Development and evaluation of an autobiographical memory training protocol for older adults using wearable cameras

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“La vida no es la que uno vivió,

sino la que uno recuerda

y cómo recuerda para contarla.

— Gabriel García Márquez, Vivir para contarla

Contents

List of Figures

List of Tables

ABSTRACT

Autobiographical episodic memory is the cognitive ability most impaired by healthy aging and it has been a primary target of cognitive training studies in this population. We propose a memory training that uses images from the participants' past days as stimuli thus training abilities closer to the way memory is used in the real world. Wearable cameras take hundreds of pictures per day from a first-person perspective without user intervention and can be used to collect personalized retrieval cues. This thesis is divided into two papers: the first describes the development of the structure of a memory training protocol and the process of adapting equipment and software for older adults. We developed a Memory Task program that integrates image processing software from Dublin City University and presents the task over the course of several weeks without the need for the researcher's intervention. The second paper discusses preliminary results for the autobiographical memory training protocol. A sample of 15 older adults was divided into two groups that trained with temporal order tasks using either wearable camera pictures (AM group) or images from a database (LM group) as stimuli. The results showed a trend for participants in the AM group to improve more than participants in the LM group. Moreover, the AM group improved significantly in a fluid cognition measure after the training. This thesis presents an innovative method for training autobiographical memory using ecologically valid stimuli that are engaging and meaningful to the participants.

Keywords: Autobiographical memory, memory training, wearable cameras

Developing a protocol with wearable cameras for memory research with older adults: a methodological report

Abstract

Even in healthy aging, older adults usually present cognitive deficits compared to younger adults. Evidence indicates that episodic memory declines with aging, while semantic memory remains stable. Research in memory aids has already demonstrated that older adults can benefit from tools that reduce the cognitive load of initiating information retrieval. Wearable cameras can be an alternative that is easy to use and can improve data collection and the development of research that investigates memory for real life events. This study describes the development stages of a memory training protocol that uses wearable cameras to stimulate autobiographical memory. We aimed to formulate a protocol structure that would allow the participants enough time to learn how to deal with the equipment and the tasks involved in the training. The results showed that a protocol structure that divided the set of instructions into two sessions allowed the participants to understand how to use the equipment correctly at home by themselves while using automatized image processing to increase protection to the participants' privacy. The older adults' response to the overall study and camera use was positive, indicating that studies using the wearable camera can be engaging and motivating.

Keywords: Autobiographical memory; wearable cameras; methodological report; older adults.

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Autobiographical memory training for older adults using wearable cameras: an exploratory study

Abstract

Evidence shows that episodic memory declines with age, which is a source of uneasiness for older adults and their families. Recently, the interest in investigating how cognitive training might mitigate these detrimental effects is growing, with a specific focus on how technology might help the development of interventions that are more effective in improving older adults' daily lives. Wearable cameras are devices that can automatically collect first-person pictures that can be used in memory interventions. The aim of this study is to investigate the effects of a temporal order decision task in older adults' memory using pictures collected from wearable cameras compared to using generic pictures from an image database. Fifteen participants were divided in two groups and did a 4-week training at home. Results indicate that reviewing automatically collected pictures from their personal lives might help improve temporal decision memory for untrained events. Using contextually rich, personally significant, real life events to train memory in a task that allows for context reconstruction might be effective in stimulating autobiographical memory. Future research should investigate these effects in larger samples.

Keywords: Autobiographical memory; wearable cameras; memory training; older adults.

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APPENDIX

Appendix A

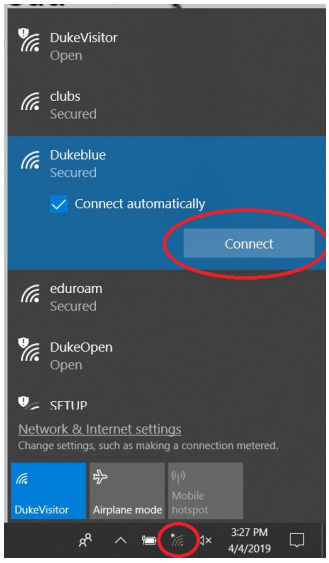
Instructions for familiarization phase

INSTRUCTIONS

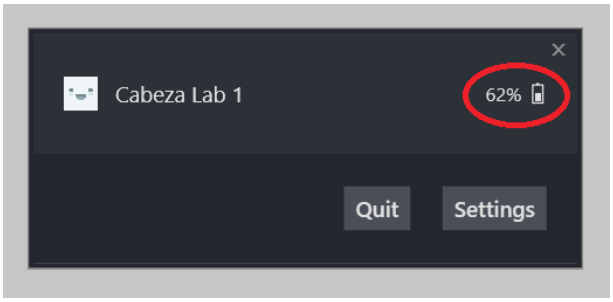
Calendar:

1st lab visit	Day 1	Day 2	Day 3	Day 4	Day 5	2nd lab visit

1. When you get home, please turn on the computer. Press any key. You'll see a blank space at the center of the screen. Type in "123" and press Enter.
2. Connect the laptop to your Wi-Fi.
    a. On the Windows bar, click the Wi-Fi icon on the right lower corner on the screen.
    b. Find your home Wi-Fi.
    c. Click the "connect" button.
    d. Type your home Wi-Fi password.

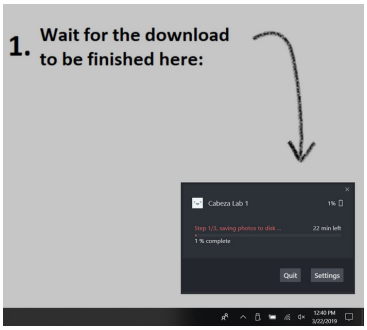


3. Charge the camera the night before your first use: plug the camera on the computer. A small window is going to appear at the inferior right corner of the screen. Leave it plugged overnight so the camera can charge.

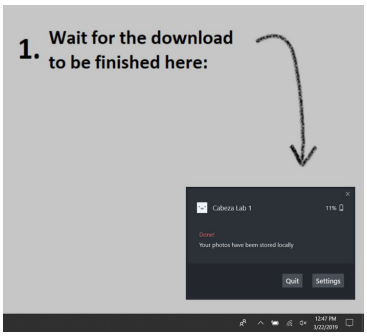


4. Use the camera during the day for around 6 hours per day.

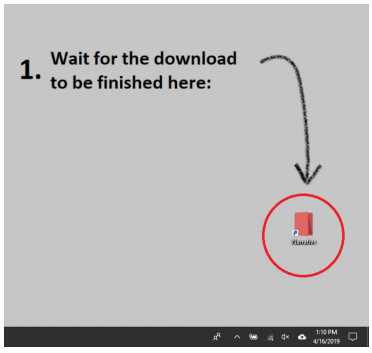
    a. As long as the camera is charged, it's always ON. There's no need to activate it. If you don't want it to take pictures of a given situation, just put it inside your pocket or turn it backwards.



5. At the end of the day plug the camera on the computer. You should do this the same day that you use the camera before midnight. A small window is going to appear at the inferior right corner of the screen. The download is going to start and you'll see a progress bar.

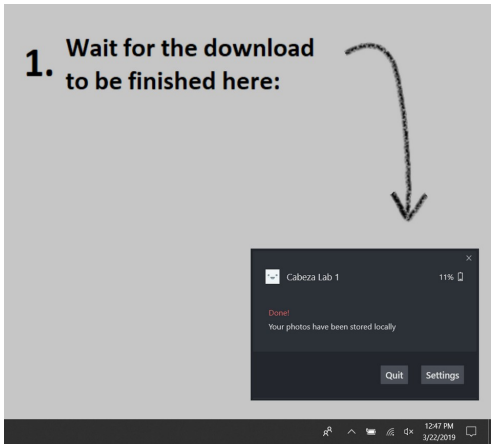


    a. If the camera app doesn't launch, double click on the Narrative icon on the screen.

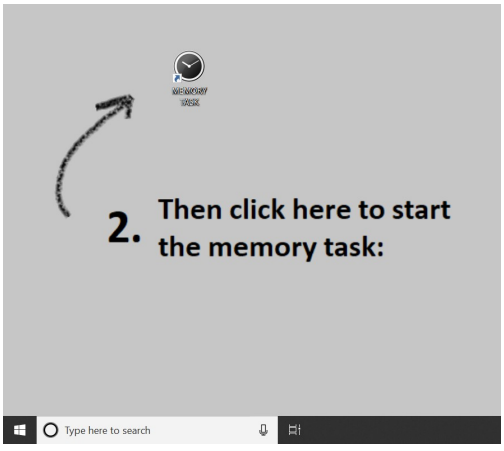


b. If you see the window but no progress bar, try unplugging the USB cable and plugging it again. If that doesn't work, inform the researcher.

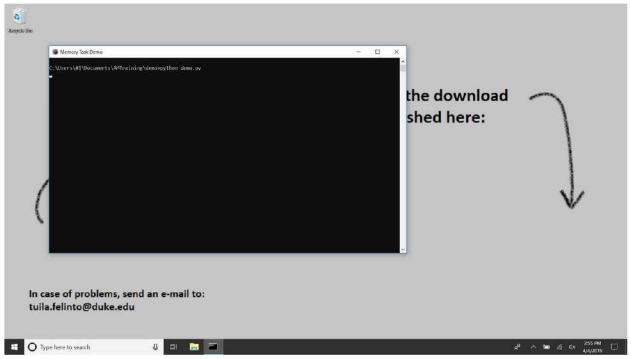
6. Wait until the download is finished (you'll see a "Done!" message). This will take less than 10 minutes. You don't need to close this window.



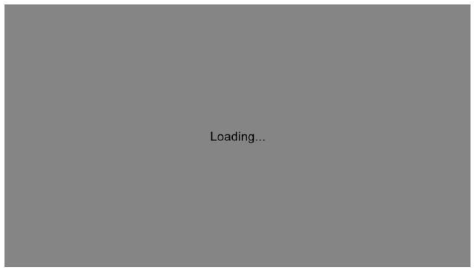
7. Double-click the Memory Task icon on your desktop. You only have to click here to start the program once a day.



8. You'll see a black window on the screen. This means that the program is starting. This is going to take a few moments. There's no need to do anything at this point. Just wait for the program to start.



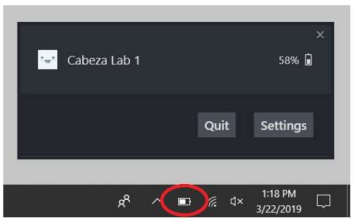
9. You'll see a grey screen with a "Loading..." message. Wait until the program is ready. This will take less than 10 minutes. You'll hear a sound indicating that it's finished.



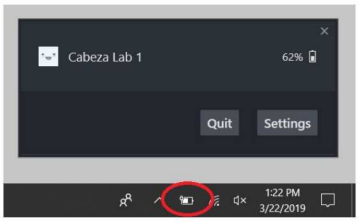
10. Follow the instructions on the screen.

11. When you finish, leave the camera connected to the computer during the night. Make sure that the computer is also charging.

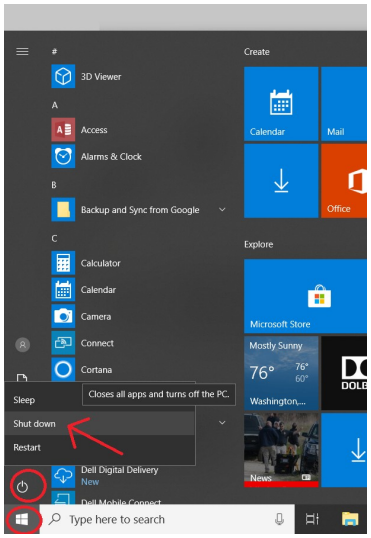
Not charging



Charging



12. In the morning, unplug the camera and turn off the computer. Use the camera during your day.



Important:

If you have any issue with the computer or the camera, please inform the researcher as soon as possible.
Send an e-mail to cabezalab@duke.edu with the subject “Memory Task Issue” or call 919 627 8270 at business hours. All our contact info is also highlighted at your laptop screen.

Computer password: 123

Appendix B

Instructions for training: AM group

Task:

Training: camera and tasks during weeks 1 to 4

	Week 1					Week 2				
2nd visit	**Day 1**	**Day 2**	**Day 3**	**Day 4**	**Day 5**	**Day 6**	**Day 7**	**Day 8**	**Day 9**	**Day 10**

Week 3					Week 4				
Day 11	**Day 12**	**Day 13**	**Day 14**	**Day 15**	**Day 16**	**Day 17**	**Day 18**	**Day 19**	**Day 20**

Last week: only camera, no tasks during week 5

Week 5					
Day 21	**Day 22**	**Day 23**	**Day 24**	**Day 25**	**3rd visit**

* NOTE: You need to use the camera, download the pictures, and start the program for the whole 8 days. On the last 3 days, there'll be no tasks to do, but you still need to start the program normally.

1. RECENCY TASK:

   a. You'll see two sequences of pictures that represent different moments of your days at the screen. You're going to watch each sequence like a video (first the left one then the right one)

   b. Wait for the sequences to finish (follow the white frame around the pictures). You'll see a question on the top of the screen.

   c. Try to remember which video is more recent. Which of those situations happened closest to the present moment?

   d. Touch the screen to choose the one that you think is more recent. If you not sure, choose your best guess.

   e. If the images on the screen are too blurred or too dark, touch the "Report problem" button on the upper right corner of the screen. Only touch this button if there is a problem with the image.

Important:

If you have any issue with the computer or the camera, please inform the researcher as soon as possible.
Send an e-mail to cabezalab@duke.edu with the subject “Memory Task Issue” or call 919 627 8270 at business hours.
All our contact info is also highlighted at your laptop screen.

Computer password: 123

Appendix C

Instructions for training: LM group

Task:

For the first 4 weeks:
Once a day, you are going to turn on the computer and click on the Memory Task icon. Follow the instructions on the screen and do the task. You are NOT going to use the camera for the first 4 weeks.

For the last week:
You are going to start using the camera again, the same way you did during your first week on this study. Charge the camera during the night, use the camera during the day, and at the end of the day, download the pictures and click on the Memory Task icon.

Training: tasks during weeks 1 to 4

	Week 1					**Week 2**				
2nd visit	**Day 1**	**Day 2**	**Day 3**	**Day 4**	**Day 5**	**Day 6**	**Day 7**	**Day 8**	**Day 9**	**Day 10**

Week 3					**Week 4**				
Day 11	**Day 12**	**Day 13**	**Day 14**	**Day 15**	**Day 16**	**Day 17**	**Day 18**	**Day 19**	**Day 20**

Last week: only camera, no tasks during week 5

Week 5					
Day 21	**Day 22**	**Day 23**	**Day 24**	**Day 25**	**3rd visit**

1. LIST TASK:
    a. This task has to phases: a study phase and a test phase.
    b. STUDY PHASE:
        i. You'll see some images of scenes on the screen. These are not images from your camera.
        ii. These images are going to be presented in two lists.
        iii. Pay attention to each image. You'll have to remember to which list each image belongs.
        iv. Between the two lists, you'll do a Word Task:
            - Choose the word that matches the definition at the center of the screen
    c. TEST PHASE:
        i. You'll see all the images presented one at a time.
        ii. Wait until you see the numbers 1 and 2 on the screen.
        iii. Try to remember if the image was presented before or after (list 1 or list 2) the Word Task.
        iv. Touch the screen to choose the number that you think is the answer.

Important:

If you have any issue with the computer or the camera, please inform the researcher as soon as possible.
Send an e-mail to cabezalab@duke.edu with the subject "Memory Task Issue" or call 919 627 8270 at business hours.
All our contact info is also highlighted at your laptop screen.

Computer password: 123

Appendix D

Consent Form

Form
M0345

DUKE UNIVERSITY HEALTH SYSTEM

Consent to Participate in a Research Study
ADULT

Measuring and Training Memory Using Photographs from Wearable Cameras

CONCISE SUMMARY

The purpose of this study is to determine if wearable cameras can be used to measure and train autobiographical memory in older adults. You will not receive direct benefit as the goal of this study. The duration of the study will be about 3.5 months and there is minimal risk associated with participation.

You are being asked to take part in this research study because you are a healthy adult between the ages of 65 and 85. Research studies are voluntary and include only people who choose to take part. Please read this consent form carefully and take your time making your decision. As you review this document, please ask the study personnel to explain any words or information that you do not clearly understand. We encourage you to talk with your family and friends before you decide to take part in this research study. The nature of the study, risks, inconveniences, discomforts, and other important information about the study are listed below. Please inform the study staff if you are currently taking part in another research study.

You may be enrolled in this study as a pilot subject, wherein you might be asked to complete only a subset of the entire protocol; we will let you know at time of enrollment which subset you will participate in, if applicable. Pilot subjects will be used at the beginning of the study in order to "test run" the various procedures in a realistic manner, and will be selected based on when in the experimental timeline a participant is enrolled in the study. Monetary compensation will be adjusted based on the number of hours participated, as described in the "Compensation" section below.

FUNDING
A grant from the National Institutes of Health (NIH) will sponsor this study. Portions of Roberto Cabeza's and his research team's salaries will be paid by this grant.

WHY IS THIS STUDY BEING DONE?
The purpose of this study is to investigate the use of wearable cameras as a basis for measuring and training autobiographical memory in older adults.

HOW MANY PEOPLE WILL TAKE PART IN THIS STUDY?
Approximately 300 people will take part in this study at Duke.

WHAT IS INVOLVED IN THE STUDY?
If you agree to be in this study, you will be asked to sign and date this consent form. Once enrolled in the study, you will have an initial lab visit lasting approximately 1 hour in which you will be asked to perform a series of cognitive tests designed to measure your mental functions. If the initial lab visit

confirms you to be eligible, you will be equipped with both a wearable camera and laptop and trained on how to use them. This training should last an additional 30 minutes. You will then partake in a familiarization period for one month in which you become familiar with the camera, tablet, and experimental procedure by taking them home with you and using them regularly. After you are familiarized a second lab visit will take place in which your memory will be tested. After your second lab visit, you may be instructed to do intensive memory training for an additional 2-3 months, after which a final lab visit, identical to the second lab visit, will take place. As noted above, if you are a pilot subject, you will only participate in some of these phases or do a shorter version of the complete task.

HOW LONG WILL I BE IN THIS STUDY?
This study will be conducted over the span of approximately three and a half months. You can choose to stop participating at any time without penalty or loss of any benefits to which you are entitled.

WHAT ARE THE RISKS OF THE STUDY?
There is a small chance that viewing photos from your own life could elicit emotions. These emotions are unlikely to be stronger than those you would naturally experience in real life, however you may contact the experimenter at any time if you are experiencing uncomfortable emotions. If you feel too much stress, your participation in the study will be stopped immediately and you will be put in contact with Duke's *Counseling and Psychological Services* (CAPS).

Because the cameras used in this study capture the wearer's surroundings automatically, there is a potential loss of privacy to persons in your immediate environment. You will be encouraged to inform everyone you interact with with that you are wearing a device that could capture his/her image at any moment.

While there are no physical risks associated with this study, there is the potential risk of loss of confidentiality. Every effort will be made to keep your information confidential; however, this cannot be guaranteed. As with your personal information, confidentiality of persons captured by your camera cannot be guaranteed.

ARE THERE BENEFITS TO TAKING PART IN THE STUDY?
If you agree to take part in this study, there is no medical benefit to you. Although there is a chance that your memory performance will be improved by participation, this is in no way a guaranteed outcome.

WILL MY INFORMATION BE KEPT CONFIDENTIAL?
Participation in research involves some loss of privacy. We will do our best to make sure that information about you is kept confidential, but we cannot guarantee total confidentiality. Your personal information may be viewed by individuals involved in this research and may be seen by people including those collaborating, funding, and regulating the study. We will share only the minimum

necessary information in order to conduct the research. Your personal information may also be given out if required by law.

The Department of Health and Human Services (HHS) has issued a Certificate of Confidentiality to further protect your privacy. With this Certificate, the investigators may not disclose research information that may identify you in any Federal, State, or local civil, criminal, administrative, legislative, or other proceedings, unless you have consented for this use. Research information protected by this Certificate cannot be disclosed to anyone else who is not connected with the research unless:

1) there is a law that requires disclosure (such as to report child abuse or communicable diseases but not for legal proceedings);

2) you have consented to the disclosure, including for your medical treatment; or

3) the research information is used for other scientific research, as allowed by federal regulations protecting research subjects.

4) if this information is disclosed to outside reviewers for audit purposes, it may be further disclosed by them and may not be covered by federal privacy regulations.

Disclosure is required, however, for audit or program evaluation requested by the agency that is funding this project.

You should understand that a Confidentiality Certificate does not prevent you or a member of your family from voluntarily releasing information about yourself or your involvement in this research. If you want your research information released to an insurer, medical care provider, or any other person not connected with the research, you must provide consent to allow the researchers to release it. This means that you and your family must also actively protect your own privacy.
Finally, you should understand that the investigator is not prevented from taking steps, including reporting to authorities, to prevent serious harm to yourself or others.

The study results will be retained in your research record for at least six years after the study is completed. While the information and data resulting from this study may be presented at scientific meetings or published in a scientific journal, your name or other personal information will not be revealed.

Photos collected by the wearable cameras are to be viewed only by the research team, and will be deleted at the conclusion of the study.

COMPENSATION
You will be paid $15 per hour plus transportation/parking costs for your visits to this lab for a total of 30 hours of participation. Withdrawal from the study before it is completed or participation in only part of

the experiment as a pilot subject will result in compensation only for the number of hours participated, as a percentage of the total amount.

WHAT ABOUT RESEARCH RELATED INJURIES?
Immediate necessary medical care is available at Duke University Medical Center in the event that you are injured as a result of your participation in this research study. However, there is no commitment by Duke University, Duke University Health System, Inc., or your Duke physicians to provide monetary compensation or free medical care to you in the event of a study-related injury. For questions about the study or research-related injury, contact Roberto Cabeza at (919) 668 - 2299 during regular business hours.

WHAT ABOUT MY RIGHTS TO DECLINE PARTICIPATION OR WITHDRAW FROM THE STUDY?
You may choose not to be in the study, or, if you agree to be in the study, you may withdraw from the study at any time. If you withdraw from the study, no new data about you will be collected for study purposes other than data needed to keep track of your withdrawal.

If you do decide to withdraw, we ask that you contact Dr. Cabeza in writing and let him know that you are withdrawing from the study. His mailing address is:

Cabeza Lab, Center for Cognitive Neuroscience
Duke University LSRC Bldg Rm B254, Box 90999
Durham, NC 27708.

WHOM DO I CALL IF I HAVE QUESTIONS OR PROBLEMS?
For questions about the study or a research-related injury, contact Roberto Cabeza at (919) 668 - 2299 during regular business hours.

For questions about your rights as a research participant, or to discuss problems, concerns or suggestions related to the research, or to obtain information or offer input about the research, contact the Duke University Health System Institutional Review Board (IRB) Office at (919) 668-5111.

DUKE UNIVERSITY HEALTH SYSTEM

Consent to Participate in a Research Study
ADULT

Measuring and Training Memory Using Photographs from Wearable Cameras

STATEMENT OF CONSENT
"The purpose of this study, procedures to be followed, risks and benefits have been explained to me. I have been allowed to ask questions, and my questions have been answered to my satisfaction. I have been told whom to contact if I have questions, to discuss problems, concerns, or suggestions related to the research, or to obtain information or offer input about the research. I have read this consent form and agree to be in this study, with the understanding that I may withdraw at any time. I have been told that I will be given a signed and dated copy of this consent form."

_____	_____	_____
Signature of Subject	Date	Time
_____	_____	_____
Signature of Person Obtaining Consent	Date	Time

Appendix E

Demographic Questionnaire

CabezaLab
Center for Cognitive Neuroscience
Duke University
Levine Science Research Center, Room B254

[Form for Cash]
Study: _____
Fund: _____
Amount paid:_____

Today's Date:

First Name: **MI:** **Last Name:**

Phone Contact:

Date of Birth:

Permanent (Home) Mailing Address:

City *State* *Zip*

Email Contact:

How did you hear about us:

Please check the highest grade or degree that you have <u>completed</u>.

- ☐ 12th grade, high school diploma or GED
- ☐ 1 year of college or professional/technical training
- ☐ 2 years of college or professional/technical training or an Associate's degree
- ☐ 3 years of college or professional/technical training
- ☐ 4 years of college or professional/technical training or a Bachelor's degree
- ☐ Some post-graduate work
- ☐ Master's degree (M.A. or M.S.)
- ☐ Doctoral degree
- ☐ Other, please describe: _____

The following information is being collected in accordance with reporting requirements of our funding agency, the National Institutes of Health. These data will only be reported in aggregate form, with no personal identifiers.

GENDER

- ☐ **Female.**
- ☐ **Male.**

ETHNICITY Do you consider yourself to be Hispanic or Latino? (See definition below.)

- ☐ **Hispanic or Latino.** A person of Mexican, Puerto Rican, Cuban, South or Central American, or other Spanish culture or origin, regardless of race. The term, "Spanish origin," can be used in addition to "Hispanic or Latino."
- ☐ **Not Hispanic or Latino.**

RACE What race do you consider yourself to be? (Please select one or more of the following.)

- ☐ **American Indian or Alaska Native.** A person having origins in any of the original peoples of North, Central, or South America, and who maintains tribal affiliation or community attachment.
- ☐ **Asian.** A person having origins in any of the original peoples of the Far East, Southeast Asia, or the Indian subcontinent, including, for example, Cambodia, China, India, Japan, Korea, Malaysia, Pakistan, the Philippine Islands, Thailand, and Vietnam. (Note: Individuals from the Philippine Islands have been recorded as Pacific Islanders in previous data collection strategies.)
- ☐ **Black or African American.** A person having origins in any of the black racial groups of Africa. Terms such as "Haitian" or "Negro" can be used in addition to "Black" or African American."
- ☐ **Native Hawaiian or Other Pacific Islander.** A person having origins in any of the original peoples of Hawaii, Guam, Samoa, or other Pacific Islands.
- ☐ **White.** A person having origins in any of the original peoples of Europe, the Middle East, or North Africa.

☐ Check here if you do not wish to provide some or all of the above information.

Thank You!

Appendix F

MMQ

Figure A1. MMQ-Satisfaction

Multifactorial Memory Questionnaire

How I Feel About My Memory

Name: _____ Date: _____

Below are statements about feelings that people may have about their memory. Read each statement and think about your feelings over the past *two weeks*. Then, check the box next to the response that best describes how much you agree or disagree.

1. I am generally pleased with my memory ability.

   4 Strongly Agree **3** Agree **2** Undecided **1** Disagree **0** Strongly Disagree

2. There is something seriously wrong with my memory.

   0 Strongly Agree **1** Agree **2** Undecided **3** Disagree **4** Strongly Disagree

3. If something is important, I will probably remember it.

   4 Strongly Agree **3** Agree **2** Undecided **1** Disagree **0** Strongly Disagree

4. When I forget something, I fear that I may have a serious memory problem, like Alzheimer's disease.

   0 Strongly Agree **1** Agree **2** Undecided **3** Disagree **4** Strongly Disagree

5. My memory is worse than most other people my age.

   0 Strongly Agree **1** Agree **2** Undecided **3** Disagree **4** Strongly Disagree

6. I have confidence in my ability to remember things.

   4 Strongly Agree **3** Agree **2** Undecided **1** Disagree **0** Strongly Disagree

7. I feel unhappy when I think about my memory ability.

   0 Strongly Agree **1** Agree **2** Undecided **3** Disagree **4** Strongly Disagree

8. I worry that others will notice that my memory is not very good.

   0 Strongly Agree **1** Agree **2** Undecided **3** Disagree **4** Strongly Disagree

9. When I have trouble remembering something, I'm not too hard on myself.

   4 Strongly Agree **3** Agree **2** Undecided **1** Disagree **0** Strongly Disagree

Please turn page over to complete the questionnaire.

10. I am concerned about my memory.

0 Strongly Agree **1** Agree **2** Undecided **3** Disagree **4** Strongly Disagree

11. My memory is really going downhill lately.

0 Strongly Agree **1** Agree **2** Undecided **3** Disagree **4** Strongly Disagree

12. I am generally satisfied with my memory ability.

4 Strongly Agree **3** Agree **2** Undecided **1** Disagree **0** Strongly Disagree

13. I don't get upset when I have trouble remembering something.

4 Strongly Agree **3** Agree **2** Undecided **1** Disagree **0** Strongly Disagree

14. I worry that I will forget something important.

0 Strongly Agree **1** Agree **2** Undecided **3** Disagree **4** Strongly Disagree

15. I am embarrassed about my memory ability.

0 Strongly Agree **1** Agree **2** Undecided **3** Disagree **4** Strongly Disagree

16. I get annoyed or irritated with myself when I am forgetful.

0 Strongly Agree **1** Agree **2** Undecided **3** Disagree **4** Strongly Disagree

17. My memory is good for my age.

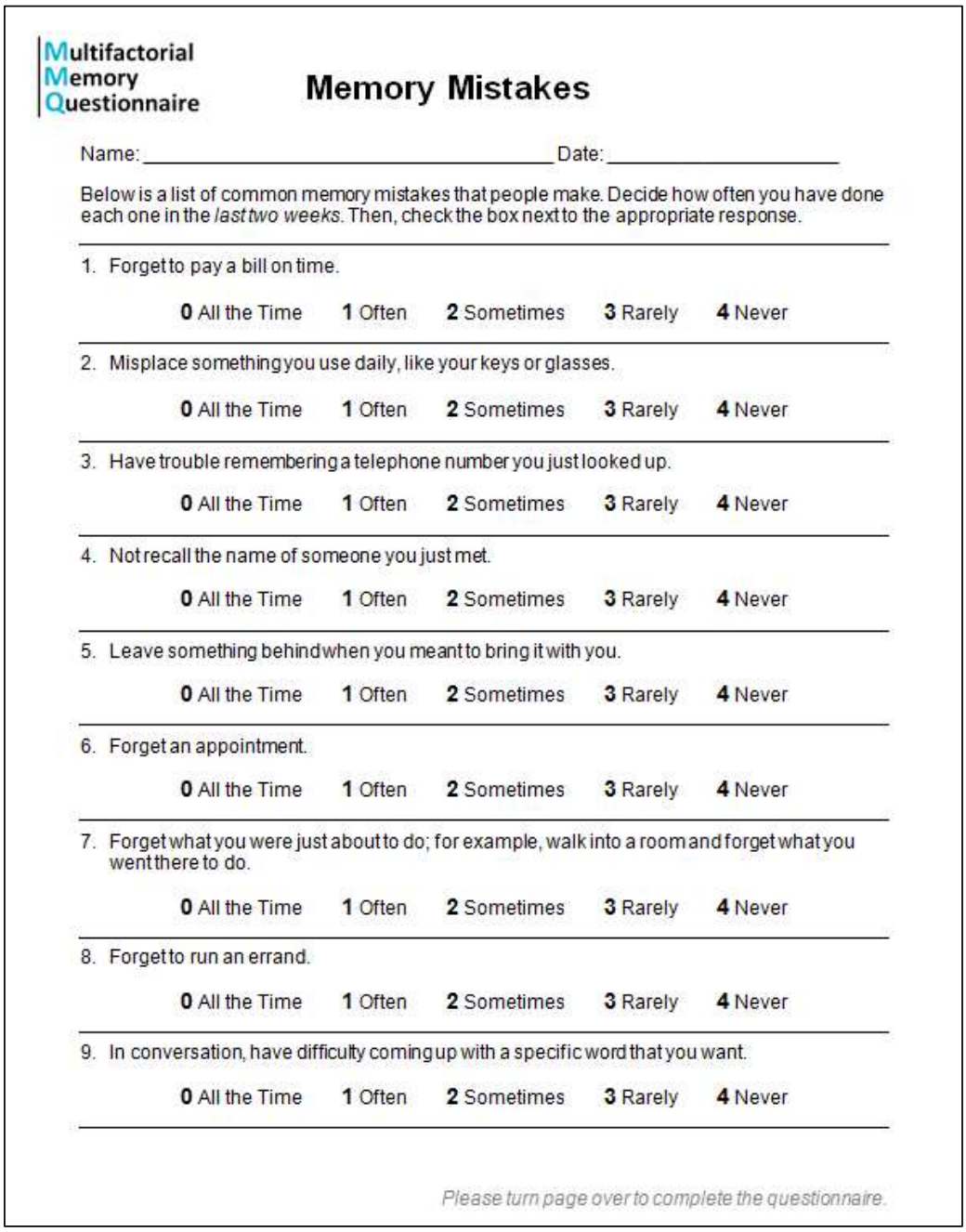
4 Strongly Agree **3** Agree **2** Undecided **1** Disagree **0** Strongly Disagree

18. I worry about my memory ability.

0 Strongly Agree **1** Agree **2** Undecided **3** Disagree **4** Strongly Disagree

Baycrest

Figure A2. MMQ-Ability



Multifactorial Memory Questionnaire

Memory Mistakes

Name: _____ Date: _____

Below is a list of common memory mistakes that people make. Decide how often you have done each one in the *last two weeks*. Then, check the box next to the appropriate response.

1. Forget to pay a bill on time.

   0 All the Time **1** Often **2** Sometimes **3** Rarely **4** Never

2. Misplace something you use daily, like your keys or glasses.

   0 All the Time **1** Often **2** Sometimes **3** Rarely **4** Never

3. Have trouble remembering a telephone number you just looked up.

   0 All the Time **1** Often **2** Sometimes **3** Rarely **4** Never

4. Not recall the name of someone you just met.

   0 All the Time **1** Often **2** Sometimes **3** Rarely **4** Never

5. Leave something behind when you meant to bring it with you.

   0 All the Time **1** Often **2** Sometimes **3** Rarely **4** Never

6. Forget an appointment.

   0 All the Time **1** Often **2** Sometimes **3** Rarely **4** Never

7. Forget what you were just about to do; for example, walk into a room and forget what you went there to do.

   0 All the Time **1** Often **2** Sometimes **3** Rarely **4** Never

8. Forget to run an errand.

   0 All the Time **1** Often **2** Sometimes **3** Rarely **4** Never

9. In conversation, have difficulty coming up with a specific word that you want.

   0 All the Time **1** Often **2** Sometimes **3** Rarely **4** Never

Please turn page over to complete the questionnaire.

10. Have trouble remembering details from a newspaper or magazine article you read earlier that day.

0 All the Time **1** Often **2** Sometimes **3** Rarely **4** Never

11. Forget to take medication.

0 All the Time **1** Often **2** Sometimes **3** Rarely **4** Never

12. Not recall the name of someone you have known for some time.

0 All the Time **1** Often **2** Sometimes **3** Rarely **4** Never

13. Forget to pass on a message.

0 All the Time **1** Often **2** Sometimes **3** Rarely **4** Never

14. Forget what you were going to say in conversation.

0 All the Time **1** Often **2** Sometimes **3** Rarely **4** Never

15. Forget a birthday or anniversary that you used to know well.

0 All the Time **1** Often **2** Sometimes **3** Rarely **4** Never

16. Forget a telephone number you use frequently.

0 All the Time **1** Often **2** Sometimes **3** Rarely **4** Never

17. Retell a story or joke to the same person because you forgot you already told him or her.

0 All the Time **1** Often **2** Sometimes **3** Rarely **4** Never

18. Misplace something that you put away a few days ago.

0 All the Time **1** Often **2** Sometimes **3** Rarely **4** Never

19. Forget to buy something you intended to buy.

0 All the Time **1** Often **2** Sometimes **3** Rarely **4** Never

20. Forget details about a recent conversation.

0 All the Time **1** Often **2** Sometimes **3** Rarely **4** Never

Figure A3. MMQ-Strategy

Multifactorial Memory Questionnaire

Use of Memory Strategies

Name: _____ Date: _____

People often use different tricks or strategies to help them remember things. Several strategies are listed below. Decide how often you used each one in the *last two weeks*. Then, check the box next to the appropriate response.

1. Use a timer or alarm to remind you when to do something.

   4 All the Time **3** Often **2** Sometimes **1** Rarely **0** Never

2. Ask someone to help you remember something or to remind you to do something.

   4 All the Time **3** Often **2** Sometimes **1** Rarely **0** Never

3. Create a rhyme out of what you want to remember.

   4 All the Time **3** Often **2** Sometimes **1** Rarely **0** Never

4. In your mind, create an image of something you want to remember, like a name and face.

   4 All the Time **3** Often **2** Sometimes **1** Rarely **0** Never

5. Write things on a calendar, such as appointments or things you need to do.

   4 All the Time **3** Often **2** Sometimes **1** Rarely **0** Never

6. Go through the alphabet one letter at a time to see if it sparks a memory for a name or word.

   4 All the Time **3** Often **2** Sometimes **1** Rarely **0** Never

7. Organize information you want to remember; for example, organize your grocery list according to food groups.

   4 All the Time **3** Often **2** Sometimes **1** Rarely **0** Never

8. Say something out loud in order to remember it, such as a phone number you just looked up.

   4 All the Time **3** Often **2** Sometimes **1** Rarely **0** Never

9. Use a routine to remember important things, like checking that you have your wallet and keys when you leave home.

   4 All the Time **3** Often **2** Sometimes **1** Rarely **0** Never

Please turn page over to complete the questionnaire.

10. Make a list, such as a grocery list or a list of things to do.

4 All the Time **3** Often **2** Sometimes **1** Rarely **0** Never

11. Mentally elaborate on something you want to remember; for example, focus on a lot of the details.

4 All the Time **3** Often **2** Sometimes **1** Rarely **0** Never

12. Put something in a prominent place to remind you to do something, like putting your umbrella by the front door so you will remember to take it with you.

4 All the Time **3** Often **2** Sometimes **1** Rarely **0** Never

13. Repeat something to yourself at increasingly longer and longer intervals so you will remember it.

4 All the Time **3** Often **2** Sometimes **1** Rarely **0** Never

14. Create a story to link together information you want to remember.

4 All the Time **3** Often **2** Sometimes **1** Rarely **0** Never

15. Write down in a notebook things that you want to remember.

4 All the Time **3** Often **2** Sometimes **1** Rarely **0** Never

16. Create an acronym out of the first letters in a list of things to remember, such as carrots, apples, and bread (cab).

4 All the Time **3** Often **2** Sometimes **1** Rarely **0** Never

17. Intentionally concentrate hard on something so that you will remember it.

4 All the Time **3** Often **2** Sometimes **1** Rarely **0** Never

18. Write a note or reminder for yourself (other than on a calendar or in a notebook).

4 All the Time **3** Often **2** Sometimes **1** Rarely **0** Never

19. Mentally retrace your steps in order to remember something, such as the location of a misplaced item.

4 All the Time **3** Often **2** Sometimes **1** Rarely **0** Never

DUHS INSTITUTIONAL REVIEW BOARD NOTIFICATION OF AMENDMENT APPROVAL

Protocol ID: Pro00100512
Reference ID: Pro00100512-AMD-6.0
Principal Investigator: Cabeza, Roberto
Protocol Title: Measuring and Training Memory Using Photographs from Wearable Cameras
Sponsor/Funding Source(s): National Institutes of Health (NIH)

The Duke University Health System Institutional Review Board for Clinical Investigations has conducted the following activity on the study cited above:
Activity: Amendment **Review Type:** Expedited
Review Date: 06/23/2022
Issue Date: June 23, 2022
Expiration Date: 01/01/2100

DUHS IRB approval encompasses the following specific components of the study:
Protocol, version/date:
DUHS IRB Application version: v1.14
Consent form reference date:
Investigator Brochure, version/date:
Pediatric Risk Category:
Other:

The DUHS IRB has determined the specific components above to be in compliance with all applicable Health Insurance Portability and Accountability Act ("HIPAA") regulations.

This study expires at 12 AM on the Expiration Date cited above. At that time, all study activity must cease. If you wish to continue specific study activities directly related to subject safety, you must immediately contact the Executive Director of the DUHS IRB or if urgent, call the IRB's main number 919-668-5111, then follow paging instructions to reach the IRB Chair on call. Continuing review submissions (renewals) must be received by the DUHS IRB office 60 to 45 days prior to the Expiration Date.

No change to the protocol, consent form or other approved document may be implemented without first obtaining IRB approval for the change. Any proposed change must be submitted as an amendment. If necessary in a life-threatening situation, where time does not permit your prior consultation with the IRB, you may act contrary to the protocol if the action is in the best interest of the subject. You must notify the IRB of your action within five (5) working days of the event.

The Duke University Health System Institutional Review Board for Clinical Investigations (DUHS IRB), is duly constituted, fulfilling all requirements for diversity, and has written procedures for initial and continuing review of human research protocols. The DUHS IRB complies with all U.S. regulatory requirements related to the protection of human research participants. Specifically, the DUHS IRB complies with 45CFR46, 21CFR50, 21CFR56, 21CFR312, 21CFR812, and 45CFR164.508-514. In addition, the DUHS IRB complies with the Guidelines of the International Conference on Harmonization to the extent required by the U. S. Food and Drug Administration.

DUHS Institutional Review Board
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