Some causes of Off-Task Behavior and Inattention

Differential diagnosis for off-task behavior or attention issues includes, but is not limited to, the following:

- **Normal behavior**

  Age-appropriate behavior that is mislabeled, e.g., "active alert" children or unrealistic adult expectations of normal development.

- **General medical problems**

  Such as anemia, hyperthyroidism, otitis media, and dietary inclusions/sensitivities.

- **Medications**

  Such as anticonvulsants, antihistamines, and antidepressants that sedate or slow the brain.

- **Toxic conditions**

  Such as environmental exposures, drugs, or an illness,long COVID-19, influenza, or Epstein-Barr virus.

- **Sensory deficits and hypersensitivities**

  Such as unrecognized hearing and visual impairments and any sensory (including olfactory and kinesthetic) hypersensitivity.

- **Neurologic problems (other than ADHD)**

  Such as sleep disturbances (including apnea and narcolepsy), seizures, and mild and major neurocognitive disorders.

- **Traumatic Brain Injury/Concussions**

  Behavioral issues or attention deficits as a result of head injuries.

- **Family style and organization**

  This may include familial, social and cultural factors.

- **School readiness**

  Younger children in primary grades have a higher incident of ADHD diagnosis due to level of development compared to the older children in the class.

- **Learning style and motivation**

  Some children (including those with ADHD) have a hands-on rather than a listen and understand learning style and may lose motivation if they aren't successful or their learning style is frustrated.

- **Trauma**

  Resulting from physical, sexual, emotional, and/or cultural trauma.

- **Stress**

  Resulting from overwhelming situations.

- **Intellectual impairment and precocity**

  High and low IQ and boundary testing.

- **Learning disabilities**

  One third of individuals with an attention deficit also have a learning disability, and vice versa.

- **Psychiatric conditions**

  Such as PTSD, psychosis, bipolar disorder, obsessive-compulsive traits/disorders, depression, ODD, dementia, conduct disorder, reactive attachment disorder, and/or anxiety.

- **Medication**

  Over and under dosing of medication and improper medication.

- **Substance use, abuse, and withdrawal**

  Illegal and legal substances (alcohol, caffeine, and nicotine).

- **ADHD** (see below)

**Note: These causes are not mutually exclusive. As noted above, 30% of individuals with ADHD (including adults) have a learning disability (and vice versa), and between 25-35% of substance abusers have ADHD. In addition, untreated individuals with ADHD often develop low self-esteem, depression, coping strategies, anxiety, and/or acting out, which may obscure the underlying ADHD.**

## 10.4 Diagnosis of ADHD

The components of a diagnostic workup for ADHD **may** include:

- **History:** A detailed personal and family history.

- ***DSM-5* Symptom checklists:** These checklists help clinicians to thoroughly review all symptoms of ADHD.

- **Behavior ratings:** Rating scales are an important part of the diagnostic process. They are best used in conjunction with a good history and objective measures like the T.O.V.A. to minimize the effects of rater bias and an overemphasis on disruptive behaviors.

- **Impairment Scales** Note and track impairments along with DSM 5 symptoms.

- **T.O.V.A.:** The T.O.V.A. objectively measures response time variability, response time, inhibitory control, focus and vigilance, all of which can be affected by many factors; however, **the T.O.V.A. does not make a diagnosis or make a recommendation of treatment**. The clinician needs to make use of the objective results in the context of the full clinical picture.

- **Performance Validity Measures** Additional performance validity measures may be compared to the embedded Performance Validity available in the visual T.O.V.A. for ages 17 and older.

- **Physical exam:** A recent exam by a primary care provider.

- **Psychological/neuropsychological assessment:** There should be emphasis on learning style, cognitive assets and liabilities, and CNS functioning.

- **Evaluation of classroom/workplace behavior and performance:** Direct observations or telephone interview of teacher or supervisor are very helpful, especially to prepare for recommendations.

- **Mental status examination/personality assessment:** This helps identify comorbid and/or other conditions (such as depression).

  **Note: A comprehensive work-up that includes all or most of the components above may not be feasible or cost-effective. The clinician must decide which steps are needed and in what sequence.**

# 11 Introduction to the T.O.V.A. test

The T.O.V.A. test was designed from the ground up to accurately and reliably measure attention and inhibitory control. Some of it's features are:

- **N**on-language-based Stimuli

  The T.O.V.A. uses non-language-based stimuli (see Figure 2) to minimize the potential confounding of the test results by language, culture, and/or a learning disability. The Auditory T.O.V.A. uses two single tones: the target is G above middle C (392.0 Hz), and the nontarget is "middle C" (261.6 Hz).

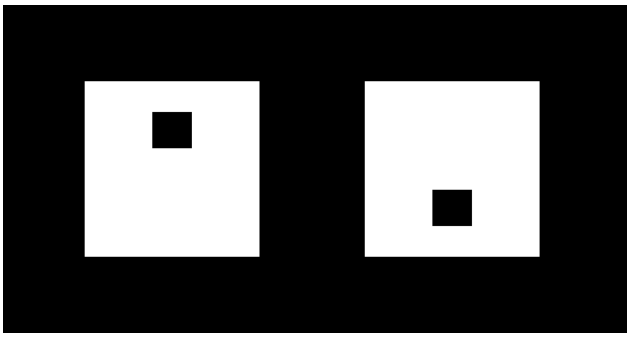


Figure 2: The T.O.V.A. visual stimuli. Left: The target stimulus. Right: the nontarget stimulus.

- **V**isual and auditory modes

  Both visual and auditory modalities may need to be evaluated since there can be problems with auditory and/or visual information processing. Most individuals process visual and auditory information similarly. That is, without a visual or auditory disorder, they process visual and auditory information similarly in terms of speed, variability, and accuracy.

  However, some individuals process one type of sensory input differently than the other. Thus, the Visual T.O.V.A. performance may be within normal limits, but the Auditory T.O.V.A. may not be normal and vice versa. The T.O.V.A. intentionally separates the auditory and visual tests to minimize distractions and/or stimulation so that specific auditory and visual processing strengths and difficulties can be identified.

- **T**ask Length

  The longer the test, the harder it is to attend and inhibit. This is important when measuring vigilance, a key factor in attention disorders. The T.O.V.A. is a 21.6-minute test with two 10.8-minute subtests. For children ages 4 and 5, the T.O.V.A. is 10.8 minutes in length, and the two subtests are each 5.4 minutes each.

- **I**nfrequent and frequent target "Subtests"

  The T.O.V.A. is made up of 648 stimuli presentations. These presentations are divided into two 10.8 minute halves, and each half is divided into two 5.4 minute quarters. The T.O.V.A. has two "subtests", one per half:

  – The **infrequent half** (or "low response demand mode" subtest) in the first half has only one target per 3.5 nontargets, and thus is the more boring task and is the traditional form for measuring vigilance. Individuals with "low CNS arousal" tend to do poorly on this form.

  - The **frequent half** (or "high response demand mode/high inhibition demand mode" subtest) in the second half has 3.5 targets to every one nontarget, and thus is a more stimulating task during which individuals with "high CNS arousal" can become overstimulated. In this half, individuals with "low CNS arousal" tend to "wake up".
  - The T.O.V.A. for children 4 to 5.5 is a shorter test and consists of only quarter 1 (infrequent target mode subtest) and quarter 3 (frequent target mode subtest) to more appropriately match a normal attention span for their age. On the T.O.V.A. report these are shown as Half 1 and Half 2.

- **T**est/Retest Reliability (Practice vs. Novelty Effects)

  The T.O.V.A. has excellent test-retest reliability (See the T.O.V.A. Professional Manual), and thus T.O.V.A. results can be compared over days, weeks, and even years. The T.O.V.A. can also be repeated even in the same day which is useful for off (baseline) off and on (challenge dose) medication testing. Note that we recommend at least 90 minutes between T.O.V.A. sessions.

# 12 Administering the T.O.V.A.

The test administrator should be familiar with the test instructions and test administration prior to testing. For detailed instructions on how to administer a T.O.V.A. session using the T.O.V.A. software and hardware, please see the *Administering the T.O.V.A. Test* section in the T.O.V.A. User's Manual. In summary, the test administrator will:

- Enter the subject information if this is the subject's first T.O.V.A. session.
- Start a new session and enter the session information (visual or auditory, treatment information, etc).
- Launch a new session.
- Play the test instructions.
- Administer the practice test and check the results.
- Administer the T.O.V.A. test.
- If the administration was valid, use a T.O.V.A. Test Credit to download the test data into your local database.
- View the report, and print or export the report as required.

## 12.1 Pre-test Preparation

Preparing the subject is crucial, because it assures that the test is administered properly and replicates the same conditions as the T.O.V.A. norms:

- Prior to testing, explain to the subject (or to caregivers) that no caffeinated beverages (e.g., coffee, tea, cocoa, or soft drinks) should be ingested on the day of a test. Nor should the subject have smoked within 3-4 hours. Please note: a baseline test assumes no stimulants have been taken prior to test administration (stimulant medication, coffee, nicotine). To evaluate treatment effects on T.O.V.A. performance administer the test during peak effect of stimulants.
- Setting: Testing should be done in a quiet, softly lit room with a glare-free monitor. Clocks should not be visible or audible. It is best if the subject faces a neutral colored wall without distracting pictures. If possible, the keyboard should not be visible during the test.
- If using the auditory T.O.V.A., use adequate speakers on either side of the computer screen. The screen will display the focus point, which the subject should visual focus on during the test.

## 12.2 Administering the T.O.V.A.

- Introduce yourself to the subject.
- Ask if the subject needs to use the bathroom.
- Determine whether they have glasses or hearing aids if needed.
- Have subject remove his or her watch; mute all potential sources of noise including cell phones and clocks and place them out of line of vision.
- Determine from subject or caregiver any and all medications taken in the last 24 hours, with dosage and interval since administered, and record them in the New Test Session window.
- Determine appropriate language to use when giving multimedia test instructions.
- Determine whether the Auditory or Visual test is to be administered based on history and any previous test results. A thorough history and clinical interview can help determine whether to administer a Visual or Auditory T.O.V.A. session first. Consider giving both practice tests if the subject is between the ages 6 and 29 to see which is the more challenging to the subject.
- Position the subject and chair so they sit with feet on the floor.
- Position the monitor so the screen is at or near eye level.
- Launch the T.O.V.A. session, and play the multimedia testing instructions.
  - Multimedia instructions explaining this is available in the T.O.V.A. in twenty languages. We strongly recommend you play the multimedia test instructions whenever administering the T.O.V.A.
  - You may also step through the test instructions manually. Be sure to instruct the subject to balance speed and accuracy in order to be as fast as they can be, while still minimizing errors.
- If more than one T.O.V.A. is being administered to the same person on the same day, allow at least 90 minutes from the end of the first T.O.V.A. to the beginning of the next T.O.V.A.

## 12.3 Observations during testing: the T.O.V.A. Observation Form

The T.O.V.A. Observation Form (page 79) can be used by the test administrator to gather information before, during, and after the test. Behaviors that affect test performance can be noted to help determine the reason for test results. These observations are often critical to understanding test performance. If the test is administered by a psychometrist or other staff member, the Observation Form should be given to the clinician along with the T.O.V.A. report.

# Part III

# Interpreting T.O.V.A. Reports

Familiarity with the scientific basis of the T.O.V.A. as well as the interpretation of the T.O.V.A. report will help establish the best use of the T.O.V.A. Clinical casework or reflections are not a recommendation for assessment, diagnosis, or treatment.

## 13 Understanding the T.O.V.A. Subtests (Half 1 vs Half 2)

To review, It is critical to remember that the T.O.V.A. consists of two subtests with no transition or warning between them.

In the **first half of the test** ( the "Infrequent" mode), the target appears randomly and infrequently with a target : nontarget ratio of 1:3.5. The person presses the microswitch infrequently and must stay on task while maintaining focus during this half. There are 36 targets and 126 nontargets per quarter in quarters 1 and 2. Easily bored ("low arousal") persons may do poorly during this half.

In the **second half of the test** (the "Frequent" mode) the target appears randomly and frequently with a target : nontarget ratio of 3.5:1. The person is frequently pressing the microswitch and must stay on task while inhibiting the tendency to respond. (There are 126 targets and 36 nontargets per quarter in quarters 3 and 4.) Easily overstimulated ("high arousal") persons may do poorly.

The length of each subtest is 10.8 minutes.

For children **4 to 5.5 years of age**: The ratios of targets to nontargets remain the same; however, only quarters 1 and 3 are administered. The length of each subtest is 5.4 minutes. On the TT.O.V.A. report quarter 1 is represented as half 1 and quarter 3 is represented as half 2.

## 14 T.O.V.A. Variables

The T.O.V.A. accurately and precisely measures *all* of the significant variables of both auditory and visual information processing, including response time, response time variability, omissions and commissions, allowing the clinician to see the full picture of the subject's performance on the test.

### 14.1 Primary Variables

The primary T.O.V.A. variables are the variables scored compared to the T.O.V.A. normative study, called the **Comparison to the Normative Sample (CNS)**. The following variables are included:

**Response Time Variability**

Response Time Variability ("RTV") is a measure of variability (consistency) of response time. RTV is the the standard deviation of correct response times, and thus directly measures the spread of the subject's response times. Individuals with ADHD tend to have inconsistent response times on the 10 - 100 millisecond time scale, and thus have a wider RTV. RTV is the most sensitive measure of the T.O.V.A. Because changes in RTV are on the 10 - 100 millisecond time scales, timing measurements must be very accurate; hence, the need for accurate timing (the T.O.V.A. USB device), an accurate and repeatable subject input device (the T.O.V.A. microswitch), and the need to calibrate out delays and variability in the computer screen (the T.O.V.A. microswitch's calibration photodiode).

**Correct Response Time**

Correct Response Time is the processing time (in milliseconds) taken to respond correctly to a target. Persons with ADHD may respond slower than the normative sample, especially in the infrequent (boring) first half of the test.

**Errors of Commission**

Errors of Commission are a measure of impulsivity and/or disinhibition and occur when the subject incorrectly responds to the nontarget; that is, the subject pushes the button when they should have refrained. In the T.O.V.A., commission errors are far more frequent in the second half (high response demand). Generally, excessive commission errors decrease omission errors, shorten response times, and increase variability. Impulsivity is a hallmark of ADHD, predominantly hyperactive/impulsive presentation, and combined presentation.

**Errors of Omission**

Errors of Omission are a measure of focus and vigilance and occur when the subject does not respond to a target stimulus; that is, the subject omits pressing the button when a target appears or is played. This may be due to inattention, distractibility, or hyperactivity (looking away from the computer). Omission errors are rare in adults, and long strings of omission errors should be investigated. Use the Observation Form (page 79) to record behaviors during the test to determine and record the reason(s) for Omission errors.

When evaluating omissions, always look at the absolute or raw numbers of omission errors on the Summary page and/or the Tabulated Data page. In some cases one or two errors reach statistical significance because of the lack of omission errors in older ages of the T.O.V.A. normative study, yet there may be little or no clinical significance to one or two errors. As an example, a single error early in quarter 1 may signify that the subject was surprised when the test began even though the practice session preceded the test. Always interpret standard score data alongside actual raw data to determine clinical significance of the results.

## 14.2 Secondary Variables

These variables provide additional information that can be helpful in understanding a person's performance on the T.O.V.A.

**Anticipatory Responses**

An Anticipatory Response (AR) occurs whenever a subject responds (pressing the microswitch) between 200 milliseconds (ms) before and 150 ms after any stimulus (target or nontarget) appears, or in the case of the Auditory T.O.V.A., any stimulus is heard. Humans need more than 150 ms to identify and respond to

a go/no-go stimulus like those used in the T.O.V.A.; hence, the use of the word "anticipatory". ARs are considered impulsive responses, and often occur when the subject is attempting to "guess" which stimulus (target or nontarget) is going to be displayed. Similarly, ARs occur when subjects try to "hit" the target by pressing the microswitch as soon as the stimulus is displayed.

ARs are not included in the calculations of omission errors, commission errors,response times, and response time variability. Since excessive anticipatory responses can affect the other variables, they are also an important measure of test validity. Generally, excessive anticipatory responses decrease the number of commission and omission scores, thereby increasing omission and commission standard scores. The Session, Response, and Performance Validity section on the T.O.V.A. Interpretation Notes page flags quarters with excessive ARs (equal or exceeding 10%) as needing to be cautiously interpreted.

**Post-Commission Response Time**

Post-Commission Response Time is the correct response time when a target immediately follows a commission error. Clinical observations (but not carefully conducted research) indicate that most people (including individuals with ADHD) recognize when they make a commission error, and slow down for the next response. It is noteworthy that a group of conduct disordered youngsters (without ADHD) either did not slow down or actually responded faster than their average response time. Rarely, some highly motivated individuals increase their focus, speed up after a commission error, and become more accurate. A post T.O.V.A. interview with the subject may help to clarify the reason for fast post-commission response times and adds depth to the clinical picture.

**Multiple Responses**

Multiple Responses are considered to be a reflection of neurological status. Excessive multiple responses (>15/test) do not alter or invalidate the other variables, and they may reflect hyperactivity or neurological dysfunction.

**$d'$ or Response Sensitivity**

$d'$ or Response Sensitivity (the ratio of hit rate to false alarm rate) is a measure derived from Receiver Operating Characteristics (ROC) which is part of Signal Detection Theory. It is a measure of performance decrement, the rate of deterioration of performance over time. Most individuals tend to fatigue over time, especially with a boring task. The performance of individuals with ADHD tends to deteriorate faster than those without ADHD.

### 14.3 Composite Scores

The**Attention Comparison Score (ACS)** is a composite of two primary (Response Time (Half 1) and RT Variability (Total)) and one secondary variable (D Prime (Half 2)) to create a secondary "cutoff" score. ACS values above zero are more like the performance of the normative study, and ACS values below zero are more like the performance of an independent group diagnosed with ADHD.

## 15 Factors Affecting T.O.V.A. Performance

The T.O.V.A. performance can be significantly improved or worsened by anything that affects attention:

- Someone with ADHD could self-medicate with nicotine and/or caffeinated beverages. Assuming that excessive quantities are not ingested, a person with ADHD who has coffee, an energy drink, or cigarettes before testing may perform within normal limits on the T.O.V.A.

- On the other hand, acute caffeine and nicotine withdrawal can have adverse effects on attention. Thus a person can do poorly on the T.O.V.A. if they do not have their habitual caffeine or nicotine.

- Any medication that can affect brain function can affect attention. Someone taking antihistamines for allergies can become sufficiently sedated so that the T.O.V.A. performance may not be within normal limits just as someone receiving lithium for a bipolar disorder may have slow response times.

- People with ADHD who have extensive video game experience and highly trained athletes may perform normally on the visual T.O.V.A. due to the hand-eye coordination training. The auditory T.O.V.A. is useful in these situations although musicians may do better on the auditory T.O.V.A.

- Sleep deprivation, anxiety, depression, and a number of psychiatric conditions can adversely affect T.O.V.A. performance. ADHD may or may not be comorbid.

- Although the literature is not definitive, a person with above-average intelligence may perform better on the T.O.V.A., and someone with below-average intelligence may perform worse, when compared with the normative sample or the ADHD sample.

**It is important that the clinician obtain a good history, behavior ratings, and impairment scales to be able to interpret T.O.V.A. results, taking the above factors into account.**

# 16 The T.O.V.A. Report

This section contains T.O.V.A. reports and a discussion of the forms and findings.

There are four types of reports:

- Visual Preschool Report (ages 4 to 5.5)

- Visual School-Age Report (ages 5.5 to 17)

- Visual Adult Report (ages 18 to 80+)

- Auditory Report (ages 6 to 29).

Reports are identified by the age and gender of the subject and the type of test administered. The example report below is a School-Age report. When printing out a report, you may select which pages you want printed. When sending a report to a clinician, we recommend sending the Introduction, Summary, Interpretation Notes, and Attention Comparison Score pages.

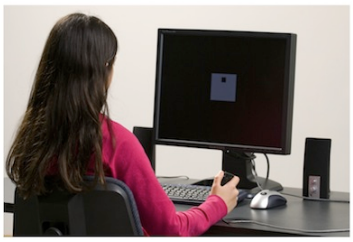
## 16.1 Introduction Page

This page provides basic information about the T.O.V.A. and its uses. It can be given to persons unfamiliar with the T.O.V.A. as an overview of the test.

## The Test Of Variables of Attention (T.O.V.A.®)

The **Test of Variables of Attention (T.O.V.A.)** is an FDA-cleared, state-of-the-art continuous performance test that provides healthcare professionals with objective measurements of attention and inhibitory control. The T.O.V.A. aids in the assessment of, and evaluation of treatment for, attention deficits, including attention-deficit/hyperactivity disorder (ADHD). T.O.V.A. results are available for children and adults (ages 4 - 80+) and should only be interpreted by qualified professionals.

The T.O.V.A. continuously measures performance during a 10.8-minute task or a 21.6-minute task, depending on age. It records speed, accuracy, and consistency of responses to a series of squares (in the visual T.O.V.A. test) or tones (in the auditory T.O.V.A. test) that are presented in two-second intervals. These measurements (accurate to ±1 ms) are then compared by age and gender to a normative sample (a sample of people without attention problems). This comparison determines whether the test results are "within normal limits" or not. The T.O.V.A. also compares results to a group of people independently diagnosed with ADHD. The T.O.V.A. report is based on these two comparisons, as well as performance, session, and response validity measures.



If you have questions about this report, please contact the person who provided it to you. For more information about attention and the T.O.V.A., please visit our website at https://www.tovatest.com/. To contact us please email info@tovatest.com or call 800.PAY.ATTN (562.594.7700).

## 16.2 Summary Page

### 16.2.1 Demographic Information

This page, and the pages to follow, include demographic data about the subject contained in a light gray outline. Demographic information includes the subject's name, gender, date of birth and age, as well as details on the T.O.V.A. session (Visual or Auditory test, T.O.V.A. software version, T.O.V.A. serial number, and the date and time of administration).

### 16.2.2 Session, Response, and Performance Validity

This section summarizes whether there were any validity issues that might affect the test results, such as user interruptions, excessive errors, or unusual test results (regardless of ADHD diagnosis).

**Validity Measures**

- User interrupts: The user can interrupt a T.O.V.A. session by pressing the 'Esc' key. Once interrupted, the user can choose to resume the test session. However, an interrupted test must be interpreted cautiously since the norms did not contain such an interruption.

- Hardware errors: The test will be interrupted if the hardware is unplugged, or fails, during the test.

- $\leq$ 25% correct responses: There were too few responses in a quarter to be a sufficient sample for that quarter. Generally, this means that the subject stopped attending to the T.O.V.A. test for some reason. For example, they could have been off task due to a distraction, or fallen asleep.

- Excessive Anticipatory Responses ($\geq$ 10% of responses were between 200 ms before and 150 ms after the stimulus appears). Quarters with excessive Anticipatory Responses (that are usually guesses) must be interpreted cautiously since most people do not process and respond correctly to information that quickly. Excessive anticipatory responses decrease the number of commission and omissions, thereby increasing omission and commission scores.

- Performance Validity (PV) is a measure of unusual patterns of performance in the T.O.V.A. that are not typically seen in ADHD. Conditions that unusual performance may flag include cognitive impairment, drug use, oppositional behavior, test maladaptation, poor effort, malingering, problems with attention and/or inhibitory control related to ADHD, attention disorders from other causes and/or other psychiatric conditions, PV is only applicable for ages 17 and older and relevant when the overall performance is not within normal limits. One or more PV flags alert the clinician to verify the clinical picture and gather further information if needed.. PV criteria are:
  - Total number of Omission Errors are $>$ 30.
  - Half 1 Commission Errors are $>$ 10.
  - Half 2 Response Time Skew is $>$150 ms. Response Time Skew is the amount the distribution is "skewed" to the left or the right from a normal distribution. Skew is calculated as the mean minus the mode.
  - Half 2 Commission Error Response Time is $>$ 75 ms slower than Half 2 Correct Response Time.

Higher numbers of flags indicate increasingly unusual patterns of performance and warrant more caution interpreting test performance. Only the clinician can determine the cause of the PV score.

In the sample protocol shown below, the Session, Response, and Performance Validity statement is "This session meets session, response, and performance validity criteria."

### 16.2.3 T.O.V.A. Interpretation

The T.O.V.A. Interpretation summarizes the results of two different performance comparisons:

- The subject's performance compared to the T.O.V.A. normative sample by age and gender, called the Comparison to the Normative Sample (CNS). The CNS compares the subject's performance with individuals who do not have an attention problem.

- The Attention Comparison Score (ACS), which compares the subject's performance with individuals who have been independently diagnosed with ADHD.

The interpretation statement will be one of the following:

- If the CNS and the ACS are within normal limits, the interpretation statement is:

  *The results of this T.O.V.A. are within normal limits.*

- If the CNS is within normal limits but the ACS is not within normal limits (below zero), the interpretation statement is:

  *The results of this T.O.V.A. are not within normal limits, and may be suggestive of an attention deficit, including ADHD, because the Attention Comparison Score is below zero.*

- If the CNS is borderline and the ACS is above zero, the interpretation statement is:

  *The results of this T.O.V.A. are borderline, but the Attention Comparison Score is above zero. In this situation, the T.O.V.A. Interpretation is considered borderline, and may be suggestive of an attention deficit, including ADHD.*

- If the CNS is borderline and the ACS is below zero, the interpretation statement is:

  *The results of this T.O.V.A. are borderline and the Attention Comparison Score is below zero. In this situation, the T.O.V.A. Interpretation is considered not within normal limits, and may be suggestive of an attention deficit, including ADHD.*

- If the CNS is not within normal limits but the ACS is within normal limits, the interpretation statement is:

  *The results of this T.O.V.A. are not within normal limits, and may be suggestive of an attention deficit, including ADHD, because the Comparison to the Normative Sample is not within normal limits.*

- If the CNS and the ACS are not within normal limits, the interpretation statement is:

  *The results of this T.O.V.A. are not within normal limits, and may be suggestive of an*

*attention deficit, including ADHD.*

On rare occasions the Quarter scores will be within normal limits while Half 1, Half 2 and/or the Total will be not within normal limits.

**Note: "May be suggestive of an attention problem" does not mean the subject has an attention disorder, including ADHD, only that the *session results* were not within normal limits.**

In the sample protocol shown below, the CNS and the ACS were not within normal limits and the Interpretation is "The results of this T.O.V.A. are not within normal limits and may be suggestive of an attention problem, including ADHD."

### 16.2.4 Treatment

Any current treatments, including any prescribed medications (with dosages and medication-test interval), neurofeedback sessions, or other forms of treatment are printed here.

**Note: The clinician will need to determine what effects the treatment may have on the T.O.V.A. performance.**

In the sample protocol shown below, treatment shows "None was entered."

### 16.2.5 Comparison to the Normative Sample

The subject's comparison to the T.O.V.A. normative study is shown as quarter-by-quarter standard scores illustrated by bar graphs. Response Time Variability (RTV) and Response Time (RT) show percentile rank below the standard score, while Commission and Omissions show the number of errors in that quarter below the standard score.

- Standard scores above 85 are within normal limits.
- Standard scores 80-85 are borderline.
- Standard scores below 80 are not within normal limits.
- If the standard score is below the limit of the vertical axis (<40), it would be noted as a downward facing red triangle.
- If the standard score is above the limit of the vertical axis (>120), it would be noted as an upward facing red triangle.

In the sample protocol shown below, the subject had results that were not within normal limits compared to the T.O.V.A. normative study for Response Time Variability (Quarters 2-4), Response Time (Quarters 1-2), and Omission Errors (Q3).

The next table shows T.O.V.A. performance in standard scores by Quarters, Halves and Totals. Each of

these is an independent calculation. They are not averages. Any quarter, half or total that is Not Within Normal Limits or Borderline causes the Interpretation to be Not Within Normal Limits or Borderline.

- Scores with a dotted line around them means that the quarter may not be valid and must be interpreted cautiously; see the Session Validity information on the Interpretation Notes page for more information.

- Shaded scores mean that the results are not within normal limits, and may be suggestive of an attention disorder.

- Outlined ("boxed") scores means that the results are borderline.

For example, in the sample protocol shown below, Response Variability is not within normal limits in Quarter 2, 3, 4, Half 2, and the Total, while it is borderline in Half 1. Similarly, Response Time is not within normal limits in Quarters 1 and 2, Half 1, and is borderline for the Total. Omission errors are not within normal limits in Quarter 3, Half 1 and 2, and the Total.

Note that even though Quarters 1 and Quartet 2 Omission errors are within normal limits, Half 1 is not within normal limits. This is because Halves are not averages of Quarters, nor is the Total an average of the Halves or Quarters. In this instance, the subject made two Omission Errors in Half 2, which, when compared to the Normative Sample, is not within normal limits, even though making one Omission Error in Quarter 1 and 2 is within normal limits.

ID: **1** **Example Subject** (Jul 1, 2004)
**Male - 12y 11m 0d**

**Visual T.O.V.A.** (v9.0-71 sn30000)
Jun 1, 2017 at 12:34 PM

## Session, Response, and Performance Validity

This session meets session, response and performance validity criteria.

## T.O.V.A. Interpretation

The results of this T.O.V.A. are not within normal limits, and may be suggestive of a possible attention deficit, including ADHD. Please see the Interpretation Notes page for additional information.

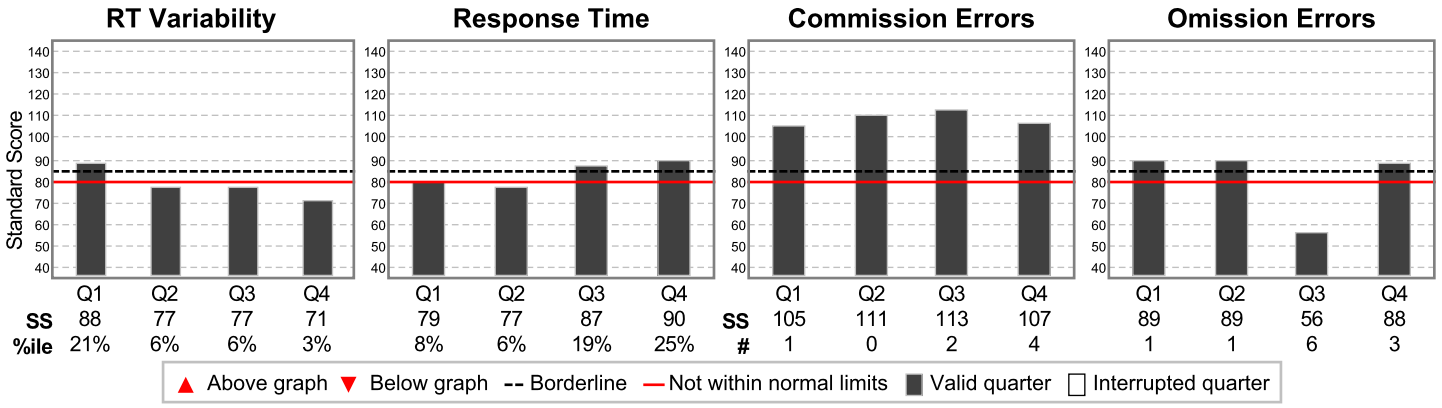
## Treatment

No treatments entered.

## Comparison to the Normative Sample

These scores compare this subject's performance to the performance of individuals of the same gender and age in the T.O.V.A. Normative Sample, a study of individuals who did not have attention problems.

Results are reported as standard scores (average standard = 100; standard deviation = 15). Standard scores above 85 are considered to be in the normal range, scores between 80 and 85 are considered borderline, and scores below 80 are considered not within normal limits. Scores less than 70 are considered significantly below normal range. Standard scores less than 40 are more than 4 standard deviations from normal, and are denoted as "<40".




Quarters, Halves and the Total are independently calculated and are not averages. Any Quarter, Half or Total that is Borderline or Not Within Normal Limits causes the Interpretation to be Borderline or Not Within Normal Limits. See the Interpretation Notes page for more information on these variables and on the subject's performance.

| | Quarter | | | | Half | | Total |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 1 | 2 | |
| **RT Variability** | 88 | 77 | 77 | 71 | 81 | 73 | 72 |
| **Response Time** | 79 | 77 | 87 | 90 | 77 | 88 | 85 |
| **Commission Errors** | 105 | 111 | 113 | 107 | 108 | 111 | 111 |
| **Omission Errors** | 89 | 89 | 56 | 88 | 79 | 72 | 72 |
| | Infrequent | | Frequent | | | | |

Key: Borderline, Not within normal limits, Invalid

## 16.3 Interpretation Notes Page

### 16.3.1 Comments

Any comments entered by the test administrator regarding the subject or session are shown here.

### 16.3.2 Notes on the Comparison to the Normative Sample:

This section summarizes the definition of each variable with a note in bold type on any Quarter, Half or Total that was not within normal limits.

This section also notes response patterns that may affect test interpretation. Examples are when 3 or more Omission Errors occur in a row, there are 15 or more multiple responses, and/or if fast response times and multiple commission errors occur or slow response times and few or no errors occur.****

### 16.3.3 Other Notes

This section may contain a note to consider administration of the Auditory T.O.V.A. for persons 6-29 or the Visual T.O.V.A. for persons 4-80+, if that test has not been administered.

ID: **1** **Example Subject** (Jul 1, 2004)
**Male - 12y 11m 0d**

**Visual T.O.V.A.** (v9.0-71 sn30000)
Jun 1, 2017 at 12:34 PM

## Session, Response, and Performance Validity

### Performance Validity

Performance Validity is applicable only to ages 17 or above.

## Notes on the Comparison to the Normative Sample

**Variability** is a precise measure of variations in correct response times, and measures the consistency of response times. **Variability was borderline in Half 1, and not within normal limits in Quarters 2, 3, and 4, Half 2, and Total.**

**Response Time** is the average speed of correct responses to targets, and is a measure of information processing speed. **Response Time was borderline in the Total, and not within normal limits in Quarters 1 and 2, and Half 1.**

**Commission Errors** occur when the subject incorrectly responds to a nontarget, and are a measure of inhibitory control. **Commission Errors were within normal limits.**

**Omission Errors** occur when the subject does not respond to a target, and are a measure of sustained attention. **Omission Errors were not within normal limits in Quarter 3, Half 1 and 2, and Total.**

## Other Notes

Consider administering an Auditory T.O.V.A. to this subject for a more comprehensive assessment of attention. This is important because an individual can have markedly different results on one test versus the other.

## 16.4 Attention Comparison Score

### 16.4.1 Demographic Information and Treatment

See the Summary Page section (page 22) for more information.

### 16.4.2 Attention Comparison Score

A brief description of the Attention Comparison Score (ACS) is followed by the ACS score and formula. The Attention Comparison Score (ACS) compares the subject's performance to a group of individuals that were independently diagnosed with ADHD. Scores below zero suggest a performance more like the ADHD sample. A simple line graph is shown with the ACS score. A right or left facing triangle indicates ACS values that are past the limits of the graph.

Note the ACS does not include important parts of the Comparison Score. The ACS should always be used with the full Comparison to the Normative Sample on the Summary page. When the Comparison to the Normative Sample is not within normal limits or borderline and the ACS is at or about zero, the results should be considered not within normal limits or borderline.

The ACS is calculated by summing three Z scores:

- Response Time (Half 1)
- D Prime (Half 2)
- RT Variability (Total)

A calibration constant of 1.80 is added to make the score easier to understand and communicate to others. Previous versions of this score started at -1.80. By adding the calibration constant of 1.80 scores are noted above and below zero.

In the sample protocol shown below, the subject's ACS is -2.62, which is consistent with the ADHD sample.

ID: **1** **Example Subject** (Jul 1, 2004)
**Male - 12y 11m 0d**

**Visual T.O.V.A.** (v9.0-71 sn30000)
Jun 1, 2017 at 12:34 PM

## Treatment

No treatments entered.

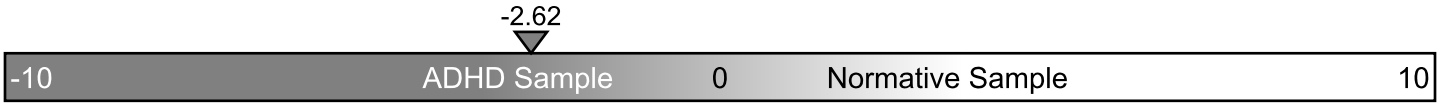
## Attention Comparison Score

The Attention Comparison Score (ACS) is a subset of T.O.V.A. variables used to compare the subject's performance to a sample of individuals independently diagnosed with ADHD. Scores below 0 suggest a performance more similar to that of individuals with ADHD.

Note that the ACS does not include important variables from the Comparison to the Normative Sample. In order to understand the overall test results, the ACS should always be used with the Comparison to the Normative Sample, found on the Summary page. In particular, when the ACS is above zero and the Comparison to the Normative Sample is not within normal limits, the results should be considered not within normal limits.

The ACS is calculated by summing the following Z scores:

| | |
|---|---|
| Response Time (Half 1) | -1.57 |
| D Prime (Half 2) | -1.00 |
| Variability (Total) | -1.86 |
| Calibration constant | 1.80 |
| Attention Comparison Score | -2.62 |



## 16.5 Tabulated Data Page

The Tabulated Data page provides tabulated statistics on the subject's test results. The T.O.V.A. session parameters used for the test are also documented on this page. Tabulated data are listed by quarters, halves and total, and include:

- Response Time Variability (ms). RTV is the first standard deviation of response time and is a measure of variance.
- Response Time (ms). Average response time to the target stimulus.
- Post-Commission Responses (#, Response Time in ms, Variability in ms). These are correct responses that occur directly after a Commission Error.
- Commission Errors (#, %, and Response time in ms). "False positive" responses. Commission Errors and Commission Error Response Time are used as part of the embedded Performance Validity.
- Omission Errors (# and %). "False negative" responses. Omission Errors are part of the embedded Performance Validity.
- D Prime (Raw, Standard Score, and Beta). D prime is part of the Receiver Operator Characteristics (ROC) analysis used in the Attention Comparison Score (ACS).
- Anticipatory Responses (%, # To Nontargets, # To Targets). Responses to stimuli made before the subject could have possibly responded appropriately (200 ms before to 150 ms after the stimulus is displayed).
- Multiple Responses (#). Multiple presses of the button for one stimulus.
- Total Correct (# and %). These are the total correct responses, both correct responses (true positives) and correct non-responses (true negatives).
- Skew (ms). Skew is a measure of response time histogram. Skew is a part of the embedded Performance Validity.
- User Interrupts (#). The number of test interruptions caused by the user pressing 'Esc'.
- Hardware Errors (#). The number of test Interruptions caused by hardware errors.

In the sample protocol shown below, the tabulated data table shows that:

- The subject's post-commission response time (454 ms) was slower than their average response time (417 ms), which is what is expected when a subject recognizes a commission error and immediately slows down.
- There were no user or hardware interrupts.

### Session Parameters, Session Information, and Hardware Information

This section contains technical details on the session's test parameters and hardware, including screen calibration.

ID: **1** **Example Subject** (Jul 1, 2004)
**Male - 12y 11m 0d**

**Visual T.O.V.A.** (v9.0-71 sn30000)
Jun 1, 2017 at 12:34 PM

This page contains tabulated raw data and documents T.O.V.A. session parameters.

| | | Quarter | | | | Half | | Total |
|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 1 | 2 | |
| RT Variability | ms | 115 | 154 | 155 | 188 | 139 | 172 | 171 |
| Response Time | ms | 492 | 550 | 426 | 409 | 521 | 417 | 441 |
| Post-commission responses | # | 0 | 0 | 2 | 2 | 0 | 4 | 4 |
| Response Time | ms | 0 | 0 | 479 | 428 | 0 | 454 | 454 |
| Variability | ms | 0 | 0 | 7 | 73 | 0 | 58 | 58 |
| Commission Errors | # | 1/126 | 0/126 | 2/36 | 4/36 | 1/252 | 6/72 | 7/324 |
| Percentage | % | 0.8 | 0 | 5.6 | 11.1 | 0.4 | 8.3 | 2.2 |
| Response Time | ms | 643 | 0 | 252 | 327 | 643 | 302 | 351 |
| Omission Errors | # | 1/36 | 1/36 | 6/126 | 3/126 | 2/72 | 9/252 | 11/324 |
| Percentage | % | 2.8 | 2.8 | 4.8 | 2.4 | 2.8 | 3.6 | 3.4 |
| D Prime | | 4.33 | 6.18 | 3.26 | 3.2 | 4.57 | 3.19 | 3.85 |
| Standard Score | | 78 | 93 | 84 | 86 | 83 | 85 | 84 |
| Beta | | 2.93 | 1425.08 | 0.88 | 0.3 | 5.43 | 0.51 | 1.46 |
| Anticipatory | % | 0 | 0 | 0 | 0.6 | 0 | 0.3 | 0.2 |
| To Nontargets | # | 0 | 0 | 0 | 1 | 0 | 1 | 1 |
| To Targets | # | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Multiple Responses | # | 0 | 1 | 0 | 0 | 1 | 0 | 1 |
| Total Correct | # | 160/162 | 161/162 | 154/162 | 154/162 | 321/324 | 308/324 | 629/648 |
| Percentage | % | 98.8 | 99.4 | 95.1 | 95.1 | 99.1 | 95.1 | 97.1 |
| Skew | ms | -14 | 115 | 78 | 51 | 88 | 59 | 83 |
| User Interrupts | # | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Hardware errors | # | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Infrequent | | Frequent | | | | |

**Session parameters**

| | |
|---|---|
| Format: | 1 (standard) |
| ISI: | 2000 ms |
| Stimulus On Time: | 200 ms |
| Stimulus Off Time: | 300 ms |
| Anticipatory Cutoff | 150 ms |

**Session information**

| | |
|---|---|
| Tester: | |
| Import Filename: | example-subject.tova |
| Import Date: | Jun 8, 2017 12:00:00 AM |
| Errors/Warnings: | |

**Hardware information**

| | |
|---|---|
| Session mode: | PTE |
| USB device: | HW 3, BD 0, FW 1.1-89-g664fc9a |
| Microswitch: | HW 3, BD 0, FW 4 |
| Monitor calibration: | 15487, 15039, 15904, 15168, 15744, 15263, 15776, 14976, 15807, 15328, 15744, 15072, 15839, 14976, 15104, 15007, 15359, 15200, 15168, 15168, 15231, 15168, 15200, 15007, 16160, 15359, 14976, 15200, 15231, 15328 |

## 16.6 Raw Data Graphs

The Raw Data Graphs are the stimuli-by-stimuli responses of the subject for each Quarter. These graphs provide a detailed picture of the subject's performance throughout the test. Quarters 1 and 2 are on the Raw Data Graphs page and Quarters 3 and 4 are on the Raw Data Graphs (continued).

Codes:

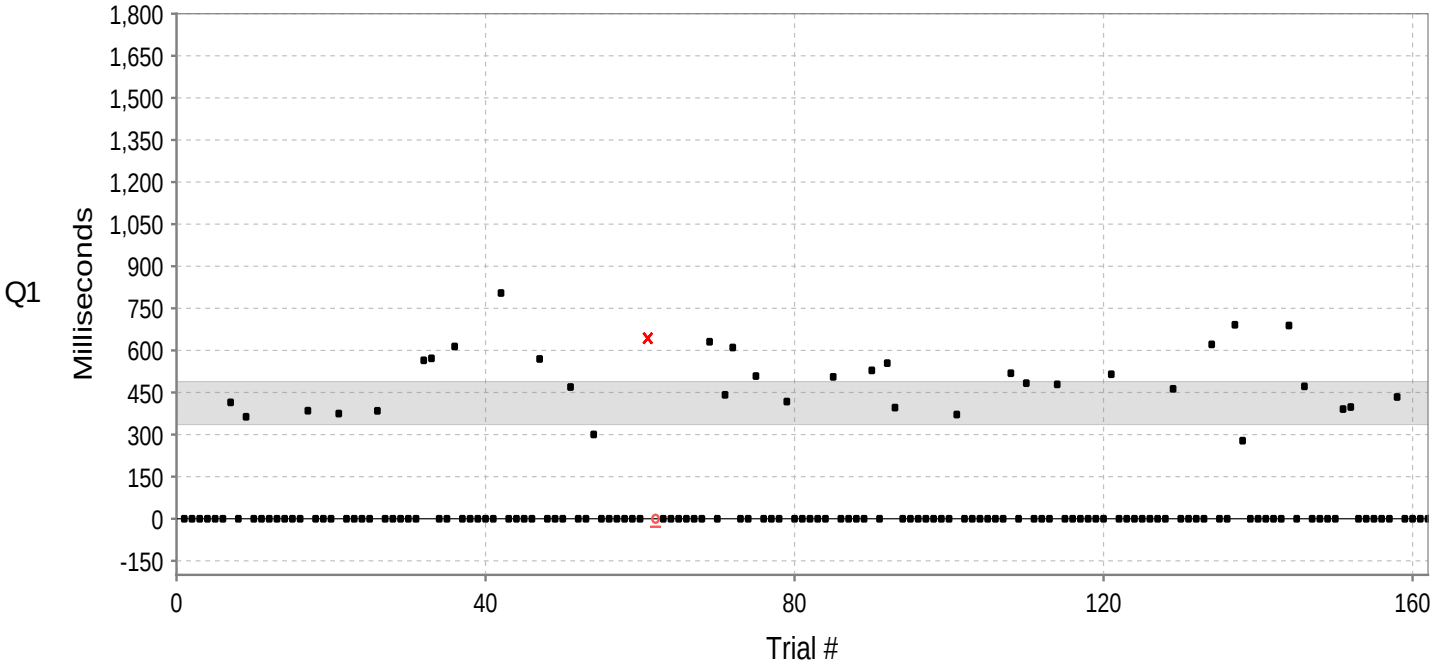
- ■ = Correct responses (black square at the time of the response)
- ■ = Correct non-responses (black square on the zero milliseconds line)
- × = Commission Errors (red X at the time of the error)
- o = Omission Error (red o at the zero milliseconds line)
- ■ = Anticipatory Error (red square between 200 ms before and 150 ms after the stimulus)
- • = Post-Commission Error Correct Response (green dot at time of response)
- | = Interruption (red line at the time of the interruption)
- Light gray area = One standard deviation range around the normative sample's mean response time, matched for age and gender
- Commission errors and post-commission responses are linked by lines:
  - A positive slope ( / ) of a light gray line identifies a usual response (slowing down) after a commission error. (The person may recognize the mistake and slow down.)
  - A negative slope ( \ ) of a black line identifies an unusual response (speeding up) after a commission error. (The person may not recognize the error, may not care, or is impulsive. In some cases, especially in older teenagers and adults with few post-commission responses, they may have extra motivation and concentration on the task resulting in a faster correct response.)
- 3 10s = The number of omissions (if 3 or more in a row) over the number of seconds between correct responses. (Strings of 3 or more omission errors are unusual and may be caused by distractibility, a neurological condition such as narcolepsy or a seizure disorder, oppositional behavior, or, rarely, a hardware error.)

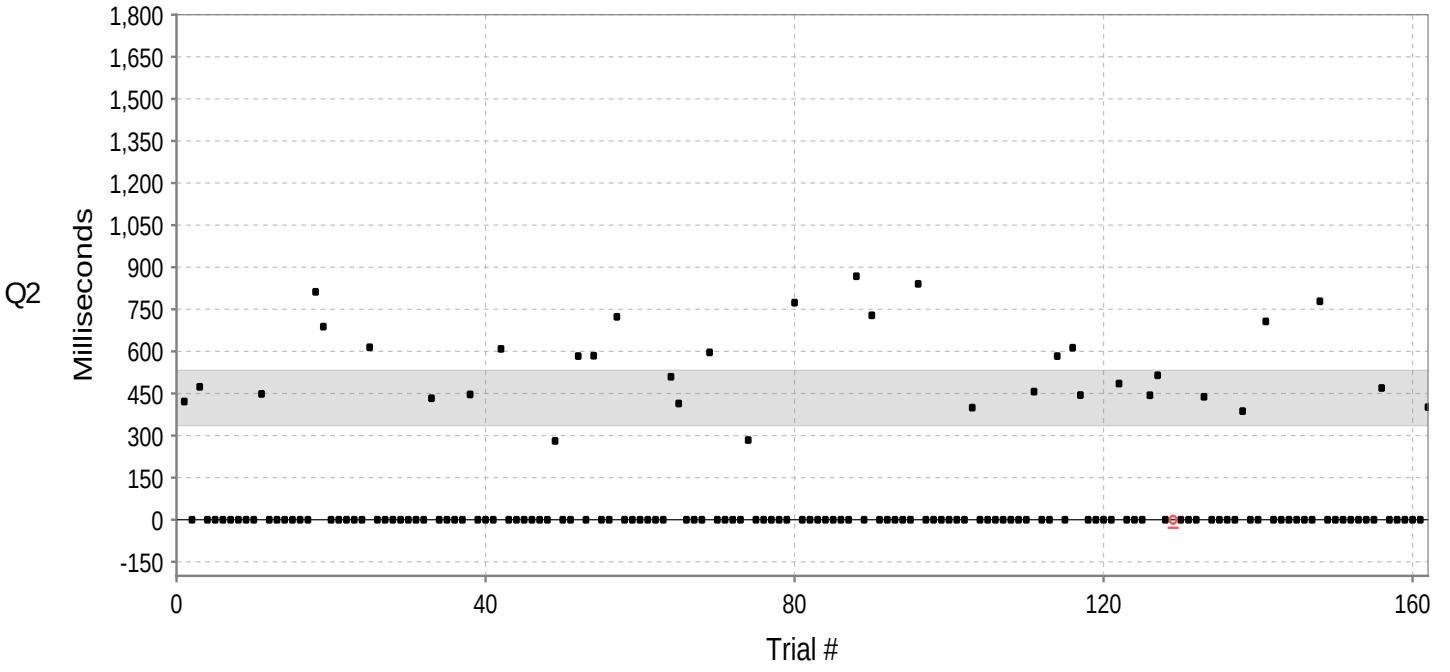
In the sample protocol shown below, the subject made one Commission Error in Quarter 1 (see red 'X') and one Omission Error in Quarter 2 (see red 'O'). There are two examples of a post-commission errors (green square) in Quarter 3, and one in Quarter 4.

ID: **1** **Example Subject** (Jul 1, 2004)
**Male - 12y 11m 0d**

**Visual T.O.V.A.** (v9.0-71 sn30000)
Jun 1, 2017 at 12:34 PM

This page graphically displays the subject's responses. Black squares mark correct responses and correct nonresponses. Red 'X's mark commission errors, red squares mark anticipatory responses, and underlined red circles mark omission errors. The light gray region represents the normative range of responses. Commission errors followed by a correct response are linked by a line: an upward slope (light gray) indicates slowing down following an error (typical), and a downward slope (black) indicates speeding up after making an error (unusual). Red numbers above the zero line indicate the number of missed targets (if three or more in a row), and the red number below the zero line indicates the number of seconds elapsed between correct target responses.



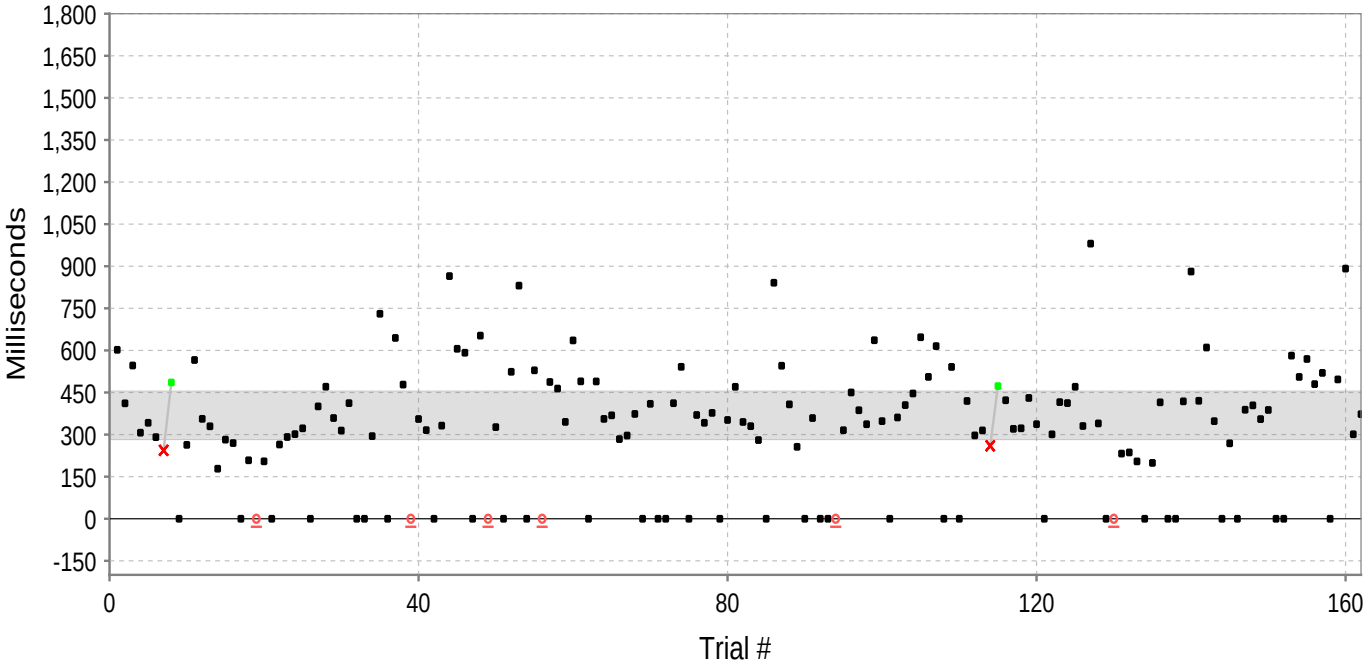

Correct response · Correct non-response · Commission error · Omission error · Anticipatory response
Post-commission error correct response · Slower post-commission RT · Faster post-commission RT
Off-scale resp./error · Normative range · Interruption · 3 10s Response gap (# Targets and Sec)

ID: **1** **Example Subject** (Jul 1, 2004)
**Male - 12y 11m 0d**

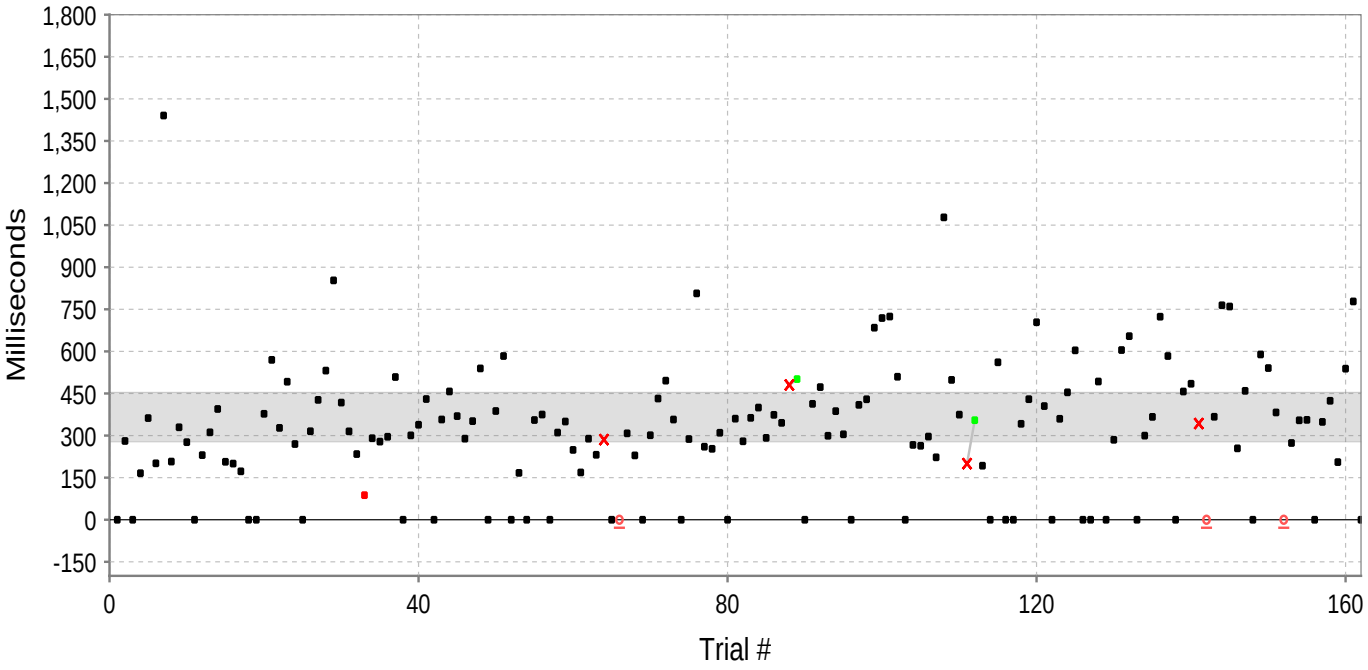
**Visual T.O.V.A.** (v9.0-71 sn30000)
Jun 1, 2017 at 12:34 PM

This page graphically displays the subject's responses. Black squares mark correct responses and correct nonresponses. Red 'X's mark commission errors, red squares mark anticipatory responses, and underlined red circles mark omission errors. The light gray region represents the normative range of responses. Commission errors followed by a correct response are linked by a line: an upward slope (light gray) indicates slowing down following an error (typical), and a downward slope (black) indicates speeding up after making an error (unusual). Red numbers above the zero line indicate the number of missed targets (if three or more in a row), and the red number below the zero line indicates the number of seconds elapsed between correct target responses.

Q3




Q4




Correct response · Correct non-response · Commission error · Omission error · Anticipatory response
Post-commission error correct response · Slower post-commission RT · Faster post-commission RT
Off-scale resp./error · Normative range · Interruption · 3 10s Response gap (# Targets and Sec)

## 16.7 Raw Data Tables

These tables present the sequence of targets and nontargets with the subject's response to each one in a tabular format. Errors are shown in red, and response times are in ms. A negative response time indicates a response that was made before the stimulus was displayed.

The codes are:

| | | |
|---|---|---|
| T = target | N = nontarget | O = Omission Error |
| C = Commission Error | A = Anticipatory Response | M = Multiple Responses |
| Red = Error Responses | T = Post-Commission Error Response | |
| U = User Interrupt | H = Hardware Interrupt | |

In the sample protocol shown below, the subject:

- In Quarter 1, made a "slow" Commission Error (643 ms as compared to an average response time of 492 ms in this quarter) immediately followed by an Omission Error.
- In Quarter 2, there was a "fast" commission error (243 ms) followed by a slowed down correct response (a post commission error responses, at 485 ms).
- In Quarter 2, there was a Multiple Response on a Target and an Omission Error later in the quarter.
- In Quarter 3, there was a fast Commission Error (243 ms) followed by a slowed down correct response (a Post Commission Error Response, at 485 ms). There were also 6 other Omission Errors, 1 Commission Error and 1 other Post Commission Error Response.
- In Quarter 4 there was 1 Nontarget Anticipatory Response (87 ms), 4 Commission Errors (one followed by a Post Commission Response and one by an Omission Error) and 2 other Omission Errors.

# TOVA — Raw Data Tables

ID: **1** **Example Subject** (Jul 1, 2004)
**Male - 12y 11m 0d**

**Visual T.O.V.A.** (v9.0-71 sn30000)
Jun 1, 2017 at 12:34 PM

This page shows a trial-by-trial view of T.O.V.A. test data. Each entry in the table indicates the stimulus type (target or nontarget) and the subject's response to that stimulus. Error responses are shown in red, and response times are in milliseconds. A negative response time indicates a response that was made before the stimulus was presented.

| 1-27 | 28-54 | 55-81 | 82-108 | 109-135 | 136-162 |
|---|---|---|---|---|---|
| N | N | N | N | N | N |
| N | N | N | N | T 483 | T 691 |
| N | N | N | N | N | T 278 |
| N | N | N | T 505 | N | N |
| N | T 564 | N | N | N | N |
| N | T 571 | N | N | T 479 | N |
| T 414 | N | C 643 | N | N | N |
| N | N | O | N | N | N |
| T 363 | T 613 | N | T 528 | N | T 688 |
| N | N | N | N | N | N |
| N | N | N | T 554 | N | T 471 |
| N | N | N | T 396 | N | N |
| N | N | N | N | T 515 | N |
| N | N | N | N | N | N |
| N | T 804 | T 630 | N | N | N |
| N | N | N | N | N | T 390 |
| T 385 | N | T 441 | N | N | T 398 |
| N | N | T 610 | N | N | N |
| N | N | N | N | N | N |
| N | T 569 | N | T 371 | N | N |
| T 374 | N | T 508 | N | T 463 | N |
| N | N | N | N | N | N |
| N | N | N | N | N | T 433 |
| N | T 469 | N | N | N | N |
| N | N | T 417 | N | N | N |
| T 384 | N | N | N | T 621 | N |
| N | T 300 | N | T 518 | N | N |

| 163-189 | 190-216 | 217-243 | 244-270 | 271-297 | 298-324 |
|---|---|---|---|---|---|
| T 421 | N | N | N | N | N |
| N | N | N | N | N | N |
| T 473 | N | T 723 | N | T 456 | T 387 |
| N | N | N | N | N | N |
| N | N | N | N | N | N |
| N | T 433 | N | N | T 583 | T 706 |
| N | N | N | T 867 | N | N |
| N | N | N | N | T 613 | N |
| N | N | N | T 728 | T 444 | N |
| N | N | T 509 | N | N | N |
| T 448 | T 446 | T 414 | N | N | N |
| N | N | N | N | N | N |
| N | N | N | N | N | T 778 |
| N | N | N | N | T 485 | N |
| N | T 608 | T 596 | T 840 | N | N |
| N | N | N | N | N | N |
| N | N | N | N | N | N |
| T 812 | N | N | N | T 443 | N |
| T 688 | N | N | N | T 514 | N |
| N | N | T 284 | N | N | N |
| N | N | N | N | O | T 469 |
| N | T 280 | N | T 399 | N | N |
| N | N | N | N | N | N |
| N | N | N | N | N | N |
| T 614 | T 583M | N | N | T 438 | N |
| N | N | T 773 | N | N | N |
| N | T 584 | N | N | N | T 401 |

| 325-351 | 352-378 | 379-405 | 406-432 | 433-459 | 460-486 |
|---|---|---|---|---|---|
| T 602 | T 470 | T 529 | T 344 | T 541 | T 414 |
| T 411 | T 359 | O | T 329 | N | N |
| T 546 | T 314 | T 487 | T 280 | T 419 | N |
| T 306 | T 412 | T 464 | N | T 297 | T 418 |
| T 342 | N | T 345 | T 841 | T 314 | T 881 |
| T 290 | N | T 635 | T 545 | C 259 | T 420 |
| C 243 | T 294 | T 489 | T 407 | T 472 | T 610 |
| T 485 | T 730 | N | T 256 | T 422 | T 347 |
| N | N | T 489 | N | T 320 | N |
| T 263 | T 644 | T 355 | T 358 | T 322 | T 268 |
| T 565 | T 478 | T 368 | N | T 430 | N |
| T 356 | O | T 283 | N | T 337 | T 388 |
| T 329 | T 355 | T 296 | O | N | T 404 |
| T 178 | T 315 | T 373 | T 315 | T 300 | T 355 |
| T 281 | N | N | T 450 | T 415 | T 387 |
| T 269 | T 331 | T 409 | T 386 | T 412 | N |
| N | T 864 | N | T 336 | T 470 | N |
| T 208 | T 605 | N | T 636 | T 330 | T 581 |
| O | T 591 | T 411 | T 347 | T 980 | T 505 |
| T 204 | N | T 541 | N | T 339 | T 569 |
| N | T 652 | N | T 361 | N | T 479 |
| T 264 | O | T 369 | T 405 | O | T 519 |
| T 291 | T 326 | T 342 | T 446 | T 232 | N |
| T 301 | N | T 377 | T 646 | T 236 | T 496 |
| T 322 | T 523 | N | T 505 | T 204 | T 891 |
| N | T 830 | T 352 | T 615 | N | T 301 |
| T 400 | N | T 470 | N | T 199 | T 372 |

| 487-513 | 514-540 | 541-567 | 568-594 | 595-621 | 622-648 |
|---|---|---|---|---|---|
| N | T 531 | T 355 | T 279 | T 498 | T 723 |
| T 280 | T 853 | T 375 | T 363 | T 374 | T 583 |
| N | T 417 | N | T 399 | C 199 | N |
| T 165 | T 314 | T 310 | T 291 | T 354 | T 457 |
| T 362 | T 234 | T 350 | T 373 | T 192 | T 484 |
| T 201 | NA 87 | T 248 | T 345 | N | C 342 |
| T 1440 | T 290 | T 168 | C 480 | T 561 | O |
| T 207 | T 278 | T 288 | T 501 | N | T 367 |
| T 329 | T 295 | T 231 | N | N | T 764 |
| T 276 | T 508 | C 285 | T 413 | T 341 | T 760 |
| N | N | N | T 472 | T 429 | T 254 |
| T 230 | T 300 | O | T 299 | T 703 | T 459 |
| T 311 | T 338 | T 307 | T 387 | T 405 | N |
| T 394 | T 430 | T 229 | T 304 | N | T 589 |
| T 206 | N | N | N | T 359 | T 540 |
| T 200 | T 357 | T 301 | T 409 | T 454 | T 382 |
| T 172 | T 457 | T 431 | T 429 | T 603 | O |
| N | T 369 | T 495 | T 684 | N | T 273 |
| N | T 289 | T 357 | T 718 | N | T 354 |
| T 377 | T 351 | N | T 724 | T 492 | T 356 |
| T 569 | T 539 | T 287 | T 509 | N | N |
| T 327 | N | T 806 | N | T 284 | T 348 |
| T 491 | T 387 | T 260 | T 266 | T 604 | T 423 |
| T 269 | T 583 | T 252 | T 263 | T 654 | T 205 |
| N | N | T 310 | T 296 | N | T 538 |
| T 315 | T 167 | N | T 222 | T 299 | T 778 |
| T 427 | N | T 360 | T 1077 | T 366 | N |

**T** = Correct response to target
**N** = Correct nonresponse to nontarget
**Green** = Post-Commission-error correct response
**O** = Omission error
**C** = Commission error
**U** = User interrupt
**A** = Anticipatory response
**M** = Multiple response
**H** = Hardware interrupt

# 17 Visual Preschool Report (Short Form)

Subjects aged 4.0 to 5.5 are given a 10.8-minute shortened version of the 21.6-minute T.O.V.A. test. The first half of the Preschool test is the same as the first quarter of the 21.6-minute test. The second half of the Preschool test is the same as the third quarter of the 21.6-minute test.

An example Summary page of a Preschool report is attached below.

ID: **1** **Example Subject** (Apr 1, 2012)
**Female - 5y 2m 0d**

**Short Visual T.O.V.A.** (v9.0-71 sn30000)
Jun 1, 2017 at 12:34 PM

## Session, Response, and Performance Validity

This session meets session, response and performance validity criteria.

## T.O.V.A. Interpretation

The results of this T.O.V.A. are not within normal limits, and may be suggestive of a possible attention deficit, including ADHD. Please see the Interpretation Notes page for additional information.

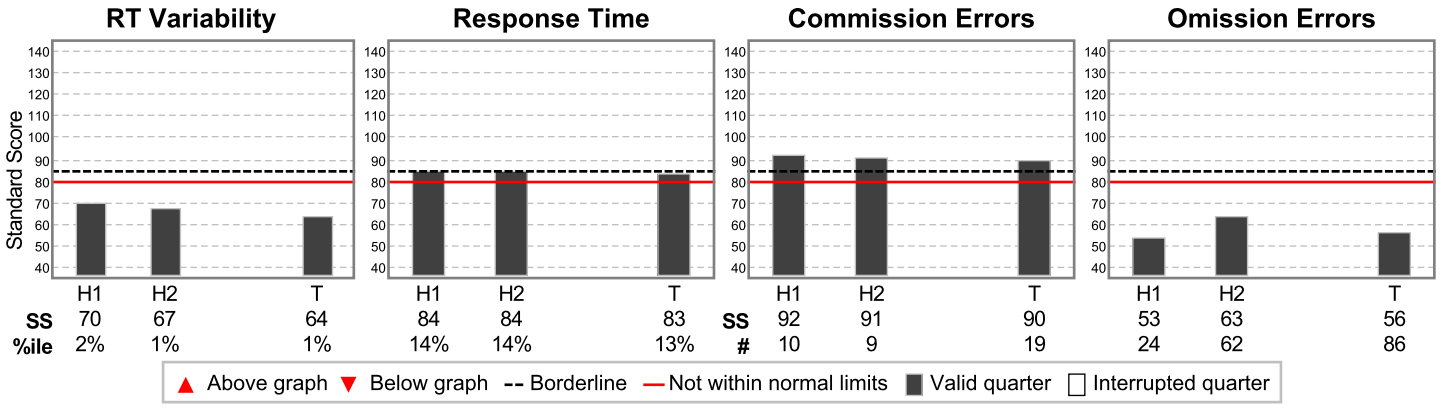
## Treatment

No treatments entered.

## Comparison to the Normative Sample

These scores compare this subject's performance to the performance of individuals of the same gender and age in the T.O.V.A. Normative Sample, a study of individuals who did not have attention problems.

Results are reported as standard scores (average standard = 100; standard deviation = 15). Standard scores above 85 are considered to be in the normal range, scores between 80 and 85 are considered borderline, and scores below 80 are considered not within normal limits. Scores less than 70 are considered significantly below normal range. Standard scores less than 40 are more than 4 standard deviations from normal, and are denoted as "<40".




Quarters, Halves and the Total are independently calculated and are not averages. Any Quarter, Half or Total that is Borderline or Not Within Normal Limits causes the Interpretation to be Borderline or Not Within Normal Limits. See the Interpretation Notes page for more information on these variables and on the subject's performance.

| | Half 1 | Half 2 | Total |
|---|---|---|---|
| **RT Variability** | 70 | 67 | 64 |
| **Response Time** | 84 | 84 | 83 |
| **Commission Errors** | 92 | 91 | 90 |
| **Omission Errors** | 53 | 63 | 56 |
| | Infrequent | Frequent | |

Key: Borderline, Not within normal limits, Invalid

# 18 Visual Adult Report (Performance Validity)

This report includes an embedded Performance Validity that flags unusual performance for persons 17 and older. If Performance Validity is flagged, this is noted in the Session, Response, and Validity Section on the Summary page, with details on the Interpretation Notes page.

An example Summary and Interpretation Notes page of an Adult report with flagged Performance Validity is attached below.

ID: **1** **Example Subject** (Jul 1, 1997)
**Male - 19y 11m 0d**

**Visual T.O.V.A.** (v9.0-71 sn30000)
Jun 1, 2017 at 12:34 PM

## Session, Response, and Performance Validity

**CAUTION:** There are important performance validity issues that affect the interpretation of this test. Please see the Validity section of the Interpretation Notes page.

## T.O.V.A. Interpretation

The results of this T.O.V.A. are not within normal limits, and may be suggestive of a possible attention deficit, including ADHD. Please see the Interpretation Notes page for additional information.

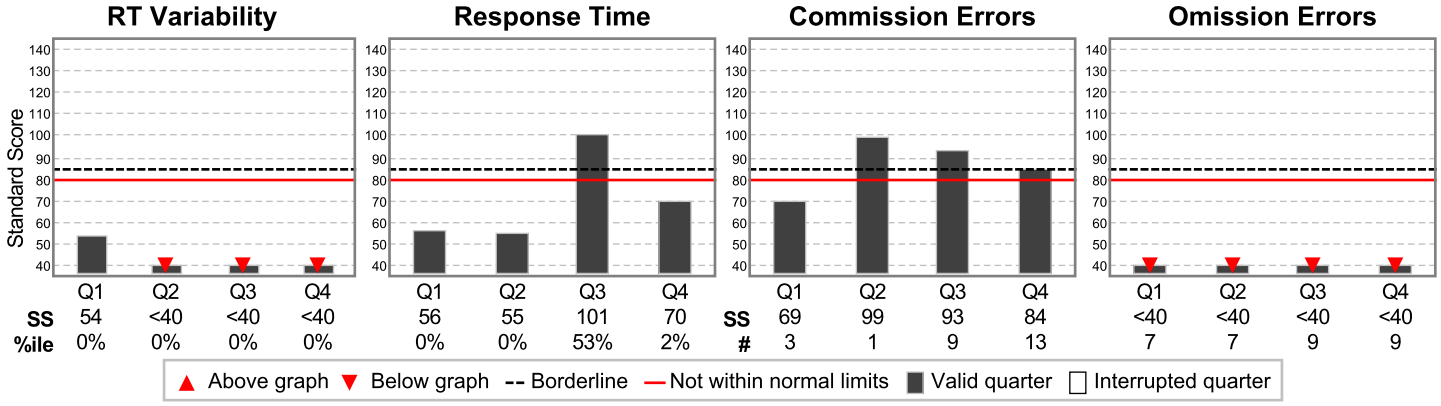
## Treatment

No treatments entered.

## Comparison to the Normative Sample

These scores compare this subject's performance to the performance of individuals of the same gender and age in the T.O.V.A. Normative Sample, a study of individuals who did not have attention problems.

Results are reported as standard scores (average standard = 100; standard deviation = 15). Standard scores above 85 are considered to be in the normal range, scores between 80 and 85 are considered borderline, and scores below 80 are considered not within normal limits. Scores less than 70 are considered significantly below normal range. Standard scores less than 40 are more than 4 standard deviations from normal, and are denoted as "<40".




Quarters, Halves and the Total are independently calculated and are not averages. Any Quarter, Half or Total that is Borderline or Not Within Normal Limits causes the Interpretation to be Borderline or Not Within Normal Limits. See the Interpretation Notes page for more information on these variables and on the subject's performance.

| | Quarter | | | | Half | | Total |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 1 | 2 | |
| **RT Variability** | 54 | <40 | <40 | <40 | <40 | <40 | <40 |
| **Response Time** | 56 | 55 | 101 | 70 | 56 | 83 | 77 |
| **Commission Errors** | 69 | 99 | 93 | 84 | 81 | 88 | 86 |
| **Omission Errors** | <40 | <40 | <40 | <40 | <40 | <40 | <40 |
| | Infrequent | | Frequent | | | | |

Key: Borderline, Not within normal limits, Invalid

ID: **1** **Example Subject** (Jul 1, 1997)
**Male - 19y 11m 0d**

**Visual T.O.V.A.** (v9.0-71 sn30000)
Jun 1, 2017 at 12:34 PM

## Session, Response, and Performance Validity

### Performance Validity

**CAUTION:** 2 of 4 performance validity rules have been flagged.

Performance Validity is flagged to alert clinicians when there is unusually poor performance on the T.O.V.A. Only a clinician can determine if the test performance is consistent with (1) ADHD, (2) attention deficits due to traumatic brain injury, substance use disorders, sleep disorders, or other causes, or (3) poor effort, or (4) malingering. Higher numbers of flags indicate increasingly unusual patterns of performance and warrant more caution interpreting test performance. Special caution should be taken when the possibility of secondary gain exists. Performance Validity is only applicable to ages 17 or older.

| Rule | Results | Flagged |
|---|---|---|
| Total omission errors greater than 30 | 32 | 1 |
| Half 1 commission errors (CE) greater than 10 | 4 | 0 |
| Half 2 response time (RT) skew greater than +150 ms | +241 ms | 1 |
| Half 2 CE RT minus RT greater than +75 ms | -137 ms | 0 |
| Total rules flagged: | | 2 |

## Notes on the Comparison to the Normative Sample

**Variability** is a precise measure of variations in correct response times, and measures the consistency of response times. **Variability was not within normal limits in Quarters 1, 2, 3, and 4, Half 1 and 2, and Total.**

**Response Time** is the average speed of correct responses to targets, and is a measure of information processing speed. **Response Time was borderline in Half 2, and not within normal limits in Quarters 1, 2, and 4, Half 1, and Total.**

**Commission Errors** occur when the subject incorrectly responds to a nontarget, and are a measure of inhibitory control. **Commission Errors were borderline in Quarter 4 and Half 1, and not within normal limits in Quarter 1.**

**Omission Errors** occur when the subject does not respond to a target, and are a measure of sustained attention. **Omission Errors were not within normal limits in Quarters 1, 2, 3, and 4, Half 1 and 2, and Total.**

## Other Notes

Consider administering an Auditory T.O.V.A. to this subject for a more comprehensive assessment of attention. This is important because an individual can have markedly different results on one test versus the other.

# 19 Auditory Report

The auditory T.O.V.A. test is normed for ages 6 to 29. The auditory test report is read similarly to the visual test, except:

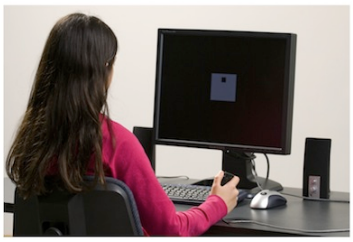
- The auditory T.O.V.A. is cleared only as an aid in the assessment of attention disorders, including ADHD.
- There is no Attention Comparison Score (ACS).
- There is no embedded Performance Validity (PV).

Example Introduction and Summary pages from an Auditory T.O.V.A. test are attached below.

## The Test Of Variables of Attention (T.O.V.A.®)

The **auditory Test of Variables of Attention (T.O.V.A.)** is an FDA-cleared, state-of-the-art continuous performance test that provides healthcare professionals with objective measurements of attention and inhibitory control. The auditory T.O.V.A. aids in the assessment of attention deficits, including attention-deficit/hyperactivity disorder (ADHD). T.O.V.A. results are available for children and adults (ages 6 - 29+) and should only be interpreted by qualified professionals.

The T.O.V.A. continuously measures performance during a 10.8-minute task or a 21.6-minute task, depending on age. It records speed, accuracy, and consistency of responses to a series of squares (in the visual T.O.V.A. test) or tones (in the auditory T.O.V.A. test) that are presented in two-second intervals. These measurements (accurate to ±1 ms) are then compared by age and gender to a normative sample (a sample of people without attention problems). This comparison determines whether the test results are "within normal limits" or not. The T.O.V.A. also compares results to a group of people independently diagnosed with ADHD. The T.O.V.A. report is based on these two comparisons, as well as performance, session, and response validity measures.



If you have questions about this report, please contact the person who provided it to you. For more information about attention and the T.O.V.A., please visit our website at https://www.tovatest.com/. To contact us please email info@tovatest.com or call 800.PAY.ATTN (562.594.7700).

ID: **1** **Example Subject** (May 1, 2001)
**Female - 16y 1m 0d**

**Auditory T.O.V.A.** (v9.0-71 sn30000)
Jun 1, 2017 at 12:34 PM

## Session and Response Validity

This session meets session and response validity criteria.

## T.O.V.A. Interpretation

The results of this T.O.V.A. are not within normal limits, and may be suggestive of a possible attention deficit, including ADHD. Please see the Interpretation Notes page for additional information.

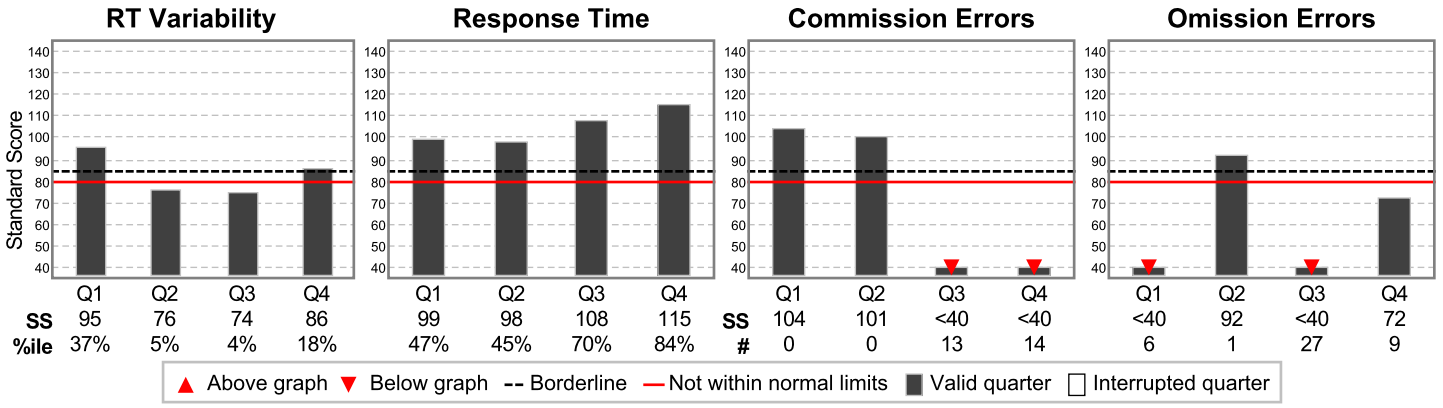
## Treatment

No treatments entered.

## Comparison to the Normative Sample

These scores compare this subject's performance to the performance of individuals of the same gender and age in the T.O.V.A. Normative Sample, a study of individuals who did not have attention problems.

Results are reported as standard scores (average standard = 100; standard deviation = 15). Standard scores above 85 are considered to be in the normal range, scores between 80 and 85 are considered borderline, and scores below 80 are considered not within normal limits. Scores less than 70 are considered significantly below normal range. Standard scores less than 40 are more than 4 standard deviations from normal, and are denoted as "<40".




Quarters, Halves and the Total are independently calculated and are not averages. Any Quarter, Half or Total that is Borderline or Not Within Normal Limits causes the Interpretation to be Borderline or Not Within Normal Limits. See the Interpretation Notes page for more information on these variables and on the subject's performance.

| | Quarter | | | | Half | | Total |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 1 | 2 | |
| **RT Variability** | 95 | 76 | 74 | 86 | 83 | 79 | 79 |
| **Response Time** | 99 | 98 | 108 | 115 | 98 | 112 | 109 |
| **Commission Errors** | 104 | 101 | <40 | <40 | 105 | <40 | <40 |
| **Omission Errors** | <40 | 92 | <40 | 72 | <40 | <40 | <40 |
| | Infrequent | | Frequent | | | | |

Key: Borderline, Not within normal limits, Invalid

# Part IV

# Evaluation of Treatment

## 20 Comparing Baseline and Treatment Interpretations

**Note: Only the visual T.O.V.A. has been FDA cleared as an aid in evaluating treatments for attention deficits, including ADHD. The auditory T.O.V.A. has only been cleared for assessing attention disorders and is not cleared to evaluate treatments. References in this section to the "T.O.V.A." refer only to the visual T.O.V.A. test and reports.**

It is recommended that multiple measures be used in the evaluation of treatment for attention deficits, including ADHD. Determining whether treatment needs to be increased, decreased, maintained, discontinued, or changed requires a thorough review of all available measures and the person's daily experience. The section below speaks to the role of the visual T.O.V.A. in the assessment process.

It is possible to measure the effects of treatment on T.O.V.A. performance. To do this most effectively, administer a visual T.O.V.A. without the treatment. This establishes a baseline of performance (baseline T.O.V.A.). To assess change in performance, the test is then repeated with the treatment. For short-acting stimulant medication, administer the visual T.O.V.A. 90 minutes after taking the medication (longer for extended release medications). Consult the drug manufacturer for peak effect of prescribed medication. For non-pharmaceutical treatment, establish a baseline prior to the beginning of the treatment if possible. Visual T.O.V.A. sessions can be administered throughout the duration of the treatment to monitor progress or identify the need to modify the treatment protocol.

Please see the **T.O.V.A. User's Manual** for information on administration of the T.O.V.A.

When comparing a baseline to a treatment interpretation, use a comparison graph to see the results side by side. If the baseline interpretation was "not within normal limits" and the treatment interpretation is "within normal limits", the treatment has been successful overall. However, it is always good to compare the results side by side to see if the scores are stable or improved in all measures of the T.O.V.A.

Please see the **T.O.V.A. User's Manual** for information on how to generate comparison graphs.

If a baseline cannot be established prior to treatment, administer the visual T.O.V.A. and review the Interpretation, the Comparison to the Normative Sample, and the Attention Comparison Score (ACS). If all standard scores are "within normal limits" and the ACS is above zero, use the other elements of the assessment to confirm optimal response to treatment. If any standard score is "not within normal limits" or "borderline" and/or the ACS is below zero, establish the reason for the "not within normal limits/borderline" performance. This could indicate a need for a modification of, or a change in, the treatment protocol. It may also mean that more time is needed to see an improvement in performance.

When a subject has significant losses and gains in performance when comparing a baseline T.O.V.A. to her/his T.O.V.A. during or after treatment, this is called a mixed result. Optimal T.O.V.A. performance will mean a rise in standard scores to "within normal limits" without any drop in standard score more than 8 points in any quarter when compared to the baseline T.O.V.A. If a mixed result occurs, determine the cause of the mixed result and adjust treatment if needed.

In any T.O.V.A. that has a drop of 8 or more points between quarters, please determine the reason(s) for the drop in performance.

Please keep in mind **Factors Affecting T.O.V.A. Performance** (page 18) when comparing baseline and treatment T.O.V.A.s.

## 20.1 Example T.O.V.A. reports measuring baseline and treatment performances, with comparison charts

### 20.1.1 Example Subject 1

This 16-year-old female had a diagnosis of ADHD, predominantly inattentive presentation. Her baseline T.O.V.A. was not within normal limits.

ID: **1** **Example Subject** (Oct 1, 2000)
**Female - 16y 9m 0d**

**Visual T.O.V.A.** (v9.0-78 sn30000)
Jul 1, 2017 at 8:33 AM

## Session, Response, and Performance Validity

This session meets session, response and performance validity criteria.

## T.O.V.A. Interpretation

The results of this T.O.V.A. are not within normal limits, and may be suggestive of a possible attention deficit, including ADHD. Please see the Interpretation Notes page for additional information.

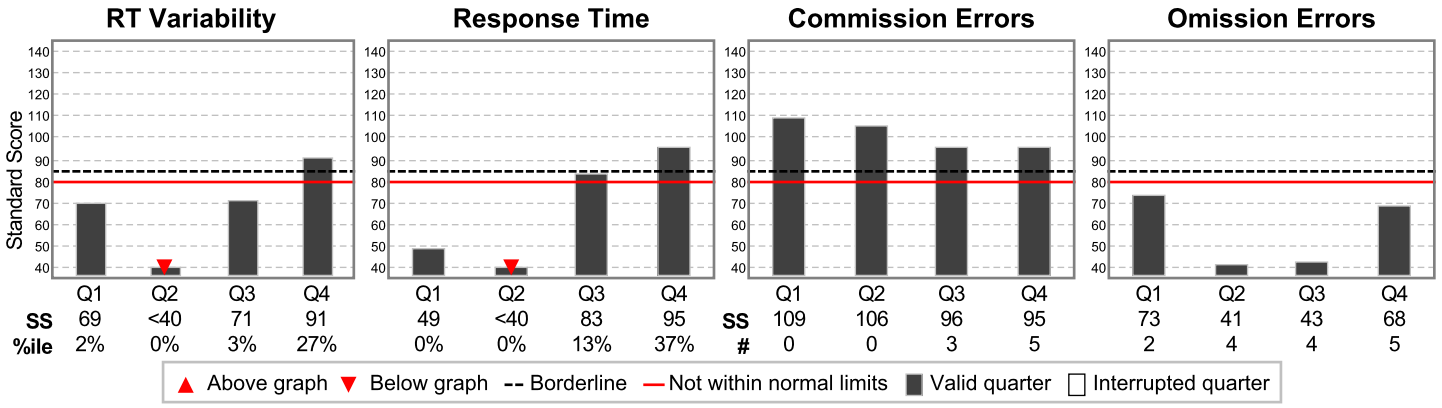
## Treatment

No treatments entered.

## Comparison to the Normative Sample

These scores compare this subject's performance to the performance of individuals of the same gender and age in the T.O.V.A. Normative Sample, a study of individuals who did not have attention problems.

Results are reported as standard scores (average standard = 100; standard deviation = 15). Standard scores above 85 are considered to be in the normal range, scores between 80 and 85 are considered borderline, and scores below 80 are considered not within normal limits. Scores less than 70 are considered significantly below normal range. Standard scores less than 40 are more than 4 standard deviations from normal, and are denoted as "<40".




Quarters, Halves and the Total are independently calculated and are not averages. Any Quarter, Half or Total that is Borderline or Not Within Normal Limits causes the Interpretation to be Borderline or Not Within Normal Limits. See the Interpretation Notes page for more information on these variables and on the subject's performance.

| | Quarter | | | | Half | | Total |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 1 | 2 | |
| **RT Variability** | 69 | <40 | 71 | 91 | <40 | 80 | 54 |
| **Response Time** | 49 | <40 | 83 | 95 | <40 | 89 | 79 |
| **Commission Errors** | 109 | 106 | 96 | 95 | 111 | 95 | 98 |
| **Omission Errors** | 73 | 41 | 43 | 68 | <40 | 47 | <40 |
| | Infrequent | | Frequent | | | | |

Key: Borderline, Not within normal limits, Invalid

Her visual treatment comparison test was within normal limits in all quarters, and her ACS improved from -7.01 to +5.01.

ID: **1** **Example Subject** (Oct 1, 2000)
**Female - 16y 11m 0d**

**Visual T.O.V.A.** (v9.0-78 sn30000)
Sep 1, 2017 at 9:16 AM

## Session, Response, and Performance Validity

This session meets session, response and performance validity criteria.

## T.O.V.A. Interpretation

The results of this T.O.V.A. are within normal limits. Please see the Interpretation Notes page for additional information.

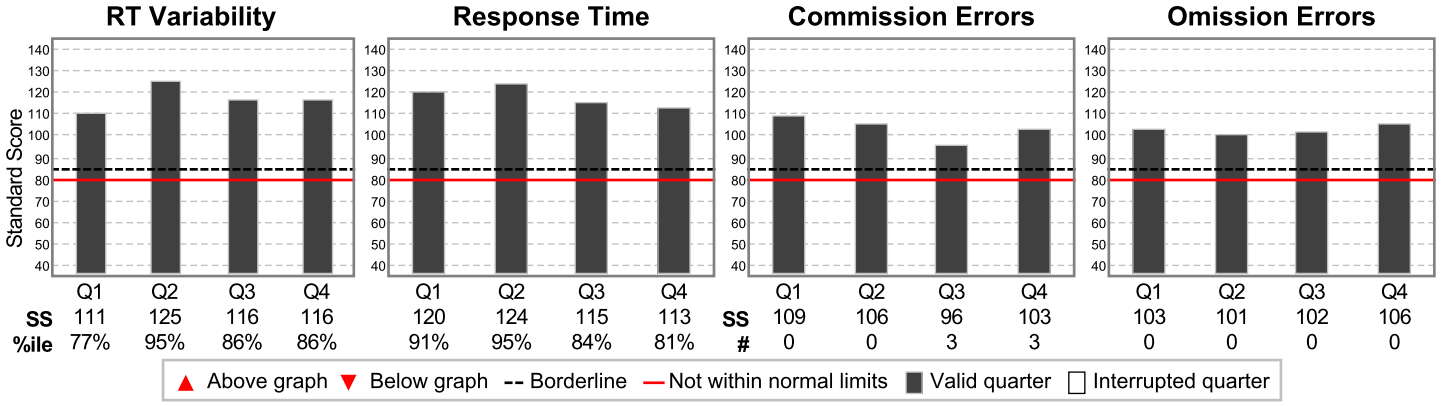
## Treatment

10.0mg dose of Adderall XR taken 2.0 hours before testing.

## Comparison to the Normative Sample

These scores compare this subject's performance to the performance of individuals of the same gender and age in the T.O.V.A. Normative Sample, a study of individuals who did not have attention problems.

Results are reported as standard scores (average standard = 100; standard deviation = 15). Standard scores above 85 are considered to be in the normal range, scores between 80 and 85 are considered borderline, and scores below 80 are considered not within normal limits. Scores less than 70 are considered significantly below normal range. Standard scores less than 40 are more than 4 standard deviations from normal, and are denoted as "<40".




Quarters, Halves and the Total are independently calculated and are not averages. Any Quarter, Half or Total that is Borderline or Not Within Normal Limits causes the Interpretation to be Borderline or Not Within Normal Limits. See the Interpretation Notes page for more information on these variables and on the subject's performance.

| | Quarter | | | | Half | | Total |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 1 | 2 | |
| **RT Variability** | 111 | 125 | 116 | 116 | 118 | 120 | 125 |
| **Response Time** | 120 | 124 | 115 | 113 | 122 | 115 | 117 |
| **Commission Errors** | 109 | 106 | 96 | 103 | 111 | 100 | 102 |
| **Omission Errors** | 103 | 101 | 102 | 106 | 104 | 106 | 108 |
| | Infrequent | | Frequent | | | | |

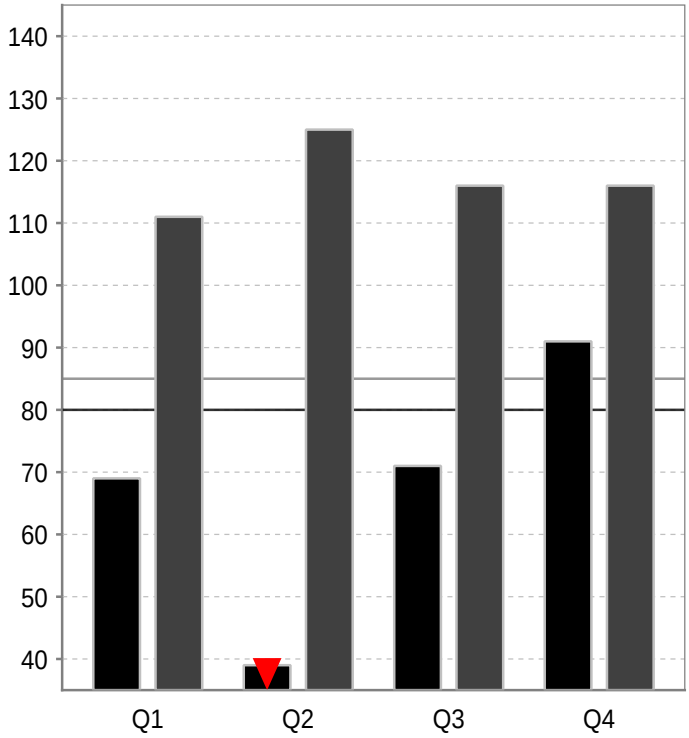
Key: Borderline, Not within normal limits, Invalid

Her treatment comparison test is within normal limits with no significant drop (8 or more points) in performance, when compared to her baseline.

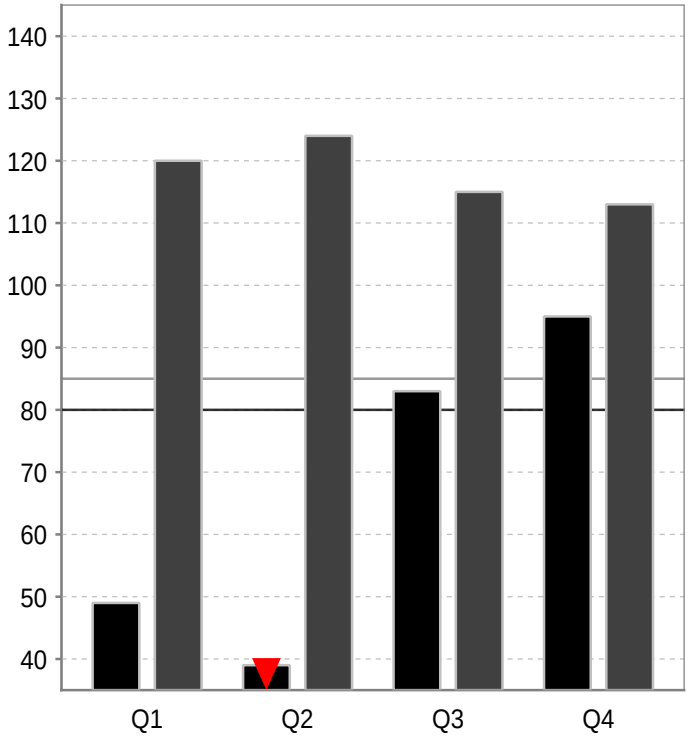
# TOVA Standard Comparison Graphs

- Example Subject, 16.75 y, Jul 1, 2017 8:33 AM, Visual
- Example Subject, 16.92 y, Sep 1, 2017 9:16 AM, Visual, Adderall XR(10.0mg)

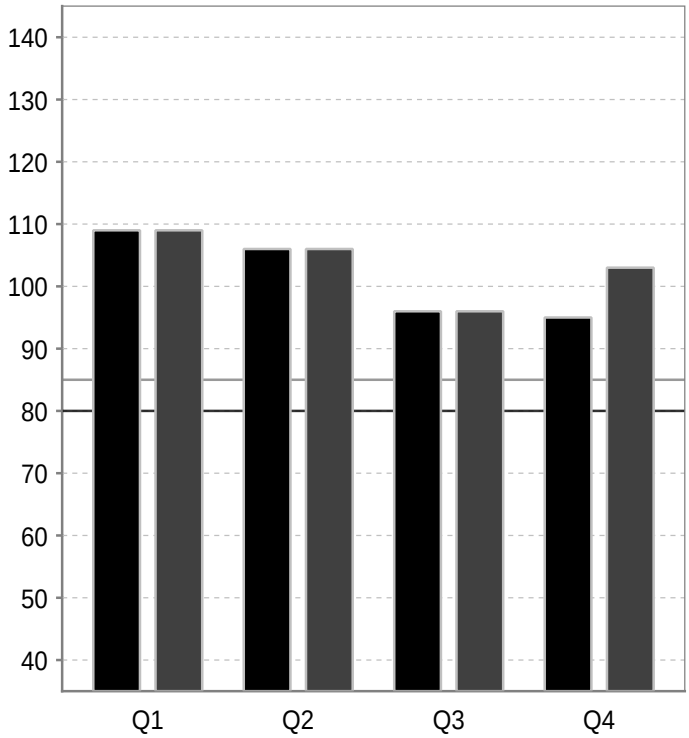
## RT Variability



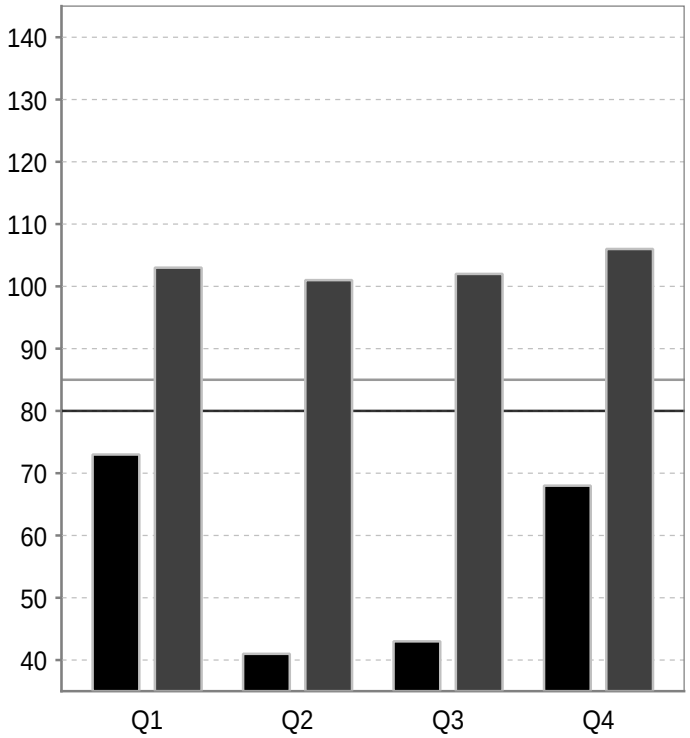

## Response Time




## Commission Errors

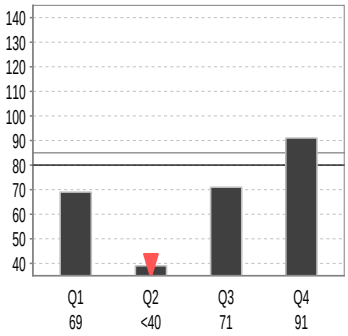



## Omission Errors

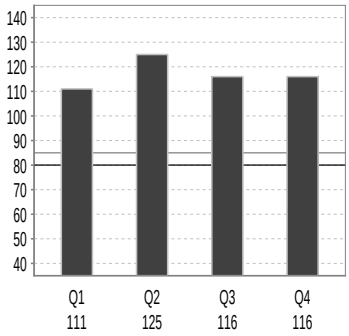


| Example Subject<br>16.75 y, 7/1/17 8:33 AM<br>Visual<br>No challenge | Example Subject<br>16.92 y, 9/1/17 9:16 AM<br>Visual<br>Adderall XR(10.0mg) |
|---|---|

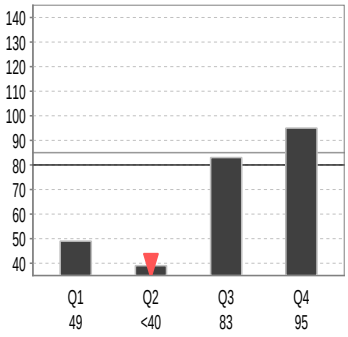
## RT Variability



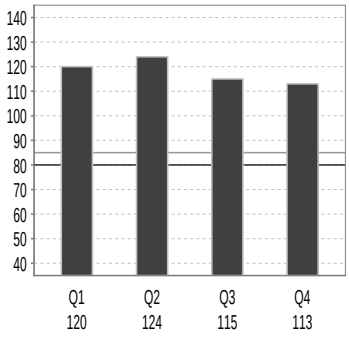

## RT Variability



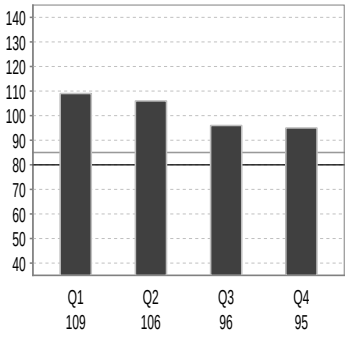

## Response Time



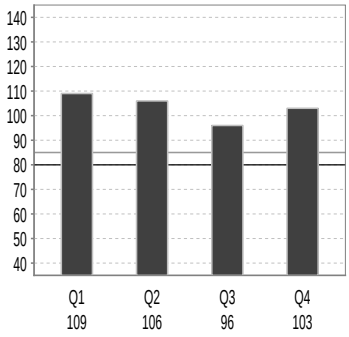

## Response Time



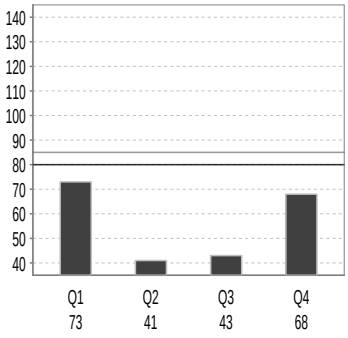

## Commission Errors



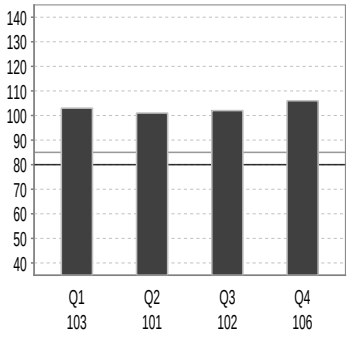

## Commission Errors




## Omission Errors

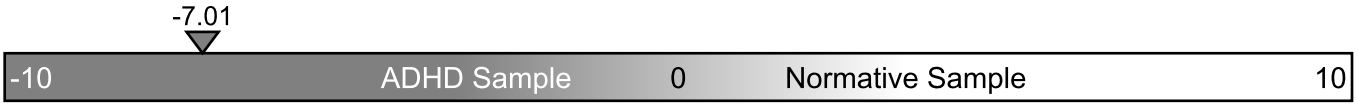



## Omission Errors

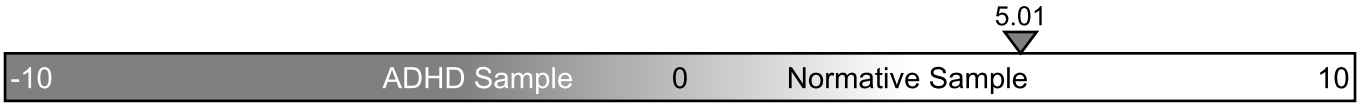


**A:** Example Subject, 16.75 y, 7/1/17 8:33 AM, Visual, No challenge
**B:** Example Subject, 16.92 y, 9/1/17 9:16 AM, Visual, Adderall XR(10.0mg)

A:




B:



### 20.1.2 Example Subject 2:

This 11-year-old male had a diagnosis of ADHD, combined presentation. His baseline T.O.V.A. was not within normal limits.

ID: **1** **Example Subject** (Apr 1, 2006)
**Male - 11y 3m 0d**

**Visual T.O.V.A.** (v9.0-78 sn30000)
Jul 1, 2017 at 11:06 AM

## Session, Response, and Performance Validity

**CAUTION:** There are important response validity issues that affect the interpretation of this test. Please see the Validity section of the Interpretation Notes page.

## T.O.V.A. Interpretation

The results of this T.O.V.A. are not within normal limits, and may be suggestive of a possible attention deficit, including ADHD. Please see the Interpretation Notes page for additional information.

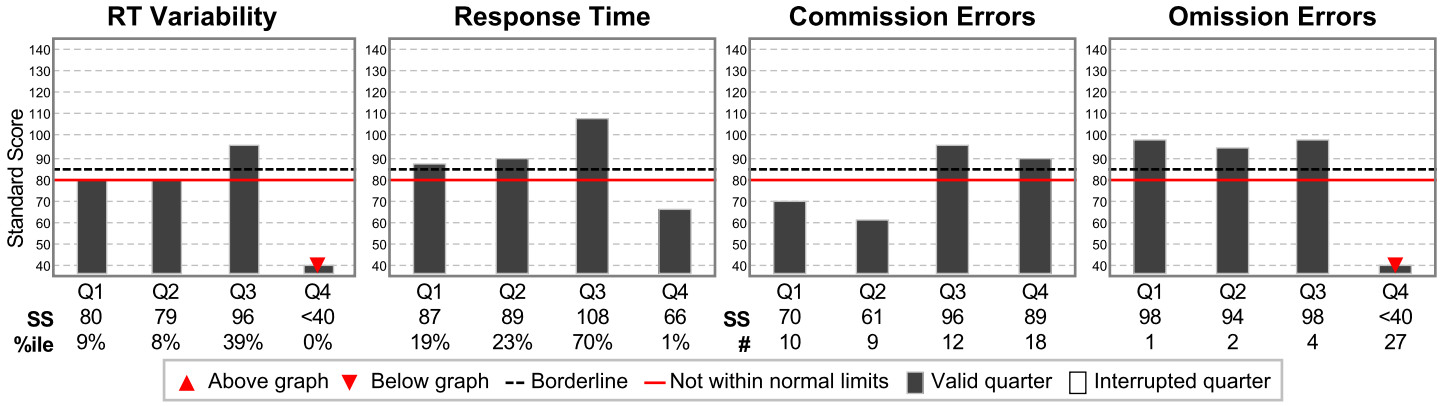
## Treatment

No treatments entered.

## Comparison to the Normative Sample

These scores compare this subject's performance to the performance of individuals of the same gender and age in the T.O.V.A. Normative Sample, a study of individuals who did not have attention problems.

Results are reported as standard scores (average standard = 100; standard deviation = 15). Standard scores above 85 are considered to be in the normal range, scores between 80 and 85 are considered borderline, and scores below 80 are considered not within normal limits. Scores less than 70 are considered significantly below normal range. Standard scores less than 40 are more than 4 standard deviations from normal, and are denoted as "<40".




Quarters, Halves and the Total are independently calculated and are not averages. Any Quarter, Half or Total that is Borderline or Not Within Normal Limits causes the Interpretation to be Borderline or Not Within Normal Limits. See the Interpretation Notes page for more information on these variables and on the subject's performance.

| | Quarter | | | | Half | | Total |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 1 | 2 | |
| **RT Variability** | 80 | 79 | 96 | <40 | 79 | <40 | <40 |
| **Response Time** | 87 | 89 | 108 | 66 | 88 | 90 | 87 |
| **Commission Errors** | 70 | 61 | 96 | 89 | 64 | 92 | 82 |
| **Omission Errors** | 98 | 94 | 98 | <40 | 96 | 79 | 82 |
| | Infrequent | | | Frequent | | | |

Key: Borderline, Not within normal limits, Invalid

A T.O.V.A. was administered while he was on his medication. His test results were not within normal limits.

# TOVA Summary

ID: **1** **Example Subject** (Apr 1, 2006)
**Male - 11y 4m 0d**

**Visual T.O.V.A.** (v9.0-78 sn30000)
Aug 1, 2017 at 10:10 AM

## Session, Response, and Performance Validity

This session meets session, response and performance validity criteria.

## T.O.V.A. Interpretation

The results of this T.O.V.A. are not within normal limits, and may be suggestive of a possible attention deficit, including ADHD, because the Comparison to the Normative Sample is not within normal limits. Please see the Interpretation Notes page for additional information.

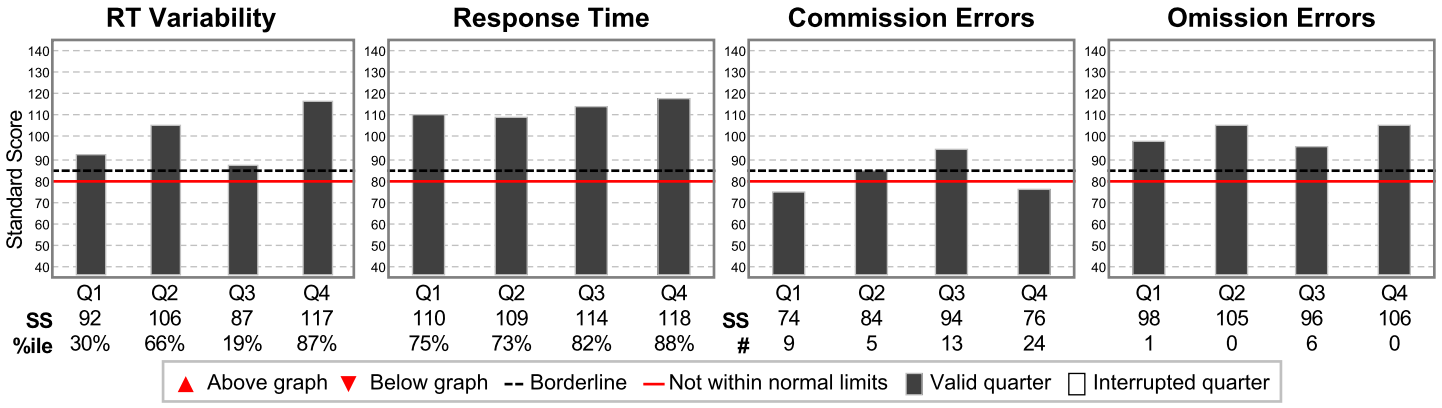
## Treatment

50.0mg dose of Adderall taken 2.5 hours before testing.

## Comparison to the Normative Sample

These scores compare this subject's performance to the performance of individuals of the same gender and age in the T.O.V.A. Normative Sample, a study of individuals who did not have attention problems.

Results are reported as standard scores (average standard = 100; standard deviation = 15). Standard scores above 85 are considered to be in the normal range, scores between 80 and 85 are considered borderline, and scores below 80 are considered not within normal limits. Scores less than 70 are considered significantly below normal range. Standard scores less than 40 are more than 4 standard deviations from normal, and are denoted as "<40".




Quarters, Halves and the Total are independently calculated and are not averages. Any Quarter, Half or Total that is Borderline or Not Within Normal Limits causes the Interpretation to be Borderline or Not Within Normal Limits. See the Interpretation Notes page for more information on these variables and on the subject's performance.

| | Quarter | | | | Half | | Total |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 1 | 2 | |
| **RT Variability** | 92 | 106 | 87 | 117 | 100 | 102 | 101 |
| **Response Time** | 110 | 109 | 114 | 118 | 110 | 117 | 116 |
| **Commission Errors** | 74 | 84 | 94 | 76 | 77 | 85 | 80 |
| **Omission Errors** | 98 | 105 | 96 | 106 | 101 | 99 | 100 |
| | Infrequent | | Frequent | | | | |

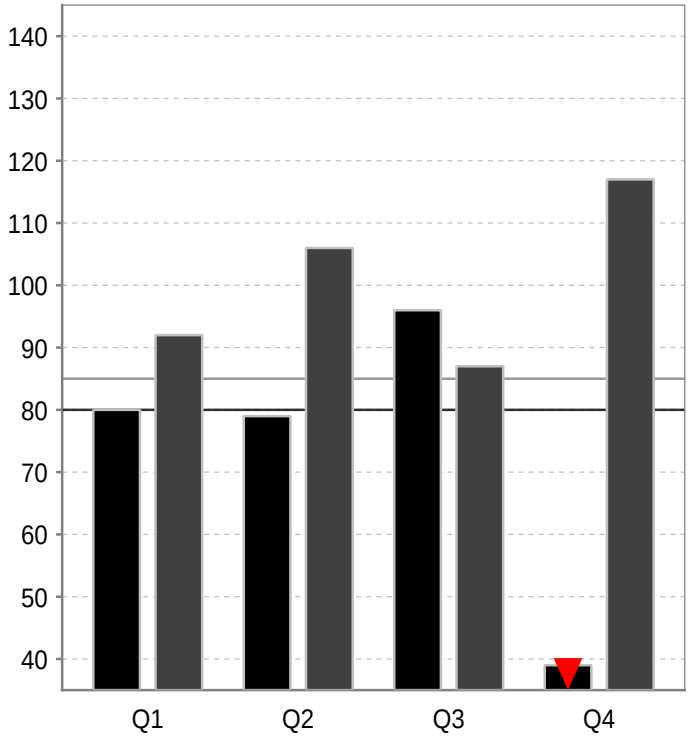
Key: Borderline, Not within normal limits, Invalid

When comparing the two tests, the subject improved in some areas and worsened in others. (See comparison graphs below.) His Response Time Variability (RTV) score dropped 9 points (from 96 to 87) in Quarter 3, and his Commission Error scores dropped 13 points (89 to 76) in Quarter 4 on his treatment comparison test. Though other standard scores improved and the ACS improved from -5.61 to +1.27, the mixed result indicated that his performance could improve.

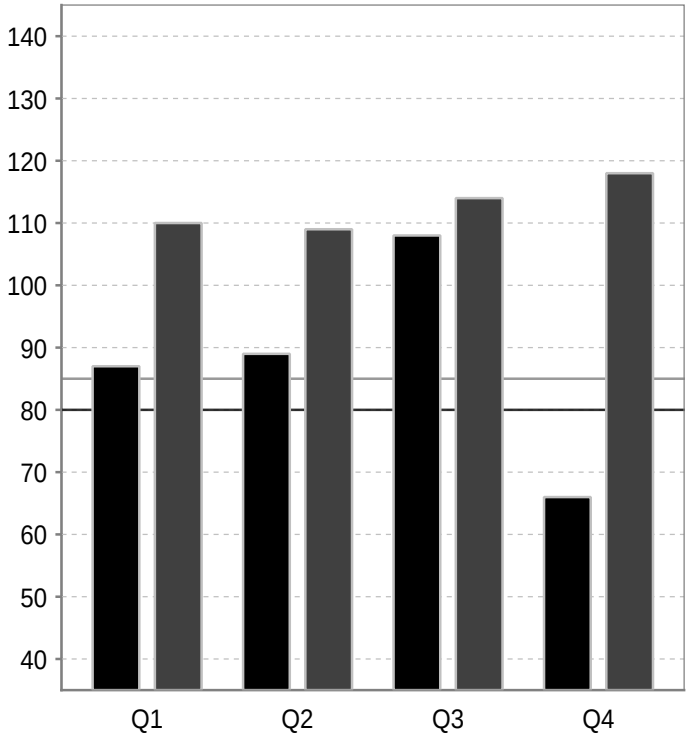
# TOVA Standard Comparison Graphs

- Example Subject, 11.25 y, Jul 1, 2017 11:06 AM, Visual
- Example Subject, 11.33 y, Aug 1, 2017 10:10 AM, Visual, Adderall(50.0mg)

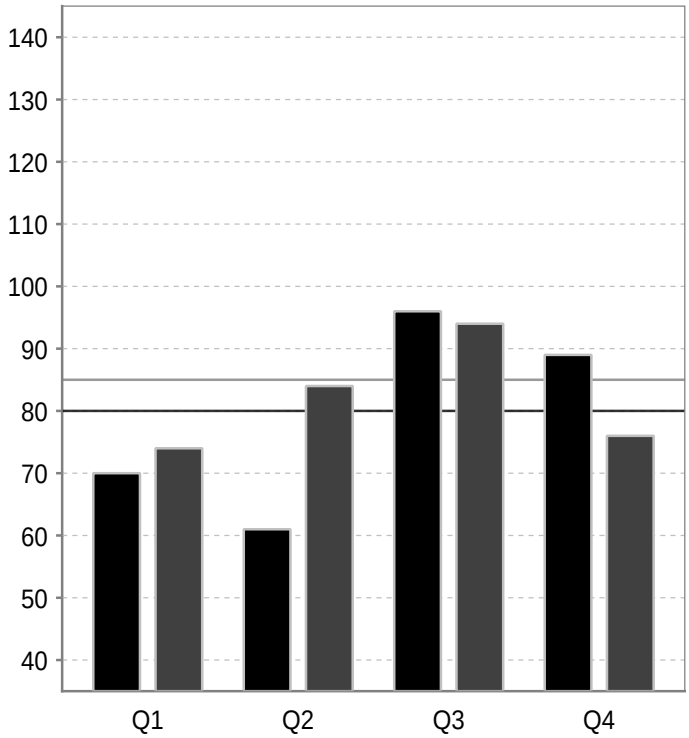
## RT Variability



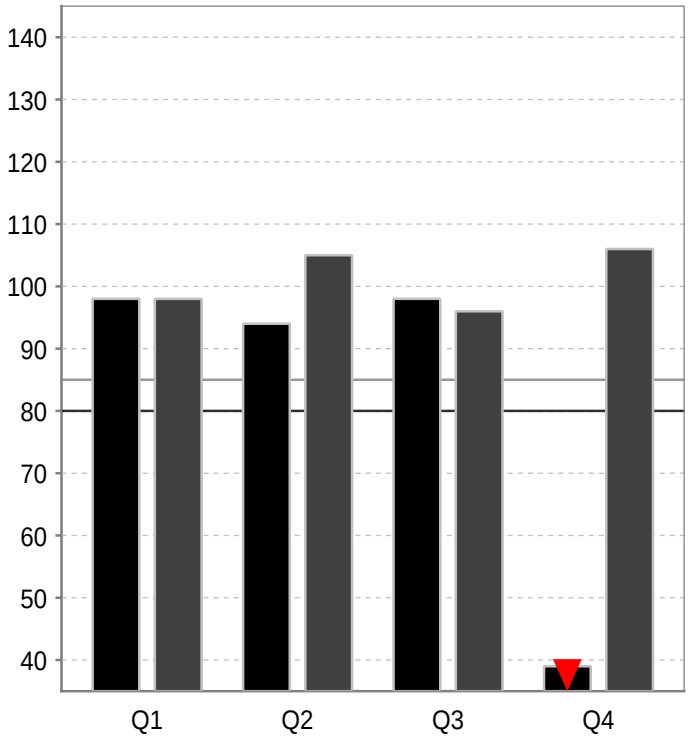

## Response Time




## Commission Errors

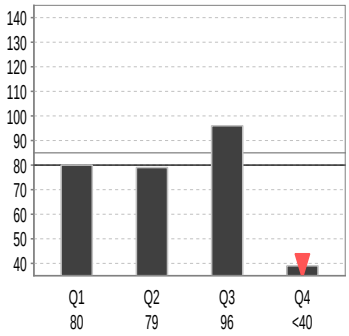



## Omission Errors

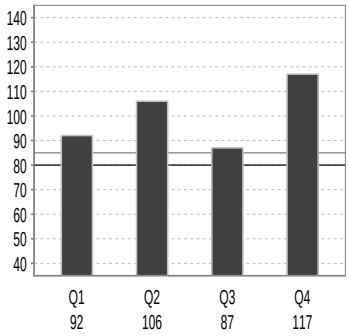


| Example Subject<br>11.25 y, 7/1/17 11:06 AM<br>Visual<br>No challenge | Example Subject<br>11.33 y, 8/1/17 10:10 AM<br>Visual<br>Adderall(50.0mg) |
|---|---|

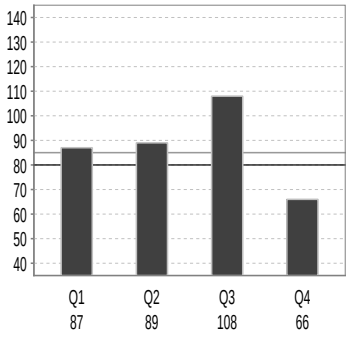
## RT Variability



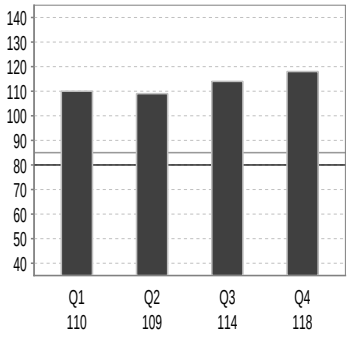

## RT Variability



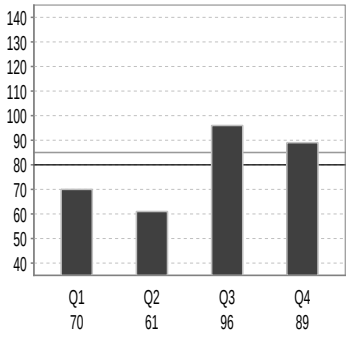

## Response Time



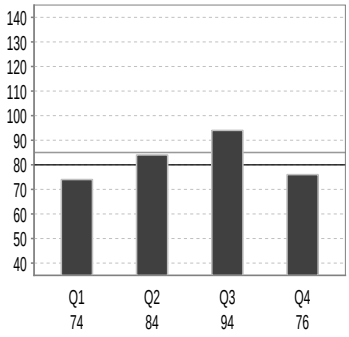

## Response Time



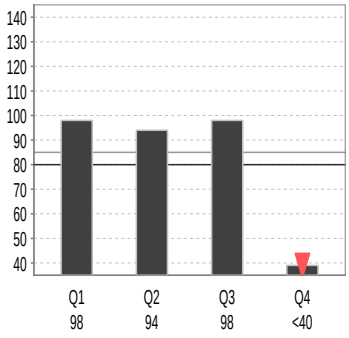

## Commission Errors



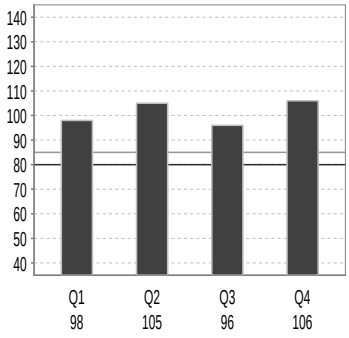

## Commission Errors




## Omission Errors

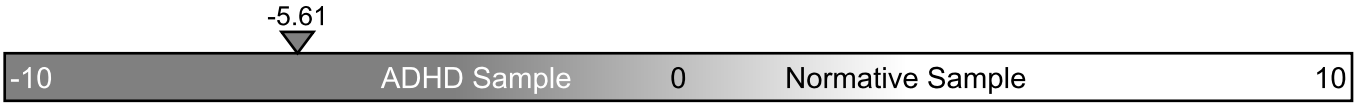



## Omission Errors

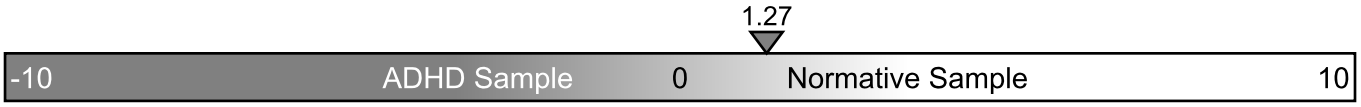


**A:** Example Subject, 11.25 y, 7/1/17 11:06 AM, Visual, No challenge
**B:** Example Subject, 11.33 y, 8/1/17 10:10 AM, Visual, Adderall(50.0mg)

A:




B:



After a review of the T.O.V.A., his behavior ratings, and a parent and teacher consult, his clinician made the decision to change his medication. His second treatment comparison T.O.V.A. was within normal limits with no drops of 8 or more points between quarters from baseline to treatment comparison, and his ACS improved from -5.61 to +3.38.

ID: **1** **Example Subject** (Apr 1, 2006)
**Male - 11y 5m 0d**

**Visual T.O.V.A.** (v9.0-78 sn30000)
Sep 1, 2017 at 12:23 PM

## Session, Response, and Performance Validity

This session meets session, response and performance validity criteria.

## T.O.V.A. Interpretation

The results of this T.O.V.A. are within normal limits. Please see the Interpretation Notes page for additional information.

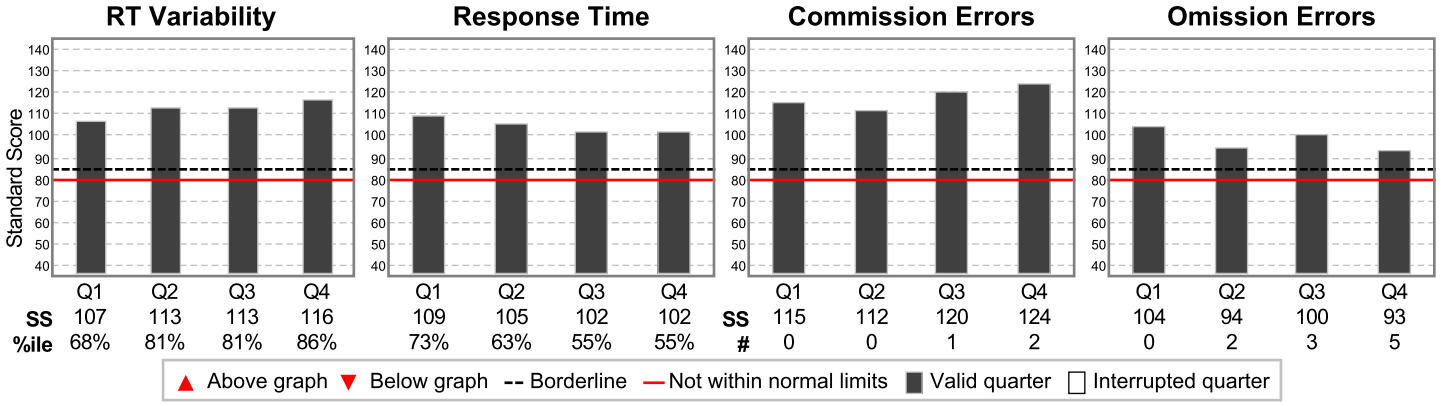
## Treatment

10.0mg dose of Adderall xr taken 2.5 hours before testing.

## Comparison to the Normative Sample

These scores compare this subject's performance to the performance of individuals of the same gender and age in the T.O.V.A. Normative Sample, a study of individuals who did not have attention problems.

Results are reported as standard scores (average standard = 100; standard deviation = 15). Standard scores above 85 are considered to be in the normal range, scores between 80 and 85 are considered borderline, and scores below 80 are considered not within normal limits. Scores less than 70 are considered significantly below normal range. Standard scores less than 40 are more than 4 standard deviations from normal, and are denoted as "<40".




Quarters, Halves and the Total are independently calculated and are not averages. Any Quarter, Half or Total that is Borderline or Not Within Normal Limits causes the Interpretation to be Borderline or Not Within Normal Limits. See the Interpretation Notes page for more information on these variables and on the subject's performance.

| | Quarter | | | | Half | | Total |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 1 | 2 | |
| **RT Variability** | 107 | 113 | 113 | 116 | 112 | 116 | 119 |
| **Response Time** | 109 | 105 | 102 | 102 | 108 | 102 | 103 |
| **Commission Errors** | 115 | 112 | 120 | 124 | 114 | 123 | 122 |
| **Omission Errors** | 104 | 94 | 100 | 93 | 99 | 97 | 98 |
| | Infrequent | | Frequent | | | | |

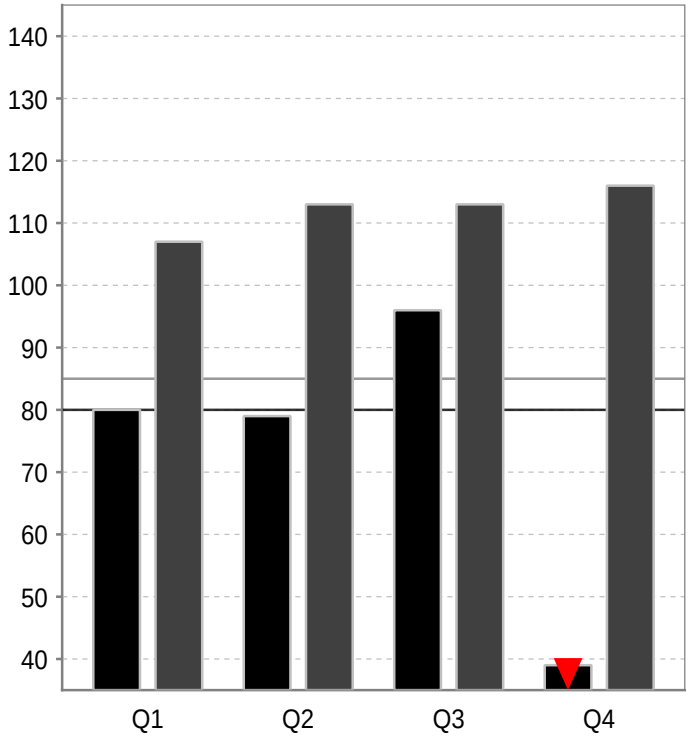
Key: Borderline, Not within normal limits, Invalid

A comparison of the first and last test show improved performance to within normal limits.

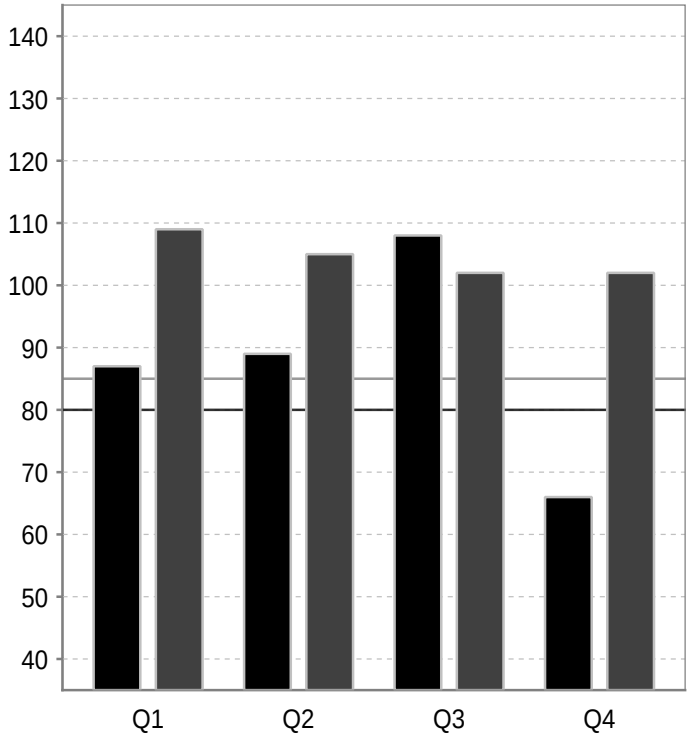
# TOVA Standard Comparison Graphs

Example Subject, 11.25 y, Jul 1, 2017 11:06 AM, Visual
Example Subject, 11.42 y, Sep 1, 2017 12:23 PM, Visual, Adderall xr(10.0mg)

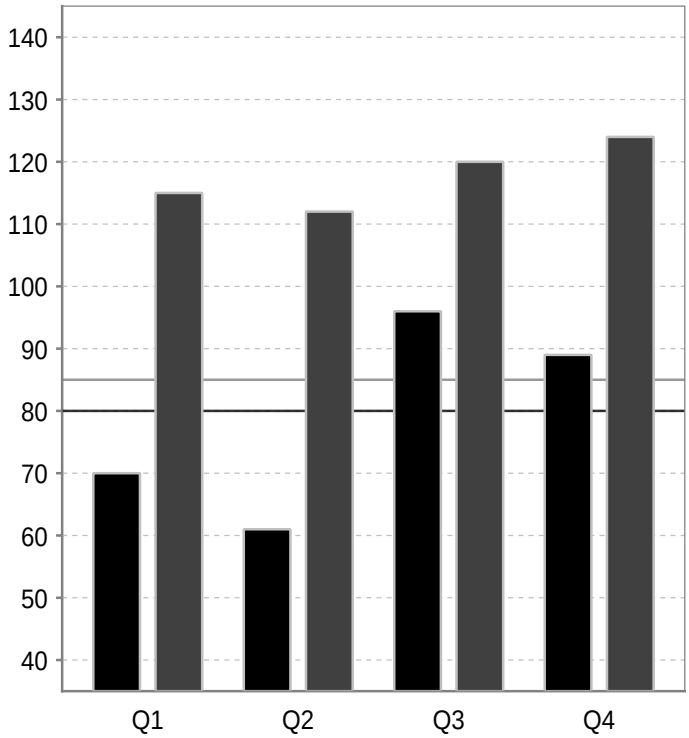
## RT Variability



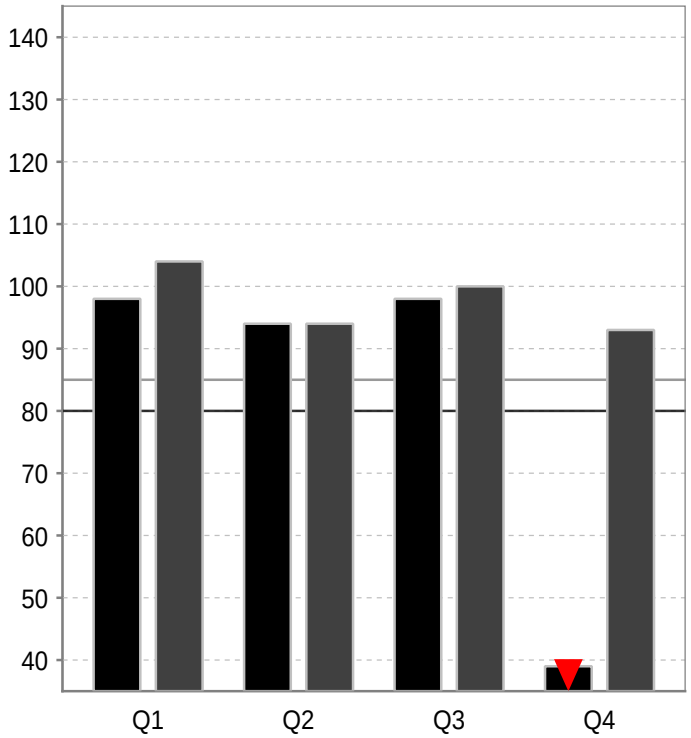

## Response Time




## Commission Errors

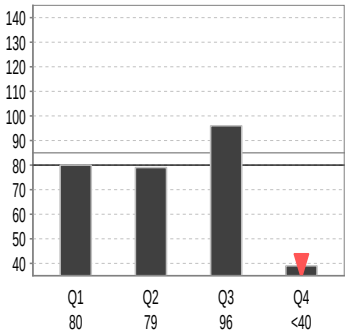



## Omission Errors

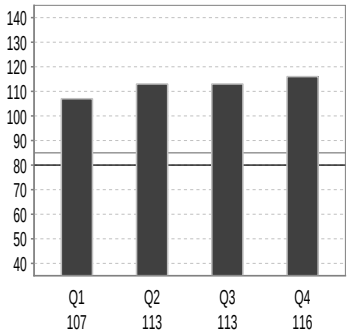


| Example Subject<br>11.25 y, 7/1/17 11:06 AM<br>Visual<br>No challenge | Example Subject<br>11.42 y, 9/1/17 12:23 PM<br>Visual<br>Adderall xr(10.0mg) |
|---|---|

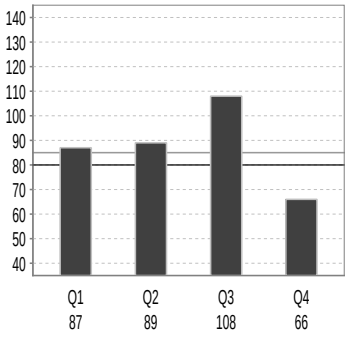
## RT Variability



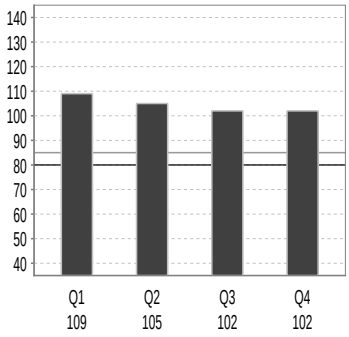

## RT Variability



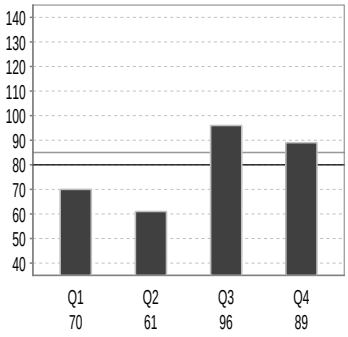

## Response Time



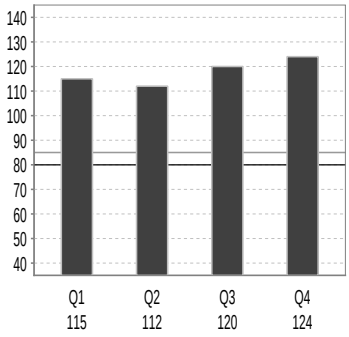

## Response Time



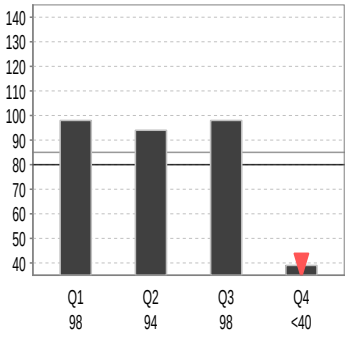

## Commission Errors



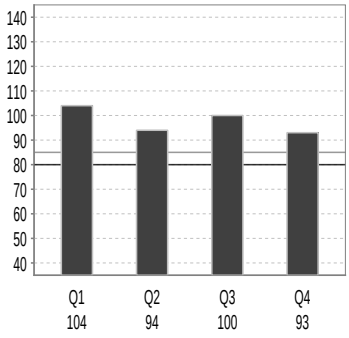

## Commission Errors




## Omission Errors

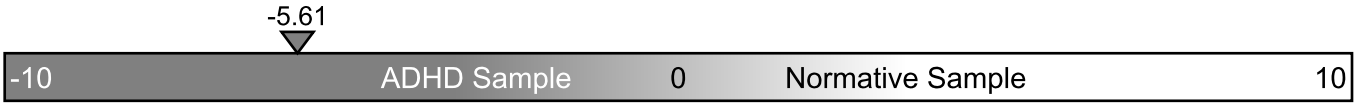



## Omission Errors

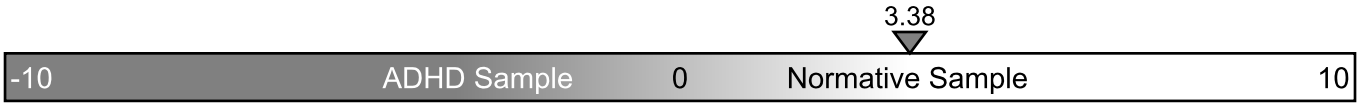


**A:** Example Subject, 11.25 y, 7/1/17 11:06 AM, Visual, No challenge
**B:** Example Subject, 11.42 y, 9/1/17 12:23 PM, Visual, Adderall xr(10.0mg)

A:




B:



### 20.1.3 Example Subject 3:

This 42-year-old male suffered a head injury years prior and exhibited signs of an acquired attention deficit from that time. His baseline T.O.V.A. was not within normal limits.

ID: **1** **Example Subject** (Jan 1, 1975)
**Male - 42y 6m 0d**

**Visual T.O.V.A.** (v9.0-78 sn30000)
Jul 1, 2017 at 8:10 AM

## Session, Response, and Performance Validity

This session meets session, response and performance validity criteria.

## T.O.V.A. Interpretation

The results of this T.O.V.A. are not within normal limits, and may be suggestive of a possible attention deficit, including ADHD, because the Comparison to the Normative Sample is not within normal limits. Please see the Interpretation Notes page for additional information.

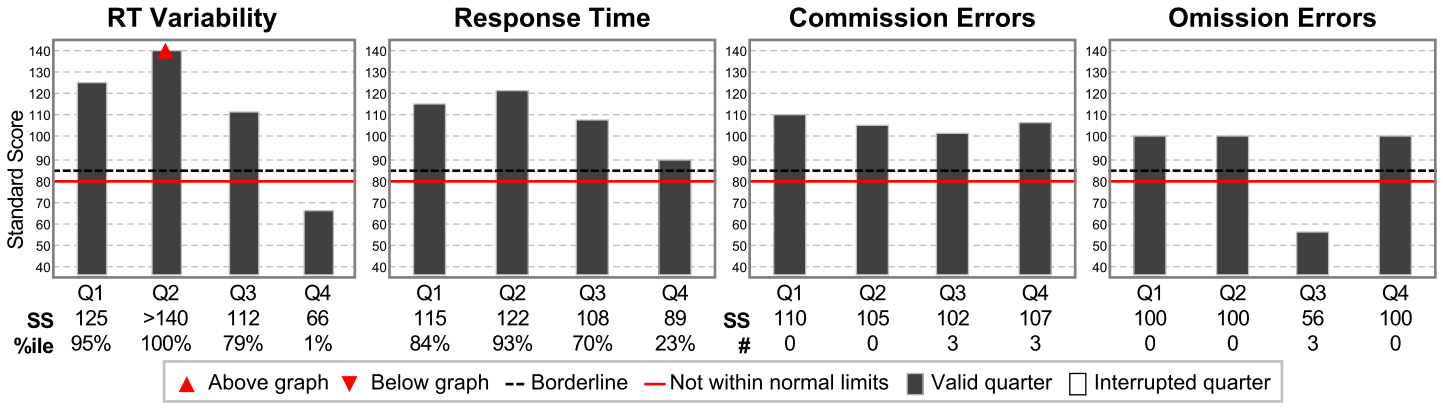
## Treatment

No treatments entered.

## Comparison to the Normative Sample

These scores compare this subject's performance to the performance of individuals of the same gender and age in the T.O.V.A. Normative Sample, a study of individuals who did not have attention problems.

Results are reported as standard scores (average standard = 100; standard deviation = 15). Standard scores above 85 are considered to be in the normal range, scores between 80 and 85 are considered borderline, and scores below 80 are considered not within normal limits. Scores less than 70 are considered significantly below normal range. Standard scores less than 40 are more than 4 standard deviations from normal, and are denoted as "<40".




Quarters, Halves and the Total are independently calculated and are not averages. Any Quarter, Half or Total that is Borderline or Not Within Normal Limits causes the Interpretation to be Borderline or Not Within Normal Limits. See the Interpretation Notes page for more information on these variables and on the subject's performance.

| | Quarter | | | | Half | | Total |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 1 | 2 | |
| **RT Variability** | 125 | >140 | 112 | 66 | >140 | 79 | 91 |
| **Response Time** | 115 | 122 | 108 | 89 | 119 | 99 | 104 |
| **Commission Errors** | 110 | 105 | 102 | 107 | 115 | 105 | 108 |
| **Omission Errors** | 100 | 100 | 56 | 100 | 100 | 56 | 56 |
| | Infrequent | | Frequent | | | | |

Key: Borderline, Not within normal limits, Invalid

His treatment comparison T.O.V.A. was within normal limits, with no mixed results.

ID: **1** **Example Subject** (Jan 1, 1975)
**Male - 42y 11m 0d**

**Visual T.O.V.A.** (v9.0-78 sn30000)
Dec 1, 2017 at 12:12 PM

## Session, Response, and Performance Validity

This session meets session, response and performance validity criteria.

## T.O.V.A. Interpretation

The results of this T.O.V.A. are within normal limits. Please see the Interpretation Notes page for additional information.

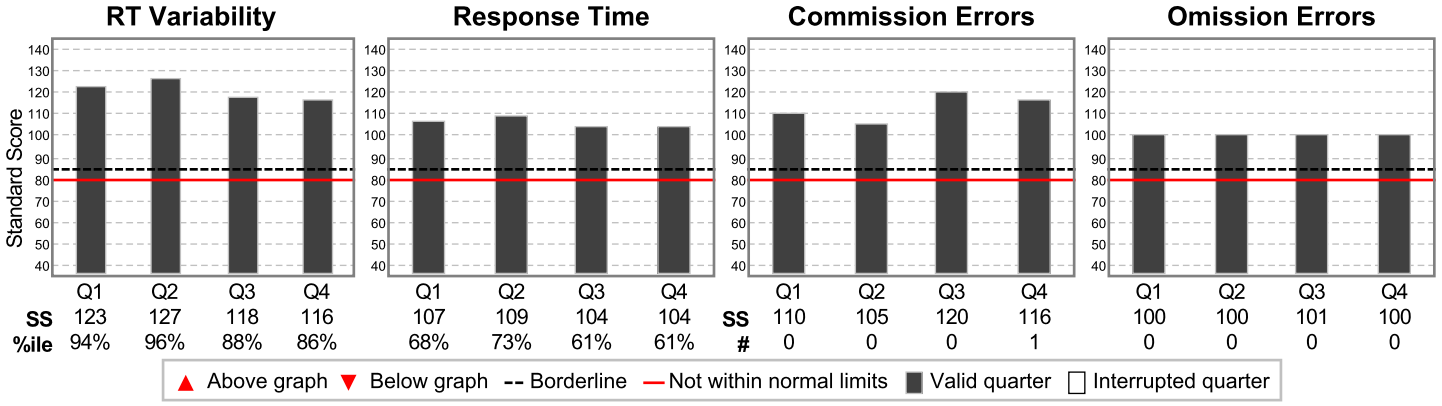
## Treatment

20.0mg dose of Methylphenidate SR taken 2.2 hours before testing.

## Comparison to the Normative Sample

These scores compare this subject's performance to the performance of individuals of the same gender and age in the T.O.V.A. Normative Sample, a study of individuals who did not have attention problems.

Results are reported as standard scores (average standard = 100; standard deviation = 15). Standard scores above 85 are considered to be in the normal range, scores between 80 and 85 are considered borderline, and scores below 80 are considered not within normal limits. Scores less than 70 are considered significantly below normal range. Standard scores less than 40 are more than 4 standard deviations from normal, and are denoted as "<40".




Quarters, Halves and the Total are independently calculated and are not averages. Any Quarter, Half or Total that is Borderline or Not Within Normal Limits causes the Interpretation to be Borderline or Not Within Normal Limits. See the Interpretation Notes page for more information on these variables and on the subject's performance.

| | Quarter | | | | Half | | Total |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 1 | 2 | |
| **RT Variability** | 123 | 127 | 118 | 116 | 140 | 122 | 126 |
| **Response Time** | 107 | 109 | 104 | 104 | 108 | 104 | 105 |
| **Commission Errors** | 110 | 105 | 120 | 116 | 115 | 120 | 120 |
| **Omission Errors** | 100 | 100 | 101 | 100 | 100 | 101 | 101 |
| | Infrequent | | Frequent | | | | |

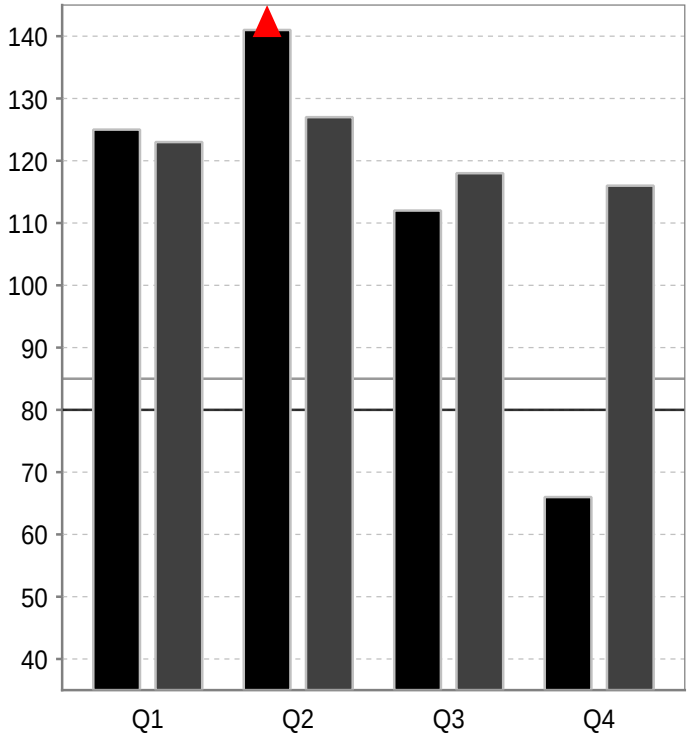
Key: Borderline, Not within normal limits, Invalid

His comparison graphs show an improvement in performance to within normal limits, with no drops of 8 or more points between quarters from baseline to treatment comparison. His ACS score improved from +0.57 on his baseline test to +4.86 on his treatment comparison test.

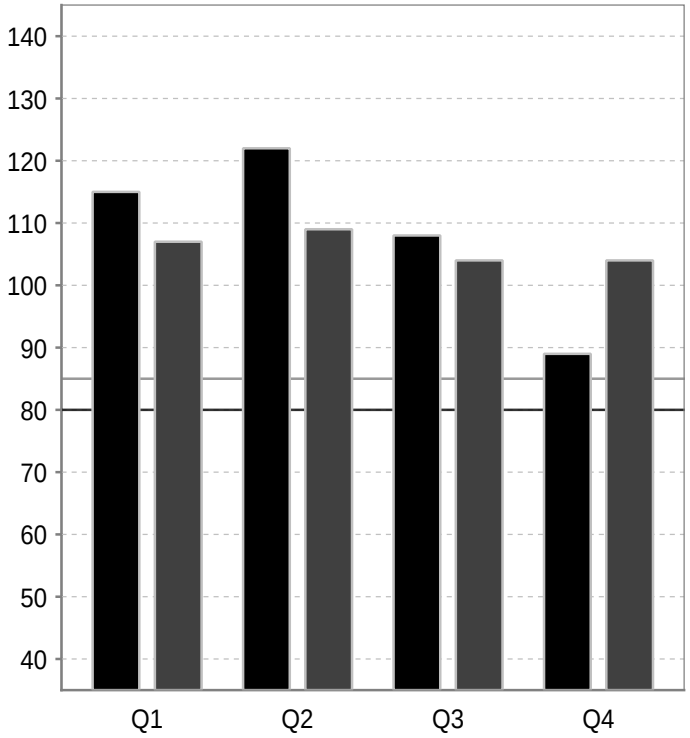
# TOVA Standard Comparison Graphs

- Example Subject, 42.5 y, Jul 1, 2017 8:10 AM, Visual
- Example Subject, 42.92 y, Dec 1, 2017 12:12 PM, Visual, Methylphenidate SR(20.0mg)

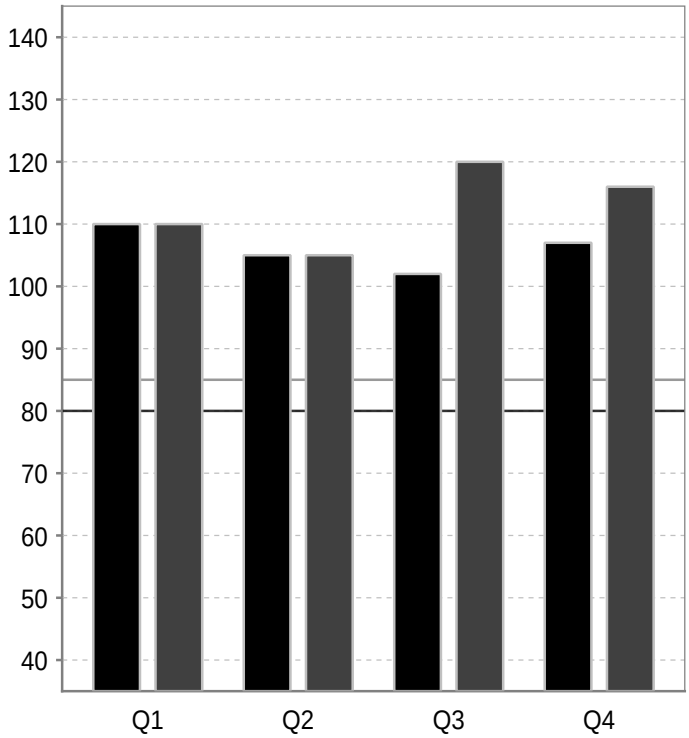
## RT Variability



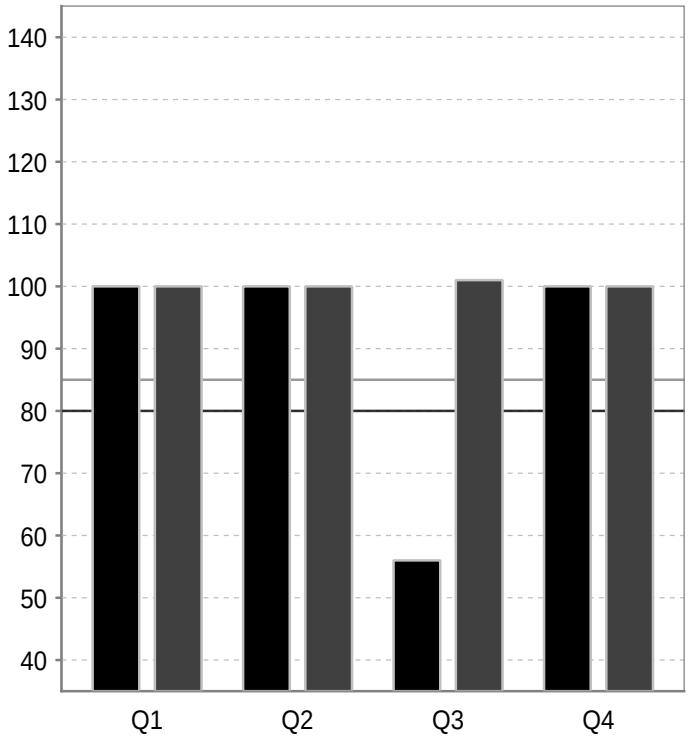

## Response Time




## Commission Errors

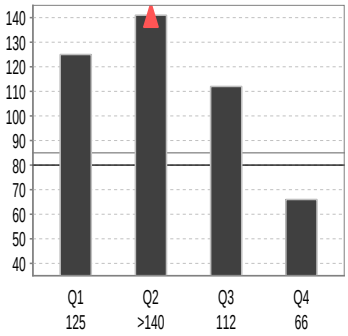



## Omission Errors

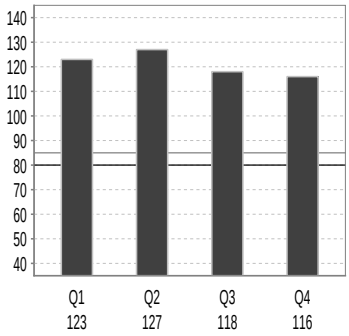


| Example Subject<br>42.5 y, 7/1/17 8:10 AM<br>Visual<br>No challenge | Example Subject<br>42.92 y, 12/1/17 12:12 PM<br>Visual<br>Methylphenidate SR(20.0mg) |
|---|---|

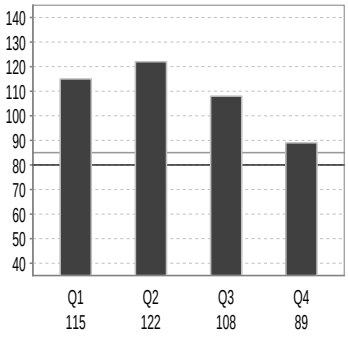
## RT Variability



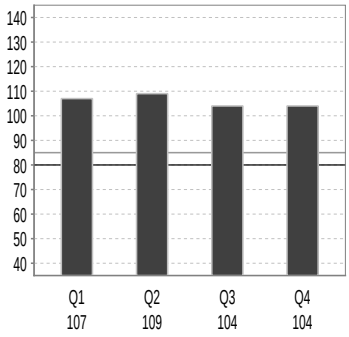

## RT Variability



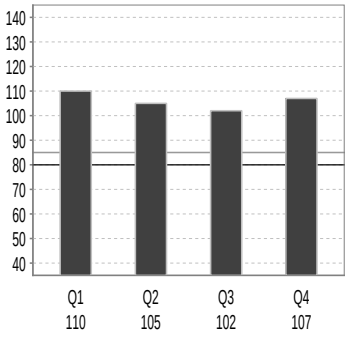

## Response Time



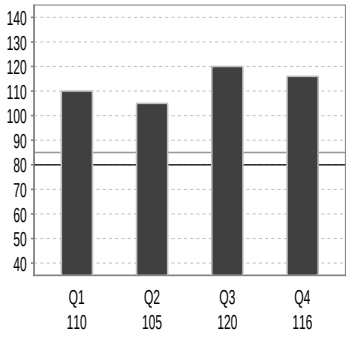

## Response Time



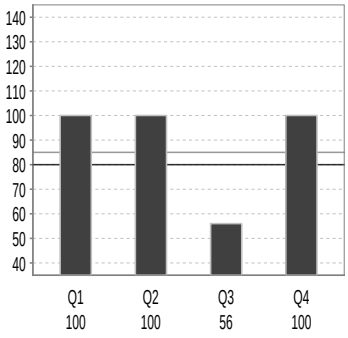

## Commission Errors



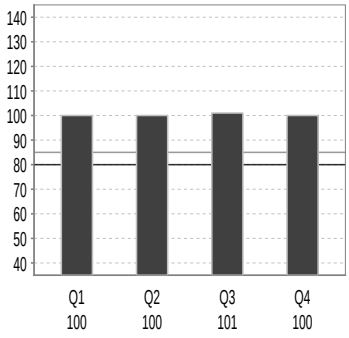

## Commission Errors




## Omission Errors

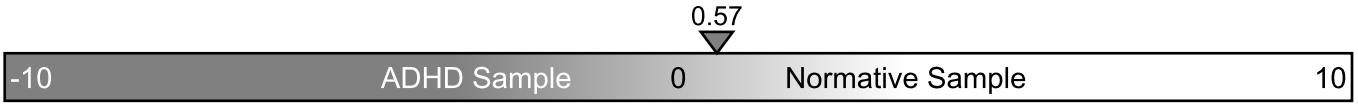



## Omission Errors

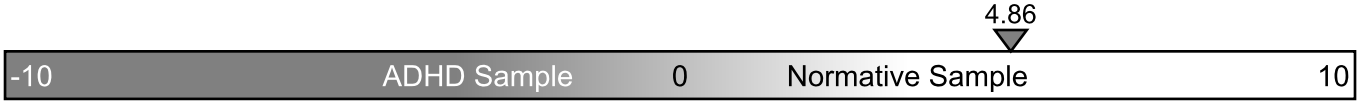


**A:** Example Subject, 42.5 y, 7/1/17 8:10 AM, Visual, No challenge
**B:** Example Subject, 42.92 y, 12/1/17 12:12 PM, Visual, Methylphenidate SR(20.0mg)

A:




B:



If any questions arise regarding interpretation of baseline or treatment comparison T.O.V.A. reports, please contact Interpretation Support.

# Part V

# Appendix

## 21 T.O.V.A. Observation Form

# TOVA Observation Form

Completed by:_____

The T.O.V.A. Observation Form is designed to provide information about factors that may influence T.O.V.A. results. **Pre-test** information can help the clinician understand some of the conditions that may influence T.O.V.A. performance. **During test** information provides behavioral clues and other information not collected by the T.O.V.A. **Post-test** information can provide insight into the subject's approach to, and experience of, the test.

## Section 1: Pre-test

Name: _____ DOB: _____ Age: _____ Gender: _____

Test Date: _____ Test Time: _____AM/PM Test type: ___Visual ___Auditory

Hours of sleep last night: _____

| | Type | Amount | Last Dose (Hrs) | Duration of use (days/Wks/Mths/Yrs) |
|---|---|---|---|---|
| Challenge Medication | | | | |
| Caffeine Intake | | | | |
| Nicotine Intake | | | | |
| Medications/Other | | | | |
| Medications/Other | | | | |

Other pre-test observations or comments:

## Section 2: During test

Practice Test Results: RTV: _____ ms RT: _____ ms Omissions:_____ Commissions: _____

Please rate all observed behaviors quarter by quarter. Note any behaviors not listed below under 'Other' or 'External Distractions'. Circle the part of the quarter where the behavior occurred. Each number (1-5) corresponds with the minutes during each quarter. For short form test sessions (e.g., 4-5 year old sessions), only quarters 1 and 2 should be used.

| **Quarter** | | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| **Time at start of quarter** (each quarter is 5 min 12 sec) | | | | | |
| Talks, makes sounds | Minute # | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| Fidgets/taps feet and or fingers | Minute # | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| Moves in chair (leaning, spinning, etc) | Minute # | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| Looks away from the computer | Minute # | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| Stops Responding | Minute # | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| Falls asleep | Minute # | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| Covers screen with hand | Minute # | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| Complains | Minute # | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| Prompting needed | Minute # | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| External distractions (list): _____ | Minute # | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| Other (list):_____ | Minute # | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |

Unsolicited comments made by the subject during the test:

## Section 3: Post-test

Unsolicited comments made by the subject at the end of the test:

Answer to "How did it go?" and/or "How did you do?":

Other observations/comments: