A Random Dot Stereoacuity Test based on 3D Technology

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3D for the diagnosis and treatment of amblyopia

❑ Using **3D** technologies to {detect, treat .. } amblyopia (lazy eye)
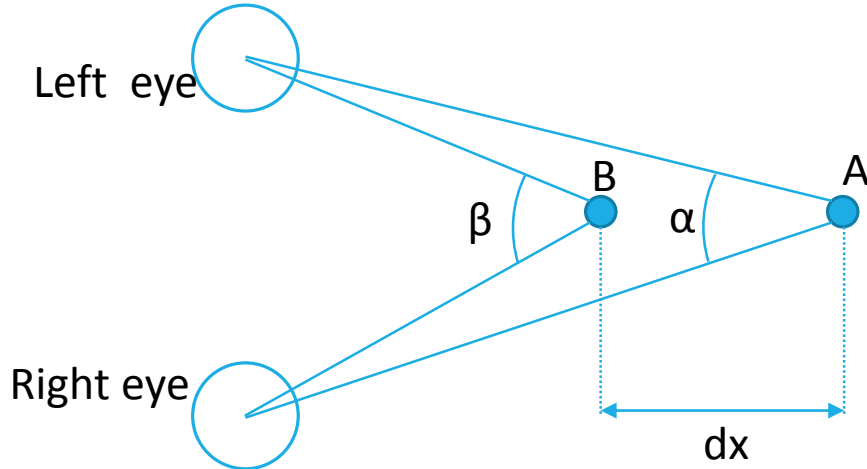
❑ In collaboration with
- ◦ Flavia Fabiani and Mariella Bana

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  Policlinico e Università di Milano

What is stereo acuity

Stereoscopic acuity, also **stereoacuity,** is the smallest detectable depth difference that can be seen in binocular vision.
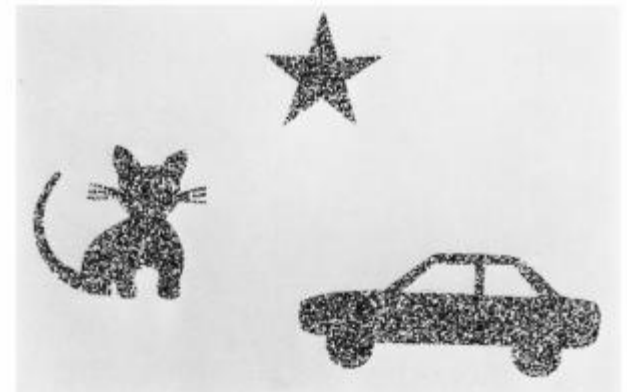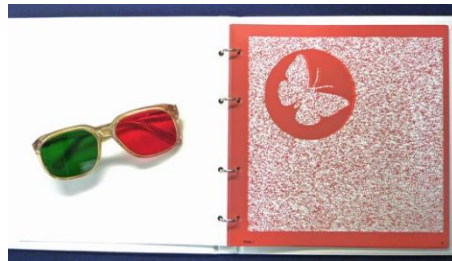
Left eye

β   B   α   A

Right eye

dx

Minimum dx one can distinguish two pegs A and B

Stereo acuity = β - α

Why stereo acuity measurement

❑ It can discover serious problems like amblyopia, strabismus and so on.

❑ It is often used as a proxy for vision acuity

❑ It should be performed as early as possible

❑ Classical tests may be not cost effective
  ◦ Very low sensitivity (in some cases 20%)

What is 3D

❑ 3D technologies are used to create by a 2D surface (like a monitor or display) a depth perception

❑ 3D Optical Illusions

❑ **Uses:**
  ◦ **Virtual reality**
  ◦ **Games**
  ◦ **Entertainment**

❑ **TWO DIFFERENT IMAGES TO THE TWO EYES**

Depth
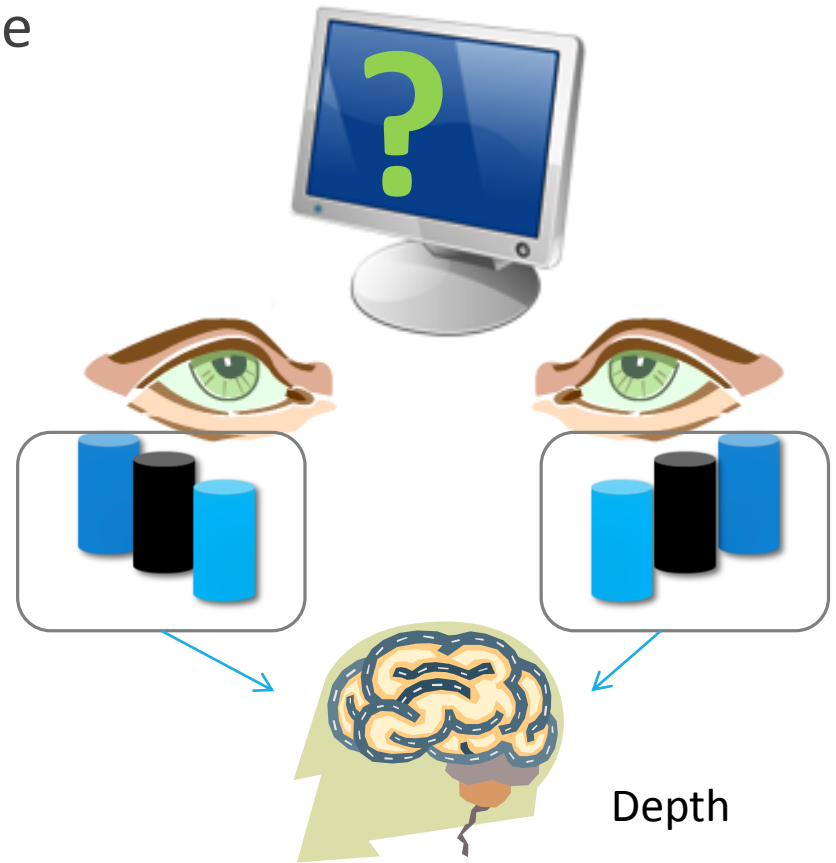
Using NVIDIA 3D vision

❑ The monitor is synchronized with the LCD glasses, which alternatively open and close the two lens

Monitor

monitor

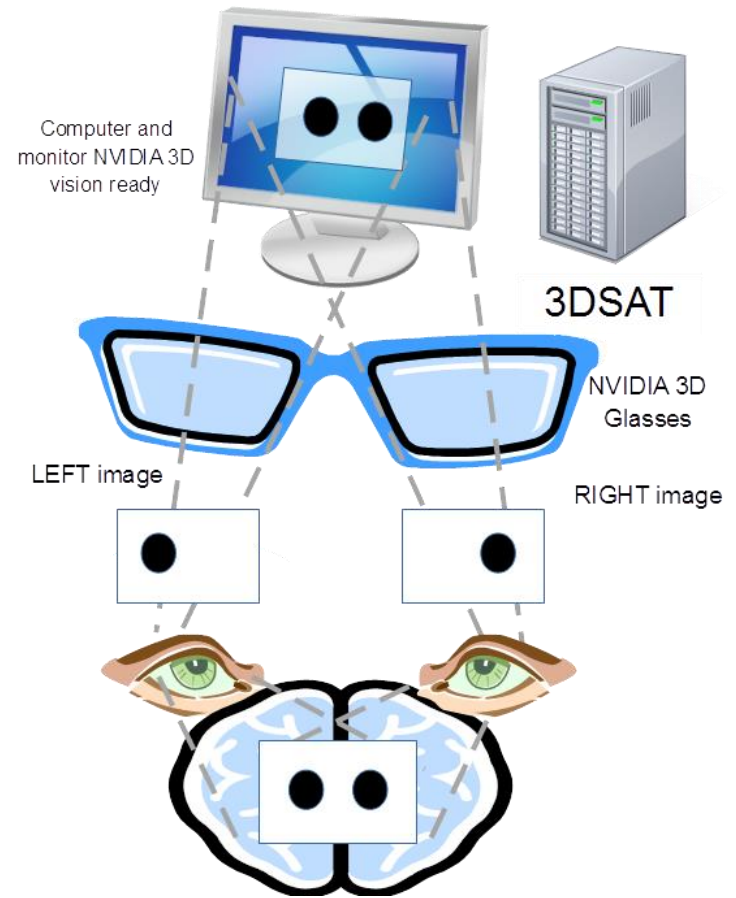| l	r	l	r

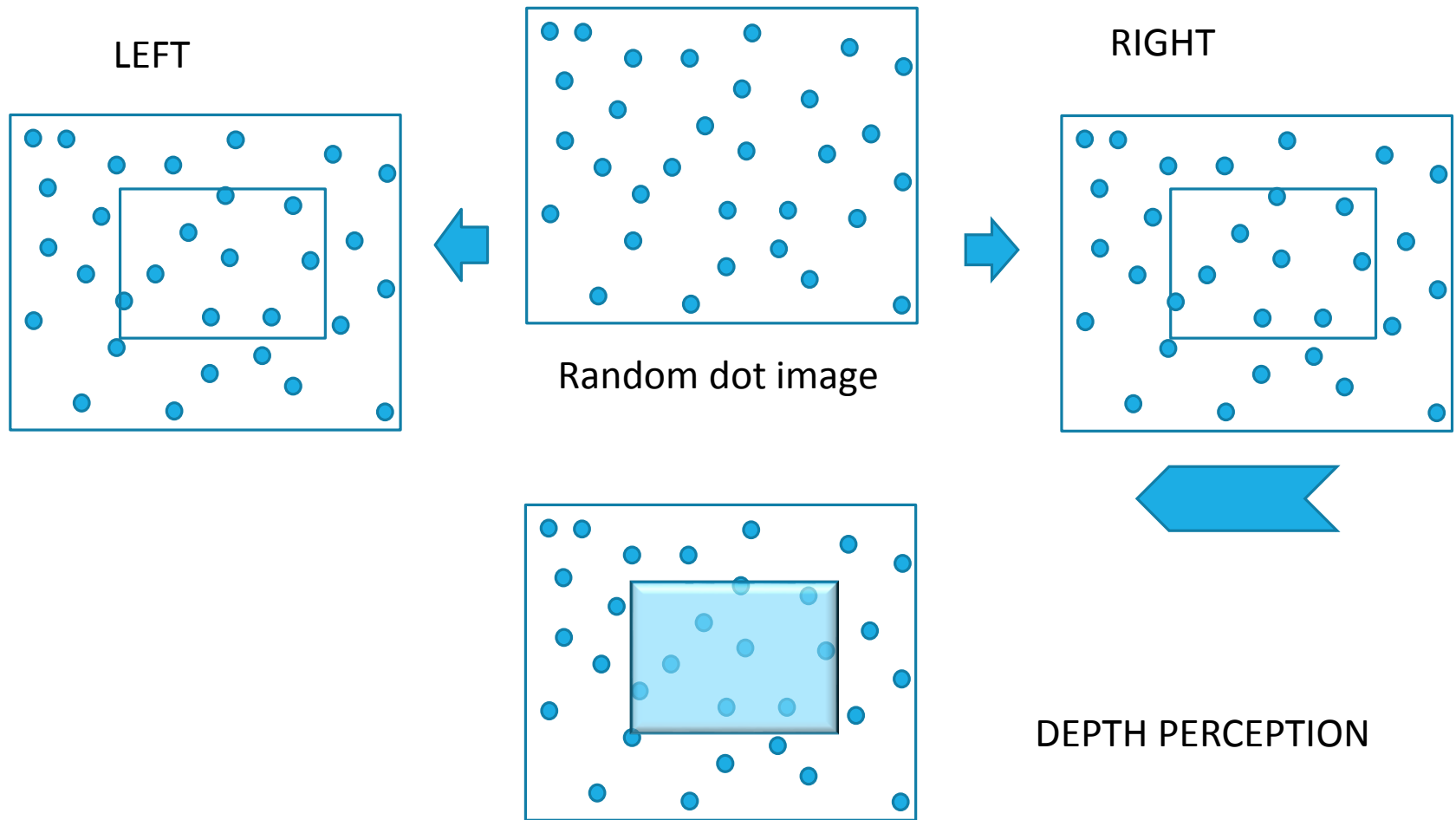Left eye

Right eye

LCD glasses

Our 3D for Stereoacuity Test

❑ Realized by a software program on a PC with 3D capabilities.

❑ The 3D technology is used to provide two separate images to the two eyes.

❑ Classical random dot test, but differently to other test printed on paper, the images shown to the patient can vary and there is no monocular clue.

❑ It can be performed in groups (instead of individuals) like school classes

❑ Very easy to deliver at a low cost. Even unqualified personnel can perform the test

3DSAT: StereoAcuity Test

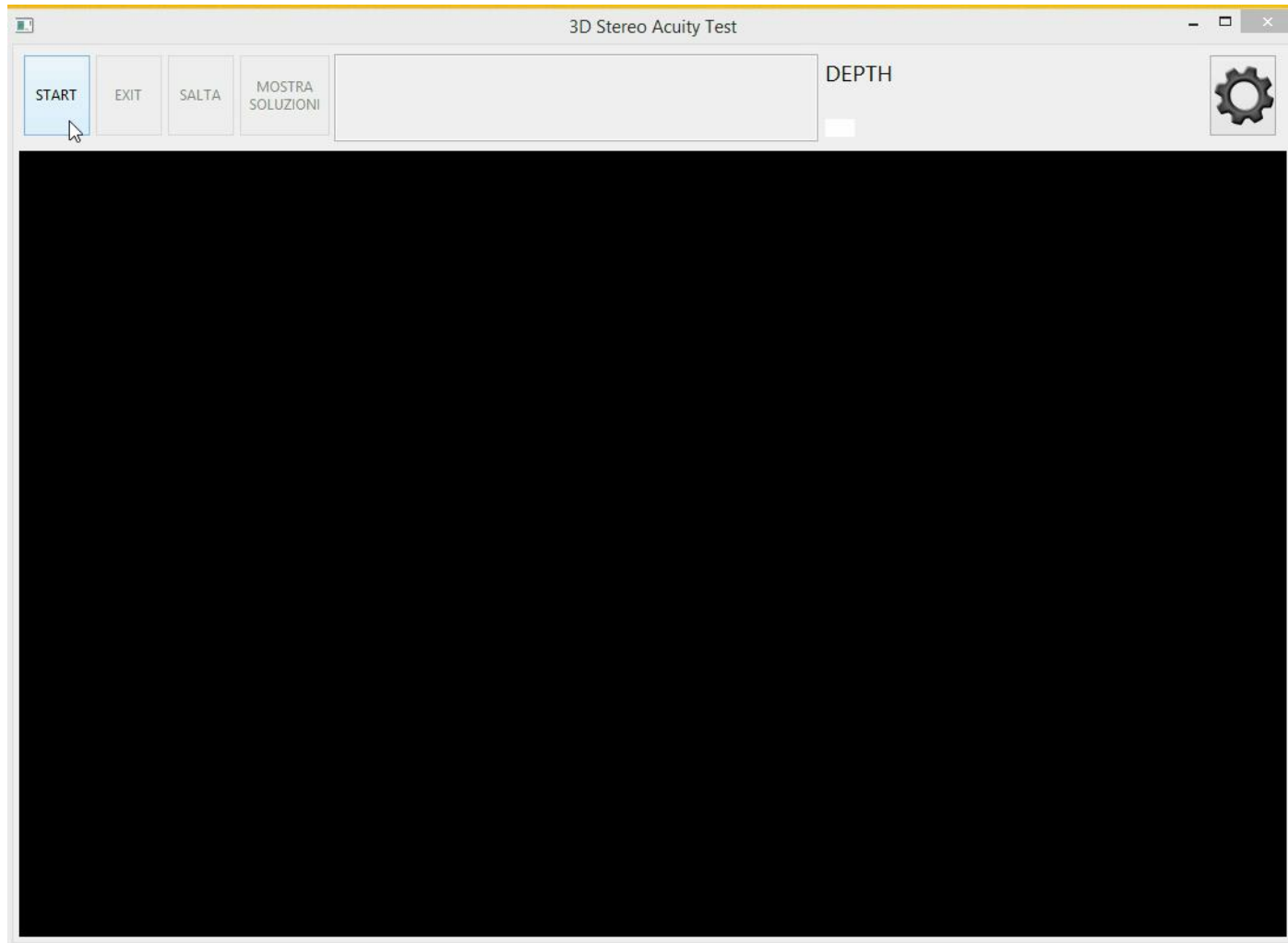❑ The 3D technology is used to provide the two eyes with two separate dots sets.

Computer and monitor NVIDIA 3D vision ready

3DSAT

NVIDIA 3D Glasses

LEFT image

RIGHT image

Building the 3D image

LEFT

RIGHT

Random dot image

DEPTH PERCEPTION

3D SAT - demo

Advantages wrt traditional tests

++++ SENSITIVITY

(-- FALSE NEGATIVE: AMBLYOPIC NOT CORRECTLY IDENTIFIED AND FALSELY PASSING)

- ❑ the shape is randomly chosen form different sets

- ❑ also the control null image

- ❑ either the operator that delivers the test has no clue about which shape is displayed

- ❑ no monocular clue, without glasses no clue

++ SPECIFICITY

(-- FALSE POSITIVE, NON AMBLYOPIC FALSELY FAILING THE TEST)

- ❑ the shape is shown as image: the child can simply point his/her finger

- ❑ the test has an initial phase in which the images are shown colored

- ❑ when a child fails the test, the test can be retried with a different set of images

Experience report

❑ The tests were carried out on a population with age between 5 years and 7 years, with a small presence of amblyopic subjects (known before starting the tests).

❑ 90 subjects for a total of 180 test results.

❑ Presented as a game

❑ NO false positive NO false negative

Conclusion

- ❑ A software for stereo acuity test
  - ◦ Base on the use of 3D
  - ◦ Random dot test with a variable set of images

- ❑ Suitable to be used by not qualified personnel

- ❑ Extremely high sensitivity

- ❑ Very high specificity

- ❑ If you want to try
  - ◦ It will be published 3d4amb.unibg.it
  - ◦ Or write an email angelo.gargantini@unibg.it

- ❑ THANKS - DANKE - GRAZIE