

SOAR Research Proposal – Summer 2012

Title: Music and Semantic Memory in Healthy Aging and Alzheimer's Disease

Faculty Information

Name: Sarah Johnson
Rank: Assistant Professor
Department/Program: Psychology/Neuroscience

Student Information

Name: Mary Petrik
Expected graduation: December, 2013
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Name: Haley Skymba
Expected graduation: May, 2013
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Start date: June 1, 2012 (10 weeks)

Description of Project

For this project, Ms. Petrik and Ms. Skymba will be working on a project that reflects collaboration between myself, a colleague in Psychology at Bucknell University, Dr. Andrea Halpern, and the Memory Disorders Center at St. Luke's Hospital in Bethlehem (contacts from this center include the center's director, Dr. Nancy Diaz, and geriatric nurse practitioner, Maryellen Dye, R.N.). The goal of this collaboration with the Memory Disorders Center is to recruit participants diagnosed with Alzheimer's disease (AD) for the proposed study. In addition, we plan to make use of a pre-existing relationship I have with the Moravian Village Residential Facility (as well as the association between St. Luke's Hospital and that facility) in recruiting healthy older adults. The multifaceted nature of the project and the time-consuming nature of data collection with these populations necessitate having two students. Furthermore, the experience of working with neurologically impaired populations and exploring their neuropsychological function makes this an exceptional opportunity for students interested in cognitive neuroscience, especially those who may be interested in going into neuropsychology.

It is relatively common knowledge that declines in memory occur with age. In actuality the picture of age-related changes in memory, both in healthy older adults and in those with neurological conditions underlying more substantial memory problems, is complicated. In part this complication comes from the fact that memory is multifaceted, and different aspects of memory (different forms of memory, different processes and strategies) rely on different neural substrates that are affected differentially by aging. The current project focuses on semantic memory, which refers to our memory for general knowledge (information we can remember, but for which we no longer have a specific source), and also on executive functions (organizational processes used to coordinate the use of that memory).

Music is a category of semantic memory that is relatively unexplored compared to other areas, particularly in relation to how information of this type is organized within our memories. My colleague, Andrea Halpern, and I recently conducted work illustrating the role of conceptual associations in the organization of this area of memory. We used a priming paradigm: Priming is the enhanced speed and accuracy in our judgment for an item when it is preceded by another item that is associated to it. Priming is typically shown with words or simple pictures. In our case, we studied priming of music, specifically familiar tunes. We found that people were faster in saying "yes, that is a real tune" if it was preceded by a tune from a similar genre (e.g., patriotic-patriotic) compared to when the two tunes were from different genres (e.g., children's-patriotic). This priming illustrates the organization of familiar tunes in a way that reflects meaning, not just musical characteristics like timbre, rhythm, etc.

The integrity of memory for music in AD is debated. Deficits in other forms of memory are well established, but anecdotally caregivers and therapists report spared memory for music in these individuals. Research findings are mixed. Several studies have shown that AD patients have trouble learning new music, as would be expected given that their encoding skills are poor. However, most studies have shown that memory for previously learned music is fairly intact: patients easily rate real songs as “Familiar” and new songs as “Unfamiliar” (e.g., Bartlett, Halpern, & Dowling, 1995). However, we do not know whether the mental associations between these familiar tunes, creating the underlying structure of general knowledge for this category of information, are intact.

We can study the integrity of these associations via the priming paradigm described above. Priming has also received attention in healthy older adults with mixed results. Recently, it has been suggested that priming may actually be greater in older adults, precisely because their psychomotor speed is slow (Laver, 2009). They may take longer to respond, but given the time to do so, greater activation of the concept builds up and spreads to related concepts. Thus, we might expect larger priming effects in healthy older adults compared to younger adults. Priming effects in AD patients might be surprisingly robust if semantic relationships are maintained. Reduced priming effects would indicate deterioration in the mental network supporting familiar music.

Overall, there are several goals to the research proposed here:

- 1) Adapt the music priming paradigm for use with older adults (e.g., accounting for slowed psychomotor speed, revising the stimuli so that they are familiar to this population, etc.)
- 2) Conduct a study with healthy older adults, with the expectation that they will show priming across musical genres, possibly even to a greater extent than young adults
- 3) Begin collecting data from AD patients to explore the extent to which music memory is preserved
- 4) Explore the basic integrity of semantic memory in healthy older adults and AD patients via a neuropsychological task (verbal fluency)
- 5) Explore executive deficits in both populations via their tendency to perseverate (repeat responses), their use of clustering strategies, and their ability to switch between sub-clusters on the verbal fluency task

Students' roles and responsibilities

The two students will be working collaboratively on this project, but also focusing on different themes within the project. Haley will be focusing on the question of basic semantic memory integrity, as well as possible executive deficits, via a neuropsychological task called verbal fluency. Mary will be focusing on priming, particularly conceptual priming and priming for music. Both students will be incorporating the study of healthy aging as well as the deficits particular to AD. Both students will also be responsible for activities across the extent of the research process, including: reading and integrating ideas from the background literature, preparing stimuli and weighing in on design issues in advance of data collection, recruitment of healthy older adults from the community, conducting experiment sessions with both healthy older adults and patients with AD, data coding and analysis, etc.

The written output of the project will include a formal APA-style experiment report that each student will write, incorporating the literature she read over the summer. In addition, the students will create presentations (either combined or individual) to submit to Scholars day, and I will also expect them to submit for a presentation at either the National Conference for Undergraduate Research, a local conference for undergraduate research in the field (either Psychology or Neuroscience), or a larger professional conference (e.g., the annual meeting of the Eastern Psychological Association).

Schedule of activities:

Week 1-2

- **Materials Prep/Recruitment:** Mary and Haley will help us to refine and prepare the stimuli and task instructions. Both students will familiarize themselves with the experimental protocol during this time, and will help us begin the recruitment process for healthy older adults. We will brainstorm techniques for this together, and they will implement our recruitment plans. If time allows, the students will help develop HSIRB proposals, which must be approved in advance of data collection.
- **Background research:** Mary will conduct background reading aimed toward adapting our priming paradigm to the older adult populations. Haley will focus on the potential degradation of semantic memory structure in healthy aging and AD. The three of us will meet regularly to discuss readings.

Weeks 3-5

- **Data collection:** We will begin data collection with healthy older adults by week 3. This goal may be affected by obstacles in experiment design, and will be easiest to achieve if we can bring the experiment to the participants. This reason is the justification for the equipment expense described at the end of the proposal. Experiment sessions will last ~45 minutes, but extra time is planned because older adults are frequently interested in hearing about the research. It is a rewarding experience for the students to interact with these individuals on a personal and professional level. Exact numbers for our two samples cannot be anticipated; ideally we will need at least 30 of each.
- **Background research/writing:** Weekly meetings to discuss their background research will continue. The students will write the experimental sections (methods) for their final papers.

Weeks 6-8

- **Data collection/coding:** We will continue data collection throughout the entire 10 week period, and should be starting data collection with AD patients by this time. We will also begin coding the data at this point. Both students will learn the coding for both parts of the project, so that they can learn more about the diversity of types of data and processes of dealing with data in cognitive science.
- **Background research/writing:** The students will begin working on the introductions (reflecting their separate topics) for their write-ups.

Weeks 9-10

- **Data collection/coding/analysis:** Even if our data collection needs are not met completely, we will begin data analysis at this point so that Mary and Haley can be involved in this part of the process.
- **Writing/Scholarly presentation:** In these final weeks, both students will finish their papers, and we will meet together to share writing. They can benefit from writing separate papers about the same project and sharing their papers, to provide feedback for each other while also seeing some of the strengths and areas for improvement in their own writing. During the final weeks, each student will also create a working draft of either a poster or oral presentation for Scholars Day and/or NCUR.

Additional project-related expenses

\$500 to purchase one laptop for use in collecting data remotely (e.g., Dell Inspiron 15 N5040). If approved, we will research the most appropriate and economical model. The laptop must meet certain minimal requirements to run the experimental presentation software I use; however, a relatively low-end laptop will meet these requirements. The project will benefit greatly from the use of a laptop in order to conduct sessions at locations that are more convenient and comfortable for our participants. We have the possibility of using various spaces at the Moravian Village retirement community, and we hope to be able to use a space for testing at St. Luke's (in collaboration with their Memory Disorders Center); however, we are still in discussion with them about those kinds of details of our collaboration.

Title: Music and Semantic Memory in Healthy Aging and Alzheimer's Disease

Name: Mary Petrik

Major: Cognitive Neuroscience

Year of Graduation: Winter of 2013

Faculty Mentor: Dr. Sarah Johnson

On-Campus Housing: Requested

Rationale for Participation

I would like to participate in this project because it is an excellent opportunity for me to learn firsthand how research in my field of study is conducted. I will learn how to be a research assistant while and will duly experience how a properly conducted experiment is run. For the first time, I will be learning through the experience of participating in an experiment as a researcher instead of as a subject or for a class project. Through laboratory work and various Psychology research focused classes, I have developed an understanding of the experimental process with an emphasis on cognitive research. This SOAR Research experience will make these classroom skills I have been honing concrete.

I will have the opportunity to work with participants outside the Moravian College student body. This opportunity to work with the elderly (both healthy and not) will give me a taste of what this kind of neuropsychological research is like, as well as guiding me to master the proper elements of good experimental design.

This research will require more complex data coding and analyses to be performed than I have ever needed in my undergraduate experiments. I will learn how to conduct these analyses with real world data and how to properly write up the findings. I will learn to formulate informed hypotheses about clinical populations and design appropriate stimuli for such hypotheses. In the future, I plan to attend graduate school and continue advancing research in this field. Specifically, I would like to study memory and how our minds store information across all age groups. This kind of research experience will lay the foundation for my future career.

There are also various ways in which I can be helpful to Dr. Johnson. By its nature, this experiment requires the participation healthy/ non-healthy aging adults. We plan to conduct the study at Moravian Village, a local nursing home in Bethlehem, to find these subjects. Since last summer, I have volunteered at this nursing home, and I have developed relationships with many of the individuals there: both in administration and patient care. In the event that we need to look outside of the Moravian Village family for a greater number of subjects, I also am familiar with many of the churches and organizations in Bethlehem having grown up in this area. For this reason, I can be of a positive use to this experiment during the physical running of the experiments. Additionally, I will assist Dr. Johnson in preliminary researching and literature reviews. I am a strong writer and enjoy this aspect of the experimental process.

Expected Outcomes

As previously stated, I expect to have an enlightening experience working with Dr. Johnson that will better train me for my ultimate goal: pursuing graduate level education. I hope to one day be a college professor myself, and I aspire to conduct research of my own one day. I plan to present the findings of this study on Moravian College's Scholar's Day the following spring. Furthermore, I plan to submit an abstract to the National Conference of Undergraduate Research with hopes of presenting at this conference as well. Presentations at both these events (and possibly even a regional undergraduate or professional conference) will give me experience in how to professionally share research with others.

Title: Music and Semantic Memory in Healthy Aging and Alzheimer's Disease

Name: Haley Skymba

Major: Neuroscience

Expected Graduation: May 4th 2013

Faculty Mentor: Dr. Johnson

On-campus housing: Is requested

My rationale for participating in this project is that my goals for the future would be helped enormously by having such an experience. I have had a few opportunities to see certain parts of the research process hands on throughout my last few years at Moravian, but mostly in areas that are more oriented toward non-clinical Psychology. I hope to gain research experience in areas that are more related to what I am looking to go toward in the future such as in Neuropsychology.

Even before entering college and having to choose a major, I always had an interest in Neuroscience and Psychology. Cognition is an area that I find particularly fascinating and am continually looking to learn more about. As I look forward to applying to various graduate schools, narrowing my interests toward what I would like to do in a future career is becoming increasingly important. Being able to work on a project such as this, which will incorporate looking at different aspects within this specific field, will be very worthwhile to help me define my interests. One of the options that I am looking into in the field of Neuropsychology is possibly working with clinical populations. This type of experience will give me some much needed understanding of what it is like to work with these patient populations (particularly those who have Alzheimer's disease) both practically and ethically. This will not only be helpful from a research perspective to better understand what goes into doing research with such a population and how to perform such research ethically, but also from a general perspective of what it is like to interact with these patients. It will also be valuable to learn how to witness and better understand participants on the range from healthy to unhealthy as far as those who are healthy compared to those who may have degenerative age-related conditions. Noticing differences and dealing with such differences properly is also an important aspect of this type of research that I will be able to learn more about.

Having the opportunity to discover more about the research process, specifically from a Neuropsychological perspective, would not only be a growing experience as a student but also give me a better understanding of the type of work that is done in this field. There is a difference between simply learning about research that has been done or certain literature as compared to being able to experience the research process hands on. Going through the stages of this process has the power to teach a lot more simply by experiencing it. The ability to work various parts of the process from conducting literature reviews, planning and running sessions, performing data coding, and data analysis in a field that I am not only interested in but looking to move forward with, will have a variety of personal benefits. I think this will bring me a better understanding of how to properly conduct research in this field and with various populations. Specifically, I will

able to use previous research and gain experience at forming hypotheses that deal with clinical populations.

I have worked on similar research with Dr. Johnson in the past that involved looking at certain cognitive processes utilizing verbal fluency tasks. The literature for these tasks also incorporated examining how they relate to frontal lobe function. However, I only got the chance to work with the data coding in a fairly limited way. I look forward to hopefully getting a more well-rounded experience by going through this project and seeing all parts of the research process related to this topic. The ability to do so and being able to examine the existing literature on how this topic relates to brain function will provide me with an experience that will not only help guide my future endeavors but also teach me more about the research process.

My expected outcomes for the project are to gain the experiences I mention above in which I can ultimately learn more about not only research in this field but how to effectively work with these types of participants. I expect to end the project having greater knowledge about how to efficiently go through all stages of this type of research and have a better understanding of how to work with clinical populations. This knowledge base will most certainly help me enormously in my future. Also, I expect to have a variety of opportunities to share what I have done with others. Presenting research is also a large component of this type of work and is valuable to the researcher and those learning about it. I expect to be able to engage in opportunities such as Scholar's Day, and the National Conference for Undergraduate Research. There are also other possibilities such as presenting at Lehigh Valley Society for Neuroscience or LVAIC which are held annually in the Lehigh Valley. This element would also be a valuable learning experience in which I expect to gain practice at how to successfully communicate research results with others. Ultimately, this entire experience will be able to teach a variety of skills that are very valuable to my future.