Worse associative memory recall in healthy older adults compared to young ones, a face-name study in Spain and Mexico

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Abstract

Introduction: The Face Name Associative Memory Exam (FNAME) is sensitive to associative memory changes early in the Alzheimer's disease spectrum, but little is known about how healthy ageing affects FNAME performance. We aimed to assess ageing effects on an extended version of the test, which captures further associative memory abilities beyond the recall and recognition domains measured in the original version.

Method: We adapted FNAME versions in Spain and Mexico, adding new subtests (Spontaneous Name Recall, Face-Name Matching). We compared the performance of 21 young adults (YA) and 27 older adults (OA) in Spain, and 34 YA and 36 OA adults in Mexico. Recall was analysed using a mixed-model ANOVA including subtest scores as dependent variables, *age group* as a fixed-factor independent variable, and *recall subtest* as a three-level repeated-measure independent variable. The rest of the associative memory domains were analysed through t-tests comparing the performance of YA and OA.

Results: In Spain, we found significant effects for *age group* and *recall subtest*, with large effect sizes. The recognition subtests (Face Recognition, Name Recognition) displayed ceiling effects in both groups. The new subtests displayed medium-to-large effect sizes when comparing age groups. In Mexico, these results were replicated, additionally controlling for education. In both studies, recall performance improved after repeated exposures and it was sustained after 30 minutes in YA and OA.

Conclusions: We document, in two different countries, a clear ageing pattern on the extended FNAME: regardless of education, OA remember fewer stimuli than YA through recall subtests. The new subtests provide evidence on associative memory changes in ageing beyond recall.

Keywords:

- Cognitive Ageing
- Memory, Episodic
- Memory and Learning Tests
- Neuropsychological Tests
- Healthy Ageing
- Associative Memory
- Cross-Cultural Adaptation

Introduction

As human life expectancy increases across the globe, the study of cognitive ageing becomes fundamental to assure the quality of life of these added years (Blazer, Yaffe, & Liverman, 2015). This issues a call for the development and improvement of standardized cognitive measurements that are specific, sensitive, cross-culturally valid, and useful both in research and clinical scenarios (Patterson, 2018).

One of the most common cognitive complaints among older adults (OA) is a decline in memory. In some cases, this decline can herald the onset of neurocognitive disorders such as Alzheimer's disease (AD) (Rabin, Smart, & Amariglio, 2017). In this context, the study of episodic memory (i.e. memory rich in context that can be explicitly stated or conjured) has gained attention, as it is particularly impaired in the earliest stages of typical AD (Dumas, 2015; Kirova, Bays, & Lagalwar, 2015).

A key process in the formation of episodic memories is binding, which concerns the creation of associative links between independent items or between items and a context. This allows for these associations to be encoded as single scenes or events (Bastin et al., 2014; Kessels, Hobbel, & Postma, 2007). In OA, the changes in episodic memory can be partly explained by a decline in associative memory (De Brigard, Langella, Stanley, Castel, & Giovanello, 2020; Greene & Naveh-Benjamin, 2020). This offers a relevant cognitive target to timely identify subjects at risk of deviating from healthy ageing to progressive neurocognitive disorders by using sensitive tests.

The Face Name Associative Memory Exam (FNAME) (Rentz et al., 2011) is an easy to administer test that measures associative cross-modal episodic memory by assessing the ability to recall newly-learned face-name pairs. From an ecological perspective, it mirrors everyday

challenges faced by OA, as the ability to recall the names of recently introduced people constitutes a predominant complaint in this age group (Horn, Kennedy, & Rodrigue, 2018).

The FNAME was developed to detect associative memory impairments in subjects in the early stages of the AD continuum, such as preclinical AD, subjective cognitive decline, and amnestic mild cognitive impairment (aMCI) (see Rubiño & Andrés, 2018 for a review). In the first version of the test, 16 face-name and 16 face-occupation pairs were presented to healthy participants and had to be memorized and recalled after 30 minutes (Rentz et al., 2011). An abbreviated version of the FNAME with fewer stimuli and increased learning trials was later developed to enhance feasibility in clinical scenarios and was found to be psychometrically equivalent to the original (Papp et al., 2014).

The FNAME has shown strong test-retest reliability (Amariglio et al., 2012; Vila-Castelar et al., 2019) and convergent validity with other episodic memory tests such as the Free and Cued Selective Reminding Test (FCSRT; Amariglio et al., 2012; Papp et al., 2014), the Wechsler Memory Scale (WMS-III; Alegret et al., 2015), and the Rey Auditory Verbal Learning Test (RAVLT, Alviarez-Schulze et al., 2021). A recent validation study on a Spanish version of the FNAME provided normative data on 511 healthy volunteers from Spain (Alviarez-Schulze et al., 2021). In said study, face-name and face-occupation subtests were revealed as two underlying components explaining most of the test variance (95.3%), weak correlations with non-memory tests (supporting divergent validity), a positive correlation with education, and a negative correlation with age. Different versions of the test have been used in Spanish (Alegret et al., 2020, 2015), Greek (Kormas, Zalonis, Evdokimidis, & Potagas, 2019), Spanish-speaking American (Alegret et al., 2015), and Latin-American populations (Vila-Castelar et al., 2020, 2019). Interestingly, ceiling effects are not observed in the recall items of this test (Enriquez-Geppert,

Flores-Vázquez, Lietz, Garcia-Pimenta, & Andrés, 2020; Rentz et al., 2017), thereby making it potentially useful to detect subtle changes in the earliest phases of AD.

Further highlighting this potential for supporting early AD diagnosis, FNAME performance is correlated to beta-amyloid burden in healthy OA (Rentz et al., 2011), OA with subjective cognitive decline (Sanabria et al., 2018) and is affected in preclinical AD mutation carriers when compared to non-carrier controls (Vila-Castelar et al., 2020).

Also recently, an FNAME version was adapted for the Dutch population to purposely explore age effects for the first time (Enriquez-Geppert et al., 2020). The results revealed a significant effect of age on recall, with a lower performance in OA compared to young adults (YA). In this study, the potential to enhance the FNAME assessment on episodic memory was discussed, as increasing the difficulty of recognition subtests and incorporating new items that tack on distinct associative memory constructs could increase its capacity to discriminate between healthy and pathological memory ageing.

In light of these findings, here we aimed to investigate age-related changes in an extended version of the FNAME in two studies in two different countries (Spain and Mexico). We concurrently developed versions of an extended FNAME for each country, introducing and testing additional items: Spontaneous Name Recall (an effortful memory retrieval ability) and Face-Name Matching (focusing on the binding of the face-name pairs). We predicted a replication of the ageing effects first observed by Enriquez-Geppert et al. (2020), with a large age effect on recall, better performance of YA compared to OA in the newly-appraised subtests, and similar effect sizes across both countries.

Materials and methods

Study design

In two consecutive observational, transversal studies, carried out in Spain (Study 1) and Mexico (Study 2), we aimed to replicate the results observed by Enriquez-Geppert et al. (2020) on age effects in FNAME. We introduced and tested additional items in an extended version of the FNAME: Spontaneous Name Recall and Face-Name Matching, thus appraising further aspects of episodic memory processes.

In Study 2, we addressed three limitations identified in Study 1 (see *Results*): 1. The difference in educational levels of young and older participants in Spain: in Study 2, Mexican younger and older subjects with similar educational levels were selected in order to rule out a possible effect of this factor. 2. The ceiling effect in Face-Name Matching: in Study 2, stimuli were presented in a different way (see *Test Overview*) in order to raise this subtest's cognitive demand. 3. We analysed the correlation between recall subtests of the extended FNAME and a culturally-adapted Mexican version of the RAVLT, (Sánchez-Nieto, Villa Rodríguez, & Mendoza-Núñez, 2016; Schmidt, 1996).

Sample selection

For the different stages (FNAME adaptation and testing) participants were informed about the study beforehand. They gave written consent to the protocol, which was approved by the ethics committee of each respective site (Department of Psychology and Research Institute of Health

Sciences, University of the Balearic Islands, Spain; National Institute of Neurology and Neurosurgery, Mexico City, Mexico). The studies were conducted following the Declaration of Helsinki.

In order to replicate and extend the age effects observed by Enriquez-Geppert et al. (2020) in the Netherlands, we conducted two studies, testing YA and OA in Spain (total n = 48) and in Mexico (total n = 70). Sample size was calculated using G*Power (Faul, Erdfelder, Lang, & Buchner, 2007), based in a previous study (Enriquez-Geppert et al., 2020). Inclusion criteria for the studies consisted of: age between 18 to 28 years in the YA group, and older than 60 years in the OA group; Montreal Cognitive Assessment (MoCA) equal or higher than 26 points or Mini-Mental State Exam (MMSE) equal or higher than 27 points. In Study 2, a range of eight to 20 years of education in both YA and OA was also considered for inclusion, in order to control for this variable after finding a significant difference in education in Study 1 (see *Study design*). Exclusion criteria for both consisted of: clinical diagnosis of major depression, dementia or other major neuropsychiatric disorders. Culturally-validated versions of the MoCA and MMSE in Spanish (the first language of the participants) were used (Ojeda, del Pino, Ibarretxe-Bilbao, Schretlen, & Peña, 2016; Ostrosky-Solís, López-Arango, & Ardila, 2000), and the cut-off scores were determined from previously-published normative data (Ojeda et al., 2016; Villaseñor-Cabrera, Guàrdia-Olmos, Jiménez-Maldonado, Rizo-Curiel, & Peró-Cebollero, 2010). The different cognitive screening instruments used (i.e., MoCA in Spain and MMSE in Mexico) reflect the common usage of the instruments in the clinical scenarios where the studies were conducted.

Test adaptation

Independent extended FNAME versions for Spain and Mexico were developed for their use in each site. Detailed instructions and materials for the development and cross-cultural adaptation of the extended FNAME can be consulted in the following link: https://osf.io/6fwaj/

Professional photographers took pictures of faces of local volunteers from Spain and Mexico, against a white background. These volunteers were asked to sit up straight, face the camera, and show a neutral facial expression. These pictures were then edited by one of the photographers to match for brightness, hue and framing, and to remove distinctive elements in the volunteers clothing (e.g., logos or stamps). The preparation of the materials for the adapted FNAME versions aimed to select photos and names controlling for age, gender and ethnicity (including diverse backgrounds).

The pictures were randomly selected and presented to volunteers from each country (117 in Spain, 44 in Mexico), who were instructed to classify a sub-set of pictures by age, and same-ethnicity typicality on a five-point Likert scale. This "typicality" consideration follows a long and consistent line of research, which shows that participants are more likely to correctly identify a previously viewed face that is ethnically similar to the own, compared to other-ethnicity faces (for a meta-analytic review on the topic, see Meissner & Brigham, 2001). Participants were furthermore asked to classify the faces into age ranges: younger than 40, between 40 and 65, or older than 65 years.

The selected pictures, different for Spain and Mexico, were then randomized, including six target pictures of each gender, and at least three target pictures of each different age range. Three additional pictures that matched the classification variables of each of the selected pictures were chosen as distractors for the Face Recognition subtest (see *Test Overview* and Figure 1). In total,

12 pictures were presented as individual targets and each of these pictures were later presented with three additional pictures at Recognition.

Name selection

To find common names to match with the faces, the National Institute of Statistics database was consulted in Spain (Instituto Nacional de Estadística España, 2019), and a database for the most common names was consulted in Mexico (Cruz, Rodríguez, Gómez, & Herrera, 2017). Names were excluded if they met one of the following criteria: 1) double names (e.g.: María del Carmen, José María), 2) names with an equivalence for both genders (e.g.: Antonio, Antonia), 3) names with the same initial letter (e.g.: Raúl, Raquel), and 4) easily combinable names (e.g.: María, Juan). The resulting selected names from the Spanish and Mexican databases were different.

Test overview

The two culturally-adapted extended FNAME were presented to participants using Microsoft Office PowerPoint, with instructions presented in white letters over a black background and presentation times were automated.

The subscales of the test include 12 steps (see Figure 1): Familiarisation: To accustom participants with the faces, 12 faces were first shown one-by-one, without the names, for two seconds each. Learning Phase I: Here, the 12 face-name pairs were presented one-by-one for six seconds each, in a different randomized sequence (equal for all participants). Participants were instructed to read the names out loud and memorize them. Immediate Recall I. Next, the pictures

without names were presented in a newly randomized sequence (eight seconds each, equal for all participants), and participants were asked to say the recalled names out loud. Learning Phase II: The face-name pairs that were not remembered in the previous phase were presented again. Immediate Recall II: For the second time, all 12 pictures were presented without names and participants were again instructed to indicate the names they remembered out loud. Learning phase III: Again, face-name pairs that were not remembered during Immediate Recall II were shown to the participant. A 30-minute delay followed, in which general questionnaires were completed, purposely avoiding memory testing during this lapse. The newly introduced scale Spontaneous Name Recall ensued. In this subtest, participants were asked to freely recall all names they learned within two minutes. Face Recognition: Each of the learned faces was presented for five seconds, together with three unknown distractor faces of the same gender, and similar in age and ethnicity; participants had to indicate the familiar face in each trial. Delayed Name Recall: The 12 pictures were presented each for eight seconds without names and participants were instructed to say the corresponding name aloud. Name Recognition: only the names that were not recalled in the previous phase were presented along with three other names of the same gender, previously not presented. Participants were instructed to indicate the previously presented name. Because only the non-recalled face-name pairs were presented, the non-recognized names were scored. Face-Name Matching: The 12 previously learned faces and names were presented in two slides (one with the six female faces and one with the male faces in Study 1 (Spain) or a single slide Study 2 (Mexico) in a randomly-allocated order for two minutes. Placing all stimuli in a single slide in Study 2 was decided in order to make the subtest more challenging, after finding a ceiling effect in in Study 1 (see *Results*). Participants were instructed to match the correct name to the corresponding face, they could point with the finger to the face they thought matched the chosen

name. Both Spontaneous Name Recall and Face-Name Matching are newly introduced items relative to previous FNAME versions.

Participants' responses were produced orally and recorded on a scoring sheet by the examiner.

Statistical design

For the comparison of demographic characteristics of the samples, independent samples t-tests and chi-square tests were used.

To assess the recall domain, we used a mixed-model ANOVA where subtest scores were entered as dependent variables, *age group* (YA, OA) was considered as a fixed-factor independent variable, and *recall subtests* (Immediate Recall 1, Immediate Recall 2, Delayed Name Recall) was entered as a within-subject repeated-measures variable. For the rest of associative memory domains, t-tests were used to compare the performance between YA and OA. Paired samples Pearson correlations were used to analyse the association between FNAME and RAVLT recall subtests.

Partial η^2 values and Cohen's d effect sizes were reported. In case of violations of sphericity, Greenhouse-Geisser corrected *F* are reported.

Effect sizes for Cohen's d are interpreted as large at a 0.99 cut-off, medium at 0.57, and small at 0.25, partial η^2 effect sizes, in contrast, are interpreted as large at a 0.41 cut-off, medium at 0.18, and small at 0.08. These reference values follow the review by Morris and Fritz on effect sizes in memory research (2013).

Statistical analyses were carried out in the SPSS software, version 26 (IBM Corp.).

Results

Study 1: Testing ageing effects in the extended FNAME in Spain

Twenty-one YA (42.9% female) and 27 OA (48.1% female) participated in this study. YA had a mean of 22.3 years of age (*range:* 18-25; *SD* = 2.9), and a mean of 14.8 years of education (*range:* 12-18; *SD* = 2.7). OA had a mean of 71.4 years of age (*range:* 60-78; *SD* = 7.8) and a mean of 11.1 years of education (*range:* 6-22; *SD* = 3.5). There was a statistically significant difference in years of education ($t_{(46.0)} = 3.99$, $d = 1.18$, $p < .001$) between YA and OA. Participants were bilingual in Spanish and Catalan, and they were tested in Spanish.

The mean scores of the FNAME subtests of the Spanish sample are presented in Table 1.

Recall Domain (mixed-model ANOVA): As expected, the main effect of *age group* was significant ($F_{(1, 46)} = 23.17$, $MSE = 182.58$, $\eta p^2 = .34$, $p < .001$); OA recalled fewer names than YA (see Table 1 and Figure 2). A further significant main effect was obtained for *recall subtests* ($F_{(1.89,\ 87.13)} = 58.68$, $MSE = 164.69$, $\eta p^2 = .56$, $p < .001$). This main effect showed the expected learning curve after re-exposure of face-name pairs: at Immediate Recall 2, more items were recalled than at Immediate Recall 1 ($t_{(47)} = -10.26$, $d = 1.49$, $p < .001$). The number of items were sustained after the 30-minute delay ($t_{(47)} = -.20$, $d = 0.03$, $p = .85$). The interaction between *age group* and *recall subtest* was however non-significant ($F_{(1.89, 87.13)} = .27$, $MSE = .78$, $\eta p^2 = .01$, $p = .75$).

T-tests: In Face Recognition, there was a significant difference between the performance of YA and OA ($t_{(26.0)} = 3.39$, $d = 0.94$ $p = .002$; see Table 1 for mean performance). However, because a ceiling effect was reached, this result cannot be interpreted. Moreover, variance in the

performance of YA was zero (with all YAs performing at the highest score), so Cohen's *d* is not reported. In Name Recognition, where errors were analysed, although OA had a higher mean of failures in this subtest (M = .52, SD = .98) than YA (M = 0.19, SD = .51); this difference was not statistically significant ($t_{(41.0)}$ = 1.50, d = .42, p = .14). The negative value in this subtest represents the mean of non-recognized names. In the Spontaneous Name Recall subtest, OA performance was significantly worse than that of YA ($t_{(46)}$ = 2.32, d = .71, p = .03), as was the case in Face-Name Matching ($t_{(26.5)}$ = 3.76, d = 1.29, p = .001). In Face-Name Matching, YA reached a ceiling effect, so the effect size cannot be interpreted.

Study 2: Testing ageing effects in the extended FNAME in Mexico

The Mexican sample consisted of 34 YA and 36 OA. YA were in average 21.9 years old (*range*: 18-28; SD = 2.7) 61.8% were female, and had a mean of 14.8 years of education (*range*: 8-20; SD = 2.8). OA were in average 67.7 years old (*range:* 61-82; SD = 4.9) 58.3% were female, and had a mean of 15.1 years of education (*range:* 8-20; SD = 2.1). YA and OA were matched according to education and did not differ statistically ($t_{(67.5)}$ = -1.62, d = .12, p = .11). The first language of the participants was Spanish, and were tested in Spanish.

Recall Domain (mixed-model ANOVA): As expected, the main effect *age group* turned out significant ($F_{(1, 68)}$ = 29.7, MSE = 313.17, ηp^2 = .30, p < .001), with lower scores in the OA group compared to YA (Table 1, Figure 3). The main effect for *recall subtest* was also significant ($F_{(1.91,\ 129.55)}$ = 95.1, MSE = 184.32, ηp^2 = .58, p < .001) and the expected learning curve demonstrated that, at Immediate Recall 2, more items were recalled than at Immediate Recall 1 ($t_{(70)}$ = -11.71, d = 1.40, p < .001), and the number of items were sustained after the 30-minute delay

($t_{(70)} = -.81$, $d = 0.1$, $p = .81$). The interaction between *age group* and *recall subtest* was non-significant ($F_{(1.91, 129.55)} = 3.10$, $MSE = 6.0$, $\eta p^2 = .06$, $p = .05$). We found small, but significant correlations between extended FNAME and RAVLT recall subtests in the whole sample (YA + OA): Immediate Recall 1 with the first RAVLT learning trial ($r_{(68)} = 0.28$, $p = 0.004$), Immediate Recall 2 with the second RAVLT learning trial ($r_{(68)} = 0.33$, $p < 0.001$), and Delayed Recall with the delayed RAVLT recall trial ($r_{(68)} = 0.45$, $p < 0.001$).

T-tests: In Face Recognition, the mean performance of YA and OA was not significantly different ($t_{(60.8)} = 1.83$, $d = .43$, $p = .072$; see Table 1 for mean performance). A ceiling effect was reached in both groups. In Name Recognition, where errors were analysed, there was a significant difference between the performance of YA and OA ($t_{(42.8)} = 2.49$, $d = .59$, $p = .02$). However, because a ceiling effect was reached, this result cannot be interpreted. In Spontaneous Name Recall, the performance of OA was significantly worse than that of YA ($t_{(64.5)} = 3.64$, $d = .87$, $p = .001$), as was the case in Face-Name Matching ($t_{(64.1)} = 2.92$, $d = .79$, $p = .005$).

The mean scores of the FNAME subtests of the Mexican sample are presented in Table 2.

Discussion

In the present study, we demonstrate age-related differences in the FNAME performance regarding recall, replicating in two additional laboratories the results by Enriquez-Geppert et al. (2020). The newly introduced subtests, that address free recall and cross-modal stimulus matching, also showed additional age effects for the first time in this test. Although previous studies using the FNAME have provided information on its sensitivity for associative memory changes early in the AD continuum (Rubiño & Andrés, 2018; Vila-Castelar et al., 2020), taking a step back to analyse to which extent healthy ageing can influence this test will aid in the interpretation of previous results, further adding to its clinical significance. In the following, we will discuss the results considering findings in both sites, limitations and implications.

Specifically, regarding the significant ageing effects in recall, we found effect sizes that can be considered as very large in the context of memory research (Morris & Fritz, 2013). Interestingly, these effect sizes were remarkably similar between sites, which implies that, having followed the same methodology in adapting versions of this test for Spain and Mexico, we obtained equivalent results. The effect sizes found in this study and the one reported by Enriquez-Geppert et al. (2020) in a Dutch study were similar, in total, with between-site differences in these three laboratories not larger than $\eta p^2 = .03$. Also providing evidence on the psychometrical properties of the extended FNAME, we found a correlation of the recall subtests with the RAVLT, supporting the convergent validity reported by previous studies in non-extended Spanish and Greek FNAME versions (Alviarez-Schulze et al., 2021; Kormas et al., 2018). Interestingly, the correlation coefficient between the delayed recall RAVLT and FNAME in the study of Alviarez-Schultze et al. (2021) and the present study is remarkably similar (r = 0.45 in both studies), and also

comparable to the one found by Kormas et al. (2018, $r = 0.48$). This replication of the results is fundamental to advance memory research, and, clinically, it adds to the availability of cross-culturally accurate tests.

The newly developed subtests included in these FNAME versions (Spontaneous Name Recall and Face-Name Matching) displayed medium to large age-related effect sizes. No ceiling effects were found in the Spontaneous Name Recall subtest, which implies that this is a cognitively demanding task for both age groups. Although this subtest might not provide additional specificity in the study of healthy ageing, it could provide additional diagnostic value in future clinical studies, taking into consideration that AD patients display an early impairment in both spontaneous and cued recall, a performance profile that deviates from healthy ageing (Teichmann et al., 2017). In the Face-Name Matching subtest, two ways of stimuli presentation were assessed in Study 1 (with six face-name pairs per slide, in each presenting only female or male subjects) and Study 2 (all twelve face-name pairs simultaneously). The number of stimuli that had to be processed at once affected the performance of the test, in the way that a ceiling effect was reached in YA in the Spanish sample, whereas in the Mexican version, the subtest was of adequate difficulty for both age groups. We would thus recommend presenting this subtest as described in Study 2. This subtest also could add specificity when distinguishing healthy ageing from cognitive changes observed in early AD, as visual working memory capacity is disproportionately affected in the latter, possibly resulting from a hippocampal network disturbance that affects the binding of visual items (Atkinson, Baddeley, & Allen, 2018; Zokaei & Husain, 2019).

However, some limitations should be noted. As convenience sampling was carried out on behalf of feasibility, the results may not be generalizable to the whole population. Particularly in Study 2, OA can be considered as outliers in terms of being highly educated compared to the

national mean education in Mexico (5.8 years of education in adults between 60 and 64 years of age), as they were matched to YA regarding education (Instituto Nacional de Estadística y Geografía, 2014).

An additional limitation might be the usage of the FNAME recognition scales to compare YA and OA. A clear ceiling effect was reached in these subtests, with small variance in the performance of YA which may inflate potentially minor statistical differences (Austin & Brunner, 2003; Michalos, 2014). Nonetheless, recognition might of valuable to measure in the study of neurocognitive disorders (Rhodes, Greene, & Naveh-Benjamin, 2019), so extending this research to clinical populations would be a logical next step.

In sum, this study provides key evidence on how normal cognitive ageing affects FNAME performance. Despite limitations, we found psychometric equivalence in the adapted versions of this test, moreover providing a blueprint that can be used for adaptation in other countries. Future refinement and understanding of associative memory in healthy and pathological ageing will likely advance FNAME implementation in clinical scenarios, potentially allowing for a timelier identification of subjects at risk of developing AD.

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Data availability statement: The data that support the findings of this study is available from the corresponding author upon reasonable request.

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The authors declare that there is no conflict of interest.

TABLES

Table 1

Extended FNAME performance in the Spanish sample (Study 1)

	Younger adults (n = 21)	Older adults (n = 27)	Group effect	Subtest (within-subject)
Immediate Recall 1	6.7 (2.6)	4.5 (2.2)	$F = 23.17$ $\eta p^2 = .34$ $p < .001$	$F = 58.68$ $\eta p^2 = .56$ $p < .001$
Immediate Recall 2	10.0 (1.4)	7.4 (1.8)		
Delayed Name Recall	9.8 (2.0)	7.7 (2.3)		
Face Recognition	12.0 (.0)	10.9 (1.8)	$t = 3.39$ $d = 0.94$ $p = .002$	
Name Recognition (failures)	.2 (.5)	.5 (1.0)	$t = 1.50$ $d = .42$ $p = .14$	
Spontaneous Name Recall	8.8 (1.8)	7.4 (2.3)	$t = 2.32$ $d = .71$ $p = .03$	
Face-Name Matching	11.9 (.2)	10.0 (2.6)	$t = 3.76$ $d = 1.29$ $p = .001$	

Mean group subtest values (0-12) are presented for each subtest with standard deviations between parentheses. To assess the recall domain, we used a mixed-model ANOVA where subtest scores were entered as dependent variables, age group (younger, older adults) was considered as a fixed-factor independent variable, and recall subtests (Immediate Recall 1, Immediate Recall 2, Delayed Name Recall) was entered as a within-subject repeated-measures variable. For the rest of associative memory domains, t-tests were used to compare the performance between younger and older adults.

Table 2

Extended FNAME performance in the Mexican sample (Study 2)

	Younger adults (n = 34)	Older adults (n = 36)	Group effect	Subtest (within-subject)
Immediate Recall 1	7.0 (2.1)	4.5 (1.9)		
Immediate Recall 2	9.5 (2.2)	7.7 (2.2)	$F = 29.70$ $\eta p^2 = .30$ $p < .001$	$F = 95.10$ $\eta p^2 = .58$ $p < .001$
Delayed Name Recall	9.9 (2.1)	6.9 (2.5)		
Face Recognition	11.9 (0.3)	11.8 (0.4)	$t = 1.83$ $d = 0.43$ $p = .072$	
Name Recognition (failures)	.2 (.3)	.6 (1.0)	$t = 2.49$ $d = .59$ $p = .02$	
Spontaneous Name Recall	10.0 (1.4)	8.6 (1.9)	$t = 3.64$ $d = .87$ $p = .001$	
Face-Name Matching	10.3 (2.2)	8.5 (2.9)	$t = 2.92$ $d = 0.79$ $p = .005$	

Mean group subtest values (0-12) are presented for each subtest with standard deviations between parentheses. To assess the recall domain, we used a mixed-model ANOVA where subtest scores (0-12) were entered as dependent variables, age group (younger, older adults) was considered as a fixed-factor independent variable, and recall subtests (Immediate Recall 1, Immediate Recall 2, Delayed Name Recall) was entered as a within-subject repeated-measures variable. For the rest of associative memory domains, t-tests were used to compare the performance between younger and older adults.

FIGURES

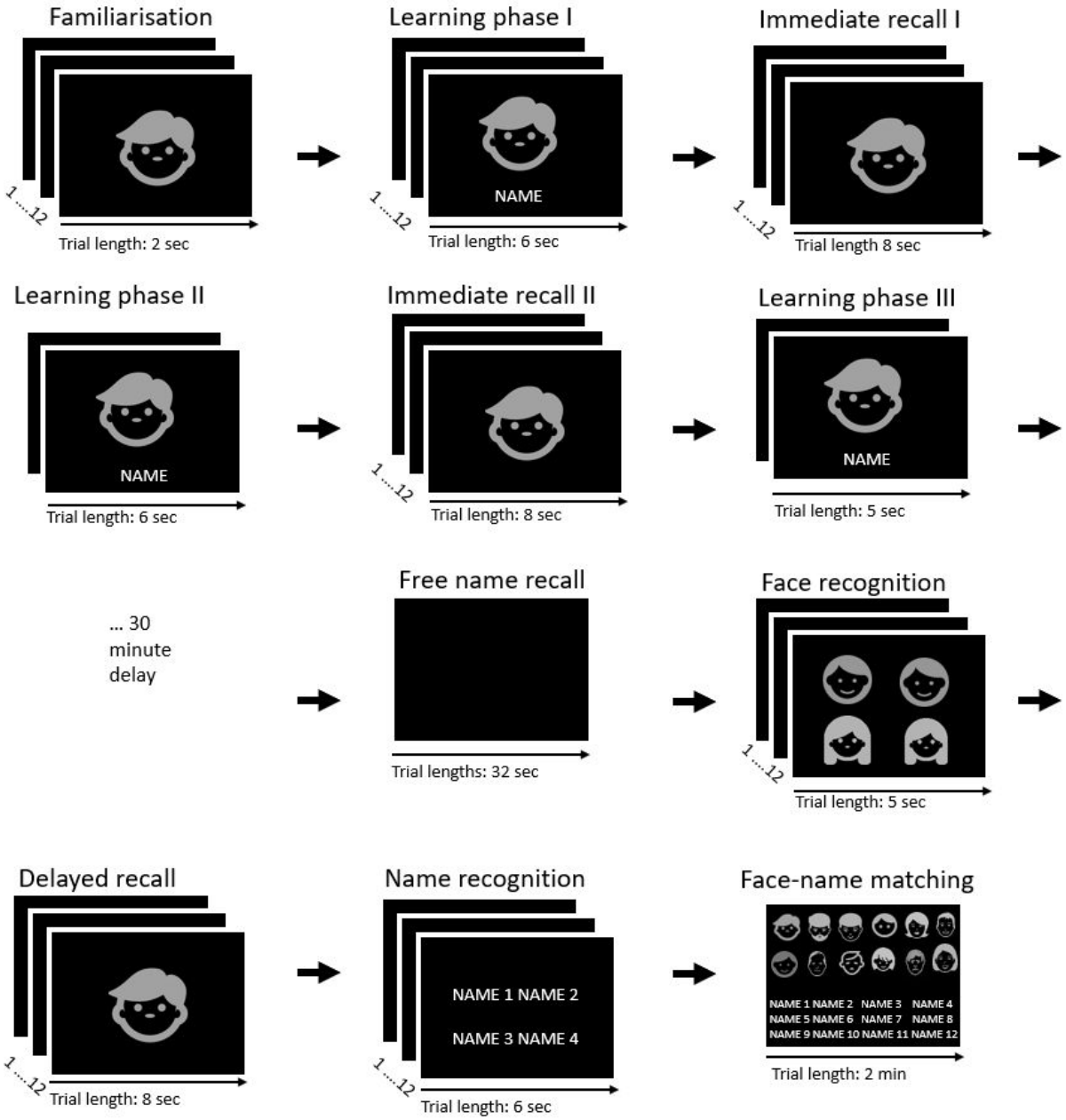

Figure 1: Outline of the different phases of the extended and modified FNAME version used.

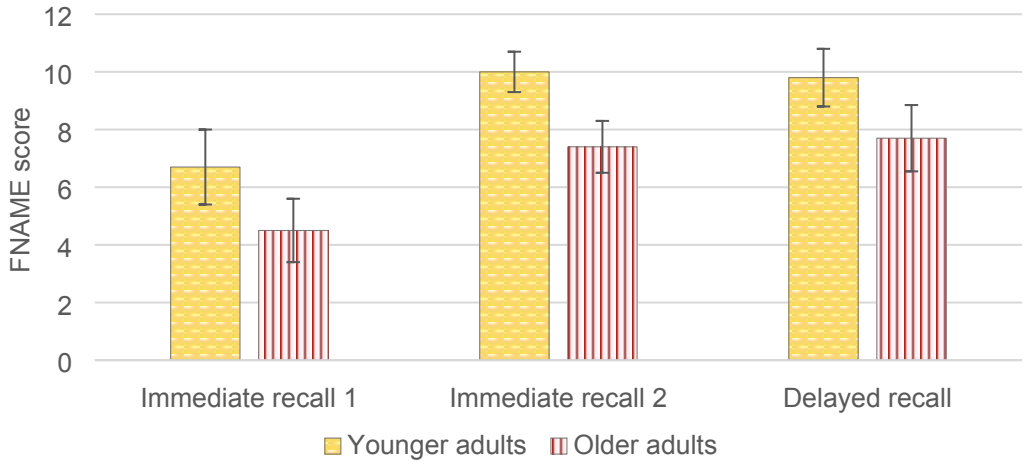

Figure 2: Recall Performance in the Spanish sample (Study 1). Mean FNAME score comparison between young and older adults. Error bars represent standard deviations. In the mixed-model ANOVA, the main effect of age group was significant, as was the main effect for recall subtests. The interaction between age group and subtest was non-significant.

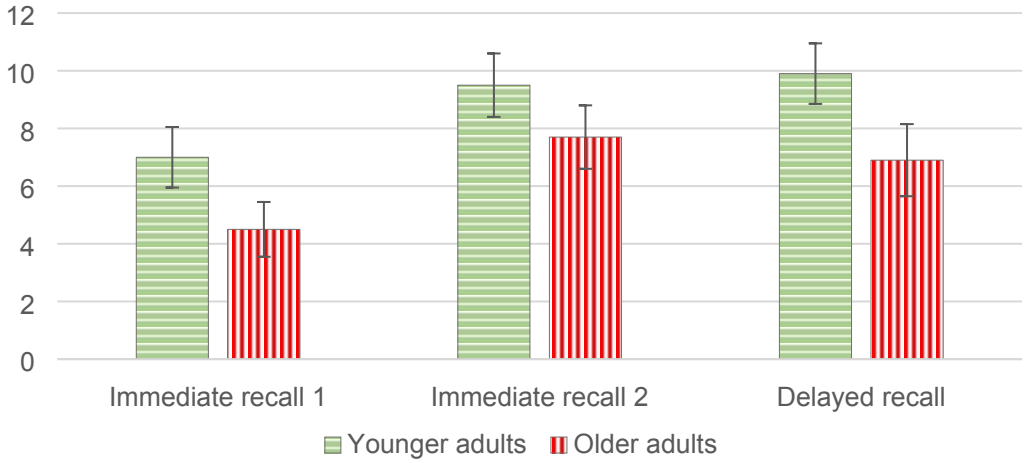

Figure 3: Recall Performance in the Mexican sample (Study 2). Mean FNAME score comparison between young and older adults. Error bars represent standard deviations. In the mixed-model ANOVA, the main effect of age group was significant, as was the main effect for recall subtests. The interaction between age group and subtest was non-significant.