

Sheet Hd: ADEMd test

Adult Developmental Eye Movement with Distractors

English Version

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Sheet Hd entails dual activity with a higher cognitive demand. This new sheet completes the functionality of the ADEM test, which, with the addition of the fourth sheet, changes its name to ADEMd.

The test can be downloaded for free and used according to the license selected. If you wish, a donation can be made (from 1€) to the “Colegio de Ópticos-Optometristas de la Comunitat Valenciana” through the following link:

<https://coocv.com/producto/adem-donacion/>

Considering our service vocation as health professionals, all funds will be given to relevant social labour through the “Casa de la Caridad de Valencia,” allowing them to continue developing their work toward those in need.

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Introduction

The Adult Developmental Eye Movement (ADEM) test allows clinicians to easily characterise the ocular movement associated with reading and other tasks involving the interaction between peripheral and central vision in adolescents and adults. It can be applied in any case in which rapid assessment of oculomotor behavior is required. This test combines spatial awareness, processing and naming speed, and ocular movements. Therefore, the ADEM, considered a tactical cognitive task, can outline a relation between the ocular movements used to read and the “free ocular movements” used in open dynamic spaces.

The test consists of three sheets and involves reading the numbers presented quickly. Both vertical sheets (V1 and V2) include 40 two-digit numbers and mainly require vertical oculomotricity. In contrast, the horizontal sheet (H) presents 80 two-digit numbers, which mainly require horizontal ocular movement.

For this version, a new sheet called the Horizontal with Distractors (Hd) was included in the test. This new sheet requires horizontal eye movements with greater attention demands than in Sheet H. Sheet Hd entails a divided task, with attention divided into identifying and naming 80 two-digit numbers and identifying, but not naming, the letters included in the sheet. In the last sheet of the test, the subject must distribute his/her attention resources to each task, which is understood as a mental process in which the person must use selective attention to process certain stimuli and ignore others. Additionally, sustained attention is evaluated based on the quality of concentration in the performance of each part of the test and potential errors.

The inclusion of the new horizontal sheet (Hd) requires dual activity with a higher cognitive demand for horizontal eye movements. This sheet completes the original functionality of the ADEM in evaluating the development of ocular movements in adults with the three existing sheets (V1, V2, and H). With the new, more demanding horizontal activity with distractors, we modified the original test name to the Adult Developmental Eye Movement with Distractors Test (ADEMd).

We consider that each vertical sheet (V1 and V2) comprises an organized task with a low spatial demand. The numbers are distributed in two columns (20 in each column) that are widely separated. The subject has to move his/her eyes vertically to name the numbers from top to bottom in each column. This task requires minimal fixating saccadic

movements and can be considered an operational cognitive task. Vertical sheets require a selective search with vertical eye movements, which is a task with lesser ocular movement demands. The task of identifying and naming numbers is considerably automatic and involves reduced cognitive effort.

The first horizontal sheet involves greater spatial demand because it presents 80 two-digit numbers in 16 horizontal lines with a space between them randomly distributed. This task entails a greater spatial search demand than saccadic at a constant distance, as in the vertical sheets. On the vertical sheets, the subject can have a precise idea of the position of the next number to read. On the other hand, in the horizontal sheets, although the subject can have a slight idea of the position of the next number to read, the exact position of the number varies among the different lines.

Horizontal Sheet (H): This task involves planning and executing selective horizontal eye movements. The focus is on fixations (pauses to take in information), saccades (quick eye movements between fixations), and selective attention. The primary goal is to identify and name numbers, concentrating on one source of information and one specific task.

Horizontal Distractor Sheet (Hd): This task also requires precise horizontal eye movements. However, it adds complexity by dividing attention between two tasks: identifying and naming numbers, and identifying but not naming letters. This means the individual must shift their focus back and forth between these different elements, managing two streams of information simultaneously.

It is our wish that the ADEMd, which is being used in the scientific literature ^{5,6}, and its possibilities with the addition of the new attentional sheet, serve you to rapidly and easily quantify and analyze the development of ocular movements in patients from different populations.

References

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- 2.- Gené-Sampedro A, Alonso F, Sánchez-Ramos C, Useche SA. Comparing oculomotor efficiency and visual attention between drivers and non-drivers through the Adult Developmental Eye Movement (ADEM) test: A visual-verbal test. PLoS ONE 2021; 16(2): e0246606. <https://doi.org/10.1371/journal.pone.0246606>
- 3.- Gené-Sampedro A, Monteiro PML, Bueno-Gimeno I, Gene-Morales J, Piñero DP. Validation of a modified version of the adult developmental eye movement test. Scientific Reports, 2021;11(1):1-11. <https://doi.org/10.1038/s41598-021-99245-5>
- 4.- Gené-Sampedro A, Alonso F, Gene-Morales J, Monteiro PL, Useche SA. Could driving help us to "see better"? A comparative assessment of saccadic efficiency, visual speed, and attention. BMC Ophthalmol. 2024;24(1):90. <https://doi.org/10.1186/s12886-024-03349-1>

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TEST Hd (attention)

32	X	76	53	H	T	96	V	M	81
25	56	H	V	74	X	43	T	M	65
18	T	M	43	H	75	V	62	X	41
71	V	92	X	37	H	97	M	T	24
44	58	H	X	M	25	T	V	14	73
57	M	V	36	X	78	T	47	H	84
72	47	X	61	56	M	V	H	T	29
93	X	18	T	H	39	M	62	V	41
66	34	21	H	67	V	T	X	M	12
76	X	M	T	44	V	67	56	H	31
58	M	33	72	V	T	49	H	X	81
43	T	V	54	H	23	X	M	14	74
76	93	35	M	X	91	V	H	T	29
19	T	H	46	X	M	76	V	67	34
26	M	59	V	71	T	X	43	H	61
35	76	X	54	M	H	95	T	V	85

The test to be performed is called ADEMd, which consists of the three sheets of the ADEM¹ and the new sheet Hd shown in this document.

ADEMd = ADEM (sheets V1, V2 y H) + sheet Hd

Therefore, the ADEMd consists of four sheets: two sheets whose numbers must be read vertically (V1 and V2) and two sheets whose numbers must be read horizontally (H and Hd).

The four sheets form must be performed as follows: V1, V2, H, and Hd. Reading (out loud and as fast as possible). The test progresses from easier to more difficult. The first two vertical sheets have a similar difficulty level, while the next two horizontal sheets increase in difficulty from one to the other.

The ADEMd presents a methodology similar to the ADEM in terms of annotation of potential errors. Because of the specific characteristics of the test, the letters in Hd must not be named. Naming a letter is considered an error. Therefore, in the last sheet, Hd, apart from the number-naming errors identified, the number of times a letter is named must be identified.

The evaluator must register the time required to complete the sheet and the errors performed (specifying the type) in the response template (Annex 1).

Specific instructions of the ADEMd

Once finished with the first subtest of the ADEMd (sheets V1, V2, and H), Sheet Hd follows. The subject must be told that in this case, there are numbers and letters (having to name the numbers but not the letters) and, therefore, the task is more difficult. The time required to complete the task and the errors made will be recorded. Naming any of the letters is considered an error and is registered on the bottom-right part of the Response Template (Annex 1).

Example sheets V and H (Annex 2) are shown to the subject pointing to the bottom-right part of the page. The following instructions must be said exactly as presented hereafter (text in bold and italic font): ***“Now, we are going to do the test with numbers and letters. It will probably be harder, do not worry. We will follow the same procedures as before. You have to read out loud and as fast as possible only the numbers presented,***

¹ <https://roderic.uv.es/handle/10550/81323>

starting from the top line from left to right, followed by the next line to the bottom. You must not read letters placed between numbers. You only need to remember them as at the end, I will ask you a question about the letters. If you make an error reading a number or name a letter do not worry, you must carry on with the test.”

When the subject is ready, the sheet named Hd must be shown to him/her and placed face down, with numbers facing the ground. The subject will be told: ***“When I say start, turn the sheet over and start reading out loud the numbers as I previously told you, from left to right as fast as you can. The time will start whenever you read the first number.”***

The time needed to read all the numbers on the sheet is registered. The time is started when the first number is read by the subject and ends when the last number of the second column is read. The time (in seconds, with a margin of 0.1 seconds) needed to read all the numbers and the errors made (with the numbers or naming letters) are written in the answer sheet.

Questions ADEMd regarding the distractor letters

Once the test is finished, the subject must be asked which letters were included in the test. The letters named by the subject must be circled in the response sheet (Annex 1) in “Question 1.- Remembers using Memory” from “Questions about Distractor Letters” (bottom-left part of the sheet). If an additional letter is named, write it in the space “Other Letters Named.” A maximum time of 10 seconds is allowed to think of possible answers, if the subject fails or does not remember a letter nothing happens.

The second question (“Question 2.- Remembers Viewing” from “Questions about Distractor Letters”) consists of showing the subject 12 letters (Annex 3) and trying to identify which were included in the sheet Hd. A maximum time of 10 seconds is allowed to think of possible answers, if the subject fails or does not remember a letter nothing happens.

Annex 1.- Register of the ocular movements ADEMd (Response Template)

Answer templates ADEM

Reference: _____

V1	
32	43
71	56
54	21
96	14
81	75
25	54
53	39
74	72
43	43
67	81
14	76
49	47
76	62
62	59
37	93
73	23
67	34
35	67
78	41
91	18

Time V1: sec.
O: ☐ S: ☒
A: — T: ☒

V2	
61	76
34	92
26	33
93	95
12	24
71	19
46	44
65	72
58	61
29	36
57	25
35	58
76	74
44	47
84	66
43	31
41	76
56	56
29	97
18	85

Time V2: sec.
O: ☐ S: ☒
A: — T: ☒

Age: _____ (note years, months)

Sex: M F (circle)

H				
32	76	53	96	81
25	56	74	43	65
18	43	75	62	41
71	92	37	97	24
44	58	25	14	73
57	36	78	47	84
72	47	61	56	29
93	18	39	62	41
66	34	21	67	12
76	44	67	56	31
58	33	72	49	81
43	54	23	14	74
76	93	35	91	29
19	46	76	67	34
26	59	71	43	61
35	76	54	95	85

Time H: sec.
O: ☐ S: ☒
A: — T: ☒

	eO	eA
V1	sec	V1aj
V2	sec	V2aj
H	sec	Haj
Hd	sec	Hdaj
Ratio Haj/(V1+V2) =		
Ratio Haj/(V1aj+V2aj) =		
Ratio Attention Hdaj/Haj =		
Ratio Errors eHd/eH =		

Test Date: _____

Hour: H m (note in 24-hour format)

Hd Attention				
32	76	53	96	81
25	56	74	43	65
18	43	75	62	41
71	92	37	97	24
44	58	25	14	73
57	36	78	47	84
72	47	61	56	29
93	18	39	62	41
66	34	21	67	12
76	44	67	56	31
58	33	72	49	81
43	54	23	14	74
76	93	35	91	29
19	46	76	67	34
26	59	71	43	61
35	76	54	95	85

Questions about Distracting Letters:

(circle)

1.- Remember Memory: H M T V X

Other Named Letters:

2.- Remember Seeing: H M T V X

Other Named Letters:

Time Hd: sec.

O: ☐

S: ☒

A: —

T: ☒

Distractor

M:

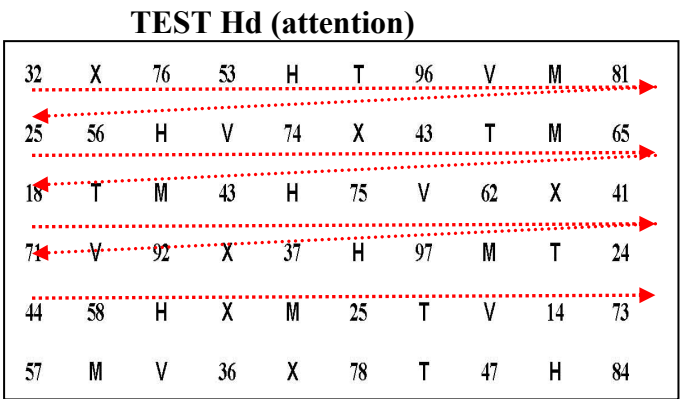
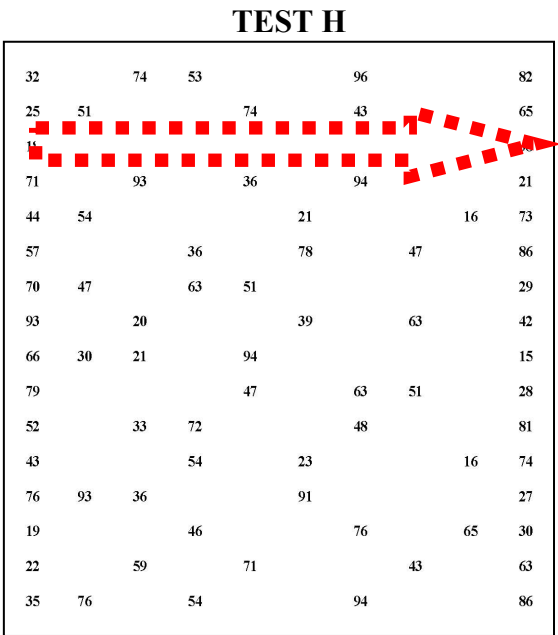
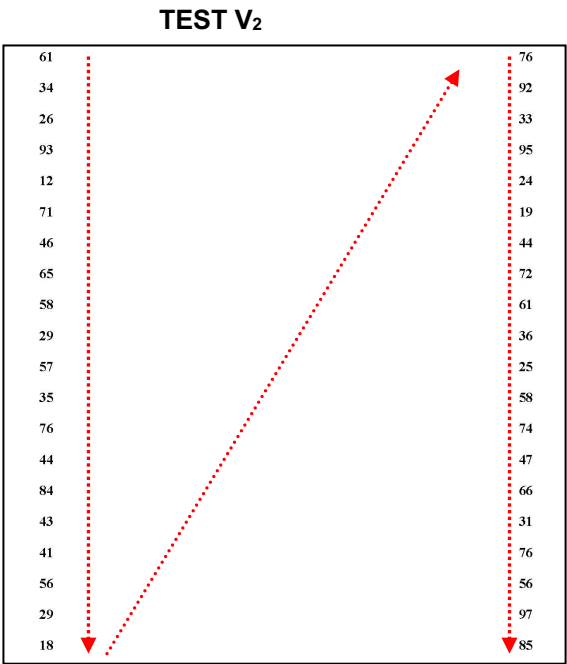
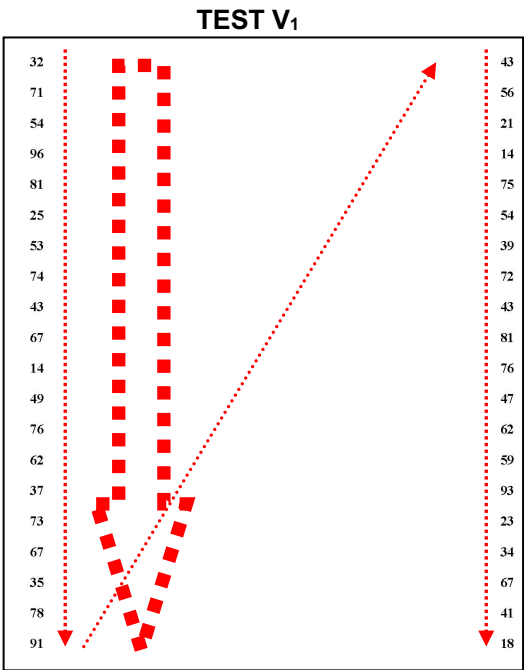
V:

H:

T:

X:

Annex 2.- Example sheets to explain how to perform the test



Annex 3.- Letters to be shown to the subject

After performing the subtest Hd, at the time of Question 2 (see response template); the subject is shown the following list of letters.

Instructions for the subject (indicated in bold and italic font)

“Of the following letters included in the square shown (point it out with the finger), please, tell me which were included in the test you have just completed?”

A B D H M O P T U V X Z

Instructions for the examiner

Write the answers of the subject in the Response Template (Annex 1, Question 2.- Remembers Viewing” from “Questions about Distractor Letters”, bottom-left part of the sheet). If an additional letter is named, write it in the space “Other Letters Named.” A maximum time of 10 seconds is allowed to think of possible answers, if the subject fails or does not remember a letter nothing happens.