

# GUSTAVUS

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## GUSTAVUS ADOLPHUS COLLEGE

6 July 2016

2015-16 Presidential Faculty-Student Collaboration Grant – Hecht (Psychological Science) & Broschard ('16)  
Grant Report

Dear Provost Braun:

We, first and foremost, would like to thank you for awarding us a 2015-16 Presidential Faculty-Student Collaboration Grant. In short, the funding allowed us to achieve the goals we described in our proposal and to begin taking steps in a new line of research that Dr. Hecht is continuing while Matt, who just graduated, heads to graduate school at the University of Iowa. Below we provide a brief summary of the project and illustrate how we accomplished the goals outlined in our grant. We conclude with a description of the project's current status and future aims for this line of research.

### *Project Summary*

The aim of our project grant was to examine aromatherapeutic claims regarding cognitive functions, specifically those addressing attention and alertness. As technology has advanced throughout the years, research has also been consistently adapting its methodology for testing aromatherapeutic claims. In other words, technological advances have allowed for more precise and specific quantitative measurements. One specific example is the use of electroencephalography (EEG) – a neuroimaging technique – to examine brain's response following the presentation of a particular odor.

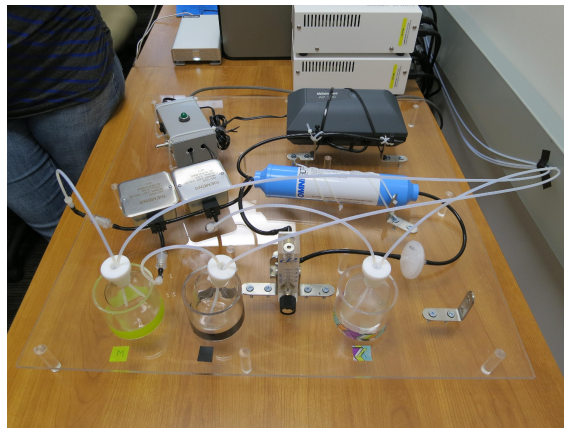
Dr. Hecht's research laboratory began examining the relationship between odors and attention, but the methodology was limited and uncontrolled because participants self-administered smells via a perfume test strip. In order to make more efficient progress and to combine behavioral measurements with physiological ones, like EEG, we needed instrumentation (i.e., an olfactometer) that would administer smells in a precise and controlled fashion without any intervention on behalf of the participant. While researching possible solutions, we found a low-cost olfactometer design published by Lowen and Lukas (2007) that would meet our needs at a fraction of the cost of buying a manufactured olfactometer. Hence, we proposed to use grant funds to build this olfactometer, which would then be tested, used by Matt for his Honors Research Project, and reside in Beck Hall for future use by Dr. Hecht and others who wish to present olfactory stimuli.

### *Project Goal #1: Build the Olfactometer (Summer 2015)*

The main goal for this grant project was purchasing and building the olfactometer itself. At the outset, we both were intrigued by, and nervous about, this task. We quickly realized that the design included in Lowen

and Lukas' (2007) contained specs for parts that were no longer available, so we spent time finding appropriate substitutions. Fortunately, most manufacturers made this relatively straightforward.

While waiting for materials to arrive on campus, we rearranged Dr. Hecht's laboratory to accommodate extra tables, tools, and other materials needed to build the olfactometer on campus. Upon arrival of materials and purchasing a few additional materials at the local hardware store, we began the build by building the complex electric circuit that would not only power the olfactometer, but also allow us to direct power toward one of three different channels, which eventually allows us to switch between scents fluidly during experiments. Although Dr. Hecht has built electric circuits in the past (Matt had not), none had ever been this complex. Building the electric circuitry that is now housed in the electric circuit box (shown below in the gray box with the green indicator light on top) was the most challenging and time-consuming aspect of this project.



*Our olfactometer, currently located in the EEG control room in Beck 205.*

After building the circuitry, we then assembled the remainder of the olfactometer. Along the way, we did run into a few minor challenges, such as determining the best way to mount all of the equipment safely to the base so that it would be more secure when moving the olfactometer from one lab space to another. This meant cutting and drilling the acrylic materials (i.e., the base and legs), which required special tools. Fortunately, Dr. Hecht's husband had access to the equipment needed for these tasks and the skills required for using it. He graciously spent two evenings helping us prepare the acrylic materials so that we could continue our assembly.

The other main concern we had was how the tubing would enter the jars holding the odor stimuli (i.e., the jars marked by different colored tape at the bottom of the picture); specifically, we were concerned about contamination issues. Fortunately, we contacted Dr. Lowen, the first author of the original design, and had a conference call where we asked specific questions about the design and his ideas for ensuring that the odors would not leak out of the caps. In fact, he told us some solutions that were included in a forthcoming update to the olfactometer's design, and he graciously shared an advanced copy with us.

#### *Project Goal #2: Test the Equipment (Summer 2015)*

Lowen and Lukas (2007) provided tests regarding the efficiency and effectiveness of their olfactometer, but we wanted to verify that our equipment was running properly. Additionally, we needed to determine how long it took for smells to reach participants in the adjoining room and determine the appropriate concentration of peppermint odor for our first experiment using the equipment. We initially conducted these tests on ourselves, taking turns serving as participant and experimenter. We determined that the equipment

was working well and that it delivered an odor stimulus to the participant 7 seconds after the odorant channel was engaged.

After doing some initial concentration testing on ourselves, Matt sought a couple student volunteers to help verify the peppermint concentration we would use in our experiments. Fortunately, Matt was able to recruit some volunteers from among other summer student researchers. They graciously sat and simply acknowledged when they detected the presence of the smell. This led us to determine a concentration of 14 microliters of peppermint essential oil diluted in 30 mL of water.

#### *Project Goal #3: Utilize the Olfactometer in a Research Experiment (2015-16 Academic Year)*

Having completed testing during Summer 2015 and determining appropriate timing and concentrations for experiments, Matt began using the olfactometer for his Honors Research Project, which was an extension of the research Dr. Hecht had been conducting in her lab. Specifically, Matt was investigating whether peppermint increased visual alertness and speeded visual orienting (i.e., he asked if peppermint increases visual attention and alertness). Not only was Matt looking for observable behavioral effects (e.g., faster manual responses), but he was also interested in locating the origin of these effects by using EEG to measure and compare brain activity when completing a visual attention task when exposed to either peppermint or a neutral odor.

Matt successfully completed data collection using the olfactometer by early Spring 2016 and spent the rest of that semester analyzing the data. Unfortunately, we did not find significant differences in visual attention overall when exposed to air versus exposure to peppermint. These results held true for both behavioral and physiological (EEG) measures. However, we did a time sub-analysis, dividing each of two experimental sessions into three sections each. In doing so, we could look at early, middle, and late trials within each experimental session and examine participant performance over time. We did find a visual orienting effect emerging in the middle section of trials, such that orienting was more efficient when the individual was exposed to peppermint. After completing these analyses, Matt orally presented his results at the Psychological Science Research Symposium and reported them in his Honors Thesis, both completed in May 2016.

#### *Current Status*

The methodology used in Matt's experiment is of a caliber frequently accepted in the peer-reviewed journals in which Dr. Hecht regularly publishes. Unfortunately, null results – in this case, not finding an effect of peppermint – are rarely, if ever, accepted for publication; this is common practice in this field of psychology. However, there are some outlets that encourage publication of results, even if they are inconclusive. We are revising the manuscript for publication in one such journal: *PSI CHI Journal of Psychological Research*.

#### *Future Goals*

Although Matt's experiment yielded inconclusive results, they will serve as preliminary results to inform Dr. Hecht's ongoing line of research in this area. Several questions remain and will be addressed to fully test the aromatherapeutic claims regarding peppermint's influence on attention and alertness. For example, recent literature suggests that we should examine the quantity and duration of exposure to the odor. Longer exposure and/or stronger exposures to the odorant may be required before seeing a measurable effect on visual attention. Another possibility is that peppermint does not influence visual attention and instead impacts a more general form of attention or alertness. Measurements using functional near-infrared spectroscopy (fNIR) can be employed to help determine if this is the case. Fortunately, we have fNIR technology on campus, and it is compatible with our olfactometer.

In short, many future experiments in this new, ongoing line of Dr. Hecht's research will continue utilizing the olfactometer that Matt and I built using this grant.

Again, we thank you for awarding us a 2015-16 Presidential Faculty-Student Collaboration Grant. It was extremely beneficial in the progress of both Matt and Dr. Hecht's scholarly endeavors. If you have any further questions about the activities we completed during the grant or any information included in this report, please do not hesitate to contact us.

Sincerely,  
Lauren N. Hecht (Psychological Science)  
Matt Broschard ('16)