Strategic learning of people's names as a function of expected utility in young and older adults

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Abstract

People's names are notoriously challenging to learn at all ages, more so than semantic information. Because people are somewhat aware of memory limitations and of their own difficulty of learning names, they might spontaneously use cost-efficient encoding strategies whereby they devote more memory resources to the names of people that are most likely to be useful to learn than others. To test this hypothesis, we told young and older participants that they would judge excerpts of a new TV series about a group of twelve musicians and that they could first review information about the characters to facilitate the upcoming viewing, which consisted of face-name-instrument triplets. Further, the probability of appearance of each character was specified via an importance label (main or secondary characters, bit parts). Participants then performed a surprise cued recall test and recalled names, instruments and importance labels associated with pictures. Unsurprisingly, young adults had better memory performance than older ones and semantic information was better recalled than names. In line with a cost-efficient encoding strategy, participants in both groups recalled names and semantic information of the most important characters better, suggesting they prioritised encoding information about those characters to the detriment of others. Interestingly, there were individual differences in spontaneous encoding strategies used. People who reported using cost-efficient strategies had better performance than others and individuals who remembered more semantic information about main characters than about bit parts also did so with names, suggesting that cost-efficient strategies improves the encoding of the two types of information.

Keywords: aging, memory, learning, naming, cost-efficiency

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In many situations of everyday life, we have to learn and remember the names of persons to whom we are introduced. A huge amount of literature has shown that associating names to faces is often challenging, and researchers developed a number of strategies to improve face-name learning (for a review, see Brédart, 2019). In addition, previous research demonstrated that associating a name to a face is more difficult than associating a piece of biographical information (e.g., an occupation) to a face, both in lab-based (Cohen, 1990; McWeeny et al. 1987; Terry, 1994) and in more ecological situations (Devue et al., 2019). This specific difficulty of learning names, compared to biographical information, is accentuated by aging (Baressi et al., 1998; James, 2004; Old & Naveh-Benjamin, 2012).

Several researchers attributed the specific difficulty to associate names with faces to the fact that names are relatively meaningless (Cohen, 1990) or lack descriptiveness in that they do not provide information about their bearers' mental or physical properties (Brédart & Valentine, 1998; Fogler et al., 2010). Many studies developed and assessed learning strategies designed to increase the meaningfulness of the association between faces and names using mental imagery. These strategies were efficient in experimental contexts but were often difficult to apply in everyday life conversational contexts (see Brédart, 2019 for a review). Others stressed the fact that when people are introduced to us, we usually have few possibilities to rehearse theirs names, and this lack of rehearsal is likely to impede name learning (Helder & Shaughnessy, 2008; Landauer & Bjork, 1978). Name learning strategies based on spaced rehearsal proved to be useful (Helder & Shaughnessy, 2008; Morris & Fritz, 2000; 2002) and to be even more efficient than strategies based on mental imagery (Morris et al., 2005; Neuschatz et al., 2005). Finally, some authors have suggested that naming difficulties in aging are due to associative learning deficits (Naveh-Benjamin, Guez, Kilb, & Reedy, 2004). Older people also tend to form irrelevant associations between relevant and distracting information (Campbell et al., 2010). However, this hyper-binding can be used to help older people learn new face-name associations (Biss et al. 2018; Weeks et al., 2016).

An important factor that received little attention in the naming learning literature is the relative expected utility of learning a person's name. In fact, we do not necessarily need to learn the names of all the persons we are introduced to, especially if we do not expect to meet them again in the future. Since memory is limited in capacity, and most people are aware of this restriction, it makes sense to prioritise more important information to the detriment of others, which people do, both in young and older age (Murphy & Castel, 2022). This view is in line with Anderson and Schooler's (2000) perspective on the adaptive nature of memory whereby a memory system should minimise processing costs while maximising gains. Such a system should privilege the allocation of resources to the encoding of items that are more likely to have to be retrieved in the future. Since people are also usually aware of their own difficulties to remember names (Condret-Santi et al., 2013; Lovelace & Twohig, 1990; Weaver Cargin et al., 2008), such prioritisation might be particularly relevant to names. As a consequence, we would be more likely to devote resources to memorise names of people we expect to encounter again in the future than of those that are less likely to be encountered. Such parsimonious encoding strategies also seem to be deployed when learning new faces in the real-world (Devue & de Sena, 2023).

Hargis and Castel (2017) examined the role of expectations about future encounters. They asked young and older participants to imagine they would encounter 20 new people at a party and to learn faces, names, and occupations triplets for three seconds each. The 20 people included three personally important people (those with whom participants would definitely interact with in the future, like their doctor), three broadly important people (those that they would see again but without interacting) and 14 less important people (those that they would not encounter again). They found similar abilities to remember both categories of important people in young and older participants. However, while both age groups performed more poorly with less important people, older participant's performance was lower than that of young participants with those people they did not expect to encounter again. A second experiment showed that differences in performance between age groups decreased when encoding time was reduced for young participants.

While Hargis and Castel's study clearly shows that older participants' performance depends on the bearer's importance and that young people show similar performance as older adults when a cognitive load is added, the exact factors that modulated performance and encoding strategies deployed by younger and older participants remain unclear. Indeed, in the authors' scenario, the likelihood to encounter people again was confounded with their personal relevance for the participants, possibly triggering self-reference effects (see Cunningham & Turk, 2017). Social status was an additional aspect of the importance manipulation (e.g. important items had higher social status), which could trigger value or distinctiveness effects (Castel, 2007; Festini, Hartley, Tauber & Rhodes, 2013). Positive facial expressions were also systematically associated with more important people and positive information is known to improve memory performance (e.g. Adelman & Estes, 2013). Finally, the difference in item numbers per category (i.e. 3 vs. 14) could have in itself reduced performance in the less important category and increased the distinctiveness of important items, giving these latter an additional advantage. In terms of strategies used at encoding, participants knew that their memory would be tested and were explicitly instructed to focus on more important information, all the while knowing that the proposed scenario was not genuine. Whether encoding strategies based on expected utility are also deployed spontaneously by young and older adults and whether this in itself positively impacts memory performance thus remain to be elucidated.

The main goal of the present study was to evaluate whether expected utility influences participants' recall performance of personal details (first name and biographical information). As the expected utility of learning information about new people depends on the probability of encountering them again in the future, we operationalised it as the probability of appearance of actors in a TV series. We used a cover story in which participants were told that they would review information (i.e. first name and instrument played) about 12 characters of a new TV show about a music band before judging excerpts from mock-up episodes of the show, and that they could learn useful information about the characters at their own convenience. We manipulated expected utility by assigning importance labels to characters that reflected their probability of appearance in the show via the well-known “Main character”, “Secondary character” or “Bit parts” categories of roles. In order to gain insights on spontaneous strategies used during the learning phase and on possible differences between young and older adults, the review of the 12 characters was self-paced and allowed sufficient time (i.e. up to 10 seconds) to deploy higher-level encoding strategies (e.g. mental imagery or the creation of associations). We used one single cued recall test to evaluate memory performance for first names, instruments as well as roles.

We hypothesised that the recall of information such as names and biographical details would depend on the role of the target person (main character >= secondary character >= bits parts; with main character > bit parts) in young and older participants (i.e. main effect of Importance label).

Further, we predicted that the performance of young adults would be better overall than that of older adults (i.e. main effect of Age group). Since the difficulty of learning names is specifically accentuated by aging compared with the learning of semantic information, we expected the difference between age groups to be higher for the recall of names than for the recall of biographical information (i.e. Age by Type of information interaction).

Methods

Transparency and openness

The methods, hypotheses and analyses plans were pre-registered on the Open Science Framework before data collection (see https://osf.io/ktjyb). Aggregated data are available on [https://osf.io/tdv72].

Participants

The number of participants to test was calculated via an a priori power analysis (with G*Power). To be able to detect a medium effect size (f = .25) for a within-between interaction with 2 groups (i.e. young, old) and 3 measurements (i.e. 3 levels of importance, see below), with a power of .9, we needed to recruit 36 participants per group, so 72 in total. We planned to exclude and replace participants who reported medical conditions that can affect memory performance (i.e. having suffered a cardiovascular event, a closed-head injury, a neurological disease), using medication affecting memory performance (e.g. some antidepressants, anxiolytics), or those explicitly reporting a misunderstanding of the task during the task or at debriefing.

We tested 72 participants and the final sample consisted of 36 young participants (21 women, 15 men) aged between 18 and 29 (Mean = 23.03 ; *SD* = 2.6), and 36 older participants (16 women, 20 men) aged between 61 and 72 (Mean = 66.11 ; *SD* = 3.07). They were all Belgian French-speakers.

They all provided informed and signed consent before the start of the experiment. The study was approved by the Ethical committee of the Faculty of Psychology, Logopedy and Educational sciences at the University of Liège (file #5404).

Materials

We selected 12 first names, half with two syllables (3 male, 3 female) and half with three syllables (3 male, 3 female), based on frequency statistics in Wallonia (i.e. French-speaking part of Belgium) for the year 2022. We selected those with frequencies between 11,000 and 15,000 in order to restrict the range while avoiding the most frequent (maximum frequency = 41,370) or rare first names. Frequencies of male first names (Mean = 13,241; *SD* = 1,177.5; range 11,573-14,920) and female first names (Mean = 13,271; *SD* = 1,392; range 11,825-14,924) were comparable.

To obtain images of faces to associate with names, we selected 12 people (6 female, 6 male) aged between 40 and 50 years old (i.e. intermediate age compared to our two groups of participants) with very low levels of media visibility on the Internet Movie Database (ranking over 36,000), so that they would be unfamiliar to our participants, and for whom two good quality pictures (frontal and three-quarter views, neutral or smiling) were available upon internet image searches. For each person, we selected one picture with a frontal view and one with a three-quarter view oriented to the right. Each of the 24 resulting images were framed around the head and resized to 405 x 486 pixels. Background information was concealed with a grey field, see **Figure 1**.

In addition, semantic information to be associated with each character consisted of 12 different instrument names (i.e., accordion, bass, clarinet, drums, flute, guitar, piano, saxophone, synthesizer, trombone, trumpet, and violin) that could be used in different musical styles so as to fit our cover story (see below).

Twelve face-name-instrument triplets were generated randomly and kept constant for all participants. However, the 12 names were split into three subgroups of four names, each including two names with two syllables (one female, one male) and two names with three syllables (one female, one male), and so that the average frequencies of use in each subgroup were similar. Three versions of the task were then constructed, wherein the importance labels (i.e. main character, secondary character and bit parts) were counterbalanced across the three names subgroups, so that each face-name-instrument triplet would be presented under each importance label to different participants. In other words, our manipulation of expected utility was restricted to the mere probability of future encounter of a character, all other factors being equal (e.g. number of items per category, names' frequency) and/or counterbalanced between importance labels (i.e. instruments and their possible differential value, individual faces and their expressions).

During the learning phase, the triplets appeared in the form of two pictures side by side, with the first name and the instrument written on two separate lines (in black Calibri 20 font) in a white box underneath the pictures, see **Figure 1**. Importance labels appeared as black text (Calibri 28 font) in the centre of the screen. To minimise any strain on the eyes, the screen background was light grey throughout the experiment.

Procedure

Participants were tested individually with a laptop in a quiet room at their home or on the university campus. The experiment was programmed and responses recorded with the online testing platform Testable (Testable.org).

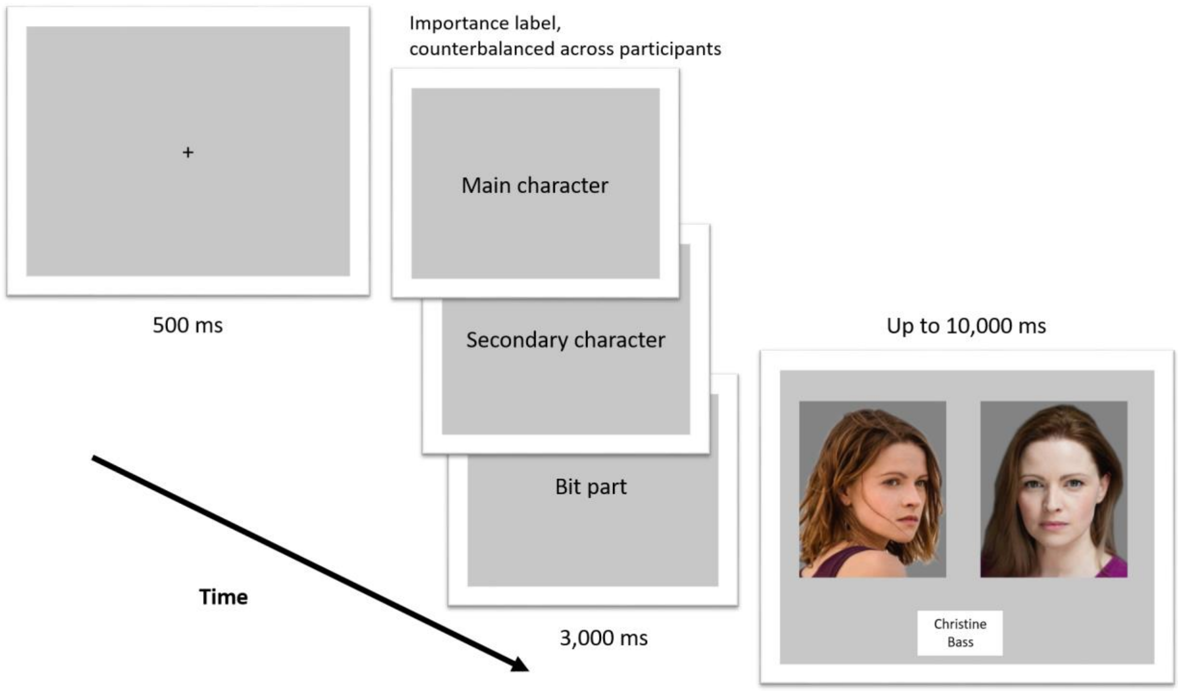

Figure 1. Time course of a learning trial. After a fixation cross, the importance of an upcoming character was displayed for three seconds before the appearance of their face-name-instrument triplet. Participants were free to press the space bar to move on to the next character before the imparted 10 seconds had elapsed. The importance label (i.e. main character, secondary character, bit parts—in French in the actual experiment) assigned to a given triplet/character was counterbalanced across participants.

Learning phase. We used a cover story in which participants were told that we were going to ask their opinion on excerpts of episode mock-ups from a new French-speaking Belgian TV show about 12 friends who play music together in a band[1]. They were told that to facilitate the viewings of these

[1]The exact instructions were: "We would like to have your opinion on some aspects of a Belgian (French-speaking) series currently in pre-production. Each short episode (about 6 to 8 minutes long) tells the story of a dozen friends who have decided to form a band that plays, for better or for worse, different types of music. They play jazz, rock, pop and world music. The series presents, in a rather humorous way, these twelve people in their daily life through their love stories, their friendship, their professional life and, of course, their musical

excerpts, we would first give them the opportunity to review the details of the 12 characters, including their first name and the instrument they play. We added that the importance of each character in the show would also be specified and it was defined as follow, in a way that emphasised the probability of future encounter: “Main character” (“personnage principal” in French) appears in each episode; “Secondary character” (“personnage secondaire” in French) appears in half of the episodes; and “Bit parts” (“personnage accessoire” in French) has a small role in a few episodes. Contrary to Hargis and Castel (2017) who had colour-coded the importance of characters, we thus made the probe as to the expected utility of learning information about characters as straightforward as possible so as not to create any additional memory load.

Participants were told that each character’s information could be viewed for up to 10 seconds but that they could progress faster through characters’ information with the space bar if they wished so. This set of instructions created a pseudo-incidental learning situation, because although people were not explicitly instructed to memorise information, the situation might entice them to do so. Further, it was up to them to decide which information they focus on and how much efforts they put into it.

The 12 characters (4 main, 4 secondary and 4 bit parts) were shown in a random order. Each trial started with a 500 ms fixation cross, followed by a 3-sec prompt indicating the importance of the upcoming character in the show. A display with a face-name-instrument triplet was then shown for 10 seconds or until participants pressed on the space bar. After reviewing all the characters once, participants were told that they would be given a second opportunity to review the 12 characters to facilitate the upcoming viewing of mock-up episodes. Reaction times (i.e. space bar presses when

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practice. To make it easier for you to watch some excerpts from the episode mock-ups, we will start by introducing the different characters so that you can learn useful information about them at your convenience.

Now you will see the faces of the twelve characters appear on the screen (side and front photos). Each face will be accompanied by an information sheet containing their first name and the musical instrument played in the band. Before the presentation of each of these characters, their importance in the series will also be specified: "main character" (appears in every episode), "secondary character" (appears in about half of the episodes) or "bit parts" (small role in a few episodes). You will have a maximum of 10 seconds per character to read their sheet. If you want to move on to the next character before the 10 seconds are up, you can press the space bar.”

participants elected to see a display for less than the imparted 10 seconds) were recorded during each of the two consecutives learning blocks.

Cued recall phase. After the two learning blocks, participants were immediately instructed to recall as many information as possible about the characters they just reviewed[2]. The twelve items were presented in a random order. The same two pictures as during learning were used as cues and presented on the screen, above a response box and the prompt "first name, instrument, importance?". The pictures were shown for up to 10 seconds but participants had an unlimited time to respond. To prevent any possible issues or delays resulting from difficulties with typing in answers in older participants, the experimenter was keying in the responses herself from a secondary keyboard for all participants.

Debriefing questions. Finally, after the test, we questioned participants as to their understanding of the real objective of our experiment in order to determine whether they believed our cover story or not and to gain insight on their strategies. First, we revealed that our actual goal was not to collect judgments on the TV series but to assess memory and asked if they had understood so[3]. Second, we asked if they expected to see episode mock-ups. Finally, we asked what learning strategies they had used, if any, and if they had adjusted their levels of effort as a function of the characters' importance.

Pre-Planned analyses

We planned to conduct a three-way mixed Analysis of Variance (ANOVA) with Age (young, older) as a between-subject factor and Type of information (name, instrument, role) and Importance label (main character, secondary character, bit part) as within-subject factors on mean proportions of correct

[2]Although there was no delay between the encoding and testing phases, participants had to read precise instructions about the memory task and the response modality (i.e. 136 words in total). Further, the experimenter interacted with participants to ensure that all instructions were clear. This interval thus ensures that we were testing long-term memory without contamination from items remaining in working memory.
[3]We realised far into data collection that answers to that question would not be usable as we did not specifically asked participants if they had understood our genuine aim *before* being exposed to the cued recall phase.

responses to the cued recall task. We planned to follow up main effects and interactions using Student t-tests (paired or independent as appropriate) with Holm correction.

We expected a main effect of Age (younger > older), a main effect of the Type of information (biographical > name), and a main effect of the Importance label (main >= secondary >= bit part; with main > bit part). We also expected an Age x Type of information interaction. Further, we planned to explore the pattern of possible interactions between the Importance label and the other two independent variables.

Results

Pre-planned analyses

Cued recall. **Figure 2** shows the results of the cued recall task. As expected, planned analyses revealed a significant main effect of Age on cued recall performance, $F(1,70) = 18.765$, $p < .001$, $\eta_p^2 = 0.211$, with better recall in young participants (Mean = .49, *SD* = .32) than in older ones (Mean = .33, *SD* = .3). As expected, recall rates decreased as a function of characters' importance ($\text{Mean}_{\text{Main characters}} = .47$, *SD* = .31; $\text{Mean}_{\text{Secondary characters}} = .43$, *SD* = .33; $\text{Mean}_{\text{Bits parts}} = .33$, *SD* = .3), as shown by a significant main effect of Importance label, $F(2,140) = 16.312$, $p < .001$, $\eta_p^2 = 0.189$. Information about main and secondary characters was better recalled than information about bit parts, $t(71) = 4997$, $p_{holm} < .001$, $d = .509$, 95% C.I. = 0.263 – 0.755 and $t(71) = 4.274$, $p_{holm} < .001$, $d = .373$, 95% C.I. = 0.137 – 0.609, respectively, but main and secondary characters did not differ significantly one from another, $t(71) = 1.595$, $p_{holm} = .115$, $d = .136$, 95% C.I. = -0.089 – 0.361. Finally, there was a significant main effect of Type of information, $F(2,140) = 29.886$, $p < .001$, $\eta_p^2 = 0.299$, and both instruments (Mean = .51, *SD* = .31) and roles (Mean = .44, *SD* = .31) were significantly better recalled than names (Mean = .29, *SD* = .29), $t(71) = 8.527$, $p_{holm} < .001$, $d = .769$, 95% C.I. = .477 –1.062, and $t(71) = 4.844$, $p_{holm} < .001$, $d = .533$, 95% C.I. = .263 – .802, respectively, and instruments better recalled than roles, $t(71) = 2.239$, $p_{holm} = .028$, $d = .236$, 95% C.I. = .015 – 0.488.

Contrary to our hypothesis, there was no significant interaction between Age and Type of information, $F(2,140) = 1.486$, $p = .23$, $\eta_p^2 = 0.021$, suggesting that both age groups were better at recalling biographical information (including roles) than names.

Further, there was no significant interaction between Age and Importance label, $F(2,140) < 1$, nor between Type of information and Importance label, $F(2,140) = 1.613$, $p = .171$, $\eta_p^2 = 0.023$. There was no three-way interaction between Age, Type of information and Importance label, $F(4,280) < 1$.

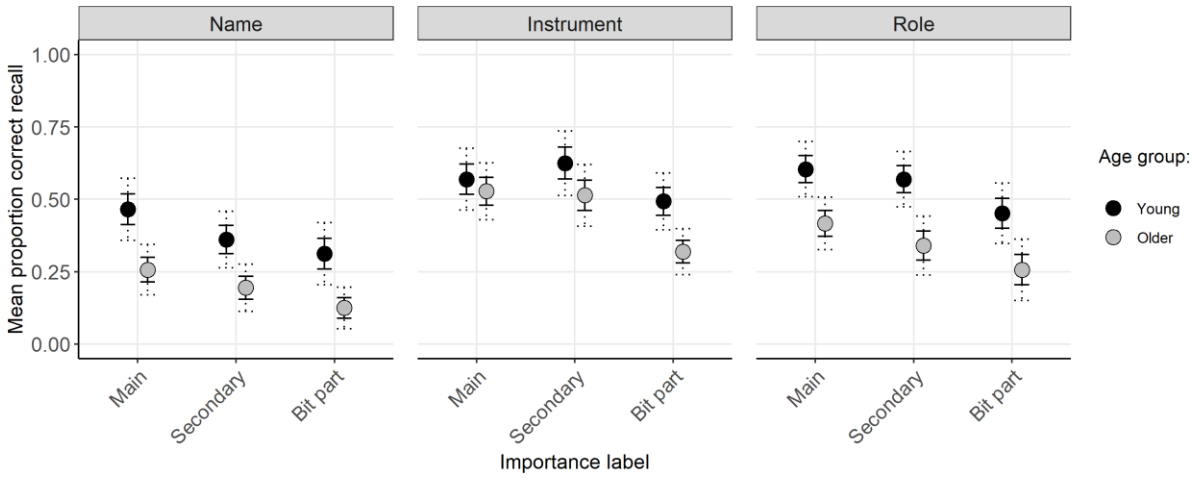

Figure 2. Mean proportion of correct cued recall for the three Types of information as a function of Age and Importance label. Solid error bars represent standard error of the mean; dotted bars represent 95% confidence interval (Morey, 2008).

Overall, results seem to suggest that people may spontaneously use cost-efficient encoding strategies and are better at recalling information that is more likely to be encountered in the future compared to information with lower expected utility, regardless of their age. Although people are worse at recalling names than other information, there is no evidence that age groups differed in how importance labels interacted with the type of information. In other words, on average, people tend to recall information with higher expected utility better than less utile information, regardless of the nature of that information (but see "Individual strategies" section below).

Additional exploratory analyses

Memory for importance labels. Results above suggest that participants used importance labels. One may wonder if participants also remember these labels. In addition to our planned analyses, we explored whether the correct cued recall of importance labels differed from chance (i.e. 0.33) in young ($Mean_{Main}$ = .60, *SD* = .28; $Mean_{Secondary}$ = .57, *SD* = .28; $Mean_{Bits\ parts}$ = .45, *SD* = .31) and older participants ($Mean_{Main}$ = .42, SD = .27; $Mean_{Secondary}$ = .34, *SD* = .30; $Mean_{Bits\ parts}$ = .26, *SD* = .31) with one sample Student t-tests. In young participants, all labels were recalled better than chance, $t(35)_{Main} = 5.756$, $p < 0.001$, $d = .959$, 95% C.I. = 0.559 – 1.351; $t(35)_{Secondary} = 4.992$, $p < 0.001$, $d = .832$, 95% C.I. = 0.448 – 1.208; $t(35)_{Bit\ parts} = 2.295$, $p = 0.028$, $d = .383$, 95% C.I. =0.041 – 0.719. In contrast, older participants were at chance level for all importance labels, $t(35)_{Main} = 1.878$, $p = 0.069$, $d = .313$, 95% C.I. = -0.024 – 0.646; $t(35)_{Secondary} = 0.146$, $p = 0.885$, $d = .024$, 95% C.I. = -0.303 – 0.351; $t(35)_{Bit\ parts} = -1.3456$, $p = 0.154$, $d = -.243$, 95% C.I. = -0.573 – 0.090. In others words, although recall performance of young and older participants is affected by importance labels, the latter do not remember that importance label itself.

Individual strategies. During debriefing questions, a portion of participants (*N* = 27; 14 young and 13 old) reported using cost-efficient strategies and devoting more resources to the encoding of important characters compared to less important ones. In contrast, others (*N* = 45; 23 young and 22 old) reported using encoding strategies unrelated to importance (e.g. linking items to familiar people/instruments, imagining the character interact with the instrument) or no specific strategy.

In addition to planned analyses, we thus categorised participants based on whether or not they reported using the importance label to prioritise most important characters or devote fewer resources to less important ones to test whether the above effects were driven by the voluntary use of cost-efficient strategies. **Figure 3** shows cued recall performance based on that split. Visually, the impact of Importance labels seems more pronounced and differences between age groups less systematic in participants who reported exploiting importance labels than in participants who did not. To formally test the impact of the reported encoding strategy, we conducted a four-way mixed Analysis of Variance (ANOVA) with Age (young, older) and Strategy (use, no use of importance label) as between-subject factors and Type of information (name, instrument, role) and Importance label (main character, secondary character, bit part) as within-subject factors on mean proportions of correct responses to the cued recall task.

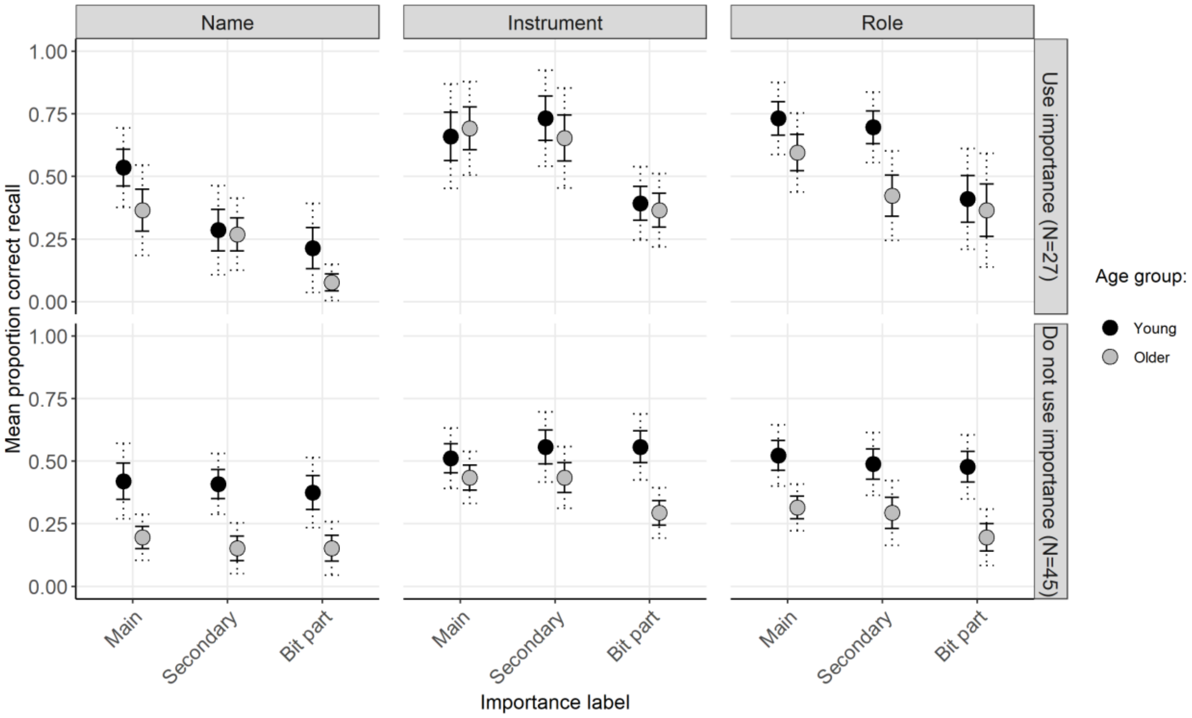

Figure 3. Mean proportion of correct cued recall for the three Types of information as a function of Age and Importance label in participants who report using or not using importance labels during learning. Solid error bars represent standard error of the mean; dotted bars represent 95% confidence interval (Morey, 2008).

In addition to the main effects of Age, Type of information and Importance label described above, there was a main effect of Strategy, $F(1,68) = 6.005$, $p = .017$, $\eta_p^2 = 0.081$, with better recall in those who tuned their learning based on importance label (Mean = .45, *SD* = .34) than in those who did not (Mean = .37, *SD* = .3). A significant interaction between Strategy and Type of information, $F(2,136) = 3.27$, $p = .041$, $\eta_p^2 = 0.046$, suggests that the advantage conferred by importance-related strategies was driven by a better recall of roles in those who used roles to prioritise more important characters

(Mean = .54, *SD* = .218) than in those who did not (Mean = .38, *SD* = .23), $t(70) = 3.005$, $p_{holm} = .024$, $d = .553$, 95% C.I. = 0.014 – 1.119. Recall of names ($Mean_{Use} = .29$, *SD* = .18; $Mean_{NoUSe} = .28$, *SD* = .25) and instruments ($Mean_{Use} = .58$, *SD* = .25; $Mean_{NoUSe} = .46$, *SD* = .22) was similar regardless of strategy, $t(70) = 0.138$, $p_{holm} = .891$, $d = .025$, 95% C.I. = -0.574 – 0.523, and $t(70) = 2.289$, $p_{holm} = .14$, $d = .421$, 95% C.I. = 0.138 – 0.98, respectively. Interestingly, there was a significant interaction between Strategy and Importance label, $F(2,136) = 10.737$, p < .001, $\eta_p^2 = 0.136$. Compared to those who did not report using importance labels, those who reported using them recalled more information about main characters ($Mean_{Use} = .6$, *SD* = .25; $Mean_{NoUSe} = .4$, *SD* = .22; $t(70) = 4.069$, $p_{holm} < .001$, $d = .702$, 95% C.I. = 0.156 – 1.248). The two groups did not differ significantly in their recall of information about secondary characters ($Mean_{Use} = .51$, *SD* = .21; $Mean_{NoUSe} = .39$, *SD* = .21; $t(70) = 2.497$, $p_{holm} = .122$, $d = .431$, 95% C.I. = 0.097 – 0.958) or bit parts ($Mean_{Use} = .30$, *SD* = .13; $Mean_{NoUSe} = .34$, *SD* = .16; $t(70) = 0.774$, $p_{holm} = .880$, $d = .134$, 95% C.I. = -0.383 – 0.650), see **Figure 3**. In other words, those who used cost-efficient strategies recalled more information than those who did not, and that extra information concerned the characters that were the most likely to be encountered in the future. In addition, to further explore this interaction between Strategy and Importance label, we conducted two separate one-way ANOVAs in each subgroup (i.e. participants who did or did not report using importance labels) with Importance label as a repeated measure factor. In participants who did not use importance labels, there was no main effect of Importance label on cued recall, $F(2,88) = 2.229$, $p = .114$, $\eta_p^2 = 0.048$. In participants who reported using importance labels, there was a main effect of Importance labels, $F(2,52) = 23.639$, $p < 0.01$, $\eta_p^2 = 0.476$. Paired comparisons showed that information about main and secondary characters was better recalled than that about bit parts, $t(26) = 6.691$, $p_{holm} < .001$, $d = 1.388$, 95% C.I. = 0.690 – 2.085; $t(26) = 4.719$, $p_{holm} < .001$, $d = 0.979$, 95% C.I. = 0.367 – 1.590, respectively. There was no significant difference between main and secondary characters, $t(26) = 1.972$, $p_{holm} = .054$, $d = 0.409$, 95% C.I. = -0.121 – 0.939. This suggests that the main effect of Importance label described in the pre-planned analysis was driven by participants who explicitly used cost-efficient strategies. No other interaction was significant, all *F*s < 2.

Further, we explored whether the individual use of strategies based on characters' importance affected the encoding of both names and semantic information (instruments), separately in young and in older participants. For both type of information, we calculated a difference score between mean proportions of accurate recall for the most important (main) and the least important (bit part) characters. Positive scores indicate that participants recalled information about main characters better than about bit parts. We conducted two Spearman's correlational analyses on the two difference scores (i.e. for names and instruments) that revealed a significant positive association in both young and older participants, rho = .428, p = 0.009, 95% CI [0.116 – 0.663] and rho = .584, p < 0.001, 95% CI [0.316 – 0.766], respectively. In other words, people who improved their performance based on importance tended to do so with both names and semantic information.

At debriefing, we had also asked participants whether they expected to see mock up episodes or not. Amongst young participants, 27 out of 36 did (75%) and nine did not. Amongst older participants, 28 out of 36 did (77.8%) and eight did not. We thus checked whether the use of cost-efficient strategies depended on participants' expectations to see mock up episodes (across age groups since expectations rates were similar), by means of a Chi square test with Yates' correction[4]. This analysis showed no significant differences in strategy use as a function of expectations to see mock up episodes, $Chi^2(1) = 2.72$, $p = 0.099$.

Learning times. To gain insights on efforts deployed by young and older participants to learn characters' information, we explored whether their respective learning times (i.e. interval between

[4]Distribution of participants in the four subgroups was as follow: Did not use importance labels and did not expect to see episodes, *N* = 14; Did not use importance labels and expected to see episodes, *N* = 31; Used importance labels and did not expect to see episodes, *N* = 3; Used importance labels and expected to see episodes, *N* = 24.

the triplets' appearance and the end of the learning trial/space bar press) varied as a function of the characters' importance across the two learning blocks.

We conducted a three-way mixed ANOVA with Age (young, older) as between-subject factor and Learning block (one, two) and Importance label (main character, secondary character, bit part) as within-subject factors on mean learning times[5]. Mean learning times per condition are shown in **Table 1**. There was a main effect of Learning block, $F(1,70) = 6.261$, $p = .015$, $\eta_p^2 = 0.082$, due to longer encoding times in the first learning block (Mean = 9,660 ms, *SD* = 928) than in the second one (Mean = 9,203 ms, *SD* = 1,475). There was a main effect of Importance label, $F(2,140) = 3.945$, $p = .022$, $\eta_p^2 = 0.053$. Participants devoted more time to secondary characters than to bit parts, $t(70) = 2.781$, $p_{holm} = .018$, $d = .142$, 95% C.I. = 0.018 – 0.269, but other paired comparisons did not reach significance; main vs. secondary, $t(70) = -1.73$, $p_{holm} = .172$, $d = -.088$, 95% C.I. = -0.214 – 0.037; main vs. bit parts, $t(70) = 1.051$, $p_{holm} = .295$, $d = .054$, 95% C.I. = -0.071 – 0.178.

Table 1. Mean learning time (in ms) in young and older participants as a function of Importance label in the two learning blocs. Standard deviations are in parenthesis.

	Bloc 1			Bloc 2		
	Main	Secondary	Bit parts	Main	Secondary	Bit parts
Young	9767 (*750*)	9741 (*970*)	9695 (*1042*)	8656 (*2150*)	8964 (*1615*)	8588 (*2063*)
Old	9576 (*954*)	9618 (*937*)	9568 (*1083*)	9669 (*962*)	9798 (*685*)	9544 (*1149*)

There was no significant effect of Age, $F(1,70) = 3.389$, $p = .07$, $\eta_p^2 = 0.046$, but there was a significant interaction between Age and Learning block, $F(1,70) = 8.746$, $p = .004$, $\eta_p^2 = 0.111$, driven by older participants using more encoding time in the second learning block than young participants, $t(70) = 3.321$, $p_{holm} = .006$, $d = .728$, 95% C.I. = 0.119 – 1.338. The time spent learning by young and older participants in the first learning block was not significantly different, $t < 1$.

[5]Note that the Type of information could not be taken into account here, since roles, names and instruments all appeared within the same learning event.

Finally, there were no significant interactions between Age and Importance label, F(2,140) < 1, or between Learning block and Importance label, F(2,140) = 2.01, p = .138, η_p^2 = 0.028, and no three-way interaction, F(2,140) < 1.

Discussion

We examined whether young and older participants deploy cost-efficient strategies when learning associations between faces, names and semantic information. We isolated one factor amongst multiple potential value-directed or motivation-related factors known to modulate learning (Halamish & Stern, 2022; Hargis & Castel, 2018; Murphy & Castel, 2022), that is, expected utility. We operationalised expected utility as the probability to encounter characters in a hypothetical TV show, which was conveyed to participants via importance labels (i.e. main or secondary characters and bit parts).

Unsurprisingly, older participants recalled less information than young participants. In addition, participants were better at recalling biographical information than names, which is consistent with previous literature (for reviews see Brédart, 2017; Hanley, 2014). However, unlike several prior studies (Barresi et al., 1998; Hargis & Castel, 2017; James, 2004; Old & Benjamin-Naveh, 2012), we did not find the expected interaction between age and the type of information to recall. In other words, the recall of names was not more impaired by aging than the recall of biographical information. Thus, the present results are consistent with studies that did not find a disproportionate age-related impairment in name retrieval (Maylor, 1997; Rendell et al., 2005).

The expected utility of information significantly influenced memory performance in both age groups: participants better recalled information (names, instruments, or roles) for main and secondary characters than for bit parts (but see discussion of individual strategies below). This result is consistent with Hargis and Castel's (2017) study and suggests that, regardless of their age, participants used cost-efficient encoding strategies to focus their efforts on people they are more likely to encounter in the future. Overall, we found no interaction between the importance label and type of information or age. Therefore, participants in both age groups better recalled information about characters they were more likely to encounter in the future than about less important characters, regardless of the nature of that information. This result suggests that manipulating expected utility could be more powerful than merely assigning arbitrary values to information. Indeed, Festini et al. (2013) showed that arbitrary value assignment improved the learning of proper names but not the learning of semantic information such as occupation. Interestingly, while both young and older participants seemed to exploit importance labels to tune their encoding efforts, older participants may not have devoted resources to remembering the labels themselves as their recall of those was at chance level. This perhaps illustrates an additional form of selective encoding used by older participants, in favour of information they deemed more useful (names and instruments).

Our learning phase consisted of two learning blocks and participants had the opportunity to skim through the items at their own pace, giving further insights into their encoding strategies. The analysis of learning times showed an interesting interaction between learning block and the age group. Younger participants' learning times were shorter for the second block than for the first one while there was no difference between blocks for older participants. Older people seem to go on using the maximum allocated time in both blocks. Taken together the analyses on cued recall performance and learning times show that younger participants have better performance than older ones despite using less learning time in the second block. Since in most cases, participants used all of the allocated time, using a self-paced study procedure (see Tauber & Rhodes, 2010; Experiment 4) in which they are instructed to study names and biographical information as long as deemed necessary to perform well in a cued recall task could provide a clearer image of the difference in learning times between young and older participants.

While we found the predicted effect of expected utility, questioning participants about their strategies at the end of the experiment revealed that only just above a third of them reported using importance labels to tune their learning and others used no or different strategies (e.g. imagining the character interact with the instrument). Interestingly, the spontaneous use of cost-efficient strategies does not seem related to age as similar proportions of young and older participants reported using such strategies. A comparison of the two strategy subgroups revealed that the memory advantage for important information compared to less important one was driven by participants who explicitly reported using importance labels to tune their learning. In contrast, there was no significant effect of importance labels in people who did not use them to guide their encoding. In other words, the positive impact of expected utility on learning seems most obvious when expected utility is exploited voluntarily. We also found that on average, those who reported having devoted more resources to important characters remembered more information than those who did not. This memory advantage was driven by a better recall of the importance labels themselves. Although this observation may seem logical or pedestrian, this aspect will warrant further investigation. Indeed, descriptive data suggest that differences between young and older participants may be attenuated in those who reported using cost-efficient strategies (see **Figure 3**). Further, numerically, the advantage for those using cost-efficient strategies seemed to affect all types of information but we may have lacked power to demonstrate it. One limitation of this analysis is of course that participants were categorized as having used a cost-efficient strategy or not from their verbal report only. Nevertheless, in line with the above observations, exploratory correlational analyses showed moderate positive associations between the impact of importance labels on the recall of semantic information and on the recall of names, both in young and older participants. People who remembered more semantic information about main characters compared to bit parts also remembered their names better. It is unclear if inter-individual differences in strategies we observe are linked to pre-existing individual differences in memory or meta-cognitive skills. Future work could thus compare performance of people explicitly instructed to use a cost-efficient strategy (i.e. to focus encoding efforts on items they are more likely to encounter in the future) to performance in a situation where no such instruction is given, to check if all individuals can benefit from a cost-efficient strategy, including those who would not use it spontaneously.

On the one hand, a number of properties of proper names make them particularly vulnerable to retrieval failure. For examples, proper names lack descriptiveness (Brédart, 1998; Fogler et al., 2010), they have no synonyms (Brédart, 1993; Cohen, 1994) and their set size of plausible phonologies is larger than that of common nouns (Brennen, 1993). Another factor that could contribute to name learning difficulty is a poor metacognitive monitoring: people tend to overestimate their ability to learn names and occupation but this overestimation is larger for names than for occupation (Festini et al., 2013; Tauber & Rhodes, 2010). In this context, it could be interesting to mix our manipulation of expected utility of learning information with instructions informing participants that many scientific studies have demonstrated that names were more difficult to learn than biographical information. Such metacognitive instructions might improve name learning and reduce or, even, eliminate the difference between the recall performance for names and biographical information. On the other hand, it could be that notorious difficulties with names also partly derive from cost-efficient strategies, when people deem names less useful than other information. Similarly, some people may give up on learning names in favour of other information after having experienced difficulties with names, worsening their naming performance. Future research could bring answers to those questions by explicitly instructing participants to favour one or the other type of information.

Conclusions

Our results suggest that cost-efficient strategies can be used spontaneously by young and older people alike to tune learning. However, exploratory analyses revealed potentially large individual variations in strategies. Indeed, just over a third of participants reported using importance labels to focus on information they expected to be the most useful, to the detriment of less useful information. A positive correlation between memory advantages for semantic information and for names resulting from importance labels suggests that cost-efficient strategies could benefit both types of information, even if names are notoriously difficult to remember. The current experiment does not tell us whether people who tend to use cost-efficient strategies are also those with better pre-existing memory or meta-cognitive skills or if encouragements to use such strategies could systematically improve encoding and recall. This will be an important question to elucidate as cost-efficient strategies could provide new promising avenues for memory interventions in aging. Interventions could focus on removing complexes of aging patients about not being able to remember everything, and explicitly encourage them to be selective and strategic in concentrating their efforts on information they deem useful.

Authors' notes

Pre-registration of the study design and analyses plans are available on the Open Science Framework: https://osf.io/ktjyb

Dataset is available on https://osf.io/e5t94/

We posted a draft of our manuscript on the preprint server PsyArXiv under the following URL https://psyarxiv.com/38fcv/ on 27 September 2023.

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