NESPLORA is a company created in San Sebastian in 2008. It was founded with the aim of analyzing human behavior using immersive technologies. By linking neuroscience with technology, we develop new tools for measuring cognitive processes (attention, memory, FFEE, etc.) in virtual reality environments.

We use the latest technologies to define, describe and provide unbiased and concise information on cognitive and behavioral processes in simulated environments. We improve the diagnosis of patients with problems such as Alzheimer’s, mental illness, brain damage of any etiology or developmental problems.

We replicate real environments in a virtual way, and evaluate the patients objectively, providing the healthcare professional with all the necessary information for a correct diagnosis. In this way, we reduce errors and evaluation times, with the consequent improvement in the quality of patients.

Accurate and objective measurement of cognition and behavior is our greatest experience, and our goal is to optimize the measurement of cognition to better guide the decision making.

We are developing a project, with which we present our candidacy to WITSA. This is VRMIND: Virtual Reality Based Evaluation of Mental Disorders.

It is a project co-funded by the European Union. It has received funding from the European Commission through Horizon 2020.

The goal of this project is to improve the performance of the tools used in general in clinical consultations of neurology, psychology and psychiatry, and to create a virtual reality platform with different applications for clinicians and / or researchers. Through virtual environments that emulate a real situation, these tools collect objective information from cognitive processes.

Within this project we group and develop different tools. Currently, we already commercialize the first one, NESPLORA Aula, and we are in the process of the normative study of two more, NESPLORA Aquarium and NESPLORA Aula School.

NESPLORA Aula evaluates attention in children aged 6 to 16 years, NESPLORA Aquarium evaluates attention and working memory in adults, and NESPLORA Aula School evaluates strengths in students from primary and secondary education.

Within the VRMIND project we will develop more tools over the course of these two years. With them, we will analyze different types of memory, cognitive impairment, executive functions ...

This is the landing page we are creating for our VRMIND project: vr.nesplora.com

The VRMIND project has been granted under a “SMEInst-01-2016-2017: Open Disruptive Innovation Scheme” call from the H2020 program of the European Commission. As described in the Topic, VRMIND focuses on proposing an innovative ICT concept, product and service applying new sets of rules, values and models which ultimately disrupt an existing market.

Through this project, we announce our candidacy for WITSA’s Emerging Digital Solutions (WEDS) Award (7).
Global impact and potential of our project

Mental disorders and neurological conditions affect to at least 20% of worldwide population during lifetime.

The overall objective of this project is the demonstration, clinically and in the market, of the higher performance of virtual reality environment based diagnosis systems for mental disorders; not only for children but also for adults; and not only by ourselves but also by independent peers that validate our findings.

The problem and opportunity for VRMIND is derived from the particular nature of mental disorders and the limitations of conventional diagnosing methods. Two remarkable particularities of mental disorders are:

- The impossibility to diagnose them through physical or chemical parameters. The only way to diagnose a mental disorder is measuring the reactions of the patient to questions, images, sounds or other stimuli.
- The dependence of the reactions of the patient on the surrounding environment. The response of the same person to a question will be different depending on the other stimuli hitting the target from the environment such as distracting sounds, images on movement, interruptions by others...

Conventional diagnosis of mental disorders is nowadays held with paper or computerized questionnaires that are fulfilled by the patient in a medical cabinet environment, thus, free of daily life environmental stimuli. In this environment the reactions of the patient are biased by the quietness of the environment itself. At the same time, experience has proven that in a conventional questionnaire based diagnosis process, no matter it is hard-paper or on a laptop, the measurement and registry of multiple variables of the reactions of the patient is extremely difficult.

There are hundreds of conventional mental diagnosis tests for mental disorders in the market. Developers and exploiters of these tests, aware of their limitations and due to the low potential to actually create remarkable market differentiations between them, are evolving from the paper to the laptop. This means that most advanced alternative products allow the patient to fulfill the test on a computer, laptop or tablet, but relaying exactly on the same clinical evidence and normative as their paper backed predecessors. Thus, state of art computerized test keeps the same low accuracy and ecological validity.

Due to these limitations, scientific evidence demonstrates that the results obtained through conventional tests lack of what has been named ecological validity: Non-correlation of the results obtained in the tests and the reactions of the patients on daily life environments. Patients running the test correctly fail in everyday life (known as Ceiling Effect).

Inability to accurately determine the degree of a mental disorder. Patients failing the tests overall do well in a remarkable portion of everyday life but are considered and treated as completely handicapped in that particular disorder (known as Ground Effect) sometimes with prejudicial effects.

This lack of ecological validity is the main reason for the inaccuracy of the conventional diagnosis methods, what, apart from the prejudicial effect on the patient and health system, brings a negative impact on the market:

-Too many false positive or false negative diagnoses and inaccurate or wrong treatment prescriptions.
- Inefficient provision of health services.
- Low confidence of society on mental disorder diagnosis.

VRMIND addresses EU-wide and global challenges in the extent that mental disorders are a major and growing health issue. The following table describes the global prevalence of the mental disorders addressed by each VRMIND test:

<table>
<thead>
<tr>
<th>Condition</th>
<th>Product</th>
<th>Target population</th>
<th>World prevalence</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attention disorders</td>
<td>VRMIND-AULA</td>
<td>Children from 6 to 16</td>
<td>7% to 12%</td>
<td>The worldwide prevalence of ADHD: A Systematic Review and Meta-regression Analysis. Am J Psychiatry 2007; 164, 942-948</td>
</tr>
<tr>
<td>Exec.functions’ dis</td>
<td>VRMIN-ICSTEST</td>
<td>Adults from 16 to 90</td>
<td></td>
<td>Global Epidemiology of Dementia: Alzheimer’s and Vascular Type. BioMed Research International’14</td>
</tr>
<tr>
<td>Memory disorders</td>
<td>VRMIND-DIMEMO</td>
<td>Adults from 19 to 90, and particularly adults over 80</td>
<td>20%</td>
<td>Dementia and Cognitive Impairment: Epidemiology, Diagnosis and Treatment. Clin Gariatr Med 2014 August; 30(3): 421-442</td>
</tr>
<tr>
<td>Mild cognitive impairment</td>
<td>VRMIND-DCLDETEC</td>
<td>Adults from 19 to 90, and particularly adults over 80</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

For the estimation of the market size for VRMIND system both potential customers (mental health practitioners) and end users (patients) must be taken into consideration. The following figures describe the current (2016) and future (2026) estimated mentally conditioned population in the world and the geographical markets where VRMIND is currently available: Europe, Northern America and Latin America:

<table>
<thead>
<tr>
<th>Population structure</th>
<th>World 2016</th>
<th>World 2026</th>
<th>Europe 2016</th>
<th>Europe 2026</th>
<th>North America 2016</th>
<th>North America 2026</th>
<th>LATAM 2016</th>
<th>LATAM 2026</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adults over 16</td>
<td>73.90%</td>
<td>75.50%</td>
<td>84.10%</td>
<td>84.30%</td>
<td>81.40%</td>
<td>82.00%</td>
<td>74.70%</td>
<td>77.90%</td>
</tr>
<tr>
<td>Children below 16</td>
<td>26.70%</td>
<td>24.50%</td>
<td>15.90%</td>
<td>15.70%</td>
<td>18.60%</td>
<td>18.00%</td>
<td>25.30%</td>
<td>22.10%</td>
</tr>
<tr>
<td>Total population [MM]</td>
<td>7,432,662</td>
<td>8,215,252</td>
<td>738,85</td>
<td>737,44</td>
<td>360,53</td>
<td>386,77</td>
<td>641,03</td>
<td>700,98</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Attention disorders</td>
<td>138,92</td>
<td>140,89</td>
<td>8,22</td>
<td>8,10</td>
<td>4,69</td>
<td>4,87</td>
<td>11,35</td>
<td>10,84</td>
</tr>
<tr>
<td>Disorders in executive functions, Memory or Mild cognitive impairment</td>
<td>1,114,9</td>
<td>1,276,65</td>
<td>131,51</td>
<td>132,74</td>
<td>63,1</td>
<td>67,84</td>
<td>97,82</td>
<td>112,43</td>
</tr>
</tbody>
</table>
While Europe is the biggest market for VRMIND in terms of potential end users, the growth in the next 10 years will be concentrated in North America and particularly in Latin America.

Currently VRMIND is capable to diagnose attention disorders, executive functions’ disorders, memory disorders and mild cognitive impairment. The next table show the targeted population and global prevalence of these mental conditions:

<table>
<thead>
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<td>20%</td>
<td><em>Global Epidemiology of Dementia: Alzheimer’s and Vascular Type.</em> BioMed Research International 2014</td>
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<td>Memory disorders</td>
<td>VRMIND-DIMEMO</td>
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<tr>
<td>Mild cognitive impairment</td>
<td>VRMIND-ICLDETEC</td>
<td>Adults over 80</td>
<td>20%</td>
<td><em>Dementia and Cognitive Impairment: Epidemiology, Diagnosis and Treatment.</em> Clin Gereiatr Med 2014 August; 30(3): 421-442</td>
</tr>
</tbody>
</table>

Regarding the expected evolution of population and population pyramids, the next figures and table summarize the size and evolution from 2016 to 2026 of the estimated mentally conditioned population in the world and the geographical markets where VRMIND is currently available: Europe, Northern America and Latin America:

VRMIND potential customers:
Potential customers of VRMIND are neurology professionals that offer and provide to the potential end user analyzed above. These are mainly neurologists, psychologists and psychiatrists developing their professional activity in public and private mental health units. According to the WHO
Mental Health Atlas 2014, there are around 670,000 practitioners in these fields worldwide. The following table shows the estimated distribution of the density of these practitioners geographically and in terms of income per 100,000 inhabitants:

**Innovative features and functionalities**

NESPLORA has developed a new ICT system for the evaluation of mental disorders, called “VRMIND”, based on the use of virtual reality (VR) environments. This technology is characterized by the ability to develop, clinically validate and perform innovative diagnosis procedures that simply couldn’t be done up to now. The patient, wearing virtual reality glasses and headphones, is introduced in different virtual environments, each one specifically designed to diagnose a particular family of mental disorders. These virtual environments put the patient through multiple expected and unexpected stimuli, propose to execute different actions and ask to respond different questions. At the same time the system monitors the reactions of the patient and registers multiple variables.

A multi centric study conducted on 2013 with more than 800 subjects has demonstrated that this technology reaches a 93,5% accuracy, a 95,2% sensitivity and a 91,9% specify, wide over the 75% accuracy offered by the conventional testing methods and other computerized tests not including a VR component.

Currently, 210 mental health units of 21 countries are using recurrently VRMIND-AULA as their main tool to diagnose attention disorders in children. These customers have demonstrated that VRMIND is the best available and most cost efficient technology for the diagnosis of mental disorders:

- Conventional diagnosis of mental disorders requires the combination of between 6 and 12 traditional tests, and an average dedication of 4 hours of the practitioner. VRMIND needs only one VR test running 30 minutes to make the same work. VRMIND improves the accuracy of the mental health units.
- Using VRMIND, a testing method with 25% higher accuracy, instead of conventional tests, reduces yearly the diagnosed false positives by 47%, and the number of patients under mental disorder treatment by 16%.
- VRMIND reduces the human suffering and personal burden of patients and non-patients.

On the other hand, also thanks to this customer portfolio and to potential customers that have opted to stay in the traditional diagnosing methods, we have been able to deeply understand the balance of motivations and resistances that is holding back a faster and broader market up-take. These are our main criteria for success:

- VRMIND is a diagnosing device, on the contrary to the conventional tests that comprise mainly texts and figures. This implies that the practitioner must purchase a device, the VR glasses or helmet. Until the recent apparition of players like SAMSUNG and FACEBOOK (with Oculus Rift) in the VR industry, VR glasses have been prohibitively expensive reducing the potential customers to very high-end mental health units. Now we need to migrate our technology to the SAMSUNG GEAR VR platform, reducing 75% of the hardware cost.

- When we addressed the market with our first VR test, VRMIND-AULA, the 80% of the market said the product was great but that they were not specialized enough in the children’s segment. They wanted VR tests to diagnose adults’ mental disorders. Hearing
this message, we developed ICSTEST, DIMEMO and DCLDETECT but it was not enough. We understood that the main criteria used by practitioners for the selection of a particular test to diagnose are the availability of enough amount of clinical evidence (normative sample), and the proximity of the clinical evidence to the characteristics of the population that each practitioner attends (validation samples) elaborated by independent peers. We also realized why VRMIND-AULA was successful mainly in Spain and Latin America: the clinical evidence was developed in populations of these regions. Now we need to develop further “regional population based” clinical evidence for VRMIND-AULA, and an equivalent basic clinical evidence amount for VRMIND-ICSTEST, VRMIND-DIMEMO and VRMIND-DCLDETECT.

The novelty of the innovation business project relies on being the unique mental disorder diagnostic system combining neuroscience and virtual reality, with clinically validated evidence, available on the market. VRMIND diagnosis system comprises basically the system itself (hardware) and a range of virtual reality environments for diagnosis. These include specific VR environments simulating the most appropriate daily life situation to diagnose a specific disorder (e.g. a classroom to diagnose ADHD), and a diagnosing protocol that asks the patient to execute several operations and answer questions while the system introduces different environmental stimuli, such as interruptions, unexpected sounds and images... The whole set of operations, questions, interruptions and virtual environment, and the responses of the patients, are clinically studied and included in the normative studies developed for the validation, standardization and homologation by practitioners’, scientific and health authorities, exactly like what is done in the case of conventional tests. VRMIND offers the following advantages and innovations:

- Ecological validity of the diagnosis protocols run under VRMIND, leading to higher accuracy. Clinical evidence has demonstrated that the virtual reality environments simulated on VRMIND are powerful enough to create a solid correlation between diagnosis results and daily life behavior of patients.
- Non-cultural bias scenarios: The scenarios developed under VRMIND are not cultural bias so the same test can be used in different countries around the world, just changing the language of the instruction.
- Scientifically demonstrated capacity for the correlation of multiple diagnosis variables. Unlike the conventional tests VRMIND is simultaneously registering multiple diagnosis variables at the same time. The introduction of time as a solid and accurately measured variable allows clinically ground correlations between variables. This makes possible, among other issues, to accurately degree the affection level of a disorder in a particular patient, what is not possible or extremely difficult with conventional tests.
- Capacity to diagnose complete set or families of mental disorders within the same product. Each conventional test is usually designed and validated to measure a single disorder or even a single variable into the diagnosis process of a single disorder. On the contrary, each virtual reality environment of VRMIND has the capacity to diagnose different related disorders within the same product.
- Capacity to include different tests in the VRMIND platform so different mental disorders can be diagnosed using the same hardware and just using another test. In this platform also rehabilitation programs can be included.

Patients, practitioners and health care systems are currently suffering from the weaknesses of current conventional diagnosing test. The low ecological validity of conventional diagnosing methods is the main reason for the inaccuracy of the conventional methods, what, apart from the prejudicial medical side-effects on patient and health system, brings a negative impact on the market, and represent the main problems to be solved:
Either insufficient, excessive or inadequate therapy prescription considering the real conditions and capacities of the patient, causing dissatisfaction in the patients and generating a low confidence level and reluctance of the general public on the mental therapies:
- Apart from false negatives, there is real evidence of a significant number of false positives; people who have received neurological treatment with no brain dysfunction but another disease that causes memory impairment or behavioral problems, etc...
- Bad prescription due to difficulties to select the best treatment. Different degrees of, or slightly different, mental disorders need quite divergent treatments. Therefore, accuracy is especially critical in this field. Being for example two patients diagnosed on memory disorder, the treatment can be radically different one case to the other depending on the degree or the kind of disorder.

Inefficient mental health care service provision, due to late diagnosing and inappropriate prescription, society is supporting a higher cost pharmacologically, on caring of the handicapped and on institutionalization of patient in extreme situations. According to a study conducted by Gustavsson et al., 2011, the total cost of disorders of the brain in Europe was €798 billion in 2010. Direct costs constitute the majority of costs (37% direct healthcare costs and 23% direct non-medical costs) whereas the remaining 40% were indirect costs associated with patients’ production losses. The European per capita cost of disorders of the brain was 1.550€ on average, varying by country.

Low confidence level of the general public on mental health diagnosing. According to recent reports, between 50% and 66% of mental disorders are not diagnosed and citizenship’s mistrust is considered an underlying key factor.

Feasibility of implementation

VRMIND addresses the problem and the derived business opportunity providing to the collective of neurology professionals a system for the diagnosis of mental disorders with high ecological validity: high correlation with activities of daily living (ADL) and with the capacity to degree the intensity of the disorder.

Up to the appearance of VRMIND, the possible shapes of diagnosis protocols where very restricted in the capacity to introduce different stimuli and the capacity to measure different reaction. Therefore, correlations that could be found in the normative studies were too weak and drove to the low accuracy and lack of validity of current mental disorder diagnosis methods. VRMIND overcomes both limitations of conventional methods through:

- The capacity to simulate daily life virtual environments (images, sounds, actions, unexpected stimuli)
- The capacity to suggest a wider range of operations to the patient, beyond answering questions.
- Multiplied power to measure, register and analyze reactions of the patient: answers, time, movement...

These new capacities allow the design, the clinical validation and the generation of the normative for more complex multi-variable, multi-stimuli, multi-disorder diagnosis methods, ecologically valid, extremely accurate and with the capacity to also accurately measure disorder degrees. An increased accuracy in the diagnosis allows earlier detection and more tailor-made therapies, improving their success rate at the same
effort, and improving the wellbeing of the person with mental disorders and their relatives.

The customer value proposition of VRMIND is summarized as:

- VRMIND is a virtual reality platform for the diagnosis of mental conditions that create immersive environments capable to put the patients into a combination of multiple stimuli and to measure on real-time multiple data generated by the patients’ reactions to the stimuli. The analysis and the correlation of these multiple input and registered data increase 25% the accuracy over the state of art of conventional diagnosing tests and makes possible to measure the intensity of the diagnosed condition, a feature out of scope up to now.
- The impact of VRMIND in the market, considering that in a population of 100,000 citizens attended by 5 neurology practitioners, in which only one of them diagnoses with VRMIND system, are the following:
  - The total number of average yearly false-positives in mental condition diagnosing is reduced in 47%.
  - The total number of patients under mental disorder treatment is reduced a 16% due to the reduction of over diagnosing.
  - At the same time the practitioner using VRMIND to diagnose increases 116% the patient portfolio while the other 4 practitioners suffer a reduction of 49%.

These neurology units, particularly those small-medium sized and private, are the main targeted user for the final solution of VRMIND project. Nowadays each neurology unit select and buy conventional tests, typically on a fee per diagnosed patient basis. At no remarkable advantages in the accuracy, the use of a particular test is not considered as an added value by the patient or user, what means that it neither generates any additional income source nor increases the demand of diagnosis services.

First market prospection studies on VRMIND-AULA have uncovered a willingness of potential patients to pay higher wages to practitioners as long as the technology they use guarantees remarkably higher accuracy in the diagnosis. This makes VRMIND an income source for the neurology unit instead being a cost source.

To make this possible, NESPLORA combines the following internal resources:
- A multidisciplinary team of 12 employees with expertise in psychology, neuropsychology and technological development (Programming, 3D graphic design, etc.) of virtual reality environments.
- The capacity and network to perform clinical studies for the validation of our products.
- Significant infrastructure and major items of technical equipment:
  - Virtual Reality development infrastructure.
  - Graphic engine license for the development of virtual reality applications.
  - Already developed VR environments that can serve as model for future VR designs.
  - Architecture and code source of developed products.

The hardware of VRMIND system comprises the following elements.
- A data processing unit, gathering the responses of the patient during the test and comparing the acquired data with the normative of each family of mental disorder for the automatic elaboration of a diagnosis report.
- Virtual reality glasses and headphones, which the patient wears during the diagnosis test process, running the virtual reality environments. These virtual reality glasses also include head movement tracking device.
- A single-button joystick as auxiliary input device for the patient.
Marketing and sales capacities:
· The marketing and sales team is based on our headquarters in San Sebastian (Spain), and is mainly reactive to the market demand and responsible for the attendance of direct demand from interested customers and for the development of a distribution network.
· NESPLORA has a small network of distributors at a national level located in the main cities of the Spanish geography: TEA Cegos (Madrid, Barcelona and Valencia); EOS (Madrid); Rehasoft (Barcelona) and Psikolan (Bilbao), due to the amount of clients located in these cities; moreover, it has another small network at an international level, related to the distribution of NESPLORA AULA in Latin America: Manual Moderno in Mexico DF (Mexico), AG Internacional in Chile; Libro Amigo editors (Lima, Peru); and JDG Consulting in Argentina.
· In addition to these networks, NESPLORA has a significant network of customer-prescribers who are essential for our marketing abroad.

Thankfully, competition pressures on the tech industry have led to a fast evolution of virtual reality technology and to its integration with other tech mainstreams, particular cloud computing and mobile technologies. A multiplicity of providers of VR technologies has arisen in the recent years and now can be considered an industry itself.

According to these projections Virtual Reality as technology will experiment an exponential growth in the following years, making it a natural and familiar technology for both practitioners and patients. This trend will be positive to reduce potential technology related resistances for products like VRMIND. Furthermore, according to a multiplicity of sources, the world is clearly going mobile and the dominance of ANDROID seems clear for the next years.

For these reasons, the most likely to succeed virtual reality technologies are those incorporating a mobile nature and one of the dominant OS systems on mobile industry, like the SAMSUNG GEAR VR, that combine an ANDROID smartphone located in the forefront of a special purpose helmet-glasses to create the virtual reality environments.

As an additional check, we have verified the ophthalmologic safety of this solution through a study performed by an independent ophthalmologist guaranteeing the safety of the solution.

**Scalability**

VRMIND includes four virtual environments for diagnosis of four mental disorder families:

VRMIND–AULA, neuropsychological test for attention in children from 6 to 16 years old: is a computerized Continuous Performance Test (CPT) designed to evaluate attention processes and support the diagnosis of attention disorders, it analyses the child’s behavior within a virtual school classroom. It is also valuable in other kind of disorders where attentional processes are essential like generalized developmental disorders, difficulties to learn of cognitive deficiencies. VRMIND–AULA offers scores about: sustained attention, divided attention (visual and auditory); impulsivity; excessive motor activity (hyperactivity); tendency to distraction, processing speed, focus on the task, attentional difference between visual and audio stimuli and between more and less stimulating tasks, sterile movement, motor activity and fatigue for tasks. Also distinguishes the tendencies to the internal or external distraction. The normative study of AULA with general population of Spain was published in Journal of Attention Disorders (Iriarte et al., 2012), and the convergent validity with Conners’ Continuous
Performance Test, the market leading test, has been recently published in Child Neuropsychology journal (Díaz et al., 2014).

- Thanks to the development of this neuropsychological test, we have created VRMIND-AULA SCHOOL. Evaluating the same attention processes and offering the same scores, it creates a report focused on the strengths of students from primary and secondary education, as this is a tool for educative centres.

VRMIND-ICSTEST (Ice-Cream Seller Test), virtual reality test for the evaluation of executive functions: evaluates executive functions in people with acquired brain injury, schizophrenia, substance abuse, adult ADHD and diverse neurodegenerative diseases such as dementia (Alzheimer’s, etc.). Variables measured by the Ice Cream Seller test include: planning, learning and working memory, performance time, attention, cognitive flexibility, impulsivity, flash memory, learning curve and attentional spam. Evaluates and differentiates multiple pathologies from degree of dementia (Alzheimer, front-temporal, etc.) or pathologies like schizophrenia, depression, attention deficit and other mental disorders in adulthood. It is also valid for long term studies for the evaluation of the increase in the degree of cognitive impairment in neurological diseases like Parkinson or multiple sclerosis and also in the assessment of the sequel of ictus, brain trauma or brain tumors. In general, evaluates a divergence in the cognitive performance either inter or intra subject.

VRMIND-DIMEMO, virtual reality test for the evaluation of memory processes: evaluates memory processes in people with acquired brain injury, schizophrenia, substance abuse, adult ADHD and diverse neurodegenerative diseases such as dementia (Alzheimer’s, etc.). Variables measured by DIMEMO include: immediate, short and long term memory, episodic memory, procedural memory, prospective memory and memory problem simulation (malingering).

VRMIND-DCLDETECT, virtual reality test for the evaluation of mild cognitive impairment: the objective is to be capable to measure slight objective differences in very short time lapses in order to be capable to intervene fast and effectively in the case of any variation of the cognitive status. It is useful for the early stages of dementia or in case of deterioration in any disorder, and to assess sequela in acute neurological affectations. With CDLDETECT differential diagnosis and early treatment is possible much faster. This test can be used as preliminary test for any disorder in any cohort and can be considered as a universal mental disorder test, able to determine complete mental health or point out the potential disorder type to be studied more accurately with alternative tests like AULA, ICSTEST or DIMEMO.

The development of new and better diagnosis methods for further disorders in the future: VRMIND offers the capacity to reproduce almost any testing protocol that a clinical researcher could imagine. This feature of VRMIND is an opportunity to integrate tests developed by third parties that run under VRMIND platform, imitating the strategies of companies like Google, Apple of Microsoft who make profit from opening their platforms to third developers while offering them the framework to access to customers.

VRMIND combines in one product all the features offered separately by these competitors: includes input devices, online diagnosing, audio–visual interaction and measures the movement of the patient.

Intended improvement potential over time comes is:
- The development of new and better diagnosis methods for further disorders in the future. VRMIND offers the capacity to reproduce almost any testing protocol that a clinical researcher could imagine. This feature of VRMIND is an opportunity to integrate tests developed by third parties that run under VRMIND platform, imitating the strategies of companies like Google, Apple or Microsoft who make profit from opening their platforms to third developers while offering them the framework to access to customers.
- The optimization of hardware costs, derived from the competing forces on the market of electronic devices, particularly with the entrance of companies like Google and Facebook in the market of virtual reality glasses and hardware.

Regarding the improvement potential of conventional testing methods, their actualization strategy has been the computerization of the tests. The test is basically the same but performed on a PC, laptop, or tablet. An indicator of this is that all current computerized tests perform and are commercialized with the same normative documents as their paper and pencil parents, meaning that the computerization itself has no clinical effect at all. The business strategy below the computerization is to try to create a higher perceived value to increase prices, but at the same time introduce the need to invest in hardware and software to perform the computerized tests, keeping the gross profit growth below price increase. Compared to the potential improvement of their competitor solutions, VRMIND already generates a higher perceived value and reduces the testing costs instead of increasing it.

Proven solution

The commonly accepted rules by the scientific community and mental health practitioners to develop, validate and use a mental health diagnosis test comprise the following steps:

1. Design and development of the test. The promoters of the test conceptualize, design, develop and materialize a testing protocol based on previous research and a series of hypotheses. Each protocol has been previously studied clinically to find the correlations between the measurements of the stimuli and the reactions of the patient registered during the application of the protocol and the probability of suffering from a particular mental disorder.

2. This prototype test is exposed to a first lab test, a lab scale clinical validation in a typical population of closely controlled 50 people. This first test points out the validity of the used hypotheses and the consecution of the expected diagnosing results on a very specific and controlled population. The result of this test can be either to continue with the next step or to redefine the hypotheses and design of the test.

3. After the lab scale test, a field test typically involving 200 subjects must be performed. This test eliminates the potentially biasing influence of performing the experiment in the controlled cohort of the lab test. After this test the product is completely developed and could be commercialized because its clinical effect has been demonstrated. Anyhow, a population of 200 subjects is not still large enough to be considered as completely representative of all potential casuistic within a family of mental disorders and further clinical validation is required to obtain a really salable product.

4. After the field test, the promoter team usually performs a normative clinical study on normal population of at least 2,000 subjects and typically 3000 subjects. These population sizes are considered large enough to exhaustively test and clinically validate a mental health test with a particular objective. The main outcome of this clinical study is
the elaboration of the Normative Document. This document is the “users’ guide” of the test, and the reference guide for practitioners willing to use the new test in their practice. Thus, the existence of the Normative Document, despite not being strictly mandatory, is a requisite of the market to purchase and use any diagnosing test.

5. Once the test is completely validated and the Normative Document is available for commercialization, it is also desirable that independent peers, practitioners, clinicians or researchers, validate the claims and findings published about the new test. These validation clinical studies, performed typically on smaller populations that have not been directly involved in the previous tests, give the final clinical validation to the new test, eliminating the potentially biasing intervention of the promoters of the new test in the outcome of the validation study. The more and more diverse validation, the more trustable the test.

These are the planned studies in the framework of VRMIND project.

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<th>Product</th>
<th>Migration to GEAR VR</th>
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<td>300 subjects</td>
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In our Publication Dossier (attached to this message), the studies carried out with NESPLORA AULA and with NESPLORA AQUARIUM can be also found.
DOSSIER DE PUBLICACIONES EN PRENSA
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OBJETIVOS DEL DOSSIER DE PUBLICACIONES EN PRENSA

Este dossier busca dar a conocer las publicaciones que diferentes medios de comunicación han realizado sobre Nesplora, así como las entrevistas realizadas a sus miembros.

NESPLORA


NESPLORA está formada por un grupo de personas comprometidas a mejorar el conocimiento sobre la conducta humana. La misión de Nesplora es proporcionar a clínicos e investigadores soluciones tecnológicas que permiten estudiar, diagnosticar o tratar de una forma precisa problemas de la conducta humana, mejorando la calidad de vida de sus pacientes.

NESPLORA diseña y desarrolla herramientas innovadoras para mejorar el diagnóstico y tratamiento de pacientes con problemas tan trascendentales y universales como el Alzheimer, hiperactividad, enfermedades mentales, ictus o autismo, entre otros. Lo hace replicando entornos reales de manera virtual, para que el clínico pueda medir de manera objetiva los síntomas de estos problemas como si se encontrara observando una situación real.

De esta manera se reducen errores y tiempos de evaluación, con la consecuente mejora en la calidad de vida de los pacientes.

Puede conocer más sobre nosotros en nesplora.com
2009

2 MAYO
el proyecto nesplora gana ‘the ten million project’ de innobasque

2010

12 ENERO
40.000 euros para una gran idea

7 JUNIO
Osasuntzuagoa bizi ahal izateko bideojokoak
El mundo

2011

19 SEPTIEMBRE
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27 SEPTIEMBRE
e-Mintza ya está disponible - Autismo Diario

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30 SEPTIEMBRE
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3 OCTUBRE
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31 ENERO
Y ahora, e-Mintza para Android - Autismo Diario
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21 FEBRERO
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22 FEBRERO
Alfonso Carmona, ponente en la presentación del Aula Nesplora del IHP
28 FEBRERO
Un test de realidad virtual posibilitará evaluar el TDAH
http://medicablogs.diariomedico.com/diariomedico/2012/02/28/un-dispositivo-percutaneo-tapona-la-orejuela-izquierda/

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3 JULIO
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2 SEPTIEMBRE
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Canarias 7

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3 SEPTIEMBRE
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Los expertos reclaman un mejor diagnóstico del Trastorno de Atención en los niños

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Huelva Información

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El Día de Córdoba

7 SEPTIEMBRE
Vencer el miedo al dolor con realidad virtual
noticias.mujer.es

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Ultima Hora Ibiza y Formentera
Un sistema virtual permite distraer el miedo al dolor
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Nesplora presenta su programa Isla Calma a los oyentes de Palabras Mayores
www.sendasenior.com
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Cuidar los implantes dentales
Diari de Terrassa – Suplemento DT Comerç

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14 OCTUBRE
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¿Es posible mitigar el dolor?
ABC – Suplemento XL Semanal
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Expertos afirman que el miedo al sufrimiento puede ser tan invalidante como el propio dolor
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El miedo al sufrimiento puede ser tan invalidante como el propio dolor
www.alertadigital.com

El miedo al sufrimiento puede ser tan invalidante como el propio dolor
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18 OCTUBRE
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www.webconsultas.com

20 OCTUBRE
Realidad virtual contra el dolor
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1 NOVIEMBRE
Contra el dolor, un buen viaje en 3D
Muy Interesante
26 DICIEMBRE
Las mujeres pelirrojas sufren más miedo a acudir al dentista
http://cronicadecantabria.com

Las mujeres pelirrojas sufren más miedo a acudir al dentista
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Diari de Balears P.12

Combata el miedo al dentista con la realidad virtual
Diario de Mallorca – Suplemento Especial P.6

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Olvídate del miedo al dentista
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16 FEBRERO
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19 FEBRERO
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22 MARZO
Nesplora, innovación en neurociencias
http://www.adegi.es/adegi/noticia-nesplora-innovacion-neurociencias-201703/

Women in VR, encuentro de mujeres del ecosistema de la RV
23 MARZO
Corresponsales extranjeros visitan San Sebastián, Ciudad de la Innovación
http://www.fomentosansebastian.eus/donostiainn/es/noticias/2452-corresponsales-extranjeros-visitan-san-sebastian-ciudad-de-la-innovacion

Las pruebas de realidad virtual son eficaces para evaluar el Trastorno por Déficit de Atención e Hiperactividad
http://www.psiquiatria.com/trastornos_infantiles/las-pruebas-de-realidad-virtual-son-eficaces-para-evaluar-el-trastorno-por-deficit-de-atencion-e-hiperactividad/#

Marca España - Realidad virtual para evaluar la conducta

Tecnología en femenino

Corresponsales extranjeros visitan Donostia como ciudad de la innovación

«Chicas, os necesitamos en esta industria»

24 MARZO
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Impulsa San Sebastián proyectos trasversales en ciencia e innovación

Impulsa San Sebastián proyectos trasversales en ciencia e innovación

Ciudad española de san Sebastián impulsa proyectos en ciencia e innovación
http://www.hoytamaulipas.net/notas/288093/Ciudad-espanola-de-San-Sebastian-impulsa-proyectos-en-ciencia-e-innovacion.html

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Errealitate birtuala izango da ‘Teknopolis’ saioan, asteburuan, ETBn
http://www.eitb.eus/eu/telebista/programak/teknopolis/osoa/4797745/errealitate-birtualaz-teknopolisen/

Teknopolis: 2017-04-29
http://teknopolis.elhuyar.eus/programak/2017-04-29/?lang=eu

30 ABRIL
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“La realidad virtual nos ayuda a entender mejor cómo procesa el cerebro”

Entrevista a Gema Climent, fundadora y directora de I+D de Nesplora
http://www.innovaticias.com/innovacion/41498/entrevista-a-gema-climent-fundadora-y-directora-de-i+d-de-nesplora

“La realidad virtual nos ayuda a entender mejor cómo procesa el cerebro”
http://www.agenciasinc.es/Entrevistas/La-realidad-virtual-nos-ayuda-a-entender-mejor-como-procesa-el-cerebro

Siete mujeres cuentan en Valencialab sus desarrollos en realidad virtual

3 MAYO
“La realidad virtual nos ayuda a entender mejor cómo procesa el cerebro”

“La realidad virtual nos ayuda a entender mejor cómo procesa el cerebro”

VALENCIALAB acoge el primer evento en España de Mujeres y Realidad Virtual

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Realidad virtual ayuda a entender mejor los procesos cognitivos de los humanos

BOLIVIA: Realidad virtual ayuda a entender mejor los procesos cognitivos de los humanos | Los Tiempos
http://www.entornointeligente.com/articulo/9934141/BOLIVIA-Realidad-virtual-ayuda-a-entender-mejor-los-procesos-cognitivos-de-los-humanos-%7C-Los-Tiempos-04052017

5 MAYO
“La realidad virtual nos ayuda a entender mejor cómo procesa el cerebro”
http://www.madrimasd.org/informacionidi/noticias/noticia.asp?id=68889

8 MAYO
“La realidad virtual nos ayuda a entender mejor cómo procesa el cerebro”
http://www.elmundoempresarial.es/noticias/es/1705/7/6484/La-realidad-virtual-nos-ayuda-a-entender-mejor-c%C3%B3mo-procesa-el-cerebro.htm

13 MAYO
“La realidad virtual nos ayuda a entender mejor cómo procesa el cerebro”
http://radiomacondo.fm/2017/05/13/la-realidad-virtual-nos-ayuda-entender-mejor-procesa-cerebro/

15 MAYO
IMF Business School Bilbao y Nesplora buscan personas para un estudio de realidad Virtual
http://www.elmundoempresarial.es/noticias/es/1705/4/6494

16 MAYO
Regreso al futuro

19 MAYO
From psychologist to medtech pioneer
http://thisismedtech.com/article/psychologist-medtech-pioneer

24 MAYO
«Con la realidad virtual conocemos la capacidad de atención y de memoria»
25 MAYO
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http://gipuzkoadigital.com/donostia-san-sebastian-tech-week/

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Diagnostics médicaux : la réalité virtuelle au service de la médecine
https://voixdeurope.wordpress.com/2017/05/26/diagnostics-medicaux-la-realite-virtuelle-au-service-de-la-medecine/

29 MAYO
Teknologia berrien hiriburua izango da Donostia

Donostia se convertirá en la capital vasca de las nuevas tecnologías del 20 al 23 de junio
http://cl.globedia.com/donostia-convertira-capital-vasca-tecnologias-junio

6 JUNIO
ATEGAL y la Realidad Virtual de la mano en Padrón, Ferrol, A Coruña, Santiago y Ourense
https://www.ategal.com/2017/06/06/ategal-y-la-realidad-virtual-de-la-mano-en-padrón-ferrol-a-coruna-santiago-y-ourense/

Miramón acoge este viernes Parkea Music Fest

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La I Donostia Tech Week convertirá a San Sebastián en capital vasca de las nuevas tecnologías del 20 al 23 de junio
https://www.lainformacion.com/ciencia-y-tecnologia/tecnologia-general/Donostia-Tech-Week-San-Sebastian_0_1033097935.html
La I Donostia Tech Week convertirá a San Sebastián en capital vasca de las nuevas tecnologías del 20 al 23 de junio

La I Donostia Tech Week convertirá a San Sebastián en capital vasca de las nuevas tecnologías del 20 al 23 de junio
http://ecodiario.eleconomista.es/espana/noticias/8410627/06/17/La-I-Donostia-Tech-Week-convertira-a-San-Sebastian-en-capital-vasca-de-las-nuevas-tecnologias-del-20-al-23-de-junio.html

Donostia, capital vasca de las nuevas tecnologías, entre el 20 y el 23 de junio
http://www.economiadehoy.es/noticia/18417/empresas/donostia-capital-vasca-de-las-nuevas-tecnologias-entre-el-20-y-el-23-de-junio.html

Donostia Tech Week 20 y el 23 de junio Donostia San Sebastián
http://gipuzkoadigital.com/donostia-tech-week/

7 JUNIO
La I Donostia Tech Week convertirá a San Sebastián en capital vasca de las nuevas tecnologías del 20 al 23 de junio

8 JUNIO
Experiencia con realidad virtual en Ategal
http://www.laregion.es/articulo/ourense/experiencia-realidad-virtual-ategal/20170806125307728334.html

9 JUNIO
ENTREVISTA A UNAI LABIRUA: CEO DE NESPLORA
http://www.grupoblc.com/entrevista-unai-labirua-ceo-de-nesprola/

12 JUNIO
Parkea Musik Fest, el Parque Científico y Tecnológico de Gipuzkoa transforma la ciencia en arte
http://www.elmundoempresarial.es/noticias/es/1706/12/6598

13 JUNIO
Indarkeria matxistari aurrea hartzeko bideo-jokoa

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Emakunde lanza un videojuego que promueve la igualdad
http://www.amecopress.net/spip.php?article16005

Cómo disfrutar del reto de la igualdad
http://www.eldiario.es/norte/euskadi/disfrutar-reto-igualdad-emakunde_0_654085577.html

Emakunde lanza un videojuego para prevenir la violencia machista entre la gente joven

Emakunde lanza un videojuego para prevenir la violencia machista entre la gente joven

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http://www.astekaridigitala.net/noticiasDetalle.asp?tm=10&sb=30&id=37353

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14 JUNIO
El videogame de la igualdad
EMAKUNDE PRESENTA UN JUEGO VIRTUAL CON EL QUE PRETENDE CONCIENCIAR A LOS JÓVENES. EL PROYECTO TAMBIÉN INCLUYE MATERIAL PARA SU REFLEXIÓN EN LAS AULAS
http://www.noticiasdealava.com/2017/06/14/araba/el-videogame-de-la-igualdad

Gafas pioneras que detectan problemas cognitivos en personas mayores

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EMPRESAS DONOSTIARRAS CONSIGUEN EL 5% DE LAS AYUDAS EUROPEAS DEL INSTRUMENTO PYME PARA ESPAÑA

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14 JULIO
TORIBIO ECHEVARRIA SARIAK /PREMIOS TORIBIO ECHEVARRIA
https://www.youtube.com/watch?v=zsUoFrO2IVc&feature=youtu.be

23 JULIO
La Euskal Encounter acerca la realidad virtual a varios ámbitos
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Cinco emprendedoras que han roto el techo de cristal tecnológico
https://retina.elpais.com/retina/2017/08/01/tendencias/1501596573_396742.html

24 AGOSTO
Tecnología: el nuevo motor del cambio social

13 SEPTIEMBRE
Torrekua será sede el día 28 del segundo encuentro de economía social y solidaria
Habrá tres ponencias y el panel de expertas será exclusivamente femenino
http://www.diariovasco.com/oarsoaldea/errenteria/torreku sede segundo 20170913001230-ntvo.html

13 OCTUBRE
Gema Climent: “Emprender no es más difícil por ser mujer, pero cuesta mucho llegar arriba”
A DISRUPTIVE CONCEPTION OF EVALUATING HUMAN COGNITION AND BEHAVIOUR USING STANDARDIZED AND SCIENTIFICALLY VALIDATED VIRTUAL REALITY SCENARIOS
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OBJECTIVES OF THE DOSSIER

This dossier aims to show the works done with Nesplora Aquarium, our investigations and the investigations in which third parties mention us. Also seeks to disseminate the contributions of Nesplora Aquarium to science through different investigations carried out by both Nesplora and different authors of reference. It also collects papers where Nesplora Aquarium has been quoted.

Thank you for relying on our product and for linking it to your product portfolio. Nesplora hopes that all the data of this dossier will be valuable for your company and will allow you to know more about our product Nesplora Aquarium.

NESPLORA

NESPLORA is a company born in the field of research. It is located in the technological and scientific park of Gipuzkoa and began its journey in October 2008.

NESPLORA is formed by a group of people committed to improving the knowledge about the human behavior. Nesplora’s mission is to provide clinicians and researchers technological solutions that allow them to accurately study, diagnose or treat problems of the human behavior, improving the quality of life of their patients.

Nesplora designs and develops innovative tools to improve the diagnosis and treatment of patients with such transcendental and universal problems as Alzheimer, hyperactivity, mental illness, stroke (ictus) or autism, among others. For doing that, Nesplora replicates real environments in virtual reality, so that the doctor can objectively measure the symptoms of these problems as if they were observing a real situation.

We reduce errors and evaluation times, with the consequent improvement of the quality of life of the patients.

You can know more about us in
vr. nesplora.com
http://www.nesplora.com

One of our products is Nesplora Aquarium, a virtual aquarium in which adults can interact through virtual reality glasses. Within the simulation there are attention and working memory tasks to perform, and the software evaluates the tasks and gives a report back. This document assists the clinician in the assessment of attention and working memory.
CONTRIBUTIONS TO CONGRESSES

The objectives of the pilot study were to create an ecological tool which assess attention in adults, to improve the validity of the current neuropsychological assessment test and, to facilitate the evaluation and the diagnosis. The participants were 205 people between the ages of 17 and 86 (70% female). The sample was evaluated using Nesplora Aquarium, the test in virtual reality for the assessment of attentional processes which is composed by 3 CPT paradigms: AX, Dual No-go, Dual No-go. The results obtained showed the difficulty (0.829; 0.818; 0.786) and reliability (0.927; 0.926; 0.929) rates of the tasks. All of them were accepted. We concluded that the tool is appropriate, attractive and ecological and it is reliable and difficult enough to assess attention in subjects over the age of 16.


The aim of this study is to analyze, through a tool in virtual reality (VR), the attentional changes associated to the age. 205 people between 17 and 86 years old, without pathology, have been assessed using a new assessment tool in VR developed to measure the attentional processes. After a usability task, the test is divided into 3 subtasks: training and AX task; training and dual Xno task with AB stimuli and; training and dual Xno task with CD stimuli. The results show that people under 30 make less omissions and they have a faster response time in the second and third tasks. Furthermore, in the third segment, people over 30, make more commissions. It is concluded that there is a decrease in the attentional capacity associated to the age.

In this study, on the one hand, the development of the Nesplora Aquarium tool is described and, on the other hand, the results obtain during the field trials are presented. A total of 77 people between 18 and 83 years old participated: 18 with acquired brain injury, 18 with ADHD and 41 without cognitive impairment. After a usability task and a training, the test is divided into 3 segments: one Xno task, one to assess working memory and a X task. The results show that the difficulty index are higher than 0.90 so, they are considered too easy. Changes have been made in the tasks, in the instructions and in the scenario. Currently, the test is divided into 3 task: one AX paradigm and two Xno dual paradigms. After the field trials with more than 200 subjects, a normative study of Nesplora Aquarium is in progress.

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OBJETIVES OF THE DOSSIER

This dossier aims to show the works done with Nesplora Aula, our investigations and the investigations in which third parties mention us. Also seeks to disseminate the contributions of Nesplora Aula to science through different investigations carried out by both Nesplora and different authors of reference. It also collects papers where Nesplora Aula has been quoted.

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We reduce errors and evaluation times, with the consequent improvement of the quality of life of the patients.

You can know more about us in vr. nesplora.com
http://www.nesplora.com

One of our products is Nesplora Aula, a virtual school classroom in which children can interact through virtual reality glasses. Within the simulation there are attention tasks to perform, and the software evaluates the tasks and gives a report back. This document assists the clinician in the assessment of Attention Deficit Disorder with or without Hyperactivity (ADHD).

More than 300 clinics in 15 countries are using Nesplora Aula, and more than 10,000 children have benefited from a more accurate assessment of the attentional processes that underlie disorders.

Soon, Nesplora is going to commercialize two more products, one for the evaluation of attentional processes in adults and other one for the evaluation of strenghts of students.
In the chapter Advances in Neuropsychological Assessment of Attention: From initial computerized continuous performance test to AULA, the tool Nesplora AULA is described in detail and refers that it is the only test in Virtual Reality with an extensive normative study carried out with clinic population. The combination of auditory and visual stimuli and distractors, which contribute more information to the diagnosis than unimodal CPTs, are emphasized. In the studies carried out with the tool, several results stand out: a) Nesplora AULA’s ability to discriminate between children with ADHD diagnosis and without diagnosis and, children with pharmacological treatment and without it; b) the influence of distractors on the performance of children; c) AULA administered at a 1-week interval does not have a learning effect; d) it shows convergent validity with test d2 and faces deffer; and finally, e) it is concluded that AULA is able to differentiate between different cognitive profiles of ADHD. In summary, the studies show that AULA is a valid test to measure attention and impulsivity, and is very useful to complete the diagnosis of ADHD with information about cognitive performance in an ecologically relevant simulation.


Currently, there’s no research that confirms the effectiveness of the lisdexanfetamina (LDX/Elvanse®) on the improvement of cognitive functions in ADHD patients. The objective of this research was to assess the effectiveness of lisdexanfetamina (LDX/Elvanse®) in the improvement of behavioral and cognitive symptoms in a group of patients with ADHD. The effectiveness was measured using the test NESPLORA Attention AULA both before and after 7.5 months of the pharmacological treatment. The sample was composed by 88 ADHD patients who were between 5 and 20 years old. The results showed significant improvement in the post-treatment evaluation on selective and sustained attention, quality of the attention focus and hyperactivity, also moderate improvements were found on impulsivity and an incidence almost nearly zero on processing speed. It can be concluded that Lisdexanfetamina (LDX/Elvanse®) is an adequate treatment for the improvement of the attention and hyperactivity and this improvement can be monitored with the virtual reality test NESPLORA Attention AULA.

The NESPLORA Attention AULA system analyzes the behavior of a child in the context of a virtual classroom. The tool is perceived initially as a game, in which the child performs a task while typical distracters of a classroom are presented to him or her. The NESPLORA Attention AULA test evaluates factors determining the existence of ADHD, such as sustained attention, impulsivity, divided visual and auditory attention, excessive motor activity, and a tendency to distraction (by means of a movement sensor.) After the test, the system returns an evaluation report that helps the clinician to perform a more accurate and reliable diagnosis.

Tour around different programs and serious games for psychological intervention. It will be published in October, 2016

In recent years, publications about Attention Deficit Hyperactivity Disorder (ADHD) using continuous performance tests are frequent, although there are few studies that allow us to have an overview of the numerous uses of these instruments and their variety. This project describes and analyzes the characteristics of this kind of tests, in relation to its use and application in ADHD with particular emphasis in the relationship between ADHD and the Integrated Visual and Auditory Continuous Performance Test (IVA/CPT). For this purpose, the scientific literature on the subject, covering the period from 1990 to May 2015 was reviewed. The results observed in 139 collected researches suggest two main utilities: 1) As a complementary tool for evaluation and diagnosis of ADHD and, 2) Regarding treatment, as a test to assess the efficacy of therapeutic interventions. The advantages and disadvantages of these instruments and its future projection are exposed.


An essential tension can be found between researchers interested in ecological validity and those concerned with maintaining experimental control. Research in the human neurosciences often involves the use of simple and static stimuli lacking many of the potentially important aspects of real world activities and interactions. While this research is valuable, there is a growing interest in the human neurosciences to use cues about target states in the real world via multimodal scenarios that involve visual, semantic, and prosodic information. These scenarios should include dynamic stimuli presented concurrently or serially in a manner that allows researchers to assess the integrative processes carried out by perceivers over time. The present review highlights the potential of virtual reality environments which combine the experimental control of laboratory measures with emotionally engaging background narratives to enhance affective experience and social interactions.


This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 739981.
The current chapter describes the serious games and the game tools used for the psychological intervention in the book titled “Integrating Technology in Positive Psychology Practice.” In this chapter, a state of the art about the “serious games,” currently available in different formats (virtual reality, computer videogames) as psychological interventions, is provided as well as its effectiveness, when this data is provided. One of the examples described in this chapter is NESPLORA Attention AULA.


The aim of this study is to analyze the correlation between the ADHD Rating Scale-IV and NESPLORA Attention AULA, by means of analyzing how these two instruments correlate with the evaluation of the ADHD. The results found a significant and negative correlation between the score provided by the fathers in the inattention variable and the mean of the reaction time when the child succeeds in the NESPLORA Attention AULA tasks. Besides, the scores provided by the mothers in the rating scores have also correlated with the variability of the response in the test. NESPLORA Attention AULA and ADHD Rating Scale-IV address different aspects or dimensions of the patients and, hence, to complement each other in order to improve the accuracy of the diagnosis of the ADHD is a beneficial choice.


In this chapter a review about the neuropsychological intervention programs in different modalities is presented. In the introduction of this chapter, NESPLORA Attention AULA is mentioned as a neuropsychological evaluation test in virtual reality, which has been standardized for the Spanish population, and which is, according to its authors, the most accurate, sensible and specific test for the support to the diagnosis of the ADHD currently available.

The goal of this project is to analyze the areas of application of virtual reality in Attention Deficit Disorder with Hyperactivity. Taking into account the brief and recent history of this technology in the childhood area, we have reviewed all publications dealing with the topic from 1990 until 2012. Based on our research, we have distinguished two basic applications: 1) Virtual reality as an instrument for the assessment and diagnosis of this disorder; 2) Virtual reality as a procedure for intervention and treatment. In this case, virtual reality can be applied as the sole technique or as part of multimodal programs, combined with cognitive behavioral techniques or with neurofeedback. This project presents the advances and drawbacks of this technology with respect to attention deficit-hyperactivity disorder.

Moreno, I., Díaz-Orueta, U., other authors (2015). Evaluación del TDAH basado en realidad virtual. Revisión monográfica sobre TDAH y realidad virtual, IN PRESS

In this chapter, the many points of criticism raised about the validity of traditional neuropsychological tests regarding their validity and questioning their predicting level of decline that individuals may show in their daily lives are described. In order to overcome this, and in parallel with the development and cost decreases of virtual reality (VR) technology, integration of informatics and neuroscience is approaching the achievement of a more objective, precise, and ecologically valid neuropsychological assessment based on VR technology. The current chapter describes the problems faced with classical neuropsychological assessment tools and the need of improvement of their validity; the potential advantages of using VR based neuropsychological tests versus classical tests; and the actual progress made in using VR based tools to measure cognitive functions such as attention, memory or executive functions, with some of these tools already standardized and available in the market. In the section of the VRtest for the measurement of the attention, NESPLORA Attention AULA is described.

The aim of the present study is to analyze the convergent validity between the NESPLORA Attention AULA Test and the Continuous Performance Test (CPT) of Conners. The NESPLORA Attention AULA and CPT were administered correlatively to 57 children, aged 6-16 years with average cognitive ability, who had a diagnosis of attention deficit/hyperactivity disorder (ADHD) according to DSM-IV-TR criteria. Significant correlations were observed between both tests in every analyzed variable (omissions, commissions, reaction time, and variability of reaction time), including for those measures of the NESPLORA Attention AULA based on different sensorial modalities. Hence, convergent validity between both tests was confirmed. In addition, the NESPLORA Attention AULA (but not Conners’ CPT) was able to differentiate between ADHD children with and without pharmacological treatment for a wide range of measures related to inattention, impulsivity, processing speed, motor activity, and quality of attention focus. Additional measures and advantages of the NESPLORA Attention AULA versus Conners’ CPT are found in the discussion section.


This review shows the current problems of the neuropsychological evaluation of the executive functions and the latest advances in the achievement of a better accuracy and validity in the evaluation through new technologies and virtual reality. Some developments in Spain are described in this review. One of the examples described is the NESPLORA Attention AULA and references about its convergence validity are provided. The NESPLORA Exec Test also is presented. This test is a virtual reality tool to evaluate the executive functions in both the general and the clinical population and it is based on the virtual environment of an ice cream shop. This instrument measures: planning, learning and working memory, processing time and speed, attention and cognitive flexibility.


NESPLORA AULA is a virtual reality test that provides the discriminatory capacity of continuous performance tests simulating a three dimensional environment (a classroom) in which you interact dynamically. It adds greater opportunities in the analysis of neuropsychological processes (divided attention and sustained visual and verbal attention; control of impulsivity, distracting elements and motor activity), and reflects the usual child’s behaviour while the own situation of the exam does not reduce the attentional requirements demanded.

This chapter focuses on the use and effectiveness of serious gaming in rehabilitation and illustrates the possibilities and strengths in this new and exciting field. Furthermore, a review of the literature and examples of rehabilitation games are presented. The state-of-the-art technologies and directions for future research are also discussed. Rehabilitation gaming has great potential for today’s and future health care, and despite the research gaps, there is increasing evidence that gaming can positively contribute to the rehabilitation and recovery process. The NESPLORA Attention AULA test is described in this chapter as an example of VR test for the evaluation of the ADHD.


AULA virtual reality test, by means of quantifiable measures of cognitive symptoms, and third parties’ direct observations of children’s behaviors, collected by means of scales like EDAH, may complement each other and increase the accuracy of clinical diagnosis of ADHD.


“The aim of this paper is to analyze the convergent validity between the NESPLORA Attention AULA test and the CARAS perception of differences test (extended version). The final sample for the study consisted of 62 children between the ages of 6 and 16. The analysis measured similarity among variables using the cosine between score vectors. Significant correlations and over 0.6 were found between the results of the NESPLORA Attention AULA and the CARAS perception of differences test (extended version) in the selective attention, sustained attention, and cognitive impulsivity variables. This study establishes the convergent validity between the NESPLORA Attention AULA and the CARAS perception of differences test (extended version), meaning that in addition to being a highly ecological test, NESPLORA Attention AULA is an effective instrument for assessing attention processes.

The current study describes the main features of the NESPLORA Attention AULA test, and analyzes the performance of the Spanish normative sample of 1272 children from 6 to 16 years old from the perspective of the influence of ecological visual and auditory distractors present in the test. Results show influence of distractors in both increasing reaction time for providing both correct answers and commission errors, and increasing the time the patients deviate their attention focus. Some of the anecdotes happened in different evaluation settings with relation to children’s reactions to distractors appearing in NESPLORA Attention AULA are also presented.


The present study describes the collection of normative data for the NESPLORA Attention AULA test, a virtual reality tool designed to evaluate attention problems, especially in children and teenagers. The normative sample comprised 1,272 participants (48.2% female) with an age range from 6 to 16 years (M=10.25, SD=2.83). The NESPLORA Attention AULA test shows both visual and auditory stimuli, while randomized distractors of ecological nature progressively appear. Differences by age and gender were analyzed, resulting in 14 groups, 7 per sex group. Differences between visual and auditory attention were also obtained. Obtained normative data are relevant for the use of NESPLORA Attention AULA for evaluating attention in Spanish children and teenagers in a more ecological way.


The purpose of the NESPLORA Attention AULA project has been to create a lab test team, or an objective variables test, ecological and useful, in order to help the clinicians to better diagnose the attention disorders and, in this way, prevent subsequent development and attention problems. In this manual, a review about the concept and characteristics of the ADHD as well as about the virtual reality, technologies used for the evaluation of the behavior is described. After this review, NESPLORA Attention AULA test is described and its statistical justification is presented. Finally, the process of installation and use is also described.

AULA is the first well developed, norm referenced, virtual reality measure to evaluate attention, vigilance, impulse control and activity level in a simulated classroom. It represents assessment of the future yet available today.

Dr Sam Goldstein. FEBRUARY 2016
Attention Deficit Hyperactivity Disorder (ADHD) and Language Disorders (LD) are two of the most frequent neurodevelopmental disorders in preschool and school childhood population, but can continue in adolescence and adulthood, and affecting their quality of life. Although these disorders present clinical and etiological heterogeneity, evidence shows that they share deficits in executive functions, especially in attention, motor activity and inhibitory control. The virtual reality (VR) test Nesplora AULA, specially designed for the evaluation of attention, vigilance, inhibitory control and activity level, was used to compare the attentional and inhibitory control profiles of ADHD and LD groups of children (6-12 years old), since VR technology is proposed as an useful tool that allows a better and accurate assessment because of their greater sensibility and power of discrimination. ADHD group showed higher attentional problems than LD group. The LD performance is influenced by the sensory modality in which the stimuli are presented, while ADHD performance is related to the response rate demanded by the task.


The objective of this study is to compare the Processing Speed Index (PSI) scores of WISC-IV with Response Time (RT) of Nesplora AULA, a CPT in virtual reality that measures attentional processes and motor activity. 35 children diagnosed with ADHD participated (74.3% male), with an age range from 6 to 16 years old (M=9.89 ; SD= 3.18). The results showed that there is not significant relationship between the WISC-IV processing speed and the total mean value of response time of visual stimuli on Nesplora AULA. However, there is a significant inverse relationship between the PSI of WISC-IV and RT of Nesplora AULA in the auditory stimuli. It is concluded that RT is a reliable measure of the time taken to respond to a stimulus, while the PSI corresponds to the time taken to complete a task. Therefore, PSI of the WISC and RT of AULA do not measure the same construct.


The aim of the present study is to assess the differential effect of Methylphenidate and Lisdexanfetamine (LDX) in the behavioral and cognitive symptomatic improvement of ADHD. The sample consists of 123 children (76.4% boys) between 5 and 20 years, all of them with ADHD diagnosis based on criteria of DSM-V and divided into two groups according to each pharmacological treatment. The virtual reality CPT NESPLORA AULA was used to assess
attentional processes and motor activity before and after having received treatment. The results showed significant differences in the Motor Activity scores when the distracting elements are present and in the No-Go task, as a reduced Activity is observed in the group with Methylphenidate.


The aim of this study was to confirm whether children with ADHD, as they grow up, show less impulsiveness and if they maintain attention deficit. For that purpose, attentional profile of two groups (between the ages of 6 and 9 and between 12 and 16) were analyzed through virtual reality and continuous performance test (CPT) AULA NESPLORA. 93 children with ADHD participated in each age group (72% male in the young group and 71% male in the old one). Nonparametric analysis for mean differences (Kruskal-Wallis) were carried out. The youngest group showed greater variability for reaction time (RT) and higher motor activity. The RT for the young group was longer in commission variables without distracting elements and in correct answers in GO task. The old group demonstrated a greater deviation of the focus of attention with distracting elements in both GO and No-GO tasks. We conclude that the RT of the youngest group is more heterogeneous during the test. Although its motor activity is higher than the other group’s, they don’t divert the focus of attention so much. Longitudinal studies which allow to deepen in this aspects are needed.

The aim of the present work was to determine the prevalence of sleep disorders in children with attention deficit/hyperactivity disorder (ADHD) and in a control population, as well as to examine the relationship between sleep disorders and symptoms of inattention, hyperactivity/impulsiveness and executive dysfunction. To do so, executive functions, sustained attention and impulse control were assessed in a sample of 126 children from 5 to 18 years through the Conner’s CPT (Continuous Performance Test) and the virtual reality based CPT Nesplora AULA. Authors consider Nesplora AULA a reliable virtual reality measure of continuous performance that provides information about sustained attention and impulse control. It has been validated, norm referenced, and has convergent validity with the Conner’s CPT. Results showed that children with ADHD slept less at night and that there is a correlation between shorter duration of nighttime sleep and omission errors. Difficulty falling sleep were more frequent in children with ADHD whose symptoms were not treated pharmacologically, than in children receiving treatment.


The objective of the research was to check out the ceiling effect and ground effect of the AULA NESPLORA test. 13,046 people’s data (69.8% male; mean age: 9.95 years) was analyzed to check the proportion of omissions and commissions (no omissions nor commissions indicate a ceiling effect and a maximum number of omissions and commissions indicate a ground effect) in total and in each condition (type of task, sensorial modality and with/without distractors) of the test. Only 5 people (0.035% of the sample) showed a ceiling effect by not making any mistake in the task. Regarding the ground effect, none of the people made the maximum number of omissions and commissions of the task. Finally, in relation to the people who made the maximum number of omissions and commissions, a clear pattern was not observed in the results. It was concluded that AULA NESPLORA has a high discriminatory power, since it allows for evaluating the attentional abilities in children between 6 and 16 years of age without ceiling and ground effect.


The objective of the research was to compare if children with ADHD diagnosis and impulsivity traits show faster reaction time (RT) than children without this trait. 208 children participated in the investigation (73.6% male, mean age: 10.20 years old, SD: 2.69). AULA NESPLORA, a Continuous Performance Task (CPT) carried out in virtual reality, was used for the assessment. The RT of the underperforming children in the commission variable, impulsivity trait (score T>60;
N=89) and the RT of the children with a high or normal performance (score T<60; N=119) was analyzed to see if there are significant differences between both groups. The result showed significant differences in all the RT between children with higher cognitive impulsivity and children who commission in AULA’s normal range, being shorter the RT of the first group. Therefore, in this study is concluded that the cognitive impulsivity of children with ADHD in a CPT paradigm is associated with shorter RT.


Traditionally, test with only visual stimuli have been employed for the evaluation of ADHD. Nevertheless, some researches underline that there is a difference between the cognitive processing of auditory and visual stimuli. The aim of this study was to analyze inter-group (ADHD and control) and intra-group differences in an attentional task with visual and auditory stimuli. For that purpose, the AULA NESPLORA virtual reality test was used in a sample of 499 subjects aged 6 to 16 (66.3% male), 232 of them with ADHD. The results showed more mistakes in children with ADHD both in visual and auditory modality. Moreover, their RT (reaction time) was lower with visual correct answers and auditory commissions. This difference in the correct answers depending on the modality could have been due to the way of processing stimuli. Finally, the SD (standard deviation) indicated a higher variability in subjects with ADHD. These results demonstrated the need to evaluate ADHD presenting both visual and auditory stimuli.


There is little evidence about the treatment with methylphenidate (MFT) through objective measures in children with ADHD. This study assesses the effectiveness in the behavioral and cognitive symptoms of the ADHD using the NESPLORA Attention AULA test before and after the pharmacological treatment. The sample was composed of 35 subjects between 6 and 19 years of age with a diagnosis of ADHD. After the treatment, the subjects commit less mistakes, the reaction time was shorter and more stable through the test and the motor activity index also decreases. In conclusion, the monitorization of the treatment with MTF through the NESPLORA Attention AULA test showed a significant improvement in the sustained attention, the processing speed and the motor activity.


This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No [716807].
The objective of this study was to check if the ADHD diagnosis is related with the reaction time measured through NESPLORA Attention AULA. 475 children between 6 and 16 years of age took part on the study, 208 of them were diagnosed with ADHD and the other 267 did not show any pathology. In the comparison between both groups, all the variables showed statistically significant differences (p<.05), except in the variable reaction time of the auditory stimuli. The ADHD group showed smaller reaction times in comparison with the control group. When the inattentive and combined subtypes were compared, no statistically significant differences were found (p<.05). This result shows the need of carrying out studies about the reaction time and the ADHD in Continuous Performance Test tasks, with the aim of identifying whether the slow reaction time is a symptom of the ADHD.

Zulueta, A., Redondo, M., Mejías, M., González, E. (2016). Tiempo de reacción en tarea GO/NO GO de AULA en niños/as de 6 a 16 años con y sin TDAH. 60º Childhood and Adolescence’s Psychiatry Congress (AEPNYA). Donostia, Spain, 1st-4th June, 2016

The aim of this study was to verify the usefulness of the NESPLORA Attention AULA test in order to differentiate between the different clinical presentations of the ADHD. The NESPLORA Attention AULA test was administered to 124 children with ADHD diagnosis aged between 6 and 16 years. The results showed worse performance for ADHD combined-type children than for inattentive in all presented variables. Combined-type children also showed (1) Worse visual processing speed and sustained attention and (2) More inattention and impulsivity when faced with auditory stimuli. NESPLORA Attention AULA test may provide objective information and increase the accuracy of differential diagnosis between ADHD clinical presentations, especially by measuring motor activity and deviation from the focus, as a low performance in these measures may be more representative of the hyperactivity component.


The current study presents initial findings obtained from complementing observations measured by EDAH scale for teachers with cognitive variables assessed with NESPLORA Attention AULA. The sample was composed by 211 children aged between 6 and 16 years. Hyperactivity items were especially addressed by commission errors, means of motor activity, and deviation from the focus. Differences in inattention symptoms observed by teachers in EDAH were more significant for NESPLORA Attention AULA scores in auditory omissions and variability (sd) in reaction time, by means of quantifiable measures of cognitive symptoms, and third parties’ direct observations of children’s behaviors, collected by means of scales like EDAH, may complement each other and increase the accuracy of clinical diagnosis of ADHD.
The objective of the current study is to show convergent validity between NESPLORA Attention AULA and d2 attention test and to show NESPLORA Attention AULA’s preliminary results in detecting attention problems and information processing patterns in children with reading disorders. Sample was composed by 60 children between 6 and 17 years of age. Sixty-eight percent of the group presented some type of learning disorders. The results showed that NESPLORA Attention AULA distinguished better than d2 between children with and without reading-writing difficulties. Convergent validity analysis showed adequate values for correct answers and concentration indexes while errors seemed to be measured differently in both tests. Compared to d2, NESPLORA Attention AULA can add value to the evaluation of attention abilities on children with reading-writing difficulties, providing valuable information on these children’s information processing patterns.


This study has a double aim: (1) To study the factorial validity of NESPLORA Attention AULA and (2) To analyze its convergent validity with EDAH scale and DSM-IV criteria. For the first aim, a sample of 2074 children were recruited and the results pointed out that the 18 variables studied tended to saturate a single factor. For the analysis of the convergent validity two subsamples of 188 and 360 children were analyzed. Results show low to moderate correlations between NESPLORA Attention AULA and EDAH and DSM-IV, being the highest correlation values for the inattention variable. Results support the structure of NESPLORA Attention AULA of one single factor. With regards to convergent validity, different nature of NESPLORA Attention AULA as an objective cognitive measure and EDAH and DSM-IV as observational scales suggest they target different aspects or dimensions of patients’ behavior and, hence, they may complement each other in the increase of ADHD diagnosis accuracy.

The objective of this study was to analyze the neuropsychological processes of the executive function underlying in NESPLORA Attention AULA, in order to specify the cognitive profile which complements the behavioral diagnosis of the ADHD. In this study, 130 with ADHD diagnosis participated. The authors found that these children can be classified, according to their performance in NESPLORA Attention AULA in six groups: (1) inattention; (2) inattention and cognitive impulsivity; (3) inattention and motor hyperactivity; (4) inattention, impulsivity and hyperactivity; (5) moderate inattention and severe impulsivity-hyperactivity; (6) normal performance with an impulsive but effective cognitive style. NESPLORA Attention AULA allows the depth and accurate approach of the cognitive performance on kids with ADHD in order to plan intervention strategies.


The objective of this work is to analyze the convergent validity of the NESPLORA Attention AULA test with respect to the Continuous Performance Test de Conners (CPT) in a sample of 53 school pupils with ADHD. After the statistical analysis, the validation of NESPLORA Attention AULA test to assess attention processes in ADHD children was confirmed with regards to a traditional attention measurement as is the CPT. NESPLORA Attention AULA also provides an ecological scenario, the differentiation between visual and auditory attention and measures of the divided attention, interference caused by distractors, quality of the attention focus, motor activity and hypo and hyper-stimulation tasks.


The objective of this study was to determine the NESPLORA Attention AULA ability to discriminate children diagnosed with ADHD versus a control group, being the sample composed by 62 children in each group. The result obtained showed that, by means of using the variables provided by NESPLORA Attention AULA, it is possible to obtain a correct classification of the 93.5% of the cases. Consequently we can say that the sensibility of the test as well as it diagnostic power are excellent.

The aim of this study was to verify the test-retest validation of the NESPLORA Attention AULA test with a sample of 30 patients with ADHD diagnosis. There were not significant differences between the results obtained in the test and in the re-test sessions. Based on the lack of statistically significant differences between data collected in the two sessions, in the same clinical conditions and a week apart, we can conclude that the administration of NESPLORA Attention AULA performed to the same patient with a week of separation does not carry with memory effect, and therefore, this period is sufficient to detect variations in the clinical course of patients studied. This endorses the usefulness of NESPLORA Attention AULA to monitor short-term clinical changes. The objectivity, speed, stability and ability to perform periodic comparisons of the situation of each individual in a short space of time are such, that NESPLORA Attention AULA is a test of great practical value in assessing patients with ADHD.


In this study, NESPLORA Attention AULA was administered to 40 patients between 6 and 16 years old and diagnosed with ADHD. The 100% of the participants could finish the study without any kind of alteration. 97% of the participants showed results compatible with the existence of excessive levels of inattention, motor restlessness or impulsivity, confirming the clinical diagnosis. In the other 3% of the participants, the authors confirmed the existence of the high intellectual capacities which biased the execution of the study. Besides, the results correlated in direct proportion with the results of the clinical evaluation scales. It can be concluded that NESPLORA Attention AULA is a test easy to complete, with a high predictive value and reliable to diagnose the ADHD with a good clinical correlation. In some groups, the children with high intellectual capacities, the results can be affected by their intellectual level.


The general objective is to know the latest advances in the evaluation and measurement in the field of child neuropsychology and to know the most advanced tool available in the market as a support in the diagnosis of the ADHD. NESPLORA Attention AULA is a Continuous Performance Test based on virtual reality which assesses attention, impulsivity and motor activity. NESPLORA Attention AULA simulates an organic classroom so it has a high ecological validity. The test is attractive and it is perceived as a game, so the cooperation of the patient increases and the dropout rate is reduced at a minimum level.

In this publication, the NESPLORA Attention AULA tool is presented. This tool, besides the traditional indicator such as mistakes and successes, reaction times and others derived from these, also offers the possibility to evaluate other interesting data such as motor activity, the answer to distractor events, and the different performance to auditory and visual stimuli. NESPLORA Attention AULA also allows to know if the performance varies due to a generalized slowing or only when distractors are present, or if the sterile movements are responsible of the attention deficit.


Studies performed with AULA show its validity, sensitivity and reliability.

<table>
<thead>
<tr>
<th>Accuracy</th>
<th>93.5%</th>
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<tbody>
<tr>
<td>Sensitivity</td>
<td>55.2%</td>
</tr>
<tr>
<td>Specificity</td>
<td>91.9%</td>
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</tbody>
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AULA classifies correctly 93.5% of the cases. AULA has a sensitivity of 55.2%. AULA has a specificity of 91.9%.

AULA has a normative sample of approximately 1,500 children between 6 and 16 years old.
Since Virtual Environments (VEs) allow for precise presentation and control of dynamic perceptual stimuli, they can provide ecologically valid assessments that combine the control and rigour of laboratory measures with a simulation that reflects real-life. Therefore, VE-based neuropsychological assessments can provide a balance between naturalistic observation and the need for exacting control over key variables. Nesplora AULA, which contains Go/No-Go stimuli, is considered to have good convergent and discriminant validity. Furthermore, it offers enhanced classification of attentional deficits when distractors are introduced into the VE.


The aim of the present work is to present the design, development and preliminary validation of a digital tool which assesses episodic memory in people over the age of 55, in order to overcome difficulties related to early detection, ecological validity, learning effect, etc. In this work, AULA is considered a relevant contribution to the study of different cognitive domains, in particular, attention, through video games and serious games. This format is able to represent real life environments, helping in the standardization of the application and in the efficient data collection.


The aim of this work was to evaluate the similarities and differences between NESPLORA AULA and BrainGaze studies’ results in the assessment of ADHD, bearing in mind the importance of an objective measure when doing a diagnosis. The sample consists of 30 children (65% boys) between 6 and 18 years and all of them have a diagnosis of ADHD based on criteria of DSM-V. The results show that there are no significant differences in the obtained scores between the BrainGaze Test and the NESPLORA AULA Test in the evaluation of the CPT at an overall level. In addition, the assessment of ocular vergences obtained results consistently similar with an 85%
correlation compared to the CPT. Authors conclude that the combination of different digital assessment tools, together with the personal interview and the elaboration of assessment scales, is the most effective and efficient strategy for the assessment and diagnosis of ADHD.


The process of evaluation-diagnosis of ADHD is far from being easy since there are many factors involved in it. The attentional profile of ADHD is nowadays commonly examined by means of Continuous Performance Tests (CPTs). Nonetheless, they are also criticized for their low ecological validity, as these settings differ considerably from most of the daily settings in which the children and adolescents are immersed. Due to the limitations of CPTs, new tools utilizing virtual reality technology have recently been developed. One such development mentioned in this publication is AULA Nesplora, which is considered a reliable and valid diagnostic system for children, replicating as closely as possible the typical conditions of a classroom.


Neuropsychological Assesment 3.0 AULA NESPLORA is presented as perhaps the best validated test of the virtual classrooms. AULA is significantly correlated with the traditional CPT and can distinguish between children with ADHD with and without pharmacological interventions. In comparison with the TOVA, AULA was found to be more sensitive to reaction time and rate of omission errors and was also rated as more enjoyable. In relation to the Conners’ CPT, a significant correlation was indicated in the variables of omissions, commissions, reaction time, and variability of reaction time.


This study has three objectives: (1) To check if the NESPLORA Attention AULA test gives complementary information to the ADHD diagnosis; (2) To explore ADHD subtypes not included in the DSM-5; (3) To compare the results obtained in NESPLORA Attention AULA with the DSM-5 results in order to see if they are complementary. The sample consisted of 96 patients between 6 and 16 years of age with ADHD diagnosis. Among their findings, the authors found ADHD subtypes not included in the DSM-5. The correlations between DSM-5...
and NESPLORA Attention AULA variables did not were statistically significant. The discriminant analysis showed an agreement between DSM-5 and NESPLORA Attention AULA in the 70.5% of the cases. The authors conclude that the NESPLORA Attention AULA test complements the clinical diagnosis of the ADHD specifying cognitive profiles.


This study compares the performance in a continuous performance test within a virtual reality classroom (CPT-VRC) in 94 children divided into three groups: (1) Medicated children with ADHD; (2) Unmedicated children with ADHD; (3) Healthy children. The authors found that the unmedicated ADHD group showed more omission errors and showed slower reaction times than the healthy group. Likewise, reaction time variability was higher in the unmedicated ADHD group compared with the other two groups. The authors wrapped up that virtual reality is a promising technology to assess ADHD symptoms in an ecologically valid environment. In this article the authors describe the NESPLORA Attention AULA test and mention the capacity of this test to differentiate between those children taking medication and those who do not take it.


This review investigates the advantages and challenges inherent in the application of virtual reality technologies to psychological assessment and interventions. In this review, NESPLORA Attention AULA is mentioned in the section of validated tests that are developed in a virtual classroom for the assessment of attentional processing. The normative study and the convergent validity study with the Conners Continuous Performance Test are mentioned. The authors conclude that “the addition of virtual reality to a psychological battery provides an opportunity for psychologists to obtain more ecologically valid data about client functioning in simulations of dynamic perceptual stimuli and the sensitivity of the test while capturing data about client performance in activities of daily living.


In this study, the authors analyze the diagnostic effectiveness of the NESPLORA Attention AULA test to discriminate between different ADHD presentations. A total of 117 students participated, and were divided into three groups with ADHD according to their presentation, and a control group. Each of the test conditions allowed the discrimination between the impulsive/hyperactive...
(I/P) and combined presentations with respect to the control group, and between the I/H and inattentive presentations. However, differences among ADHD presentations were only evident when the results were separately analyzed for the visual and auditory modalities. This study showed that the indicators offered by the NESPLORA Attention AULA test (omissions, commissions, response times, and motor activity) makes possible to establish a differential diagnosis of ADHD presentations when analyzed under different contextual conditions.


This study assessed whether urinary arsenic (UA) levels are associated with attention performance and ADHD. A cross-sectional study was conducted on 261 children aged 6-9 years. Attention was measured by using 4 independent tools: a) tests from the Behavioral Assessment and Research System (BARS): RTT, CPT and SAT; b) NESPLORA Attention AULA Test; c) Child Behavior Checklist (CBCL), administered to parents; and d) Teacher’s Report Form (TRF), administered to teachers. Higher UA levels were associated with an increased latency of response in RTT and SAT as well as with a worse performance on selective and focalized attention in the NESPLORA Attention AULA test. A dose-response relationship was observed between UA levels and inattention and impulsivity scores. On the other hand, results from the CBCL and TRF tests failed to show a significant association with UA levels. In conclusion, UA levels were associated with impaired attention/cognitive function, even at levels considered safe.


The current meta-analysis aimed: (1) To investigate the sensitivity of virtual reality-based measures of cognitive processes between clinical and healthy populations; (2) To investigate potential moderators of the results. The findings support the sensitivity of virtual reality-based measures in detecting cognitive impairment. That means that the control groups of this meta-analysis obtained better scores in these evaluation tools in comparison to the clinical groups. These authors highlight that NESPLORA Attention AULA is the only virtual reality-based tool designed to measure attention impairments in children with ADHD which has been standardized.


In the current paper, the authors review the virtual reality instruments for the neuropsychological assessment of executive functions. Within these instruments, they mention NESPLORA Attention
AULA as a virtual environment which has proven to have a good convergent and discriminant validity.


This work describes the characteristics of continuous performance tests, in relation to its use and application on ADHD. For this purpose, the scientific literature on the subject, covering the period from 1990 to May 2015 was reviewed. The results observed in 139 collected researches suggest two main utilities: 1) As a complementary tool for evaluation and diagnosis of ADHD and, 2) Regarding treatment, as a test to assess the efficacy of therapeutic interventions. The advantages and disadvantages of these instruments and its future projection are exposed. One of the tests described in this review is NESPLORA Attention AULA. The authors say that this test is an example of virtual reality assessment tool which is useful and sensible for the ADHD diagnosis.


This project consists of an application which allows the user to interact with a virtual environment by means of a web interface where there are models in three dimensions which simulate different activities. The application is focused on the education through the use of virtual reality. This fact allows enriching the student’s perception through the use of different objects in an artificial world. The results obtained in the questionnaires show that the use of the virtual reality as valid, accepted and it helps to the understanding of the context. The authors describe the NESPLORA Attention AULA system and highlight that the children perceive this test as a game where they have to perform a task at the same time the different distractors are present.


The main aim of this exploratory study is to analyze the descriptive statistical criteria of the TEA-Ch Battery version A, Test of Everyday Attention for Children, in a sample of 133 Spanish children between 6 and 11 years of age, in order to compare the results with the original study and with other attention tests (questionnaire and CPT). In the section dedicated to the review of the instruments for the assessment of the attention, the author of this thesis describes NESPLORA Attention AULA and points out that the most used test in Spain which cover the needed
requirements are: Conners CPT (CPT, 1998), CSAT, adapted by Severa into Spanish (2004) and NESPLORA Attention AULA


This study aims to analyze if the naming speed can be a predictor of both the learning of reading and the attention problems. In the state of the art section of this work, NESPLORA Attention AULA is mentioned as a recommended test for the evaluation of the attention and concentration capacities.


This article shows the preliminary results of the pilot-phase of a tele-therapy tool based on Serious Games for Health. This tool has the objective of improving the time management abilities and the prioritization of the tasks in children and teenagers with ADHD. After the results, the authors concluded that there is a need for new interactive content in order to work on time management skills in this sample. Nevertheless, authors consider that this kind of adaptive tele-therapies should be adopted as a support tool for traditional therapies, not as a substitute for conventional interventions. In the section dedicated to the review of the ADHD assessment tools, the authors describe NESPLORA Attention AULA and highlight its applicability outside of a laboratory setting.


The aim of this work is to analyze the characteristics of the most frequently used evaluation measures and their degree of applicability in clinical and educative context with their consequent practical implications. The first conclusion is the relevance of the executive functions as determinants of the behavior and performance of children and teenagers in contexts as diverse as it’s the education, the family or social relationships. The second conclusion is the need for reliable and valid assessment tools that not only enable the evaluation of these components, but also predict the extent to which possible deficits in the executive functions may determine the daily functioning of children and teenagers in significant contexts. In this work, NESPLORA Attention AULA is summarized and the authors highlight that NESPLORA Attention AULA has a better ecological validity that the rest of the paper-pencil based measures.
In this book, the authors review the instruments currently available for the evaluation of the cognitive functions used both in the clinical practice and in the research field. In one of the chapters of this book dedicated to the instruments for the evaluation of the executive functions, NESPLORA Attention AULA is mentioned as a CPT carried out in a virtual reality environment that seeks to reproduce conditions as similar as possible to the classroom reality. It has greater ecological validity than the rest of the measures.


To carry out a comparison between what the scientific literature expose about the traditional way to conceptualize, diagnose and the make the treatment of the ADHD and what it is really done by the professionals of Tres Arroyos. NESPLORA Attention AULA is described in this work as one of the instruments used to help with the diagnosis of ADHD.


Attention Deficit Hyperactivity Disorder is a common neurobehavioral disorder in school population. However, its diagnosis is complicated due to the difficulty of the objective assessment of subjective aspects such as inattention or impulsiveness. The aim of the present study was to describe the most used assessment scales as tools for the diagnosis of this disorder, its subtypes and comorbidity. These include AULA NESPLORA as a novel tool which provides a combination of continuous performance tests which assesses sustained attention, divided visual and auditory...
attention, impulsiveness, excessive motor activity, tendency to distraction and processing speed in a virtual classroom. It is also concluded that the sensitivity of the test and its diagnostic capacity are excellent.


This study explored auditory and visual attention in 50 children with ADHD in comparison with control children. The authors found that deficiency of visual attention is more serious than auditory attention in children with ADHD. On the auditory modality, only the deficit of attentional inconsistency is enough to explain most cases of ADHD; however, most of the children with ADHD suffered from deficits of sustained attention, response inhibition, and attentional inconsistency on the visual modality. According to the authors, these results also showed that the deficit of attentional inconsistency is the most important indicator in diagnosing and intervening in ADHD when both auditory and visual modalities are considered. The authors of this article support their findings in an article of NESPLORA Attention AULA in which the importance of the study of the variability in the reaction time, as a measure of the attentional consistency both in auditory and visual attention in children with ADHD, is highlighted.


In this issue of the journal it is announced that the Instituto Psicopedagógico EOS Perú has incorporated the NESPLORA Attention AULA test for the evaluation of the children with ADHD. In this announcement they highlight that NESPLORA Attention AULA: (1) Is the only test which provides complete attention and movement profiles; (2) The test is more attractive than other tests, so it facilitates the work of the clinician and the participation of the child; (3) It carries out an ecological evaluation in which the child is immersed in a daily environment close to reality.

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The aim of this study was to know executive functioning in a sample of 108 children and adolescents with ADHD and ADHD with reading disabilities associated, through the administration of the Behavior Rating Inventory of Executive Functions-BRIEF in its parents form. We found a higher executive deficit in the comorbid group than in the ADHD isolated group, being working memory and planning the most relevant domains. In this article, NESPLORA Attention AULA is mentioned as one of the Continuous Performance Test (CPT) most frequently used.
In this interview to the pediatrician Mr. Miguel Rufo, from the IHP Center, the NESPLORA Attention AULA test is described. According to doctor Rufo, NESPLORA Attention AULA “is a great advance in order to do a more accurate diagnosis of the ADHD and it implies a huge leap in quality with respect to the existing tools, because NESPLORA Attention AULA evaluates in a very easy and convenient way for the children, their parents and the doctors.

Diario Médico, 28th February, 2012. Interview to Miguel Rufo, children’s neuropsychologist of the Seville’s Pediatric Institute – IHP

In this article a large description of the test AULA NESPLORA is carried out, concluding that we stand at a pioneer test in the domain of behavioural assessment via virtual reality. It is added that it is going to be an essential tool for assessment and decision making for clinicians working in an office evaluation environment and devoid of the possibility of direct observation in a natural environment.


The goal of this work is to analyze the areas of application of virtual reality in ADHD, reviewing all publications dealing with the topic from 1990-2012. Based on our research, we have distinguished two basic applications: 1) Virtual reality as an instrument for the assessment and diagnosis of this disorder; 2) virtual reality as a procedure for intervention and treatment. NESPLORA Attention AULA is described as one application for the assessment and diagnosis of ADHD. The authors affirm that the results obtained in the different research of NESPLORA Attention AULA endorse the efficacy of this tool for the evaluation of ADHD.


In this doctoral dissertation the different patterns of cortical activation and of executive control in the different presentations of ADHD are analyzed. According to his author, the findings confirm that each pattern is configured but a profile with its own entity; hence it is possible to
talk about three different disorders instead of a single disorder with different intensity degrees. In the theoretical framework of this thesis the different continuous execution test are reviewed and NESPLORA Attention AULA is presented. The author of this thesis adds that the authors of NESPLORA Attention AULA carried out the validation process and the results show a high sensibility of the scale (>0.97) and an excellence internal consistency.


The aim of this study is to know the intellectual and academic profile of 21 clinical cases with ADHD combined subtype and 19 ADHD inattentive subtypes. The statistical analysis used, values the differences between working memory (WM), processing speed (PS), global cognitive profile (GCP) and academic performance between both subtypes. All the subjects were evaluated by the tests WISC-IV, NESPLORA Attention AULA and a behavior and performance scale. There were not significant differences between PS and WM in the ADHD subtypes respect their global cognitive profile and his academic performance. These results were the same in WISC-IV and NESPLORA Attention AULA. The author concludes that it does not exist an intellectual and academic profile which discriminates between ADHD’s subtypes.

Álvarez, V. Perfil Cognitivo en niños con Trastorno por Déficit de Atención con o sin Hiperactividad evaluados mediante realidad virtual: influencia sobre el rendimiento académico. Master’s dissertation. Universidad de Sevilla, Spain
In the section devoted to the attention evaluation instruments of this manual, the authors include the NESPLORA Attention AULA test and highlight that it is a reliable tool for children between 6 and 16 years of age. They add that this a computerized attention test which uses virtual reality to assess the different variables taken into account in a continuous performance test.


Work of reference about the speech problems from a scientific point of view. This manual has been written by a multidisciplinary team involved in the work of this pathology.