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by Jeffrey Langer Coughlin
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A Letter from President Wagner

Emory enjoys the distinction of being one of our nation’s top research universities. The Emory Vision Statement challenges our campus to be “inquiry-driven.” How should that designation and that aspiration shape the educational experience of Emory undergraduates? In the classroom, the fact that Emory students receive instruction from faculty who are inquiry-driven does in fact make a difference. Conceivably, a freshman history course at Emory, for example, might use the very same text being used in the classrooms at other non-research universities. In fact, the class syllabus could be very similar as well. But the fact that the course takes place at a research university like Emory ensures not only that the facts are delivered to our students, but also that classroom discussion elicits speculative thought, addressing “why” as well as “what” and “when.”

Beyond the classroom experience, students at Emory have the opportunity to participate in research and scholarship activities guided by our faculty. These undertakings are especially valuable educational experiences since they offer students direct exposure and involvement in the methods of original scholarship and research. In libraries and laboratories, students learn first-hand the disciplines of discovery, and hypothesis framing, support, and testing. In some cases these experiences lay the groundwork for career-long commitments to pursue academic research.

Academic research is characterized by a critical dimension not necessarily required of researchers who pursue their work outside of academia, in commercial or government settings, for example. Having invested time and energy in the processes of discovery, analysis, and hypothesis testing, academic researchers are expected to announce (profess, if you will) the results of their findings. Doing so can thrust them and their work into an international conversation that invites peer review. The Emory Undergraduate Research Journal, therefore, is an important form of an essential outlet for fulfilling that responsibility for disclosure so critical for academic researchers. Congratulations to the editors and backers of this effort, as well as to the authors whose works fill this first volume of the journal to appear in print.

Sincerely,

W. Wagner
President, Emory University

What is EURJ?

What you are holding in your hand, or viewing on our newly launched web site, is the latest culmination of the long standing tradition Emory University enjoys as an internationally renown research institution. With the inaugural print issue of the Emory Undergraduate Research Journal (EURJ) we hope to provide at least a slight preview into the research interests of Emory undergraduates presented in accessible fashion, eschewing esoteric jargon that sometimes litters research articles. Contained within these pages, you will find seven premier articles showcasing the original and talented research selected from over fifty submissions. In each, the authors have worked with editors to make the research as accessible as possible without jeopardizing the essence of the work—focusing on clarity, readability, and approachability.

EURJ currently features a state of the art submission and review system on our website, www.eurj.com, that allows each article to be blindly peer reviewed by PhD candidates, PhDs, faculty, and full time researchers who are considered experts in their respective fields. In 2005, when Zain first proposed the idea to Sudeep to create an undergraduate research journal, no venue existed for Emory undergraduates to share their research with the Emory community. With the support of Emory administrators, faculty, and academic departments, EURJ now fills that void and is already one of the premier student-run research journals.

Having now completed its first print issue, EURJ’s subsequent goals include increasing the number and involvement of faculty, post-doctorate fellows, and graduate students as reviewers, opening submission to all undergraduates across the nation, having our print publications sent to other universities and research institutions across the nation to promote scholarly exchange and interest in research, organizing an annual research symposium with a prominent keynote speaker, providing a central database for listings of Emory researchers interested in having undergraduate research assistants and various research opportunities on and off campus, creating a handbook to serve as a model to start undergraduate research journals in other universities, among many other initiatives that will further contribute to our ultimate vision.

We especially extend our thanks to Dr. Keith Easterling, Dean Joanne Brzinski, Dr. Pat Martsteller, Dr. Cathy Quinones, Mr. Michael Derry, Mr. Allen Cattier, the reviewers, Media Council and everyone else that was involved in making EURJ a success. We would also like to thank President Wagner for his continued support and enthusiasm for undergraduate research. Finally, the EURJ staff deserves inestimable credit for working tirelessly and endlessly despite the number of obstacles that we faced throughout the entire process.

EURJ is now accepting submissions for our next issue. We encourage every Emory student researcher, especially undergraduates working on an honors thesis, to submit a manuscript to EURJ. We are also accepting applications for the 2007-2008 EURJ staff. Please visit our website at www.eurj.com for more information. With your continued support, we suspect EURJ to have a long and prosperous future at Emory University.

Starting a new publication of such caliber was certainly no easy task. Very much like research process itself, we encountered many challenges throughout the entire nascent process that tested the patience, persistence and conviction of the EURJ staff. EURJ members enthusiastically trudged on, and in Spring 2006 we launched a pilot issue at www.eurj.com.

James W. Wagner
President, Emory University
Creativity Differences between Fine Arts and Science Majors

Katherine Thomas

Abstract

Researchers tested for differences in creativity levels between fine arts and science majors. In addition to examining overall differences in the overall trait of creativity, specific components of creativity were studied. The primary hypothesis was that fine arts majors would exhibit higher levels of creativity overall. This hypothesis was confirmed. Also significant were research hypotheses that fine arts majors would express higher levels of all components of creativity. Researchers additionally predicted that fine arts majors would express higher levels of originality than fine arts majors, and while this hypothesis was not supported, interesting results emerged. The study is valuable to scholars interested in creativity because it extends research suggesting that artistic students exhibit higher levels of creativity than non-artistic collegiate students. The present study also examines differences in academic areas of study as well as specific components of creativity.

Introduction

It is not merely a general assumption that artists are more creative than scientists; research in the field of creativity verifies this assumption ( Hoecevar, 1976; Alter, 1984; Cheung, Rudowicz, Xiaodong, & Kwan, 2003; Rubenstein, 2003). But before psychologists can begin researching a topic as vague as creativity, a formal definition of the term must be accepted. One reason that research on creativity has been so broad is that people define the term in a multitude of ways; however, most researchers in the field have accepted the broad definition that creativity relies primarily on "originality and functionality" (Guilford, 1959). Thus to be classified as creative, an idea must be both original in its scope and useful in its nature. However, modern scales of creativity have broadened this definition to include multiple components of creativity, with some components assessing the originality of ideas and other components assessing the function of creative ideas. Such a scale is used in the present study, which recognizes the importance of these components of creativity, and divides creativity into five subcomponents: creative engagement, cognitive style, spontaneity, tolerance, and fantasy (Kelly, 2004). Psychologists have researched whether or not there are different types of creativity that manifest in different areas of academic study. Substantial research lends credit to the idea that people with different academic focuses and backgrounds exhibit higher levels of the various components of creativity (Hoecevar, 1976; Cheung et al 2003). The purpose of the present study was to determine if there are differences in creativity between undergraduate fine arts majors and science majors, and specifically to examine in which components of creativity these differences exist.

Alter (1984) performed a simple study testing whether college dance students differed from students in other disciplines. Her findings suggested that dance and art students were significantly more creative than students in the general college body (Alter, 1984). Other studies have found similar trends suggesting that students in artistic academic areas are more creative than their classmates in other academic majors (Hoecevar, 1976; Cheung et al 2003; Rubenstein, 2003). A more detailed study by Rubenstein (2003) tested whether college students with academic majors of fine arts and science and technology students scored significantly higher on measures of creative innovativeness, defined as openness to new ideas and experiences, than business, humanities, or social science students. Consistent with other research in the field, Cheung (2003) found humanities and social science students to exhibit significantly higher levels of both originality and overall creativity than science and technology students (Hoecevar, 1976; Alter, 1984; Rubenstein, 2003). However Cheung et al's research did not directly compare science students to art students, thus researchers in the present study are interested in testing whether measures of creative innovativeness will still be higher in science students when they are examined in conjunction with art students.

In addition to studying creative differences among students of different academic disciplines, psychologists have researched whether creativity is a general trait that some people possess in higher levels than others, or whether it is a trait that manifests itself in certain, and different, aspects of people's lives. In 1996, Hoecevar developed a likert scale that measured creativity based on activities and achievements in fine arts, crafts, performing arts, math-science, literature and music. He found that participants who scored high on creativity in a specific area were likely to score relatively high in multiple areas. He interpreted these findings as suggesting that people are creative in general, not just in specific facets of their lives. More than 20 years later, Plucker (1999) performed three different analyses of previous studies; one of these was Hoecevar's (1976) study of the dimensionality of creativity. Plucker's analysis proved that Hoecevar's measurement was valid and that there is strong support of content generality with regard to creativity. Plucker's findings support that 40-50% of the variance in creative checklists can be accounted for by a content general factor (Plucker, 1999). These studies suggest that creativity is a general trait that some individuals possess in greater levels than others.

However, while Hoecevar (1976) concluded that people who are are not creative in general, Plucker (1999) noted that while a fairly high percentage of variance could be explained by a content general factor, there was still 50-60% of variance unexplained by this factor. Thus Plucker concluded that this portion of unexplained variance could be due to a content specific factor, implying that a person exhibits different levels of creative ability depending on the area being measured. So while Hoecevar concluded that creativity was a personality trait, Plucker noted that creativity is both a personality trait and context dependent. Noting Plucker's (1999) findings, it is vital for researchers to be cognizant that more than half of variance explained by creativity could be due to factors regarding the specific type of creativity being tested. For this reason, researchers are examining not only overall levels of creativity in participants, but also creativity levels in five subcomponents of creativity.

Based on previous research in the field of creativity, researchers in the present study formulated three distinct hypotheses. First is that fine arts students will exhibit higher levels of overall creativity. This prediction is based on previous research in the field suggesting that students with artistic majors have higher levels of general creativity than students with academic majors in a non artistic department (Hoecevar, 1976; Alter, 1984; Rubenstein, 1999; Cheung et al, 2003). Based on these studies, we predict that fine arts students in the present study will exhibit higher levels of creativity than science students.

The second hypothesis of the present study is that fine arts majors will score higher specifically on the measure of creative fantasy, defined as the tendency to daydream and imagine (Kelly, 2004), than science majors. This prediction is drawn from literature suggesting that artistic students score higher on measures of creative originality, measured participants. In regard to creative fluency, she found that design students were significantly more creative than both behavioral science and law students, who did not significantly differ from each other. The results of tests measuring creative originality showed the most creative students studied design, followed by behavioral science, then, finally law, and that all significantly differ from each other (Rubenstein, 2003). These findings indicate that measures of creative originality differ in students with different majors, with students in more artistic fields expressing higher levels of originality.

Research has not solely found artistic students to be more creative than students in all other academic departments; some research has shown science students to exhibit higher levels of creativity in certain areas as well. Cheung and his colleagues (2003) found that science and technology students scored significantly higher on measures of creative innovativeness, defined as openness to new ideas and experiences, than business, humanities, or social science students. Consistent with other research in the field, Cheung (2003) found humanities and social science students to exhibit significantly higher levels of both originality and overall creativity than science and technology students (Hoecevar, 1976; Alter, 1984; Rubenstein, 2003). However Cheung et al's research did not directly compare science students to art students, thus researchers in the present study are interested in testing whether measures of creative innovativeness will still be higher in science students when they are examined in conjunction with art students.

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as the production of unconventional and unique ideas (Guilford, 1959; Rubenstein, 1999; Cheung et al., 2003). While the components of creativity differ in past research and the present study, researchers equate creative originality with the modern component of creative fantasy because both involve an individual’s ability to produce imaginative ideas. Thus, as artistic students in previous studies exhibited higher levels of creative originality than students not studying the arts, researchers in the present study expect fine arts majors to exhibit higher levels of fantasy than science majors.

The final research hypothesis of the present study is that science majors will exhibit higher scores of creative tolerance defined as flexibility in thinking (Kelly, 2004) than fine arts majors. This prediction is drawn from research suggesting that science students exhibit higher levels of innovativeness than art and social science students (Cheung et al., 2003). This could be the result of science based learning revolving around abstract formulas representing theoretical concepts, a method of problem solving that requires great levels of mental flexibility. Again, the present study uses a different measure of the components of creativity, however researchers equate innovativeness with creative tolerance in the present study. Tolerance is regarded as openness to new ideas and experiences, and researchers believe that high levels of innovativeness are essential to openness to new experiences because both require individuals to be flexible in their thinking. Thus we predict that similar to the high innovative score of science students in past research, science students in the present study will score higher on the measure of tolerance.

### Methods

#### Participants

Participants in this study were undergraduate students enrolled in advanced courses (defined as 300 level or above) in either biology, chemistry, creative writing, or theater at Emory University in Atlanta, Georgia. A total of 54 students participated in the study. Twenty nine participants were science majors (34% biology, N = 10; and 66% chemistry, N = 19). Twenty five participants were fine arts majors (44%, creative writing, N = 11; and 56% theater, N = 14). Half of the participants were male, half female. Of science majors surveyed, 41% (N = 12) were men and 59% (N = 17) were women. Of fine arts majors surveyed, 60% (N = 15) were men and 40% (N = 10) were women.

Because participants were chosen only from classes at a 300 level or above, it is safe to assume that the majority of participants in the study were juniors and seniors, though year in school was not asked on the survey.

#### Design

Researchers chose the survey method as the most appropriate means of collecting data in the present study for multiple reasons. Primarily, surveys measure personal accounts of particular attributes, and no researcher can evaluate creativity as well as the participant him/herself. Another factor researchers considered is that surveys allowed a larger sample size working on creative activities, cognitive style measures the aspect of creativity encompassing divergent thinking and creative problem solving, spontaneity measures individuals levels of excitement seeking, tolerance is a measurement of person’s flexibility with ideas and openness to new experiences, and fantasy measures a person’s level of imagination and tendency to daydream (Kelly, 2004).

#### Measures

Researchers selected the Scale of Creative and Attributes (SCAB) (Kelly, 2004). Researchers found many advantages favoring use of the SCAB test including the fact that it is a newly developed test, while some little research has been done using this measure, it was formed based on modern theories of creativity. This measure was also chosen because it takes multiple dimensions into account when measuring creativity; it assesses the behavioral, cognitive, and personality factors that combine to comprise levels of creativity.

The SCAB test includes 20 survey questions, and is divided so that four questions measure each of the five subcomponents of creativity being tested. Researchers were specifically interested in results from the tolerance and fantasy subgroups. Overall creativity was also examined by averaging participant’s scores on all 20 likert scale items. An example of question measuring engagement is: “I dabble in many different hobbies.” Cognitive style: “I have an ability to find the hidden potential of ideas that others often can’t see.” Spontaneity: “I am impulsive.” Tolerance: “I am accepting of other people’s ideas.” Fantasy: “I like to imagine going new places.”

Kelly (2004) presents an analysis of three separate studies providing reliable and valid results of the SCAB test. The first study tested the reliability of the five measures of creativity used in the SCAB and found that all five components had good internal reliability. The 127 items tested on 118 students found that coefficient alphas, which were analyzed to determine construct validity, ranged from .65 to .82. The second study Kelly completed verified the SCAB test’s construct validity. The SCAB test administered to 271 undergraduate students had a Coefficient Alpha of .82 and factor analyses indicated that 64% of the systematic variance in creativity was explained by the five components being measured. All measurements loaded on the higher order construct of creativity, thus factor analysis supports the five factor model of creativity. Kelly completed the third study to measure test-retest reliability of SCAB. Her findings suggest that SCAB measures stable traits as test-retest, over a one month time period, coefficients were: .83 (creative engagement), .86 (creative cognitive style), .90 (spontaneity), .78 (tolerance), .70 (fantasy), and .80 (total scale). The study also showed that SCAB is not biased in producing social desirability responses.

#### Results

The first hypothesis tested by researchers was that fine arts students would exhibit higher levels of overall creativity than science students. Researchers from this test, performed using an independent means t test, found that fine arts majors exhibited significantly higher levels of overall creativity than students majoring in sciences (t(52) = 3.67, p < .005). On the likert scale ranging from 1-7, fine arts majors had a mean score of 5.69 (SD = .56) when responses were averaged across all 20 items. Students majoring in sciences exhibited a mean score of 5.08 (SD = .65) across all 20 survey items. Next, researchers calculated Cohen’s D to determine the effect size of these results and found that the effect size was very strong (d = 1). The strength of this effect size indicates that the results have high practical, as well as statistical, significance.

The second research hypothesis, also tested using an independent means t test, was that fine arts majors would score higher on the specific measure of creative fantasy than science majors. Results from this test supported our hypothesis, indicating that fine arts students did indeed have significantly higher levels of fantasy than science students (t(52) = 2.61, p < .05). When scores of the four questions measuring creative fantasy were averaged, fine art majors were significantly higher (M = 6.01, SD = .81) than hard sciences majors (M = 5.31, SD = 1.11). Researchers also followed this finding by calculating Cohen’s D to determine the effect size and found that these results also have a high level of practical significance, as indicated by a strong effect size (d = .71). The third and final hypothesis tested by researchers, again performed using an independent means t test, was that science majors would score higher on the measure of creative tolerance than fine arts majors. Results of this test did not support our hypothesis, showing no significant difference between science and fine arts majors in regard to measured levels of creative tolerance. In fact, a very small effect size was found in the average score of creative tolerance between fine arts majors (M = 5.92, SD = .82) and science majors (M = 5.90, SD = .83), with means actually in the opposite direction of our proposed hypothesis.
Results of statistical analyses confirmed the first research hypothesis of the present study, with fine arts majors displaying significantly higher levels of overall creativity than science majors. These findings coincide with results found by previous researchers studying academic creativity (Hocevar, 1976; Alter, 1984; Cheung et al 2003; Rubinstein, 2003). While the specific academic areas studied have varied, researchers have consistently found that students in artistic majors, in their respective samples, score higher on measures of creativity than students in non-artistic majors (Hocevar, 1976; Alter, 1984; Cheung et al 2003; Rubinstein, 2003).

Results from tests of our second research hypothesis also proved significant, with fine arts majors scoring significantly higher on the specific measure of creative fantasy than science majors. Little research has been done testing creative differences in the specific component of fantasy because it is a relatively new (developed in 2004) measure. However, researchers in the present study related creative fantasy to creative originality, a measure that previous literature has shown to be significantly higher in artistic majors than in science majors (Guilford, 1959; Rubenstein, 1999; Cheung et al, 2003). Creative fantasy assesses an individual’s propensity to imagine new places and fantasies through their writings. Similarly, theater majors must imagine themselves as other characters in order to perform. While previous research has shown that artistic majors possess high levels of creativity in relation to college students from the general population (Hocevar, 1976; Alter, 1984; Cheung et al 2003; Rubinstein, 2003), the present study illustrates that artistic majors should possess high levels especially on the measure of creative fantasy as well.

Results from the third research hypothesis of the present study, in which researchers predicted science majors would score higher on the measure of creative tolerance than fine arts majors, were not significant. However researchers’ error was not in assuming that science majors would score higher on the measure of tolerance, but rather in expecting that art majors would score significantly lower. While hard science majors did not significantly differ from fine arts majors on this measure, they did significantly differ from their own scores on other components of creativity tested. In both biology and chemistry students, mean scores were substantially highest on the measure of creative tolerance. Biology majors averaged a score of 6.13 on creative tolerance (the highest of any of the four majors tested), with their next highest mean score being 5.58, in cognitive style. Biology majors’ scores on creative tolerance were more than a point greater than their mean scores on overall creativity (M = 5.04). Though their means were not quite as high as the biology majors, chemistry majors also showed this same general trend, with creative tolerance being their highest mean score of all components of creativity tested (M = 5.78). This score was considerably greater than their score on overall creativity (M = 5.10). Thus researchers were correct in predicting that science majors would exhibit high levels of creative tolerance.

The flaw, then, in researchers’ hypothesis that science majors would score significantly higher on measures of creative tolerance than fine arts majors was not that hard science majors did not score substantially higher on this measure, but that fine arts majors did not score lower. Researchers were correct in assuming that science majors would exhibit high levels of creative tolerance, however this hypothesis was made without consideration of the fact that fine arts students in previous studies have shown no tendency to score lower on this measure. Tolerance measures an individual’s flexibility in thought and openness to experience. These traits are important to students studying in the arts in terms of being able to try new ideas with their creative work and to appreciate the work of fellow artists, thus it follows that fine arts students would not be significantly lower in this measure. It also follows that students studying sciences would score high on this measure because flexibility in thinking is essential when working with abstract, scientific formulas and theories.

Predictions regarding differences between science and fine arts majors in the specific components of engagement, cognitive style, and spontaneity were not made because minimal research has been done on these measures to direct a research hypothesis; however, interesting results emerge when examining the means of majors in these areas. Fine arts majors scored significantly higher on the measures of engagement and spontaneity than science majors, with no significant differences emerging between the two groups on the measure of cognitive style. These findings follow logically from the conceptual definitions of the measures and the different specifications of study in science and art. Engagement is a measure of how much time a person spends working on creative activities. Considering that creativity is an essential part of many assignments in both creative writing and theater, it is not surprising that fine arts students would score higher on this measure than science students. The other significant difference between majors was found in spontaneity, which measures an individual’s level of excitement seeking. This also follows logically from typical behaviors of students in the different majors. Based on the nature of their academic study, students interested in creative writing and theater are likely also more interested in activities that seem thrilling, as writing and acting both involve components of seeking

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<th>Academic Major</th>
<th>Biology</th>
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<th>Theater</th>
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<td>Overall Creativity</td>
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<td>.65</td>
<td>5.10</td>
<td>.67</td>
</tr>
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</table>

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Predictions regarding differences between science and fine arts majors in the specific components of engagement, cognitive style, and spontaneity were not made because minimal research has been done on these measures to direct a research hypothesis; however, interesting results emerge when examining the means of majors in these areas. Fine arts majors scored significantly higher on the measures of engagement and spontaneity than science majors, with no significant differences emerging between the two groups on the measure of cognitive style. These findings follow logically from the conceptual definitions of the measures and the different specifications of study in science and art. Engagement is a measure of how much time a person spends working on creative activities. Considering that creativity is an essential part of many assignments in both creative writing and theater, it is not surprising that fine arts students would score higher on this measure than science students. The other significant difference between majors was found in spontaneity, which measures an individual’s level of excitement seeking. This also follows logically from typical behaviors of students in the different majors. Based on the nature of their academic study, students interested in creative writing and theater are likely also more interested in activities that seem thrilling, as writing and acting both involve components of seeking

![Mean Scores of Overall Creativity](image-url)
excitement in work. Science classes do not entail this same degree of thrill seeking, thus it is understandable that fine arts majors scored higher on the measure of spontaneity. It also logically follows that no significant differences were found in the specific measure of cognitive style between science and fine arts majors. Cognitive style refers to an individual’s capacity for divergent thinking and problem solving. This measure produced similar results as the findings on tolerance. For both biology and chemistry majors, mean scores on cognitive style were greater than all other mean scores, excluding tolerance. But again, results for cognitive style were not significant because fine arts majors did not score significantly lower on this measure. The work requirements of both sciences and fine arts, and all collegiate majors for that matter, require the ability of divergent thinking and problem solving, thus it is logical that scores on this measure would not be significantly greater in any particular major. Overall, results of the three hypotheses tested in the present study extend psychologists’ knowledge regarding creativity differences between artistic and non-artistic majors. Significant findings of the hypothesis that fine arts majors are more creative in general than science majors, expands upon research in the field depicting individuals with artistic interests as more creative than individuals studying in science departments. The results of both the second and third hypothesis of the present study, with one showing fine arts majors to have significantly higher levels of a particular component of creativity and the other finding no significant differences between fine arts and science majors with respect to a different component of creativity, extend previous research suggesting that specific aspects of creativity are utilized differently in individuals with different interests (Plucker, 1999). Our study lends credit to the modern development of creativity, extending previous research suggesting that creativity is not only a complex concept illustrating that creativity is not only a complex concept, but also a trait that varies considerably across different populations. An interesting direction for future research would be to examine ways of measuring whether students declared as artistic majors possess higher levels of creativity in general, and thus choose artistic majors as the best way of expressing themselves, or whether their creativity is developed and enhanced through their chosen field of artistic study. Research by Plucker (1999) examines this issue of whether creativity is a general trait possessed in higher levels by some people than by others, or whether it is a trait that manifests itself in certain areas more than others. Future research should aim to combine and extend the knowledge that artistic students consistently score higher on measures of creativity with Plucker’s analysis on the generality and specificity of human creativity. With the foundations of research on creativity already established that artistic students appear to be more creative than their classmates in other majors, psychologists interested in creativity and academia should now look to ways of analyzing whether creative students are drawn towards artistic based majors, or whether students in artistic majors are taught and allowed to express themselves creatively while creativity is not required of students in other majors.

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A special thanks to my fellow research partners who were an integral part of this research project, as well as to my professors, without whom I would not have known anything about performing academic research.

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The Pervasiveness of Hunger in America

Peter Baron Matz

Despite the fact that the United States is both the wealthiest and most proficient food producer of any nation in the world, 35 million Americans—including 13 million children—are threatened by hunger each year. Hunger does not discriminate in that “Hungry people can be found in every city, county and state in the United States, and the ill effects of hunger touch everyone in some way.” In addition, people of every age, gender, race, and ethnicity all stand a chance of falling victim to hunger. Despite the fact that it has made it to the attention of federal policymakers and been placed on their policy agenda, hunger in America continues to be a harsh reality.

While the first food stamp program was enacted in 1939, it was not in response to the problem of hunger in America. Rather, it was intended to address Depression Era issues such as unmarketable food surpluses and widespread unemployment. The short-lived program was brought to an end just four years after its implementation, when these conditions no longer existed. It was not until the late 1960s and early 1970s that hunger in the United States rose to the national forefront. In 1967, the Field Foundation of Social Service provided a grant in order to conduct a major study of hunger in the South, Appalachia, and other poor areas in America. In their report to the U.S. Senate, they disclosed that it was not malnutrition that they found, but rather that people were suffering from hunger and directly or indirectly dying from it. This report had an enormous impact on American society. To begin with, it served as the foundation for “Hunger in America,” a 1968 CBS television documentary that, among other things, showed American children suffering from severe illnesses related to hunger. This documentary served as an eye-opener to many Americans, who, prior to viewing it, were under the impression that such conditions were unique to third-world countries. This report also set the time for the first national hunger conference, led to the creation of the U.S. Senate Select Committee on Nutrition and Human Needs, which would go on to play a large role in creating and expanding many of today’s existing food programs.

Additional proof that many Americans continue to suffer from hunger comes from widespread accounts of increases in the number of households seeking “emergency food” via food pantries, soup kitchens, and emergency shelters serving short-term residents. Hunger in America 2006, for example, was a comprehensive national survey of emergency feeding programs that was conducted for the benefit of America’s Second Harvest, a food bank network that comprises the nation’s largest network of emergency food providers. The results showed that the food bank network of emergency food providers served 25 million people in just one year, including over nine million children. Everyone, regardless of age, gender, race, ethnicity, gender, or ability, had access to food recipients were women, while more than twenty percent were elderly. Among all emergency food recipients, the study showed that 70 percent were food insecure (73 percent among households with children). This patently dismisses the argument made by critics that requests for emergency food are driven simply by the lure of free food. The study found that over 30 percent of those surveyed reported having to make choices between paying for food and paying for other bare necessities such as rent or mortgage and medicine or medical costs. Over 40 percent of those interviewed reported having to choose between food, utilities and heating fuel. This is simply another reflection of the severity of this problem.

In the 2004 USDA report based on the Census Bureau surveys, the fifth consecutive increase in the number of food insecure Americans was confirmed. It was determined that 13.5 million households (11.9 percent of all U.S. households) were food insecure and that, of those 13.5 million households, 4.4 million suffered so severely that they were classified as food insecure with hunger. This equates to 38.2 million individuals who lived with food insecurity in 2004, including 24.3 million adults (11.3 percent of all adult households) and 13.9 million children (19 percent of all children). Inadequate family resources lie at the heart of the matter; as the USDA study shows, food secure households typically spend 31 percent more for food than food insecure households of the same size and household composition.

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of them are similar to our Sun, which means the rest of the stars in our galaxy. Even then, only three percent of the stars in our galaxy comprise less than one-tenth of a star's mass. And if we are lucky enough to look at a star with a point of light, we can look at how a star's light varies with wavelength, called a spectrum. Based on a star's spectrum, you can determine its temperature, which is directly proportional to its brightness. Additionally, you can deduce the chemical make-up of a planet's surface from its spectrum and determine whether it is a normal, main-sequence star like our Sun, or a peculiar, dying star such as a supergiant or a white dwarf. However, even with the overwhelming amount of light pollution from cities and towns, we can still observe and measure stars that are thousands of times fainter than the human eye can see, allowing us to observe and measure stars that are thousands of times fainter than the human eye can see, even with the overwhelming amount of light pollution from Emory and Atlanta.

I am very lucky to be the first astronomy major at Emory to conduct undergraduate research; the major itself was just created in 2003. I have nearly unlimited access to both the telescope and astronomy faculty, making it very easy to get started. I started research in September 2005, the first semester of my junior year, and I will complete an honors thesis in May 2007. The focus of my research is what holds the key to determining all those interesting physical properties of stars that I discussed earlier. Binary stars are two stars that orbit each other, or more accurately stated, that orbit their common center of mass. Of all the stars in the universe, nearly half of them are actually binaries. The two stars may be very similar to each other, or they could vary greatly with respect to their individual masses, sizes, and temperatures. They can be separated by as much as thousands of times the distance from Earth to the Sun, and they can have orbital periods of tens of thousands of years, or could be so close that they come in physical contact, resulting in a period of mere hours. An eclipsing binary is a binary star system whose orbital plane just happens to be such that the two stars eclipse each other when viewed from Earth. This extremely fortuitous arrangement is exactly what allows us to determine stellar masses, sizes, and magnetic cycles. After studying planetary position data collected by Tycho Brahe, Johannes Kepler deduced his 3rd law of planetary motion in 1619, which states that the period of a planet's orbit is directly proportional to the square of the planet's distance from the Sun. Sir Isaac Newton later elucidated the physics behind the law, which holds for binary systems as well as planets. Most of the eclipsing binaries that we study are short-period systems, so they have a very small separation such that we are unable to resolve them; the entire system appears as a point of light. The way that we determine whether an object in the sky is an eclipsing system is by observing the total brightness of that point over time;
the pinprick of light we see from Earth will periodically dim as one star eclipses the other and blocks out a large fraction of the system's overall light. By calculating the length of time between each eclipse, we can precisely determine the system's period and, by applying the well established physics of Newton, calculate how far apart the two stars truly are. By looking at how the spectra of the system changes over time we can determine how fast each star is moving and directly calculate each star's mass. Once we know how fast they are moving, we can look at the length of the eclipse and easily calculate the radius of each star.

How amazing is that? Simply due to the favorable alignment of a binary pair, we can determine all the physical properties that we could not determine for a single star. By studying numerous eclipsing binaries, we can establish general trends and patterns which can then be applied to every solitary star out there. Eclipsing binaries are truly the Rosetta Stones of stellar astrophysics, as they open the door for the investigation and inquiry of the entire multitude of stars in the universe. We need only to point our telescopes and scrutinize the starlight.

In order to look at the magnetic activity of a star, we need to observe its pattern of starspots and flares. The presence of starspots and flares will have a very distinct effect on how the brightness of a binary system changes over time. Using computer modeling, we can determine where spots are located on a star and when flares occur, and by mapping the data out over time, we can successfully investigate the star's internal dynamos.

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Access to regular primary health care has been shown to have a positive effect on individual health. However, in the United States, African-Americans across all income levels depend much more heavily on physicians than non-Hispanic whites (McCaig & Burt, 2005). After examining “the relationship between having a regular doctor and access to care, as measured by a set of preventive and primary care utilization indicators recommended by the Institute of Medicine” (1996) researchers from the US Department of Health have concluded that individuals with a regular primary care provider have better access to health care than those without one (Lambrew et al., 1996). For millions of African-Americans and other minorities, the emergency department (ED) serves as their source of health care. In 2005, “hospital emergency rooms comprised 13 percent of the nation’s population, account for 86 percent more ED visits than whites (McCaig & Burt, 2005). These facts reveal a huge disparity across racial, socioeconomic, and geographic lines with regards to regular access to quality regular primary care physicians, and suggest a strong correlation between minority racial or ethnic status and the utilization of emergency medical services for non-urgent medical care. An individual’s definition of health is the foundation of their health-seeking behavior. The World Health Organization defines health as “a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity” (1948). With that in mind, an individual’s definition of their personal health is highly dependant on culture, which is in turn tied to nationality, ethnicity, religion, age, gender, education, occupation, life experiences, and religious affiliation (Gilead, 2006). In a 2003 study, African-Americans agreed that “health is being independent and being oneself”; not what someone else wants [one] to be or do (Purnell & Paulanka, 2003). For the urban, working class populations who are the focus of this paper, health is merely the ability to proceed with daily life in face of the stressors (Gilead, 2006). This definition of health can become problematic, as it implies that African-Americans may ignore potential warning signs or symptoms that would enable early disease treatment; instead, many are arriving at EDs in crises that regular medical attention could have prevented. In the United States, universally equal access to health care is not a reality, and despite “total health care spending represent[ing] 16 percent of the gross domestic product (GDP),” there are still some 46 million people who are uninsured. Millions more are underinsured (Borger et. al, 2006). Socioeconomic status and class are crucial determinates in predicting an individual’s health status and ability to access quality health care, because these factors are intimately tied to insurance status. Recently, the CDC discovered that “persons living in poverty are considerably more likely to be in fair to poor health and are less likely to have used many types of health care” (2005). In 2003, 12.5 percent of African-Americans were living in poverty, up from 12.1 percent in 2002, and 11.7 percent in 2001. In 2003, more than 60 percent of African-American and Hispanic children under 18 years of age, and more than one-half of the Black and Hispanic population aged 65 years and older, were poor or near poor ($18,810 income for a family of 4 in 2003, as defined by the US Office of Management). In 2002, households with an annual income of less than $50,000 represented 43 percent of uninsured Americans (Bodenheimer & Grumbach, 2005). Additional data from the 2002 US census revealed that 20 percent of non-Hispanic African-Americans were uninsured. When all the data are considered concurrently, African-Americans without insurance, typically but not exclusively the poor, are exceedingly more likely to be in poor health and to seek their health care from the charity of emergency departments rather than a regular primary care provider (Bodenheimer & Grumbach, 2005). For increasing numbers of African-Americans, the emergency department acts as their first source of medical care. In 2005, “hospital emergency rooms were the usual port of entry to the medical care system for seven million African-Americans” (Quaye, 2005). Major contributors to this limited access are socioeconomic and insurance status; however, distrust, cultural differences affecting patient-physician interactions, discontinuity of care, and limited access to preventative care create hostile environments that further discourage African-Americans from seeking human health delivery services. This paper will examine the multi-variant determinants that influence African-Americans’ health seeking behavior, including, but not limited to cultural differences, socio-economic status, and how their access to regular primary care affects emergency department use. Emergency departments are vital to our nation’s health care safety net, operating under a “do no harm” philosophy in treating all incoming patients 24 hours a day, seven days a week, regardless of their symptoms or “their ability to pay” (Health Care Financing Administration, 1990). Currently there are over 100 million visits to the ED, which account for approximately 25 to 30 billion dollars in annual health care expenditure (Steinbrook, 1996). Physicians, nurses, and allied health care professionals like pharmacists and emergency medical technicians, constitute the majority of health care professionals who provide care for these millions of Americans. In spite of advances in preventive health sciences, over the last thirteen years the number of ED visits has increased by 26 percent, or 2 million visits annually (McCaig & Burt, 2005). In 2005, one major result of this increase was an average waiting time of 3.4 hours in the emergency department (McCaig & Burt, 2005). After adjusting for population growth, the researchers concluded that the major contributing factor to this delay in treatment was the inappropriate use of the ED as a source of non-emergent primary care. An analysis of the 1998 Health Interview Survey determined that poverty, lack of insurance, and minority race or ethnicity were good predictors for patients who identified the emergency department as their usual source of care (Walls et al., 2000). Recently, falling numbers of primary care practitioners in inner cities and rural areas have also reduced minority access to regular primary care; illuminating a strong correlation between access to a primary care practitioner and ED use. Additional data from the Center for Disease Control (CDC) found that 60 percent of emergency departments are located in urban areas, and they account for 81 percent of encounters with health care providers. It can be concluded that persons living in urban centers experience greater accessibility to ED caregivers than to primary care physicians (CDC, 1995). African-Americans, who comprise 13 percent of the nation’s population, account for 86 percent more ED visits than whites (McCaig & Burt, 2005). These facts reveal a huge disparity across racial, socioeconomic, and geographic lines with regards to regular access to quality regular primary care physicians, and suggest a strong correlation between minority racial or ethnic status and the utilization of emergency medical services for non-urgent medical care. An individual’s definition of health is the foundation of their health-seeking behavior. The World Health Organization defines health as “a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity” (1948). With that in mind, an individual’s definition of their personal health is highly dependant on culture, which is in turn tied to nationality, ethnicity, religion, age, gender, education, occupation, life experiences, and religious affiliation (Gilead, 2006). In a 2003 study, African-Americans agreed that “health is being independent and being oneself”; not what someone else wants [one] to be or do (Purnell & Paulanka, 2003). For the urban, working class populations who are the focus of this paper, health
Aging disparities in the quality of health care. Sënesing African-Americans, perhaps the most severely impoverished group and the most familiar with racism, suffer from chronic illnesses (e.g., diabetes, renal complications and vascular infections) that could otherwise be mitigated by consistent monitoring. Their diminished health can also be correlated with a decrease in the number of regular visits to a physician before their health problems become a health crisis. As a result, overall ED visits for African-American persons 65 years of age and older have increased by 59 percent since 1992 (McCaig & Burt, 2000). These patients arrive at EDs suffering strokes, end-stage renal failure, and heart failure that “are a direct result of the inaccessibility of proper treatment, delay in diagnosis and treatment, and inability to get adequate and appropriate pharmacological treatment” (Quaye, 2005).

Managed health care like Medicare, Medicaid and HMOs further compound the issue of access. Medicaid, which covers half of the 12 million impoverished African-Americans, provides the chance of an adequate healthcare system to doctors who rarely communicate the severity of illnesses, test results, the extent of injury or the cause of death, and these patient-physician interactions are critical to their non-utilization of primary care providers (Dressler, 1993). Further evidence came from Case Western University, where Sarver and others analyzed statistics gathered from the Agency for Healthcare Research and Quality. The Case Western team elucidated that “dissatisfaction with an interpersonal aspect of care...lack of confidence and scheduling conflicts with primary care providers and their staff were all associated with having non-emergency department use” (Sarver et al, 2000). To compound this, Afflalo and others found that confidence in emergency departments and familiarity with them were major factors for patients presenting to EDs for non-emergency care. The cumulative effect is that African-Americans, regardless of socio-economic or insurance status, perceive barriers to accessing healthcare from regular primary care providers, and as a result are more likely to seek healthcare from the ED.
the specific population that each clinic serves. This improved sensitivity, while it includes the recognition of common pathologies in local communities, is an indicator of the improved cultural competency and increased patient-physician interaction that these smaller, community-based clinic offer. Many of the issues affecting healthcare access, such as low income and stressors associated with urban or rural living, are addressed and mitigated by these smaller neighborhood VA clinics. Research serves as an affirmation of how community-based health services would positively impact African-Americans and their overall health.

A clear pattern has been established along cultural and socioeconomic lines indicating that many African-Americans prefer emergency departments to a regular primary care physician because of both perceived and actual difficulties in accessing primary and preventive health care. This phenomenon has deleterious effect on the health of African-American communities because emergency departments are inappropriate ports of entry into health care for non-emergent medical situations (Quaye, 2005). Emergency departments are unduly burdened, as their infrastructure is not tailored to meet the needs of such volumes of patients. In order to alleviate the stress put on the health of African-Americans and the health care system, new networks of smaller community-based health clinics must be established. Through the increased promotion of preventative health care, improved continuity of care and increased cultural competency, these clinics offer the hope of improved access and the delivery of high quality regular primary health care to the African-American community.

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Aldous Huxley and the Psychedelic Movement
Mark Swails

Abstract
In 1953 well-known author Aldous Huxley published a short essay, The Doors of Perception, about his first experience with the psychedelic drug mescaline. This essay and a follow up essay a few years later, Heaven and Hell, were adopted by the youth of the middle 1960’s as fundamental works of the acid culture. How did an elderly, upper-class, British intellectual become allied with a counter-culture youth movement? This essay provides a brief outline of Huxley’s ten years of research into psychedelics, and his influence on the movement. It positions Huxley as a central player in the early psychedelic movement of the 1950’s and traces his influence on key leaders of the later psychedelic movement, particularly Timothy Leary.

Huxley died in 1963, before the later psychedelic movement swelled in popularity. The second part of the essay challenges the assertion of biographers of Aldous Huxley and historians of the psychedelic movement that Huxley would have completely disapproved of the later psychedelic movement as it manifested itself in the mid 1960’s. Through examination of Huxley’s letters, actions, and essays the paper concludes that Huxley’s opinions of the psychedelic movement can not be determined and that Huxley’s biographers have presented an incomplete image of his opinions. The final paragraphs explore a possible reason for the inaccuracy.

Aldous Huxley and the Psychedelic Movement
Mark Swails

In the spring of 1953 on a “bright May morning,” well-known novelist and essayist Aldous Huxley “swallowed four-tenths of a gram of mescaline [sic] dissolved in a half a glass of water and sat down to wait for the results.” The following year Huxley published “The Doors of Perception,” an essay about his experience that morning. In the essay, Huxley argues that the mind works as a reducing valve, screening out all sense perception that is not necessary for day to day life. Mescaline, Huxley argues, opens the “doors of perception” in the mind and allows the drug taker to observe the world in a new and more complete way. Huxley compares this new way of seeing the world with the experience of religious mystics and revolutionary artists. His essay presents a positive interpretation of the psychedelic experience, and a strong endorsement of mescaline. Through this endorsement Aldous Huxley came to be seen as an ally of the psychedelic movement in America.

When it was first published, Huxley’s essay was a great success in bookstores. In Huxley’s own words “the sales of the book [were] excellent, I should say, for an essay.” Despite the good sales the essay received mixed reviews in the literary press. Because Huxley presented mescaline as a chemical shortcut to mystical experience, those who considered themselves serious mystics denounced the work as phony and cheap. Others, like novelist Thomas Mann, criticized the work as irresponsible because of its endorsement of drug use. In a letter to Ida Herz, Thomas Mann said of the book, “It is . . . a completely – I do not want to say immoral, but must say irresponsible book.” He claimed, “Now, given the eloquent endorsement of this famous writer, many young Englishmen and especially Americans will try the experiment.”

In some ways, a mass youth experiment is precisely what happened. Although Huxley’s essay was popular when it was originally published, its popularity peaked ten years later at the height of the psychedelic movement in America. At that time thousands of young people across the country were using psychedelic drugs. Huxley was seen as an intellectual forefather of the movement, an ally among the establishment who could help interpret the psychedelic experience. How did a 60-year-old Aldous Huxley, a sober, upright, British intellectual, become associated with the counter culture youth movement of the 1960’s? Did Huxley really influence the movement as much as he is credited? Would Huxley and the hippies really have been such compatible allies? Unfortunately, Huxley passed away in 1963, before the psychedelic movement really became popular in America, and never commented on
the final form of the movement that he is said to have so greatly influenced. However, historians have argued that Huxley may not have been as accepting of the movement as his reputation suggests.

Following his first psychedelic experience with mescaline in 1954 Huxley became more and more involved in the drug scene. From 1954 until his death in 1963 Huxley experimented with mescaline, morning glory seeds, LSD, psilocybin to induce psychedelic experience. He also attended conferences, wrote articles and letters, and gave lectures about psychedelic drugs. During these ten years Huxley was a central figure in the world of psychedelic research.

Huxley also had a monumental role in defining how the psychedelic experience was interpreted. Huxley entered the drug scene at a time when the only people experimenting with psychedelics were psychologists, doing research into the effects of the drugs on the mentally ill. Huxley was the first to undertake a literary, aesthetic, and humanistic study of psychedelics. When Huxley entered the psychedelic scene the prevailing theory was that psychedelic drugs were "psycho-mimetic", that is, they imitated the effects of individuals with psychiatric disorders like schizophrenia. This theory was based on the similarity between the reported effects of psychedelics and the known symptoms of schizophrenia. To those who endorsed the psycho-mimetic theory of psychedelics, Huxley's notion that drugs could be used to expand a person's understanding of reality was absurd. However, it is because of Huxley's unique take on the psychedelic experience that he was so influential. Had it not been for Huxley's psychedelic philosophies, the psychedelic revolution might never have come about and the use of drugs like LSD might have remained strictly experimental.

During his ten years of psychedelic research, Huxley met and ingratiated himself with nearly every pharmaceutical. During his ten years of psychedelic research, Huxley met and ingratiated himself with nearly every pharmaceutical. Huxley entered the psychedelic scene at a time when the use of drugs like LSD might have remained strictly experimental. Psychiatric test. This approach became central in the movement and was used by Leary to portray Huxley's thought to the masses following his death.

Leary's research eventually brought him into contact with Huxley in the fall of 1960. In his essay "Mushrooms for Lunch" Leary tells about his meeting with Huxley and their discussion of psychedelics and how they should be used. According to Leary, the two laid down a list of "do's and don'ts" for Leary's psychedelic experiments. Primary among Huxley's warnings to Leary was against a "scientific" approach to psychedelics. Huxley felt that research into psychedelics should be done humanistically, without the systematic and sterile procedure of a normal psychiatric test. This approach became central in the movement and was used by Leary to portray Huxley's thought to the masses following his death.

From this time onward Timothy Leary was seen as the unofficial spokesman for the psychedelic movement. Using slogans like "Turn on, Tune in, Drop out" and the constant media attention surrounding him, Leary brought psychedelics, and Huxley's theories, to the masses. So, although Huxley was only involved in the early portions of the psychedelic movement, his influence was carried through the height of the movement, and many of his philosophies were present, sometimes in distorted form, in the "hippie" way of seeing the world. Huxley became an icon of sorts to the psychedelic movement. Jim Morrison's band The Doors got its name from the title of Huxley's book, The Doors of Perception, which included a short essay on the effects of mescaline, a drug that Leary and other psychedelic advocates were interested in using. Huxley also popularized the use of The Tibetan Book of the Dead as a guide to be used during an acid trip, and together with Richard Alpert and Ralf Metzner updated the book for the acid user.

From this time onward Timothy Leary was seen as the unofficial spokesman for the psychedelic movement. Using slogans like "Turn on, Tune in, Drop out" and the constant media attention surrounding him, Leary brought psychedelics, and Huxley's theories, to the masses. So, although Huxley was only involved in the early portions of the psychedelic movement, his influence was carried through the height of the movement, and many of his philosophies were present, sometimes in distorted form, in the "hippie" way of seeing the world. Huxley became an icon of sorts to the psychedelic movement. Jim Morrison's band The Doors got its name from the title of Huxley's book, The Doors of Perception, which included a short essay on the effects of mescaline, a drug that Leary and other psychedelic advocates were interested in using. Huxley also popularized the use of The Tibetan Book of the Dead as a guide to be used during an acid trip, and together with Richard Alpert and Ralf Metzner updated the book for the acid user.

Leary also embraced the psychedelic philosophies expounded in Huxley's other works, particularly Island, Huxley's final novel. In Island Huxley presents an answer to the dystopia of Brave New World. He tells the story of a society on an island where the inhabitants use Moksha, a hallucinogenic drug similar to LSD, to achieve mystical understanding and harmony. In Island Huxley combined all of his philosophies and experiences into one book; he saw it as the culmination of his literary career.

Island met with mixed criticism in the press. Those in favor of the novel said it succeeded in presenting both a story and a strong intellectual message. Others claimed it was too preachy and didactic. One reviewer, Frank Kermode of the Partisan Review, said of Island, "Reviewers ought to watch their superlatives, but Island, it is reasonable to say, must be one of the worst novels ever written."

Timothy Leary, however, liked the philosophies in Island so much that he established a commune based on Huxley's principles. In the spring of 1963 Leary was kicked out of Harvard, but wanted to continue his research into the psychedelic experience, so he and his colleagues founded a non-profit organization, the International Federation for Internal Freedom (IFIF), dedicated to the notion that the psychedelic experience should be available for everyone. In the summer of 1963, three months before Huxley's death, the group moved its headquarters to a hotel in Zihuatanejo, Mexico. The group founded a commune called The Brotherhood of the Wild Flower, which was later to become a key leader in the psychedelic movement. The group was invited to join the commune, but he declined because of illness and the media attention surrounding the endeavor. The commune stayed open for only six weeks, but not for lack of popularity. Leary and his colleagues received thousands of applications and hundreds were turned away. One of the commune members gave Leary and his group a bad reputation, and amid negative media coverage in Mexican newspapers and rumors of orgies, the group was kicked out of Mexico. Still, for a time Leary had attempted to live Huxley's psychedelic philosophy.

For those who participated in the later psychedelic movement saw themselves as heirs to Huxley's philosophies. They, like Leary, felt they were carrying out Huxley's dream of a world made better by psychedelic drugs. However, Huxley biographers and historians of the psychedelic movement have been quick to dismiss this idea. Instead, they argue that Huxley would have wholeheartedly denounced the later psychedelic movement. Biographers, like Sybille Bedford, and Nicholas Murray, offer quotes from Huxley's letters that express his dislike of media attention, his call for moderation in the use of psychedelics, and his belief that drugs should be used only by the elite. Historians of the psychedelic movement, like Martin A. Lee and Bruce Shlain, also maintain that Huxley would have disliked the psychedelic movement, and use this claim to support their position against the later psychedelic movement. However, these assumptions are based on an incomplete understanding of Huxley's life and letters. Huxley's letters and actions present evidence to suggest that Huxley would have been far more approving of the psychedelic movement. Early in his life Huxley was strongly against any drug use, despite his interest in drugs and their effects. In his 1931 Treatise on Drugs Huxley speaks strongly against the use of drugs. "Mushrooming drugs are treacherous and harmful . . . They kill first the soul, then, in a few years, the body." Huxley wrote disparagingly of drug use as late as 1952, just one year before his first mescaline experience, in the epilogue of his book psychedelic drugs. Huxley described drug use in
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Huxley himself was a promoter of mescaline. He was ecstatic about the good sales of “The Doors of Perception,” which meant that more than just intellectuals were reading his work. Also, in 1956, the same year he wrote about the “lunatic fringe,” while in New York for a drug conference Huxley scheduled at least seven radio and TV appearances. Perhaps his his opinion about drugs changed. Relying on quotes from this early period in Huxley’s life to collect evidence for his condemnation of the later psychedelic movement presents an incomplete image of his opinions. Many of the biographers also compare Huxley’s beliefs about the world, about human potential, about

Huxley’s actions seem to suggest that his opinion about the widespread use of psychedelics may have been more ambivalent than these historians have claimed. His close relationship with Al Hubbard, who played a major role in spreading LSD across America in the 1950’s, suggests he supported widespread use of psychedelics. Huxley was not only personally fond of Hubbard, he was also enthusiastic about Hubbard’s activities and the use of his influence to make psychedelics popular. In a 1955 letter to Humphry Osmond he wrote: “what extraordinary luck that [Hubbard] . . . should (a) have become so passionately interested in mescaline and (b) be such a very nice man.” It is doubtful that Huxley would have been so approving of Hubbard if he was ardently against the popular use of psychedelics.

Although Huxley would have disliked the culture of the later psychedelic movement, he shared the counter culture’s condemnation of mainstream consumerism. The utopia he describes in Island is free from the consumerism that marks modern suburban society. Huxley wrote in 1938, “Under the current dispensation the vast majority of individuals lose . . . all the capacity to be aware of other things than those enumerated in the Sears-Roebuck catalogue which constitutes the conventionally ‘real’ world.” This sentiment is not a far cry from the counter culture sentiment expressed during the hippie movement. Huxley perhaps disliked the society that hippies “dropped out” of as much as he would have disliked hippie society. Therefore, one can assume that although Huxley would have disapproved of the culture that hippies adopted, he would have agreed with their decision to flee from the consumer-driven culture of the establishment. Perhaps Huxley would not have been as absolutely critical of the late psychedelic movement as his biographers assume.

Huxley historians also claim that he would have reacted against the use of LSD by the general populace. According to them, Huxley thought that LSD and other psychedelic substances should be used only by the elite, and certainly he expressed sentiment to this effect. Also, Huxley’s criticism of publicity for psychedelic drugs seems to imply that he wished the drugs to remain a secret. In their book Acid Dreams, historians of the psychedelic movement Martin A. Lee and Bruce Shlain claim, “Huxley felt the best way . . . was to offer the [psychedelic] experience to the talented, the well-born, the intelligent rich, and others in positions of influence.” However, Huxley’s actions seem to suggest that his opinion about the widespread use of psychedelics may have been more ambivalent than these historians have claimed. His close relationship with Al Hubbard, who played a major role in spreading LSD across America in the 1950’s, suggests he supported widespread use of psychedelics. Huxley was not only personally fond of Hubbard, he was also enthusiastic about Hubbard’s activities and the use of his influence to make psychedelics popular. In a 1955 letter to Humphry Osmond he wrote: “what extraordinary luck that [Hubbard] . . . should (a) have become so passionately interested in mescaline and (b) be such a very nice man.” It is doubtful that Huxley would have been so approving of Hubbard if he was ardently against the popular use of psychedelics.

In the utopian society he depicts in Island, the drug Moksha is used by nearly everyone with very positive consequences. According to Huxley biographer Nicholas Murray, Island contains “all of [Huxley’s] beliefs about the world, about human potential, about the meaning and purpose of life.” Why would Huxley reject a utopian society where psychedelic use was widespread, if he thought that psychedelics should remain a secret from the masses?

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Huxley’s early life and personality would certainly be difficult to reconcile with the wild counter culture revolution of the 1960’s. Perhaps this is part of the reason for the biographers’ bias. Both Bedford and Murray cover Huxley’s entire life in their biographies, and Huxley only began to experiment with drugs in the final ten years of his life; Huxley’s opinions on drugs are certainly not the focus of their works.

Reactions against the drug movement probably also contributed to the particular interpretations of Huxley biographers. At one point in her biography Sybille Bedford mentions “the potential dangers physical, genetic, and social of these drugs [psychedelics].” It would have been difficult for Bedford to reconcile a belief in the immorality of drugs with Huxley’s strong approval of the psychedelic movement. Therefore, she concluded that Huxley would have been opposed to the excessive drug use of the 1960’s. Bedford even mentions in the author’s note of her biography that she “freely extracted, eliminated, juxtaposed, [and] conflated as best suited [her] immediate purpose.” So it comes as no surprise that some of the information about Huxley’s feelings is obscured in her biography.

Similar feelings among other biographers probably contributed to the assumption that Huxley would have completely disapproved of the 1960’s counter culture movement.

Interestingly, almost all other biographers of Huxley and historians of the psychedelic movement use Bedford’s biography as one of their sources. Murray extends a special thanks to Bedford in the first sentence of his acknowledgements and Horowitz and Palmer, editors of Moksha adopt a special abbreviation sentence of his acknowledgements and Horowitz and Palmer, editors of Moksha adopt a special abbreviation.
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Effects of Neonatal Neurotoxic Lesions of the Amygdala in Infant and Adult Rhesus Monkeys on Stimulus-Reward Association Learning

Umangi Patel

Abstract

Previous studies in adult monkeys indicate that the amygdala (AMYG) is crucial for stimulus-reward learning since AMYG lesions, using aspiration or radiofrequency techniques, yield significant deficits (Jones & Mishkin, 1972; Aggleton & Passingham, 1981). To investigate whether the deficit observed was due to specific damage to the AMYG or to extramammillary areas which are also damaged by this type of lesion, we tested the effects of neurotoxic AMYG lesions, which spare fibers passing through the amygdala and adjacent cortical areas on stimulus-reward learning in monkeys (Macaque mulatta). The data indicated that selective AMYG lesion spared stimulus-reward learning; thus the brain regions most critical for this type of learning are the cortical areas on the parahippocampal gyrus. Second, we followed the maturation of stimulus-reward learning in monkeys and assessed the effects of neonatal neurotoxic AMYG lesions on object discrimination learning and reversal. Monkeys that had received neurotoxic amygdala lesions (Group AMYG) at 10-12 days of age and age-matched sham operated monkeys (Group SHAM) were trained in an object discrimination reversal (ODR) task at 3 months (N=6 in each group) and 3 years (N=2 in each group). We predict that (1) significant improvement in the task with age would suggest that the neural substrate for stimulus-reward learning has a progressive postnatal maturation and (2) equal performance in Groups AMYG and SHAM at both 3 months and 3 years of age would suggest that, as for the adult animals, the amygdala is not a critical substrate to support stimulus-reward learning in either infancy or adulthood.

Introduction

Presently, very little research has been done in the investigation of the neural mechanisms involved in the development of the ability to learn stimulus-reward associations in primates. Nonetheless, previous studies involving electrophysiology in monkeys and functional magnetic resonance imaging (fMRI) in humans indicate that the amygdala is crucial for stimulus-reward learning (Arana, Parkinson, Hinton, Holland, & Roberts, 2003). Furthermore, lesions of the temporal pole, including the amygdala, using aspiration or radiofrequency techniques resulted in significant deficits in stimulus-reward associations learning (Jones & Mishkin, 1972). It is still not clear whether the deficits observed after amygdala lesions were due to damage to the amygdala or to fibers passing through and around the amygdala, since these fibers are destroyed by such non-specific lesion techniques (Baxter & Murray, 2000). With the recent development of magnetic resonance imaging (MRI)-guided stereotactic approaches combined with injections of neurotoxins (i.e. ibotenic acid), however, selective lesions that destroy the cells but spare a great majority of the fibers of passage in the amygdaloid nuclei have been able to be conducted. Such techniques have been used in the present experiment.

In order to investigate the effects of neurotoxic lesions of the amygdala on rhesus monkeys in the development of stimulus-reward learning, a specialized task designed to measure this associative learning was conducted. The Object Discrimination Reversal (ODR) task is a sensitive measure of stimulus-reward associative learning because it requires subjects to continuously form and break stimulus-reward association through acquisition and reversal trials. The ODR task is thus a perfect task to facilitate (1) the understanding of the maturation of stimulus-reward learning in rhesus monkeys and (2) the assessment of the effects of neonatal neurotoxic amygdala lesions in this learning ability. In addition, due to the notable neurobiological and behavioral similarities in non-human primates, rhesus macaques are the animal model of choice for understanding brain systems in humans (Machado & Bachevalier, 2003). By the second month of gestation, neurogenesis has ceased in the primate amygdala and by birth, most of its afferent and efferent connections are established (Machado & Bachevalier, 2003). Thus, we hypothesized that if learning stimulus-reward association depends on the amygdala, adult-facility on the ODR task will be present at an early age and should not improve with age. In addition, performance of amygdalectomized monkeys (Group AMYG) on the ODR will be significantly impaired as compared to control monkeys (Group SHAM) at both three months and three years of age.

Materials and Methods

Subjects

A total of twelve experimentally naïve monkeys (Macaque mulatta) of both sexes were used. They were housed individually in rooms with automatically regulated lighting (12 hr light/dark cycle; lights on at 7:00 A.M.). All subjects were fed a controlled diet (monkey chow supplemented with fresh fruits) to ensure a healthy body weight and ample motivation to respond in the testing apparatus but water was always available. Six of the twelve subjects were assigned to the experimental group (Group AMYG) and received neonatal neurotoxic lesions of the amygdaloid complex. The remaining six subjects were assigned to the control group (Group SHAM). All subjects were tested at 3 months of age, but only two subjects of each group were tested at three years of age, since they are the only 4 subjects that have reached this age at the current time. The study was approved by the Institutional Animal Care and Use Committees of the University of Texas Health Science Center at Houston and Emory University.

Surgical procedures

All subjects received surgical brain procedures between 8-12 days of age. All surgeries were performed under deep anesthesia and using aseptic procedures. Heart rate, respiration rate, blood pressure, body temperature and expired CO2 were monitored throughout surgery. For the six subjects in Group AMYG, surgical MRI-guided stereotactic procedures were used to inject the neurotoxin ibotenic acid in 7-9 sites per amygdala (total of 3.4-6µl, 10 mg/ml in PBS, pH 4.0, rate of 0.2 µl/30 secs). The six subjects in Group SHAM received sham surgeries consisting of opening of the skull and dura, but no injection or aspirations of neural tissue were performed. All monkeys received pre- and postoperative treatment consisting of dexamethasone sodium phosphate (0.4 mg/kg, i.m.) and cefazolin (25 mg/kg, i.m.) 1 day before surgery and for 1 week after surgery to reduce swelling and to prevent infection, respectively. They also received acetaminophen for days after surgery for relief of pain.

Lesion Verification

The extent of ibotenic acid lesions (Figure 1) was assessed using MRI in a GE sigma 1.5 Tesla Echo Speed scanner (GE Medical Systems, Milwaukee, WI) using both Fluid Attenuated Inversion Recovery (FLAIR) and 3D T1-weighted fast spoiled gradient-echo sequence FSPGR scans performed seven to ten days after surgery. Extent of hypersignals on FLAIR images (indicative of brain edema, due to cell death) were calculated for each lesion site, according to procedures previously described by Nemanic et al. (2002).


Behavioral Apparatus

The ODR task was performed in a modified Wisconsin General Testing Apparatus (WGTA) located in a darkened, sound-shielded room. The test compartment was illuminated, whereas the test room and monkey's compartment were always unlit. The test tray contained two food wells, center to center, on the midline of the tray. For discrimination and reversal learning, the same two objects were utilized.

Experimental Procedure

The experiments began when subjects reached three months of age and consisted of three consecutive phases: 1) Pre-training phase. Each subject was first given sufficient shaping, so that it will consistently displace an object over any food-well to retrieve rewards (positive objects). These objects were not re-used in the other phases; 2) Acquisition phase: each subject learned to discriminate between two objects, and 3) Reversal phase: each subject had to inhibit a learned response and chose another response. In the acquisition phase, the two objects were presented simultaneously over the two wells. One object concealed a reward and the other not. The two objects were presented for 30 trials a day, 5 days a week, until the following criterion were met: a score of at least 28 correct trials out of 30 (80%) on the next consecutive day.

Reversal Phase

On the day following attainment of criterion, the positive and negative reward contingencies were reversed. The same procedure used in acquisition was implemented in this task until the criterion were attained again. Each subject was presented with a total of six reversals following the initial discrimination.

Predictions

Because the amygdala is not the critical substrate of stimulus-reward learning in the adult monkeys and because earlier studies have indicated that “the cytological constituents of the amygdala are in place at birth in monkeys,” it is reasonable to predict that “a progressive postnatal development of stimulus-reward learning abilities will suggest that other neural substrates apart from the amygdala play a more significant role in stimulus-reward learning” (Kling, 1996). Existing evidence claims that, despite the amygdala's ontogenetic maturation, “the connectional system of the amygdala with other brain areas, and more specifically the adjacent temporal cortical areas, appears to continue maturing postnatally in monkeys (Webster et al., 1991).” Thus, these cortical areas may be the limiting factor for the protracted maturation of stimulus-reward association learning. This conclusion is supported by data indicating that damage to these cortical areas in adult monkeys yield a profound impairment in stimulus-reward learning (Baxter and Murray, 2000). Further investigations will be necessary to investigate this possibility.

Due to almost complete neurogenesis of the primate amygdala at birth, we also hypothesized that the performance of Group AMYG would not differ from that of Group SHAM at birth. However, because the amygdala (Easton & Gaffan, 2000). These results would indicate that: (1) the amygdala’s involvement in learning is much more selective than previously thought, (2) stimulus–reward learning involves multiple neural systems and is a complicated process, and (3) neural structures other than the amygdala can mediate this type of learning (Baxter & Murray, 2002).

Acknowledgements

I would like to thank the Center for Behavioral Neuroscience for providing funding and support for this project and for offering advice on graduate school, training in working with rhesus monkeys, eye-tracking data analysis, as well as, neurological insight throughout this whole experience.

Umangi Patel is an Emory College Senior majoring in biomedical engineering and primate psychology. She is now working with Professor Bachevalier and Goursand on a project exploring the conclusions reached in this study.

Several control measures were undertaken to ensure that this experiment remained balanced and consistent. First, the testing order of the subjects and food types remained consistent throughout this study. Second, to ensure that subjects are motivated to perform this task at a high level of accuracy, food intake was restricted. In the interest of each subject’s well-being, weekly weights were taken, and no animal was deprived to the extent that their testing weight dropped below 85% of their initial weight. Third, an effort to control for any effects of circadian rhythm on the subject’s motivation, all testing was completed between 1200 and 1400 hours.

Acquisition phase

After a subject was placed in the WGTA, a food reward (or treat, such as a peanut) was placed in both lateral wells, and two different objects were placed, one covering each well. The subject was allowed to choose and displace an object to retrieve the reward (Figure 2); thus, this determined the subject’s preference for the two objects and this preferred object was selected as the positive one for the acquisition phase. Next, for each trial, the positive object was placed randomly in one of the lateral well and the subject choice was recorded. In case of incorrect choice, the negative object was replaced on the well and the two objects were represented for choice. The correction trial was continued. This procedure was repeated for 30 trials, five days a week, until the following criterion were met: A score of at least 28 correct trials out of 30 on one day (better than 90%) followed by a score of at least 24 correct trials out of 30 (80%) on the next consecutive day.

Figure 2: The subject undergoing a trial in the ODR task. In this particular example, the positive object is the cube and the negative object is the cone (from Baxter and Murray, 2002).

Experimental Apparatus

The experimental apparatus used was the Wisconsin General Testing Apparatus (WGTA) located in a darkened, sound-shielded room. The test compartment was illuminated, whereas the test room and monkey’s compartment were always unlit. The test tray contained two food wells, center to center, on the midline of the tray. For discrimination and reversal learning, the same two objects were utilized.

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Due to almost complete neurogenesis of the primate amygdala at birth, we also hypothesized that the performance of Group AMYG would not differ from that of Group SHAM at both three months and three years of age. If the performance of Group AMYG does not differ from that of Group SHAM at both 3 months and 3 years of age, then this suggests that the amygdala is not a critical substrate to support stimulus-reward learning in both infancy and adulthood. This provides additional support that the impairment in stimulus-reward learning after amygdala lesions through aspiration or radiofrequency may have relied on structures that send their projections through the amygdala (Easton & Gaffan, 2000). These results would indicate that: (1) the amygdala’s involvement in learning is much more selective than previously thought, (2) stimulus–reward learning involves multiple neural systems and is a complicated process, and (3) neural structures other than the amygdala can mediate this type of learning (Baxter & Murray, 2002).

Completion of this longitudinal study will provide important findings on the development of stimulus-reward learning in non-human primates and the implication of the amygdala in this cognitive process. Animal models of brain developmental disorders, such as the one presented in this paper may have much to contribute to the study of neurological disorders in humans and “behavioral lesion experiments provide an opportunity to discover how brain and behavior reorganize the following insults at different points during development” (Machado & Bachevalier, 2003).
References


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Rubens in Context: The Council of Trent and its Eucharistic Doctrine Present in Peter Paul Rubens’ Antwerp Altarpieces

Alexia Rostow

Abstract
The Council of Trent, which had solidified the stance of the Catholic Church on liturgical and artistic matters, had ended only 44 years earlier and its effects were still being acutely felt throughout Europe. Especially in the art world, artists were feeling the pressure to conform to the Council’s views of what art should be like. It was in the midst of all this that Peter Paul Rubens painted probably his most famous altarpieces of The Raising of the Cross and The Descent from the Cross, both of which now hang in the Cathedral of Our Lady of Antwerp. The importance of the Council of Trent and its decisions is underscored through an analysis of Rubens’ altarpieces. This paper attempts to place these two paintings in their proper historical context and to analyze them from a new standpoint.

Introduction
Peter Paul Rubens returned to his hometown of Antwerp in 1608 after studying painting in Italy for a number of years. Upon his return, he was showered with commissions for paintings, including his two most famous altarpieces, The Raising of the Cross [Fig. 1] and The Descent from the Cross [Fig. 3]. These two paintings depict, respectively, the elevation of the cross at Christ’s crucifixion and the removal of Christ’s body after his death. For the most part, these altarpieces have been analyzed in terms of Rubens’ life and his personal changes as an artist. These aspects are certainly important to the understanding of the paintings, but it is also necessary to look beyond the artist and to address the larger context in which these altarpieces were painted.

The Council of Trent, which met on and off for 19 years between 1545 and 1564, was a meeting of church officials to discuss and settle matters of Church doctrine and practice. It is considered to be one of the most important councils in the history of the Catholic Church. One of the main topics of discussion was the celebration of the Catholic Mass. In the early 1600s when Rubens was commissioned to create these two large altarpieces, the issues that had been discussed at Trent were still impacting the way certain artistic scenes could be depicted. With this idea in mind, I would like to suggest that the Council’s decisions concerning the Mass are the main themes illustrated in Rubens two altarpieces.

The Raising Of The Cross

Let me start with a discussion of Ruben’s Raising of the Cross. It may at first seem obvious that an altarpiece designed for an high altar would have a theme that relates to the Eucharist and the ritual of the Mass; after all, an altarpiece generally hangs above the altar at which the rite of the Mass is performed. However, when one looks at Ruben’s Raising of the Cross, it may not be entirely obvious how it makes this connection. The painting looks at first glance simply to be a depiction of a scene from the Passion cycle. But on closer observation one can see many aspects of the image that are not typical for scenes such as this. Through these devices, taken together, the image becomes not only the Raising of the Cross but also a representation of the actions of the priest and his parishioners during the celebration of the Mass.

Another title for Rubens’ triptych is The Elevation of the Cross. This word choice may be closer to the truth than Raising of the Cross. This is because the scene of raising Christ’s body is analogous to the moment in the liturgy of the Mass called the Elevation. This is the crucial moment of the Mass, after the Consecration of the Host, in which the Priest raises it high above the altar, to be seen and venerated by the congregation. In other words, Rubens has played off the concept of the Elevation of the Host by linking it with the physical elevation of the cross by Christ’s executioners. This certainly gives a clear indication of the rationale behind the choice of scene.

FIGURE 1: THE RAISING OF THE CROSS

Peter Paul Rubens, The Raising of the Cross- open, The Cathedral of Antwerp, 1610

The main bulk of the imagery within this painting that connects to the Eucharist in the Mass is found in the body of Christ himself. The position of the body, its implied weight, and those surrounding him all connect to various aspects of the Mass. It is commonly acknowledged in the scholarship on this painting that the body of Christ is meant to symbolize the consecrated Host in the Mass. The color of Christ’s body, which is the whitest area in the central panel (if not in the whole image), represents the bread of the Eucharist, which becomes the body of Christ when consecrated. This sacramental mystery, called transubstantiation, was a primary concern of the Council of Trent, which emphasized its centrality to the celebration of the Mass. This is important in understanding Rubens’ altarpieces.

Rubens also reminds the viewer, through visual means, of the reasons behind the celebration of the Mass. Christ carried the sins of the world with him, and he died to save those sinners. Pictorially, it was traditional to show Christ as an heavily burdened figure. In The Raising of the Cross, the executioners are exerting all of their strength to raise the crucified Christ. They push and pull together to maneuver the base of the cross into a hole already dug for it. This action reminds the viewer of what Christ’s sacrifice truly entailed. By placing seven figures in the central panel all straining under the weight of this enormous cross, Rubens is reminding the viewer not only of the weight of Christ, but also that through the Eucharist, our burdensome sins will be forgiven because of the sacrifice that was made by Christ at the crucifixion.

FIGURE 3: INTERIOR OF ST. WALBURGA

Anton Ghering, Interior of St. Walburga at Antwerp (Detail), Antwerp, Church of St. Paul, 1661
The positioning of the altarpiece itself within the church also reminds the viewer of the continued sacrifice. As one sees in Anton Gheiring’s painting of *The Interior of St. Walburga*, the high altar of the church was on a tall and steeply raised platform. [Fig. 3] Nineteen steps led up to the platform on which the high altar sat. The steep elevation of the altar created a virtual Mount Golgotha that the eye must follow up to reach the image of Christ, who in turn is being raised even farther up onto space. This, therefore, makes a tangible connection between the event that occurred at Mount Golgotha and the reenactment of Christ’s sacrifice in the Mass. The sacrifice was, of course, the basis of the Mass itself. Just as God sacrificed his Son for the sake of man’s salvation, so the sacrifice of the Mass was an offering to God as a thanksgiving for the first and last sacrifice of Christ’s martyrdom.

So far, I have only discussed the central panel of the *Raising* triptych. The side panels of the triptych are unusual to the time and greatly inform the overall theme of the painting. [Fig. 4] During one of its sessions, the Council of Trent declared that only those Christians who have performed the sacrament of penance (which cannot be done without first confessing all of one’s sins) may receive the Eucharist. Pictorially, the figures standing to Christ’s right are worthy of experiencing the pleasures of heaven whereas those who are not are relegated to the left side. The men on the right panel show no signs of penitence or any desire to eradicate their sins. This idea is underscored by the fact that these figures appear to the left of Christ’s body.

The **Descent from the Cross**

The second altarpiece that I am going to discuss is Rubens’ *Descent from the Cross*. [Fig. 5] Rubens was commissioned to paint this altarpiece by the Guild of Harquebusiers of Antwerp in 1611. The *Descent from the Cross* is a common iconographic scene for the time, but Rubens has depicted the traditional scene of the Deposition with scenes not normally associated with it. In doing this, Rubens is visually declaring the Virgin’s role in the scene is stressed and her intercession on behalf of man is emphasized. Thus, one can see references to the Mass and the Council’s decrees throughout this altarpiece.

The Antwerp Guild had agreed with the Guild of Harquebusiers that Rubens could paint St. Christopher and had to argue with the Guild to let him paint the current scene. However, it is said that Rubens did not want to paint St. Christopher and had to argue with the Guild to let him paint the current scene. It was only after Rubens agreed to paint Christopher on the exterior of the wings that the Guild agreed. The reason for Rubens’ hesitation, it has been suggested, was because of the decrees of the Council of Trent. The Council agreed that “subjects taken from the Gospels would have been preferred, for the decoration of altars, to those taken from the Lives of Saints.” While the theme of the “Christ-bearers” may be the most obvious theme for the altarpiece, it must not be forgotten that this is an altarpiece. There are explicit allusions to the Eucharist and the celebration of the Mass.

The exterior depicts the story of St. Christopher carrying Christ across a river. [Fig. 6] Rubens realized that the Latin name “Christorphorus” meant “Christ-bearing.” As a result, Rubens played with the idea of Christ-bearers throughout Christ’s life. In the left panel of the triptych, Rubens painted the *Visitation*. In the scene, the Virgin is carrying Christ in her womb before he is born. In the right panel Rubens depicted the *Presentation in the Temple* in which Simeon carries the infant Christ. Finally, in the central scene, Christ is being borne down from the cross into the arms of his friends and family.

Just as in *The Raising of the Cross*, Rubens has painted the body of Christ as the brightest object in the scene. [Fig. 7] In *The Descent from the Cross*, however, the shroud in which the figures are wrapping his body emphasizes its whiteness. It is therefore easy to compare the white skin of Christ to the whiteness of the Host. His Body is therefore the central idea, just as the body itself is the centrally present in the Eucharist because of Transubstantiation.

![FIGURE 5: THE DESCENT FROM THE CROSS](image-url)

![FIGURE 6: EXTERIOR OF DESCENT](image-url)

![FIGURE 7: CENTRAL PANEL OF DESCENT](image-url)
style (as we saw in Raising) in favor of more subtle action and symbolic references. The most obvious of these symbols appears in the lower right corner of the central panel. One sees a copper dish containing the arma Christi, or the instruments of Christ's torture. [Fig. 8] The dish contains Christ's blood, the nails from the Cross and the Crown of Thorns. Just to the left one sees the words that were nailed to the Cross along with the sponge. Most obviously, the blood in the dish is meant to make the viewer think of the wine of the Eucharist, in which Christ is truly present after consecration. In addition, the copper dish reminds one of the patron, the shallow dish on which the Host is placed during the Mass after it has been consecrated. Because the Council of Trent decreed that Christ is bodily present in both the bread and the wine at the same time, the blood becomes a reference to Christ's body, which may be placed on the paten during the Mass.27

The wings, too, refer to the salvation of humankind through the sacrament of the Eucharist. The Visitation appears on the left wing of the triptych. With reference to the St. Christopher theme, this scene simply shows the Virgin as a bearer of Christ. On the left panel, Simeon acts in the capacity of a priest, receiving Christ from the Virgin. On the left panel the peacock acts as a reminder of the Church's power to offer the Eucharist. Here, Simeon acts as the priest who carries out the Mass, thus mediating between the congregation and God.28

In addition, both panels depict a sort of "elevation" of Christ.29 The Virgin appears on a raised platform and Simeon raises the Infant Christ in his arms. A reference to the Elevation of the Host after it has been consecrated, this pictorial symbolism again reminds the viewer of the importance of Christ in the salvation of man through the taking of communion.

It is known that Rubens was a devout Catholic. He went to Mass every morning before going to work.30 It was therefore probable that he was fully aware of the changes in religious practices brought about by the Council of Trent. These two altarpieces show how Rubens adapted his art to the new decrees. This concern for the decrees was not limited to the paintings themselves. During the Council of Trent, the medium of engraving was recognized as an "instrument didactique de transmission des dogmes catholiques."31 So, in 1620, Rubens had the Descent from the Cross copied by Lucas Vorsterman.32 Rubens' motivation for producing these prints was twofold. First he wanted to establish the altarpieces as his "invention." Second, he wished to propagate his own religion's current views, expressed in his altarpieces, through engravings that would be seen in many far off countries.

Rubens was greatly influenced by the Council of Trent. The current thinking about the Council is that it limited the artistic community rather then broadened it. However, an examination of Rubens' two Antwerp altarpieces reveals that the Council's decrees informed his readings of the Gospel scenes in terms of the Mass and so created richer and more interesting compositions.

Acknowledgments

I would like to thank Walter Melion for all his help and guidance throughout the process of writing this paper.

Notes

1 The wings, too, refer to the salvation of humankind through the sacrament of the Eucharist. The Visitation appears on the left wing of the triptych. With reference to the St. Christopher theme, this scene simply shows the Virgin as a bearer of Christ. However, the Bible does not describe Simeon as a priest, Rubens has depicted him wearing "priestly vestments."29 And in this panel, Simeon acts in the capacity of a priest, receiving Christ from the Virgin. On the left panel the peacock acts as a reminder of the Church's power to offer the Eucharist. Here, Simeon acts as the priest who carries out the Mass, thus mediating between the congregation and God.

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4 Cynthia Lawrence's article "Before The Raising of the Cross: The Origins of Rubens's Earliest Antwerp Altarpieces," The Art Bulletin, vol. 81, no. 2 (Jun. 1999), 267-296 is one of the few authors I have come across who suggests that the broader context had more than a fleeting impact on these paintings.


6 In fact, the design for The Raising of the Cross was not a new one. It is said that Rubens took the idea for his painting from Tintoretto's Crucifixion in the Church of Scuola San Rocco in Venice. See Martin, 99.

7 These English titles often differ based upon the language from which the original text was translated.

8 Cynthia Lawrence, 282.

9 One such author is Roger d'Hulst. See Roger d'Hulst, L'Erection de la Croix: Pierre Paul Rubens, (Die Keuze Brugge, 1992), 90.


11 Martin, 40. See also Lawrence, 269.

12 Martin, 114.

13 This same connection is mentioned by Lawrence, 278.


16 Schroeder, 77.
Author Nicole Verhaegen wrote that the Deposition was represented on altarpieces "because these subjects were intended to present to the devotion of the faithful the body of Christ, the Corpus Christi, in connection with the cult of the Eucharist, a cult which moreover originated in the Lowlands in the thirteenth century." See Martin, 66.

For a more detailed discussion of the significance of the shroud, see Hans Gerhard's article in Martin, 120-121.

The quote from The Canons and Decrees of the Council of Trent goes as follows: "immediately after the consecration of the true body and the true blood of our Lord, together with His soul and divinity exist under the form of bread and wine, the body under the form of bread and the blood under the form of wine ex vi verborum; but the same body also under the form of wine and the same blood under the form of bread and the soul under both... Wherefore, it is very true that as much is contained under either form as under both." (Schroeder, 75)

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