Dr. Toth: Article 2010-1095 (z2m - 2496) is available for download

---

Psychology and Aging Published by American Psychological Association

Dear Author,

The page proof of your article (# 2010-1095), which is scheduled for publication in the Psychology and Aging, is now ready for your final review. To access your proof, please refer to this URL:

http://rapidproof.cadmus.com/RapidProof/retrieval/index.jsp

Login: your e-mail address
Password: 77ABVq65xk87

The site contains one file. You will need to have Adobe Acrobat® Reader software (Version 4.0 or higher) to read it. This free software is available for user downloading at http://www.adobe.com/products/acrobat/readstep.html.

If you have any problems with downloading your article from the Rapid Proof site, please contact rpmhelp@cadmus.com. Please include your article number (2010-1095) with all correspondence.

This file contains a reprint order form, information regarding subscriptions and special offers, instructions for correcting the PDF proof electronically, and a copy of the page proof for your article. The proof contains 13 pages.

Please read over your article carefully, as this will be your last opportunity to review the article prior to publication. APA now publishes journal articles Online First, in advance of print issues. Once corrections have been submitted and incorporated, your article could be published Online First within 2-3 weeks. Once your article has been released for Online First publication, no additional corrections may be made without a formal correction notice. The Editor makes all final decisions regarding the publication order for print issues.

Your article has been copyedited to conform to APA style and for grammar, punctuation usage, and formal consistency. Other changes in wording are intended to more clearly convey your meaning; if meaning has been altered, please suggest an alternative that will restore the correct meaning and clarify the original passage.

Please be sure to respond to any queries that appear on the last page of the proof. Proofread the following elements of your article especially carefully:

- Tables
- Equations and mathematical symbols
- Figures (including figure and caption placement)
- Non-English characters and symbols

Please use the comments and notes features in Adobe Acrobat (instructions provided in the PDF file to be downloaded) and return the annotated PDF to APAProduction@cadmus.com within 48 hours. If you are unable to use Adobe Acrobat and your changes are minimal, you may summarize them in an email to the Journal Production Manager, clearly indicating the location of each change. If you are unable to use Adobe Acrobat and have changes too extensive to summarize in an e-mail, please scan your marked up proof and send it to APAProduction@cadmus.com or fax a clearly marked proof to the Journal Production Manager at the fax number given at the end of this message.

To order reprints, please fill out the reprint order form and return it to Cadmus Reprints, Reprint Account Manager, P.O. Box 822942, Philadelphia, PA 19182-2942.

For information about the NIH PubMed Central deposit request as it relates to articles published in APA journals, including a PubMed Central deposit request form, please go to http://www.apa.org/pubs/authors/pubmed-deposit.aspx.

If you have questions or concerns about the editing of your proof, please contact me at the email address below.

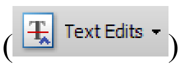
Sincerely,

Mark Armacost
Journal Production Manager
Psychology and Aging
Cadmus Communications
8621 Robert Fulton Drive, Suite 100
Columbia, MD 21046
E-mail: APAProduction@cadmus.com
Phone: 410-691-6982
FAX: 410-691-6926

Adding Comments and Notes to Your PDF

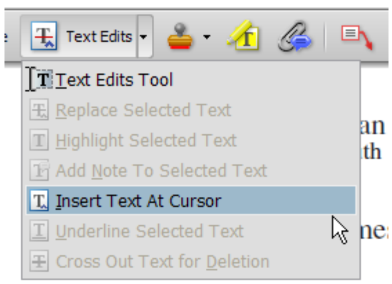
To facilitate electronic transmittal of corrections, we encourage authors to utilize the comments and notes features in Adobe Acrobat. The PDF provided has been "comment-enabled," which allows you to utilize the comments and notes features, even if using only the free Adobe Acrobat reader (see note below regarding acceptable versions). Adobe Acrobat's Help menu provides additional details on the tool. When you open your PDF, the comments/notes/edit tools are clearly shown on the tool bar (though icons may differ slightly among versions from what is shown below).

For purposes of correcting the PDF proof of your journal article, the important features to know are the following:

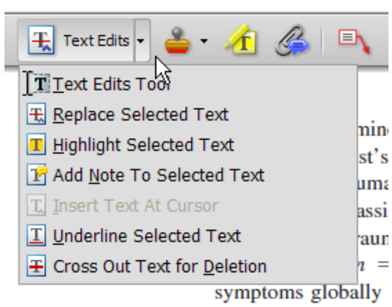
- Use the **Text Edits tool** (

) to insert, replace, or delete text.

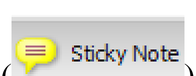
    - To **insert text**, place your cursor at a point in text and select "Insert Text at Cursor" from the text edits menu. Type your additional text in the pop-up box.



    - To **replace text** (do this instead of deleting and then re-inserting), highlight the text to be changed, select "Replace Selected Text" from the text edits menu, and type the new text in the pop-up box.



    - To **delete text**, highlight the text to be deleted and select "Cross Out Text for Deletion" from the text edits menu (see graphic above).

- Use the **Sticky Note tool** (

) to describe changes that need to be made (e.g., changes in bold, italics, or capitalization use; altering or replacing a figure) or to answer a question or approve a change that was posed by the editor. To use this feature, click on the sticky note tool and then click on a point in the PDF where you would like to make a comment, then type your comment in the pop-up box.

- Use the **Callout tool** () to point directly to changes that need to be made. Try to put the callout box in an area of white space so that you do not obscure the text, as in the example below.

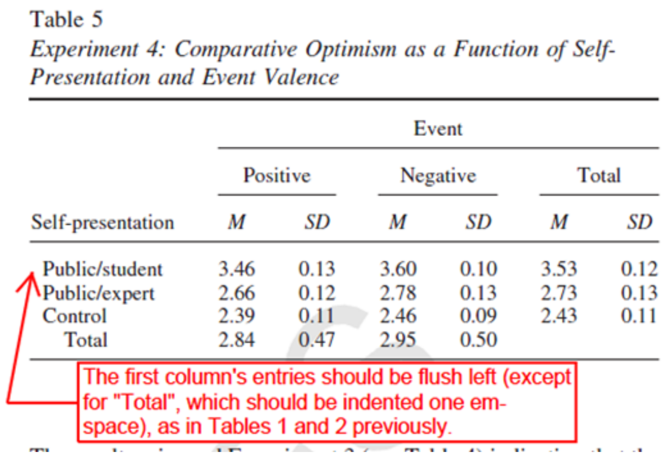
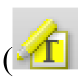


Table 5

Experiment 4: Comparative Optimism as a Function of Self-Presentation and Event Valence

	Event					
	Positive		Negative		Total	
Self-presentation	*M*	*SD*	*M*	*SD*	*M*	*SD*
Public/student	3.46	0.13	3.60	0.10	3.53	0.12
Public/expert	2.66	0.12	2.78	0.13	2.73	0.13
Control	2.39	0.11	2.46	0.09	2.43	0.11
Total	2.84	0.47	2.95	0.50		

- Use the **Highlight tool** () to indicate font problems, bad breaks, and other textual inconsistencies. Describe the inconsistencies with the callout tool (shown) or a sticky note. One callout (or sticky note) can describe many changes.

Close up minus sign to lambda (3 times, highlighted)

$$du/dt = - \lambda v^{\alpha} = - \lambda u$$

$$du/u = - \lambda dt$$

$$u_t = ue^{-\lambda t}.$$

An alternate method is to select the appropriate text with your cursor, select **"Add Note to Selected Text"** from the text edits menu, and then type your note in the pop-up box (the selected text is highlighted automatically).

As with hand-annotated proof corrections, the important points are to communicate changes clearly and thoroughly; to answer all queries and questions; and to provide complete information for us to make the necessary changes to your article so it is ready for publication.

To utilize the comments/notes features on this PDF you will need Adobe Reader version 7 or higher. This program is freely available and can be downloaded from http://get.adobe.com/reader/

REPRINTS

Authors have two options for ordering reprints: Authors who need to use purchase orders may order reprints from the standard *Purchase Order Service.* For a substantially lower price, authors may use the *Prepaid Service.* The rate schedules on page 3 give the prices for each service. All international prices include shipping via WWDS. All domestic shipments will be made via UPS. We request that you do not use Post Office box numbers; provide a full street address if possible. Authors may request expedited shipping – the additional cost will be billed. You are required to pay all duties that apply.

- **Prepaid Service:** To take advantage of this lower price option, submit your credit card information with your order or enclose a money order, certified check, or personal check. The prices given on page 3 include postage.

- **Purchase Order Service:** Reprint orders that are not prepaid must be accompanied by a purchase order. Cadmus Reprints will bill you later for the cost of the reprints. **Do not send remittance with the reprint order form and purchase order.** Remember that the price you see on page 3 includes postage, so it is the exact amount you will be billed. (Exception: Authors requesting expedited shipping will be billed the additional cost.)

Complete the order form on the next page and return it to Cadmus Reprints (not to APA). Only one order form is provided – include your coauthors' orders on this form or make photocopies of the order form for your coauthors. Check the box for either the prepaid service or the purchase order service. Give explicit instructions for all authors receiving reprints, using the space at the bottom of the order form.

To determine the cost of the reprints, count the number of pages in the printed article and refer to the rate schedules on page 3. For example, if your article is 11 pages long, you want 100 reprints, you live in the United States, and you are using the prepaid service, your total cost would be $126. If your proof includes a page of queries following the text, do not include the query page in your article page count.

Send the order form to Cadmus Reprints when you return the page proofs. Reprints will be mailed within two weeks of the publication of the journal. Orders received after the issue goes to press will be processed with the next issue.

Where to Order Reprints

Send your order form with credit card information, money order, certified check, personal check, or purchase order in the amount indicated on the rate schedule to:

Cadmus Reprints
P.O. Box 822942
Philadelphia, Pa 19182-2942

Phone: (410) 943-0629 FAX: (877) 705-1371

Personal checks must clear before reprints are processed. There is a $30.00 charge for returned checks.

AMERICAN PSYCHOLOGICAL ASSOCIATION

2011 REPRINT ORDER FORM

APA Journal Authors: To order reprints, complete all sections of this form. Please read the instructions on page 1.

Psychology and Aging

2010-1095

3686937

SEND the reprint order and
(1) credit card number, or
(2) money order/certified check, or
(3) approved purchase order, or
(4) check
to:

Cadmus Reprints
P.O. Box 822942
Philadelphia, PA 19182-2942

BILLING NAME ____________________ DATE ____________________

ORGANIZATION ____________________ PHONE # ____________________

ADDRESS (no P.O. Box) ____________________ FAX # ____________________

____________________ E-MAIL ____________________

CITY STATE ZIP CODE ____________________ REPRINTS INCLUDE COLOR? ☐ YES ☐ NO

ARTICLE TITLE ____________________ # OF TOTAL ARTICLE PAGES ____________________

AUTHOR ____________________ # OF REPRINTS ____________________

OF COVERS ____________________

PAYMENT METHOD: CHECK ONE:

___ CREDIT CARD CARD NUMBER ____________________
______ VISA EXPIRATION DATE ____________________
______ MASTERCARD SIGNATURE ____________________
___ MONEY ORDER/CERT. CHECK (make payable to **Cadmus Reprints**)
___ APPROVED PURCHASE ORDER (original PO must be attached)
___ CHECK (shipment delayed until check clears)

COMPUTE COST OF ORDER

PRICE (per chart) $ ____________________

Add'l for Covers $ ____________________

SUBTOTAL $ ____________________

PA residents add 6% tax $ ____________________

Add'l for Expedited Shipping $ ____________________

TOTAL $ ____________________

COMPLETE SHIPPING LABEL below. No P.O. Boxes.
Include phone number on international shipments. International shipments can be made via AIR for additional charges; please indicate in Special Shipping Instructions if you desire this expedited service.

(TYPE OR PRINT MAILING LABEL BELOW)

SHIP TO: Phone No. ____________________
Name ____________________
Address ____________________
____
City ____________________ State ___________ Zip ______________
Expedited Service (enter service required): ____________________

AMERICAN PSYCHOLOGICAL ASSOCIATION

RATES EFFECTIVE WITH 2011 ISSUES

Black and White Reprint Prices Prepaid

Domestic (USA only)

# of Pages	50	100	200	300	400	500
1-4	$55	$75	$85	$116	$148	$180
5-8	$72	$97	$147	$195	$245	$296
9-12	$93	$126	$200	$278	$357	$438
13-16	$107	$157	$256	$357	$459	$558
17-20	$126	$187	$309	$440	$564	$692
21-24	$146	$214	$366	$519	$668	$823
25-28	$165	$248	$424	$598	$797	$990
29-32	$184	$279	$479	$685	$897	$1,106
33-36	$203	$310	$538	$774	$997	$1,220
37-40	$219	$343	$595	$861	$1,097	$1,335
41-44	$243	$373	$654	$949	$1,197	$1,449
45-48	$260	$407	$712	$1,036	$1,296	$1,564
Covers	$68	$76	$101	$126	$155	$182

Color Reprint Prices Prepaid

Domestic (USA only)

# of Pages	50	100	200	300	400	500
1-4	$120	$205	$290	$390	$453	$496
5-8	$189	$248	$371	$544	$659	$771
9-12	$209	$275	$429	$632	$831	$984
13-16	$226	$297	$490	$719	$950	$1,178
17-20	$248	$321	$554	$812	$1,068	$1,376
21-24	$271	$346	$619	$903	$1,188	$1,580
25-28	$354	$516	$876	$1,257	$1,611	$2,040
29-32	$439	$683	$1,126	$1,611	$2,030	$2,509
33-36	$523	$850	$1,380	$1,966	$2,450	$2,977
37-40	$606	$1,018	$1,632	$2,321	$2,870	$3,445
41-44	$691	$1,184	$1,886	$2,675	$3,289	$3,913
45-48	$774	$1,354	$2,139	$3,030	$3,709	$4,381
Covers	$68	$76	$101	$126	$155	$182

Black and White Reprint Prices Prepaid

International (includes Canada and Mexico)

# of Pages	50	100	200	300	400	500
1-4	$83	$100	$124	$177	$225	$278
5-8	$115	$136	$223	$305	$390	$476
9-12	$155	$186	$309	$443	$567	$701
13-16	$185	$234	$401	$568	$737	$903
17-20	$225	$285	$488	$704	$909	$1,117
21-24	$258	$326	$578	$830	$1,080	$1,332
25-28	$300	$379	$665	$956	$1,272	$1,580
29-32	$332	$424	$758	$1,097	$1,439	$1,779
33-36	$364	$470	$851	$1,237	$1,592	$1,978
37-40	$397	$516	$932	$1,376	$1,757	$2,176
41-44	$435	$562	$1,025	$1,515	$1,921	$2,375
45-48	$467	$608	$1,118	$1,654	$2,761	$2,573
Covers	$98	$105	$150	$206	$261	$315

Color Reprint Prices Prepaid

International (includes Canada and Mexico)

# of Pages	50	100	200	300	400	500
1-4	$148	$231	$329	$450	$530	$594
5-8	$232	$287	$448	$653	$803	$950
9-12	$271	$335	$539	$797	$1,041	$1,248
13-16	$305	$375	$635	$930	$1,229	$1,523
17-20	$347	$419	$733	$1,076	$1,413	$1,802
21-24	$384	$458	$830	$1,215	$1,600	$2,088
25-28	$490	$647	$1,117	$1,614	$2,086	$2,630
29-32	$587	$828	$1,404	$2,024	$2,572	$3,182
33-36	$685	$1,009	$1,693	$2,430	$3,045	$3,735
37-40	$784	$1,191	$1,969	$2,836	$3,529	$4,287
41-44	$882	$1,373	$2,257	$3,242	$4,014	$4,839
45-48	$981	$1,555	$2,545	$3,648	$5,173	$5,391
Covers	$98	$105	$150	$206	$261	$315

Additional Rates	
Set title page, each	$16.00
Each extra mailing	$32.00
Remake pages, each	$50.00

AMERICAN PSYCHOLOGICAL ASSOCIATION

RATES EFFECTIVE WITH 2011 ISSUES

Black and White Reprint Prices Purchase Order						
Domestic (USA only)						
# of Pages	50	100	200	300	400	500
1-4	$60	$81	$92	$126	$161	$195
5-8	$78	$105	$159	$211	$266	$322
9-12	$101	$137	$217	$302	$387	$475
13-16	$116	$170	$278	$387	$498	$605
17-20	$137	$203	$335	$478	$612	$750
21-24	$158	$232	$397	$563	$725	$893
25-28	$179	$269	$460	$649	$865	$1,074
29-32	$199	$303	$520	$744	$973	$1,200
33-36	$220	$337	$584	$839	$1,082	$1,324
37-40	$238	$372	$646	$934	$1,190	$1,448
41-44	$264	$405	$709	$1,029	$1,298	$1,572
45-48	$282	$441	$772	$1,124	$1,407	$1,696
Covers	$74	$83	$109	$137	$169	$198

Color Reprint Prices Purchase Order						
Domestic (USA only)						
# of Pages	50	100	200	300	400	500
1-4	$130	$223	$314	$423	$492	$538
5-8	$205	$269	$403	$590	$715	$837
9-12	$227	$298	$466	$686	$902	$1,068
13-16	$245	$322	$532	$780	$1,031	$1,278
17-20	$269	$349	$601	$881	$1,159	$1,493
21-24	$295	$375	$671	$980	$1,289	$1,714
25-28	$385	$560	$950	$1,364	$1,748	$2,214
29-32	$476	$741	$1,222	$1,748	$2,203	$2,722
33-36	$568	$922	$1,497	$2,133	$2,658	$3,230
37-40	$658	$1,105	$1,771	$2,518	$3,113	$3,738
41-44	$749	$1,285	$2,046	$2,903	$3,569	$4,246
45-48	$839	$1,469	$2,321	$3,288	$4,024	$4,753
Covers	$74	$83	$109	$137	$169	$198

Black and White Reprint Prices Purchase Order						
International (includes Canada and Mexico)						
# of Pages	50	100	200	300	400	500
1-4	$90	$109	$134	$192	$244	$301
5-8	$125	$147	$242	$330	$423	$516
9-12	$168	$202	$336	$480	$615	$761
13-16	$201	$254	$435	$616	$799	$980
17-20	$244	$309	$529	$764	$986	$1,212
21-24	$280	$354	$627	$901	$1,172	$1,445
25-28	$326	$411	$722	$1,037	$1,381	$1,714
29-32	$360	$460	$822	$1,191	$1,561	$1,930
33-36	$395	$509	$923	$1,342	$1,727	$2,146
37-40	$430	$559	$1,011	$1,493	$1,906	$2,361
41-44	$472	$609	$1,112	$1,644	$2,085	$2,577
45-48	$507	$659	$1,213	$1,795	$2,995	$2,792
Covers	$106	$113	$163	$224	$283	$341

Color Prices Purchase Order						
International (includes Canada and Mexico)						
# of Pages	50	100	200	300	400	500
1-4	$160	$250	$356	$488	$575	$644
5-8	$252	$311	$486	$709	$871	$1,031
9-12	$294	$364	$585	$864	$1,130	$1,354
13-16	$331	$406	$689	$1,009	$1,333	$1,652
17-20	$377	$455	$796	$1,167	$1,533	$1,955
21-24	$416	$497	$901	$1,318	$1,736	$2,266
25-28	$531	$702	$1,211	$1,752	$2,263	$2,854
29-32	$637	$898	$1,524	$2,196	$2,791	$3,452
33-36	$743	$1,095	$1,836	$2,636	$3,303	$4,052
37-40	$850	$1,292	$2,136	$3,077	$3,829	$4,651
41-44	$957	$1,489	$2,449	$3,518	$4,355	$5,250
45-48	$1,065	$1,687	$2,762	$3,958	$5,613	$5,849
Covers	$106	$113	$163	$224	$283	$341

Additional Rates	
Set title page, each	$16.00
Each extra mailing	$32.00
Remake pages, each	$50.00

Subscriptions and Special Offers

In addition to purchasing reprints of their articles, authors may purchase an annual subscription, purchase an individual issue of the journal (at a reduced rate), or request an individual issue at no cost under special "hardship" circumstances. To place your order, fill out the order form below (including the mailing label) and send the completed form and your check or credit card information to the address listed on the order form.

For information about becoming a member of the American Psychological Association, call the Membership Office at 1-800-374-2721.

2011 APA Journal Subscription Rates

Journal*	Non-agent Individual Rate	APA Member Rate
American Psychologist	$ 310	$ 12
Behavioral Neuroscience	$ 321	$ 157
Developmental Psychology	$ 280	$ 121
Emotion	$ 107	$ 60
Experimental & Clinical Psychopharm.	$ 167	$ 55
Health Psychology	$ 179	$ 70
Jrnl of Abnormal Psychology	$ 179	$ 75
Jrnl of Applied Psychology	$ 280	$ 105
Jrnl of Comparative Psychology	$ 107	$ 55
Jrnl of Consulting & Clinical Psychology	$ 280	$ 126
Jrnl of Counseling Psychology	$ 145	$ 55
Jrnl of Educational Psychology	$ 179	$ 81
JEP: Animal Behavior Processes	$ 107	$ 55
JEP: Applied	$ 107	$ 55
JEP: General	$ 107	$ 55
JEP: Human Perception & Performance	$ 392	$ 167
JEP: Learning, Memory & Cognition	$ 392	$ 167

Journal*	Non-agent Individual Rate	APA Member Rate
Jrnl of Family Psychology	$ 167	$ 60
Jrnl of Personality & Social Psychology	$ 548	$ 235
Neuropsychology	$ 167	$ 60
Professional Psych.: Research & Practice	$ 145	$ 55
Psychological Assessment	$ 167	$ 55
Psychological Bulletin	$ 280	$ 106
Psychological Methods	$ 107	$ 55
Psychological Review	$ 179	$ 79
Psychology & Aging	$ 179	$ 75
Psychology of Addictive Behaviors	$ 107	$ 78
Psychology, Public Policy & Law	$ 107	$ 55
Rehabilitation Psychology	$ 107	$ 55
Clinician's Research Digest	$ 107	$ 55

*For journal descriptions, see APA's website: http://www.apa.org/pubs/journals

---

Instructions: Check the appropriate box, enter journal title and price information, and complete the mailing label in the right column. Enclose a check made out to the **American Psychological Association**, and mail it with the form to the APA Order Department or complete the credit card information below.

☐ Annual Subscription (available on January-December basis only). To subscribe, specify calendar year of the subscription. Refer to the Subscription Rates shown above.

Journal: ____

Calendar year of subscription: ___________ Price: ___________

Special Offers! If you are an APA journal article author, you may take advantage of two Special Offers. (These offers do not apply to Educational Publishing Foundation journals.)

☐ **Individual Copy.** You may order individual copies of the entire issue in which your article appears. As an author, you receive a special reduced rate of $5 per copy for up to a maximum of 25 copies. No phone requests accepted.

Journal: ____

Vol. no.: _______ Issue no.: _______ Issue month: _________

____ copies @ $5 a copy = $________ (order amount)
+________ (handling; see below)
TOTAL enclosed: $________

Shipping & Handling Fees			
Order amount:	U.S. & Puerto Rico	Guaranteed Non-U.S.*	Economy Non-U.S.**
Up to $14.99	$5.00	$50.00	$15.00
$15 to $59.99	$6.00	$75.00	$16.00
$60.00+	10% Order Total	$125.00	$20.00

*International rates for guaranteed service are estimates.

**I agree that international economy service is non-guaranteed and does not provide tracking or date/time specific delivery. Delivery time for this level of service can take up to 8 weeks. If this level of service is selected, APA will not be held liable and will not honor any claims for undelivered, delayed, or lost shipments.

☐ **Hardship Request.** If you do not have a personal subscription to the journal and you do not have access to an institutional or departmental subscription copy, you may obtain a single copy of the issue in which your article appears at no cost by filing out the information below.

Journal: ____

Vol. no. : ________________ Issue no.: ________________

Issue month: ______________________________________

CREDIT CARD PAYMENT

___ VISA ___ MASTERCARD ___ AMERICAN EXPRESS

CARD NUMBER____

Expire Date ___________ Signature _________________________

PRINT CLEARLY – THIS IS YOUR MAILING LABEL

SHIP TO: Phone No. ___________________

Name ____________________________________

Address __________________________________

____

City _______________ State ________ Zip ________

Expedited Service (enter service required): _____________

Send the completed form and your check, made out to the **American Psychological Association**, or your credit card information to:

APA Order Department
750 First Street, NE
Washington, DC 20002-4242

All orders must be prepaid. Allow 4-6 weeks after the journal is published for delivery of a single copy or the first copy of a subscription.

tapraid5/z2m-aging/z2m-aging/z2m00211/z2m2496d11z | xppws | S=1 | 3/10/11 | 6:19 | Art: 2010-1095

Psychology and Aging

0882-7974/11/$12.00 DOI: 10.1037/a0023379

AQ: 1

What You Know Can Hurt You: Effects of Age and Prior Knowledge on the Accuracy of Judgments of Learning

Jeffrey P. Toth, Karen A. Daniels, and Lisa A. Solinger
University of North Carolina Wilmington

How do aging and prior knowledge affect memory and metamemory? We explored this question in the context of a dual-process approach to *Judgments of Learning* (JOLs), which require people to predict their ability to remember information at a later time. Young and older adults ($n = 36$, mean ages = 20.2 & 73.1) studied the names of actors who were famous in the 1950s or 1990s, providing a JOL for each. Recognition memory for studied and unstudied actors was then assessed using a Recollect/Know/No-Memory (R/K/N) judgment task. Results showed that prior knowledge increased recollection in both age groups such that older adults recollected significantly more 1950s actors than younger adults. Also, for both age groups and both decades, actors judged R at test garnered significantly higher JOLs at study than actors judged K or N. However, while the young showed benefits of prior knowledge on relative JOL accuracy, older adults did not, showing lower levels of JOL accuracy for 1950s actors despite having higher recollection for, and knowledge about, those actors. Overall, the data suggest that prior knowledge can be a double-edged sword, increasing the availability of details that can support later recollection, but also increasing nondiagnostic feelings of familiarity that can reduce the accuracy of memory predictions.

Keywords: judgments of learning, recognition memory, recollection, prior knowledge, aging

Predicting future memory performance is an important ability in everyday life, from students judging whether they have mastered course material for an upcoming exam, to older adults assessing whether they will remember a doctor's medical instructions. In the lab, this predictive ability is often measured with Judgments of Learning (JOLs), which require a person to estimate the likelihood that they will remember studied material at a later time. Theoretical interest focuses not only on the factors that affect observed JOLs but also, perhaps more importantly, on the factors that mediate JOL accuracy—that is, the correspondence between JOLs and later memory performance. The present research is focused on the relative accuracy of immediate JOLs, those made during one's initial encounter with the to-be-remembered material, and whether such accuracy is affected by aging and prior knowledge about that material.

Understanding JOL accuracy is complicated by the fact that it reflects a relation between two judgments, one occurring at study (the JOL) and one occurring at test (the memory response). Any complete account of JOL accuracy will therefore need to explain not just the factors affecting JOLs but also the factors affecting subsequent memory performance. It is thus interesting that much of the research investigating JOL accuracy has focused on the JOL itself (for exceptions, see Dunlosky & Nelson, 1997; Dunlosky, Rawson, & McDonald, 2002; Weaver & Kelemen, 2003). This focus has led to important insights. For example, one of the key findings over the last few decades is that JOLs, as well as other metacognitive judgments, are strongly tied to processing fluency, the ease or speed with which an item is processed at the time of judgment (Begg, Duft, Lalonde, Melnick, & Sanvito, 1989; Koriat & Ma'ayan, 2005; Matvey, Dunlosky, & Guttentag, 2001). As a case in point, Benjamin, Bjork, and Schwartz (1998) found that the answers to trivia questions that participants produced quickly at study led to higher JOLs than those produced more slowly, yet later episodic memory for these answers showed the opposite pattern (better memory for answers produced slowly), thus leading to relatively poor JOL accuracy. These and related results suggest that the effects of processing fluency on JOLs will be a key component of any comprehensive account of JOL accuracy.

While not denying the influence of processing fluency on JOLs, we (Daniels, Toth, & Hertzog, 2009) recently explored the possibility that JOL accuracy may be partially mediated by the recollection at test of contextual details that were generated and used to formulate JOLs at study. The idea was that, although participants experience different degrees of fluency at study which likely influence their JOLs, they also generate idiosyncratic content (images, associations, etc.) and bind contextual detail to the to-be-remembered material, and recollection of this content and detail at test may mediate a significant portion of JOL accuracy (cf., Kelley & Sahakyan, 2003; Souchay, Moulin, Clarys, Taconnat, & Isingrini, 2007). This approach to JOL accuracy has its basis in dual-process theories of memory, which propose that memory performance reflects both controlled influences such as conscious recollection as well as more automatic influences such as famil-

AQ: 11
Jeffrey P. Toth, Karen A. Daniels, and Lisa A. Solinger, Department of Psychology, University of North Carolina Wilmington.

This research was supported by the National Institute on Aging (AG13845). Portions of this research were presented at the 50 Annual Meeting of the Psychonomic Society in Boston, MA.
AQ: 12

Correspondence concerning this article should be addressed to Jeffrey P. Toth, Department of Psychology, University of North Carolina Wilmington, 601 S. College Road, Wilmington, NC 28403. E-mail: tothj@uncw.edu

tapraid5/z2m-aging/z2m-aging/z2m00211/z2m2496d11z | xppws | S=1 | 3/10/11 | 6:19 | Art: 2010-1095

iarity (Mandler, 1980; Jacoby, 1991; Yonelinas, 2002). In effect, Daniels et al. wondered whether JOLs could be viewed as a person's attempt to predict what they would *consciously* remember at a later time, not what would be remembered on the basis of more automatic forms of memory.

To test these ideas, Daniels et al. had participants study a list of common words, instructing them to covertly generate images or personal associations to each, along with providing an immediate JOL. Then, at test, participants were presented with studied and unstudied words and asked to classify each using a Recollect (R) / Familiar (F) / No Memory (N) judgment. These responses were defined as in standard Remember/Know experiments (see Gardiner, Ramponi, & Richardson-Klavehn, 1998) such that participants were to respond R if they could remember episodic details surrounding a word's prior study, F if the test word was familiar from the study list but elicited no episodic detail, and N if the word elicited neither recollection ~~or~~ familiarity. Two main findings are worth note. First, using a "back-sorting" procedure similar to that used in neurological studies to investigate "subsequent memory" or "differential memory (Dm)" effects (Paller & Wagner, 2002), Daniels et al. found that JOLs were significantly higher for items subsequently judged R at test, compared with items judged either F or N. Indeed, JOLs did not differ for F and N items, suggesting that participants were unable to predict which items they would later recognize on the basis of familiarity. These findings suggest an important role for conscious recollection in mediating JOL accuracy.

The second main finding from Daniels et al. concerns age. Prior research comparing young and older adults has consistently found age-invariance in relative JOL accuracy, even under conditions where age-related memory declines are observed (Connor, Dunlosky, & Hertzog, 1997; Dunlosky & Hertzog, 2000; Hertzog, Kidder, Powell-Moman, & Dunlosky, 2002; Lovelace & Marsh, 1985; Rabinowitz, Craik, Ackerman, & Hinchley, 1982; Shaw & Craik, 1989). Daniels~~, Toth, & Hertzog~~ (2009), however, found two sources of evidence that, at least under some conditions, aging may indeed impair JOL accuracy. In particular, the back-sorting analysis revealed that the difference in JOLs for items later judged R versus F was significantly smaller for older, as compared with younger, adults; that is, there was an age-related decline in the ability of JOLs to discriminate between items that would later be recollected versus those that would not. An age-related decline in JOL accuracy was also observed in Goodman-Kruskal gamma correlations when memory was exclusively defined in terms of recollection. Overall, Daniels et al.'s findings suggest that older adults may show impaired JOL accuracy when recollection is the primary basis of remembering, but not when memory is largely supported by more automatic forms of memory. More generally, they suggest that, in contrast to JOL-related factors such as processing fluency, which appear to provide a relatively unreliable cue to later memory performance (Benjamin, Bjork, & Schwartz, 1998; Koriat, Bjork, Sheffer, & Bar, 2004), the recollection of contextual details may offer a more reliable source of JOL accuracy, but one that can be compromised by deficits in recollection such as those experienced by older adults (e.g., Chalfonte & Johnson, 1996; Prull, Dawes, Martin, Rosenberg, & Light, 2006).

One interpretation of Daniels et al.'s results is that recollection serves as the primary basis of JOL accuracy. If that was the case, then any manipulation that enhanced recollection would be expected to improve JOL accuracy. However, that interpretation is almost certainly too simplistic; as noted above, JOL accuracy reflects the relation between JOLs and memory performance and thus factors affecting the JOL itself are also likely to play a role in mediating such accuracy. The goal of the present study was to manipulate a variable (prior knowledge) that past research suggests can not only modulate recollection but which likely influences encoding fluency as well. In doing so, we aimed to further demonstrate the importance of recollection in mediating JOL accuracy, but also to highlight how recollection must be considered along with influences on the JOL itself to provide a full account of JOL accuracy.

Research has shown that prior knowledge can have substantial beneficial effects on episodic memory for both younger and older adults (e.g., Backman, Herijtz, & Karlsson, 1987; Castel, 2005; Gillund & Perlmutter, 1993; Hambrick & Engle, 2001). For example, in a series of experiments comparing recognition memory for dated versus contemporary names and faces, Backman (1991) showed that older adults performed significantly better with the dated material while younger adults showed the opposite pattern. These results support the assumption that prior knowledge provides a semantic context or schema with which to form more elaborate or distinctive episodic memories (Craik & Brown, 2000; Ericsson, 1985; Van Overschelde, Rawson, Dunlosky, & Hunt, 2005). More recently, Long and Prat (2002) examined the effects of prior knowledge on recollection and familiarity by testing young adults who had either high or low knowledge about the fictional series *Star Trek*. Using both Remember/Know (Tulving, 1985) and Process-Dissociation (Jacoby, 1991) procedures, they found that prior knowledge enhanced recollection of previously presented text material, having little or no effect on familiarity. Brandt, Cooper, and Dewhurst (2005) replicated the selective effects of prior knowledge on recollection using lists of single words and different subject matter (psychology vs. radiography terms). One of the goals of the present study was to extend these findings to a new set of material (famous actors) and to determine whether the selective influence of prior knowledge on recollection also occurs in older adults.

If prior knowledge enhances episodic memory (Backman, 1991) and that effect is achieved via increased recollection (Long & Prat, 2002) then the results of Daniels~~, Toth, & Hertzog~~ (2009) might suggest that prior knowledge will enhance memory monitoring as well, such that older adults will show greater JOL accuracy for dated, compared with contemporary, material. However, that prediction focuses on recollection only and fails to consider how prior knowledge may affect JOLs. Unfortunately, only a few studies have examined the effects of knowledge on metacognitive judgments, and the findings from those studies have been inconsistent. Glenberg and Epstein (1985) examined young adults' ability to assess their understanding of texts immediately after reading, and found that such "calibration of comprehension" was strikingly poor. Follow-up research by Glenberg, Sanocki, Epstein, and Morris (1987) extended this poor calibration to tests of verbatim recognition and suggested that a major reason for inaccurate metacomprehension judgments was that "subjects assess familiarity with the general domain of a text instead of assessing knowledge gained from a particular text" (p. 119). The above research thus suggests that elevated knowledge about a domain may have both positive and negative consequences, increasing recollection for contextual details associated with the study episode, but decreasing JOL accuracy via nondiagnostic, familiarity-based influences on the JOL itself.

More recent research, however, shows that prior knowledge can have positive effects on metacognitive accuracy. For example, Nietfeld and Schraw (2002) found that individuals high in mathematics knowledge gave more accurate confidence judgments to math problems compared with less knowledgeable individuals. Similarly, de Bruin, Rikers, and Schmidt (2007) found that experienced chess players had higher JOL accuracy for reproducing newly-learned endgame moves in chess, compared with inexperienced players whose JOL accuracy was not significantly different from zero. And Griffin, Jee, & Wiley (2009) found that baseball knowledge increased the absolute accuracy of predictive metacomprehension judgments about baseball-related texts, although they did not find a corresponding benefit of knowledge for relative accuracy. They concluded that "higher knowledge individuals not only achieve better comprehension of domain-related texts, but they also estimate their performance on domain-related tests more precisely and are less biased in their estimates" and so "to the extent that prior knowledge does inform their judgments, it seems to do more good than harm" (p. 1011).

In summary, research investigating the effects of prior knowledge on memory monitoring is mixed, with some studies suggesting that it enhances monitoring and others suggesting that it undermines such monitoring. Moreover, we are not aware of any studies that have examined the effects of prior knowledge on JOLs and JOL accuracy in older adults. The present research was designed to provide data on both of these issues, while also extending our previous work showing the importance of recollection in mediating JOL accuracy. To address these issues, we assessed JOL accuracy for young and older adults using material for which the two age groups possessed differing amounts of prior knowledge. Knowledge was manipulated by presenting all subjects with the names of actors famous in the 1950s or 1990s on the assumption that young adults would know more about 1990s actors and older adults more about 1950s actors. In addition to following previous research (e.g., Backman, 1991) this assumption was supported by both observed JOLs, as well as post-test interviews that explicitly asked about familiarity with the names. Based on prior research (Brandt, Cooper, & Dewhurst, 2005; Long & Prat, 2002) we expected both groups to show better recollection for names from their higher-knowledge decade. The question of interest was whether the enhanced recollection stemming from prior knowledge would also increase JOL accuracy. We suspected that while the young may benefit, older adults may not because of the interfering effects of pre-experimental familiarity on JOLs. If so, the results would demonstrate an association in young adults between cognition (memory) and metacognition (JOL accuracy) with prior knowledge enhancing both, but a dissociation in older adults, with prior knowledge enhancing their recollection but impairing their JOL accuracy.

Method

Participants

Seventy-four participants were initially recruited for this study. Thirty-eight undergraduates (13 male; mean age = 20.2; range 18–26) enrolled in psychology courses at Washington University in St. Louis participated in exchange for course credit. Thirty-six older volunteers from the St. Louis community (10 males; mean age = 73.1; range 62–84) were paid $10 per hour for their participation. The data from two young participants were not included because of experimenter error, resulting in a final sample of 36 young adults (12 male; mean age = 20.3).

Materials

Stimuli were the names of male and female actors from the 1950s and 1990s who were Academy Award winners and nominees. Examples from the 1950s included Laurence Olivier, Natalie Wood, and Lana Turner. Examples from the 1990s included Julia Roberts, Kevin Spacey, and Anna Paquin. Sets were constructed in 2003 by norming names from both decades using the Altavista search engine, searching for the number of Web pages that contained the exact name (i.e., the name in quotes). The number of hits for each name was used as a measure of name frequency/familiarity for set construction. Names from the two decades were divided into three sets of 24, closely matched on hit frequency (means of 3807, 3359, and 3386 for 1950s and 16,381, 15,186, and 14,991 for 1990s). For any one participant, names from two sets per decade were used as studied items while names from the remaining set were used as unstudied items during the test phase (for a total of 144 names). Names were counterbalanced across participants such that (a) each name served equally often in the studied and unstudied conditions, and (b) each set within a decade was paired equally often with the sets from the other decade. Testing was done on Windows-based PCs programmed in E-Prime Version 1.0 (Schneider, Eschman, & Zuccolotto, 2002). Eleven keys across the top of the keyboard, from "~" to "0", were re-labeled "0" to "100" in intervals of 10 (e.g., "0," "10,, "20," etc.).

Procedure

Participants were individually tested in a quiet room seated at a computer. After completing consent and demographics forms, participants were told that they would be presented with names of actors from the 1950s and 1990s. They were further instructed to study the names and to try to remember as many as possible for a later, unspecified test. After four practice items (two from each decade) but before the actual study list, participants were asked to make a global, pre-test rating, using the keys labeled 0 to 100 to enter the total percentage of names they believed they would remember on the later memory test.

During study, participants saw a randomized presentation of 96 names, 48 from the 1950s and 48 from the 1990s, one at a time in the center of the screen. For each name, participants were asked to rate, using the labeled keys, how likely they were to remember that name on the later memory test. The scale ("0 . . . 100") appeared at the bottom of the screen 3 seconds after the name first appeared. Participants were told to use a rating of 0 when they were "absolutely certain" they would not remember the name, a rating of 100 when they were "absolutely certain" they would remember the name, and ratings of 10 to 90 for intermediate levels of certainty. Participants were encouraged to use the entire scale. Names remained visible until the JOL was entered. One second after the rating was entered, the next name appeared. Upon completion of the study list, participants made a global, post-test rating, using the same 0–100 scale to estimate the total percentage of names they thought they would remember on the memory test.

Immediately after the post-test rating, participants completed a recognition memory test where they were shown names one at a time in the center of the screen and were asked to rate the quality of their memory for each using *Recollect*, *Know*, or *No Memory* as responses. Note that, unlike the *Familiar* response option used by Daniels, Toth, & Hertzog (2009), we used *Know* in this study because of worries that *Familiar* might cause subjects to erroneously judge the pre-experimental familiarity of the names. Definitions of these responses were similar to those used in other Remember/Know studies (e.g., Gardiner, Ramponi, & Richardson-Klavehn, 1998). Briefly, participants were told to respond *Recollect* when they could remember specific details associated with studying a name; *Know* when the name felt familiar from the study list but did not bring to mind any specific details; and *No Memory* when the name felt neither familiar, nor could they remember any details about its earlier presentation. The response options were presented at the bottom of the screen ["Recollect (R), Know (K), No Memory (N)"] and participants responded using the "R," "K," and "N" keys.

After the recognition test, participants were given a structured interview that asked the following questions: (1) *Considering all the names you have seen in this experiment, what percent did you recognize as being a famous actor or actress?*; (2) *Which names were more familiar to you, the 1950s, the 1990s, or were they about even?*; (3) *In the first part of the experiment, did you use any particular strategy to help you judge how likely you were to remember the names during the later test? If so, briefly describe any strategies you used*; (4) *Was the distinction between Recollection, Know, and No Memory clear, or did you find that distinction to be confusing at times? If confused, how often were you confused, and in what way?*; (5) *Overall, how accurate do you think your memory predictions were (i.e., did your ratings during the first part of the study predict your memory performance in the second part of the study)?* The options for this question were *not at all accurate, occasionally accurate, fairly accurate, extremely accurate*~~, and *no idea*~~; (6) *Do you believe you were more accurate for names from the 1950s, the 1990s, or were they about even?*

R, K, F*, & N should be centered BELOW the terms "Studied" and "Unstudied". Also, please provide more more space between the R, K, F*, & N values in the table.

... dy, ... We then turn to JOL accuracy which we analyzed using a back-sorting procedure (Daniels~~, Toth, & Hertzog~~, 2009), the Goodman-Kruskal gamma coefficient, and the signal-detection-based measure d_a. We finish by describing the post-test interview.

Judgments of Learning

Mean item-by-item JOLs, separated by decade, showed a nearly symmetrical cross-over interaction, with older adults rating 1950s actors as more likely to be remembered than 1990s actors (66.4 vs. 39.7) and young adults showing the opposite pattern (37.1 vs. 63.4). ANOVA confirmed a reliable age-by-decade interaction [$F(1, 70) = 362.23$, $MSE = 69.91$, $p < .0001$, $\eta_p^2 = .84$] with neither main effect being significant ($Fs < 1$). Overall, and consistent with the post-test interview (see below), JOLs showed older adults to be more familiar with the 1950s actors and younger adults to be more familiar with the 1990s actors.

In addition to item-by-item JOLs, participants also made global JOLs immediately before and after presentation of the study list. Examination of these judgments showed that, while young adults lowered their expectations about memory performance after study (from 58.3 to 51.7), older adults raised their expectations (from 53.1 to 59.2) (cf. Conner et al., 1997). ANOVA revealed an AQ: 2 interaction between age and time-of-rating (pre/post) [$F(1, 70) = 8.70$, $MSE = 168.97$, $p < .005$, $\eta_p^2 = .11$] with neither main effect being significant ($Fs < 1$). Planned comparisons showed no statistical difference between the two age groups for predictions made before the study list [$t(70)$, $p = .19$], but with older adults making higher predictions than the young after the study list [$t(70) = 2.11$, $p < .05$, $d = .50$]. These results replicate prior findings of overconfidence for older compared with younger adults (Bruce, Coyne, & Botwinick, 1982; Conner et al., 1997; Hertzog et al., AQ: 3 2002).

Memory Performance

Mean R, K, and N judgments as a function of age and decade are AQ: 4 presented in Table 1. Note that the table also includes a measure of T1 familiarity (F), equal to K/(1-R), based on the assumption that familiarity and recollection make independent contributions to recognition performance (Jacoby, Yonelinas, & Jennings, 1997). Figure 1 shows corrected memory performance (hits – false F1 alarms) for the R, K, and F measures for each of the two decades. We analyzed each of these corrected measures using mixed-model ANOVAs with age (young, old) and actor decade (1950s, 1990s) as factors.

Analysis of corrected R responses revealed a main effect of decade [$F(1, 70) = 6.97$, $MSE = .015$, $p < .05$, $\eta_p^2 = .091$] with recollection being higher for 1990s actors compared with 1950s actors (.45 vs. .39), but that effect was qualified by a strong

Table 1
Mean Proportions of Recollect (R), Know (K), and ~~New~~ (N) Responses, and Estimated Familiarity (F), for Studied and Unstudied Actors as a Function of Participant Age (Young, Old) and Actor Decade (1950s, 1990s)

	Studied R	K	F*	N	Unstudied R	K	F*	N
1950s Actors								
Young								
M	.30	.37	.55	.33	.00	.10	.10	.90
SD	.16	.13	.18	.17	.02	.08	.08	.08
Old								
M	.55	.20	.49	.25	.06	.08	.09	.86
SD	.22	.12	.21	.16	.09	.09	.10	.14
1990s Actors								
Young								
M	.58	.26	.62	.16	.02	.08	.08	.90
SD	.18	.13	.19	.10	.03	.08	.08	.09
Old								
M	.39	.30	.49	.30	.06	.13	.14	.81
SD	.19	.18	.25	.17	.08	.09	.10	.13

* Estimated Familiarity (F) = K/(1-R).

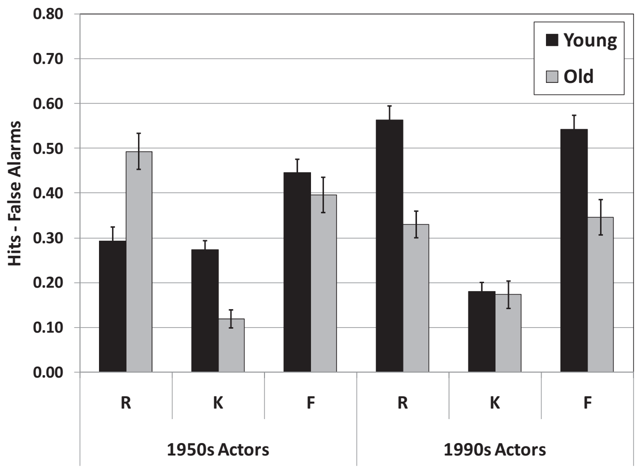


Figure 1. Corrected recognition performance (hits – false alarms) for the names of actors from the 1950s and 1990s as a function of participant age. Error bars represent standard errors. R = Recollect; K = Know; F = K/(1 − R).

AQ: 13

age-by-decade interaction [$F(1, 70) = 114.25$, $MSE = .015$, $p < .001$, $\eta_p^2 = .620$]. Post hoc analyses of this interaction confirmed that recollection of 1950s actors was significantly greater in older adults compared with the young [.49 vs. .29, $t(70) = 4.06$, $p < .0001$, $d = .97$], while recollection of 1990s actors showed the opposite pattern [.33 vs. .56, $t(70) = 3.08$, $p < .005$, $d = .74$].

Analysis of corrected K responses revealed a main effect of age [$F(1, 70) = 8.71$, $MSE = .027$, $p < .005$, $\eta_p^2 = .111$], as well as a significant age-by-decade interaction [$F(1, 70) = 16.41$, $MSE = .012$, $p < .001$, $\eta_p^2 = .190$]. The interaction reflected the fact that corrected K judgments to 1990s actors were very similar for young and older adults (.18 vs. .17, $t < 1$); in contrast, K judgments for 1950s actors were greater in young compared with older adults [.27 vs. .12, $t(70) = 5.76$, $p < .0001$, $d = 1.38$]. This latter finding suggests that younger adults gained more familiarity from studying 1950s actors than did older adults. However, that difference is likely an artifact of the different opportunities for making K responses in the two groups (Jacoby, Yonelinas, & Jennings, 1997). The independence-based measure of F is designed to correct for this issue.

Analysis of estimated F revealed a main effect of age [$F(1, 70) = 8.31$, $MSE = .066$, $p < .01$, $\eta_p^2 = .106$], as well as a significant age-by-decade interaction [$F(1, 70) = 10.19$, $MSE = .019$, $p < .01$, $\eta_p^2 = .127$]. The interaction was driven by the fact that F for 1950s actors was relatively similar for young and older adults [.45 vs. .40, $t(70) = 1.09$, $p = .28$], while F for 1990s actors was greater for the young [.54 vs. .35, $t(70) = 3.85$, $p < .0001$, $d = .92$].

Finally, it is worth note that false recollection was significantly higher in older compared with younger adults for both 1950s actors [.06 vs. .00, $t(70) = 3.46$, $p < .0001$, $d = .83$] and 1990s actors [.06 vs. .02, $t(70) = 3.08$, $p < .005$, $d = .74$]. Older adults also made reliably more false K responses to 1990s actors than did the younger adults [.13 vs. .08, $t(70) = 2.56$, $p < .05$, $d = .61$], but false K responses to 1950s actors showed no age difference (.08 vs. .10, $p > .30$).

Overall then, and as expected, both age groups showed better memory for actors from their high-knowledge decade (cf. Backman, 1991). Most important was the relatively symmetrical age-by-decade interaction for recollection (which can be seen by comparing the pattern of R judgments for young and old in Figure 1). This pattern is interesting relative to the question of what drives JOL accuracy. Daniels~~, Toth, & Hertzog~~ (2009) found evidence that JOL accuracy may be largely driven by recollection—perhaps by remembering details at test that were used to formulate JOLs at study. According to this idea, while older adults may show lower JOL accuracy for 1990s actors compared with the young [replicating the pattern in Daniels~~, Toth, & Hertzog~~ (2009)], they should show higher JOL accuracy for the 1950s actors given their higher level of recollection. Failure to find this pattern would suggest that factors influencing the JOL itself were undermining the predictive accuracy of JOLs, irrespective of recollective detail.

JOL Accuracy: Back-Sorting

We analyzed JOL accuracy in three ways. The first was a back-sorting procedure which compared mean JOL ratings for items subsequently rated R, K, or N. These data, shown in Figure 2, replicated the general patterns observed by Daniels~~, Toth,~~ F2
~~& Hertzog (2009)~~ (2009): JOLs at encoding were higher for items that would later receive an R judgment at test, a pattern that held for both age groups and both decades; however, JOL differences between R items and the other two categories were generally greater for the young adults, suggesting an age-related impairment in predicting later memory. More important for the present research was whether JOLs were more discriminative for high-knowledge versus low-knowledge names.

To assess these issues, we first conducted a mixed-model ANOVA of the back-sorting data with age, decade (1950s, 1990s), and test response (R, K, N) as factors. Note that two young and three older participants were not included in this analysis for failure to make at least one R, K, or N response (hence, $ns = 34$ & 33). This analysis revealed main effects of decade [$F(1, 65) = 5.36$, $MSE = 148.95$, $p < .05$, $\eta_p^2 = .076$] and test response [F(2,

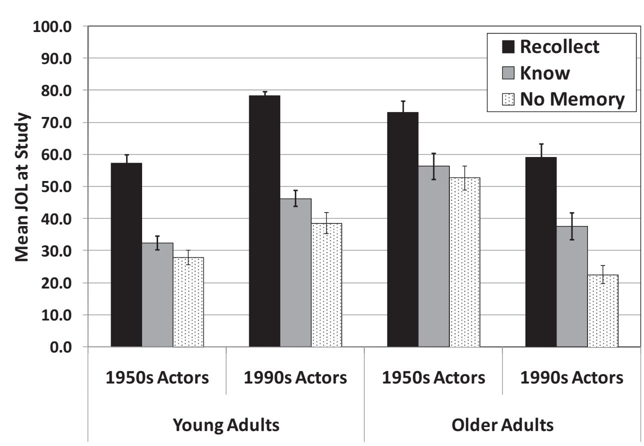


Figure 2. Mean JOL ratings at study for items judged Recollect (R), Know (K), or No Memory (N) at test as a function of actor decade for young (n = ~~33~~) and older (n = ~~34~~) adults. Error bars represent standard errors.

tapraid5/z2m-aging/z2m-aging/z2m00211/z2m2496d11z | xppws | S=1 | 3/10/11 | 6:19 | Art: 2010-1095

130) = 121.09, MSE = 297.90, $p < .0005$, $\eta_p^2 = .651$], but not age [$F(1, 65) = 1.05$]. Both main effects, however, were qualified by two-way interactions between decade and age [$F(1, 65) = 220.41$, MSE = 148.95, $p < .0005$, $\eta_p^2 = .772$] and decade and test response [$F(2, 130) = 17.89$, MSE = 84.36, $p < .0005$, η_p^2 = .216], as well as a nearly significant interaction between age and test response [$F(2, 130) = 2.51$, MSE = 297.90, $p = .085$, η_p^2 = .037]. The decade-by-age interaction reflected the higher JOLs given to each group's higher-knowledge decade, thus mirroring the analogous interaction reported for mean JOLs above. The decade-by-test-response interaction reflected the larger spread (in JOLs) between test responses for 1990's actors (R = 69.0, K = 42.1, N = 30.8) relative to the 1950s actors (R = 65.1, K = 44.2, N = 40.3). Finally, the marginal age-by-test-response interaction reflected the larger spread between R and K responses, and smaller spread between K and N responses, for younger adults (R = 67.9, K = 39.4, N = 33.4) compared with older adults (R = 66.2, K = 47.0, N = 37.8). Importantly, the three-way interaction between age, decade, and test response, which would be expected if both age groups showed enhanced JOL discriminability in their high-knowledge/high-recollection decade (1950s for old, 1990s for young), was not significant [$F(2, 130) = 1.82$, MSE = 84.36, p = .167].

To more clearly unpack the relation between prior knowledge and JOL discriminability, and to examine whether the current patterns replicated those found by Daniels, Toth, & Hertzog (2009), we also ran separate two-way ANOVAs for the young and older adults, with decade and test response as factors. For the young adults, this analysis revealed main effects of decade [$F(1, 33) = 116.57$, MSE = 101.84, $p < .001$, $\eta_p^2 = .779$] and test response [$F(2, 66) = 195.27$, MSE = 118.24, $p < .001$, η_p^2 = .855], both qualified by a significant interaction [$F(2, 66) = 6.32$, MSE = 77.50, $p < .005$, $\eta_p^2 = .161$]. Planned comparisons showed that, for both decades, JOLs for actors judged R were higher than
Fn1 those for actors judged either K or N (all ps < .001, ds > 2.15).[1] In contrast to our prior study, JOLs associated with K responses were reliably greater than those associated with N responses for both 1950s actors [32.5 vs. 28.1, $t(33) = 3.84$, $p < .005$, $d = .67$] and 1990s actors [46.4 vs. 38.8, $t(33) = 2.58$, $p < .05$, $d = .45$]. Most interesting for present purposes, the difference between JOLs for R and K responses was greater for 1990s compared with 1950s actors [32.1 vs. 24.8, $t(33) = 2.44$, $p < .05$, $d = .42$], showing that younger adults' JOLs to 1990s actors foreshadowed greater mnemonic discriminability than their JOLs to 1950s actors.

A comparable analysis of the data from the older adults also revealed main effects of decade [$F(1, 32) = 109.40$, MSE = 197.53, $p < .001$, $\eta_p^2 = .774$] and test response [$F(2, 64) = 28.71$, MSE = 483.17, $p < .001$, $\eta_p^2 = .473$] as well as a significant interaction [$F(2, 64) = 12.71$, MSE = 91.44, $p < .001$, $\eta_p^2 = .284$]. As with the younger adults, JOLs for actors given an R at test were higher than those for actors given either K or N responses (all ps < .001, ds > .64), thus replicating Daniels~~, Toth, & Hertzog~~ (2009) and confirming the important role played by recollection in JOL accuracy, even for older adults. Also paralleling the young, older adults' JOLs for 1990s actors were greater for K versus N responses [37.6 vs. 22.7, $t(32) = 3.94$, $p < .001$, $d = .73$]; the comparable difference for 1950s actors, however, was not reliable ($t < 1$). Most important, the mean difference between JOLs for R and K responses did not differ for 1950s versus 1990s actors [16.7 vs. 21.6, $t(32) = -1.51$, $p > .10$]; indeed, the difference was numerically in the wrong direction. Thus, despite having greater recollection for 1950s actors, that superiority in memory performance did not translate into better JOL accuracy for older adults.

JOL Accuracy: d_a and Gamma Correlations

Although the back-sorting analysis provides compelling evidence that recollection plays an important role in mediating JOL accuracy, that analysis is conducted at the level of groups of items and does not capture the predictability of JOLs at the item-by-item level. In an influential paper, Nelson (1984) argued that Goodman- AQ: 5
Kruskal gamma correlations provide the best index of this (item-by-item) level of prediction. However, recent work (Benjamin & Diaz, 2008; Masson & Rotello, 2009) has indicated potential measurement problems with gamma and have instead suggested the use of a signal-detection framework for measuring JOL accuracy. Following these suggestions, we computed estimates of d_a, a non-biased measure of JOL accuracy.[2] Moreover, following Dan- Fn2
iels~~, Toth, & Hertzog~~ (2009), we computed d_a in two ways. The first was designed to mimic standard old/new recognition by coding both R and K as "old" responses and N as "new." For the second "recollect only" method, only R responses were coded as "old" with both K and N responses coded as "new." This latter coding was designed to assess whether JOL accuracy would be enhanced, and age differences observed, when memory was restricted to instances of recollection.

The top half of Table 2 provides standard and recollect-only d_a T2
estimates as a function of age and decade. Analysis of the standard d_a values revealed a main effect of decade [$F(1, 64) = 35.67$, MSE = .19, $p < .0001$, $\eta_p^2 = .36$] such that memory predictions were more accurate for the 1990s compared with 1950s actors. Neither the main effect of age nor the age by decade interaction were significant (Fs < 1). The failure to find an age effect replicates prior research (e.g., Hertzog et al., 2002). In contrast, analysis of the recollect-only d_a values revealed reliable effects of age [$F(1, 68) = 8.26$, MSE = .62, $p < .01$, $\eta_p^2 = .12$] and decade [$F(1, 68) = 16.43$, MSE = .30, $p < .0001$, $\eta_p^2 = .20$] as well as their interaction [$F(1, 68) = 4.83$, MSE = .30, $p < .05$, $\eta_p^2 = .07$]. The interaction reflected the fact that, for 1990s names, JOL accuracy was relatively similar for the young and old ($p > .15$), whereas for 1950s names, JOL accuracy was much lower for the older adults [$t(68) = 3.53$, $p < .0005$, $d = .86$], despite their showing greater recollection of these names, and expressing greater familiarity for them in the post-test interview (see below).

Given the novelty of d_a as a measure of metacognitive accuracy, we also computed gamma correlations which, as can be seen in Table 2, produced the same general pattern as that shown by d_a. Analysis of the standard-memory gammas also revealed the same pattern as did d_a, a main effect of decade [$F(1, 66) = 28.47$, MSE = .06, $p < .0001$, $\eta_p^2 = .30$] with neither the main effect of

[1] For all within-subject comparisons, estimates of effect size (Cohen's d) were corrected for dependence using equation 8 from Morris and DeShon (2002).

[2] To compute d_a, we followed the procedure outlined in Benjamin and Diaz (2008) and used the formula $d_a = \sqrt{2}y_0 / \sqrt{1 + m^2}$, where y_0 and m^2 respectively represent the y intercept and slope of a normal-deviate iso-sensitivity function relating JOLs to later memory performance.

Put "Standard" above the parenthetical so as to match the format for the "Recollect-Only" column.

Table 2
JOL Accuracy: Mean ~~D_A~~ Estimates and Goodman-Kruskal Gamma Correlations as a Function of Participant Age (Young, Old) and Actor Decade (1950s, 1990s)

	Standard (R&K > N)		Recollect-Only (R > K&N)	
	1950s	1990s	1950s	1990s
d_a				
Young				
M	.57	1.07	1.24	1.42
SD	.34	.45	.84	.44
Old				
M	.58	.98	.66	1.24
SD	.46	.64	.57	.80
Gamma				
Young				
M	.40	.61	.62	.73
SD	.21	.24	.24	.16
Old				
M	.40	.64	.48	.68
SD	.29	.33	.37	.36

Note. Standard values were computed by coding both R and K responses as 1 ("old") and N responses as 0 ("new"). Recollect-only values were computed by coding R responses as 1 ("old") and K and N responses as 0 ("new"). See text for details.

age nor the interaction being significant (Fs < 1). Analysis of the recollect-only gammas, in contrast, deviated from the statistical pattern found for d_a. That is, while the main effect of decade was reliable [$F(1, 70) = 22.89$, $MSE = .04$, $p < .0001$, $\eta_p^2 = .25$], neither the main effect of age nor the age-by-decade interaction reached the .05 level ($ps > .14$). Given that Daniels~~, Toth, & Hertzog~~ had found a significant age difference in JOL accuracy for recollect-only gammas, a pattern replicated above in d_a, we re-ran the gamma analyses on the entire stimulus set (i.e., 1950s & 1990s actors considered together). That analysis replicated our prior work, showing no age effect for the standard-memory gammas ($t < 1$) but a significant age difference for the recollect-only gammas, $t(70) = 2.49$, $p < .05$, $d = .60$.

Overall, the d_a and gamma analyses provided three important findings. First, replicating Daniels~~, Toth, & Hertzog~~ (2009), they showed that age-related deficits in item-by-item JOL accuracy may only be revealed for recollective memory; standard measures of memory that include a large automatic/familiarity component may often fail to reveal such deficits. Second, they show that older adults were nearly as accurate as the young in predicting their recollective memory for 1990s actors, despite these actors being better known by the young adults. For 1950s actors, in contrast, the older adults' greater knowledge undermined their memory predictions such that they performed significantly worse than the young. Finally, from a measurement perspective, the results demonstrate how d_a may reveal effects that are not detected by gamma correlations, perhaps because of differences in response bias for young and older adults (see Benjamin & Diaz, 2008; Masson & Rotello, 2009).

Post-Test Interview

Participants were given a structured interview immediately after
T3 the recognition test, a summary of which is provided in Table 3. Because of experimenter error, the interview was not administered to three young adults (thus $n = 33$ for the young). Three findings were most relevant. First, Question 2 (see also Question 6) confirmed a major assumption underlying the present research, that older adults were more familiar with the 1950s actors than the 1990s actors, and vice versa for the younger adults. Second, concerning Question 3 (*Did you use a strategy to make your JOL?*), of the 28 young adults (85%) who reported using a strategy, 18 (64%) mentioned basing their judgment on name recognition, seven (25%) mentioned memory for a movie role, five (18%) memory for the actor's face, 12 (43%) the strangeness of the name, and two (7%) prior knowledge about the actor. Of the 23 older adults (61%) who reported using a strategy, 10 (43%) mentioned name recognition, 14 (61%) memory for a movie, three (13%) face memory, two (9%) name strangeness, and four (17%) a positive opinion of the actor. These data are consistent with the ideas that (a) younger adults were more likely to use a strategy in forming their JOL than were the older adults; and (b) for both young and older adults, when strategies were used they reflected a mix of contextual content (e.g., image of a face, memory of a movie) as well as more fluency-related influences (e.g., name recognition, name strangeness). Finally, Question 4 showed that older adults had more difficulty with the distinction between recollection and knowing than did the younger adults. Although this finding might seem to call into question the use of the R/K method with older adults, we believe it is consistent with age-related declines in recollection. That is, given impaired memory for detail, it is not surprising that older adults find it more difficult to distinguish between memories with and without such detail (see McCabe & Geraci, 2009). Along these lines, it is worth noting that all of the "not clear" responders expressed difficulties in *applying* the distinction rather than *understanding* it. Typical responses were that the distinction was "mostly clear, although difficult to use in some instances"; that while "R was easy, K caused some debate"; and that "R and K felt very similar at times."

Discussion

In earlier work (Daniels, Toth, & Hertzog, 2009), we found evidence that recollection plays an important role in mediating

Table 3
Summary of Response to Post-Test Interview

Question[a]	Young	Old
1. Percentage of names that were famous?	50.8	71.8
2. More familiar with 1950s or 1990s names?		
1950s:	0	30
1990s:	33	0
Equal:	0	6
3. Used specific strategy for making JOL? % "yes":	84.9	61.1
4. Clear distinction between R, K, & N? % "yes":	100.0	63.9
5. Accuracy of memory predictions?[b]	2.61	2.64
6. More accurate for 1950s or 1990s names?		
1950s:	2	26
1990s:	27	0
Equal:	4	10

Note. $n = 33$ for young adults and 36 for older adults.
[a] Questions are in abbreviated form here; see Method for complete questions. [b] Question 5 used a four-point scale where 1 = not at all, 2 = occasionally, 3 = fairly, and 4 = extremely.

JOL accuracy and that age-differences in JOL accuracy emerge when memory is exclusively defined in terms of recollection. The goal of the present study was to determine whether these effects would be moderated by prior knowledge. Using the names of actors from the 1950s and 1990s, we replicated previous research (Long & Prat, 2002) showing that the memory-enhancing effects of prior knowledge are primarily found in recollection. Indeed, the effects of prior knowledge on recollection were nearly symmetrical over age, such that older adults significantly outperformed young adults on recollective memory for 1950s actors. Despite the positive effect of prior knowledge on memory for both age groups, such knowledge conferred a benefit in JOL accuracy only to the young. That is, while the young adults were better able to predict later memory for names for which they were more familiar, older adults failed to show this benefit. Overall, prior knowledge acted as a double-edged sword for older adults, enhancing recollection but undermining JOL accuracy. Below, we argue that this pattern likely reflected an inability of the older adults to filter out nondiagnostic information from their JOLs. Overall, we believe the results are best explained by a dual-process approach to judgments of learning whereby both JOLs and subsequent memory performance reflect both controlled and automatic influences. The results also show the importance of considering both study (JOL-related) and test (memory-related) factors in explaining JOL accuracy. We elaborate on these issues below.

Effects of Prior Knowledge on Memory and Metamemory

Prior knowledge has been shown to enhance episodic memory in both young and older adults (e.g., Backman, 1991; Backman~~, Herijtz, & Karlsson~~, 1987; Castel, 2005). More recently, it has been shown in young adults that the effects of prior knowledge on episodic memory are largely mediated by increased recollection, with little or no effect on more automatic forms of memory such as familiarity (Brandt~~, Cooper, & Dewhurst~~, 2005; Long & Prat, 2002). The present study replicated the beneficial effects of prior knowledge on recollection using a novel set of stimuli and extended those effects to older adults. As noted by others (e.g., Craik & Brown, 2000; Ericsson, 1985), prior knowledge appears to increase memory by providing an organized schema that can be used to both enrich encoding and support retrieval. Prior knowledge likely enriches elaboration by providing access to a variety of background details that could be bound with the new event. Details elicited by actors' names, for example, may have included biographical information (e.g., film roles, spouses), images (the actor's face, a compelling scene), as well as more personal knowledge (episodic details associated with seeing one of the actor's films, one's opinion of the actor, etc.).

A few points of difference did emerge between our study and prior research examining the effects of knowledge on memory. For one, our young adults showed significantly higher familiarity [K/(1 − R)] for 1990s actors compared with 1950s actors [.54 vs. .45, $t(35) = 3.02$, $p < .01$, $d = .51$]. The same comparison for older adults was not significant [.35 vs. .40, $t(35) = 1.51$, $p = .14$], perhaps because they had been pre-exposed to, or had some prior knowledge about, names from both decades. Second, we found age-related declines in estimated familiarity for both the 1990s actors [.54 vs. .35, $t(70) = 3.85$, $p < .001$, $d = .92$] and the stimulus set as a whole [.48 vs. .36, $t(70) = 2.78$, $p < .01$, $d = .66$]. Age-related declines in F are not unprecedented and may reflect a true decline in familiarity under rich stimulus conditions (Toth & Parks, 2006) or measurement related issues (Prull et al., AQ: 6
2006). Regardless, the critical finding of enhanced recollection for high knowledge stimuli seems unassailable and, as discussed in the next section, is most critical for informing questions about the basis of JOL accuracy.

In terms of the effects of prior knowledge on metamemory, our findings for the young adults are in agreement with those of Griffin~~, Jee, & Wiley~~ (2009; see also de Bruin~~, Rikers, & Schmidt~~, 2007) in showing that metamnemonic accuracy can be increased by prior knowledge. Indeed, while they found benefits only for calibration (absolute accuracy) in a metacomprehension task, we found that such benefits may also extend to resolution (relative accuracy) using JOLs for individual names. At least for the young, we found that prior knowledge significantly increased the ability of JOLs to discriminate between items that would later be recollected and those that would not, and enhanced item-by-item JOL accuracy as well. We also note that our gamma correlations were relatively high in comparison with studies that have used more homogenous stimuli such as common words or word pairs (see Nelson & Dunlosky, 1991). We believe ours is the first study to show that prior knowledge can elevate relative JOL accuracy for episodic memory.

Age Deficits in JOL Accuracy: Knowledge as a Double-Edged Sword

In contrast to the young, the findings from our older adults paint a more complicated picture of JOL accuracy that underscores the need to take both judgment (JOL) and retrieval (memory performance) factors into account. As mentioned above, our older adults showed clear benefits of prior knowledge on memory such that, for 1950s actors, they had significantly more recollection than the young (.49 vs. .29). Interesting, they also had less familiarity (.12 vs. .27 for K responses and .40 vs. 45 for estimated F). If JOL accuracy was primarily driven by recollection, then this higher-R/lower-F condition would represent the clearest opportunity for our older participants to show greater JOL accuracy than the young. Yet it was in this condition that the older adults suffered their lowest level of accuracy. What accounts for this low level of monitoring accuracy?

Daniels~~, Toth, & Hertzog~~ (2009) noted two retrieval-based phenomena that could produce lower JOL accuracy in older versus younger adults: Forgetting of the details used to generate JOLs at study (resulting in high-JOL items being judged as K or N), and false recollection of encoding details (resulting in low-JOL items being judged as R). However, neither of these explanations seems adequate to explain the older adults' low level of JOL accuracy for 1950s actors. Recollection was clearly higher in older adults for 1950s actors relative to 1990s actors, ruling out the forgetting hypothesis. And false recollection, while significantly higher in the older adults, was nevertheless similar for 1950s and 1990s actors, ruling out the false recollection hypothesis. Thus, although our findings clearly identify recollection as an important factor mediating JOL accuracy, the overall pattern of data points to factors operating at encoding as the source of older adults' reduced accuracy. Following Glenberg et al. (1987), we believe our older

tapraid5/z2m-aging/z2m-aging/z2m00211/z2m2496d11z | xppws | S=1 | 3/10/11 | 6:19 | Art: 2010-1095

adults' JOLs may have been overly influenced by their general familiarity with 1950s actors, instead of the details of their encoding experience which would likely have been more diagnostic of their later memory performance.

Three sources of evidence support the idea that older adults made their JOLs based on general familiarity with 1950s actors, rather than on the episodic details surrounding their encoding of
F3 ~~these~~ actors. First, as shown in Figure 3, older adults made significantly more "100" JOLs to 1950s actors compared with those made by the young to 1990s actors [$t(70) = 2.37$, $p < .05$, $d = .57$]. Second, compared with the young, older adults gave much higher JOLs to actors from their high-knowledge decade that they did *not* remember at test. To see this, compare the JOLs given to N actors by the young and older participants (Figure 2). For the young, JOLs associated with N responses went from 27.7 for 1950s actors to 38.8 for 1990s actors; in comparison, JOLs associated with N responses in older adults went from 20.8 for 1990s actors to 52.4 for 1950s actors, a nearly three-fold increase relative to the young. These data show that older adults were unduly confident in remembering *all* 1950s actors, a pattern consistent with a familiarity-based judgment strategy. Finally, in the post-test interview, fewer older adults reported using a specific strategy for making their JOLs than the young. Although there are a number of potential explanations for this result, it is nevertheless consistent with the claim that younger adults used a more analytic approach to JOL formation while the older adults were more likely to base their JOLs on factors such as processing fluency and general familiarity.

Of course, in addition to identifying the judgment factors responsible for older adults' low JOL accuracy, it is also important to specify *why* they were unable to make more accurate JOLs for 1950s actors, especially given their ability to recollect episodic details about these actors. One possibility is that age-related declines in cognitive resources impaired the ability of older participants to filter out nondiagnostic (familiarity-based) information from their JOL, or to use only relevant information in forming their JOL, information that was episodically bound to the target name. This idea is similar to one expressed by Hertzog et al. (2002), who suggested that age-related deficits in JOL accuracy may occur "when multiple diagnostic sources of information are available as cues for JOLs. The idea is simply that when individuals must monitor and combine multiple cues to optimize JOL accuracy,

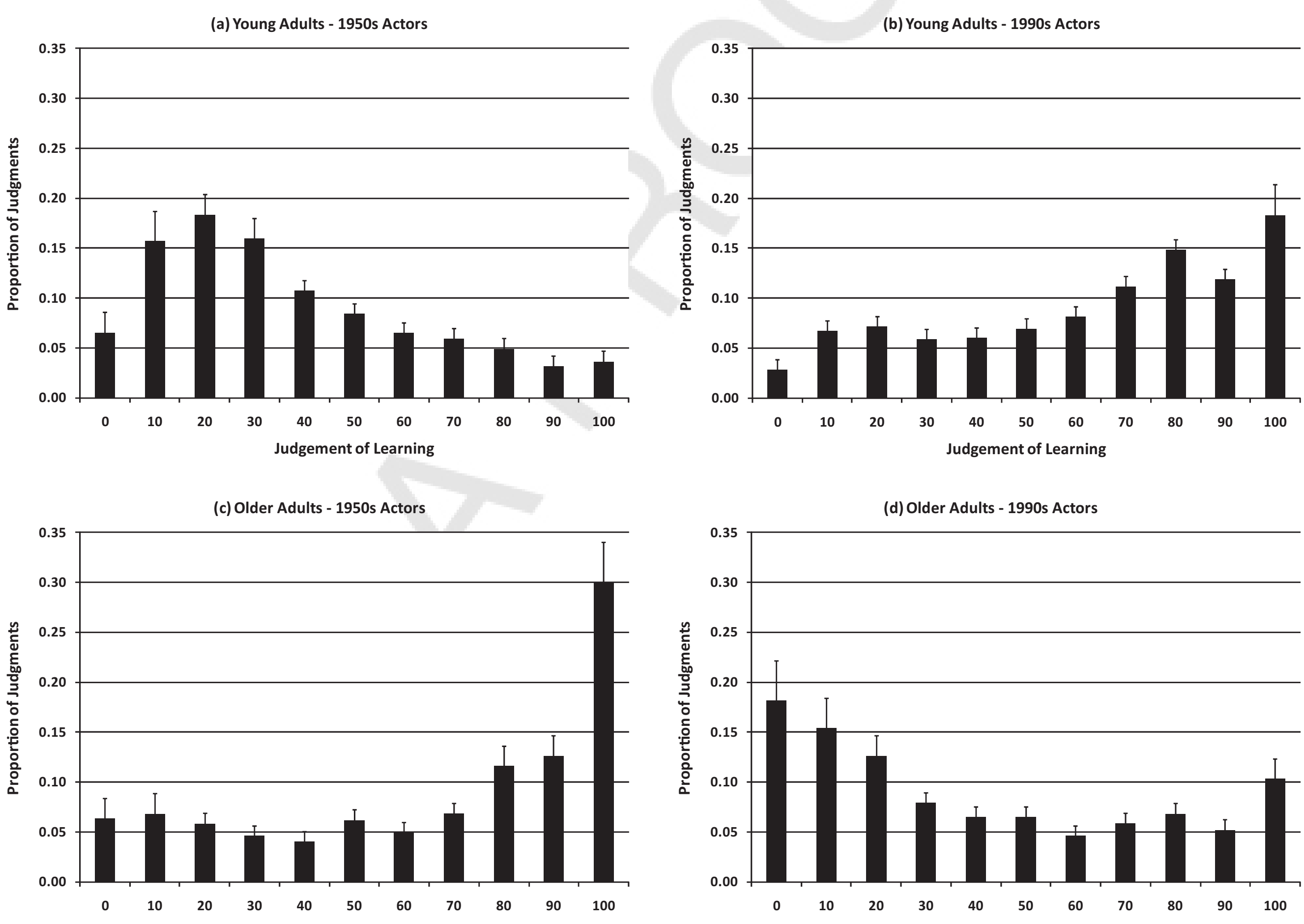


Figure 3. Distribution of JOL ratings given by (a) Young Adults for 1950s actors, (b) Young Adults for 1990s actors, (c) Older Adults for 1950s actors, and (d) Older Adults for 1990s actors. Error bars represent standard errors.

resource limitations during encoding may be more likely to reduce cue accessibility or to deter optimal cue utilization when making JOLs" (p. 210). Hertzog et al. failed to find evidence for this in their experiments using paired associates, but we believe the present experiment, by using arguably richer stimuli that engendered semantic retrieval during episodic encoding, may have better instantiated this multiple-cue situation.

Note that a resource-deficit explanation of older adults' low JOL accuracy for 1950s names is also consistent with research suggesting a relation between metacognitive monitoring and executive (frontal lobe) processes. For example, it has been shown that dividing the attention of young adults at encoding undermines their monitoring accuracy (Kelley & Sahakyan, 2003; Sacher, Taconnat,
AQ: 7 Souchay, & Isingrini, 2009). Significant correlations have also been found between monitoring tasks and measures of executive functioning (Souchay & Isingrini, 2004; Souchay, Isingrini, & Espagnet, 2000; but see Souchay et al., 2004), and less effective monitoring has been observed for individuals with low working memory capacity (Griffin~~, Jee, & Wiley~~, 2009) and for patients with frontal lobe damage (Vilkki, Servo, & Surma-aho, 1998; Vilkki, Surma-aho, & Servo, 1999; for reviews see Pannu & Kaszniak, 2005; Schwartz & Bacon, 2008; Shimamura, 2008). Additionally, using fMRI, Kao, Davis, and Gabrieli (2005) found a significant relationship between JOL accuracy and activation of the ventromedial prefrontal cortex. Together, these studies support the possibility that the reduced JOL accuracy for our older adults was attributable to deficits in their ability to effectively manage the effects of multiple cues on JOL formation. An executive/frontal resource deficit is also consistent with our finding that reduced JOL accuracy for older adults occurred only in their high-knowledge decade, the one where declining resources would have been most needed to oppose the misleading effects of general familiarity engendered by well-known actors.

Regardless of the exact mechanism, the present study clearly shows that prior knowledge in older adults can act as both virtue and vice, enhancing recollection while also undermining the ability to monitor new learning. This pattern may have implications for education, expertise, and the effects of resource limitations brought on by aging or other factors, such as divided attention. For example, our results suggest that older adults might show impaired JOLs when trying to remember information for which they have extensive prior knowledge, such as a grocery list of typical items, or a doctor's new instructions about a long-standing medical condition. That is, metamnemonic judgments about specific pieces of information, and thus the effective control of learning, might be undermined as a result of high fluency or familiarity with the general topic. Similar findings may be expected with young adults under conditions of divided attention or other forms of resource depletion (e.g., stress, illness, fatigue, or sleep deprivation).

On the positive side, our results suggest that, at least in young adults, knowledge about a topic can increase the relative accuracy of predicting memory for items related to that topic. This finding could be useful in understanding the conditions under which monitoring judgments (like JOLs) most effectively guide learning activities (like self-paced study time). For example, our results suggest that students could better trust their immediate monitoring of material for which they have sufficient background knowledge (e.g., courses in their major) as opposed to less well-known domains (courses outside of their major) for which other learning strategies may be more appropriate. Finally, the results suggest the possibility of training individuals, both young and old, to exercise caution when making memory predictions about well-known material for which fluency and familiarity is high, and instead to base their predictions on the kind of distinctive, contextual details that could later serve as the basis of recollection.

Toward a Dual-Process Theory of JOL Accuracy

As noted earlier, one of the difficulties in understanding JOL accuracy is that it reflects a relation between two judgments, one occurring at encoding (the JOL) and one occurring at retrieval (the memory response). This relation is made more complex if one assumes that both JOLs and memory responses are subject to controlled and automatic influences. Despite the challenge, we believe there is ample evidence to support a dual-process orientation in both the cognitive/memory domain (e.g., Mandler, 1980; Jacoby, 1991; Yonelinas, 2002) and the metacognitive domain (e.g., ~~Jacoby & Kelley,~~ 1996; Koriat, 1997; Koriat & Levy-Sadat, AQ:8,9
1999). Thus, an important goal for understanding metacognitive accuracy will be finding a way to combine these two orientations into one integrated theory.

Koriat and his colleagues have argued that metacognitive judgments are best understood in terms of a distinction between information-based and experience-based factors (see Koriat, 2007; Koriat, Nussinson, Bless, & Shaked, ~~2007~~). Information-based AQ: 10
factors include explicit beliefs and "theories" about one's memory abilities, whereas experience-based factors are thought to reflect more automatic factors such as encoding fluency. This distinction usefully integrates extant findings and has been fruitful in spurring important new research (e.g., Koriat & Bjork, 2005, 2006; Koriat et al., 2004). A drawback with using this distinction to explain JOL *accuracy*, however, is that it is primarily focused on JOLs (and other metacognitive judgments) and thus fails to take the nature of retrieval into account. A selective focus on metacognitive judgments to explain metacognitive accuracy can also be seen in Griffin~~, Jee, & Wiley~~'s (2009) recently proposed model of metacomprehension accuracy (see their Figure 1). For that model, there are two influences on metacognitive judgment, one heuristic and one more analytic, but memory performance is depicted as a unitary process or outcome. In contrast, based on dual-process approaches to memory, we have focused on the relevance of separating controlled and automatic influences operating at retrieval for understanding JOL accuracy. We believe the present findings highlight the need to integrate these two orientations (for a similar perspective, see Souchay et al., 2007). In effect, what needs to be understood is how automatic and controlled aspects of metacognitive judgments (such as JOLs and FOKs) relate to automatic and controlled aspects of memory performance (such as recollection and familiarity).

Investigating the correspondence between controlled and automatic influences on cognitive and metacognitive judgments can provide new perspectives on existing issues and raise new questions for future research. For example, consider delayed JOLs which generally result in much higher JOL accuracy than immediate JOLs (Nelson & Dunlosky, 1991). Notwithstanding effects of the JOL on memory performance itself (Spellman & Bjork, 1992), one of the most common explanations for this effect is that delayed, but not immediate, JOLs involve attempted retrieval of the target items, which provides a highly diagnostic cue to later performance. From a dual-process perspective, one might speculate that delayed JOLs in this context are largely automatic, based on the fluency of retrieval. If so, we would predict that use of our back-sorting procedure would result in large differences between JOLs for K and N responses, in contrast to the small (present study) or nonsignificant differences (Daniels~~, Toth, & Hertzog~~, 2009) found in prior research. Stated differently, the automatic processes engaged during an initial retrieval attempt would likely be good predictors of the automatic processes engaged on a later test.

Another issue that may be informed by combining dual-process orientations on metacognitive judgments and cognitive performance concerns the nature of recollection. As noted earlier, the main hypothesis behind the present study, as well as Daniels~~, Toth, & Hertzog~~ (2009), was that JOL accuracy is reliably mediated by recollection at test of contextual details that were used to form JOLs at study. That is, we assumed that, in contrast to automatic influences which are highly task-specific, controlled influences such as recollection can better transcend changes in context and stimulus form. An interesting question is the degree to which the generation and use of contextual details at study is a controlled or automatic process~~es~~. The fact that recollection is generally considered to be a voluntary, controlled process suggests that the generation and use of context at study may also be controlled. However, generation of contextual details could also occur through more automatic processes akin to involuntary conscious recollection (see Roediger, Suparna, & Geraci, 2007), and their influence on JOLs could be mediated by automatic heuristics based on fluency or availability. Addressing this and related issues may require the development of methods that can separate and measure controlled and automatic influences on the JOL, similar to how the process-dissociation procedure was created to separate these influences in memory performance (Jacoby, 1991).

Given the important role played by recollection in metacognitive accuracy, a broader question concerns how this mnemonic process relates to Koriat's distinction between information-based and experience-based metacognitive influences. Indeed, we find it difficult to fit recollection into this theoretical distinction. Given its personal, idiosyncratic nature, recollection would seem to clearly be an experience- or mnemonic-based influence. Yet such influences are thought to be "contentless" and operating "automatically and unconsciously," qualities that do not seem consistent with recollection. This theoretical tension encourages more research and theory on the role of recollection in metacognitive monitoring.

In summary, building on prior research (Backman, 1991; Daniels, Toth, & Hertzog, 2009; Long & Prat, 2002; Tulving, 1985), the present experiment investigated the effects of prior knowledge on memory and metamemory in young and older adults. Results revealed an association between memory predictions and memory performance in young adults, with prior knowledge enhancing both. Older adults, in contrast, exhibited a dissociation between memory and metamemory, with prior knowledge enhancing recollection but impairing predictions about what they would later remember. These results suggest that older adults should exercise caution when monitoring memory performance in a domain for which they have extensive prior experience.

References

Backman, L. (1991). Recognition memory across the adult life span: The role of prior knowledge. *Memory & Cognition, 19,* 63–71. doi:10.3758/BF03198496

Backman, L., Herijtz, A., & Karlsson, T. (1987). Pre-experimental knowledge facilitates episodic recall in young, young-old, and old-old adults. *Experimental Aging Research, 13,* 89–91.

Begg, I., Duft, S., Lalonde, P., Melnick, R., & Sanvito, J. (1989). Memory predictions are based on ease of processing. *Journal of Memory and Language, 28,* 610–632. doi:10.1016/0749-596X(89)90016-8

Benjamin, A., Bjork, R., & Schwartz, B. (1998). The mismeasure of memory: When retrieval fluency is misleading as a metamnemonic index. *Journal of Experimental Psychology: General, 127,* 55–68. doi:10.1037/0096-3445.127.1.55

Benjamin, A., & Diaz, M. (2008). Measurement of relative metamnemonic accuracy. In J. Dunlosky & R. Bjork (Eds.), *Handbook of metamemory and memory* (pp. 73–94). New York: Psychology Press.

Brandt, K. R., Cooper, L. M., & Dewhurst, S. A. (2005). Expertise and recollective experience: Recognition memory for familiar and unfamiliar academic subjects. *Applied Cognitive Psychology, 19,* 1113–1125. doi:10.1002/acp.1163

Bruce, P. R., Coyne, A. C., & Botwinick, J. (1982). Age differences in metamemory. *Journal of Gerontology, 37,* 354–357.

Castel, A. D. (2005). Memory for grocery prices in younger and older adults: The role of schematic support. *Psychology and Aging, 20,* 718–721. doi:10.1037/0882-7974.20.4.718

Chalfonte, B. L., & Johnson, M. K. (1996). Feature memory and binding in young and older adults. *Memory & Cognition, 24,* 403–416. doi:10.3758/BF03200930

Connor, L. T., Dunlosky, J., & Hertzog, C. (1997). Age-related differences in absolute but not relative metamemory accuracy. *Psychology and Aging, 12,* 50–71. doi:10.1037/0882-7974.12.1.50

Craik, F. I. M., & Brown, S. C. (2000). Memory: Coding processes. In A. E. Kazdin (Ed.), *The Encyclopedia of Psychology* (Vol. 5, pp. 162–166). New York: Oxford University Press.

Daniels, K. A., Toth, J. P., & Hertzog, C. (2009). Aging and recollection in the accuracy of judgments of learning. *Psychology and Aging, 24,* 494–500. doi:10.1037/a0015269

de Bruin, A., Rikers, R., & Schmidt, H. (2007). Improving metacomprehension accuracy and self-regulation in cognitive skill acquisition: The effect of learner expertise. *European Journal of Cognitive Psychology, 19,* 671–688. doi:10.1080/09541440701326204

Dunlosky, J., & Hertzog, C. (2000). Updating knowledge about strategy effectiveness: A componential analysis of learning about strategy effectiveness from task experience. *Psychology & Aging, 15,* 462–474. doi:10.1037/0882-7974.15.3.462

Dunlosky, J., & Nelson, T. O. (1997). Similarity between the cue for judgments of learning (JOL) and the cue for test is not the primary determinant of JOL accuracy. *Journal of Memory and Language, 36,* 34–49. doi:10.1006/jmla.1996.2476

Dunlosky, J., Rawson, K. A., & McDonald, S. L. (2002). Influence of practice tests on the accuracy of predicting memory performance for paired associates, sentences, and text material. In T. J. Perfect & B. L. Schwartz (Eds.), *Applied metacognition* (pp. 68–92). Cambridge, UK: Cambridge University Press. doi:10.1017/CBO9780511489976.005

Ericsson, K. A. (1985). Memory skill. *Canadian Journal of Psychology, 39,* 188–231. doi:10.1037/h0080059

Gardiner, J., Ramponi, C., & Richardson-Klavehn, A. (1998). Experiences of remembering, knowing, and guessing. *Consciousness and Cognition, 7,* 1–26. doi:10.1006/ccog.1997.0321

Gillund, G., & Perlmutter, M. (1993). Episodic memory and knowledge interactions across adulthood. In L. L. Light & D. M. Burke (Eds.), *Language, Memory and Aging* (pp. 191–208). New York: Cambridge University Press.

Glenberg, A. M., & Epstein, W. (1985). Calibration of comprehension. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 11,* 702–718. doi:10.1037/0278-7393.11.1-4.702

Glenberg, A. M., Sanocki, T., Epstein, W., & Morris, C. (1987). Enhancing calibration of comprehension. *Journal of Experimental Psychology: General, 116,* 119–136. doi:10.1037/0096-3445.116.2.119

Griffin, T. D., Jee, B. D., & Wiley, J. (2009). The effects of domain knowledge on metacomprehension accuracy. *Memory & Cognition, 37,* 1001–13. doi:10.3758/MC.37.7.1001

Hambrick, D. Z., & Engle, R. W. (2001). Effects of domain knowledge, working memory capacity, and age on cognitive performance: An investigation of the knowledge-is-power hypothesis. *Cognitive Psychology, 44,* 339–387. doi:10.1006/cogp.2001.0769

Hertzog, C., Kidder, D., Powell-Moman, A., & Dunlosky, J. (2002). Aging and monitoring associative learning: Is monitoring accuracy spared or impaired? *Psychology and Aging, 17,* 209–225. doi:10.1037/0882-7974.17.2.209

Jacoby, L. L. (1991). A process dissociation framework: Separating automatic from intentional uses of memory. *Journal of Memory and Language, 30,* 513–541. doi:10.1016/0749-596X(91)90025-F

Jacoby, L. L., Yonelinas, A. P., & Jennings, J. (1997). The relation between conscious and unconscious (automatic) influences. A declaration of independence. In J. Cohen & J. W. Schooler (Eds.), *Scientific Approaches to Consciousness* (pp. 13–47). Mahweh NJ: Erlbaum.

Kao, Y. C., Davis, E. S., & Gabrieli, J. D. (2005). Neural correlates of actual and predicted memory formation. *Nature Neuroscvience, 8,* 1776–1783. doi:10.1038/nn1595

Kelley, C., & Sahakyan, L. (2003). Memory, monitoring, and control in the attainment of memory accuracy. *Journal of Memory and Language, 48,* 704–721. doi:10.1016/S0749-596X(02)00504-1

Koriat, A. (1997). Monitoring one's own knowledge during study: A cue-utilization approach to judgments of learning. *Journal of Experimental Psychology: General, 126,* 349–370. doi:10.1037/0096-3445.126.4.349

Koriat, A. (2007). Metacognition and consciousness. In P. Zelazo, M. Moscovitch, & E. Thompson (Eds.), *The Cambridge Handbook of Consciousness* (pp. 289–325). New York: Cambridge University Press.

Koriat, A., & Bjork, R. A. (2005). Illusions of competence in monitoring one's knowledge during study. *Journal of Experimental Psychology: Learning, Memory and Cognition, 31,* 187–194. doi:10.1037/0278-7393.31.2.187

Koriat, A., & Bjork, R. A. (2006). Mending metacognitive illusions: A comparison of mnemonic-based and theory-based procedures. *Journal of Experimental Psychology: Learning, Memory and Cognition, 32,* 1133–1145. doi:10.1037/0278-7393.32.5.1133

Koriat, A., & Bjork, R. A., Sheffer, L., & Bar, S. K. (2004). Predicting one's own forgetting: The role of experience-based and theory-based processes. *Journal of Experimental Psychology: General, 133,* 643–656. doi:10.1037/0096-3445.133.4.643

Koriat, A., & Ma'ayan, H. (2005). The effects of encoding fluency and retrieval fluency on judgments of learning. *Journal of Memory and Language, 52,* 478–492. doi:10.1016/j.jml.2005.01.001

Long, D. L., & Prat, C. S. (2002). Memory for Star Trek: The role of prior knowledge in recognition revisited. *Journal of Experimental Psychology: Learning, Memory, & Cognition, 28,* 1073–1082. doi:10.1037/0278-7393.28.6.1073

Lovelace, E. A., & Marsh, G. R. (1985). Prediction and evaluation of memory performance by young and old adults. *Journal of Gerontology, 40,* 192–197.

Mandler, G. (1980). Recognizing: The judgment of previous occurrence. *Psychological Review, 87,* 252–271. doi:10.1037/0033-295X.87.3.252

Masson, M. E. J., & Rotello, C. M. (2009). Sources of bias in the Goodman-Kruskal gamma coefficient measure of association: Implications for studies of metacognitive processes. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 35,* 509–527. doi:10.1037/a0014876

Matvey, G., Dunlosky, J., & Guttentag, R. (2001). Fluency of retrieval at study affects judgments of learning (JOLs): An analytic or nonanalytic basis for JOLs? *Memory & Cognition, 29,* 222–232. doi:10.3758/BF03194916

McCabe, D. P., & Geraci, L. D. (2009). The influence of instructions and terminology on the accuracy of remember-know judgments. *Consciousness and Cognition, 18,* 401–413. doi:10.1016/j.concog.2009.02.010

Morris, S. B., & DeShon, R. P. (2002). Combining effect size estimates in meta-analysis with repeated measures and independent-groups designs. *Psychological Methods, 7,* 105–125. doi:10.1037/1082-989X.7.1.105

Nelson, T. O., & Dunlosky, J. (1991). When people's judgments of learning (JOLs) are extremely accurate at predicting subsequent recall: The "delayed-JOL effect." *Psychological Science, 2,* 267–270. doi:10.1111/j.1467-9280.1991.tb00147.x

Nietfeld, J. L., & Schraw, G. (2002). The effect of knowledge and strategy training on monitoring accuracy. *The Journal of Educational Research, 95,* 131–142. doi:10.1080/00220670209596583

Paller, K., & Wagner, A. D. (2002). Observing the transformation of experience into memory. *Trends in Cognitive Sciences, 6,* 93–102. doi:10.1016/S1364-6613(00)01845-3

Pannu, J. K., & Kaszniak, A. W. (2005). Metamemory experiments in neurological populations: A review. *Neuropsychology Review, 15,* 105–130. doi:10.1007/s11065-005-7091-6

Prull, M. W., Dawes, L. L. C., Martin, A. M., III, Rosenberg, H. F., & Light, L. L. (2006). Recollection and familiarity in recognition memory: Adult age differences and neuropsychological test correlates. *Psychology and Aging, 21,* 107–118. doi:10.1037/0882-7974.21.1.107

Rabinowitz, J., Craik, F., Ackerman, B., & Hinchley, J. L. (1982). Aging and metamemory: The roles of relatedness and imagery. *Journal of Gerontology, 37,* 688–695.

Roediger, H. L., Suparna, R., & Geraci, L. (2007). Three forms of consciousness in retrieving memories. In P. Zelazo, M. Moscovitch, & E. Thompson (Eds.), *The Cambridge Handbook of Consciousness* (pp. 251–287). New York: Cambridge University Press.

Schneider, W., Eschman, A., & Zuccolotto, A. (2002). *E-Prime user's guide.* Pittsburgh, PA: Psychology Software Tools.

Schwartz, B. L., & Bacon, E. (2008). Metacognitive neuroscience. In J. Dunlosky & R. Bjork (Eds.), *Handbook of metamemory and memory* (pp. 355–371). New York: Psychology Press.

Shaw, R., & Craik, F. (1989). Age differences in predictions and performance on a cued recall task. *Psychology and Aging, 4,* 131–135.

Shimamura, A. P. (2008). A neurocognitive approach to metacognitive monitoring and control. In J. Dunlosky & R. Bjork (Eds.), *Handbook of metamemory and memory* (pp. 373–390). New York: Psychology Press.

Souchay, C., & Isingrini, M. (2004). Age related differences in metacognitive control: Role of executive functioning. *Brain and Cognition, 56,* 89–99. doi:10.1016/j.bandc.2004.06.002

Souchay, C., Isingrini, M., Clarys, D., Taconnat, C., & Eustache, F. (2004). Executive functioning and judgment-of-learning versus feeling-of-knowing in older adults. *Experimental Aging Research, 30,* 47–62. doi:10.1080/03610730490251478

Souchay, C., Isingrini, M., & Espagnet, L. (2000). Aging, episodic memory feeling-of-knowing, and frontal functioning. *Neuropsychology, 2,* 299–309. doi:10.1037/0894-4105.14.2.299

Souchay, C., Moulin, C. J., Clarys, D., Taconnat, L., & Isingrini, M. (2007). Diminished episodic memory awareness in older adults: Evidence from feeling-of-knowing and recollection. *Consciousness and Cognition, 16,* 769–84. doi:10.1016/j.concog.2006.11.002

Spellman, B. A., & Bjork, R. A. (1992). When predictions create reality: Judgments of learning may alter what they are intended to assess. *Psychological Science, 3,* 315–316. doi:10.1111/j.1467-9280.1992.tb00680.x

Tulving, E. (1985). Memory and consciousness. *Canadian Psychology, 26,* 1–12. doi:10.1037/h0080017

Van Overschelde, J. P., Rawson, K. A., Dunlosky, J., & Hunt, R. R. (2005). Distinctive processing underlies skilled memory. *Psychological Science, 16,* 358–361. doi:10.1111/j.0956-7976.2005.01540.x

Vilkki, J., Servo, A., & Surma-aho, O. (1998). Word list learning and prediction of recall after frontal lobe lesions. *Neuropsychology, 12,* 268–277. doi:10.1037/0894-4105.12.2.268

Vilkki, J., Surma-aho, O., & Servo, A. (1999). Inaccurate prediction of retrieval in a face matrix learning task after right frontal lobe lesions. *Neuropsychology, 13,* 298–305. doi:10.1037/0894-4105.13.2.298

Weaver, C. A., & Kelemen, W. L. (2003). Processing similarity does not improve metamemory: Evidence against transfer-appropriate-monitoring. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 29,* 1058–1065. doi:10.1037/0278-7393.29.6.1058

Yonelinas, A. (2002). The nature of recollection and familiarity: A review of 30 years of research. *Journal of Memory and Language, 46,* 441–517. doi:10.1006/jmla.2002.2864

Received August 5, 2010
Revision received February 16, 2011
Accepted February 17, 2011 ■

AUTHOR QUERIES

AUTHOR PLEASE ANSWER ALL QUERIES 1

AQ1: Author: This article has been lightly edited for grammar, style, and usage. Please compare against your original document and make changes on these paged proofs. If no change is required in response to a question, please write "OK as set" in the margin.

AQ2: Author: Connor et al. (1997) is not in your references. Please add to the reference list or delete from the text.

AQ3: Author: Connor et al. (1997) is not in your references. Please add to the reference list or delete from the text.

AQ4: Author: Please review the typeset table(s) carefully against your original table(s) to verify accuracy of editing and typesetting.

AQ5: Author: Nelson (1984) is not cited in your text. Please cite in the text or delete from the references.

AQ6: Author: Toth and Parks (2006) is not in your references. Please add to the reference list or delete from the text.

AQ7: Author: Sacher et al. (2009) is not in your references. Please add to the reference list or delete from the text.

AQ8: Author: Jacoby & Kelley (1996) is not in your references. Please add to the reference list or delete from the text.

AQ9: Author: Koriat & Levy-Sadat (1999) is not in your references. Please add to the reference list or delete from the text.

AQ10: Author: Koriat et al. (2007) is not in your references. Please add to the reference list or delete from the text.

AQ11: Author: Please confirm that all authors' institutional affiliations and all correspondence information are correct as shown.

AQ12: Author: Please carefully review any Acknowledgments, Sources of Funding, and/or Disclosures listed and confirm that they are accurate and complete for all authors.

AUTHOR QUERIES

AUTHOR PLEASE ANSWER ALL QUERIES

AQ13: Author: Please confirm figure(s) and legend(s) as set.