VRMIND– Virtual Reality Based Evaluation of Mental Disorders
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D4.3 – Normative document for AQUARIUM

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1. EXECUTIVE SUMMARY

VRMIND-AQUARIUM (Nesplora Aquarium from now on) is a neuropsychological test for evaluating 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 for the commercialization of Nesplora Aquarium we wanted to offer a tool with its norms. That is why we have developed a normative study in 2017 to a large extent by ourselves, but also with the help of some external collaborators. This way, the results obtained from the test, are automatically compared with the average of the person's reference group, where both age and sex are taken into account.

This deliverable describes in section 4 the development of the normative study in the Spanish population and the collaborators that are taking part in equivalent studies in other countries. In section 5, the results of these studies are shown, although most of these collaborators are still collecting the data that will be analysed. Finally, the main conclusions and future work are described in section 6.

2. RELATION WITH OTHER WPS AND DELIVERABLES

This deliverable is related with "D2.3 – GEAR version AQUARIUM", since this deliverable details the Nesplora Aquarium tool. It is also related with D5.10, D5.11 and D5.12 that explain the clinical studies with Nesplora Aquarium.

3. OBJECTIVES OF THE NORMATIVE STUDY

The main objective of the normative study is to establish a normal curve in the execution of the Nesplora Aquarium test with the aim to represent the population in which we are going to use the measurement and from which we will extract the rules that will be used in the diagnosis.

Once we have the norms, we can evaluate each subject and know if this subject is within the rule or not, and in its case in which parameters differs and how much. These parameters indicate the distance to the rule and, depending on them; the clinician can suspect a concrete pathology.

Although the main normative study is carried out in the country of origin where the test is carried out, it is also advisable to carry out small contrasting normative studies in those countries where it is intended to be marketed. The main reason is that one of the ways to enter these countries is through the collaborators who carry out these studies. Likewise, potential clients in that country feel more confident when buying if there are previous studies carried out with this test in their own socio-cultural environment. For this reason, a normative study has been carried out not only in Spain but also in other countries as detailed in the following section.

4. METHODOLOGY OF THE NORMATIVE STUDY

We have carried out normative studies in Spain, Greece, Portugal, Mexico and United Kingdom. In each one of these places the methodology carried out has been a little bit different, so that is why the results are presented in different sections. But in general one of the most important things is to recruit a heterogeneous sample, in terms of age, socioeconomic level, etc, which represents the general sample.

In general, the inclusion criteria for all the studies have been the following:

- Voluntarily participation
- Sign of the informed consent
- Older than 16 years
- Not blind or deaf people
- No mental illness

As a requirement to be able to administer the test to the people who compose the present study, both the participants and their parents or legal guardians (in the case of minors) had to sign an informed consent. The personal data was anonymised. The only personal data collected for these analyzes were basic sociodemographic data (sex, age and educational level).

3.1 Methodology of the Spanish normative study

Most of the evaluations for the normative study in Spain have been carried out by Nesplora. In total we have evaluated 1262 people with the following sociodemographic characteristics.

Table 1. Sociodemographic characteristics of the Spanish sample recruited by Nesplora

N	Age range	Gender	Location
1262	16-90	56.9% Female 43.1% Male	San Sebastián, Bilbao, Vitoria, Azpeitia, Urretxu, Rentería, Zamudio, Ávila, Madrid, Santiago de Compostela, Padrón, Coruña ,Ferrol, Ourense.

We have contacted multiple centres, but finally those who have agreed to collaborate have been: (1) ATEGAL; (2) the memory programme of the social affairs service of the Ávila council; (3) EASO Politeknikoa (4) Axular Lizeoa; (5) Sta. María del Naranco School; (6) ALTER VÍA; (7) Santa Barbara Day Center; (8) Innova Azpeitia; (9) Bilbao Supervised Apartments; (10) KUTXA Fundazioa; (11) KUTXAbank; (12) BIC Gipuzkoa; (13) Auren Bilbao; (14) GFI-North Bilbao and Zamudio; (15) ADEGI; (16) Fomento San Sebastián; (17) ELKARGI SGR; (18) Bantec; (19) Hala Bedi Irratia; (20) EITB and, (21) Oarsoaldea through Habian!. These centres are located over Ávila, different towns in Galicia and the Basque Country. To have sample from different Spanish regions is intended to reduce cultural biases. The procedure with these centres has been to contact them and send them information about the tool and then professionals from Nesplora have moved to do the tests. Also, there have been many people who have come to be evaluated in the Nesplora facilities and which have been captured through social networks, ads, etc.

However two collaborators have also recruited sample for the Spanish normative study.

Table 2 Sociodemographic characteristics of the Spanish sample recruited by other Spanish collaborators

Collaborator	N	Age range	% Male - % Female	Location
Barcelona Autonomous University	51	19 – 47	17.6% - 82.4%	Barcelona
Oviedo University	156	16 – 61	44.9% - 55.1%	Oviedo

At a national level, the tests administered by both ourselves and the collaborators have been 1469, of which 1262 have been administered by Nesplora and 207 have been administered by the collaborators.

For the study of sociodemographic characteristics, at the same time that Nesplora Aquarium has been administered, each participant has also received a questionnaire asking for their socio-demographic data, such as educational level, profession, bilingualism, etc. These data allow us to carry out studies whose purpose is to obtain more knowledge of basic processes such as attention. For example, it has been possible to study whether there is a bilingual advantage in the functioning of attentional processes, if the type of work performed influences attention, etc.

3.2 Methodology of the Greek sample

The Greek sample has been recruited by MultiTimeLab in Athens. The commitment of this collaborator was to recruit 100 participants over the age of 16. MultiTimeLab administered Nesplora Aquarium and also asked for sociodemographic data.

They have completed the agreement with a data collection of 113 participants, 25 male and 88 female. The mean age of the sample is 22 ranging from the age of 16 to 63 and 92% are bachelor's degree students.

3.3 Methodology of the Mexican sample

The Mexican sample is being recruited by the clinic center CEPPIA Centro Psicológico y Pedagógico in Mexico D.F. We work through the Dr. Luis Mendez and the commitment of this collaborator is to recruit 100 participants over the age of 16. Dr. Luis Méndez administered Nesplora Aquarium for the normative study of this test and asked for sociodemographic data. In addition, both Toulouse-Piéron (Toulouse & Piéron, 1986) and ASRS (Adult ADHD self-report scale) (Adler, Kessler & Spencer, 2004) were administered as well in order to carry out convergent studies between these tests and Nesplora Aquarium. These last studies belong to the clinical studies of Nesplora Aquarium.

Up to now, they have sent us data from 28 participants, 16 male and 12 female. The mean age of the sample is 22 years old, ranging from 19 to 36.

However, at the end of 2018 this collaborator changed his work and location and went to live and work in London, so he told us that he could not continue with this study in Mexico and that he did not see the feasibility of following it in his new work in London. For this reason, we have not continued with the analysis of these 28 cases and we are waiting to see if any new collaborator is recruited in Mexico to gather a significant minimum sample in order to be able to make statistical analyses.

3.4 Methodology of the English sample

The English sample is being recruited by the University College of London, through Dr. Frances Knight who belongs to the Faculty of Psychology. The commitment of this collaborator is to recruit 100 participants over the age of 16. The University College of London administers Nesplora Aquarium and also asks for sociodemographic data.

Up to now, they have sent us data from 30 participants, 11 male and 19 female. The mean age of the sample is 33 years old, ranging from 16 to 66.

3.5 Methodology of the Portuguese sample

The Portuguese sample is being recruited by the Clinic Mente Idílica in Baltar (Porto). The commitment of this collaborator is to recruit 300 participants over the age of 16. Mente Idílica administers Nesplora Aquarium and also asks for sociodemographic data. For the moment, we have received data from 59 evaluations, but the collaborator is still working on it.

Table 3. Summary of the evaluations carried out for the Nesplora Aquarium normative study

Country	Collaborator name	Comminment	Sample shared with Nesplora until end of December 2018
Spain	Nesplora	-----	1262
Spain	UAB	50	51
Spain	University of Oviedo	100	156
Greece	MultiTimeLab	100	113
Mexico	CEPPIA Centro Psicológico y Logopédico	100	28
UK	UCL	100	30
Portugal	Mente Idílica	300	59

So, in total the collaborators committed to share with us a total of 750 evaluations but up to know we have a total of 437 evaluations from the collaborators and 1699, including the evaluation carried out by Nesplora.

5. RESULTS

First of all, it is important to mention that Nesplora Aquarium produces more than 200 variables, of which 43 have been selected for the clinical report. This selection has been based on clinical criteria and ease of interpretation. The remaining variables may be used in the future either to produce other types of reports or to supplement the existing clinical report. Therefore, the results shown in this section correspond to those of the 43 variables that appear in the report. In the following table the final variables used by the clinical report and their corresponding abbreviation can be seen in the following table:

Variables	Description	Measurement unit
T_correct_n	Correct total items	n
T_omission_n	Total Omissions Errors	n
T_commission_n	Total Comissions Errors	n
T_correctreactime_mean	Average reaction time of the correct answers	ms
T_correctreactime_sd	Standard deviation of reaction time from correct answers	ms
T_commissionreactime_mean	Average reaction time of commission errors	ms
T_commissionreactime_sd	Standard deviation of reaction time of commission errors	ms
T_distancemean_sum	Summation of movement averages	n
V_omission_n	Total visual omissions	n
A_omission_n	Total auditory omissions	n
V_commission_n	Total visual commissions	n
A_commission_n	Total auditory Commissions	n
S2_correct_n	XnoDUALab correct items	n
S2_omission_n	XnoDUALab omisión errors	n
S2_commission_n	XnoDUALab comission errors	n
S2_correctreactime_mean	XnoDUALab Average reaction time of the correct answers	ms
S2_correctreactime_sd	XnoDUALab Standard deviation of reaction time from correct answers	ms
S2_commissionreactime_mean	XnoDUALab Average reaction time of commission errors	ms
S2_commissionreactime_sd	XnoDUALab Standard deviation of reaction time of commission errors	ms
S2_errorfocus_n	XnoDUALab Errors when participant is looking at the main fish tank	n
S2_distancemean_sum	XnoDUALab Summation of movement averages	n
S2_visual_omission_n	XnoDUALab Visual errors of omission	n
S2_auditory_omission_n	XnoDUALab Auditory omission errors	n

S2_visual_commission_n	XnoDUALab Visual commission errors	n
S2_auditory_commission_n	XnoDUALab Auditory commission errors	n
S3_correct_n	XnoDUALba Correct items	n
S3_omission_n	XnoDUALba Omission errors	n
S3_commission_n	XnoDUALba Commission errors	n
S3_correctreactime_mean	XnoDUALba Average reaction time of the correct answers	ms
S3_correctreactime_sd	XnoDUALba Standard deviation of reaction time from correct answers	ms
S3_commissionreactime_mean	XnoDUALba Average reaction time of commission errors	ms
S3_commissionreactime_sd	XnoDUALba Standard deviation of reaction time of commission errors	ms
S3_errorfocus_n	XnoDUALba Errors when participant is looking at the main fish tank	n
S3_distancemean_sum	XnoDUALba Summation of movement averages	n
S3_visual_omission_n	XnoDUALba Visual errors of omission	n
S3_auditory_omission_n	XnoDUALba Auditory omission errors	n
S3_visual_commission_n	XnoDUALba Visual commission errors	n
S3_auditory_commission_n	XnoDUALba Auditory commission errors	n
V_correctreactime_mean	Visual - Average reaction time of the correct answers	ms
V_correctreactime_sd	Visual - Standard deviation of reaction time from correct answers	ms
A_correctreactime_mean	Auditory - Average reaction time of the correct answers	ms
A_correctreactime_sd	Auditory - Standard deviation of reaction time from correct answers	ms
S2_correctdisc_n	Discrepancy between the correct answers of task block 1 and task block 2 XnoDUALab	n
S3_correctdisc_n	Discrepancy between the correct answers of block 1 and block 2 of task XnoDUALba	n
T_correctdisc_mean	Mean of discrepancies in correct	n

	answers	
S2_switcha_n	Discrepancy between the correct answers of the XnoDUALab trea block 2 and the correct answers of the XnoDUALba task block 1.	n
XnoDUALab_TRswitcha	Discrepancy between the reaction time of the correct answers of block 2 of task XnoDUALab and the reaction time of the correct answers of block 1 of task XnoDUALba.	ms
T_dualtaskcorrectpress_mean	Average of correct answers in dual execution tasks	n
S3_perserrors_n	Perseveration errors in the XnoDUALba task (maintaining XnoDUALab instructions)	n

N= number; ms= milliseconds

5.1. Results of the Spanish normative study

In this section we present the results of the evaluations carried out in Spain. We present altogether the results collected by Nesplora and the other two national collaborators. To obtain the scales for the Spanish population, we had the help of a psychometrician from the University of Oviedo.

Thus, in this section the characteristics of the variables for the total sample, the normative groups obtained and the homoscedasticity and normality analysis will be presented. Secondly, the differences according to sex and age that have been found in the normative sample are shown. To finish, the reliability that the scales of the Nesplora Aquarium test have shown will be explained.

Description of the sample:

The objective of the normative study of Nesplora Aquarium was to identify the different groups existing in the sample based on the scores obtained in the execution of this test, while establishing the normality curve for each one of them. To carry out this normative study, the data of 903 subjects were initially analyzed. With the data obtained an analysis of variance was carried out, which showed that three age groups had to be made: of 16 to 40 years old, 41 to 60 years old and over 60 years old; depending on the differences found between your scores. Later it was verified that "intra-group" there were

no differences, but there were differences in the different variables depending on age between the three groups. Significant differences were also found within each age group according to sex. Therefore, each age group has two differentiated scales for men and women, as it can be seen in the following table

Group	Age	Sex
1	16-40	Male
2	16-40	Female
3	41-60	Male
4	41-60	Female
5	61-90	Male
6	61-90	Female

The final sample of the first age group was 667 participants, 345 women and 322 men, aged between 16 and 40 years, with an average of 25.52 and a standard deviation of 7.63.

With regard to the second age group, the sample was 415 participants, 213 women and 202 men, aged between 41 and 60 years, with an average of 49.39 and a standard deviation of 5.62.

In the third age group, the sample consisted of 387 participants, 288 women and 99 men, with age equal to or greater than 61 years, with an average of 73.15 and a standard deviation of 7.37.

The extraction of these groups and the differences by sex are compatible with the previous findings of the literature (McAvinue et al., 2012; Fortenbaugh et al., 2015).

Despite the fact that more than 1600 people have been evaluated during the normative study, some of them have had to be eliminated from the sample because they did not meet any inclusion criteria or for sociodemographic reasons. Currently, the total sample has 1469 people, and we intend to continue recruiting participants to be able to count with updated rates at all times.

5.1.1 Characteristics of the variables of the total sample:

It is necessary to verify the homoscedasticity assumption for the study of the differences by sex of the sample. That is, it is sought that the different groups obtained present the same variance. For the study of homoscedasticity the Levene test was used. The Levene statistic follows a Snedecor F distribution. In table 1, 2 and 3 (annex I), the results of differences by sex are shown in the age groups from 16 to 40 years, from 41 to 60 years and from 61 years, where W is the value of the statistic, gl1 and gl2 the degrees of freedom of the numerator and the denominator, respectively and p the value of the probability associated with W. The variables for which it is necessary to reject the null hypothesis (α = .05) of equality of variances between the group of men and women are marked with an asterisk.

For the study of the normality of the variables, the Shapiro-Wilk statistic was used, since it is the one that gives the best result for samples superior of 500 people. The results obtained for the total sample can be seen in table 4, 5 and 6 (annex I). Those variables whose distribution can be considered normal (α = .05) are marked with an asterisk.

Table 7, 8 and 9 (annex I) show the results of the normality test for men and women separately. The test used in this case is that of Kolmogorov-Smirnov, with the Lilliefors correction being the most appropriate. The variables whose distribution could be normal (α = .05) are marked with an asterisk.

5.1.2 Study of differences according to age and sex of the normative group:

Before beginning with the evaluation of the different variables, it is essential to carry out a study of interindividual differences. Depending on the results obtained, it will be necessary to decide the number of different scales that will be necessary to perform.

The differences between men and women are analysed for the total sample (n = 1469) using the non-parametric "U" test of Mann-Wihtney and the results are presented in the table 1 (annex II). The variables in which the differences are statistically significant (confidence level = 95%) are highlighted with an asterisk. As can be observed in the tables, there are differences between men and women of the entire sample in most of the variables analysed.

Table 2 (annex II) shows the differences according to age through the non-parametric test Kruskal-Wallis. Variables in which there are statistically significant differences, highlighted with an asterisk, are found in all the variables, except in 2 (NC = 95%).

5.1.3 Discussion

With the results obtained from the application of the test to the normative group, the following analyzes were carried out:

- A Kolmogorov-Smirnov test to check the normality of the distributions of the scores on the different scales.
- A test of F to test the equality of variances.

The results obtained, at the 95% Confidence Level (α <0.05), show that in the majority of cases the homoscedasticity assumption is not fulfilled. Neither is the normality of the distributions met to be able to carry out parametric tests for the study of the differences of the means by groups.

For the study of the differences of the means between the different groups, in the 43 variables studied the following tests were carried out:

- The "U" of Mann-Whitney for the study of the differences between sexes in the complete sample collected (n = 1469).
- Kruskal-Wallis test for the study of age differences.

The results obtained (α <0.05) show:

- Statistically significant differences between men and women in most of the variables in the complete sample (n = 1469).
- Statistically significant differences between the three age ranges identified in the sample.

According to the groups (psychologists, neurologists, psychiatrists, etc.) and potential users of the tests, the results were measured on percentile scales and T scores. In order to facilitate the interpretation and comparison of results, it was decided that Scores T were normalized, and these are the scores that appear in the clinical report.

5.2.3 Reliability study of the scales

The Nesplora Aquarium test presents certain special characteristics that, in some aspects, bring it closer to an "adaptive" type test, since the presentation time between stimuli, the appearance of distractors, their frequency, etc. depend on the sequence of responses given by the person. In many aspects it could be said that the subject, in fact, may be responding to a "different" test. This, which considerably improves the ecological validity of the test and its real efficiency, makes more difficult to estimate the reliability of all the measured scales, at least in what is traditionally understood as the reliability coefficient of a test. This is the reason why it is only possible to estimate classical reliability in the scales. However, if these are reliable, in turn, they also guarantee the reliability of the rest of the aspects considered.

It should also be clarified that aspects such as standard deviations, reaction times, etc. which can be very useful for the diagnosis and classification of adults, do not support, strictly speaking, the concept of reliability coefficient.

In order not to lengthen the text, only two tables are presented in the tables 1 (annex III) and 2 (annex III) to show the indices of difficulty, discrimination and standard deviation of the items that make up the 2 tasks. In general, these indices have acceptable values.

Finally, the statistical analysis of the scales have been carried out, and the results can be seen in the table 3 (annex III).

5.2. Results of the Greek sample

After having completed two groups (each one composed by 113 people) matched by age and sex, a nonparametric analysis has been carried out to compare the means of the Greek and Spanish groups. That is, we aim to create two different groups matched in terms of sociodemographic factors, so that we can assure that the relation observed between both samples will not be influenced by this type of personal factors.

We aimed to check if there are significant differences in the variables of the test between both populations, since if there were no differences, we could assume that Nesplora Aquarium could be applied in Greek population and use the same norms that we obtained for Spanish population.

In the following table the variables which have shown a significant difference appear.

Variable	Group	Mean	Significance
Total commissions	Spanish	124.9	.008
	Greek	102	
Reaction Time SD	Spanish	129.9	.001
	Greek	99.1	
Auditory omissions	Spanish	124.1	.014
	Greek	102.8	
Auditory commission	Spanish	125.8	.004
	Greek	101.1	

Although these are differences in only 4 variables, it is advisable before applying the scales of Spain in Greece to investigate these differences or increase the Greek sample to see if they are still found.

5.3. Results of the Mexican sample

So far, they have sent the data of 28 people, with which we have done some preliminary analyses. Once they send us the remaining data, we will analyse them in depth. The first results indicate that omission errors are much more common with auditory stimuli (M= 16.8) in front of visual stimuli (M= 9), which suggests greater difficulties to process through auditory channel. Conversely, more impulsive errors are observed with visual stimuli than with auditory ones (M= 10.4 and M= 8.1, respectively), while the difference is smaller. In regards the reaction time, this one increases when the stimuli to be processed are

auditory. In addition, a worse performance can be observed in the second task comparing to the first task, both in omission and commission errors.

Regarding the normative study, we plan to compare their data with the one obtained in Spain by matching their cases with Spanish cases by age, gender and educational level. If we do not find differences in any of the scores of Nesplora Aquarium, then we can affirm that Nesplora Aquarium can be used by Mexican population and that the normative data are the same.

5.4. Results of the English sample

We have analysed the data and the results show that people make less commission errors (impulsivity) in the second task (M=8.2) comparing with the third task (M=12.6), and the general scores of correct answers suggest an overall better performance in the second task comparing with the third one (M=115 and M=111.5, respectively). However, omission errors decrease slightly from M=16.7 to M=15.8 by the end of the test. Greater differences are observed when comparing the performance depending on sensorial modality. Actually, omission errors are higher with auditory stimuli (M=22.9) than with visual ones (M=9.6), although this pattern change with respect to commission errors, which show higher scores with visual stimuli (M=13.2) than with auditory stimuli (M=7.6). In regards of the reaction time for the correct answers, people are slower with auditory stimuli than with visual ones (M=1120.14 and M=879.27, respectively).

In order to compare the sample collected with the Spanish norms we have paired a control group by gender and age. Group 1 represents the UK sample, while group 2 represents the Spanish one:

	Age		Gender	
	1	2	1	2
Valid	30	30	30	30
Std. Deviation	8.938	8.931	0.4901	0.4983
Minimum	19.00	19.00	1.000	1.000
Maximum	56.00	56.00	2.000	2.000

Mann-Whitney non parametric analyses have been performed in order to test means differences in the variables between both groups:

	W	p
T_correct_n	344.0	0.119
T_correctreactime_mean	826.0	< .001
T_correctreactime_sd	672.0	< .001
T_omission_n	565.5	0.089
T_commission_n	556.0	0.119
V_omission_n	534.0	0.214
A_omission_n	572.5	0.071
V_commission_n	536.0	0.205
A_commission_n	539.0	0.189
V_correctreactime_mean	833.0	< .001
V_correctreactime_sd	749.0	< .001
A_correctreactime_mean	701.0	< .001
A_correctreactime_sd	645.0	0.004

As we can see in the table, reaction time variables and their standard deviation present significant differences between both groups.

Once we receive the remaining data from this collaborator, we will again analyse the differences between the English and Spanish populations.

5.5. Results of the Portuguese sample

So far, they have sent the data of 59 people, with which we have done some preliminary analyses. Once they send us the remaining data, we will analyse them in depth. The first results indicate that omission errors are much more common with auditory stimuli (M= 63,15) in front of visual stimuli (M= 47,1) (p<0,001), which suggests greater difficulties to process through auditory

channel. Conversely, more impulsive errors are observed with visual stimuli than with auditory ones (M= 13,661 and M= 9,441, respectively; p<0,001), while the difference is smaller. In regards the reaction time, this one increases when the stimuli to be processed are auditory (M= 753,7 and M= 908,7, respectively; p<0,001). In addition, a worse performance can be observed in the first task comparing to the task for omission errors (M= 57,59 and M= 52,66, respectively; p<0,001), and a better performance in commission errors is observed in the first task (M= 10,66 and M= 12,44, respectively; p<0,001).

Regarding the normative study, we plan to compare their data with the one obtained in Spain by matching their cases with Spanish cases by age, gender and educational level. If we do not find differences in any of the scores of Nesplora Aquarium, then we can affirm that Nesplora Aquarium can be used by Portuguese population and that the normative data are the same.

6. CONCLUSIONS AND FUTURE WORK

As it has been observed, until today we have been able to carry out several analyses based on a considerable sample size that allows us to obtain reliable results with minimized biases. Part of the sample has been collected by us, but it is important to highlight the support of external independent collaborators that allow us, at the same time to increase the sample, to carry out studies in other countries and direct our efforts to create scientific evidence in other contexts as well, which will allow us, at some point, to strengthen commercial channels.

The data obtained thanks to the extensive normative study carried out in Spain allowed us to start marketing the Nesplora Aquarium tool in May last year. Before its commercialization we passed a beta version to a total of 15 clients and collaborators of the VRMIND project who tested it for a month. The objective of testing this beta version was to identify possible bugs or points of improvement, before selling it, both in the product itself and in the clinical report. On the other hand, feedback was also obtained through these tests on the perception that customers have in the market of these tests, their feedback on the price, etc... After analysing the feedback from these "beta clients" of the Nesplora Aquarium tool, the relevant changes were analysed and made both in the clinical report and some minor modifications in the control application of the test. Finally, the sales model was also established,

through a license that gives access to the use of the different tests (Nesplora Aula, Nesplora Aquarium and Nesplora Aula School) and for which uses are later acquired in order to be able to make the evaluations.

The data obtained so far, allow us to carry out preliminary analysis that enable us to guide the next steps to take, but once we finish the collection of the data from the different collaborators, we will analyse in depth the results of the performance of the different samples from outside of Spain, in order to obtain their attention profile and compare it to the Spanish normative group.

To carry out the normative study characteristics of the variables such as homoscedasticity and normality have been carried out. On the other hand, significant differences have been found regarding gender and age, concluding in three age groups which range from 16 to 40 years, from 41 to 60 and from 61 to 90. The whole sample consists on 1469 people. Finally, the analyses of the reliability of the scales indicate good and excelent results ranging from α=0.85 to α=0.985.

In Annex 4 Nesplora Aquarium Manual can be found. This manual is sent to customers once they purchase the tool. In addition to a theoretical introduction on the evolution of attention processes in youth and adult life and how they can be involved in different pathologies, the manual also details the test itself, the recommendations for use, the variables that are derived an the clinical report and the statistical analysis followed to obtain the scales.

Currently, we have sent the article with the results of the Nesplora Aquarium normative study to the *Computers and Human Behaviour.* Starting from a theoretical basis based on scientific evidence, we made a justification for the study and showed, in addition to the methodology used, the most significant results along with a presentation of the Nesplora Aquarium test. It only remains to make some small adjustments so that the article is ready to publish it.

On the other hand, we have already attended different congresses where we have presented different works carried out with Nesplora Aquarium. Among these contributions to congresses, for instance, in March we presented a poster in the FANPSE congress, one of the most important congresses at a

national level in Spain. In this case, we presented the results of the comparison between monolingual and bilingual people in regards of the performance of Nesplora Aquarium (Aierbe, Moreno, Redondo, Mejías & González, 2018). In addition, recently in July, we have been in one of the most important international reference congresses of neuropsychology, the one organized by the INS (International Neuropsychological Society). This time, we went to Prague to present the results of the analysis of the factorial structure of Nesplora Aquarium through a poster (Aierbe, Mejías, Moreno, González & Climent, 2018).

These contributions, in addition to providing scientific evidence to the test, help us to make it known among professionals from various countries.

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ANNEX 1 – CHARACTERISTIC OF THE VARIABLES

Table 1: Homoscedasticity in variables according to sex from 16 to 40 years

Variables	W	gl^1	gl^2	p
T_correct_n	1.757	1	665	.185
T_omission_n	.515	1	665	.473
T_commission_n	.990	1	665	.320
T_correctreactime_mean	1.313	1	665	.252
T_correctreactime_sd	.084	1	665	.771
T_commissionreactime_mean	.241	1	665	.624
T_commissionreactime_sd	1.142	1	665	.286
V_omission_n	.118	1	665	.731
A_omission_n	1.321	1	665	.251
V_commission_n	.556	1	665	.456
A_commission_n	2.249	1	665	.134
S2_correct_n	.661	1	665	.417
S2_omission_n	.046	1	665	.830
S2_commission_n	2.523	1	665	.113
S2_correctreactime_mean	1.458	1	665	.228
S2_correctreactime_sd	.613	1	665	.434
S2_commissionreactime_mean	.929	1	665	.335
S2_commissionreactime_sd	.107	1	665	.744
S2_visual_omission_n	.674	1	665	.412
S2_auditory_omission_n	.017	1	665	.895
S2_visual_commission_n	3.813	1	665	.051
S2_auditory_commission_n	1.145	1	665	.285
S3_correct_n	.022	1	665	.882
S3_omission_n	.000	1	665	.992
S3_commission_n	.142	1	665	.706
S3_correctreactime_mean	.828	1	665	.363

S3_correctreactime_sd	.042	1	665	.837
S3_commissionreactime_mean**	7.299	1	665	.007
S3_commissionreactime_sd	2.019	1	665	.156
S3_visual_omission_n	.363	1	665	.547
S3_auditory_omission_n	.069	1	665	.793
S3_visual_commission_n	.001	1	665	.980
S3_auditory_commission_n	2.336	1	665	.127
V_correctreactime_mean	.089	1	665	.765
V_correctreactime_sd	.000	1	665	.994
A_correctreactime_mean	.379	1	665	.538
A_correctreactime_sd	.008	1	665	.930
S2_correctdisc_n	.014	1	665	.907
S3_correctdisc_n	.310	1	665	.578
T_correctdisc_mean	.283	1	665	.595
S2_switcha_n	.586	1	665	.444
XnoDUALab_TRswitcha	.018	1	665	.894
T_dualtaskcorrectpress_mean	.401	1	665	.527
S3_perserrors_n	.002	1	665	.966

*Statistically significant differences

Table 2: Homoscedasticity in variables according to sex from 41 to 60 years

Variables	W	gl^1	gl^2	p
T_correct_n	.035	1	413	.851
T_omission_n	.001	1	413	.981
T_commission_n**	8.545	1	413	.004
T_correctreactime_mean	.075	1	413	.785
T_correctreactime_sd	.207	1	413	.649
T_commissionreactime_mean	.045	1	413	.831
T_commissionreactime_sd	.905	1	413	.342
V_omission_n	.814	1	413	.367
A_omission_n	.086	1	413	.770
V_commission_n**	11.620	1	413	.001
A_commission_n*	5.582	1	413	.019
S2_correct_n	.104	1	413	.747
S2_omission_n	.006	1	413	.940
S2_commission_n**	7.476	1	413	.007
S2_correctreactime_mean	.640	1	413	.424
S2_correctreactime_sd	.078	1	413	.780
S2_commissionreactime_mean	.000	1	413	.992

S2_commissionreactime_sd*	4.301	1	413	.039
S2_visual_omission_n	.664	1	413	.416
S2_auditory_omission_n	.064	1	413	.800
S2_visual_commission_n**	7.526	1	413	.006
S2_auditory_commission_n	1.486	1	413	.224
S3_correct_n	1.307	1	413	.254
S3_omission_n	.078	1	413	.780
S3_commission_n**	9.604	1	413	.002
S3_correctreactime_mean	.004	1	413	.950
S3_correctreactime_sd	.232	1	413	.631
S3_commissionreactime_mean	2.690	1	413	.102
S3_commissionreactime_sd	3.876	1	413	.050
S3_visual_omission_n	1.038	1	413	.309
S3_auditory_omission_n	.022	1	413	.882
S3_visual_commission_n**	16.644	1	413	.000
S3_auditory_commission_n	2.340	1	413	.127
V_correctreactime_mean	.633	1	413	.427
V_correctreactime_sd	.139	1	413	.710
A_correctreactime_mean	.003	1	413	.957

A_correctreactime_sd	.186	1	413	.666
S2_correctdisc_n	.097	1	413	.756
S3_correctdisc_n	1.079	1	413	.300
T_correctdisc_mean	.012	1	413	.911
S2_switcha_n	.131	1	413	.718
XnoDUALab_TRswitcha	.007	1	413	.935
T_dualtaskcorrectpress_mean	.029	1	413	.864
S3_perserrors_n*	3.963	1	413	.047

*Statistically significant differences

Table 3: Homoscedasticity in variables according to sex from 61 years

10	W	gl^1	gl^2	p
T_correct_n	.292	1	385	.589
T_omission_n	.126	1	385	.722
T_commission_n	.807	1	385	.370
T_correctreactime_mean**	6.990	1	385	.009
T_correctreactime_sd	.325	1	385	.569
T_commissionreactime_mean	3.049	1	385	.082
T_commissionreactime_sd*	5.177	1	385	.023

V_omission_n	.165	1	385	.685
A_omission_n**	9.097	1	385	.003
V_commission_n	.143	1	385	.705
A_commission_n**	10.005	1	385	.002
S2_correct_n	.403	1	385	.526
S2_omission_n	.007	1	385	.936
S2_commission_n	.006	1	385	.936
S2_correctreactime_mean	3.303	1	385	.070
S2_correctreactime_sd*	3.944	1	385	.048
S2_commissionreactime_mean	.166	1	385	.684
S2_commissionreactime_sd	.063	1	385	.802
S2_visual_omission_n	.758	1	385	.385
S2_auditory_omission_n**	7.158	1	385	.008
S2_visual_commission_n	.056	1	385	.814
S2_auditory_commission_n*	6.771	1	385	.010
S3_correct_n	1.750	1	385	.187
S3_omission_n	2.283	1	385	.132
S3_commission_n	.155	1	385	.694
S3_correctreactime_mean*	6.567	1	385	.011

S3_correctreactime_sd	.084	1	385	.772
S3_commissionreactime_mean	.440	1	385	.507
S3_commissionreactime_sd	.113	1	385	.737
S3_visual_omission_n	.001	1	385	.979
S3_auditory_omission_n**	14.996	1	385	.000
S3_visual_commission_n	2.805	1	385	.095
S3_auditory_commission_n	.258	1	385	.612
V_correctreactime_mean	1.164	1	385	.281
V_correctreactime_sd*	5.143	1	385	.024
A_correctreactime_mean	2.569	1	385	.110
A_correctreactime_sd	.637	1	385	.425
S2_correctdisc_n	1.992	1	385	.159
S3_correctdisc_n	.799	1	385	.372
T_correctdisc_mean	.415	1	385	.520
S2_switcha_n	2.683	1	385	.102
XnoDUALab_TRswitcha	1.895	1	385	.169
T_dualtaskcorrectpress_mean	1.278	1	385	.259
S3_perserrors_n	.001	1	385	.972

*Statistically significant differences

Table 4: Normality in variables (Shapiro-Wilk) from 16 to 40 years

	Shapiro-Wilk		
	W	gl	p
T_correct_n**	.889	1469	.000
T_omission_n**	.827	1469	.000
T_commission_n**	.938	1469	.000
T_correctreactime_mean**	.934	1469	.000
T_correctreactime_sd**	.989	1469	.000
T_commissionreactime_mean**	.938	1469	.000
T_commissionreactime_sd**	.982	1469	.000
V_omission_n**	.763	1469	.000
A_omission_n**	.754	1469	.000
V_commission_n**	.938	1469	.000
A_commission_n**	.829	1469	.000
S2_correct_n**	.760	1469	.000
S2_omission_n**	.636	1469	.000
S2_commission_n**	.918	1469	.000
S2_correctreactime_mean**	.975	1469	.000
S2_correctreactime_sd	.995	1469	.082
S2_commissionreactime_mean**	.957	1469	.000
S2_commissionreactime_sd**	.975	1469	.000
S2_visual_omission_n**	.532	1469	.000
S2_auditory_omission_n**	.614	1469	.000
S2_visual_commission_n**	.936	1469	.000
S2_auditory_commission_n**	.703	1469	.000
S3_correct_n**	.840	1469	.000
S3_omission_n**	.668	1469	.000

S3_commission_n**	.952	1469	.000
S3_correctreactime_mean**	.875	1469	.000
S3_correctreactime_sd**	.991	1469	.001
S3_commissionreactime_mean**	.924	1469	.000
S3_commissionreactime_sd**	.986	1469	.000
S3_visual_omission_n**	.617	1469	.000
S3_auditory_omission_n**	.626	1469	.000
S3_visual_commission_n**	.951	1469	.000
S3_auditory_commission_n**	.902	1469	.000
V_correctreactime_mean**	.849	1469	.000
V_correctreactime_sd**	.897	1469	.000
A_correctreactime_mean**	.619	1469	.000
A_correctreactime_sd**	.947	1469	.000
S2_correctdisc_n**	.965	1469	.000
S3_correctdisc_n**	.988	1469	.000
T_correctdisc_mean**	.991	1469	.001
S2_switcha_n**	.925	1469	.000
XnoDUALab_TRswitcha**	.970	1469	.000
T_dualtaskcorrectpress_mean**	.796	1469	.000
S3_perserrors_n**	.967	1469	.000

*Statistically significant differences

Table 5: Normality in variables (*Kolmogorov-Smirnov-Lilliefors*) from 41 to 60 years

	Kolmogorov-Smirnov-Lilliefors		
	K-S-L	gl	p
T_correct_n**	.135	415	.000
T_omission_n**	.173	415	.000
T_commission_n**	.113	415	.000
T_correctreactime_mean**	.059	415	.002
T_correctreactime_sd	.043	415	.069
T_commissionreactime_mean	.038	415	.156
T_commissionreactime_sd**	.069	415	.000
V_omission_n**	.201	415	.000
A_omission_n**	.191	415	.000
V_commission_n**	.133	415	.000
A_commission_n**	.177	415	.000
S2_correct_n**	.175	415	.000
S2_omission_n**	.210	415	.000
S2_commission_n**	.157	415	.000
S2_correctreactime_mean**	.064	415	.000
S2_correctreactime_sd	.040	415	.117
S2_commissionreactime_mean**	.113	415	.000
S2_commissionreactime_sd**	.078	415	.000
S2_visual_omission_n**	.228	415	.000
S2_auditory_omission_n**	.247	415	.000
S2_visual_commission_n**	.175	415	.000
S2_auditory_commission_n**	.249	415	.000
S3_correct_n**	.172	415	.000
S3_omission_n**	.230	415	.000
S3_commission_n**	.129	415	.000

S3_correctreactime_mean*	.047	415	.028
S3_correctreactime_sd*	.046	415	.032
S3_commissionreactime_mean**	.102	415	.000
S3_commissionreactime_sd**	.065	415	.000
S3_visual_omission_n**	.247	415	.000
S3_auditory_omission_n**	.267	415	.000
S3_visual_commission_n**	.155	415	.000
S3_auditory_commission_n**	.178	415	.000
V_correctreactime_mean	.042	415	.072
V_correctreactime_sd**	.068	415	.000
A_correctreactime_mean**	.298	415	.000
A_correctreactime_sd**	.132	415	.000
S2_correctdisc_n**	.126	415	.000
S3_correctdisc_n**	.079	415	.000
T_correctdisc_mean**	.282	415	.000
S2_switcha_n**	.104	415	.000
XnoDUALab_TRswitcha**	.063	415	.000
T_dualtaskcorrectpress_mean**	.182	415	.000
S3_perserrors_n**	.087	415	.000

*Statistically significant differences

Table 6: Normality in variables (Kolmogorov-Smirnov-Lilliefors) from 61 years

	Kolmogorov-Smirnov-Lilliefors		
	K-S-L	gl	p
T_correct_n**	.093	387	.000
T_omission_n**	.080	387	.000

T_commission_n**	.114	387	.000
T_correctreactime_mean**	.077	387	.000
T_correctreactime_sd	.033	387	.200
T_commissionreactime_mean*	.046	387	.044
T_commissionreactime_sd	.043	387	.084
V_omission_n**	.068	387	.000
A_omission_n**	.153	387	.000
V_commission_n**	.115	387	.000
A_commission_n**	.156	387	.000
S2_correct_n**	.080	387	.000
S2_omission_n**	.119	387	.000
S2_commission_n**	.140	387	.000
S2_correctreactime_mean**	.073	387	.000
S2_correctreactime_sd*	.051	387	.017
S2_commissionreactime_mean**	.089	387	.000
S2_commissionreactime_sd**	.078	387	.000
S2_visual_omission_n**	.090	387	.000
S2_auditory_omission_n**	.177	387	.000
S2_visual_commission_n**	.172	387	.000
S2_auditory_commission_n**	.222	387	.000
S3_correct_n**	.094	387	.000
S3_omission_n**	.130	387	.000
S3_commission_n**	.107	387	.000
S3_correctreactime_mean**	.082	387	.000
S3_correctreactime_sd	.034	387	.200
S3_commissionreactime_mean**	.097	387	.000
S3_commissionreactime_sd**	.085	387	.000
S3_visual_omission_n**	.105	387	.000
S3_auditory_omission_n**	.225	387	.000
S3_visual_commission_n**	.154	387	.000

S3_auditory_commission_n**	.185	387	.000
V_correctreactime_mean**	.100	387	.000
V_correctreactime_sd**	.081	387	.000
A_correctreactime_mean**	.212	387	.000
A_correctreactime_sd**	.086	387	.000
S2_correctdisc_n**	.069	387	.000
S3_correctdisc_n**	.062	387	.001
T_correctdisc_mean**	.246	387	.000
S2_switcha_n**	.066	387	.000
XnoDUALab_TRswitcha**	.059	387	.002
T_dualtaskcorrectpress_mean**	.093	387	.000
S3_perserrors_n**	.092	387	.000

*Statistically significant differences

Table 7: Normality in variables according to sex (Kolmogorov-Smirnov) from 16 to 40 years

		Kolmogorov-Smirnov-Lilliefors		
		K-S-L	gl	sig.
Female	T_correct_n**	.140	345	.000
	T_omission_n**	.196	345	.000
	T_commission_n**	.104	345	.000
	T_correctreactime_mean	.029	345	.200
	T_correctreactime_sd	.030	345	.200

	T_commissionreactime_mean*	.052	345	.047
	T_commissionreactime_sd**	.072	345	.001
	V_omission_n**	.226	345	.000
	A_omission_n**	.186	345	.000
	V_commission_n**	.109	345	.000
	A_commission_n**	.140	345	.000
	S2_correct_n**	.188	345	.000
	S2_omission_n**	.250	345	.000
	S2_commission_n**	.122	345	.000
	S2_correctreactime_mean	.027	345	.200
	S2_correctreactime_sd	.046	345	.200
	S2_commissionreactime_mean**	.068	345	.002
	S2_commissionreactime_sd**	.062	345	.007
	S2_visual_omission_n**	.300	345	.000
	S2_auditory_omission_n**	.259	345	.000
	S2_visual_commission_n**	.133	345	.000
	S2_auditory_commission_n**	.194	345	.000
	S3_correct_n**	.144	345	.000
	S3_omission_n**	.232	345	.000

	S3_commission_n**	.095	345	.000
	S3_correctreactime_mean**	.089	345	.000
	S3_correctreactime_sd	.049	345	.085
	S3_commissionreactime_mean**	.093	345	.000
	S3_commissionreactime_sd*	.054	345	.038
	S3_visual_omission_n**	.268	345	.000
	S3_auditory_omission_n**	.246	345	.000
	S3_visual_commission_n**	.132	345	.000
	S3_auditory_commission_n**	.136	345	.000
	V_correctreactime_mean*	.052	345	.048
	V_correctreactime_sd**	.084	345	.000
	A_correctreactime_mean**	.245	345	.000
	A_correctreactime_sd**	.085	345	.000
	S2_correctdisc_n**	.130	345	.000
	S3_correctdisc_n**	.072	345	.001
	T_correctdisc_mean	.052	345	.054
	S2_switcha_n**	.130	345	.000
	XnoDUALab_TRswitcha**	.065	345	.004
	T_dualtaskcorrectpress_mean**	.176	345	.000

	S3_perserrors_n**	.083	345	.000
Male	T_correct_n**	.164	322	.000
	T_omission_n**	.200	322	.000
	T_commission_n**	.137	322	.000
	T_correctreactime_mean	.042	322	.200
	T_correctreactime_sd	.035	322	.200
	T_commissionreactime_mean	.048	322	.200
	T_commissionreactime_sd	.030	322	.200
	V_omission_n**	.262	322	.000
	A_omission_n**	.199	322	.000
	V_commission_n**	.118	322	.000
	A_commission_n**	.181	322	.000
	S2_correct_n**	.228	322	.000
	S2_omission_n**	.262	322	.000
	S2_commission_n**	.137	322	.000
	S2_correctreactime_mean**	.065	322	.008
	S2_correctreactime_sd	.041	322	.200
	S2_commissionreactime_mean**	.102	322	.000
	S2_commissionreactime_sd	.047	322	.200

	S2_visual_omission_n**	.325	322	.000
	S2_auditory_omission_n**	.272	322	.000
	S2_visual_commission_n**	.126	322	.000
	S2_auditory_commission_n**	.196	322	.000
	S3_correct_n**	.175	322	.000
	S3_omission_n**	.235	322	.000
	S3_commission_n**	.089	322	.000
	S3_correctreactime_mean	.051	322	.092
	S3_correctreactime_sd	.040	322	.200
	S3_commissionreactime_mean**	.067	322	.006
	S3_commissionreactime_sd**	.076	322	.001
	S3_visual_omission_n**	.280	322	.000
	S3_auditory_omission_n**	.278	322	.000
	S3_visual_commission_n**	.099	322	.000
	S3_auditory_commission_n**	.151	322	.000
	V_correctreactime_mean	.055	322	.052
	V_correctreactime_sd**	.071	322	.002
	A_correctreactime_mean**	.260	322	.000
	A_correctreactime_sd**	.082	322	.000

	S2_correctdisc_n**	.118	322	.000
	S3_correctdisc_n*	.060	322	.021
	T_correctdisc_mean*	.058	322	.029
	S2_switcha_n**	.134	322	.000
	XnoDUALab_TRswitcha**	.073	322	.002
	T_dualtaskcorrectpress_mean**	.206	322	.000
	S3_perserrors_n**	.080	322	.000

*Statistically significant differences

Table 8: Normality in variables according to sex (Kolmogorov-Smirnov) from 41 to 60 years

		Kolmogorov-Smirnov-Lilliefors		
		K-S-L	gl	sig.
Female	T_correct_n**	.164	213	.000
	T_omission_n**	.197	213	.000
	T_commission_n**	.119	213	.000
	T_correctreactime_mean	.058	213	.075
	T_correctreactime_sd	.049	213	.200
	T_commissionreactime_mean*	.065	213	.029
	T_commissionreactime_sd**	.084	213	.001

	V_omission_n**	.211	213	.000
	A_omission_n**	.198	213	.000
	V_commission_n**	.149	213	.000
	A_commission_n**	.162	213	.000
	S2_correct_n**	.190	213	.000
	S2_omission_n**	.234	213	.000
	S2_commission_n**	.164	213	.000
	S2_correctreactime_mean*	.067	213	.021
	S2_correctreactime_sd	.059	213	.070
	S2_commissionreactime_mean**	.115	213	.000
	S2_commissionreactime_sd**	.083	213	.001
	S2_visual_omission_n**	.238	213	.000
	S2_auditory_omission_n**	.248	213	.000
	S2_visual_commission_n**	.168	213	.000
	S2_auditory_commission_n**	.241	213	.000
	S3_correct_n**	.180	213	.000
	S3_omission_n**	.249	213	.000
	S3_commission_n**	.112	213	.000
	S3_correctreactime_mean	.058	213	.077

	S3_correctreactime_sd*	.065	213	.027
	S3_commissionreactime_mean**	.108	213	.000
	S3_commissionreactime_sd**	.098	213	.000
	S3_visual_omission_n**	.256	213	.000
	S3_auditory_omission_n**	.278	213	.000
	S3_visual_commission_n**	.162	213	.000
	S3_auditory_commission_n**	.162	213	.000
	V_correctreactime_mean*	.062	213	.044
	V_correctreactime_sd*	.064	213	.034
	A_correctreactime_mean**	.310	213	.000
	A_correctreactime_sd**	.126	213	.000
	S2_correctdisc_n**	.146	213	.000
	S3_correctdisc_n**	.082	213	.002
	T_correctdisc_mean**	.269	213	.000
	S2_switcha_n**	.110	213	.000
	XnoDUALab_TRswitcha**	.093	213	.000
	T_dualtaskcorrectpress_mean**	.200	213	.000
	S3_perserrors_n*	.071	213	.011
Male	T_correct_n**	.114	202	.000

	T_omission_n**	.163	202	.000
	T_commission_n**	.102	202	.000
	T_correctreactime_mean**	.075	202	.007
	T_correctreactime_sd	.048	202	.200
	T_commissionreactime_mean	.044	202	.200
	T_commissionreactime_sd	.056	202	.200
	V_omission_n**	.191	202	.000
	A_omission_n**	.192	202	.000
	V_commission_n**	.117	202	.000
	A_commission_n**	.188	202	.000
	S2_correct_n**	.162	202	.000
	S2_omission_n**	.188	202	.000
	S2_commission_n**	.155	202	.000
	S2_correctreactime_mean*	.072	202	.013
	S2_correctreactime_sd	.053	202	.200
	S2_commissionreactime_mean**	.131	202	.000
	S2_commissionreactime_sd**	.076	202	.006
	S2_visual_omission_n**	.218	202	.000
	S2_auditory_omission_n**	.262	202	.000

	S2_visual_commission_n**	.190	202	.000
	S2_auditory_commission_n**	.255	202	.000
	S3_correct_n**	.173	202	.000
	S3_omission_n**	.217	202	.000
	S3_commission_n**	.151	202	.000
	S3_correctreactime_mean**	.075	202	.008
	S3_correctreactime_sd	.060	202	.070
	S3_commissionreactime_mean**	.098	202	.000
	S3_commissionreactime_sd*	.073	202	.011
	S3_visual_omission_n**	.237	202	.000
	S3_auditory_omission_n**	.262	202	.000
	S3_visual_commission_n**	.155	202	.000
	S3_auditory_commission_n**	.197	202	.000
	V_correctreactime_mean	.047	202	.200
	V_correctreactime_sd**	.081	202	.003
	A_correctreactime_mean**	.293	202	.000
	A_correctreactime_sd**	.142	202	.000
	S2_correctdisc_n**	.105	202	.000
	S3_correctdisc_n**	.097	202	.000

	T_correctdisc_mean**	.295	202	.000
	S2_switcha_n**	.100	202	.000
	XnoDUALab_TRswitcha*	.066	202	.031
	T_dualtaskcorrectpress_mean**	.163	202	.000
	S3_perserrors_n**	.109	202	.000

*Statistically significant differences

Table 9: Normality in variables according to sex (Kolmogorov-Smirnov-Lilliefors) from 61 years

		Kolmogorov-Smirnov-Lilliefors		
		K-S-L	gl	sig.
Female	T_correct_n**	.092	288	.000
	T_omission_n**	.082	288	.000
	T_commission_n**	.123	288	.000
	T_correctreactime_mean**	.072	288	.001
	T_correctreactime_sd	.039	288	.200
	T_commissionreactime_mean*	.054	288	.040
	T_commissionreactime_sd	.030	288	.200
	V_omission_n**	.086	288	.000
	A_omission_n**	.147	288	.000

	V_commission_n**	.105	288	.000
	A_commission_n**	.149	288	.000
	S2_correct_n**	.077	288	.000
	S2_omission_n**	.112	288	.000
	S2_commission_n**	.150	288	.000
	S2_correctreactime_mean**	.082	288	.000
	S2_correctreactime_sd	.045	288	.200
	S2_commissionreactime_mean**	.096	288	.000
	S2_commissionreactime_sd**	.094	288	.000
	S2_visual_omission_n**	.093	288	.000
	S2_auditory_omission_n**	.179	288	.000
	S2_visual_commission_n**	.179	288	.000
	S2_auditory_commission_n**	.213	288	.000
	S3_correct_n**	.091	288	.000
	S3_omission_n**	.131	288	.000
	S3_commission_n**	.121	288	.000
	S3_correctreactime_mean**	.079	288	.000
	S3_correctreactime_sd	.038	288	.200
	S3_commissionreactime_mean**	.106	288	.000

	S3_commissionreactime_sd**	.094	288	.000
	S3_visual_omission_n**	.116	288	.000
	S3_auditory_omission_n**	.228	288	.000
	S3_visual_commission_n**	.168	288	.000
	S3_auditory_commission_n**	.189	288	.000
	V_correctreactime_mean**	.131	288	.000
	V_correctreactime_sd**	.086	288	.000
	A_correctreactime_mean**	.201	288	.000
	A_correctreactime_sd**	.079	288	.000
	S2_correctdisc_n*	.061	288	.012
	S3_correctdisc_n**	.70	288	.002
	T_correctdisc_mean**	.241	288	.000
	S2_switcha_n*	.059	288	.016
	XnoDUALab_TRswitcha*	.054	288	.040
	T_dualtaskcorrectpress_mean**	.090	288	.000
	S3_perserrors_n**	.104	288	.000
Male	T_correct_n*	.101	99	.015
	T_omission_n*	.103	99	.012
	T_commission_n*	.104	99	.010

	T_correctreactime_mean	.087	99	.060
	T_correctreactime_sd	.064	99	.200
	T_commissionreactime_mean	.075	99	.188
	T_commissionreactime_sd	.085	99	.071
	V_omission_n	.081	99	.113
	A_omission_n**	.184	99	.000
	V_commission_n**	.143	99	.000
	A_commission_n**	.180	99	.000
	S2_correct_n**	.114	99	.003
	S2_omission_n**	.154	99	.000
	S2_commission_n**	.127	99	.000
	S2_correctreactime_mean	.067	99	.200
	S2_correctreactime_sd*	.100	99	.015
	S2_commissionreactime_mean*	.095	99	.028
	S2_commissionreactime_sd	.067	99	.200
	S2_visual_omission_n*	.095	99	.029
	S2_auditory_omission_n**	.201	99	.000
	S2_visual_commission_n**	.157	99	.000
	S2_auditory_commission_n**	.254	99	.000

	S3_correct_n**	.140	99	.000
	S3_omission_n**	.142	99	.000
	S3_commission_n*	.092	99	.039
	S3_correctreactime_mean**	.105	99	.009
	S3_correctreactime_sd	.049	99	.200
	S3_commissionreactime_mean*	.099	99	.019
	S3_commissionreactime_sd	.082	99	.098
	S3_visual_omission_n*	.101	99	.014
	S3_auditory_omission_n**	.221	99	.000
	S3_visual_commission_n**	.129	99	.000
	S3_auditory_commission_n**	.192	99	.000
	V_correctreactime_mean	.045	99	.200
	V_correctreactime_sd	.069	99	.200
	A_correctreactime_mean**	.247	99	.000
	A_correctreactime_sd**	.116	99	.002
	S2_correctdisc_n**	.107	99	.007
	S3_correctdisc_n	.072	99	.200
	T_correctdisc_mean**	.307	99	.000
	S2_switcha_n	.086	99	.067

	XnoDUALab_TRswitcha	.089	99	.053
	T_dualtaskcorrectpress_mean**	.112	99	.004
	S3_perserrors_n	.081	99	.115

*Statistically significant differences

ANNEX 2 – STUDY OF DIFFERENCES ACCORDING TO AGE AND SEX

Table 1: Mean differences according to sex (*Mann-Whitney "U" test and Wilcoxon W value*)

Variables	Mann-Wihtney U	Wilcoxon W	Significance
T_correct_n**	235395.000	593676.000	.000
T_omission_n**	227830.000	422206.000	.000
T_commission_n**	242482.500	600763.500	.009
T_correctreactime_mean**	215629.500	410005.500	.000
T_correctreactime_sd**	239564.500	433940.500	.003
T_commissionreactime_mean*	246161.500	440537.500	.031
T_commissionreactime_sd**	234041.500	428417.500	.000
V_omission_n**	223886.500	418262.500	.000
A_omission_n**	233194.500	427570.500	.000
V_commission_n**	234610.500	592891.500	.000
A_commission_n	261221.000	455597.000	.773
S2_correct_n**	236101.500	594382.500	.001
S2_omission_n**	231630.000	426006.000	.000
S2_commission_n*	246337.000	604618.000	.032
S2_correctreactime_mean**	221487.500	415863.500	.000
S2_correctreactime_sd*	247410.000	441786.000	.045
S2_commissionreactime_mean	251238.000	445614.000	.126
S2_commissionreactime_sd	253332.500	447708.500	.204
S2_visual_omission_n**	229059.500	423435.500	.000
S2_auditory_omission_n**	236479.500	430855.500	.001
S2_visual_commission_n*	243067.500	601348.500	.010

S2_auditory_commission_n	259432.500	453808.500	.603
S3_correct_n**	235879.000	594160.000	.001
S3_omission_n**	225564.500	419940.500	.000
S3_commission_n**	241900.000	600181.000	.007
S3_correctreactime_mean**	222279.000	416655.000	.000
S3_correctreactime_sd*	242849.000	437225.000	.010
S3_commissionreactime_mean	252684.500	447060.500	.177
S3_commissionreactime_sd*	244022.000	438398.000	.015
S3_visual_omission_n**	221001.500	415377.500	.000
S3_auditory_omission_n**	234484.000	428860.000	.000
S3_visual_commission_n**	232285.500	590566.500	.000
S3_auditory_commission_n	260208.500	618489.500	.677
V_correctreactime_mean**	212892.500	407268.500	.000
V_correctreactime_sd**	215401.000	409777.000	.000
A_correctreactime_mean	251969.000	446343.000	.150
A_correctreactime_sd**	239735.500	434111.500	.003
S2_correctdisc_n*	247058.000	441434.000	.040
S3_correctdisc_n	251689.000	609970.000	.140
T_correctdisc_mean	259722.500	454098.500	.635
S2_switcha_n	258405.000	616686.000	.522
XnoDUALab_TRswitcha	261578.500	619859.500	.808
S1_totalcommission_targetrelatedeitem_n**	234649.500	429025.500	.000
T_dualtaskcorrectpress_mean**	235395.000	593676.000	.000
S3_perserrors_n**	237862.500	432238.500	.001

*Statistically significant differences

Table 2: Difference of means according to age (Kruskal-Wallis)

Variables	Chi-cuadrado	g.l.	Sig. asintótica
T_correct_n**	553.503	2	.000
T_omission_n**	546.756	2	.000
T_commission_n**	21.236	2	.000
T_correctreactime_mean**	185.994	2	.000
T_correctreactime_sd**	47.088	2	.000
T_commissionreactime_mean**	103.488	2	.000
T_commissionreactime_sd	.572	2	.751
V_omission_n**	653.996	2	.000
A_omission_n**	351.331	2	.000
V_commission_n**	13.499	2	.001
A_commission_n**	10.494	2	.005
S2_correct_n**	553.201	2	.000
S2_omission_n**	547.432	2	.000
S2_commission_n**	22.174	2	.000
S2_correctreactime_mean**	112.484	2	.000
S2_correctreactime_sd**	36.487	2	.000
S2_commissionreactime_mean**	21.225	2	.000
S2_commissionreactime_sd**	15.373	2	.002
S2_visual_omission_n**	666.775	2	.000
S2_auditory_omission_n**	330.672	2	.000
S2_visual_commission_n**	11.956	2	.003
S2_auditory_commission_n**	19.088	2	.000
S3_correct_n**	494.411	2	.000
S3_omission_n**	495.068	2	.000
S3_commission_n**	12.295	2	.002
S3_correctreactime_mean**	188.635	2	.000
S3_correctreactime_sd**	16.354	2	.000
S3_commissionreactime_mean**	54.271	2	.000

S3_commissionreactime_sd*	9.203	2	.010
S3_visual_omission_n**	561.762	2	.000
S3_auditory_omission_n**	318.885	2	.000
S3_visual_commission_n**	22.011	2	.000
S3_auditory_commission_n	4.426	2	.109
V_correctreactime_mean**	192.878	2	.000
V_correctreactime_sd**	243.569	2	.000
A_correctreactime_mean**	19.048	2	.000
A_correctreactime_sd**	28.711	2	.000
S2_correctdisc_n**	60.455	2	.000
S3_correctdisc_n**	19.08	2	.000
T_correctdisc_mean**	53.521	2	.000
S2_switcha_n**	60.063	2	.000
T_dualtaskcorrectpress_mean**	553.503	2	.000
S3_perserrors_n**	389.906	2	.000

*Statistically significant differences

ANNEX 3 – RELIABILITY STUDY OF THE SCALES

Table 1: Item statistics. Dual execution task; total correct answers.

Ítems	Discrimation Index	Difficulty Index	Standard Deviation
1	0.41	0.86	0.351
2	0.04	0.93	0.257
3	0.58	0.80	0.401
4	0.07	0.92	0.278
5	0.71	0.74	0.441
6	0.07	0.94	0.245
7	0.68	0.78	0.414
8	0.66	0.72	0.448
9	0.06	0.92	0.264
10	0.65	0.78	0.414
11	0.06	0.93	0.257
12	0.09	0.92	0.269
13	-0.20	0.52	0.500
14	0.68	0.65	0.479
15	0.09	0.82	0.385
16	0.53	0.38	0.486
17	0.57	0.71	0.452
18	0.58	0.70	0.460
19	0.65	0.72	0.450
20	0.64	0.78	0.411
21	0.68	0.77	0.422
22	0.38	0.85	0.358
23	0.03	0.92	0.277
24	-0.06	0.68	0.468
25	0.67	0.72	0.448
26	0.53	0.73	0.442
27	0.52	0.83	0.377
28	0.14	0.70	0.459
29	0.10	0.82	0.381
30	0.88	0.57	0.495
31	0.91	0.63	0.482
32	0.08	0.90	0.301
33	0.11	0.93	0.255
34	0.59	0.81	0.394
35	0.69	0.70	0.460
36	0.07	0.77	0.422
37	0.17	0.88	0.326
38	0.12	0.91	0.287
39	0.01	0.91	0.290
40	0.74	0.68	0.468
41	0.79	0.45	0.497
42	0.07	0.75	0.433
43	0.13	0.92	0.273
44	0.03	0.92	0.278
45	0.69	0.71	0.456
46	0.60	0.81	0.396
47	0.52	0.84	0.367
48	0.74	0.70	0.458
49	0.15	0.84	0.365
50	0.70	0.77	0.420
51	0.11	0.89	0.314
52	0.69	0.77	0.423

53	0.44	0.84	0.369
54	0.15	0.81	0.392
55	0.52	0.83	0.377
56	0.15	0.87	0.340
57	0.45	0.86	0.351
58	0.71	0.76	0.429
59	0.64	0.80	0.402
60	0.68	0.77	0.418
61	0.42	0.86	0.350
62	0.66	0.77	0.418
63	0.06	0.89	0.317
64	0.71	0.73	0.442
65	0.65	0.74	0.441
66	0.02	0.79	0.409
67	0.65	0.74	0.441
68	0.48	0.76	0.429
69	0.48	0.83	0.374
70	0.55	0.77	0.421
71	0.65	0.79	0.420
72	0.50	0.77	0.409
73	0.67	0.77	0.424
74	0.49	0.86	0.419
75	0.45	0.75	0.349
76	0.66	0.84	0.431
77	0.09	0.78	0.369
78	0.64	0.72	0.414
79	0.67	0.74	0.451
80	0.66	0.75	0.446
81	0.65	0.84	0.435
82	0.05	0.71	0.367
83	0.68	0.73	0.455
84	0.65	0.71	0.442
85	0.13	0.88	0.452
86	0.13	0.75	0.330
87	0.69	0.86	0.433
88	0.09	0.88	0.345
89	0.12	0.77	0.328
90	0.65	0.84	0.418
91	0.44	0.77	0.367
92	0.66	0.58	0.418
93	0.81	0.77	0.493
94	0.68	0.85	0.423
95	0.43	0.80	0.359
96	0.65	0.81	0.403
97	0.25	0.61	0.393
98	0.88	0.89	0.488
99	0.14	0.74	0.351
100	0.64	0.73	0.438
101	0.65	0.49	0.446
102	0.79	0.73	0.500
103	0.08	0.71	0.442
104	0.66	0.61	0.453
105	0.83	0.76	0.488
106	0.66	0.66	0.425
107	0.85	0.85	0.472
108	0.13	0.84	0.360
109	-0.08	0.76	0.370

110	0.62	0.78	0.426
111	0.66	0.81	0.417
112	0.61	0.76	0.394
113	0.68	0.79	0.428
114	0.63	0.85	0.409
115	0.42	0.76	0.361
116	0.56	0.76	0.427
117	0.60	0.85	0.425
118	0.48	0.76	0.361
119	0.64	0.81	0.425
120	0.62	0.79	0.389
121	0.66	0.78	0.404
122	0.66	0.85	0.417
123	0.41	0.59	0.361
124	0.84	0.78	0.492
125	0.68	0.78	0.417
126	0.66	0.81	0.416
127	0.64	0.81	0.393
128	0.64	0.83	0.392
129	0.43	0.89	0.375
130	0.05	0.75	0.312
131	0.00	0.78	0.432
132	0.62	0.80	0.412
133	0.06	0.54	0.402
134	0.84	0.74	0.498
135	0.61	0.82	0.438
136	0.53	0.67	0.381
137	0.01	0.76	0.469
138	0.63	0.83	0.426
139	0.46	0.74	0.376
140	0.64	0.76	0.440

*Statistically significant differences

Table 2: Item statistics. Dual execution + i task; total correct answers.

Ítems	Discrimation Index	Difficulty Index	Standard Deviation
1	0.01	0.94	0.237
2	0.07	0.92	0.270
3	0.62	0.79	0.407
4	0.54	0.78	0.412
5	0.19	0.66	0.474
6	0.78	0.50	0.500
7	0.53	0.81	0.393
8	0.53	0.83	0.376
9	0.49	0.85	0.355
10	0.52	0.80	0.399
11	0.51	0.83	0.377
12	0.57	0.78	0.417
13	0.51	0.75	0.433
14	0.16	0.73	0.445
15	0.63	0.46	0.498

16	0.54	0.79	0.407
17	0.52	0.78	0.417
18	0.46	0.83	0.374
19	0.55	0.79	0.408
20	0.50	0.84	0.366
21	0.13	0.64	0.480
22	0.51	0.79	0.410
23	0.84	0.63	0.484
24	0.03	0.69	0.463
25	0.52	0.81	0.391
26	0.50	0.84	0.367
27	0.83	0.61	0.487
28	0.58	0.65	0.476
29	0.55	0.74	0.438
30	0.58	0.74	0.438
31	0.58	0.79	0.408
32	0.55	0.75	0.435
33	0.54	0.78	0.415
34	0.52	0.83	0.376
35	0.47	0.85	0.354
36	0.12	0.61	0.488
37	0.56	0.79	0.428
38	0.56	0.8	0.390
39	0.09	0.77	0.424
40	0.85	0.65	0.478
41	0.65	0.67	0.472
42	0.01	0.71	0.456
43	0.11	0.83	0.377
44	0.65	0.74	0.440
45	0.71	0.45	0.498
46	0.67	0.67	0.469
47	0.64	0.73	0.443
48	0.02	0.80	0.400
49	0.65	0.74	0.441
50	0.76	0.65	0.477
51	0.63	0.37	0.484
52	-0.14	0.66	0.475
53	0.56	0.77	0.421
54	0.50	0.84	0.365
55	0.05	0.69	0.461
56	0.50	0.79	0.410
57	0.05	0.75	0.435
58	0.60	0.73	0.445
59	0.07	0.86	0.347
60	0.82	0.65	0.478
61	0.69	0.76	0.426
62	-0.01	0.66	0.474
63	0.58	0.76	0.429
64	0.53	0.82	0.386
65	0.52	0.80	0.404
66	0.54	0.84	0.369
67	0.53	0.79	0.406
68	0.50	0.84	0.370
69	0.15	0.71	0.455
70	0.14	0.79	0.406
71	0.48	0.84	0.367
72	0.61	0.80	0.403
73	0.61	0.67	0.471

74	0.55	0.81	0.392
75	0.43	0.85	0.356
76	0.53	0.82	0.386
77	0.56	0.80	0.401
78	0.53	0.83	0.374
79	0.50	0.85	0.360
80	0.12	0.63	0.484
81	0.46	0.84	0.365
82	0.08	0.67	0.470
83	0.01	0.82	0.381
84	0.67	0.76	0.426
85	0.74	0.49	0.500
86	0.58	0.80	0.404
87	0.18	0.72	0.450
88	-0.01	0.74	0.438
89	0.67	0.75	0.435
90	0.07	0.78	0.416
91	0.68	0.77	0.421
92	0.72	0.70	0.458
93	0.54	0.77	0.420
94	0.44	0.85	0.357
95	0.50	0.84	0.365
96	0.13	0.76	0.428
97	0.06	0.85	0.362
98	0.68	0.75	0.434
99	0.02	0.75	0.432
100	0.75	0.70	0.459
101	0.78	0.51	0.500
102	0.04	0.77	0.424
103	0.54	0.81	0.389
104	0.48	0.82	0.385
105	0.55	0.78	0.411
106	0.54	0.81	0.396
107	0.54	0.79	0.405
108	0.07	0.85	0.356
109	0.69	0.76	0.429
110	0.68	0.78	0.415
111	0.01	0.68	0.466
112	0.11	0.84	0.370
113	0.72	0.69	0.464
114	0.19	0.77	0.424
115	0.70	0.73	0.443
116	0.59	0.76	0.424
117	0.50	0.83	0.378
118	0.67	0.43	0.495
119	0.55	0.81	0.389
120	0.54	0.81	0.393
121	0.50	0.85	0.360
122	0.11	0.82	0.384
123	0.15	0.88	0.321
124	0.69	0.76	0.430
125	0.09	0.89	0.314
126	0.76	0.74	0.441
127	0.71	0.77	0.423
128	0.04	0.70	0.459
129	0.14	0.86	0.350
130	0.04	0.86	0.342
131	0.54	0.80	0.401
132	0.14	0.87	0.340

133	0.15	0.85	0.359
134	0.66	0.68	0.413
135	0.55	0.77	0.423
136	0.73	0.51	0.500
137	0.06	0.69	0.463
138	0.70	0.69	0.461
139	0.53	0.77	0.424
140	0.12	0.83	0.380

*Statistically significant differences

Table 3: Statistical analysis of the scales

Task	Average	Variance	Standard deviation	Cronbach Alpha	N of items	Sample Size
Total correct task 2 (Dual Xno)	108.66	725.1	26.93	.975	140	1469
Total correct task 3 (Dual Xno + i)	105.73	639.5	25.28	.968	140	1469
Task 2 (Dual Xno) correct by pressing	73.48	698.67	26.43	.985	98	1469
Task 3 (Dual Xno + i) correct by pressing	73.47	626.52	25.03	.982	98	1469
Task 2 (Dual Xno) correct without pressing	35.17	31.54	5.62	.850	42	1469
Task 3 (Dual Xno + i) correct without pressing	32.26	47.74	6.91	.871	42	1469
Task 2 (Dual Xno) visual correct by pressing	38.40	201.16	14.18	.979	49	1469
Task 3 (Dual Xno + i) visual correct by pressing	37.77	216.75	14.72	.981	49	1469
Task 2 (Dual Xno) visual correct without pressing	16.56	15.97	3.99	.832	21	1469

Task 3 (Dual Xno + i) visual correct without pressing	15.09	21.91	4.68	.851	21	1469
Task 2 (Dual Xno) auditory correct by pressing	35.08	274.77	16.58	.985	49	1469
Task 3 (Dual Xno + i) auditory correct by pressing	35.7	221.63	14.89	.980	49	1469
Task 2 (Dual Xno) auditory correct without pressing	18.61	9.98	3.16	.830	21	1469
Task 3 (Dual Xno + i) auditory correct without pressing	17.17	14.55	3.81	.832	21	1469

ANNEX 4 – NESPLORA AQUARIUM MANUAL