

The TOVA Test

Visual and Auditory ADD Test for
Adults and Children



The T.O.V.A. is a computerized continuous performance test (CPT) that is used by clinicians and other professionals in the assessment and treatment of attention problems such as attention deficit disorders and traumatic brain injuries.

There are two types of T.O.V.A. test: the visual test measures visual information processing, and the auditory measures auditory information processing. Designed like computer games, both T.O.V.A. tests are easy to administer to children (age four and older) as well as adults.

The visual T.O.V.A. uses two simple geometric figures to measure attention, and the auditory uses two tones. Unlike other CPTs, the T.O.V.A. avoids the confounding effects of language, cultural differences, learning problems, memory, and processing complex sequences. The visual test target is a square with a second but smaller square inside of it, near the upper border. The nontarget is a square with the smaller square near the lower border. The auditory test uses two easily discriminated notes. The high note is the target, and the low note is the nontarget. That's it- no complicated sequences of numbers or letters, no confusing colors or sounds. A target or a nontarget randomly flashes on the screen or is sounded every two seconds for a tenth of a second (100 msec). The instructions are to press a specially designed, accurate microswitch as fast as you can every time a target appears or is heard, but not to press the microswitch when a nontarget appears or is heard. It's important to be fast but not too fast- it's just as important to avoid pressing the microswitch when it's a nontarget. It's that simple.

Well, it actually isn't that simple. The targets and nontargets are presented in two different patterns. In the first half of the test, the target randomly occurs once for every 3.5 nontargets. So the first half of the test is called the infrequent (target) condition. With the visual test you really have to focus on the screen, or you'll miss the occasional target. With the auditory test, you have to listen carefully, or you'll miss the occasional high note. The excitement (if there is any) wears off very quickly for the first half of the test is 10.8 minutes long. It gets very boring very soon, and that's what we want- a measure of attention in a boring task.

The second half of the test is also 10.8 minutes long, and now the target occurs 3.5 times to every one random nontarget. So it's called the frequent (target or response) condition. In contrast to the first half, you're pressing the microswitch most of the time, and every once in a while you have to inhibit the natural tendency to respond because a random nontarget occurs. This half is more exciting than the first half and provides a measure of attention in a stimulating task.

Why do we need visual and auditory versions of the T.O.V.A.? Most people are "concordant" for both visual and auditory information processing. That is, they visually and aurally process information similarly whether it be slowly, quickly or in between. However, a significant number (estimated at 12%) of individuals are "discordant" and process visual and auditory information differently. That is, they may be significantly slower in one than in the other modality. So we need to test both visual and auditory processing.

The T.O.V.A. is used by many different professionals, including physicians (especially family practitioners, neurologists, pediatricians and psychiatrists), nurse practitioners, psychologists, educational specialists, mental health counselors, social workers, hearing and speech specialists, and, of course, researchers.

There are two versions of the T.O.V.A. report: the clinical and the screening. The only difference is that the screening version (used by school-based professionals) has no diagnostic terms in the report. The screening version summarizes the results as within or not within normal range.

Variables Measured by the T.O.V.A.

The consistency of the response times is called Response Time Variability and is measured in milliseconds. Response Time Variability is the most important measure of the T.O.V.A. and tells us how consistent (or inconsistent) a person's Response Time is. People with ADHD are more inconsistent than others. That is, sometimes they respond to the target very slowly and sometimes very quickly. When "they're with it" they do well, but they're frequently "not with it".

The time it takes to respond to a target is called Response Time and is measured in milliseconds. This measure tells how fast (or slow) a person processes information and responds by pressing the microswitch. People with ADHD process slower and/or faster than others.

d' (d prime) is derived from Signal Detection Theory and measures how quickly one's performance worsens (deteriorates) over the 21.6 minutes of testing. People with ADHD "lose it" much more quickly than others.

When someone responds to the nontarget, it is called a Commission Error, a measure of impulsivity (also called disinhibition). People with ADHD make many more Commission Errors than others.

When someone does not respond to the target, it is called an Omission Error, a measure of inattention. People with ADHD have more Omission Errors than others (without ADHD).

Post-Commission Response Times measure how much faster or slower a person becomes after mistakenly responding to a nontarget. People with ADHD usually slow down after a Commission Error as do others. This measure helps us to identify one of the other causes (like conduct disorder) of the symptom complex.

Multiple Responses are the number of times a person presses the microswitch more than once a target. Like others, people with ADHD usually press the microswitch only once per target. This measure helps us to identify other neurological conditions.

Anticipatory Responses measure how often a person presses the microswitch so quickly (

Note: We are constantly revising the T.O.V.A. as we learn more about ADHD. For example, people (kids especially) are training themselves to respond faster by playing computer games. To compensate for this increased speed, we shortened the Anticipatory Response time from 200 to 150 milliseconds.

i) The ADHD Score is a comparison of the person's T.O.V.A. performance to an age/gender specific group with ADHD. All of the other measures tell us how different this person's performance is when compared

to others who do not have ADHD. The ADHD Score tells us how similar this person's performance is to others with ADHD.

The T.O.V.A. Microswitch

In contrast to other commercially available CPTs that use the computer keyboard or mouse to record responses, the T.O.V.A. uses a microswitch. Since Response Time Variability and Response Time are two very important measures (that is, two measures with the high correlations with the diagnosis of ADHD), we need to measure time very accurately to determine how fast and inconsistent Response Times are.

Why a microswitch? To obtain very accurate time measurements (± 1 msec). Computer keyboards and mice, are not as reliable and can vary significantly (± 28 msec). In addition, if you use a different computer with a different measurement error to retest someone, it's very difficult to compare the results.

"Norms"

Once testing is completed (21.6 minutes long for 6 years old and older and 10.8 minutes for 4 and 5 years old), the results are immediately analyzed, and the complete interpretation and graphics are available on the monitor and to be printed out.

The T.O.V.A. report compares the test results with the results of a large number of people who do not have an attention problem. The test results are interpreted and reported as within the normal expectable range or not. If within the normal range, the results are "not indicative of an attention disorder". If not within the normal range, the results are "deviant from the norm and compatible with an attention disorder".

As the brain matures and changes, it processes information faster and more accurately from childhood to the late teen years/early twenties, remains pretty steady until the early- to mid-sixties when it slows somewhat. (So it is accurate to say that younger adults are faster than older ones, but older ones can compensate by exercising better judgment.) It's also true that males and females process information differently.

Thus, age and gender make a difference. For instance, when comparing individuals without ADHD, eight year old boys perform differently than eight year old girls and differently than nine year old boys. And individuals with ADHD process more slowly and variably and with more errors than others in the corresponding age and gender group.

The T.O.V.A. report compares the performance of one individual with the "norms" (that is, the aggregate results of the same age and gender group of persons without ADHD). The larger (within reason) and more representative the "norm" group, the better. Unfortunately, in comparison with the T.O.V.A., most CPTs have too small of a sample of individuals without ADHD per age and gender groupings.

Special T.O.V.A. Features

The T.O.V.A. is long enough, simple enough, boring enough, and so accurate that it's the best CPT. It's long enough to "catch" those individuals with ADHD who can "rise to the occasion" and do all right with shorter CPTs. It doesn't use complex, sequential targets that other CPTs do. It keeps the same boring presentation interval. And none of the other CPTs use a microswitch.

T.O.V.A. Accuracy

Research has documented that T.O.V.A. results correlate with the diagnosis of ADHD, Inattentive Type at least 84% of the time and with ADHD, Hyperactive-Impulsive Type at least 86% of the time. In the same study, the T.O.V.A. correctly identified 89% of the non-ADHD children. Add in other relevant data from history, behavior ratings, etc., and the "hit rate"(the accuracy of the diagnosis) increases.

At the same time, the clinician needs to be aware of and take into consideration the many factors other than ADHD that could affect a person's T.O.V.A. performance. As examples, if someone slept poorly the night before, the performance could be adversely affected. Conversely, if someone had two cups of coffee or a cola, their T.O.V.A. performance might be enhanced. Again, the sophistication and knowledge of the clinician is very important in making a proper diagnosis and prescribing effective treatment

For more information, please visit: <http://www.tovatest.com/media/av/>