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Memory for proper names in old age: A disproportionate impairment?

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A common complaint of older adults is that they have trouble remembering names, even the names of people they know well. Two experiments examining this problem are reported in the present article. Experiment 1 tested episodic memory for surnames and occupations; older adults and younger adults under divided attention performed less well than did full attention younger adults, but showed no disproportionate loss of name information. Experiment 2 examined the ability to name photographs of public figures and of uncommon objects; this experiment therefore tested retrieval from semantic memory. In this case adults in their 70s did show an impairment in recall of names of known people, but not of known objects. Further analyses revealed systematic relations between naming, recognition, and rated familiarity of the categories used. Familiarity largely determined the proportions of recognizable items that were named in a prior phase. Overall, little evidence was found for a disproportionate age-related impairment in naming in either episodic or semantic memory.

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One of the commonest complaints by older adults is an increased difficulty in remembering proper names. This difficulty often occurs at social gatherings when the older person forgets the names of people he or she has just been introduced to; but it also occurs as a failure to recollect well-known names—personal friends as well as names of celebrities and public figures. The first example may simply reflect the well-established inefficiency of new learning associated with ageing, but the second example appears to be a clear case of an age-related problem of retrieval. The present article reports two studies of ageing and name retrieval, the first involving new learning, and the second involving retrieval of previously established information. The general question motivating both experiments was whether there is a special difficulty associated with name recall in older adults; that is, do older adults show a disproportionate impairment in name recall relative to the retrieval of other types of information? Previous research has shown that proper names are the linguistic category most likely to cause retrieval difficulties in normal adults (Maylor & Valentine, 1992) and that proper name recall is the only linguistic problem for some brain-injured patients (see Valentine, Brennan, & Brédart, 1996, for a review). This issue is important both at the behavioural and at the neuropsychological level, as a disproportionate impairment might suggest that brain regions and networks involved in proper name encoding and retrieval are particularly affected by the ageing process, resulting in the behavioural consequences of specific memory failures. Alternatively, it may simply reflect the fact that naming people is a particularly difficult task.

The existing evidence regarding this issue is mixed. First, questionnaire studies in which people rate their own cognitive abilities strongly confirm that older adults perceive themselves to have problems with name retrieval. In fact, forgetting names was by far the largest age-related problem reported in one study (Maylor, 1997). A second source of evidence is diary studies in which adults of different ages record their memory failures over several days or weeks. In one such study, Cohen and Faulkner (1986) found that a group of older adults (mean age 71 years) reported more memory blocks for names than did either a young or a middle-aged group (mean ages 31 and 47 years, respectively). The majority of name blocks occurred for the names of friends or relatives whose names were rated as well known and usually easy to retrieve, suggesting that retrieval failure results from some fluctuation in the efficiency of the retrieval process. In a similar study, Burke, MacKay, Worthley, and Wade (1991) also found that older adults reported a greater incidence of tip-of-the-tongue (TOT) states than did their younger counterparts, and that the age difference was greatest for proper names. Further analysis of the proper names showed that age differences were greater for names of acquaintances than for names of famous people. One plausible reason for this difference is that "place names and famous names may take on a sort of borrowed semanticity (and perhaps associated imagery as well), which links them into the semantic network. Proper names of ordinary people lack semantic associations, and it is this semantic isolation that causes retrieval problems" (Cohen & Faulkner, 1986, p.195).

In the category of laboratory studies, Burke et al. (1991) found that older adults experienced more TOT states for the names of famous people than did younger participants, although Maylor (1997) points out that when TOTs were expressed as a proportion of unsuccessful retrievals, the age differences were similar for nouns, adjectives, verbs, and names. In a more recent study, Evrard (2002) presented photographs of everyday objects and famous people (the task was to name the object or person as rapidly as possible) and found significantly greater percentages of TOT responses for proper names, a greater incidence of TOTs for the group of older adults, and a significant age by word type interaction, suggesting a disproportionate

age-related problem in lexical access to proper names. In line with this result, Maylor and Valentine (1992) presented evidence for a disproportionate slowing of naming on the part of older adults. Finally, in a thoughtful article, Maylor (1997) showed that whereas older adults were less able to retrieve proper names than were their younger counterparts, this age-related difficulty was no more severe for the final stage of recalling the name than it was for such prior stages as face recognition and retrieval of relevant semantic information (Bruce & Young, 1986). That is, according to Maylor there is no compelling evidence to suggest a *disproportionate* age-related impairment in the recall of names. One further point that is unclear is whether any age-related difficulty with name retrieval is purely a semantic memory phenomenon, or whether it is also found in episodic memory. That is, are proper names (or perhaps just names of people) inherently difficult to acquire and remember, possibly reflecting their specificity of reference (Craik, 2002)?

The present experiments were carried out in an attempt to cast further light on these important issues; the first experiment examined episodic memory for newly learned names, and the second investigated semantic memory—the ability to name pictures of public figures and uncommon objects. In Experiment 1, we capitalized on the ingenious study by McWeeny, Young, Hay, and Ellis (1987) in which the investigators tested younger adults and contrasted memory for unambiguous surnames (e.g., Hyde, Rothwell) and occupations (e.g., architect, grocer) with that for surnames that are also names of occupations (e.g., Baker, Cook). McWeeny and her colleagues found that ambiguous labels were better recalled when they were presented as occupations than as names. That is, it is harder to recall that a person's name is Baker than to recall that his occupation is a baker. We argued that if older adults do have a specific difficulty in learning and recalling names of people, then they should show a greater drop than do their younger counterparts in the ability to recall ambiguous labels when they are surnames than when they are occupations. Furthermore, it may be the case that situations of reduced attentional resources (e.g., divided attention) in younger adults might lead to comparable impairments to that of older adults in terms of name and occupation recall. In Experiment 2 we presented photographs of famous people and uncommon objects for participants to name. The same photographs were then presented in two further phases; in the first of these, participants were given a multiple-choice identification test to check whether they could select the correct name, and in the final phase they rated how well they knew the photographed person or object. This procedure allowed us to examine age differences in failures to recall the names of people and objects that participants knew well. Again, if older adults have a disproportionate problem with proper name recall then, relative to young adults, they should fail to recall a larger proportion of names of people or objects that they do in fact know; further, this age-related difference should be greater for the names of people than for the names of objects.

EXPERIMENT 1

Three groups of participants studied photographs of unfamiliar male faces, each of which was labelled with a name and an occupation (e.g., "Mr. Stevens is a lawyer") and later attempted to recall these labels when shown the series of faces. The three groups were one group of older adults, one group of younger adults who studied the faces and labels under full attention, and one group of younger adults who studied the faces and labels under conditions of divided attention (DA). The reason for running the third group was to explore

the possibility that division of attention might produce a pattern of results similar to that produced by the effects of ageing. Previous research has shown such similarities (Castel & Craik, 2003; Craik, 1982; Troyer & Craik, 2000), and it was hoped that inclusion of the young divided attention group might help to elucidate the factors relevant to remembering names.

Method

Participants

A total of 24 older adults (14 women, 10 men, mean age = 70.2 years, mean number of years of education = 14.2) participated in the study and were offered $10 to cover their expenses for participation. A total of 24 undergraduate students from the University of Toronto (14 women and 10 men, mean age = 22.9 years, mean number of years of education = 15.8) comprised the young full attention group (young-FA); they had volunteered to participate and received course credit for participation. A second group of 24 undergraduates from the University of Toronto (18 women and 6 men, mean age = 19.1 years, mean number of years of education = 13.6) comprised the young divided attention group (young-DA); they were also volunteers who received course credit for participation. The young-FA group was drawn from second- and third-year university courses, whereas the young-DA group was drawn from first year courses; the groups therefore differed in their years of education, $t(43) = 7.27$, $p < .001$. The young-FA group had also received more education than had the older group, $t(46) = 3.10$, $p < .01$, as is often the case in cognitive ageing studies. However, the older adult group and the young-DA group did not differ in this respect, $t(46) = 1.32$, $p > .10$.

Materials and design

Photographs of 16 male faces were chosen from a pool of nonfamous middle-aged faces maintained by the Psychology Department at the University of Toronto. The selection of the faces was based on the criteria that none of the faces had facial hair or wore glasses, and the photos of the faces were cropped such that they were free of any background information. They were in black and white and were presented on a VGA computer screen. Eight "ambiguous" names (names that could also be an occupation, e.g., Mr. Baker) and eight "unambiguous" names (names that are not typically thought of as occupations, e.g., Mr. Stevens) were then chosen from the Toronto telephone book and were matched for frequency of occurrence (based on the procedure used by McWeeny et al., 1987). These 16 names were then randomly assigned to the faces and were paired with either an ambiguous occupation (e.g., barber) or an unambiguous occupation (e.g., lawyer). The occupations were normed and matched for frequency of occurrence. In total, there were four different "types" of name–occupation pairs, each with four exemplars: (a) unambiguous name–unambiguous occupation (e.g., Mr. Edwards is a lawyer), (b) unambiguous name–ambiguous occupation (e.g., Mr. Stevens is a cook), (c) ambiguous name–unambiguous occupation (e.g., Mr. Singer is a banker), (d) ambiguous name–ambiguous occupation (e.g., Mr. Baker is a barber). A complete list of the materials is presented in Appendix A. Two different versions of the face–name–occupation slides were constructed such that ambiguous names in one version served as ambiguous occupations in the other version, and vice versa. This counterbalancing technique was between subjects and allowed for a between-subject comparison of how well these words were remembered when they served as names and when they referred to occupations.

Procedure

Participants were tested singly and were told that they would be presented with faces, as well as the name and occupation of the person, on the computer screen. They were told that their task was to

remember the person's name and occupation for a later memory test, in which they would be presented with the face, and that they would be asked to recall as much information as possible (name or occupation or both) associated with the face. The 16 slides were presented twice during the study phase (in the same order), and all of the information was presented visually. Thus, on each slide, below the photo of the face, the phrase "Mr X is a Y" was printed in 32-point Times New Roman font. Each slide was presented for 10 seconds, followed immediately by the next slide. In total, the study phase took just over 5 minutes to complete. Participants then began the recall phase, in which they were presented with the faces one at a time (for 10 seconds each) and attempted to recall the associated name and occupation; the order of presentation was different from that of the study phase.

In addition to studying the stimuli, participants in the DA condition also carried out a secondary task (digit monitoring) during the study phase of the experiment. The digit-monitoring task consisted of an auditory presentation of single digits ranging from zero to nine in a random order. Twelve hundred digits were spoken by a female voice and recorded on a tape recorder at a rate of one digit every 1.5 seconds, producing a 30-minute long recording. The participant's task was to monitor the series of digits for target sequences defined as "three successive odd digits" (e.g., 3,9,1, or 9,5,1) and to report the targets to the experimenter. The lags between target sequences ranged from 6 to 19 digits, with a mean lag of 12.5 digits. Each participant was exposed to 14 target sequences during the study phase of the experiment, and performance on this task was recorded by the experimenter. The retrieval phase of the experiment was performed under full attention conditions for all participants.

Results and discussion

The overall recall performance for the three groups is shown in Figure 1 with the means collapsed over both types of names and occupations (ambiguous and unambiguous). This overall pattern shows that occupations were better recalled than surnames, and that the advantage for occupations was similar for all three groups (i.e., there was no evidence for a disproportionate impairment for names for the older adults relative to the other two groups, although all three groups remembered fewer names than occupations). The figure also shows that the young-FA group performed at a higher level than did the old and young-DA groups; these

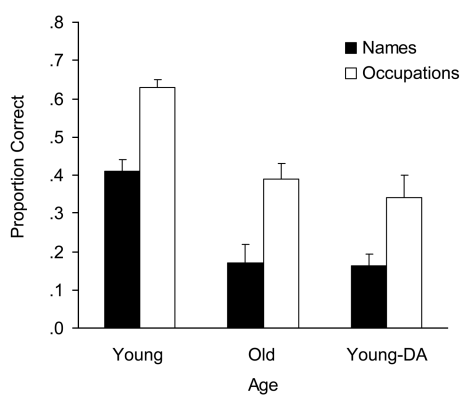

Figure 1. The mean overall proportions of correctly recalled names and occupations for younger adults, divided attention younger adults (young-DA), and older adults in Experiment 1. Error bars represent standard errors of the mean.

TABLE 1
The mean proportions of correctly recalled names (ambiguous and unambiguous) and occupations (ambiguous and unambiguous) for each group in Experiment 1

	Names				*Occupations*			
	Ambiguous		*Unambiguous*		*Ambiguous*		*Unambiguous*	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Young-FA	.43	.25	.40	.24	.62	.24	.64	.23
Old	.14	.11	.21	.17	.30	.16	.50	.19
Young-DA	.12	.15	.19	.18	.28	.19	.41	.15

last two groups performed comparably, with both showing a similar impairment for names relative to occupations. The young-DA group detected 81% of the target sequences in the digit-monitoring task, confirming that they had divided their attention between auditory monitoring and the study of the visual material. To provide greater detail, the data are also presented split down into ambiguous and unambiguous items in Table 1. The table confirms the superior recall of occupations over surnames, even when the words were identical (baker vs. Baker) in the ambiguous case, and it confirms the higher performance of the young-FA group. There is also some suggestion that unambiguous items are better recalled than ambiguous items in the old and young-DA groups, but not in the young-FA group. A three-way analysis of variance (ANOVA; Group × name/occupation × ambiguity) on these data revealed main effects of group, $F(2, 69) = 24.97$, $MSE = 0.09$, $p < .001$, of name/occupation, $F(1, 69) = 207.60$, $MSE = 0.02$, $p < .001$, and ambiguity, $F(1, 69) = 26.92$, $MSE = 0.06$, $p < .001$. The interaction between name/occupation and ambiguity was reliable, $F(1, 69) = 6.85$, $MSE = 0.03$, $p = .01$, showing that unambiguous labels had a greater recall advantage in the case of occupations than with surnames. The only other interaction to approach significance was that between ambiguity and group, $F(2, 69) = 2.90$, $MSE = 0.02$, $p = .06$, signaling a trend for the superior recall of unambiguous words to be confined to the old and young-DA groups. A further $2 \times 2 \times 2$ ANOVA comprising only the old and young-DA groups revealed no main effect of group and no interactions involving groups (all Fs < 1).

The results of Experiment 1 confirm the interesting finding of McWeeny and colleagues (1987) that the same words are better recalled when they are presented as occupations rather than as names, and that this holds true for both younger and older adults. We endorse the suggestions of previous researchers (e.g., Cohen & Burke, 1993; Cohen & Faulkner, 1986) that this superiority is probably due to the greater semantic richness of such occupational terms as baker, cook, and carpenter than that of their counterparts as surnames (Baker, Cook, and Carpenter), especially perhaps in situations like the present one in which these surname labels were associated episodically to previously unknown faces. The drop in recall performance from occupations to surnames was equivalent for all three groups, however, disconfirming the hypothesis that older adults would be disproportionately disadvantaged by the switch to proper names. This experiment thus provided no support for the notion that name recall is especially penalized by the ageing process.

Other results of interest include the superior recall of unambiguous words (e.g., Jones, architect) and that this finding was confined to the old and young-DA groups (for young-FA,

unambiguous mean = .52, ambiguous mean = .53; Table 1). Speculatively, the reduced efficiency of encoding processes in the young-DA, and presumably also in the old, group had a greater deleterious effect on ambiguous words, leading perhaps to confusion at retrieval as to whether the word had been a name or an occupation. It should be noted that errors (e.g., recalling an incorrect name or occupation for a given face) were similar for all three groups, with incorrect name recall occurring on 5–8% of all trials (5% for young-DA, 6% for older adults, and 8% for young-FA), and incorrect occupation recall occurring on 11–13% of all trials (11% for both young-DA and older adults, and 13% for young-FA). Finally, the experiment provides a further illustration of the similarity between the effects of divided attention and ageing on human memory (e.g., Castel & Craik, 2003; Craik, 1982; Troyer & Craik, 2000). The similarity goes beyond the simple demonstration of poorer performance in the old and young-DA groups; it is also seen in the comparable reduction in recall of name and occupation words, and in the comparable asymmetry in the reduction of ambiguous and unambiguous words relative to the young-FA group.

In summary, Experiment 1 showed that older adults recalled fewer newly learned names than did younger adults, but that this age-related loss was proportional to the age-related loss in memory for names of occupations. Apparently older adults have no special difficulty with people's names in episodic memory. Experiment 2 examined possible age differences in the ability to name photographs of public figures and relatively uncommon objects. It thus dealt with the recall of names from semantic memory.

EXPERIMENT 2

In overview, younger and older adults were shown two separate series of 36 photographs; one series was of public figures, and the other was of uncommon objects. The participant's task was to name the person or object. If they were unable to provide a name, participants rated how well they thought they knew the name on a 4-point scale. If they did produce a name, participants rated their confidence in their answer on a 4-point scale. After viewing all 36 photographs in this first phase, participants were shown the complete set again in a second phase. The purpose of the second phase was to see whether the participant could recognize the correct name. To this end, we provided a list of the 36 correct names plus 36 similar distractors, mixed together in alphabetic order. The participant selected a name that matched the current photograph and again indicated his or her confidence in the choice on a 4-point rating scale. The series of 36 photographs was then shown for a third time; in this phase each photograph was named by the experimenter, and the participants' task was to rate how familiar the person or object (plus its name) was to them. The entire procedure was then repeated for the second series of 36 photographs.

This three-phase design enabled us to determine which names of faces or objects each participant knew—as indicated by correct identification in Phase 2 plus high rated familiarity in Phase 3. The person's ability to name the photograph in Phase 1 was then expressed as the number of people and objects named as a proportion of people and objects they actually knew. Naming latencies were also recorded. The main points of interest were to check whether older adults were less able to name photographs of items they knew, whether there were any differences between the ability to name people as opposed to objects, and whether the ability to name was affected by the familiarity of the category from which stimuli were

drawn. Preliminary evidence suggested that adults older than 70 years might be particularly vulnerable to naming problems, so three groups of participants were tested: young adults, young-old adults (mean age = 67 years), and older old adults (mean age = 73 years).

Method

Participants

A total of 60 adults participated in the experiment: 20 young (mean age = 21.3 years), 20 young-old (mean age = 66.9 years), and 20 old-old (mean age = 73.4 years). Table 2 summarizes the characteristics of the three age groups. The groups did not differ significantly on their health self-ratings or on their number of years of education ($F < 1$ in both cases). The young adults were undergraduates from the University of Toronto; they volunteered to participate and received course credit for participating. The older adults were community dwelling participants who were offered $10 to cover their expenses. Given that the study involved familiarity with the names of famous people and of objects connected with North American culture, it was important to ascertain that our groups were reasonably homogeneous in this respect. Table 2 demonstrates that all participants had lived in Canada or the US for a large part of their lives, and that nearly all had spoken English all their life.

Materials

There were two sets of items: pictures of 36 famous faces and pictures of 36 somewhat uncommon objects. Each set comprised six categories, with six items in each category. The "famous faces" stimuli were photographs of public figures, mostly in colour, taken against a plain background and without such context cues as sports clothes or professional equipment. For each person depicted we selected the name

TABLE 2
The characteristics of participants in Experiment 2

		Young adult[a]		*Young-old*[a]		*Old-old*[a]	
		M	*SD*	*M*	*SD*	*M*	*SD*
Age[b]		21.25	3.02	66.85	1.35	73.40	2.76
Sex	Number of men	7		4		5	
	Number of women	13		16		15	
Health self ratings[c]		2.05	0.89	2.00	0.92	1.95	0.94
Education: years completed		15.90	1.62	16.27	2.52	16.10	3.16
Years living in Canada/US		18.50	5.12	56.80	16.20	66.40	13.08
Years speaking English		18.95	5.06	66.65	1.46	72.90	3.23

[a]$n = 20$. [b]In years.
[c]Participants rated their own health on scale of 1 (excellent) to 5 (poor).

of a similar distractor person to be used in the recognition test in the second phase of the study. Half of the famous faces depicted women, and half depicted men. The six categories plus their paired distractors are shown in Appendix B. The final set of 36 photographs was chosen after conducting pilot tests with 5 older and 4 younger adults; the personalities were selected so that all participants would find the set reasonably challenging and so that floor and ceiling effects would be avoided. Pictures of objects were also selected so that participants of all ages would find them challenging but possible; the final selection was again made after considering pilot results from 5 older and 4 young adults. Half of the 36 objects were living things, and half were manmade objects, again organized into six categories of six items each (Appendix B). The object images were obtained from the Hemera Photo-Objects 50,000 Volumes 1 and 2. Photo-objects are photographic images of objects without the surrounding background. They were in colour and were presented on a VGA computer screen.

In the second phase of the experiment, participants were presented with a typed sheet of 72 names after each block of items (famous faces or objects). In the case of famous faces, the task sheet had two separate alphabetic lists of men and women. The sheet for objects had two separate alphabetic lists of living and nonliving objects. The sheets were organized in this way to facilitate participants' ability to check the list rapidly (although this phase was untimed). In each recognition set the target names and distractors were mixed and presented on one sheet in a large font that could be easily read.

Half of the participants in each group were given the famous faces first, and half were given the objects first. Additionally, there were two different random orders of the items within each set; half of the participants in each age group were given one order, and the remainder were given the other order. The items were shown in the same order in each phase.

Procedure

Phase 1: Naming task. Participants were tested singly. After filling in a brief questionnaire giving basic biographical information (Table 2), participants were told that we were interested in people's ability to recollect names of famous people and of objects. They were also told that after providing a name they had to rate each item as to how certain they were that the name was correct: 1 = very uncertain; 2 = fairly uncertain; 3 = fairly certain; and 4 = very certain. Each face or object to be named was exposed for 10 seconds; if participants could not remember the name in that time, they were asked whether they had any idea of the name. Again a 4-point rating scale was used in which 1 = no idea, 2 = some idea, 3 = fairly sure, and 4 = certainly know name, but just cannot recall it. Participants were then given a practice trial in which the use of the rating scales was rehearsed, and the importance of first giving the full name of the person or object as quickly as possible was stressed.

In the main part of the experiment each picture was shown for a maximum of 10 seconds, followed by a blank screen. As soon as the participant said the name of the item, the experimenter pressed a key that brought up the blank screen. This key press also recorded the response latency. If no response was given by the participant, the blank screen appeared after 10 seconds. While the screen was blank, participants rated the certainty of knowing the item name (whether of not they had recalled the name) and then the experimenter pressed a key that displayed the image of the next item.

Phase 2: Recognition task. This phase immediately followed Phase 1. Participants were given the appropriate recognition task sheet and were told that they would be shown the same series of pictures again but this time they had to select the name of the person or object from the sheet. For the famous faces, participants were informed that the recognition sheet of 72 names was organized alphabetically and that men and women were listed separately. For the objects, they were informed that the list of names was organized alphabetically and as separate lists of living and nonliving objects. After selecting a name from the list (in their own time), participants were required to give a 4-point certainty rating where 1 = complete guess, 2 = possibly correct, 3 = fairly sure, and 4 = complete certainty. As

in Phase 1, the experimenter recorded the responses said aloud by the participant. The experimenter exposed the next slide as soon as participants made their selection and had given their rating.

Phase 3: Familiarity ratings. This phase followed immediately after Phase 2. Participants were informed that they would see the same pictures for a third time, but that this time the experimenter would say aloud the name of the famous person or object as it was presented. They were then told that their task was to rate how familiar the combination of name and person (or object) was, using a 4-point rating scale (1 = never encountered, 2 = some slight experience, 3 = fairly well known, and 4 = extremely familiar). It was emphasized that they were required to rate the familiarity of the object/person as pictured in combination with the name. The pictures were shown in the same order as in the first two phases. Participants responded by saying the rating aloud, and the experimenter recorded their responses. After participants had given their response, the experimenter initiated the presentation of the next item.

Results and discussion

The principal results are shown in Table 3 and Figure 2. The main measure of interest is the proportion of known items named (see Figure 2), for the two types of item and three age groups, but other measures are also provided to give a fuller picture. The first line in Table 3 shows the number of public figures ("faces") and objects named out of the 36 presented. This number declined with age for faces, but increased somewhat with age for objects. A 3×2 ANOVA (Age Group $\times$ Type of Item) revealed that age was not a significant main effect, $F(2, 57) = 2.92$, $MSE = 32.09$, $p = .062$, but that the Age $\times$ Item interaction was significant, $F(2, 57) = 7.09$, $MSE = 29.96$, $p = .002$. The main effect of item was also significant, $F(1, 57) = 34.27$, $MSE = 29.96$, $p < .001$. That is, objects were more easily named than famous faces, and this was particularly true for the older participants. Within each type of item, age was a significant simple main effect for naming faces, $F(2, 57) = 4.69$, $p = .013$, and for naming objects, $F(2, 57) = 5.28$, $p = .008$. The age-related trend was different in the two cases, however, with the old-old group being poor at naming public figures, but the young adults being worst at

TABLE 3
The overall results from Experiment 2

	Faces						*Objects*					
	Young adult		*Young-old*		*Old-old*		*Young adult*		*Young-old*		*Old-old*	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Number named[a]	14.9	5.5	14.3	7.3	9.6	5.1	15.9	5.9	20.8	4.3	19.7	4.8
Number recognized[a]	24.2	4.9	24.9	8.1	21.5	7.1	25.1	4.9	30.8	3.7	31.0	3.5
Proportion known[b]	.64	.14	.64	.24	.56	.19	.65	.14	.81	.11	.78	.15
Proportion of known items named	.64	.16	.57	.17	.46	.13	.65	.17	.71	.12	.68	.11
Reaction time[c]	3.15	0.47	4.13	0.74	4.31	0.79	3.28	0.63	3.55	0.60	3.72	0.68

Note: See text for a more detailed description of the measures.
[a]Out of all 36 faces and 36 objects.
[b]*Known* was defined as items recognized and also given familiarity rating 3 or 4.
[c]Reaction time in seconds for correctly named items, regardless of familiarity rating.

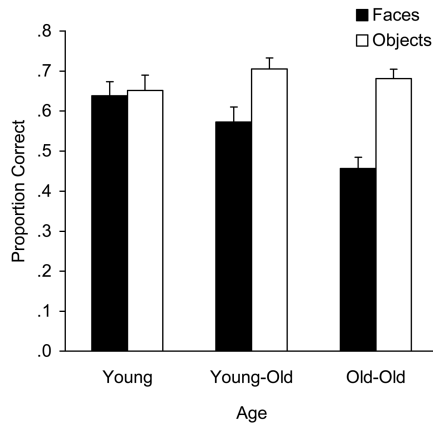

Figure 2. The mean proportions of items correctly named as a proportion of those recognized for items rated 3 and 4 for familiarity in Experiment 2. Error bars represent standard errors of the mean.

naming uncommon objects. Clearly this pattern of results may well reflect the specific public figures and objects chosen, but it is interesting to note that whereas the old-old and young-old groups do not differ in their ability to name objects, the old-old group is significantly poorer than the young-old group at naming faces (Tukey post hoc test, $p = .042$).

The number of items recognized in Phase 2 shows a similar pattern. Overall, the main effect of age was only marginally significant, $F(2, 57) = 3.12$, $MSE = 32.78$, $p = .052$, and the Age $\times$ Item interaction was significant, $F(2, 57) = 6.18$, $MSE = 30.50$, $p = .004$. Table 3 shows that for faces, young and young-old groups recognized the same number of public figures, but the old-old group recognized somewhat fewer; tests of simple effects showed that age was not a significant effect, however, $F(2, 57) = 1.38$, $p = .260$. For objects, in contrast, age was a significant simple main effect, $F(2, 57) = 13.73$, $p = .001$, and Tukey post hoc tests revealed that the two older groups recognized the same number ($p = .979$), but the young group recognized significantly fewer than did both older age groups ($p < .001$). The same pattern occurs in the proportions of items that were known to participants—where "known" is defined as an item that was selected correctly in the recognition phase and was also given a familiarity rating of 3 or 4 in the third phase. Age approached significance as a main effect ($p = .064$), and the age by item interaction was significant, $F(2, 57) = 4.10$, $MSE = 0.03$, $p = .022$. Age was not significant for the proportion of known public figures ($p = .348$) but age was a significant simple main effect for the proportion of known objects $F(2, 57) = 8.71$, $p = .001$. Post hoc tests revealed that the two older groups knew the same proportion of objects ($p = .668$), but the young group knew significantly fewer objects than did both older age groups ($p < .001$).

For each participant we calculated the number of items "known" as those recognized in Phase 2 that were also given a familiarity rating of 3 or 4 in Phase 3. We then calculated the proportion of these known items correctly named in Phase 1. The results are shown in Figure 2. An overall ANOVA on these data revealed that age was not a reliable main effect, $F(2, 57) = 2.89$, $MSE = 0.02$, $p = .064$, but that the age by item interaction was highly reliable, $F(2, 57) = 6.68$, $MSE = 0.02$, $p = .002$. The interaction reflects the finding that naming of known objects did not change with age ($F < 1$), but age was a significant simple

main effect for the naming of known public figures, $F(2, 57) = 7.25$, $p = .002$. Tukey post hoc tests revealed that the old-old named a significantly lower proportion of known public figures than did the young ($p < .001$) and the young-old ($p = .05$), but the young and young-old groups named the same proportion ($p = .370$). Additionally, known objects were named more often than faces by the young-old, $F(1, 57) = 10.53$, $p = .002$, and by the old-old, $F(1, 57) = 30.17$, $p < .001$, but not by the young group, $F < 1$ (as shown in Figure 2).

Since we considered this analysis the most revealing, we checked the validity of the results by re-analysing the data taking items as the random factor. That is, we calculated the proportion of participants who named each item given that it was known to them, as defined above. Items were blocked into categories (e.g., musicians, politicians, games, fruit) and separate 3 (age groups) × 6 (categories) ANOVAs were run for the faces and objects. For faces, the ANOVA revealed a main effect of age $F(2, 60) = 8.43$, $MSE = 0.02$, $p < .001$, showing that the old-old named fewer people that they knew. The effect of category was also significant, $F(5, 60) = 4.04$, $MSE = 0.09$, $p < .01$, as was the interaction between age and category, $F(10, 60) = 7.76$, $MSE = 0.02$, $p < .001$. Thus some categories gave participants more difficulty than others (e.g., Canadian politicians = .33; popular musicians = .67), and there were marked age difference in this respect (e.g., classic actors were named often by the old-old group, .71, but infrequently by the young group, .38, whereas contemporary actors showed the opposite trend, old-old = .37, young = .78). Bear in mind, however, that all of the naming proportions are of the items that were well known to the participants. A similar ANOVA was run on an item analysis of the object data. This analysis showed a main effect of age, $F(2, 60) = 3.16$, $MSE = 0.02$, $p = .049$, and no effect of category ($F < 1$) but a significant age by category interaction, $F(10, 60) = 4.02$, $MSE = 0.02$, $p < .001$. The proportions of known items named by each group and category are shown in Appendix C. The finding that the proportion of well-known items named varied substantially from category to category was unexpected and is considered in a following section. It should be emphasized that the item analysis yielded essentially the same result as the analysis by participants—there was no effect of ageing on object naming (means were .60, .68, and .67 for young, young-old, and old-old, respectively) but there was a significant effect of ageing on the naming of people (means were .52, .57, and .43 for the young, young-old, and old-old, respectively).

Finally, the bottom line in Table 3 shows mean naming latencies for the different groups and item types. An ANOVA on these data yielded significant main effects of age, $F(2, 57) = 14.24$, $MSE = 0.50$, $p < .001$, and of item type, $F(1, 57) = 9.79$, $MSE = 0.38$, $p < .01$, as well as a significant interaction between age and item type, $F(2, 57) = 4.45$, $MSE = 0.38$, $p < .05$. Table 3 shows that reaction time increased systematically with age as expected; it also shows that naming persons took longer than naming objects—but only for the two older groups; the young adults showed a nonsignificant trend in the opposite direction.

Familiarity: In order to be "fair" to the various age groups, the categories of objects and names included in the experiment were chosen such that some would be more familiar to young adults and some more familiar to older adults. The item analysis showed that this happened, both at the level of categories and at the level of items (e.g., George Clooney was named by 20 out of 20 young adults, 7 out of 20 young-old, and 3 out of 20 old-old, whereas Judy Garland was named by 0, 11, and 16 young, young-old, and old-old adults, respectively). We expected these asymmetries, but argued that a valid estimate of age-related naming problems could be obtained by conditionalizing on those items that each participant

knew—defined as items that were correctly recognized in Phase 2 and also rated "fairly well known" or "extremely familiar" in Phase 3. However (prompted by reviewers of a previous draft), it also seemed worthwhile to check whether the ability to name people or objects varied as a function of the item's familiarity, even if the item was correctly identified in Phase 2. Accordingly, for each category we calculated the ratio of items correctly named in Phase 1 over items correctly recognized in Phase 2, and we plotted this ratio against the average rated familiarity of each category. These calculations were performed separately for each age group and separately for objects and public figures.

If the ratio of items named to items recognized is independent of familiarity the scatterplot should be random, but Figures 3a and 3b show that the relation is highly lawful. For categories of high mean familiarity, the ratio of items named to items recognized was also high. For the faces data (Figure 3a) the correlation between familiarity and the name/recognized ratio was $r(16) = +.88$, and for the objects data (Figure 3b) the corresponding correlation was $r(16) = +.71$, both $p < .01$. It is also clear from Figure 3 that there were no systematic differences associated with age group; the ratio of items named to items recognized is strongly influenced by rated familiarity in all three age groups.

One possible reason for the strong relationship between the named/recognized ratio and familiarity is that prior success, or lack of success, at naming each item in Phase 1 influences the familiarity rating that it is given in Phase 3 (cf. Valentine, Hollis, & Moore, 1998). A stronger reason is provided by the scatterplots shown in Figure 4, however. These graphs plot the probability of naming and recognizing items as a function of familiarity. For both the faces data and the object data, recognition performance is higher than naming performance, and both recognition and naming functions are well fitted by linear functions. It is also clear from the figures that the ratio of named to recognized items will therefore decline

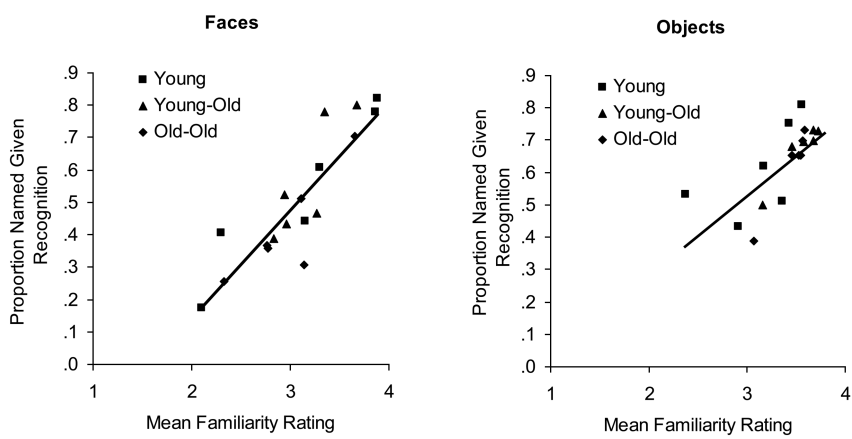

Figure 3. The mean proportions of items correctly named in Phase 1 given recognition in Phase 2, plotted as a function of mean rated familiarity of each category in Experiment 2. Data from faces stimuli are shown in the left panel (3a), and data from the object stimuli are shown in the right panel (3b). The regression lines represent the best-fit linear function for all data points (see text for details).

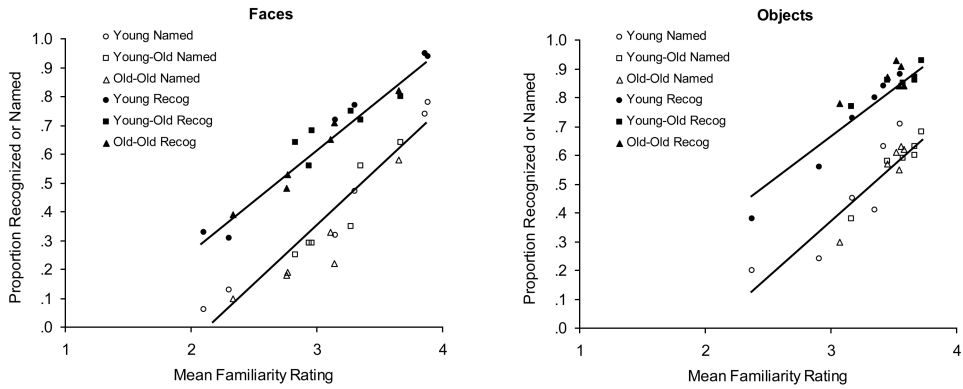

Figure 4. The mean proportions of items correctly named in Phase 1 (open symbols) and correctly recognized in Phase 2 (filled symbols) as a function of rated familiarity (Phase 3) for each category and age group in Experiment 2. Faces stimuli are shown in the left panel (4a), and object stimuli are shown in the right panel (4b). The regression lines represent the best-fit linear functions for correctly named and correctly recognized items for all age groups (see text for details).

systematically from highly familiar to less familiar categories. It is important to note that for both recognition and naming, younger and older adults appear to lie on the same function. Although in the faces data the old-old group has a lower mean familiarity rating (2.96) than either the young-old group (3.17) or the young adult group (3.10), these differences were not significant by a one-way ANOVA, $F(2, 57) = 1.26$, $MSE = 0.23$, $p > .05$. For the objects data, familiarity ratings rose with age (means were 3.13, 3.45, and 3.54 for young, young-old, and old-old groups, respectively), and in this case the differences were significant, $F(2, 57) = 10.22$, $MSE = 0.09$, $p < .001$.

Figures 3 and 4 make it clear that naming and the ratio of named to recognized items are strongly determined by familiarity. Does this mean that the age-related drop in ability to name known faces reported in the previous section simply reflects an age-related reduction in familiarity? We argue against this possibility on two grounds; first, there is no reliable age-related decrease in mean familiarity ratings, and, second, the previously reported ratio was the proportion of known items named, where "known" signified recognized items that were also given familiarity ratings of 3 or 4. The ratio thus controls for familiarity, or at least restricts consideration to well-known faces and objects. Finally, Figure 4a reveals that the naming data for faces in the old-old group tend to fall beneath the best-fit function for the whole group (five of the six categories fall below the function) whereas five of the six categories for the young group fall either on or above the line. Our conclusion is therefore that whereas familiarity is a strong predictor of naming ability, there is an additional negative effect of ageing on naming public figures that does not appear to apply to the naming of objects.

In summary, Experiment 2 showed that older adults, especially those over 70 years of age, were less able than their younger counterparts to name public figures that they demonstrably knew. This age-related trend was not found for the ability to name uncommon objects, however. Further analyses showed that the ratio of named to recognized stimuli declined systematically as a function of the mean familiarity of each category, calculated from the familiarity ratings given in Phase 3 (Figure 3), and that absolute probabilities of correct

naming (Phase 1) and correct recognition (Phase 2) also declined systematically as rated familiarity declined (Figure 4). The strong relation between familiarity and the named/recognized ratio (Figure 3) is thus understandable in terms of the declining functions for naming and recognition shown in Figure 4. Given that both functions decline linearly with decreasing familiarity, it follows that the proportion of recognized items that were named also declines as familiarity declines. The old-old group's relative inability to name recognizable faces may thus be driven partly, but not wholly, by their lower rated familiarity for some of these categories.

GENERAL DISCUSSION

The principal objective of the study was to gather further evidence on the question of whether older adults suffer a disproportionate loss in memory for names, relative to memory for other types of information. The two experiments reported here appeared at first to yield contradictory answers to this question: Experiment 1 found equivalent age-related losses for surnames and occupations, whereas Experiment 2 showed that adults in their 70s were as good as young adults at recollecting the name of known objects, but were substantially poorer than young adults at recollecting the names of known public figures. One obvious difference between the experiments is that Experiment 1 involves new learning and the episodic pairing of labels (whether "surname" or "occupation") with previously unknown faces, whereas Experiment 2 involves the retrieval of well-learned information. In a previous study, Cohen and Faulkner (1986) also found equivalent age-related losses in proper names and other types of information (places, occupations, hobbies) when the material was previously unknown and presented in an episodic learning situation. As in the present Experiment 1, Cohen and Faulkner found that surnames were recalled less well than occupations (although in their experiment the exemplars were different words).

One further finding from Experiment 1 was the equivalent pattern of results shown by the older adults and the young-DA group, which is similar to other experiments involving comparisons between ageing and divided attention in terms of memory performance (e.g., Castel & Craik, 2003). Relative to the young adults working under full attention, both groups showed proportionate age-related decrements in recall of names and occupations. In the present Experiment 1, the young-DA group worked under divided attention conditions at encoding only—retrieval was performed under full attention conditions. A tentative conclusion is therefore that the parallel memory loss for names and occupations shown by the older adults is attributable to an encoding deficit. This conclusion further differentiates the two present experiments, with Experiment 1 illustrating an age-related encoding impairment and Experiment 2 illustrating an age-related problem of retrieval.

In order to equate the knowledge base for naming in Experiment 2, we conditionalized naming ability on items that were known to each participant, where "known" was defined as items that were recognized in Phase 2 and were also rated "fairly well known" or "extremely familiar" in Phase 3. On this basis, the data showed that naming ability declined with age for famous faces but not for uncommon objects. It should be noted, however, that this age-related decline is not necessarily a disproportionate impairment; it may very well be the case that other relevant cognitive operations show comparable losses in our older group (cf. Maylor, 1997). Nonetheless, compared with the ability to name known objects, the older groups showed some impairment. The young adults named the same proportion of known

faces (.64) as known objects (.65), but for the young-old group the proportions were .57 and .71, respectively, and for the old-old group the proportions were .46 and .68, respectively.

These comparisons must be treated cautiously, however, in light of the analyses shown in Figures 3 and 4. The ratio of named to recognized items declined as a function of declining familiarity of categories used (Figure 3), and this relationship is understandable in terms of the relative decline of naming and recognition shown in Figure 4. Given that there are no obvious differences among the age groups in these functions, we concluded that the age-related impairment in naming faces is partly but not wholly attributable to a corresponding decline in rated familiarity for the categories used.

This conclusion immediately raises the question of what factors determine rated familiarity. Clearly the major determinant must be exposure to the name and face of the public figure, or the name and appearance of the object. The names of the Canadian politicians used in the study (see Appendix B) are probably not well known outside of Canada, for example. Recency of usage is a second likely factor, as are the variables of naming success and recognition success from Phases 1 and 2. The relative salience of these and other factors, and how they interact to give rise to the final experience of familiarity at different ages, are interesting questions for further research.

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APPENDIX A

Materials used in Experiment 1

Unambiguous names
Dixon, Flynn, Gilmour, Graham, Gordon, Harrison, Spencer, Waddell

Ambiguous names/occupations
Baker, Barber, Bishop, Butler, Carpenter, Cook, Farmer, Gardener, Mason, Mechanic, Merchant, Painter, Potter, Singer, Tailor, Usher

Unambiguous occupations
Actor, Banker, Butcher, Doctor, Engineer, Lawyer, Teacher, Politician

APPENDIX B

Experiment 2 stimulus items organized into the six categories for each set of items

Faces			*Objects*		
Category	*Target name*	*Distractors*	*Category*	*Target name*	*Distractors*
Actor (classic)	Cary Grant	Jimmy Stewart	Games	Backgammon	Cribbage
	Rock Hudson	Gregory Peck		Bishop (chess piece)	Rook
	Sydney Poitier	Harry Belafonte		Canteen	Knapsack
	Elizabeth Taylor	Vivienne Leigh		Croquet	Lawn bowls
	Judy Garland	Grace Kelly		Crossbow	Javelin
	Sophia Loren	Gina Lollabrigida		Shuttlecock (or birdie)	Lawn dart
Actor (contemporary)	Bill Murray	Dan Aykroyd	Kitchen	Garlic press	Tea infuser
	George Clooney	Pierce Brosnan		Honey dipper (or stick)	Meat tenderizer
	Kevin Costner	Martin Sheen		Ladle	Baster
	Jodie Foster	Helen Hunt		Mortar & pestle	Dough blender
	Julia Roberts	Michelle Pfeiffer		Tongs	Jar opener
	Sandra Bullock	Demi Moore		Whisk	Egg separator
Music (singers)	Elton John	Billy Joel	Tools	Allen keys	Wrench
	Mick Jagger	David Bowie		Chisel	Gouger
	Paul McCartney	George Harrison		Hacksaw	Coping saw
	Cher	Barbra Streisand		Sickle (or scythe)	Hedge clipper
	Geri Halliwell	Jennifer Lopez		Trowel	Trencher
	Shania Twain	Sheryl Crow		Wood planer	Sander
Politician	Arthur Eggleton	Paul Martin	Animals (+ birds, bugs & insects)	Bobcat	Cougar
	Dalton McGuinty	Howard Hampton		Doberman	Rottweiler
	John Manley	Brian Tobin		Holstein	Jersey
	Alexa McDonough	Eleanor Caplan		Praying mantis	Longhorn beetle
	Anne McLellan	Ethel Blondin-Andrew		Puffin	Toucan
	Madeleine Albright	Golda Meir		Salamander	Chameleon

APPENDIX B (Cont.)

Faces			*Objects*		
Category	*Target name*	*Distractors*	*Category*	*Target name*	*Distractors*
Sport	Andre Agassi	Pat Rafter	Flowers	African violet	Agapanthus
	Mats Sundin	Chris Pronger		Arum lily	Orchid
	Mike Tyson	George Foreman		Crocus	Cyclamen
	Catriona Le May Doan	Susan Auch		Hyacinth	Daffodil
	Jenny Capriati	Monica Seles		Iris	Tulip
	Michelle Kwan	Tara Lipenski		Poppies	Zinnia
Television (celebrity)	Andy Rooney	Walter Cronkite	Fruit (+ vegetables & nuts)	Artichoke	Broccoli
	Jay Leno	Mike Bullard		Eggplant	Zucchini
	Peter Jennings	Ron McLean		Ginger	Garlic
	Anne Robinson	Sandy Rinaldo		Leek	Onion
	Connie Chung	Katie Couric		Lychee	Paw paw
	Dianne Sawyer	Andrea Thomson		Pistachio nuts	Hazel nuts

APPENDIX C

For Experiment 2, the proportions of "known" items named by each age group and category

	Young	*Young-old*	*Old-old*
Faces			
Classic actor	.38	.82	.71
Contemporary actor	.78	.53	.37
Musicians	.81	.74	.45
Politicians	.19	.46	.34
Sport	.57	.42	.31
TV celebrities	.40	.46	.38
Objects			
Games	.82	.69	.72
Kitchen utensils	.51	.67	.71
Tools	.47	.72	.68
Animals	.63	.52	.46
Flowers	.41	.74	.77
Fruit and vegetables	.78	.74	.67