VRMIND– Virtual Reality Based Evaluation of Mental Disorders
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# D5.11 – Independent Report on the performance of AQUARIUM on Latam population

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# 1. EXECUTIVE SUMMARY

VRMIND-AQUARIUM (Nesplora Aquarium from now on) is a neuropsychological test for attention in people from 16 to 90 years old. It is a Continuous Performance Test (CPT) designed to evaluate mainly attentional processes and working memory and support the diagnosis of attention disorders, as well as the assessment of any adult with a clinical condition where attention is impaired. This assessment is carried out through the performance of the person within a virtual aquarium. Therefore, it is also valuable in disorders where attentional processes are essential like different dementias, acquired brain injury, affective and anxiety disorders and multiple sclerosis, among others. Nesplora Aquarium offers scores about: sustained attention, selective attention; working memory, inhibitory control; processing speed and its deviation, switching capacity and perseveration. Both visual and auditory stimuli are presented, so that both sensory channels are working at the same time.

This product was launched to the market on 2018 and from the development of the tool up to now both the professionals from Nesplora and also our customers have made different studies with this tool and we continue researching with Nesplora Aquarium since these studies increase the visibility of the tool and its clinical value.

This deliverable describes in section 3 the contacts with potentials collaborators made and the studies which were finally carried out, while the main conclusions are drawn up in section 4.

It is important to notice that our current collaborators in Latin America have not shared with us all the data and they will do it in the future. Besides, we are currently talking and trying to reach agreements with other potential collaborators in Latin America to take advantage of the collaborations than can be stablished in the last months of the project.

# 2. RELATION WITH OTHER WPS AND DELIVERABLES

This deliverable is closely related with D5.10 (Independent report on the performance of AQUARIUM on European population) and D5.12 (Independent report on the performance of AQUARIUM on N. American population).

# 3. COLLABORATOR'S STUDIES

Since the moment the tool Nesplora Aquarium was developed and ready for its use in the research field, we started looking for Latin American collaborators. First of all, we contacted with those members who signed an interest letter to collaborate with us and also with our current clients who were already using Nesplora Aula but also have access to adult population and that have previously expressed interest in carrying out studies with Nesplora Aquarium. Unfortunately, our pool of current clients in Latam it is not so big.

The unsuccessful contacts are shown in table 1.

### 3.1 CEPPIA – Centro Psicológico y Pedagógico

Collaborator's description:

CEPPIA- Centro Psicológico y Pedagógico is a center where they provide psychological and pedagogical services not only to children but also to young adults. Our collaborator Dr. Luis Méndez is part of the team and has access to healthy people as well.

Location: Mexico City (Mexico)

Sample: 100 people over the age of 16.

Sociodemographic data received by now:

| | Number | Education level (average) |
|---|---|---|
| Male | 25 | Bachelor's degree |
| Female | 36 | Bachelor's degree |
| Total | 61 | Bachelor's degree |

Measurements:

- Nesplora Aquarium: Nesplora Aquarium (Climent, 2018) is a continuous performance test that takes place in a virtual scenario, very similar to a real aquarium. During 20 minutes, the person is situated in a virtual context, shown through a head-mounted display with movement sensors and earphones and a single-button switch. Perspective places the person in one seat of the main hall, facing the principal fish tank, where the stimuli appear. Stimuli are presented both on a visual and

auditory basis, and, at the same time, previously randomized distractors of ecological nature appear progressively. The core of Nesplora Aquarium is composed by two main exercises: (a) a Dual Xno paradigm-based exercise (i.e., "Press the button with every stimuli EXCEPT when you see the clownfish or you hear the word surgeon"") and (b) a Dual Xno paradigm-based exercise with interference (i.e., "Press the button with every stimuli EXCEPT when you see the surgeon or you hear the word clown").

- TP-R. Toulouse-Piéron: This test (Toulouse & Piéron, 2013) allows assessing the perceptive and attentional skills of adults. Specifically, it allows assessing the capacity for sustained attention, concentration, speed and perceptive acuity, as well as resistance to fatigue. Composed of a sheet of graphic elements, it consists of identifying which figures are equal to two given models. Its application can be individual or collective and lasts 10 minutes.

- ASRS – Adult ADHD self-report scale: it is a self-reported questionnaire used to assist in the diagnosis of adult ADHD, It was developed in conjunction with the World Health Organization (WHO) (Adler, Kessler & Spencer, 2004). The ASRS has eighteen questions, which are consistent with the DSM-IV criteria and address ADHD symptoms in adults. Conducted research proved that the scale is a valid and useful tool for the screening of adult ADHD. The ASRS was externally validated on approximately 60 adult patients, and showed high internal consistency and high concurrent validity with the physician-administered ADHD rating system.

Objective of the study:

The aim of this study is to analyse the convergent validity between Nesplora Aquarium and TP-R and ASRS, to probe that these lasts traditional test can be substituted by Nesplora Aquarium.

Hypotheses:

Nesplora Aquarium will show convergent validity (high significant correlations) with at least some of the main indices of the TP-R and ASRS. If this is probed, Nesplora Aquarium could substitute these tests, or at least, complement their measures.

Results and conclusions:

Our collaborator has sent us data belonging 61 subjects. However, in the middle of the project this collaborator has moved to live and work in London. Initially, we tried to follow the collaboration from there, but it was not possible, so he will not be able to send any more data. In addition, other collaborators (see deliverable D5.10) are also collecting data for the same study, so we aim to gather it and to analyze it as a whole.

After the study is finished, the results obtained will be published in a congress or in an open source scientific journal.

## 3.2 Hospital Infantil Federico Gómez

Collaborator's description:

It is a public reference hospital specialized in pediatrics. In addition to medical assistance, they have a large research team. In this way, its objective is to maintain the Institution as a center of knowledge through biomedical research to promote the advance of pediatrics, as well as the training of high quality human resources capable of developing research, in addition to providing high-quality medical care, especially in the prevention, diagnosis and treatment of diseases of the child population without social security and therefore, with the lowest socio-economic resources.

This collaboration allows us to develop 4 different studies which are explained in the following lines. Both Nesplora Aula and Nesplora Aquarium will be used in this study, depending on the age of the participant.

Location: Mexico City (Mexico)

Sample: 100 people for each study, so it is expected to assess 400 people. Nesplora Aquarium will be used to assess people who are over the age of 16.

Sociodemographic data:

We have not received any data yet, since the studies are being developed yet.

Measurements:

- Nesplora Aquarium: Nesplora Aquarium (Climent, 2018) is a continuous performance test that takes place in a virtual scenario, very similar to a real aquarium. During 20 minutes, the person is situated in a virtual

context, shown through a head-mounted display with movement sensors and earphones and a single-button switch. Perspective places the person in one seat of the mail hall, facing the principal fish tank, where the stimuli appear. Stimuli are presented both on a visual and auditory basis, and, at the same time, previously randomized distractors of ecological nature appear progressively. The core of Nesplora Aquarium is composed by two main exercises: (a) a Dual Xno paradigm-based exercise (i.e., "Press the button with every stimuli EXCEPT when you see the clownfish or you hear the word surgeon") and (b) a Dual Xno paradigm-based exercise with interference (i.e., "Press the button with every stimuli EXCEPT when you see the surgeon or you hear the word clown").

- Moxo (Soto, 2016): It is a CPT (Continuous Performance Test) validated and used with frequency for the diagnosis of ADHD, since it evaluates Attentiveness, Impulsiveness, Timeliness and Hyper-Reactivity. Also, how much interfere the presence of visual and auditory distractors throughout the test, which has added popularity to the test. It has two versions, one for children between 6 and 12 years (Moxo kids) and one for teenagers and adults that covers the age range from 13 to 70 years (Moxo teens-adults). The adult version lasts approximately 18 minutes, and the test generates an automatic report.

Objective of the studies:

As previously said, this collaborator is going to carry out 4 different studies which objectives are:

- Determine the prevalence of ADHD in patients with epilepsy through the tools Nesplora Aula and Nesplora Aquarium.
- Analyze the genetic concordance between parents and children with ADHD.
- Study of the attentional profile in a population diagnosed with Autism Spectrum Disorder (ASD).
- Convergence study between Nesplora Aquarium and Moxo.

Hypotheses:

- The prevalence of ADHD in patients with epilepsy will be significant and higher than in the healthy population.
- There is a genetic concordance between parents and children with ADHD.
- People diagnosed with ASD will show a characteristic attentional profile.
- There will be a high convergent validity between Nesplora Aquarium and Moxo, so the former can replace the latter while adding more value to the evaluation.

Results and conclusions:

Given that it is a complex collaboration involving different studies, we still have partial data an we are waiting for more data before carrying out the analysis. However, we have the certainty that the studies are being carried out as planned, and once the entire process is finished, we will proceed to disseminate the results.

## 4. CONCLUSIONS

The aim of these validation clinical studies is, on the one hand, to measure the convergent validity of the Nesplora Aquarium test. From the commercial point of view, it is very common for reference neuropsychological tests to probe their correlation with the measures of other widely used tests. Thus, we decided to carry out this study in order to provide validity to Nesplora Aquarium and facilitate its immersion not only in the Spanish market, but in the international one, since both TP-R, ASRS and Moxo are well known and used in most of the assessment protocols for attention problems. On the other hand, thanks to these studies wee are also testing the capacity of Nesplora Aquarium to measure the attentional processes in different pathologies such as epilepsy, ASD or ADHD.

On the other hand, these collaborations not only provide scientific validity to our tests, but also provide knowledge to the scientific community with information that will be useful in order to ultimately improve the quality of life of people. Thus, Nesplora Aquarium is used to investigate about epilepsy, ADHD and Autism Spectrum Disorders.

Nesplora Aquarium has been deployed into the market in 2018 and from that moment until now several studies have been carried out by the R+D department of Nesplora but also by independent experts.

For this report we expected to count with more studies. This reduction is due to the difficulties to find new collaborators to perform the studies in Latam mainly due to ehe ethical constraints and the deadline of the studies.

Even though, we have been able to close two agreements in Mexico and we are satisfied because despite they are unique Latam collaborators for the moment, the data provided is very valuable and will add a large amount of data to the samples obtained by other collaborators. That means that the results of these studies will show a good level of reliability. Also, between the two collaborators we will reach 468 subjects in 5 different studies and this exceeds the 300 subjects planned to be evaluated at the beginning.

## 5. REFERENCES

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