



WICHITA STATE UNIVERSITY

The Metropolitan Advantage

Journal of Research Reports McNair Scholars Program Wichita State University

Volume 1

Summer 1996



Editor

Holly Liles

Professional Staff Members

Larry A. Ramos, Director

LaWanda Holt-Fields, Program Counselor

Linda Lindsly, Secretary

Holly Liles, Graduate Assistant

Support Staff Members

Jodi Drinkwater

M. Ziaul Hasan

Rosa Palacio

Malaika Reed

The Journal of Research Reports is produced and published annually by the Wichita State University McNair Scholars Program to further the objectives of the program. The mission of the McNair Scholars Program is to encourage students who are underrepresented in higher education to pursue a postbaccalaureate degree. The program focuses on African American, Hispanic, and Native American students. The program concentrates on providing services to ensure that participants graduate with a bachelors degree from Wichita State University and improve their chances to enter postbaccalaureate study.

Research reports are accepted from students participating in the WSU McNair Scholars Program. Reproduction of material in this publication is hereby authorized. No responsibility for the views expressed by the authors in this document are assumed by the editors, professional staff, or the McNair Scholars Program at Wichita State University.

The McNair Scholars Program at Wichita State University is supported by funds from the United States Department of Education under the Ronald E. McNair Postbaccalaureate Achievement Program.



The Journal of Research Reports, Summer 1996, Vol. 1, is published annually by the Wichita State University McNair Scholars Program, 1845 Fairmount, Wichita, KS 67260-0199.

**Journal of Research Reports
McNair Scholars Program
Wichita State University**

Volume 1

Summer 1996

Contents

Facing the Challenge: Approaches to Addressing Cultural Diversity in Higher Education <i>Shukura Bakari-Issa</i>	3
Content Analysis of the Burial 9 Seed Jar: Ewing Site, Yellow Jacket, Colorado <i>Bradley W. Cole</i>	11
The Role of Religion in the Novel and Movie <u>The Color Purple</u> <i>Jodi A. Drinkwater</i>	39
My Experience with SPSSX and the McNair Program <i>Sara Fisher</i>	49
Ergonomic Evaluation of a Computer Console on a UH60 Helicopter <i>Dishayne T. Garcia</i>	53
Ergonomic Evaluation of an Office Workstation <i>Dishayne T. Garcia</i>	65
Use of Non-Elliptic Lift Distribution to Reduce Life Cycle Cost of a Business Jet <i>Chau Huynh</i>	73
A Cross-Cultural Perspective of Parenting Stress by Mothers with Young Chronically Ill Children <i>Janice E. McCoy</i>	91
The Native American Graves Protection and Repatriation Act Affiliation Study <i>Marcus Monenerkit</i>	105
Urban Renewal and Impact on 1st National Black Historical Society Area <i>Michael Munoz</i>	109
Testing the Validity of an Epistemological Questionnaire <i>Julie Rhoads</i>	111
The Research Process <i>Charolette Loraine Simmons</i>	121
Possible Reaction Pathways to a Symmetrical Spheroid of Zinc Oxide <i>Tony V. Smith</i>	125
Valued Contributions Suggested for Financially Unprepared Adolescent Minority Fathers <i>Vanessa Souriya</i>	153
Transformations: Women and Recovery, Women Changing Research <i>Christine Taylor</i>	157
Using Portfolios in Teacher Education <i>Jessica Tinsmon</i>	161

Facing the Challenge: Approaches to Addressing Cultural Diversity in Higher Education

Shukura Bakari-Issa, McNair Scholar
Dr. Daisy Akiiki Kabagarama, Faculty Scholar

Abstract

With the increasing demographic changes in higher education, administrators need to allow room for change in their institutions. Cultural diversity programs are becoming more popular in colleges and universities nationwide. Data collected from 115 institutions of higher education, nationwide, show a culturally diverse group of students and staff. Findings also show that students participate in diversity programs more often than administrators and faculty. All four groups used in this study--students, staff, faculty and administrators-- most frequently utilized approaches to diversity programs such as discussions, lectures, dances and other cultural events.

Introduction

By the year 2050, the United States will be a "minority-majority" nation in which no one group of people will dominate numerically.¹ With these demographic changes, educators need to reshape their objectives in order to create an atmosphere and community that maintains integrity of difference.² Historically, higher education catered to the needs of those of non-minority backgrounds. As time moved on, and as the demographics changed, so did the opportunities for racial and ethnic minorities, as well as immigrants, in higher education. However, these increasing opportunities came with a price. The Eurocentric ideologies of education had to be grasped by these non-traditional students, many of whom found this important adjustment crucial to their success, let alone their livelihood. In the past, this Eurocentric focus in higher learning has been the center of the "American success." With changes in demographics, civil rights laws, and changes in the attitudes of society, administrators changed their focus from preparation and access of the 70s, to meeting recruitment requirements during the 80s, to sustaining and retaining those who do enroll.³ Administrators in higher education need to pay greater attention to the diverse groups of people that enter colleges and universities each year.⁴ In 1993, for example, college attendance rates for 18-24 year old students were 42.3% Caucasian, 28.3% African American, and 26.3% Hispanic. Between 1980-1990, immigration accounted for nearly 1/2 of the Hispanic, 3/4 of the Asian, and 1/6 of the African American college population. By the year 2005, nearly four out of ten youths under age 18 will be non-white.⁵

These changes are not limited to students alone. The makeup of instructors, administration and staff is also showing a trend toward diversity. According to the 1993 *Change* magazine, there was an increase in the newly hired minority faculty

between 1972 and 1989. However, the majority of these hires remained at the lower end of the academic ranks.⁶ Cheryl Farr wrote that once talented, diverse staff members are hired, retention should become a priority. She added, "In a multicultural environment, it is not enough to focus on similarities among individuals. There is a need for programs that will help staff treat citizens and fellow staff members with greater respect, and recognize that each person is a part of many groups and brings to every situation expectations based on his/her cultural experiences."⁷

Colleges and universities who serve populations of diverse people, who come from different kinds of backgrounds, who speak many different languages, and who have different ways of learning, need to rethink their objectives to better accommodate the "entire" campus community. In a culturally diverse nation, if some groups of people are left out of the mainstream society, they may develop feelings of alienation, inferiority, uselessness, and even hostility toward a particular group that is not their own. This alone affects productivity of the entire nation. In addition, those who have given up their own culture to "assimilate" into the mainstream culture run the risk of being alienated from both sides, (i.e. their own culture and the mainstream culture). Stereotypes, fears, suspicions, and ignorance also contribute to the anxieties of these outside groups.⁸

The Impact of Culture on Learning

Culture impacts and molds one's behavior, and how one views the world. Specifically, culture influences the environment in which people live, thereby affecting thought, perception, and learning. Systems of education differ from one culture to another. In an industrial society, for example, the role of education has been almost entirely handled by the schools and other formal institutions, whereas in non-industrial societies, education is the responsibility of parents and elders.

According to Kabagarama,⁸ another example of differences is in learning styles. She cites research which shows that African American children and youth who have been raised outside of the macro culture as having a learning style that tends to be more relational as opposed to the analytical style typical of the mainstream culture. Their creativity in music, dance, and religion closely resembles that of their ancestors in Africa even after centuries of living apart. This example illustrates the power of culture in molding behavior. It shapes patterns of thought and action that endure throughout generations. African Americans also tend to see the "whole picture" or respond to things in whole. They also tend to believe that anything can be subdivided into parts, and tend to prefer to be "accurate" in terms of space, numbers and time.⁹ Native Americans tend to approach learning from their natural environment. This custom is deeply rooted in their culture where nature is the center of their existence. They tend to approach tasks visually with careful observation before performance.¹⁰ As the adults teach the young learners these tasks, speech is minimal. This can present a major problem to a Native American student in a Eurocentric environment because the mainstream society relies heavily on abstract concepts, and class participation instead of observation.

Focus of Study

This study attempts to accomplish the following objectives:

1. Present demographic data in a select sample of institutions of higher learning.
2. Show which approaches are the most and least frequently used to administer cultural diversity programs.
3. Compare and contrast between cultural diversity programs for administration, faculty, staff, and students.

Methodology

A questionnaire was mailed out to a sample of colleges and universities nationwide, during the spring of 1995. Analysis is based on the information obtained from 115 institutions that responded to the questionnaire. Frequencies and summary statistics are employed to display the results.

Results

Demographic data is presented in Tables 1-3, while information about cultural diversity programs is presented in Tables 4-7.

Table I:

Percentage of students who are:

	<u>Category</u>	<u>Percentage</u>
1.	Caucasian	75.26
2.	African American	12.97
3.	Asian American	4.60
4.	Native American	1.22
5.	Hispanic American	7.27
6.	Foreign Born	4.60

Table II:

Percentage of staff who are:

	<u>Category</u>	<u>Percentage</u>
1.	African American	15.18
2.	Asian American	2.19
3.	Native American	.65
4.	Hispanic American	2.56
5.	Foreign Born	1.54

Table III:

Percentage of faculty who are:

	<u>Category</u>	<u>Percentage</u>
1.	African American	6.81
2.	Asian American	3.80
3.	Native American	.50
4.	Hispanic American	1.59
5.	Foreign Born	.41

Table IV:

Has your institution ever provided cultural diversity programs for the students?

1.	Yes	95
2.	No	17

If yes, how often have the following programs been provided?

1. Never 2. Once a year 3. Twice a year 4. More than twice a year

<u>Category</u>	<u>Scale (1 to 4)</u>
Cultural sensitive training workshops	2.20
Discussions	2.82
Lectures	2.70
Video presentations	2.30
Potluck dinners	1.91
Dances and other cultural events	2.61
Formal classes	2.27
Cultural drama skits	1.78

Table V:

Has your institution ever provided cultural diversity programs for the staff?

1.	Yes	79
2.	No	31

If yes, how often have the following programs been provided?

1. Never 2. Once a year 3. Twice a year 4. More than twice a year

<u>Category</u>	<u>Scale (1 to 4)</u>
Cultural sensitivity training workshops	1.81
Discussions	2.18
Lectures	1.99
Video presentations	1.80
Potluck dinners	1.44
Dances and other cultural events	1.92
Formal classes	1.50
Cultural drama skits	2.90

Table VI:

Has your institution ever provided cultural diversity programs for the faculty?

- 1. Yes 78
- 2. No 31

If yes, how often have the following programs been provided?

- 1. Never
- 2. Once a year
- 3. Twice a year
- 4. More than twice a year

<u>Category</u>	<u>Scale (1 to 4)</u>
Cultural sensitivity training workshops	1.90
Discussions	2.32
Lectures	2.10
Video presentations	1.63
Potluck dinners	1.50
Dances and other cultural events	1.90
Formal classes	1.50
Cultural drama skits	1.50

Table VII:

Has your institution ever provided cultural diversity program for the administrators?

- 1. Yes 80
- 2. No 32

If yes, how often have the following programs been provided?

- 1. Never
- 2. Once a year
- 3. Twice a year
- 4. More than twice a year

<u>Category</u>	<u>Scale (1 to 4)</u>
Cultural sensitive training workshops	1.82
Discussions	2.13
Lectures	1.97
Video presentations	1.84
Pot luck dinners	1.37
Dances and other cultural events	1.89
Formal classes	1.40
Cultural drama skits	1.40

Discussion:

The demographic data collected for this study indicate that colleges and universities, nationwide, are becoming more diverse especially for students and staff. Although we see an increase in traditional minority populations, in higher education this increase is among students and staff, as opposed to faculty and top administrators. For example, only 12.64% of top administrators, and 13.12% of faculty are from minority backgrounds whereas, about 25% of the student body is from a minority background.

When asked if there were cultural diversity programs on these campuses, the number of those who answered yes was 95 to 17 of no responses for students, 79 to 31 for staff, 78 to 31 for faculty, and 80 to 32 for administrators. These numbers indicate that approximately 30% of institutions nationwide do not have cultural diversity programs for their staff, faculty, and administrators, whereas 81% had cultural diversity programs for their students. This poses several questions with regard to who has access to these programs and how often these programs are implemented. Furthermore, data show that students and staff, by far, participated in cultural diversity programs more often than faculty and administrators. This observation sends a signal that a lot more needs to be done. It is also noteworthy to mention that students, staff, faculty and administrators all found discussions, lectures, dances and other cultural events as the most popular approaches when addressing cultural diversity.

Recommendations and Conclusions:

Although this study may be limited in scope and sample size, it reveals very key information regarding diversity in higher education. Future research might focus on mentoring programs, sources of funding, and other studies indicating why there are low numbers of minorities in top administration positions. In order to have a more "universal" campus, cultural diversity programs need to be implemented, and made more readily available to faculty and administrators, as well as students and staff. Without these programs, it is difficult for colleges and universities nationwide to adjust to the demographic changes, and to produce well educated citizens capable of effectively moving the nation forward into the next century.

Bibliography:

1. Bouview, L. F., 1991b.
Peaceful Invasions: Immigration and Changing America.
Lanham, Md.: University Press America.
2. Parker Redmond, S., 1990
"Mentoring and Cultural Diversity in Academic Settings."
American Behavioral Scientist. No. 2 vol. 34, Nov./Dec. 1990:
pp. 188-200.

3. Vermilye, D. W., 1974.
Lifelong Learners- A New Clientele for Higher Education.
San Francisco, Ca., Jossey - Bass Publishers.
4. Kabagarama, D. Ph.D., 1995.
Cultural Diversity and Institutional Effectiveness: A Study of Higher Education.
Wichita, KS: Wichita State University Printing Office.
5. The U.S. Bureau of Census: Statistical Abstract of the U.S., 1994.
Washington D.C.: Government Printing Office.
6. Milem, J.F. and Austin, H. S., 1993.
"The Changing Composition of the Faculty:
What Does it Really Mean for Diversity?"
Change. Mar/Apr, 1993: pp. 21-27
7. Farr, C.L., 1992
Ibid: p. 27
Needham Heights, MA., Allyn & Bacon Press.
8. Kabagarama, D. PH.D., 1993
Breaking the Ice: A Guide to Understanding People from Other Cultures.
Needham, M., Allyn & Bacon Press
9. Etaugh, C. And Riley, S., 1983.
"Evaluating Competence of Men and Women: Effects of Marital Status and Occupational Sex-typing." Sex Roles. Vol 9, 1983: pp. 943-952.

Content Analysis of the Burial 9 Seed Jar: Ewing Site, Yellow Jacket, Colorado

Bradley W. Cole, McNair Scholar
Dr. Arthur Rohn, Faculty Scholar

Abstract

The Anasazi-Pueblo people of the American Southwest have for a long time peaked the interest of archaeologists with their continuous cultural history and their egalitarian lifeways. When compared with others, Pueblo society appears remarkably unified. Pueblo habits of mind harmonize with Pueblo behavior and ritual. Art, morality, and philosophy are one. Pueblo religion is a form of instrumentalism controlling the natural through the supernatural as a flow of interest rather than a planned enterprise. The technique of control is mostly magical, and ritual acts are considered automatically effectual as the outlet and means of expression. The present research is an investigation of a seed jar and its contents placed in a burial at a Pueblo II site near Yellow Jacket, Colorado. The purpose of the analysis of this seed jar and its contents was to determine: 1) what are the materials found inside it; 2) how did those materials come to be there; and 3) what significance or relationships those results may reveal about the person buried in the grave as well as what it might imply about the nature of the site itself.

Problem Statement

The main purpose of this study was to identify and make comments on the depositional nature of the seed jar and its contents, which was excavated from Burial 9 at the Ewing Site near Yellow Jacket, Colorado. This was done in an effort to separate materials placed in the seed jar by humans as part of the burial offering from material introduced later by burrowing rodents and other natural processes. The seed jar was found broken near the woman's chest and a rodent's nest was found inside the chest cavity area. A further purpose of this study was to see what the results from the content analysis might have to "say" about the person in this grave.

The importance of this study lies in several objectives. First and foremost is the obligation of the archaeologist to "write up" excavation projects so as to share the insights and information gained with the public and other professionals in the discipline. Considering the fact that this was a 100 percent excavation and the site was totally destroyed as it was removed from the ground, the importance of reporting findings is amplified. Another reason to conduct this analysis was to find out something about the person buried with the seed jar, which in turn helps to understand the nature of the entire site, i.e., placement in time, with whom these people may have been associated, and the homogeneity and discordance between

groups of Pueblo Indians from different areas. Also, this work was conducted to observe the nature and results of rodent burrowing as it relates to the excavation of burials and those problems of interpretation.

Historical Context

The Anasazi people appear as an identifiable group in the Four Corners area of the American Southwest approximately 2,500 years ago. Two developments differentiated them from the broadly based, wide-spread hunting and gathering cultures of the peoples before them: the building of semipermanent to permanent living and storage structures and the practice of horticulture and the domestication of plants. An agricultural way of life soon brings a variety of additional cultural baggage and eventually a more elaborate way of life. Agriculture leads to a host of other cultural, social, and environmental adaptations that, over time, redefine the group into a more distinctive culture (Matlock 1988:21).

To understand the Anasazi, one must have an appreciation of the mesas, mountains, and canyons that make up the Four Corners area where Colorado, Utah, New Mexico and Arizona meet. (See Fig.1 pg.4a) This area includes some high mountains, but is dominated by hundreds of well-defined mesas and buttes, deep sheer-walled canyons, and wide, flat river valleys. The environment forms the backdrop which contributed to the character of the Anasazi people. From its influence came their foods, tools, crafts, arts, and other goods. The landscape, climate, and physical character of the Southwest provided a setting for, and contributed to, the form of the Anasazi culture-its religion, ritual, and society. And when the climate changed the environment, so too did it change the Anasazi (Matlock 1988:3).

By AD 900 to 950, most Anasazi societies began a pattern of growth and complexity that would eventually allow distinction of several Anasazi branches. Technology, subsistence, and settlement patterns, as well as village size and form changed sufficiently and marks the beginning of what is known as Pueblo II in the Pecos Classification System (a way for archaeologists to categorize Anasazi developments through time). By then, most of the distinctive cultural characteristics that are thought of as Anasazi were in place. Material culture as pottery, masonry construction techniques, and other crafts were consistent in form and character and were broadly shared throughout Anasaziland (Matlock, 1988:31).

The Northern San Juan Anasazi, or Mesa Verde Anasazi as they have been known, developed amongst the dense pinyon and juniper forests on the broad mesas and in the large valleys of southwestern Colorado and southeastern Utah. The previous name is now used over the latter because it has been discovered that most of the people lived in the Montezuma Valley north of Mesa Verde and on the mesa lands to the west. The area seems to have been highly productive for the estimated 30,000 Anasazi that lived there. The large expanses of land in the valleys, the sandy-clay soils on the mesas, and the development of water control systems allowed for the production of large amounts of agricultural goods. The Northern San Juan Anasazi participated in trading systems and developed an extensive and

important ritual system centered on small kivas located in each of the villages. With a large population scattered over the landscape, well-developed agriculture and crafts, sufficient rainfall, an elaborate ceremonial system, and trade with their neighbors, the Pueblo II period in the Northern San Juan area was probably one of the best for the Anasazi. It was at its apex as the breadbasket of the Anasazi world (Matlock 1988:47,81).

Over this time period and the next, Pueblo III, there were eight towns that were central to Anasazi settlement. Each of these central communities had a population exceeding 1000 and was tied culturally, economically, and most likely even ritualistically to a group of small communities made up of villages and hamlets. All of the towns had a community water supply with flow control devices for increased efficiency. They also had a series of towers, a great kiva for community ritual, and streets or avenues (Matlock 1988:50). One of the towns has been called Yellow Jacket and there is a good possibility that the Ewing Site was one of its outliers.

The Ewing Site was located at an elevation of 6760ft on the edge of Yellow Jacket Canyon in a grove of pinyon pine and juniper woodlands which is found commonly in this area along canyon rims and slopes (See Fig. 2 pg. 4a) It has been dated by tree-rings to have been occupied between AD1040 and 1120, the period of transition from the Pueblo II to the Pueblo III stage. It was divided into a northern and southern division consisting of two habitation sites in each (See Fig. 3 pg. 4b), with at least one potter in all four houses, each house with an estimated number of two to six people (Hill 1984:19,3, 131). This woman's burial was found in a pit house grinding bin in the south part of the site, and is associated with buildings in the southern division (See Fig.4 pg.4b) The pit house burned at some point before the burial and around the time the masonry structures were built to replace the earlier posthouses there, which also burned. The seed jar was found with her, near her chest and knees-her body lying in a semi-flexed position with her legs drawn up.

It can be demonstrated that once cultural change inspired by Spanish and Euro-American contact is factored out, the best analog for prehistoric Pueblo behavior are the modern day Pueblos (Hill:1984:154). The Pueblos are closely associated with the Hopi and the Zuni and are considered the modern day descendants of the Anasazi. Tens of thousands of Pueblos live in some thirty towns and villages in New Mexico and Arizona today. Even though they speak different languages, from one village to the next, the Pueblos share a fairly similar culture that continues in many ways the long tradition of the Anasazi (Matlock 1988:15).

The Pueblo Indians are unique among the surviving cultures of the world in that they are one of a very few groups to have maintained continuity of customs, attitudes, methods of government, language, religious beliefs, and architecture from the Anasazi beginnings to the 20th century. These Indians have preserved their central way of life despite centuries of environmental catastrophes and assaults on their lives and social organizations by other Indians, Spaniards, and Anglos. Few peoples are able to demonstrate such resistance to acculturation as have the Anasazi-Pueblo Indians of the American Southwest (Rohn 1987:72).

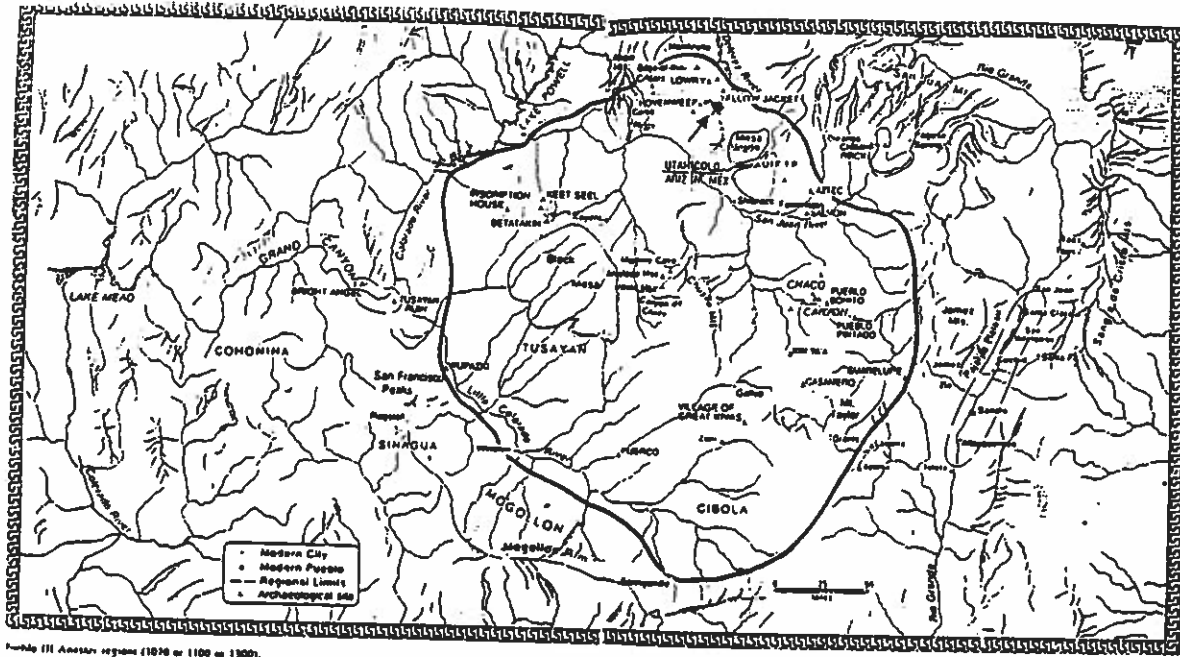


Fig. 1 The Four Corners Area
Dr. Arthur Rohn, *Anasazi Ruins of the Southwest in Color*, University of New Mexico Press, 1987.

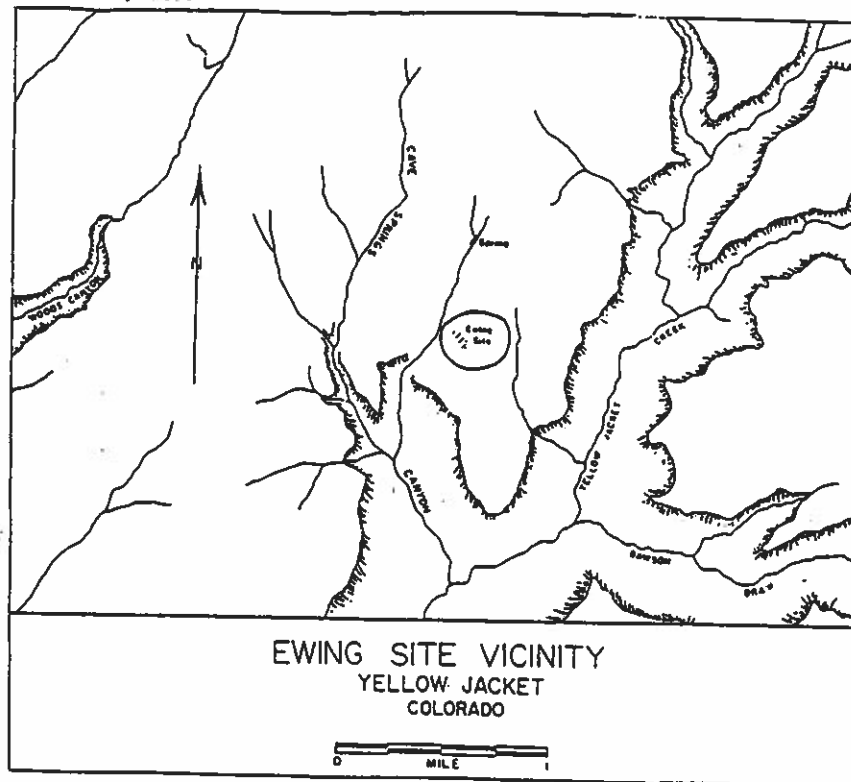


Fig. 2 Dr. Arthur Rohn

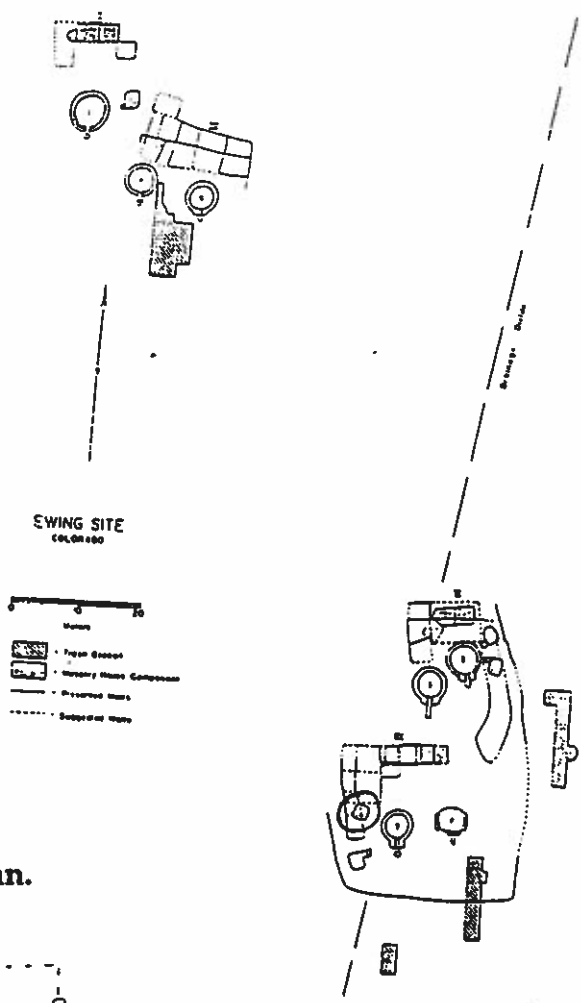


Fig. 3 Northern and Southern Habitation Areas. Dr. Arthur Rohn.

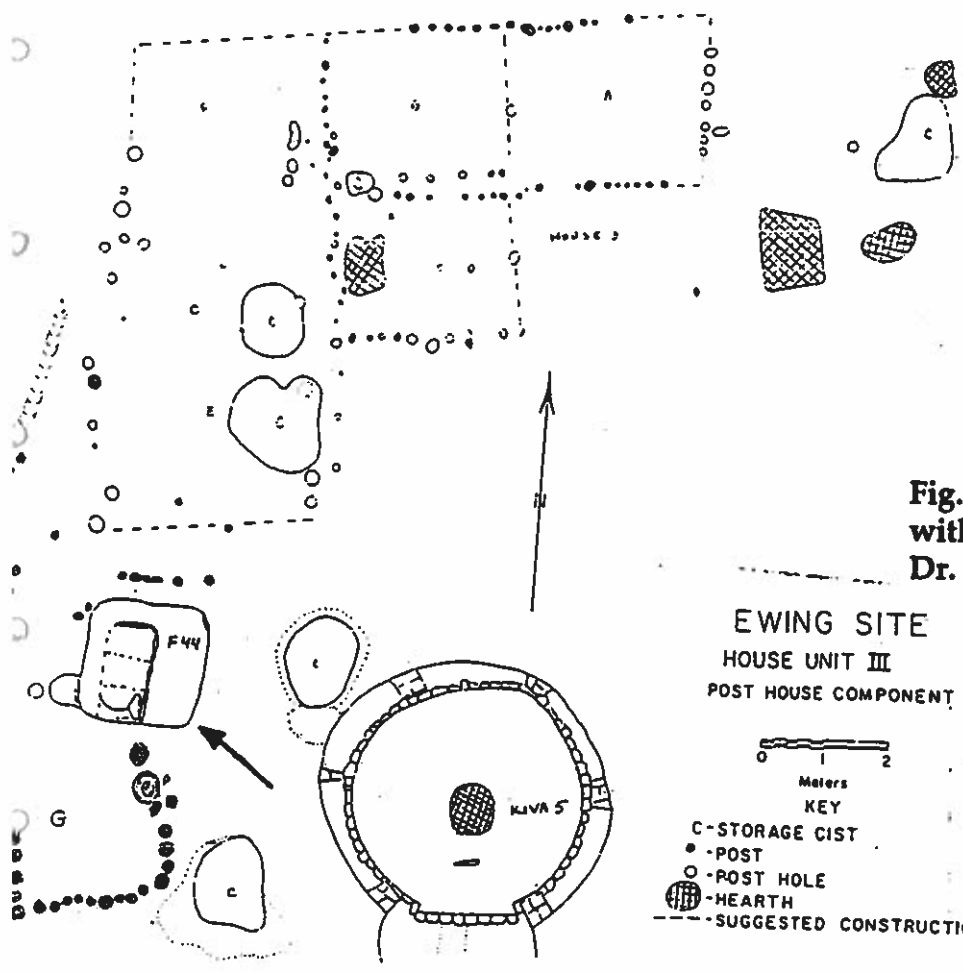


Fig. 4 Southern Habitation Area with Pit House Feature 44. Dr. Arthur Rohn.

Data

The excavated contents of the seed jar, by the nature of the research, was the most important data to be dealt with. Fieldnotes taken by C. Bergstedt during the excavation proved to be very useful in describing spatial relationships which helped to recreate not only the burial, but also its context within the grinding room feature and the pithouse itself. Dr. Rohn's "Investigator's Notes" were used for general information about the Pueblo II Anasazi and the site itself. Gary Matlock's "Enemy Ancestors" was quite helpful in this respect as well. David V. Hill's masters thesis "Pottery Making at the Ewing Site" helped to define activities at each house unit as well as provide information about local geologic, flora, and fauna conditions. Elsie Clews Parsons' work "Pueblo Indian Religion" proved indispensable for understanding grave goods and their association with the ceremony and ritual of burials. Finally, Stewart Peckham's "From This Earth" and James R. Cunkle's "Talking Pots" allow for comment on the nature of the vessels themselves and a possible meaning to the design around the top of the seed jar.

This study could not have been conducted without the contributions and assistance of several professors associated with Wichita State University. Indeed, each in their own way expressed pleasure at being involved with a multi-disciplinary project that drew together different areas of science. Personal communications were indispensable from each of the following professors and I would like to express my gratitude to: Dr. Arthur Rohn, PhD, Anthropology/Archaeology; Dr. Arthur Youngman, PhD, Biological Sciences; Dr. Dan Distler, PhD, Biological Sciences; Dr. Peer Moore-Jansen, PhD, Bio-Physical Anthropology; and a special thank you to Dr. Colette Burke, PhD, Geological Sciences and source of inspiration and guidance. Identifications of each sample were made with the help of these people and with book research on the local geology, flora, and fauna along with clues from Pueblo Indian burial practices. Although it was discussed, thin-slide testing of all materials and X-ray diffraction analysis of the geologic material proved to be beyond the scope of this study.

Methods

The contents of the seed jar were received in a sack, unsorted, as they had been excavated from the burial. They could readily be broken down into categories of geologic, floral, and faunal materials; which was the nature of the first sorting and is represented by the letter designation following the site designation of Y-7. The second sort further separated materials and is represented by the number following the letter, i.e., first sort, Y-7-M; second sort, Y-7-M1, et cetera. These are identification designations for the most part, but also reflect the fineness of each sorting. Weights and numbers of each sample are presented as a means to understand the percentage of the sample as it relates to the total group of materials found. Each sample was described visually using 0-50x power as the inspection range of magnification. Descriptions are written with jargon of each scientific discipline in mind. The bulk of the material was geologic and lent itself to specific testing. The floral and faunal material was more problematic to direct testing, but

lent itself to visual testing. With further help from the site's field notes, and some book research on the local environment for comparison purposes, the nature of each sample was determined. Identification results and comment on local environmental relationships will be discussed at the end of each material category.

Geological Material Descriptions

<u>Sample</u>	<u>Wt.</u>	<u>#</u>	<u>Descriptions</u>
Y-7-M1	37.8	4	Clay-like nodules, unfired, yellowish (0-35x) very fine grained aggregate with very tiny inclusions, soft, dull luster, includes some fibrous vegetative material
Y-7-M2	18.0	2/1	igneous-like nodule, broken in two pieces, hard, dull luster, blackish (0-35x) fine grained crystalline dark matrix with radiating feather-like crystals, metallic luster, fine grained white amorphous inclusions
Y-7-M3	1.7	1	caliche-like rock, flat on two opposite sides, hard, dull luster, light grey (0-35x) fine grained conglomerate with inclusions of quartz and Y-7-M2
Y-7-M4	7.0	2	sandstone-like rocks, one piece with a spot of mineral deposit, soft, dull luster, brownish (0-35x) fine grained aggregate with small inclusion of quartz and Y-7-M2
Y-7-N1	19.1 +(2.9)	1	very fine grained to powdery, flat roundish shape with striation marks on one flat side, very soft and friable, dull luster, orange-red (0-35x) very fine grained aggregate with occasional small white inclusions, some vegetative fiber
Y-7-N2	1.4	1	same as above but with more and bigger white inclusions, medium hard, dull luster, orange-red (0-35x) very fine grained aggregate with medium white inclusions
Y-7-01	3.4	28+	sandstone-like rocks, small to tiny, flat to round, hard, dull luster (0-35x) small granular aggregate with quartz crystal inclusions
Y-7-02	1.8	50+	caliche-like pebbles, small to tiny, globular, soft, dull luster (0-35x) extremely fine grained nodules, powdery
Y-7-03	0.4	12	caliche-like slivers, one flat side, tiny, hard, dull luster, light grey (0-35x) aggregate, banded on the flat side, cement-like, cracks, small inclusions of banded material in matrix

Y-7-04	0.5	25+	caliche-like amorphous modules, globular, tiny, medium hard, dull luster, light grey
Y-7-05	4.2	55+	(0-35x) very fine matrix with some fine white veining dried or burnt earth, amorphous clods, small to tiny, friable, dull luster, dark brown
Y-7-06	0.4	1	(0-35x) small grained aggregate with fine quartz crystals, a few small white inclusions turquoise-like, amorphous nodule, small, powdery, soft, dull luster, sky blue, with off-white coating
Y-7-Q	949.3	---	(0-35x) fine grained material, powdery on the surface but hard on the inside, covering resembles Y-7-03 material
Y-7-O	7.7	---	small to tiny chunks of dirt, friable, dull luster, red-brown (0-35x) very fine grained aggregate with fine quartz crystals tiny pieces of mixed material containing all of the above, too fine to sort

Legend:
 under weights+(0.0) = powder
 under numbers 00+ = approximate count
 --- = too many to count

Sample	<u>HCL Acid Test</u> Reaction	<u>Hardness Test</u>	<u>Streak Test</u>	<u>Taste, Odor, Feel Test</u>
Y-7-M1	slight reaction			earthy odor and taste
Y-7-M2	no reaction	scratches	dk grey/black	
Y-7-M3	reaction			
Y-7-M4	no reaction	no scratch	lt brown/yellow	earthy odor/gritty taste
Y-7-N1	slight reaction		red/orange	
Y-7-N2	no reaction		lt brown/orange	
Y-7-O1	reaction scratches			
Y-7-O2	no reaction			earthy taste
Y-7-O3	slight reaction			
Y-7-O4	slight reaction			
Y-7-O5	strong reaction			
Y-7-O6	no reaction	no scratch	lt blue	
Y-7-Q	slight reaction			

Identification and Depositional Nature of Samples

Y-7-M1	clay	human
Y-7-M2	pyrolusite	human
Y-7-M3	caliche	geologic/human/fill
Y-7-M4	limonite	human
Y-7-N1	hematite cement	human
Y-7-N2	hematite aggregate	human/fill
Y-7-O1	sandstone	geologic/fill
Y-7-O2	kaolinite	human
Y-7-O3	caliche	geologic
Y-7-O4	popcorn caliche	geologic
Y-7-O5	calcium carbonate enriched soil	geologic
Y-7-O6	turquoise	human

Geologic Results

Anasaziland is described geologically as having relatively thin soils over thick horizontal rock layers. The rock formations are made up of sediments-sands, clays, limes, and other basic materials-deposited by ancient eroding mountains and drying inland seas. Soils tend to be red clay types of decomposing Dakota Sandstone, Mancos Shale, and airborne red sands blown in from the west. Porous sandstone beds underlie the soil, and those formations meet with shales and limestone deposits which support groundwater reserves. Erosion in the area forms arroyos, river valleys, mesas, and canyons (Matlock 1988:7).

Discussing the identification results is best broken down into categories of deposition-geologic or human-with some comment on either/or possibilities when depositional processes are questionable. Each of these categories contain common depositional characteristics of some samples and are best considered in groups.

Geologic Results

Y-7-Q

This sample consisted of the general soil clods of the area and probably represents material that was used as fill for the burial.

Y-7-O5

This sample was unique over the rest in that it reacted very strongly to the HCL acid test and its color was darker than the soil sample in Y-7-Q. The locally enriched calcium carbonate soil may be explained by geologic processes, or it may be related to something placed in the seed jar as grave goods that has since lost its substance.

Y-7-O1

These samples were identified as being small pieces of Dakota Sandstone and were most likely deposited in the burial either by geologic processes or unintentionally as fill over the body.

Y-7-O3, Y-7-O4, Y-7-M3

These samples all appear to be caliche, although in different forms. Caliche is calcite

that is deposited in the ground as a solution through percolating groundwater. Isolated nodules form on roots or on hard surfaces such as rocks or pottery. The nodules, if allowed to continue to develop, eventually form a continuous hardpan layer normally with a lamellar structure that is common in arid environments (Reading 1978:41). Y-7-O4 is called "popcorn" caliche because of its globular appearance, and most likely represents the small nodules that first form before the hardpan develops. Y-7-O3 represents caliche that formed on some flat surface, probably on one side of the seed jar's sherds. Y-7-M3 is more problematic because of its larger size, its two flat sides, and the fact that there was only one piece of it. This sample could have been part of the grave fill as an unintentional deposit or it could have been placed in the seed jar purposely.

Human Deposition

Y-7-M1

This sample was determined to be globes of paste (potters clay) and are out of context geologically. Paste has been included in burials as grave goods throughout Anasaziland.

Y-7-M2

This sample proved to be pyrolusite. A mineral mixture of this material with limonite and psilomelane was used to make a black pigment and applied in pottery decoration (Hill 1984:77).

Y-7-M4

This sample is limonite. Not only was limonite used for mixing pigment, it was also used to make a slip to cover the surface of a vessel.

Y-7-N1, Y-7-N2

These samples appear to be hematite cement. Y-7-N1 has pronounced striation lines on one flat surface that are not natural and reflect the act of scraping grooves. This sample is soft and friable and most likely represents pigment used in the pottery making process. Y-7-N2 was much the same as Y-7-N1 only much smaller with larger and more frequent inclusions and no grooves.

Y-7-O2

This sample was found to be kaolinite. Its white color reflects the pureness of the sample. Kaolinite is used in the pottery making process as part of the clay paste, or used in the slipping process. It also has religious symbolic meaning to the Anasazi.

Y-7-O6

This sample proved to be turquoise. Although covered with a layer of caliche and deteriorated on the exposed outer surface, the interior was found to be quite firm and intact. Turquoise has an extended religious significance throughout Anasaziland. One of only several important deposits in the world, the Four Corners area of the American Southwest, along with California, is the primary producer of this gem. Most American turquoise is light in color, porous and chalky, usually with a matrix (Sofianides 1990:113). The extent of turquoise mining and collection in the Southwest is represented by an open cut in the earth 2000ft deep and 300ft wide in the Los Cerillos Mountains of New Mexico. Around the man-made crater is

20 acres of waste material with 600 year old trees growing from them, which speaks to the antiquity of the mining activity (Hurlbut 1970:253).

Floral and Faunal Material Descriptions

Again, as mentioned above, the floral and faunal materials were best identified by visual analysis. Most samples were examined under 50x+magnification to look at cell structure, growth rings and lines, striation patterns, and the effects of deterioration. Bone samples were examined for their porosity, cell structure, and general descriptions such as color and size, since all of the samples were badly deteriorated and broken up. Because of the added disturbance of the rodent's nest, the depositional categories break down a little differently for these materials, which are: human and rodent introductions. As with the geologic section, identification results will be discussed after descriptions are presented. Possible depositional natures are listed on the identification chart.

Floral Material Descriptions

<u>Sample</u>	<u>Wt.</u>	<u>#</u>	<u>Description</u>
Y-7-E	0.3	13	small, half round pieces, burnt, granular, cavity in center, black
Y-7-D	0.2	6	squash or pumpkin seeds, deteriorated, rim ridge on edge, light brown
Y-7-I1	0.4	18	small, narrow wood pieces, striated texture, well preserved, soft, fine grained growth lines, orange/red
Y-7-I2	1.2	4+	mid-sized wood pieces, one piece of "C" shaped bark, hard, bulbous and knobby, parallel growth lines, light brown to brown
Y-7-I3	0.9	10+	mid-size to small flattish wood pieces, badly deteriorated, fibers, striated, soft, light brown to yellow
Y-7-H	14.7	100+	medium to tiny assorted pieces of charcoal and burnt wood, black
Y-7-G	0.4	n/a	small, thin, fibrous vegetative mat pieces with a dirt-like matrix in some places, light brown to yellow
Y-7-B	0.6	n/a	small, fine twisted fibers, short strands, brown to light yellow
Y-7-A	0.1	24	variety of material-stoma with parallel lines, yucca-like roots from at least two shrubs, bark from a shrub, a few other roots, and some flat fiber or leaf

Floral Results

On the high mesas, between 5,000 and 7,500ft, the land is covered with a forest of pinyon pine and juniper. In other places, large open areas were covered with 6ft sagebrush before the introduction of today's farming methods. Many desert-adapted plants such as shrubs, grasses, yuccas, and flowering cacti would have been found among the great sage flats at this altitude. Other useful plants to the Pueblo peoples that are found there include bee weed, globe mallow, and sunflowers. Along streams and around desert springs cottonwoods, hackberry, mosses, ivy and other

riparian plants could grow in oasis-like micro environments. In the high country douglas fir, ponderosa pine, and spruce forest dominate the landscape. At lower elevations and in the canyon bottoms, there are full desert conditions, with no trees and only low-growing shrubs, cacti, and grasses (Matlock 1988:11).

Identification and Depositional Nature of Samples

Y-7-E	charred corn kernels	human
Y-7-D	squash seeds	human
Y-7-I1	juniper wood	human/fill/offering
Y-7-I2	shrub hardwood	human/rodent
Y-7-I3	pinyon pine or fir	human/fill/offering
Y-7-H	charcoal	human/fill/offering
Y-7-G	rodent nesting material	rodent
Y-7-B	yucca cordage	human
Y-7-A	variety-yucca stoma, juniper and ponderosa pine wood, shrub bark, shrub root	rodent

Human Deposition

Y-7-B

Because of the obvious twisting of these fibers into pieces of cordage, this sample definitely represents human deposition. The fibers are from some kind of monocot species, most likely yucca. The Anasazi had a common burial practice that included putting miniature clothes, particularly miniature sandals, into the ceremonial seed jar or bowl as grave goods.

Y-7-E

This sample was found to be charred kernels of corn. Charred corn has symbolic religious meaning and is part of a common ritual practice associated throughout Anasaziland.

Y-7-D

This sample is squash seeds. Squash seeds, like corn, were a part of the religious ceremony associated with burials.

Y-7-I1

This sample was determined to be juniper wood. Juniper was used in making Anasazi living structures, and this sample may represent part of the pit house that had gotten in the fill of the grave. However prayer sticks, or pahos as they are called, were important in the burial ritual and this sample could also represent one of them.

Y-7-I3

This sample proved to be pinyon pine or Douglas fir. Its depositional nature is much the same as that described for Y-7-I1. It is interesting to note that prayer sticks were usually deposited in burials as pairs, normally each made of different woods.

Y-7-I2

This sample is thought to be some kind of hardwood, most likely from a bush or

shrub. This could have been left as part of the offering in the seed jar, but could just as easily been brought into the burial by a rodent, or it may have been part of the grave fill.

Y-7-H

These samples are charcoal. Curiously, the cellular evidence in these pieces suggests that they are what is called spring and summer wood, although what that means to this circumstance is unclear. Because the pit house in which the burial was found had burned at one time, charcoal would be expected to be found in the fill. However, charcoal has several utilitarian purposes as well, and at least some of these specimens may have been included as part of the burial ritual.

Y-7-G

This sample appears to be a vegetative mat that would have been associated with the rodent's nest. Although remnants of willow or cotton blankets have been found in Anasazi burials, it was determined that this highly deteriorated mat was most likely part of the rodent's nest located in the woman's chest cavity.

Y-7-A

This group had a variety of material including small pieces of yucca stoma, juniper and ponderosa pine wood, and also bark and roots from undetermined shrubs. Because of the small size of these samples and their low numbers (one or two representations at best) it is thought that they were brought into the burial by rodents as either food or nesting material.

Faunal Results

For the most part, the animal communities of today are much the same as those that would have been found in Anasazi times. Large mammals in the pinyon-juniper zone include deer, antelope, and bighorn sheep. After consumption, certain bones from these animals were used for making tools. Turkeys were domesticated early by the Anasazi as pets, and they used their feathers for weaving softness and warmth into their blankets. Later on, they were used as a food source (Matlock 1988:12). One of the most important faunal food resources for the Anasazi were several species of rabbits found in the area. Rabbits, along with a number of small to medium-sized rodents such as woodrats, ground squirrels, kangaroo rats, pocket gophers, and the white-footed mouse were constant pests in the Anasazi farmlands. Keeping the fields free from these interlopers led to a practice called "garden hunting" which meant that as the Indians cleared their fields of the rodent problem, they also ate them. Rabbits, by far out-numbering the other species or because they are more easily taken by hunters, were the major food resource from this group (Rood 1985:59).

Faunal Material Description

<u>Sample</u>	<u>Wt.</u>	<u>#</u>	<u>Description</u>
Y-7-J	11.0	10+	badly deteriorated, thin, curved pieces of bone, long-bone like, off-white to yellow with black spots and veining
Y-7-L1	0.7	20+	small amorphous bone pieces, very porous, light brown
Y-7-L2	0.7	50+	very tiny pieces, mixed debris of Y-7-J, Y-7-L1, Y-7-K

Y-7-L3	0.1	1	sliver of small long bone, flat, brown
Y-7-L4	---	1	tooth-like, tiny, with spiral, light brown
Y-7-F	0.7	25+	small, cornflake size pieces of dried skin, sandy, orange to light yellow
Y-7-K	2.2	100+	small, flat bone-like flakes, light brown to off-white with black spots
Y-7-C	0.3	20+	beetle-like shells, hollow, mid-section and abdomen parts, leg sockets, one leg, all black

Identification and Depositional Nature of Samples

Y-7-J	human femur	human
Y-7-L1	human trabecular bone	human
Y-7-K	long bone flakes	human
Y-7-L2	mix of Y-7-J, Y-7-L1, Y-7-K	human
Y-7-L3	rodent diaphysis fragment	rodent
Y-7-L4	rodent tooth, incisor	rodent
Y-7-F	peritoneum tissue	rodent/human
Y-7-C	beetle carapaces	human/insect

Human Deposition

Y-7-J

Although badly deteriorated and broken up, this sample was found to be the proximal end of a human femur that includes part of the diaphysis and the lesser trochanter. It is thought that this is actually part of the woman in the burial.

Y-7-L1

This sample is trabecular bone, sometimes called "spongy" bone because of its appearance. This too was found to be most likely human and associated with the woman in the burial.

Y-7-K

This sample is thought to be flakes of human bone, most likely associated with rib bones or sample Y-7-J. These flakes may be a result of the decomposition process or may represent rodent gnawing, although deterioration was such that no teeth marks were visible on the specimens.

Y-7-L2

This was found to be a mixed sample of tiny pieces of material from samples Y-7-J, Y-7-L1, and Y-7-K; all human.

Y-7-L3

This was the only sample of rodent bone found. It is a long bone and may have been brought into the burial through scavenging behavior by the nest's occupants.

Rodent Deposition

Y-7-4

This sample proved to be a very small rodent's tooth. It has a "C" shape with an angled curve on one end which gives it a spiral look. It appears to be an incisor.

Y-7-F

This was found to be dried peritoneum tissue, or the membrane lining on the wall of the abdominal cavity. This tissue could actually have been part of the woman in the burial or it may be associated with activity in the rodent's nest, i.e., eating of the weak young.

Y-7-C

These samples were beetle carapaces, or the shells of their body parts. They appear to be bombardier beetles, which are ground dwelling carnivorous scavengers that are part of the carabidae family. They may have entered the burial through rodent burrowing activity or of their own accord, or they may have been placed there as part of the burial ritual, since beetles figure prominently in Pueblo mythology.

Vessel Descriptions

Both the seed jar itself, and the miniature pitcher found inside it, were identified at the time of their excavation by Dr. Arthur Rohn as Mancos Black-on-White ware. The terminology, black-on-white is a common way to describe pottery styles of the Southwest and refers to the black design being laid down over a white background. Mancos refers to the geographic area and time period in which the pieces were made. Characteristics used to "type" pottery are described in certain terms. Paste refers to the clay itself. The core is the main matrix of the clay and temper refers to the aplastic added to the clay to reduce shrinkage and cracking in the drying as well as the firing processes. Surface characteristics have to do with how the piece was finished after the main body of the vessel was produced. Scraped refers to a surface that has been smoothed with a tool and left as is. It may also be defined as unslipped. Slipped refers to a surface that has had a thin layer of clay applied as a kind of glaze. Paint refers to the substance used to apply the design to the vessel. Finally, the term sherds refers to pieces of broken pottery. Identification of these characteristics were taken from Field Notes and Field Sample Report sheets as well as from Hill's masters thesis concerning pottery making at the Ewing Site.

The Seed Jar

Total Sherds: 24

Missing Sherds: 0, all found and accounted for

Paste:

core; light to medium grey
temper; crushed pot sherds
remarks; two light to dark carbon spots
carbon streak, mostly in top half of vessel

Surface:

interior; unslipped, scraped
exterior; slipped thinly white
remarks; coil technique

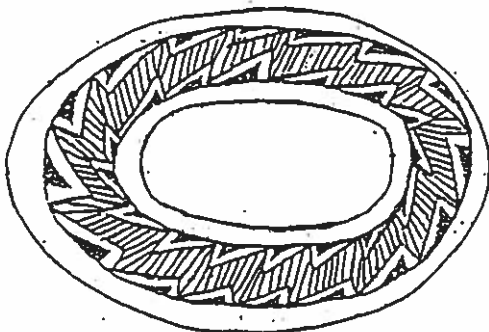
Paint: mineral with brownish cast

Dimensions:

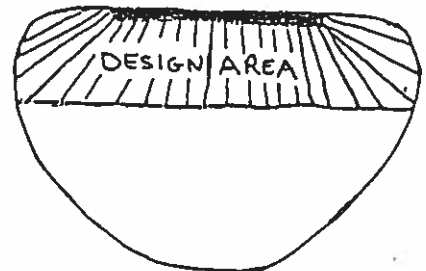
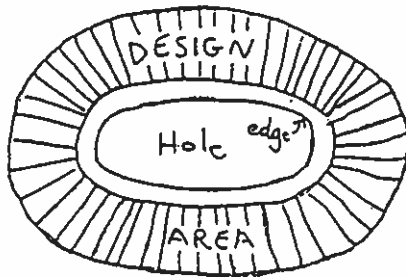
total height; 143mm
diameter; 262 x 217mm
orifice diameter; 124 x 80mm
wall thickness; 5mm average

Special Features:

heavily worn on top around orifice
large stain on the bottom inside of jar



DESIGN



The Pitcher

Total Sherds: 1

Paste:

core; light grey

temper; sand

remarks; formed from paste

Surface:

interior; unscraped, unshipped

exterior; white slip on base, base polished

black paint above base

remarks; lumpy calcium carbonate deposits in interior

temper protrudes

Paint: mineral

Dimensions:

total height; 41mm

diameter; 26mm

orifice diameter; 15 x 20mm

wall thickness; 3mm average with wide variation

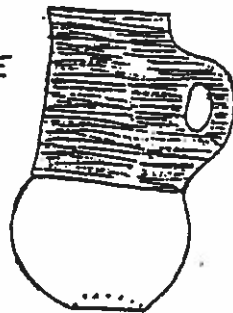
Special Features:

vertical rope handle on one side of neck

dimpled bottom

yellow pigment over much of interior and exterior

ACTUAL SIZE



Vessel Results

The clay used to make these pieces was probably collected from the shale lenses in the Dakota Sandstone of Yellow Jacket Canyon, as was the sandstone itself that was crushed and used as the temper (Hill 1984:142). Ewing Site potters constructed their decorated vessels in one of two ways. Miniature vessels, small bowls, and dippers were molded from lumps of tempered paste, while larger bowls and decorated jars were constructed by stacking coils or circuits of clay on a hand molded base (Hill 1984:145). The base was formed by pressing a flat pat of clay into a special mold that is usually made from the base of large broken jars, or sometimes a shallow basket (Hill 1984:71). These pieces are a representation of each technique; the seed jar being made by the coil technique and the miniature pitcher being molded from paste. The well worn area around the top of the seed jar indicates use before being placed in the burial.

The majority of the black-on-white ceramics removed from the Ewing Site were decorated with an iron-based pigment or mineral paint (Hill 1984:128). The transition from Pueblo II to Pueblo III in the San Juan drainage area is defined by the change potters made from the use of a mineral paint in an organic binder to the use of organic paint alone (Hill 1984:52). The Ewing Site, that dendrochronology (tree-ring dating) places in the transition period of paint usage, was using both organic and mineral pigments simultaneously throughout the site's 80-year occupation (Hill 1984:52). The correlation between tree-ring dating and changes in paint ingredients helps to type pottery as well as sites. Mancos black-on-white ware is identified with the time period between 1000-1075AD (Peckham 1990:76).

Ceramics from the Pueblo II stage were decorated viewing the vessel's surface as a symmetrical field for organizing decorative motifs as opposed to isolated design elements on a flat surface which dominated earlier Pueblo basketry patterns (Hill 1984:49). Some believe these design motifs have meaning and can be "read." Miniatures have been found as grave goods throughout Anasazi land and are thought to represent offerings and/or occupational activities of the deceased as well as being symbolic of useful things that may be needed in the next life.

Discussion/Conclusions/Speculations

It is thought that the Anasazi, like their Pueblo descendants, practiced animism. Animism is a concept in which animals and inanimate objects of nature have souls and as spirits they may do good or evil for humans. People are considered as only one of several kinds of beings that inhabit the earth and spirit world and all are considered to be equal in importance (Rohn 1987:57-58). To Pueblos, the universe is endowed with the same "breath." Fetishists, animists, animatists; Pueblo Indians are confirmed anthropomorphists. The Pueblo Spirits act humanly-clouds, kachina (representations of the different spirits by masks), the dead, cosmic beings, animals, birds, and insects as well as the indwelling spirits in trees, plants, and stones-all have human needs and desires and live under familiar economic and social conditions (Parsons 1974:198). Burials indicate there was a proper way to treat the dead. Position of the body along with the inclusion of food

and water vessels, tools, clothing, and jewelry in the grave were attempts to make provisions for life after death (Rohn 1987:58).

Key to understanding the concept of fetishists is the principal of "like causes like" and "the whole following a part." Funerary practices express the notion of like causes like. The Pueblo "plant" a dead person for another world. They include provisions in the burial for use there (size is not important and miniatures represent conservation of this world's materials) and also offerings for a smooth journey (Parsons 1974:93). Grave goods also tend to represent past or future roles of the individual in the burial (Hill 1984:14).

For the most part, the dead are associated with Cloud Beings. The Pueblo believe that clouds are their ancestors and that what you see as clouds are really their ancestors' breath. They believe that the newly dead body must become light to go up to become clouds. Some dead become kachina and help to bring the ever-needed rain to those left on earth. The Dead, the Clouds, and the Kachina are the outstanding collective Spirits among the anthropomorphic spirits of the Pueblo people; ancestors of the Anasazi (Parsons 1974:171-177).

Life after death is envisaged as the same as before death. The deceased journeys to a town or village where s/he was associated with in life; all who may be thought of as clouds or lightning. On the trail, getting there they must pass a spirit sentinel that evaluates the traveler. If the deceased is not deemed worthy to continue, there are a series of four purification rites (fire pits) to be dealt with. The spirit of the dead person may be found good to go on after any of these "punishments" and the further they are detained represents their failure at living a proper life or preparing properly for death (Parsons 1974:216).

There are specific fears about death and about the dead, who might pull or draw themselves back to the living. Offerings are made so that the deceased will not "drag down" anyone else into death as well. Neglect of the burial or death ritual will cause death scare or sickness, since the ghost returns to pester the living. The dead are buried as close as possible to the time that the "breath" leaves the body and the remains have been prepared properly for the burial rites. The burial ritual lasts for four days after the body is placed in the ground. The living must "make the four days," or in other words, must do the proper things lest the ghost returns. Details of behavior during those four days the ghost is thought to linger vary from area to area. Separating the dead from the living and preparing the deceased for the journey that has to be made, whatever the destination, are the general outstanding funerary traits. Fear, sickness and death come through the dead by whom the living would like to be quite done with. Part of pacifying the ghost includes putting food in the burial as well as preparing it, and putting it out, each of the four days of the ritual. After they "make the four days" the scare is over for the living. Often a cooked or burnt offering is considered proper for a ghost (Parsons 1974:68-74).

Part of the "art" of archaeology is to apply meaning to the clues left in the archaeological record and found during excavation. These clues are left in the artifacts, their context within the site and beyond to include settlement patterns, as well as architecture and craft production technologies. The purpose in deciphering

these clues is to try to understand the people who inhabited the excavation area and to learn something about their lifeways. Building and craft technologies are ways that individuals do things but only begin to speak as to the reasons why. Determining religious concepts is even more problematic, especially when there are no written accounts from the time period under study. Fortunately, trying to interpret the religious practices of the Anasazi back through time is facilitated by the fact that today's Pueblo, Hopi, and Zuni Indians are the direct continuous descendants of the ancient Anasazi. Because these peoples have made conscientious efforts to maintain their mode of egalitarian society and have participated in religious practices handed down through the centuries, it may be easier to apply meaning to religion from their past than to religion of groups who have become "lost." Attempts to understand significance associated with religious concepts, even under the best circumstances, involves a certain amount of speculation. With that in mind, context and contents of the seed jar will now be discussed.

To facilitate discussion of the material, organization of the samples into general categories, and then specifically to groups is the easiest approach. If need be, there will be cross-referencing between groups or samples to illustrate a particular situation or possibility but, in general, like is considered with like. Some geologic materials are not discussed here because they are considered to be natural occurrences.

This seed jar was found placed in a burial that was located in a grinding bin which was inside a pit house that is associated with the southern division of the Ewing Site. The pit house burned at some time and was abandoned for use. Later, a woman died and it was found proper to bury her specifically in the grinding bin within the burnt out pit house (Hill 1984:125; Beigstedt 1969:field notes).

In western Anasaziland, the matrilineal clan prevailed and women owned the houses that they passed down from one generation to another. (See Fig.5 pg.26a) The husband married into her clan, but he also maintained ties with the clan in which he was born. Clans being family groups, marriage within them was non-existent (Wormington 1974:5). Also in Pueblo society, females are identified as the major pottery producers. Most pottery making activities were carried out at the potter's residence, the location of most of the other women's associated activities such as food preparation (Hill 1984:127, 120). (See Fig.6 pg. 26a) Grinding bins in pit houses served to grind corn, and most likely clay, progressively finer. Normally, three different grinding slabs, or metates, were arranged to grind from coarse to fine. Not all items of material culture are associated with specific activities. The metate illustrates this point and demonstrates the multifunctionality of certain tools and work areas (Hill 1984:80). In the spirit of "the dead are planted," the earliest sepulchers of Anasaziland were circular stone-lined pit granaries, and association with death and fertility (Parsons 1974:218). It seems that perhaps this woman was a potter, along with her other female duties, and lived in the southern division of the Ewing Site where she owned a house and stayed with her clan. She probably spent much time in her, or her clan's, pit house grinding corn and clay into useable

materials before it burnt down. Later, when she passed on, it was found proper to bury her in the refuse of the defunct grinding bin, which had its metates removed before she was placed there and it was filled in. (See Fig.7 pg.26a)

But what of the seed jar and its contents? According to the osteological report, the woman buried in the grinding bin was somewhere around 50 years old when she died. By Anasazi life expectancies, she had a rather average length life. The seed jar was well worn at the top of the vessel around the orifice, which indicates some use before its placement in the burial. Outside the burial context, seed jars were normally used to store small valuable items, perhaps sometimes even fetishes. It is possible that the seed jar was owned and used, and maybe even made by the burial occupant or someone close to her.

As mentioned above, items that were placed in burials were put there as representations of offerings and goods that were meant to make the passage into the afterlife less complicated and so the deceased may have the things needed and used from this life to continue a smooth existence in the next. Some of the grave goods in this burial are rather common occurrences and are found throughout Anasaziland in different contexts. Others are directly related to this burial.

Perhaps the most obvious common occurrence of items found in burials as grave goods is the piece of turquoise. Turquoise was used for many things by the Anasazi, but was used to make offerings such as fetishes and also it was used in almost any kind of dedication ceremony, burial, or appeasement to the spirits. It was offered to the War gods before going to war, it was placed under the foundations of kivas, in door-sills and lintels of houses, it was included in human burials as well as in burials of domesticated turkeys, dogs, and even in places where a hunter had taken a deer or another large mammal and left a piece of turquoise in the place of the butchered remains as a gesture of thanks and respect for the food and other useful parts of the body. Turquoise was thought to have the power to make one attractive and desirable. It was begun to be used for these purposes by the Anasazi around 500AD and was related to the sun and the emergence of their ancestors from the earth. Sun was a spirit alone in the world and was lonely so he called forth man to keep him company. Sun had all the needs and desires of a man and found turquoise, precious shell, food in various forms, and prayer-sticks pleasing (Parsons 1974:300,206,171). No doubt the sky blue color of turquoise from the Southwest related it to the sun and sky. Directly associated with the turquoise in this burial is the kaolinite. This sample is quite pure and therefore very white. It is naturally in the shape of small amorphous pieces, like clouds. Kaolinite can be used in the pottery making process, but in this case, considering the dead are thought of as clouds, it was most likely placed there to represent them.

Food was a common item left in burials for use on the trail to, and during the afterlife. Any perishable items usually placed in graves such as meat or meat stew, wafer-bread, honey, corn meal and corn pollen would have long since deteriorated. The staple food crops of the Anasazi were corn, beans, and squash. Most likely the squash seeds found in the seed jar represent the potential for new crops in the next world. Food for ghosts or the dead was cooked, since odor is the only thing a ghost

can absorb or consume. Charred corn kernels were a common part of the burial ritual, some placed in the grave and some thrown on the fire. Even on an everyday basis, bits of food were tossed on the fire as an offering to the Cloud People (Parsons 1974:300,18,70).

Prayer-sticks were used for many things and were a part of virtually every ritual of the Pueblo peoples. They were used as an offering before any journey of importance, even the journey of the dead. In some places, they were put in the burial as the deceased "letter," so in the other world s/he would be recognized by his/her mother. It was also considered as a letter of introduction used on the trail to get there. On earth, prayer-sticks are given to Sun and to the Cloud People for their services of life-giving sunshine and rain. Of prayer-sticks there are three kinds, two being for the dead. One kind for the dead were used by the living during the four days of the burial ritual and were either laid on top of the grave at the end of the fourth day or buried at a sacred spot, usually on a riverbank or in the mountains or cliffs. The other kind of prayer-sticks offered to the dead were short, measured from the center of the palm to the tip of the middle finger. They were often bound together as pairs, particularly if the Spirits they represent are thought of in terms of pairs. They may also represent male/female associations. Pairs of prayer-sticks were commonly made of different woods and highly decorated before being placed in the burial (Parsons 1974:271-272, 570, 280).

There were three different woods found in this burial. Two are identified as juniper and pinyon pine and the third is of an undetermined hardwood, perhaps a shrub. Anasazi people constructed their houses of juniper and pinyon pine and since this pit house structure had burned, building material for the pit house is probably represented by the charcoal, although at least some of it may be an offering of wood burnt to travel with the ghost; like the cooked and burnt food. The seed jar, when excavated, was broken into 24 pieces. Fieldnotes identified the materials in this study as found "inside" the seed jar, or in other words, immediately within the broken sherds. Considering the fact that the juniper and pinyon pine fragments showed no traces of burning, they could very well be the leftovers of what was once prayer-sticks. The unidentified hardwood was also unburned and may be associated with grave goods, or may have been introduced later through rodent activity.

A curious grave good found in nearly every Anasazi burial from the earliest periods on was a pair of new sandals, presumably designed for use in the afterlife. Over time, the full-sized sandals were scaled down to miniatures (Wormington 1939:30). Strips of wide-leafed yucca and leaves of narrow-leafed yuccas were woven into sandals and baskets. Two specially prepared yucca fibers were used to make twine: well-separated fibers of a warm gold color and a soft, white fiber which seems to be pounded or rubbed and superficially resembles cotton. Sandals found at Long House (a site close to and from the same time period as the Ewing Site) are described as being made on a warp of two-ply S-twist yucca twine which is warm gold in color. The weft is also two-ply S-twist of fine fibers off-white in color and superficially resembling cotton (Cattanach 1980:317,331,328). The fibers from the burial at the Ewing Site have been identified by Dr. Rohn in his "Investigator's Notes" about the

site as being of the two-ply S-twist variety. Because of the short strands and the amount of cordage present, it is likely that this sample could represent a miniature pair of sandals left as an offering in the seed jar.

As mentioned above, some things were put in seed jars as part of the regular ceremonial burial ritual. Other things were put there to represent things needed in the afterlife and, by extension, were things used by the individual in this life. It has been established that there was pottery making going on at the Ewing Site and that the women made most of it. Some of the geologic material in this burial supports this notion, such as the sample of clay paste found in the seed jar. Lumps of clay were buried with some individuals and it is thought that they were meant to represent a gaming ball or the use of clay for pottery. Game ball possibilities are found with graves associated with men and possible potter representations are normally found with women. At the Ewing Site, in burial 8, a male individual was found with potter's clay on a possible kneading or drying slab (Hill 1984:141). It has been established that the woman in burial 9 was found in a grinding pit that may have been used for clay, corn, or both. The lumpy clay-paste supports the notion that she was involved with ceramic production. Further, the limonite, hematite, and pyrolusite found inside the seed jar are common materials used to make paint pigment used in the pottery making process. Considering her place of internment, the evidence points to these items as being important to this woman's character both in this world and the next. The "bigger" flat piece of caliche found in the seed jar may also be associated somehow with the pottery making process, or it could have been a keepsake, or it could be just part of the grave fill.

Although bone tools and awls, as well as bodkins, are a common occurrence as grave good items, it was found that the bits of bone in these samples were probably human and a part of the woman's skeleton. One sample could have represented a large mammal bone, perhaps from a bighorn sheep or deer fashioned into a tool, but in this case the deteriorated pieces of long bone are thought to be human.

Rodent activity played a certain role in the events of disturbance at the grave since the burial proper. As the woman was excavated, it was discovered that some small mammal had chosen her chest cavity as a good place to build a nest. All of her ribs and some of her finger bones were missing. The seed jar was placed in the burial near her chest. The Four Corners area being as it is; hard sandstone formations under thick soils, rodents and ground dwelling animals dig in the least resistive places. In a village or an area populated with people, certain burrowing rodents find the refuse pits and fill in houses prime areas for their homes. Of the animals found to inhabit the Ewing Site areas, it is thought that perhaps a white-footed mouse was responsible for this nest.

White-footed mice are well-known for being comfortable living amongst humans. The size of the nesting area along with the vegetative mat as a representation of the nest itself, is conducive to this creature. Some ground dwelling rodents use their nest generation to generation and leave waste middens from their bodily functions in deposits under the nest. White-footed mice do not,

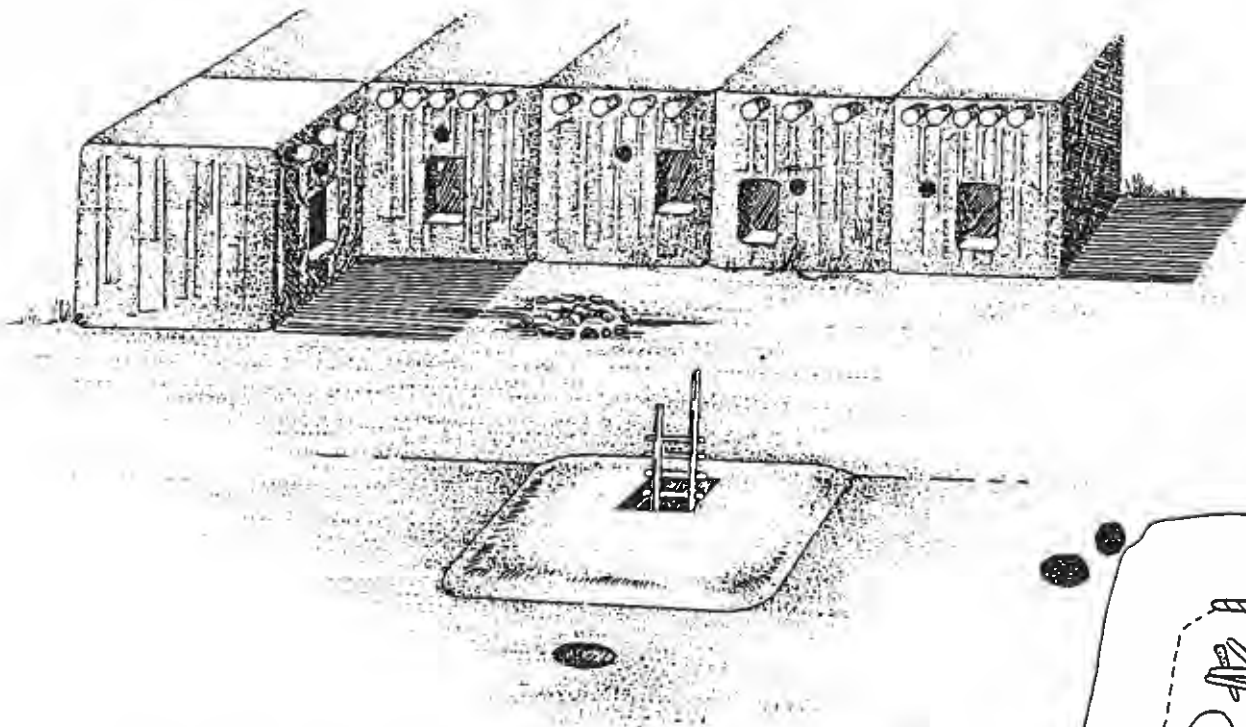


Fig. 5 Underground Pit House with Above Ground Storage and Work Space. Lisa Ferguson, *Anasazi Ruins of the Southwest in Color*, University of New Mexico Press, 1987.

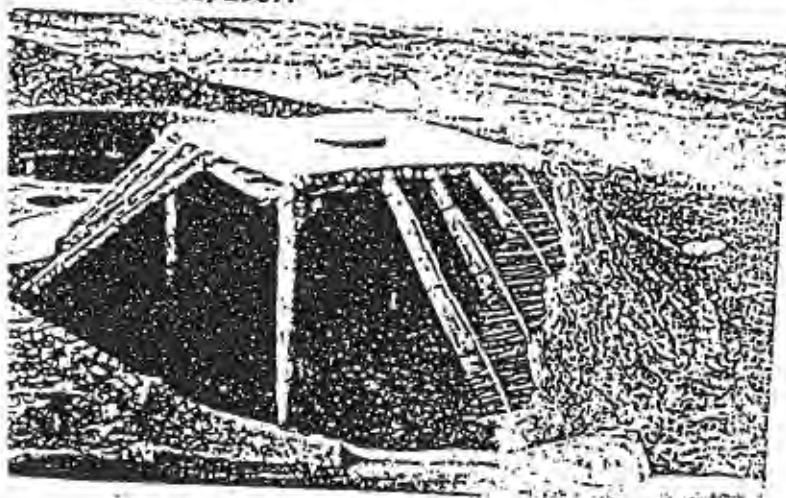
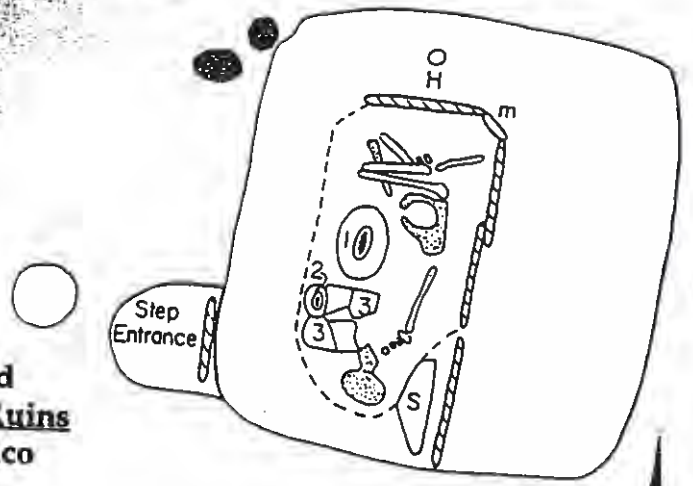


Fig. 6 Semi-Subterranean Pit House. *Anasazi Ruins of the Southwest in Color*, University of New Mexico Press, 1987.



EWING SITE
FEATURE 44



- KEY
- m - Mano
 - H - Hammerstone
 - S - Sandstone Slab
 - - Post Hole
 - - Post
 - - Burial
 - 1 - Seed Jar
 - 2 - Corrugated Jar
 - 3 - Shards From a 2nd Corrugated Jar
 - - Upright Stone Slab
 - - - - Grave Outline

Fig. 7 Pit House with Grinding Bin Area and Burial. Dr. Arthur Rohn

and there was no indication of a midden or sign of extended habitation. The easily dug cavernous quality of the rib cage, and the attraction of the seeds and other food left in the burial probably drew the mouse to that particular spot. Evidence supporting the white-footed mouse would be the small rodent's tooth and the nesting material. However, the sliver of rodent long bone would be too large to be from a white-footed mouse and probably represents food brought in by the nest's occupants.

Also related to the rodent activity is the peritoneum tissue found in the seed jar. Although it is possible that the dried tissue may represent the remains of a food offering, or maybe even a potter's tool (rabbit skin mops were used for surface finishing), it seems more likely that it is left over abdomen tissue from either the mice eating their young or from the body of the woman herself. It must also be said that the mice nesting in her chest probably brought in the variety sample of yucca stoma, juniper and pine wood fragments, root pieces, and bark. These items helped to support identification of some of the other samples in this study.

The beetle carapaces are an interesting inclusion in this burial. Although it is possible that they made their way into the nest on their own accord, beetles play a role in Pueblo medicine as an ingredient in an emetic. Vomiting is part of some purification rites and is a means of separating one's self from dangerous spirits, as well as gaining power either before or after dealing with them. It is also used on lightning strike victims to exorcise unwanted spiritual trouble. The beetle is considered the warrior's pet and is brewed in the medicine of the war-like Snake Society. It also serves as an ingredient in a snake bite antidote. Perhaps most curious of all, in the series of fire pits that the traveler on the trail to the afterlife may have to deal with when s/he meets the spirit sentinel, emergence of the "breath" from the second pit successfully to continue the journey is expressed by the breath taking the form of a beetle. Otherwise, it is on its way to the third pit (Parsons 1974:457,416,192,216). Although the beetle carapaces could have been included in the burial for a number of reasons, it seems most probable that they were there as part of the purification beliefs and symbolic to the trial by fire. It could be, too, that the woman was somehow connected to the Snake Society. Wilder speculations may even include the idea that she met her death through snake bite or lightning strike.

Finally, the vessels themselves must be considered. As mentioned above, miniatures were a way for the Pueblo to include offerings in the burial without feeling like they were wasting resources. It also fits neatly with their notion of the whole following a part, or much from little. There are recurrent tales and myths concerning tiny cups that never empty, or the scrap of food that never lessens. Undoubtedly the miniature pitcher represents a burial offering of something that would always be there for this woman on her journey. Perhaps it was filled with honey, since honey was a stable food offering (Parsons 1974:94,301). Honey may also help to explain the stain on the inside bottom of the seed jar itself.

There were a number of different black-on-white pottery styles that emanate from the Four Corners area, and just how all the renditions of essentially the same

style relate to one another has been a dilemma for archaeologists trying to sort them out. It has been said that much of the pottery was related to the Chaco Canyon phenomenon, and that the black-on-white decorative styles and designs originated there. However, these traits can also be found on pottery a great distance from Chaco Canyon in any direction, and the original stimuli for it has not been determined with any certainty. A great deal of pottery was brought to Chaco Canyon from outlying settlements, so it is possible that the style may have originated elsewhere (Peckham 1990:73,76,72).

Speculating on the meaning of design in archaeology can be just as tenuous as speculating on religious practices. Nonetheless, something can be said about possibilities and that can lead to some kind of further understanding. Through the study of petroglyphs and their comparison with pottery design elements, and along with comparisons of hand signs from both Native American sign language used in the past and American Sign Language used today, some meaning has been associated with certain symbols, designs and patterns. When symbols are combined, they may convey not only their individual meanings, but also a further meaning because of the combination (Cunkle 1993:10,15).

Small right triangles that are solid represent clouds. They may occur singularly or strung together in a line connected by the acute point. If small right triangles are hatched with parallel lines, they are meant to represent mountains, since hatchure lines are the symbol for earth (Cunkle 1993:59). Many connections with clouds have already been made in this study. Being that Cloud People are the ancestors of the living and the breath of the body (or its soul), as well as the source of rain and fertility to the earth, having symbols of clouds on a burial item seems appropriate.

The zig-zag pattern around the orifice of the seed jar may be the most encompassing symbol of all in this study. Beyond most any doubt, it represents lightning, but it could be connected in other ways to different possible meanings in this context. To begin, in some parts of Anasaziland it was thought that the design around a pot was like a "road," or life-path, and if the design was closed into a circle, the life road of the potter would end and she would die (Parsons 1974:93). The pattern on the seed jar is closed.

One of the problems with the icon for lightning is this symbol's similarity to other icons, such as river, confusion/fear, and serpent. Even in the presence of other symbols that include weather elements, it is often inconclusive and hard to interpret. The icon for lightning is thought to hold other nuances of meaning such as virility, strength, or destruction and is not necessarily limited to its association with the coming of rain. Lightning is also thought to represent a pathway (Cunkle 1993:89). Being that the zig-zag lightning pattern in this case has hatchure marks, it could represent a path between the earth and the sky. All of these concepts fit the circumstance of death; fear and confusion over what is to come, a path to another place, closure of the road of life, and elements of the sky where all good Pueblo go to be with their kind when they pass on to the next world.

Summary

To conclude, the purpose of this project was to identify the contents and context of a seed jar placed in Burial 9 at the Ewing Site near Yellow Jacket ruins in southwestern Colorado. The contents, or materials, were identified and supported by testing, and research of the local environment. The context was determined by the burial location at the site and its relationship to other structures and activities that are known to have been present there. Comment on possible reasons for these particular items being placed in the seed jar have been addressed by research and interpretation of Anasazi-Pueblo Indian practices of death and burial ritual as well as concepts of the way they perceive their afterlife.

References Cited

- Beigstedt, C.
1968. Fieldnotes, excavation of the Ewing Site. Yellow Jacket, Colorado.
- Cattanach, George S., Jr.
1980. Long House: Publications in Archaeology 7H, Wetherill Mesa Studies. Washington, DC: National Park Service, U.S. Department of the Interior.
- Cunkle, James R.
1993. Talking Pots: Deciphering the Symbols of a Prehistoric People. Phoenix: Golden West Publishers.
- Hill, David V.
1984. Pottery Making at the Ewing Site. Masters Thesis: Wichita State University.
- Hurlbut, Cornelius S., Jr.
1970. Mineral and Man. New York: Random House. (Third Printing).
- Matlock, Gary
1988. Enemy Ancestors. Japan: Northern Press.
- Parsons, Elsie Clews
1939. Pueblo Indian Religion. Chicago: The University of Chicago Press. (Midway Reprint 1974).
- Peckham, Stewart
1990. From This Earth: The Ancient Art of Pueblo Pottery. Santa Fe: Museum of New Mexico Press.
- Reading, H. G.
1978. (Ed.) Sedimentary Environments and Facies. Elsevier, New York: Blackwell Scientific Publications.
- Rohn, Arthur H. & William M. Ferguson
1987. Anasazi Ruins of the Southwest in Color. Albuquerque: The University of New Mexico Press.
- Rohn, Arthur H.
1996. "Investigators Notes." Work in Progress. Wichita State University.

Rood, Ronald J.

1985. Faunal Remains from Puebloan Sites in the Yellow Jacket District
Southwestern Colorado. Masters Thesis: Wichita State University.

Sofianides, Anna S. & George E. Harlow

1990. Gems, Crystals, and Minerals. New York: Simon and Schuster.

Wormington, H. M.

1947. Prehistoric Indians of the Southwest. The Denver Museum of Natural
History. (Eleventh Printing 1973).

The Role of Religion in the Novel and Movie The Color Purple

Jodi A. Drinkwater, McNair Scholar
Dr. Beth McCoy, Faculty Scholar

Abstract

This project explores and compares the role of religion in Alice Walker's novel and Steven Spielberg's movie, The Color Purple. Both works deal with the idea of religion through the main character, Celie, who in both the novel and the movie, treats God as a confidant to whom she relays the story of her abused and hollowed life in order to make sense of it. Although they have this in common, the novel and the movie use the theme of religion in very different ways. Walker's Celie moves from a fundamentalist, monotheistic, Christian belief in God to a religion that takes on a more pantheistic, humanistic, existentialist view of God. This shift in perspective allows Celie to see God in herself and therefore, heal emotionally. The movie's Celie starts out with the same fundamentalist, patriarchal, Christian view of God and the Bible and then moves to a more encompassing view of God. However, unlike in the book, after symbolic confession and redemption to the religious community, Celie returns to the conservative Christian view of God. The first work has Celie ending in autonomy and independence while the second brings her on a recuperative journey back to where she started--under the control of a larger society. The stark differences between the novelistic and cinematic treatment of religion raise crucial issues about who has ultimate control of Celie and also, therefore, of the system of African-American women which she represents.

Introduction

Alice Walker's novel and Steven Spielberg's movie, The Color Purple, deal with the role of religion in very different ways. Both works convey the idea of religion through the main character, Celie, who approaches God as a confidant by writing letters to this God because she is too ashamed to speak to Him. Relaying the story of her abused and hollowed life, the letters attempt to make sense of that life. Although the novel and movie have this in common, they use the theme of religion to convey different ideas. The book shows Celie as she moves from a fundamentalist, monotheistic, Christian belief in God to a religion that takes on a more pantheistic, humanistic, existentialist view of God. This shift in perspective allows Celie to see God as a loving and accepting "Universe." She is able to see this God in herself and therefore, heals emotionally, which allows her to find autonomy and independence from her abusers. The movie's Celie starts out with the same fundamentalist, patriarchal, Christian view of God and the Bible and also moves to a more encompassing view of God. However, unlike in the book, after symbolic

confession and redemption to the religious community, Celie returns to the conservative Christian view of God. Her move from the original concept of God is short and consequential only in the sense that it quickly directs her back to the more traditional view. The movie brings Celie on a recuperative journey back to where she started--under the control of the larger white, masculine society. She is resubordinated to her victimizing view of God, and her autonomy is limited by the social expectations of her. The stark differences between the novelistic and cinematic treatment of religion raise crucial issues of who has ultimate control of Celie and also, therefore, of the system of African-American women which she represents.

"Everything Want to be Loved"

The understanding of Celie's psychological concept of God in the novel is vital to knowing the implications of the changes made in the movie. From the beginning, Celie is driven to God as confidant. As Carolyn Williams points out in her article, *Trying to Do Without God": The Revision of Epistolary Address in The Color Purple* (275), the only words in the book that are not Celie's or Nettie's are those spoken by her first abuser, rapist, and genitor of her two children, Pa, at the opening of the book: "You better not never tell nobody but God. It'd kill your mammy." The significance of these words are set apart from the rest of the novel in order to show their psychological power over Celie and to set up the connection between Pa and God. From the outset, Celie is closed off from other people and is turned, by her abuser, toward a remote and distant God to whom she tenaciously reaches out in order to make sense of her life--a repetition of abuse, subjugation, humiliation, and loss. Her letters to God are attempts to understand it.

Celie first believes in a God she closely associates with her abuser, Pa. At the outset of the novel, Celie makes this psychological connection. Celie reveals her concept of God in a letter to the very God that she sees as abuser. In her letter, she relays her conversation with her dying mother about her own children:

She ast me bout the first one Whose it is? I say God's . . .

Finally she ast Where it is?

I say God took it.

He took it. He took it while I was sleeping. Kilt it out there in the woods.

Kill this one too, if he can. (3)

God, from whom she seeks comfort, her confidant, the one to whom she reveals her innermost suffering, is also connected, in her psyche, to the perpetrator of the abuse. As Williams notices, Pa is the one who gives her children through violence and the one who takes them through murder (275). To Celie, God is Pa and vice-versa. Her traditional Christian view of God as father--old, male, omnipotent, judge--associates the Entity with her own Pa; therefore, the actions of Pa become, in her mind, the actions of God:

I ast him to take me instead of Nettie while our new mammy sick.

But he just ast me what I'm talking bout. I tell him I can fix myself up for him. I duck into my room come out wearing horsehair, feathers, and a

pair of our new mammy high heel shoes. He beat me for dressing trampy but he do it to me anyway. (8)

Pa is her judge; in his control over her, he is omnipotent. He moves from the position of *man*, in Celie's mentality, to parallel God. Pa's actions work to distort Celie's understanding of God. She cannot distinguish between the violent man of Pa and the distant idea of God. Because all that Celie knows of God is that he is a remote and powerful male, she can only conceptualize Him to be like the men she knows. She has been taught to see God as a man; therefore, she creates him in the image of Pa.

Alice Walker's essay, "In Search of Our Mothers' Gardens," sheds light into the character of women like Celie:

...black women whose spirituality was so intense, so deep, so *unconscious*, that they themselves were unaware of the richness they held. They stumbled blindly through their lives: creatures so abused and mutilated in body, so dimmed and confused by pain, that they considered themselves unworthy even of hope. In the selfless abstractions their bodies became to the men who used them, they became more than "sexual objects," more even than mere women: they became "Saints." Instead of being perceived as whole persons, their bodies became shrines: what was thought to be their minds became temples suitable for worship. These crazy Saints stared out at the world, wildly, like lunatics--or quietly, like suicides; and the "God" that was in their gaze was as mute as a great stone. (232)

Celie is deeply spiritual in the sense that she is a wonderful creation meant to commune with God, but she does not know it. She is unable to see the beauty within herself. She sees herself as deserving the violence she receives and knows no other way to see herself. She has to believe what she is told both directly and indirectly: Her worth is derived from the function she is to others.

To the men that used Celie, she is merely an object, but what she cannot recognize about herself is that she is a temple, holy and sacred, a place wherein to meet a Creator separate from the God she has learned about in church. This God of church is able only to accept Celie when she is perceived by the religious society as clean and respectable. Celie neither sees herself as pure, nor worthy of dignity. This God cannot accept Celie and she believes she is unworthy of the attention of God.

Celie is loyal to the God who does not notice her. She is faithful and persistent in trying to please God and Pa. She allows herself to be broken in body and spirit in order to fulfill her religious and life obligations. After she marries Mister (more accurately she is sold like the milk cow that accompanies her) she explains to Sofia why she accepts his beatings without question:

Bible say, Honor father and mother no matter what Then after while every time I got mad, or start to feel mad, I got sick. Felt like throwing up. Terrible feeling. Then I start to feel nothing at all. . . .

Well, sometime Mister git on me pretty hard. I have to talk to Old Maker.

But he my husband. I shrug my shoulders. This life soon be over, I say. Heaven last always. (44)

Celie's view of God reinforces her victimization, and works to subjugate her to her abusers. Her religion tells her to submit to those who would rend her soul, batter her body, and violate her sexuality. She represses her rightful anger until it comes out of her physically. In an attempt to do what is acceptable to her religion and to those who have control of her life, she unknowingly assists in her own destruction. Again, to the psyche, a God who requires such passivity to personal suffering must be a victimizer as well. If through this passivity, taught by her victimizers and her religion, the abuse is allowed and fostered, then her religion is an accomplice to her abuse and thus the view of religion causes the distorted connection between Pa and God. Without the passivity, the abuse could not thrive; without the religion, her passivity would not continue to be reinforced.

Celie's religion which causes her to submit more easily to her abusers is propelled by her isolation from other women, another aspect of her life controlled by her perpetrators. Celie is alone and just trying to survive: ". . . I don't know how to fight. All I know how to do is stay alive" (18). Mister keeps Nettie's letters from reaching Celie which adds to her aloneness. When Celie learns about Shug, Celie begins to change. Shug enters Celie's life even before Shug knows about Celie's existence. Celie gets an announcement with a picture of Shug on it, and the womanly concept of God begins to emerge in Celie's mind, although not overtly connected with God yet. Celie begins to worship this dark, black, beautiful, rebellious woman. She admires Shug far beyond the point of respect, even fantasizing about the glamorous singer during the sexual violations from Mister. Shug works her way into Celie's mind with such intensity and force that Celie is able to begin escaping her suffering before she even meets Shug. After meeting Shug, Celie begins to heal even more. Williams explains in her article:

Sexuality in this novel represents the principle of transference, substitution, and internalization. As Celie learns to love Shug, she finds her mother, sister and lost babies within. (279)

But after meeting Shug, Celie not only finds the lost women of her life in herself, she also begins to see a fresh, womanly concept of God which comes out in Celie's admiration and worship of Shug. Shug begins to substitute for God, and Celie begins to be "born again" into life and into a more personal religion. Her description of Shug reflects the woman's power over Celie's mind:

She got the nottiest, shortest, kinkiest hair I ever saw, and I loves every strand of it. The hair that come out of my comb I kept. (55)

This personal, intense connection with Shug not only draws Celie's mind to link Shug with God but also directs Celie back to herself where she sees the connection between herself and this new God. This God has knotty and kinky hair like herself; she can touch her new God unlike the remote distant God of the Bible: "I wash her body, it feels like I'm praying" (51).

Celie's worship of this new God comes out in a sexual way. Her first sexual feelings in her life come out toward Shug, another way in which Celie is beginning

to come to life. Celie's newly discovered sexuality is connected with the spirituality that has been struggling inside of her against its own death. This sexuality and spirituality is Celie, the Celie that has been denied until now. These new feelings do not fit into her old idea of God, yet to deny these feelings would be to deny the essential part of herself. These feelings are leading her to an unconscious decision--the decision to choose between herself and the concept of God that victimizes her.

As Celie is able to see a more female God and expand her concept of God, she is able to begin to heal her sexuality:

Something bout it, maybe the little tender veins I see and the big ones I try not to, make me scared. I feel like something pushing me forward. If I don't watch out I'll have hold of her hand, tasting her fingers in my mouth. (53)

At the same time that Celie is having her concept of God challenged, her sister Nettie is having to reevaluate her beliefs. In her letter to Celie, coming from a strict fundamentalist belief as she is a missionary in Africa, Nettie relays her reaction to a question asked her by a villager that is basic to the theme of religion in the novel:

We know a roofleaf is not Jesus Christ, but in its own humble way is it not God?

So there we sat, Celie, face to face with the Olinka God. And . . . all that Joseph said made perfect sense to me. (160)

Even Nettie, who lives the fundamental, Christian experience recognizes the possibility that God cannot be contained within the confines of a mere book. She sees how a different culture could conceive of the same God she worships. This is an echo of Celie's conversion to a more pantheistic view of God in nature. The more fundamentalist sister is noticing the various forms that an infinitely complex, incomprehensible God could take. She is open to the vast potential of such an immense God and is recognizing the possible justification for a more existential view of the Creator. In the meantime, Celie is beginning to reject her traditional view of God because the church's confined understanding of God does not satisfy the needs of her complex suffering:

Dear Nettie. I don't write to God no more, I write to you.

What happen to God? Ast Shug.

Who that? I say. . . .

All my life I never care what people thought bout nothing I did, I say. But deep in my heart I care about God. What he going to think. And come to find out, he don't think. Just sit up there glorying in being deaf, I reckon. But it ain't easy, trying to do without God. Even if you know he ain't there, trying to do without him is a strain. (199-200)

Celie struggles with the feelings of isolation she has had throughout the novel that she has only just now acknowledged. Celie's isolation stems from the understanding that God exists, he just does not acknowledge her because she is a poor, black, woman. To Celie, He is absent. Her struggle now, is to accept that the Creator exists but is dead to her. She knows she must learn to live without Him

until she realizes that the God she has believed in thus far is not God, but a god created in the image of man.

Until her relationship with Shug, Celie was so isolated from love, understanding, or support that she was unable to rebel against the traditional view of religion she has been taught. She depended on her traditional concept of God to carry her through, but this view was not enough to make her feel a living God. She realized that her concept of God was unfulfilling to her. She realized that all along she had been thinking of God as a man:

Anyhow, I say, the God I been praying and writing to is a man. And act just like all the other mens I know. Trifling, forgetful and lowdown. (199)

This is the key to the revision of her understanding of God. Once Celie realizes how even God was a victimizer in her mind, she is able to change her concept of "It." With the help of Shug, she learns her new idea of God:

Here's the thing, say Shug. The thing I believe. God is inside you and inside everybody else. You come into the world with God. But only them that search for it inside find it. And sometimes it just manifest itself even if you not looking, or don't know what you looking for. . . . (202)

once Celie understands that God is inside her, that it is all around her and wants only to be loved by her, she begins to see herself a new way. This is the freeing moment for Celie. This is the moment she can begin to love herself. In this empowering understanding of God, Celie moves away from her victimizers. She begins the process of obliterating them from their distorted connection with God. And in the process of her shattering that link, God moves out of the sphere of being punishing, judging, victimizing man, to that of nature where God is a tree, a flower, a rock just wanting to be loved. She is important to the universe. This new understanding of the Creator causes a loosening of her abusers' power over her, and she is beginning to become a new person. This new insight acts as the catalyst for her leaving Mister which is her greatest step toward autonomy. This revised concept of God, therefore, is the direct factor that brings about Celie's liberation from her oppressors.

"Trying [Not] to do Without God"

The movie does not develop the psychological connection Celie has made in the novel between her rapist, abuser Pa and God, her confidant. Instead, the movie leaves out any suggestion of a connection there. The movie allows for not identifying the abuser with God:

Now I got two children by my daddy, a baby boy call Adam He took while I was sleeping, and a baby girl, call Olivia that he took right out my arms. . . . I don't think he kilt my baby boy. I heard he sold it to a preacher and his wife.

Without the initial connection between Pa and God, there is no way to see the immensity of Celie's religious journey away from the traditional God and how vital it is to her mental health. The movie gives Celie God to aid her in her battle against

Pa and later Mister so that she does not have any reason to move away from Him, to doubt Him, or to rethink Him. He is merely the silent presence who reveals himself in church after the suffering is over. Without the connection to God as abuser, the movie does not have to take responsibility for saying that the fundamentalist Christian view worked to victimize Celie. The movie avoids showing any connection between the abuser and God for reasons that may include attempting to spare its audience the discomfort of seeing the association between the Christian church and the victimizer.

Celie remarks in the words of a loyal victim to Sofia in the movie merely: "This life soon be over, heaven last always." The scripture quoted in the novel instructing to honor parents, is conspicuously left out of the movie. This works to focus on the passivity of Celie's spirit without suggesting any responsibility on the part of the fundamentalist Christian faith. This idea shows a faithful, steadfast victim ready to accept her fate without anyone to blame. In fact, the movie would like to blame Celie for her own fate. Because she does not stand up to her abusers she can be the one at fault. Yet the larger system works to force her under the control of those very abusers.

The movie negates Celie's relationship with Shug and in so doing breaks the religious quality of the union. Their sexual interaction is treated as a passionate mistake, a fluke which means nothing more than a wonderful friendship run rampant. The religious psychological connection of the book is non-existent. Shug is not in any way suggested as linking to God. She is not a god, nor a pathway to a new god. Unlike in the book, the movie's Shug is not even liberated from the control of men.

A very odd addition is found in the movie which is not found in the book; Shug has a Pa. He is a phantom character who appears only in the movie and is a vital tool in working to bring the women back into the control of the dominant society. In the bathtub scene, instead of Celie admiring Shug's "long black body with it plum nipples (51)" that makes Celie think she must have turned into a man, Shug talks about her father, the local preacher who has disowned her because she is a "nasty woman" and is not a part of the Christian community. Shug's Pa is the dominant male force and religious force that controls, shames, and punishes Shug for her independence of spirit:

Children gots to have a Pa (*quivering lip*)...

Your Pa love you? My Pa loved me. My Pa still love me cept he don know it. He don't know it (*She begins to cry*).

The movie sets up this early connection between Shug and her Pa so that Shug has a weakness that is strong enough to pull her, and Celie with her, back into submission to the larger Christian society. In the book, Shug has no weakness for men that works to undermine her independence, but the movie needs male dominant control in order to accomplish making the women choose to be back under control of the larger social structure.

Harpo's juke-joint and the church are overt symbols for the struggle between socially perceived good and evil. Harpo's contains the evil characteristics that

incorporate independence, freedom, self-affirmation, revelry, and sensuality. The church across the creek contains the socially perceived good characteristics that loudly denounce Shug and Harpo's juke-joint. The church has the good qualities of upholding righteousness and order, maintaining submissiveness to a hierarchy of men, and requiring subjugation to a larger system of values which deny the independence, autonomy, and free thought of the women of the movie.

Eventually, Harpo's juke-joint enters into a symbolic battle with the church that sits 200 yards away. Harpo's is the sensual, wild, bawdy "hell" of the movie, while "heaven" lies just the other side of the creek. There, the angelic choir tries to drown out the "devil music" Shug sings, and Shug's daddy preaches feverishly against her. Eventually, the church wins the symbolic battle over the perceived wickedness of Harpo's.

Just after the scene in which the sexual encounter between Shug and Celie is suggested, we see Shug walking straight for the church to speak to her father. Alternating the sex scene with the church scene, in which Shug reaches out as a sinner to her father and is rejected, works to alleviate the fears of any audience which might be uncomfortable with the direction suggested by the previous scene. It quickly puts Shug in a place which would be more comfortable to a conservative audience, the place in the view of this audience, of unforgiven, unworthy sinner. She is scorned, rejected, and humiliated as if her sins in the view of the church were being punished. She is made to suffer for functioning outside the approved practice of the societal structure.

Another point the movie takes which openly defies the perspective of the novel, has Shug half-defending Mister when Celie admits to her that he beats her. Shug replies heartlessly: "I know he a bully, but there's still some things I love about him." Instead of the outrage and disgust Shug feels in the book, she suggests, between the lines, that Celie should try and understand. This gives a strong message to the audience that says that Mister is in some way excusable for his actions; thus justifying the abuse Celie receives at his hands. Later in the movie, Shug betrays Celie by abandoning her with her abuser. Shug shifts from being a freeing force for Celie to becoming an accomplice to her abuse. In contrast, at this point in the book, Shug promises she will not leave until she knows Albert will no longer abuse Celie (79). The movie takes many liberties in shifting the healing process of the book into a large scheme of revictimization.

In the movie, Shug and Celie take steps toward becoming acceptable in the view of the male-dominated, Christian culture. Shug marries Grady and stays with him until the end of the movie, dispelling any future worries of the women lapsing into lesbianism. (In the book Celie and Shug did not have their affair until after Shug was married).

The ending works to bring both women back into the society in a manner that is more satisfactory to that society and more within the norms of the fundamentalist Christian community. In one of the last scenes, Shug is singing at Harpo's while the choir is singing at the church across the creek. Suddenly, Shug stops in the middle of her song to Celie--"Sister"--and starts to sing "God's trying to Tell You

Something." She walks across the bridge while the band and a crowd follows her. She is singing the entire way. Once to the church she bursts through the doors, crowd behind her, stopping the choir and the church with her beautiful and loud voice. She begins to cry, runs into her father's arms and says: "See Daddy, sinners have soul too." He hugs her and Celie, in the background, looks on in approval. The crowd claps and sings.

With this rather dramatic act, the two women are purged of their "sins" and readmitted into the church society. They are washed of their lesbian affair, their rebellion against men, and the other deviations from the Christian "norm." They are brought back under the control of the larger society that they rebelled against for a while. And thus, the women are brought directly back into the position of submission to the all-male and largely white hierarchy. They are being victimized on a grander, more ominous level which denies the emancipation of the women of the movie.

Conclusion

The movie works to resubjugate Celie and Shug to the White God of the beginning of the novel. The victimizers, at the last, have won. In comparison to the book, Celie and Shug rebel against the social structure only to a mild extent. After the symbolic confession and redemption of the main characters, Shug and Celie are reintegrated into the Christian community along with their places of victimization in the social hierarchy. Their friendship is turned into a pious and respectable supportive female relationship instead of a passionate life-long love relationship. The consequences of such changes, intentional or not, are that the autonomy, and process required to achieve it, reached by Celie in the novel are never achieved in the movie. She remains a victim who has found a permanent place in her state of victimization, and less aware of it. She has been made satisfactory in the view of the very society that wants to use her. She has been compromised while given a new hairstyle and fancy clothes. The movie gives the impression that Celie's life has been improved by giving her a retail shop through which she can earn money--the prime factor of value in white, male-dominant society. But her soul is still entangled in the web of oppression that has been spun throughout the story, only the web she steps into at the end is much more sinister because it is made to appear to be the release of her soul into freedom when really it is the opposite. She has been forgiven by the very people who need forgiveness. She is accepted by those who will never truly accept her. Walker explains the resubjugation of the characters and the overall society which allows such a movie to give such blatant messages to victims to submit to society's expectation at the expense of the individual souls in her essay, "In Search of our Mothers' Gardens:"

They forced their minds to desert their bodies and their striving spirits sought to rise, like frail whirlwinds from the hard red clay. And when those frail whirlwinds fell, in scattered particles, upon the ground, no one mourned. Instead, men lit candle to celebrate the emptiness that remained, as people do who enter a beautiful

but vacant space to resurrect a God. (232)

The movie works to deny, even destroy the spirits of Celie and Shug. In its failure, the movie works to confirm the issues that are central to the novel--that what society deems proper, and appropriate sometimes wins over the truth of the single person's suffering.

Works Cited

- The Color Purple*. Dir. Steven Spielberg. Warner Bros. and Amblin Entertainment. 1985.
- Walker, Alice. *In Search of Our Mothers' Gardens*. 1983. Harcourt Brace
- Walker, Alice. *The Color Purple*. 1982. Simon & Schuster. NY: NY.
Jovanovich, NY: NY.
- Williams, Carolyn. "Trying to Do Without God.": *The Revision of Epistolary Address in The Color Purple*. *Callaloo: A Journal of African-American and African Arts and Letters*. 1989. Baltimore, MD.

My Experience with SPSSX and the McNair Program

Sara Fisher, McNair Scholar
Dr. Kathleen O'Flaherty, Faculty Scholar

Abstract

This article is about a learning experience. The article goes through the experiences of the student, the objectives established and the path taken to reach those objectives. The objectives were to develop a code book for the faculty scholar and to gain the skills necessary to work with the SPSSX software package. This report goes through the steps taken while working with two data sets. The first data set required only the generation of statistics while the second data set required extensive coding and program development. The experience was a success. A code book was developed as were skills that could be taken to graduate school.

Introduction

My experience with the McNair program was a very positive one. As the project wraps up with this paper, it becomes clear how much I have learned in the course of a semester. I have greatly improved my computer and data analysis skills. The McNair Shadow-A-Scholar program has proven to be an advantageous opportunity.

I was presented with the opportunity to choose my faculty scholar. The choice was not a difficult one--Dr. O'Flaherty in the Sociology Department at Wichita State University was my chosen faculty scholar. This decision was based on my classroom experiences with Dr. O'Flaherty, including a statistics class--a frightening concept that had been made fun by Dr. O'Flaherty. The first meetings were to discuss Dr. O'Flaherty's work and projects that might be "workable" for the McNair program. Additionally, the meetings addressed what computer, statistical and research skills that I felt Dr. O'Flaherty could assist me in developing. Well aware of my computer anxiety and the need to overcome it, this became an opportunity to develop skills in that area. I was, however, unaware of how very important this experience would be for my future study until I had both feet in.

SPSSX, the Statistical Package for the Social Sciences is a tool that would ultimately need to be mastered now or later, as it is a basic tool for social science research. Fortunately, I was able to develop basic skills as an undergraduate, thanks in part to the McNair Shadow-A-Scholar program. Mastering the basic skills of SPSSX assisted me in gaining a graduate research assistantship at Kansas State University. I look forward to expanding my computer data analysis skills as I further my education.

The project objective became to develop basic skills and knowledge in the understanding of the analysis of question-based data and the use of SPSSX. The

project was a transition from undergraduate to graduate school, a hands-on learning experience of quantitative analysis skills. "Quantitative," as the American Heritage Dictionary of the English Language defines it is, "of or pertaining to numbers," therefore, I would be working with numbers and "quantities."

The project involved two data sets, one generated from a Sociology 111 class, the other from a needs assessment of a local church-sponsored not for profit agency. I am able to refer to the Sociology class but not the needs assessment data, as it is not property of the university and the board of directors of the agency has not yet been privy to the findings.

After having the objectives established, the learning began. The first step involved becoming familiar with the language of the computer system--CMS, as well as developing several practice files to become accustomed to the keyboard and computer commands. File construction involved adding, deleting and filing--very elementary tasks had to be mastered first. The next step was to become familiar with the software package itself. Dr. O'Flaherty allowed for the use of her manual to the SPSSX software, from which various reading assignments were given. The following meetings were then to discuss what was read and address any questions.

SPSSX consists of three parts: data definition, data transformation commands and procedure specification commands. Data definition commands do simply that, they define the variables and identify their locations in the data file. These commands include variable labels and value labels. Data is presented into the computer as strings of numbers. The data definition commands specify which number represents which variable. For example, data definition commands specify that column five and six indicate the respondent's age. If the respondent has indicated that he/she is seventeen years old, columns five and six will be one and seven. If the respondent indicates that he/she is six years old, the columns will be a zero and six, accordingly. Variable labels identify the variable in question by allowing up to an eight letter code. Value labels identify the given response to a question by up to a forty character code. Both variable and value labels will be addressed further in this paper.

Data transformation commands are used to restrict analysis to a subset of cases, create new variables and modify existing variables. Common transformation commands include the "recode" command which combines two or more values, that may influence statistics one way or another. For example, a common use for the "recode" command is age. Assume all respondents indicated their specific age as such: 14, 19, 29, 34, 46, 57, 63 or 70 years old. The researcher might be interested in the responses by age category such as 0-20, 21-40 and 41 and up and so forth, the recode command could be used to recode the given responses into the desired categories of 0-20, 21-40, and so forth. Transformation commands allow the researcher to manipulate the data for generating statistics.

Procedure commands indicate what statistics or tables are to be produced. Procedure commands include, among others, "missing values" and "frequency" commands. The missing value commands tell the computer what to do with the data that the user identifies as missing or unusable. For the project at hand, missing

values were assigned a value of nine. In other words, every time the user ruled that data was missing, either unanswered or inconsistent with the other data, a nine was inserted for that value. Using the example of age from earlier, if the respondent did not answer the question, a 99 was inserted. Frequency commands tell the computer to generate frequency tables to express, in table form, how many respondents indicated a specific answer. For example, how many people indicated that they were male or female, or that they were a freshman, sophomore, junior or senior in school. Frequency commands can be used for any or all indicated variables. As the project progressed, all three types of commands were used, some more than others. In short, procedure commands tell the computer what to do.

The first data set that I worked with was the Sociology class data set. The work with the Sociology data set proved to be a much simpler project than the latter. At this stage, a "code book" or coding system had already been developed for the data set and the respondents' information had also been entered into the computer. The task was to develop the data file, which consisted of variable labels and value labels, both taken from the code book. Variable labels identify the question being responded to, while value labels identify the responses to the question asked. Variable labels must be no more than eight characters long, while value labels may be no more than forty characters long. Also, part of the entry process is the identification of the location, or column number of the variable within the data file. For example, if a variable such as "status in school" is identified as being in column three, in the third column one would find a numerical value corresponding to the respondent's answer to "status in school." If we assume the value labels for this particular variable are 1=freshman, 2=sophomore, 3=junior, 4=senior and 5=graduate, and the number found in column three is 4, then the respondent answered that he/she was a senior to the above mentioned question.

After entry of the data file, it was necessary to analyze the frequency distribution tables. This included discussion of the level of measurement and any visible patterns. Development of cross-tabulation tables for selected variables was next, a procedure command. Cross-tabulation tables identify relationships between variables. Cross-tabulation tables generate percentages that can be used to test the significance of the control variable. For example, by generating cross-tabulation, one can test the significance of a respondent's age to his/her use or lack thereof of marijuana. A cross-tabulation would indicate if a certain age group was more or less likely to have used the substance than another group. A write-up of the cross-tabulation tables would include a discussion of the level of significance and any variable relationships.

The final task with this data set was to recode indicated value labels, a data transformation command. Next, was the regeneration of the desired statistics to identify if the relationship among the variables had changed. In the final analysis, the recoding process did not produce a significant difference.

Work with the second data set was a bit more complicated than the first. I was presented with a needs assessment questionnaire from a local not-for-profit agency. The first task was to develop the code book or coding system. The process

began with identifying the questions most pertinent to the data analysis. Next, the questions were assigned an eight character variable label. Caution was taken so that the labels were not too similar, too long or too abstract. The job of data analysis is made easier if the variable labels somehow represent the questions being asked. For example, if date of birth is requested, DOB is a good variable label, also if "age at first sexual intercourse" is requested AGESEX might make a good variable label. In the end, the development of the code book required three revisions. As part of the code book, value labels were also assigned. Unlike the first data set that offered the respondent possible answers from which to select from (multiple choice type questions), this data set was made up of many open-ended questions from which a "roster" was developed. The roster was developed based on fifty questionnaires, one sixth of total respondents. The remainder of the questions, designed by the agency, were "yes" or "no" questions.

The second step was to enter the data and generate statistics. This would test the code book and identify potential problems. The first fifty questionnaires were entered using the newly developed coding system. All the data was numerical in nature--simply a list of numbers. Each row of numbers is called a record. Each record could be no more than eighty numbers long. Therefore, data that is said to be two records long is two rows of eighty numbers long. To avoid having to reenter data, one should be sure not to make each row eighty numbers long, rather seventy-five or so. This is so that mistakes are easier to fix as there is space for additional numbers in the records.

After the responses were entered (the rows and rows of numbers), the data file was developed. Again, this included the variable labels and value labels. This was the same task as was done with the first data set except this time I was using my own system instead of a multiple choice type survey. Following the entry of the data file, the computer was commanded to generate the statistics of mode, median, mean and range. These are all procedure commands. The final procedure command was "finish" which instructed the computer that the task was complete.

The purpose of the project was to develop a system or code book that Dr. O'Flaherty could use to generate more statistics to provide information upon which to draw conclusions about the clientele and services of the particular agency. The data set was quite problematic, requiring that special attention be paid to the next step known as data cleaning. I regret that time did not allow me to take this project further into the recoding process, as there was much to be done. However, I was able to develop skills that enabled me to diagnose problems within a data set.

The project objective was to develop basic computer skills and an understanding of the analysis of question-based data. This was successfully done. The experience was a positive one that afforded learning more than just computer and statistical analysis skills. I learned about my prospective profession as a college professor. In conclusion, I think that I will enjoy my prospective career and the road that will take me there.

Ergonomic Evaluation of a Computer Console on a UH60 Helicopter

Dishayne T. Garcia, McNair Scholar
Dr. Hugh Murray, Industrial Scholar

Abstract

This report contains results of an ergonomic evaluation of a computer console design, to be installed on a UH60 helicopter. Anthropometric data of the general armed forces along with the military human factor design guidelines was utilized. Recommendations are made with respect to the design of the console citing the specific military sections that governed. The project was never completed, therefore the recommendations were never fulfilled.

Introduction

The need to effectively detect and identify Biological Warfare (BW) agents became very apparent during Operation Desert Storm (ODS). In order to protect itself from potential threats, the national military strategy specified a world-wide force that could detect BW agents. The CPLidar program was part of the comprehensive Biological Defence Program approved by DOD. The CPLidar program was to provide commanders with an effective system to detect the presence of a BW aerosol cloud¹. As of mid-winter, the CPLidar program was canceled

The CPLidar was to be mounted on rotary-wing aircraft (UH60 Helicopter). The platform for the data collection system is mounted in the helicopter and consists of a computer monitor and console. The helicopter baseplate has a number of prefabricated connection holes that are used to mount or fasten objects to the helicopter bed (figure 1), thus limiting the options available to place the console. The 54-B is the unit that would be operating the console and the helicopter.

The purpose of this paper was to update the human factor's information on the CPLidar console. Specific areas of interest were recognized and this information will primarily focus on these areas. Specific areas of interest were:

1. Monitor Specifications
2. Monitor Location
3. Console Location
4. Trackball Location
5. Anthropometric data (body measurements) on the 54-B
6. Hand Clearance needed to adjust bolts on the baseplate
7. Acceptable hip room
8. Can uniform compressibility be assumed?

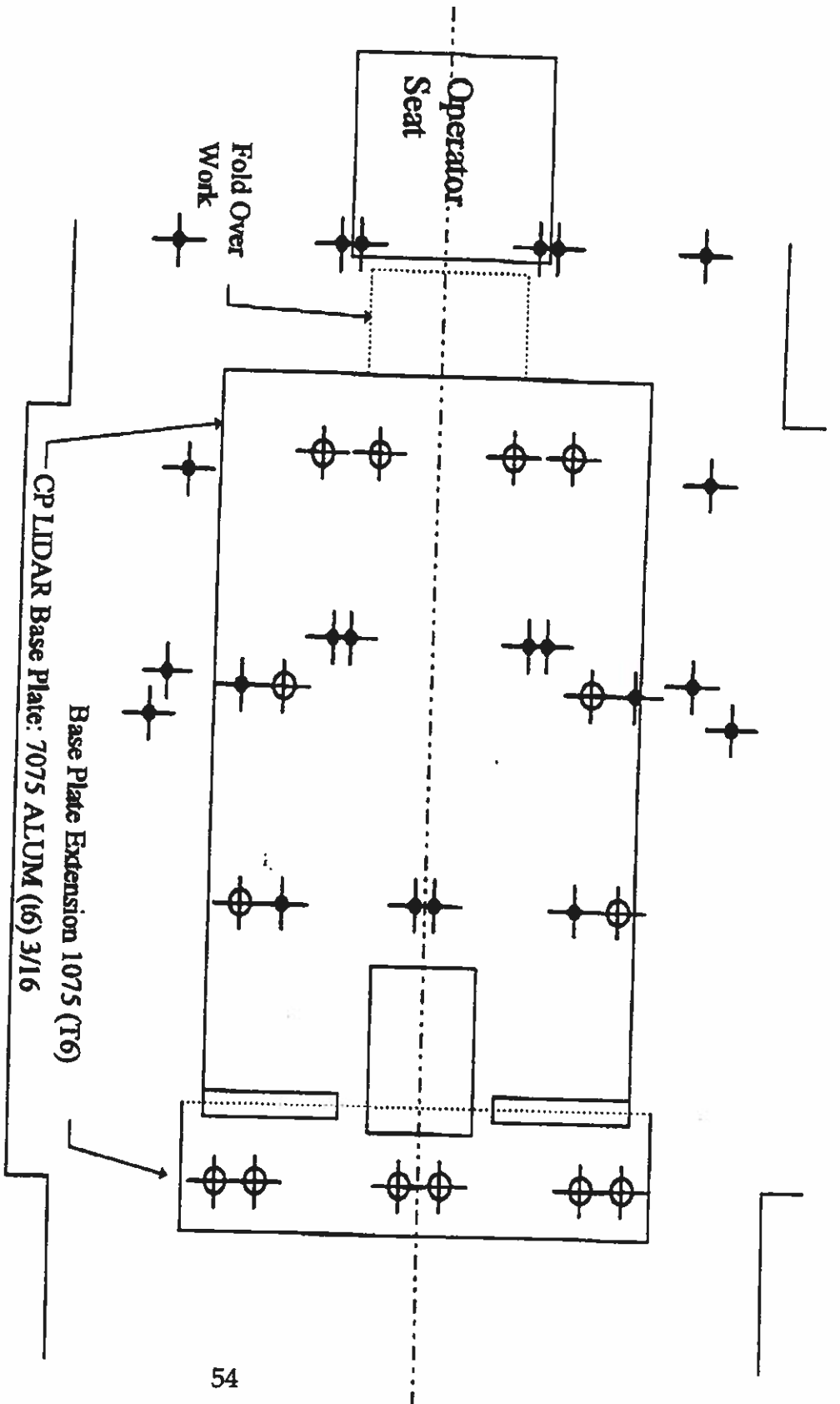


Figure One: Base Plate

This was a proactive project, meaning recommendations would be made on a design not yet completed. Therefore, some assumptions had to be made.

1. The anthropometric data on the 54-B is comparable to the 5% to 95% male in the United States general forces
2. No women are in the 54-B
3. Monitor will be placed on the slanted surface of the console and will be centered
4. Flat screen monitor will be used
5. Midpoint of the screen is used for all distance measurements used in this report

Methods

The general methodology used for this report was to 1) become familiar with general ergonomic principles and tools, 2) become familiar with military and government documentation on the 54-B and the military's ergonomic regulations, which includes the anthropometric data and, 3) recommend design specifications.

A. Ergonomics Overview

Ergonomics is defined as the study of design of the workplace, equipment, machine, tool, product, environment and system, while taking into consideration a human's physical, physiological, biomechanical and psychological capabilities². The goal of ergonomics is to optimize the effectiveness and productivity of work systems while assuring the safety, health and well-being of the workers. The most important concept is to fit the task to the user.

The basic ergonomic model consists of the human, task, and environment. These three components put constraints on the human capabilities and the task demands. Figure two is a graphical representation of the model. The ergonomic components all work together and are evaluated as a system. If the system accommodates more than the 95% of the evaluated population, then the system passes. The two controls available are engineering controls and administrative controls. In the past, administration controls were invoked due to ease. The wisest choice is to start with the engineering controls, primarily due to the rapid change of administration. Ideally, the engineering change will last longer and correct the root of the problem, not simply provide a Band-Aid. Therefore, if the model does not accommodate 95% of the ergonomic model, then the question is asked if engineering changes can be made. If so, the model is re-evaluated.

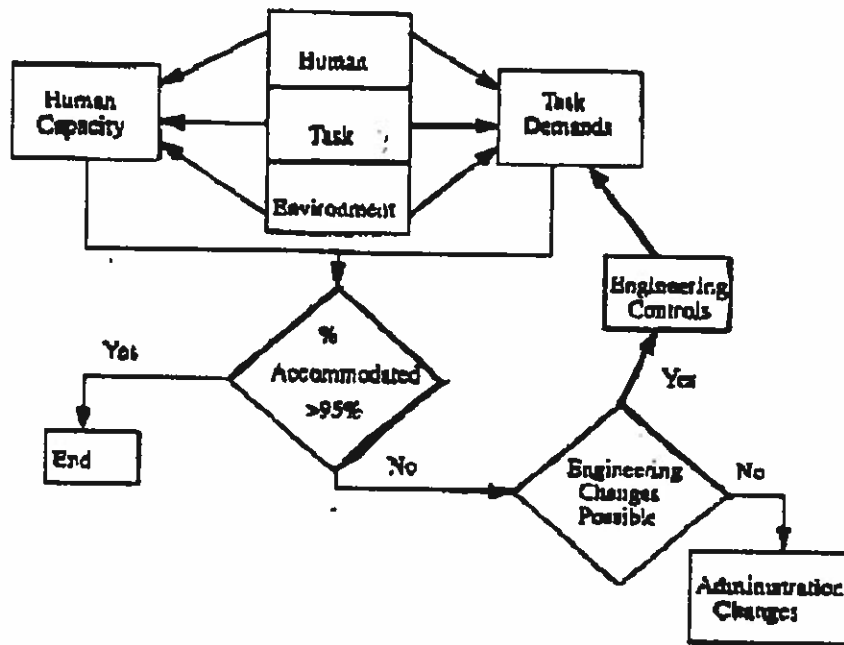
Engineering changes consist of but are not limited to: light, noise, climate, equipment and workstation dimensions. If engineering controls are not possible then administration controls are evaluated. Administration controls include but are not limited to: job sequencing, new equipment and training.

Ergonomics has been the subject of many studies that show its significance in the reduction of Cumulative Trauma Disorder (CTD). CTD is defined as the wear and tear on tendons, muscles and sensitive nerve tissue caused by continuous use over an extended period of time. The key word is "cumulative," meaning

something that happens gradually over time³. CTDs are accountable for almost 40% of all workers compensation claims⁴. The average cost of a CTD case is \$15,000.00, which includes lost time, retraining, and loss in productivity by injured workers. The average cost of disability claims is another \$30,000.00 to \$60,000.00¹. Therefore, the average total of a CTD case can be up to \$75,000.00.

Basic Ergonomic Model

Basic Ergonomic Model



Traditionally, an ergonomic evaluation consists of assessing the work risk factors through anthropometric data, workstation measurements, interviews and body part pain discomfort problems, there are no interviews or discomfort surveys available.

Work risk factors consist of workstation measurements, workstation location, environment characteristics and task characteristics. Once the work risk factors are assessed, recommendations are made utilizing engineering controls and then administration controls. Training and follow-up concludes the evaluation.

The nature of this project, being proactive, means that the recommendations were to the design of the console with respect to the environment. A helicopter is not an environment that is easily changed. A major consideration to this evaluation was that the seat was fixed. There was no changing the actual seat or its position and the operator was securely fastened. This meant that the controls and everything that needed to be obtained by the operator had to be in the reach of the operator. This was the driving point in determining the anthropometry of the 54-B.

Although this information could not be released, anthropometry on U.S. Male soldiers was obtained and shown in the results section in table one.

B. Military and Government Documentation

Locating the documentation that contained the pertinent information was very difficult. The military produces a sizeable library yearly. The MIL-STD 1472 document was found through a military database. This document is the human factor guide for general military units. It contains regulations and anthropometry of general armed forces for both men and women.

Results and Discussion

A. Anthropometric Data on the 54-B

The anthropometric data on the 54-B could not be released due to lack of time to investigate. The 54-B is a very unique unit in the armed forces and therefore was not in any of the general military documents that were investigated. Special permission to request this data was in the process. The military document AR-611-201 contains information on the 54-B classification. A portion of this document contains information on the 54-B and lists the following as some of the physical requirements:

1. A physical demand rating of "very heavy"
2. Physical profile of 122221
3. Frequently pushes and pulls 474 pounds, 3 feet (task may require two soldiers)
4. Constantly raises from horizontal to vertical position, 237 pounds, 3 feet
5. Occasionally lifts and carries 86 pounds approximately 50 feet

The full document was being sought after, plus any document that might have a description of the physical profile of 122221. Table one is a compiled list of anthropometric measurements of male soldiers in the general armed forces⁵.

Table One: Compiled Anthropometric Data (Ref. MIL-STD-1472D)

Percentile Values in Inches General Forces			
# Refers to the measurement number according to MIL-STD 1472D			
#	Measurement Description	5% Male	95% Male
12	Functional (Thumbtip) Reach	28.20	34.90
17	Eye Height Sitting, Erect	28.70	33.50
24	Elbow Rest Height	7.20	11.30

25	Thigh Clearance Height	5.40	7.50
26	Knee Height, Sitting	19.70	23.90
27	Popliteal Height	15.60	19.70
24+27	Elbow Rest Height (from ground)	22.80	31.00
28	Buttock-Knee Length	21.70	26.60
33	Buttock Depth	8.30	11.30
37	Forearm-Forearm Breadth	18.80	24.40
62	Foot Length	9.70	11.50
71	Head Length	7.20	8.30

B. Console Location

The CPLidar cabinet had a 30 degree surface where the monitor would have been placed. There were two locations where the base plate would have been located in the UH-60. The front edge of the base plate would have either been two inches from the right side corner edge of the helicopter door or flush with that edge. The operator's seat was bolted down in the helicopter, so all anthropometric data was analyzed with this consideration. The following are considerations and standards that needed to be addressed when deciding the location of the console. Many of the standards pertain to the anthropometric data found in the MIL-STD 1472D compiled in table one.

Foot Space: There should be sufficient room for the 95% male's foot with military boots. One and one-half inches should be allowed for a military boot⁸. Therefore, at least 13" must be accommodated.

Kicking Space: MIL-STD 1472D states that a kick space at least four (4) inches deep and four (4) inches high will allow for protective or specialized apparel. ANSI/100 calls for a clearance envelope, figure three, that in the farthest aft position only the 5% criteria is met.

Taking this information into consideration, it was suggested that there be at least 17" between the edge of the chair and the front surface of the console.

Work Table Specifications: MIL-STD 1472D section 5.7.3 addresses seated operations and calls for a work space at least thirty (30) inches above the floor. Figure four shows the position of the work surface on the console. The design called for a work space seventeen (17) inches wide by twelve (12) inches deep. It was my suggestion that the work space be at least twenty-five (25) inches wide to accommodate the

forearm breadth of the 95% male. I also suggested that the work space be fifteen (15) inches deep and be placed on rollers for adjustability; first, to provide extra working space and second, to cover the slant and provide more coverage for the monitor. Third, if rollers are not used and the console is in the farthest back position there are only four (4) inches of work space (current design) for the 5% male.

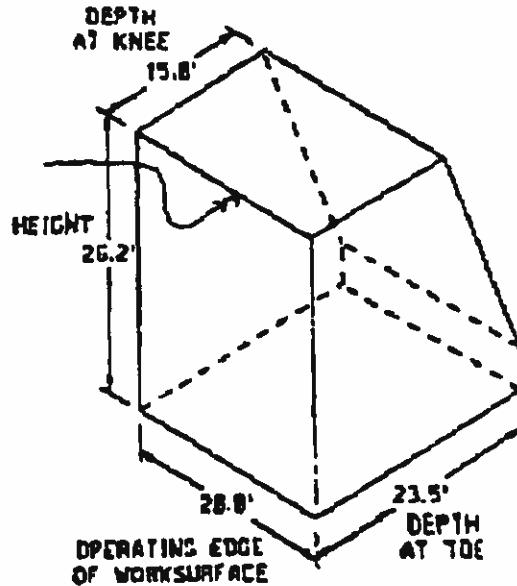


Figure Three: ANSI/100 Minimum Clearance Envelope for 95% Male

C. Track ball Location

The location of the track ball should have been within the 5% male's reach envelope. Functional reach envelope information could not be located for the general armed forces at the time of the investigation; therefore, the functional reach given in MIL-STD 1472D was used as the driving criteria. The functional reach of a 5% male is 28.2 inches measured from the back of the head⁵. The farthest point of the track ball should have been located within this value. With the console in the farthest aft (with respect to the operator) position, the track ball could still have been located on the work surface. If the track ball was not located on the work surface then it would have been directly in front of the shoulder, the 5% male's functional reach would have still been the limiting value to consider.

D. Monitor Location

The reference point was taken at the midpoint of the slanted surface. The two (2) primary concerns were the distance from the operator's eye to the monitor, and the angle of the monitor. The information found in MIL-STD 1472D pertains specifically to CRT displays. No anthropometric data specific to flat panels was able to be located within the research of this document.

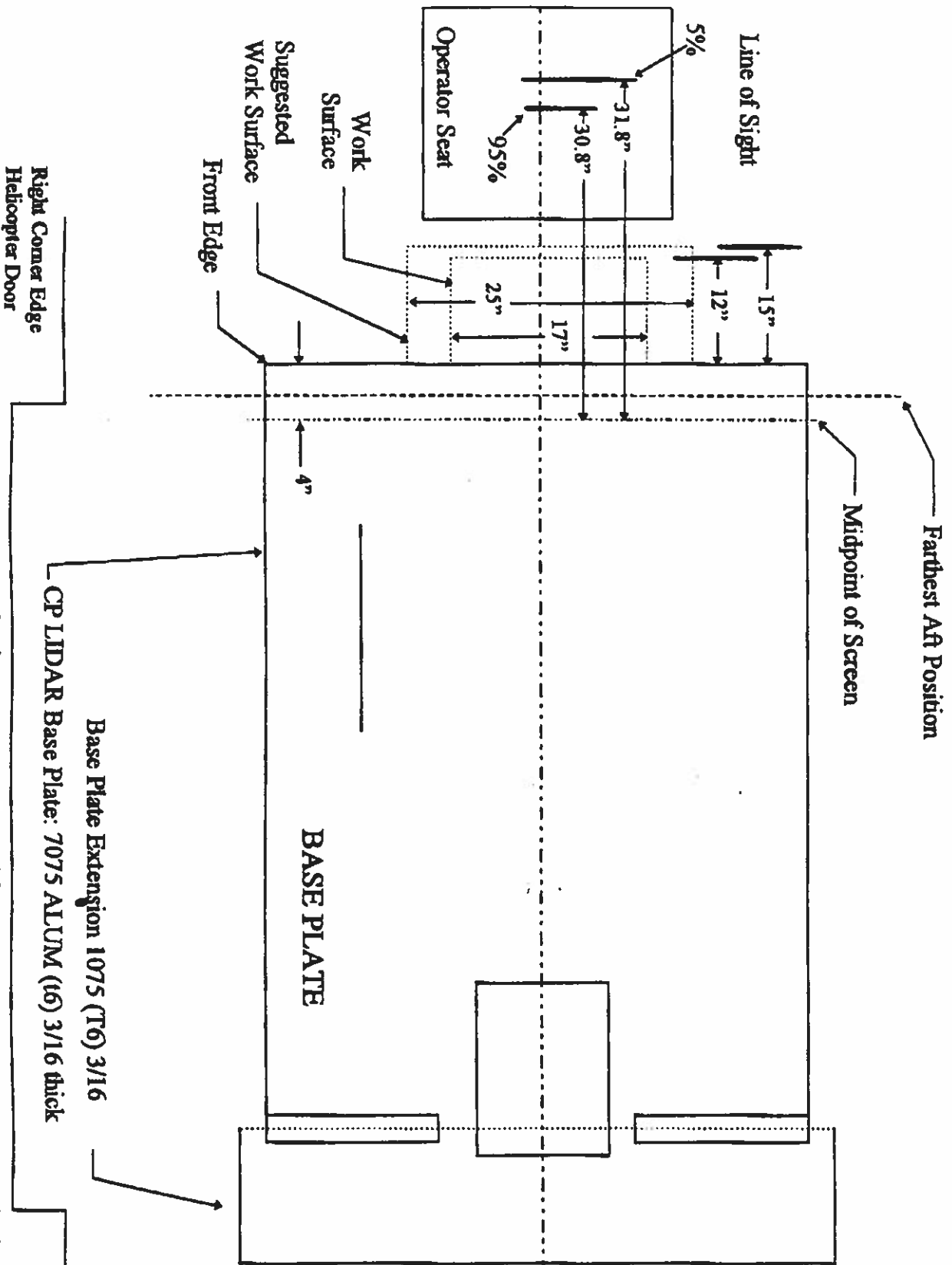


Figure Four : Workstation on CP LIDAR Base Plate

NOT TO SCALE

Monitor Angle: MIL-STD 1472 section 5.2.1.4.3 states that the monitor shall not be less than 45 degrees from the normal line of sight, figure five. It is important to note that the normal line of sight is defined as -15 degrees from the horizontal line of sight. There is no mention in MIL-STD 1472D of an acceptable range for the normal line of sight. There is an 8.9 inch sitting eye height difference between the 95% male and the 5% male. Since the operator is fixed and at the time there was no mention of an adjustable monitor, it was assumed that the normal line of sight is at fifteen (15) degrees in order to perform initial analysis. With this assumption, the angle of the the monitor and the normal line of sight is 60 degrees and fully meets the MIL-STD criteria.

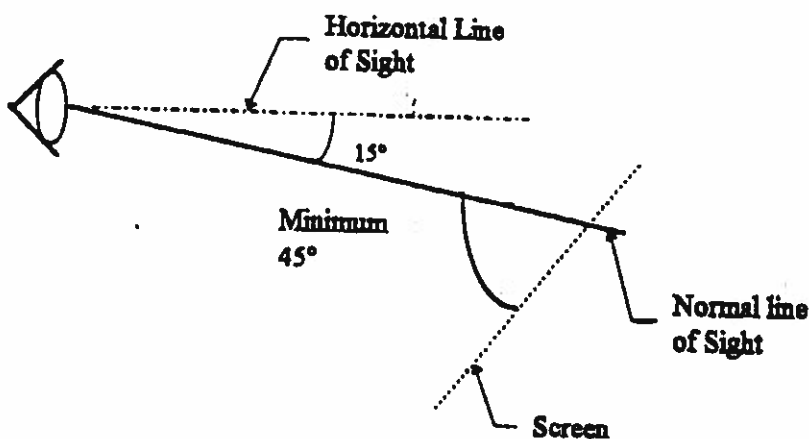
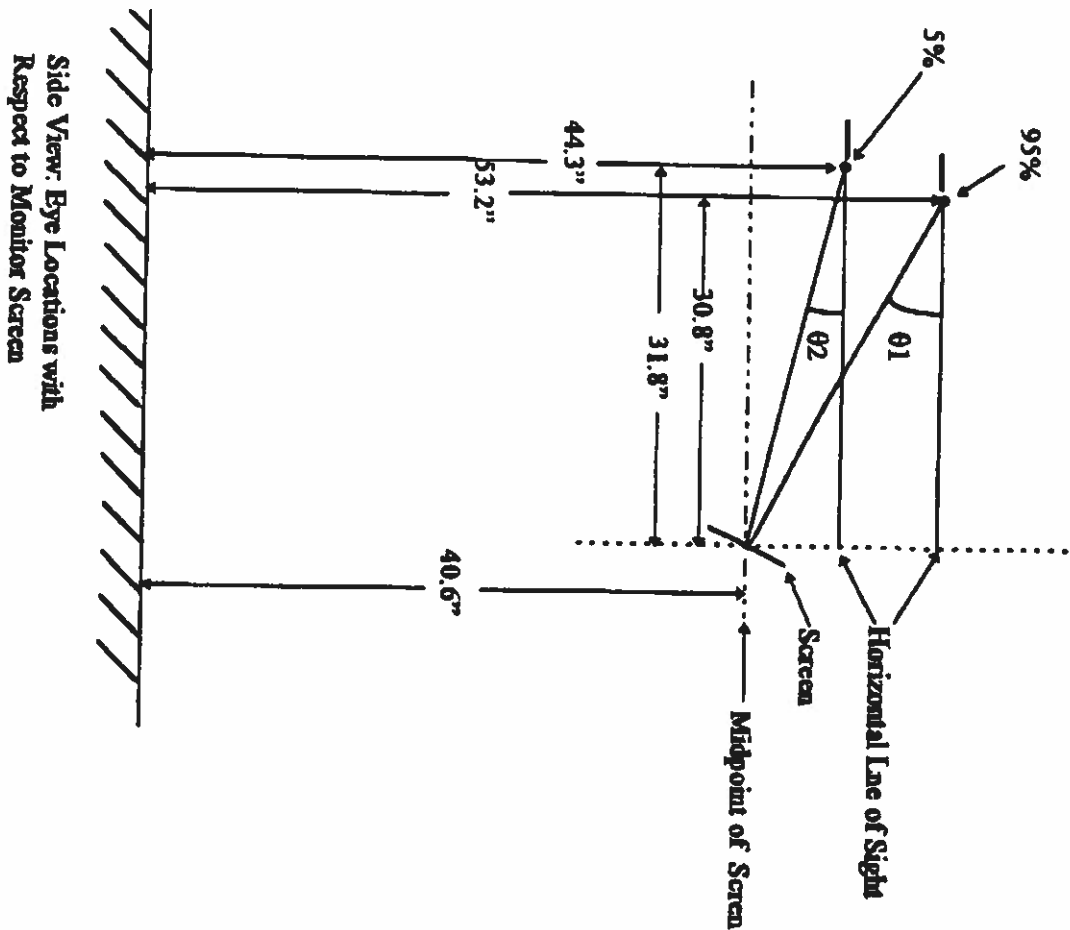


Figure Five: Horizontal Line of Sight

Figure six illustrates the sitting eye height difference and the angles of the normal line of sight that were investigated. For both cases, the angle of the normal line of sight did not meet the fifteen degree criteria, this was due to the large range of users and inability to adjust the monitor. As per the last design, only the 50% male would have met the criteria. If the monitor could have been lowered 4.82 inches then down to the 5% male, it would have met the criteria. I did not believe the latter could be accommodated due to the design of the console. Another possibility was to provide a seat raise of some sort to those men in the lower 50%.

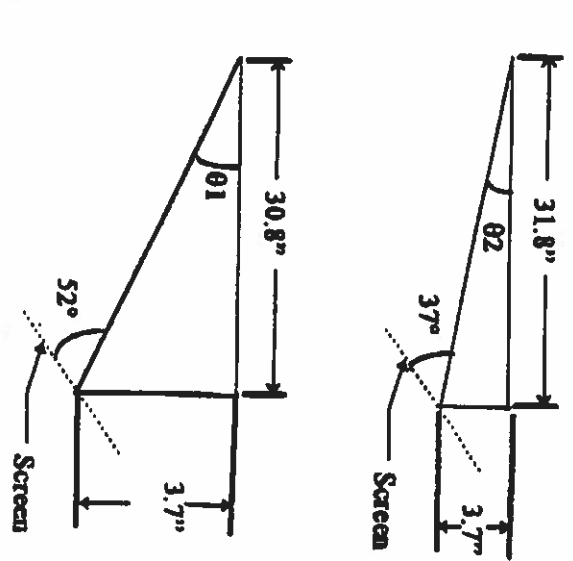
Viewing Distance: MIL-STD 1472D section 5.2.1.4.11 states that the viewing distance for the eye reference point of the seated operator to the display shall not exceed 25 inches. MIL-STD 1472D section 5.2.4.2 specifically for CRTs states that "a display that must be placed at viewing distances greater than sixteen (16) inches shall be appropriately modified in aspects such as display size, symbol size, brightness ranges,

Eye Locations



Side View: Eye Locations with Respect to Monitor Screen

Monitor Distance with Respect to the 5% and 95% Eye



Farthest Back Positions

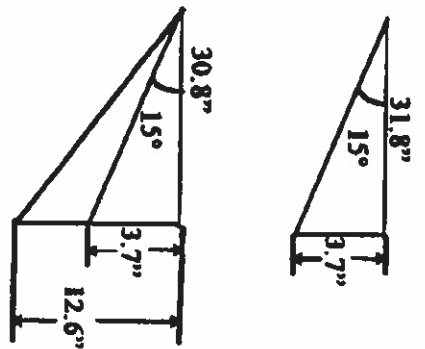


Figure Six : Eye and Angle Difference of Normal Line of Sight

NOT TO SCALE

line-pair spacing and resolution." In the farthest back position, the viewing distance will be between 30.8 and 31.8 inches, so accommodations would have had to be made in the previously mentioned categories.

E. Monitor Specifications

Due to the location of the screen in relation to the operator, the monitor should meet criteria so that legibility is not a problem.

Font Legibility: MIL-STD 1472D section 5.2.4.10 states that the font and size should be determined so that the operator can discriminate between the number 1 and the letter I (as this font does not) and the number 2 and the letter z at the maximum viewing distance.

Character Height and Viewing Distance: MIL-STD 1472D section 5.5.5.15 states information regarding dial and panel design although this information can be used as a guideline for character height for certain viewing distances. At the maximum viewing distance of 31.8 inches, the recommended character height is 0.18 inches.

Screen Size: In a previous report, it was suggested that the screen size be 17 inches. This was based on the previous program monitor specifications. At the time, no documentation had been found that defined a screen size. It was my suggestion to obtain a monitor as large as physically and economically possible due to the viewing distance.

F. Specific Work Station Questions

The 95% male basic trainee hand breadth is 4.5 inches⁸. It was suggested by Greg Rowell that 1.5 inches be used as the thickness of the glove. Therefore, at least seven (7) inches of clearance had to be met in order to work with the hand in tight locations.

The acceptable hip room is 16.3 inches for the 95% male⁵. Uniform compressibility cannot be assumed. It was suggested that one (1) inch total be added to the 95% male hip breadth to accommodate.

Bibliography:

1. Department of the Army. CP LIDAR Statement of Work CBDCOM LANL LLNL, Date Unknown
2. Fernandez, Jeffrey. IE 549 Human Factor Engineering Class Notes. Industrial Engineering Department, WSU, KS, Spring 1996.
3. Comprehensive Loss Management, Inc., The Way We Work: A User's Guide to Office Ergonomics and Body Mechanics, MN, 1991.
4. OSHA, Advance Notice of Proposed Rulemaking for Ergonomic Safety and Health Management, 57 FR 34192. 3 August 1995

5. Department of the Defense. MIL-STD 1472D-Human Engineering Design: Criteria for Military Systems, Equipment and Facilities. Military Document. 14 March 1989
6. Human Factors Society, Inc., ANSI/HFS 100-American National Standard for Human Factors Engineering of Visual Display Terminal Workstations. 4 Feb 1988
7. Military Author Unknown. AR-611-201. 30 April 1992
8. Van Cott, H. P., PhD (ed.) and Kinkade, R. G., PhD (ed.), (1963) Human Engineering Guide to Equipment Design, (Human Engineering Guide to Equipment Design), Joint Army-Navy-Air Force Steering Committee, McGraw-Hill Company
9. Rowell, Greg. Update on CP-BSDS Project. TSA-9: 95-06M, Los Alamos National Laboratory, Los Alamos, NM. 19 October 1995

Ergonomic Evaluation of an Office Workstation

Dishayne T. Garcia, McNair Scholar
Dr. Jeffrey Fernandez, Faculty Scholar

Abstract

An ergonomic evaluation of an office workstation at the NIAR building on the WSU campus was accomplished using ergonomic principles and tools. Anthropometric data compared to workstation measurements, video analysis, a body part pain discomfort survey, and a client interview were the tools utilized in the evaluation. Problem areas were identified and recommendations to engineering controls and administration controls were made.

Introduction

Anthropometry is defined as a branch of physical anthropology. There are two divisions of anthropometry. Static anthropometry is the first division and involves the study of the body in static, or where no motion is involved. This helps fit the person in the workplace. Dynamic anthropometry is the second division and involves the study of the body in motion.

This study is concerned with human body measurements including body size, range of movement, and muscle strength. The study determines if a person can function in the workplace. Our project focused on both static and dynamic anthropometry. The measurements taken will be used to redesign Glenda's workstation to her individual anthropometric measurements.

The workstation evaluated was that of Glenda Condon, office assistant, Room 214 NIAR Bldg., WSU campus. Glenda was assigned to our team by random selection. She is 4'11" in height which only puts her in the fifth percentile for adult females, and weighs 104 lbs. At her previous job, Glenda was diagnosed with carpal tunnel syndrome in her left wrist.

Glenda spends 50% of her time working at her writing desk and 50% of her time at her computer and typewriting desks. Her duties include filing, typing and filling out forms, as well as performing miscellaneous tasks on the computer. She has been doing this type of work for twenty-six months and clerical work in general for the last nine years.

Our objective was to evaluate her workstation and make recommendations using ergonomic principles and tools to reduce the risk of further harm to the employee. The advantages of this type of analysis are:

- Improved health and safety
- Increased productivity

- Reduction of lost time due to injury
- Decreased possibility of further progress of client's carpal tunnel syndrome
- Improved quality of life

Methods and Procedures

The apparatus used to conduct the workstation analysis are a video camera and a measuring tape. The following methods and procedures were used in gathering data:

- I. Anthropometric measurements were taken to determine whether the workstation was appropriate for Glenda and to make applicable changes or recommendations as necessary. First, anthropometric and workstation measurements were taken before changes. Second, anthropometric and workstation measurements were taken after her body was positioned in a neutral body posture. When the body is in the neutral body posture, feet, knees, hips, and elbows are at 90 degrees; feet are flat on a surface; and back is supported and straight. The anthropometric measurements taken are the following:
 1. Eye Height
 2. Elbow Height
 3. Thigh Height
 4. Popliteal Height
 5. Heel Height
 6. Buttock to Popliteal

All measurements were taken from the floor except for the buttock to Popliteal length. All measurements are in inches.
- II. Videotape analysis was used to view Glenda performing her individual tasks and identify problem or discomfort areas. A video checklist was used to evaluate each possible problem area.
- III. Workstation measurements were taken to determine whether the workstation layout was appropriate for Glenda based upon her anthropometric measurements.
- IV. A client, or employee, survey was used to gather personal information, work history, previous medical history, hobbies, etc. Hobbies pose as another factor of possible harm and may be the cause or adding to the discomfort of the client.
- V. The Body Part Pain/Discomfort survey was used by the client to identify discomfort areas and rate the pain/discomfort from just noticeable (1) to intolerable (3).
- VI. A client interview was used to expand on the client survey. Specific questions were asked regarding her individual tasks and areas of discomfort.

Results and Discussion

- I. The following tables are the results of our data collection. Table one is a compilation of the client survey. Table two and three are compilations of the

workstation measurements and anthropometry respectively. Table four is a compilation of the ergonomic video analysis checklist. Table five outlines the results from the Body Part Pain and Discomfort Survey.

Table One: Client Survey Information

How many years and months have you been doing your present type of work?	2 years, 2 months
Which shift are you on?	1st-8:00 am-5:00 pm
Please list the machines which you have worked at during the past 7 days.	Computer, 10-key, Typewriter
Gender	Female
What year were you born?	1958
What is your weight?	104 lbs
How tall are you?	4'11"
Are you right-handed or left-handed?	Left
Have you ever been diagnosed with CTS, tendinitis or ganglionic cysts?	Yes
Has anyone in your family ever been diagnosed with CTS?	No
Please list your hobbies or outside interests. Approximately how many hours per day do you spend on these activities?	Biking-1 hr each evening/summer Reading-1-2 hrs each evening

Table Two: Workstation Measurements

Measurement	Writing Desk (in.)	PC (in.)	Typewriter (in.)
Top of Screen		13.75	
Bottom of Screen		5.75	
Distance from Screen		23.00	
Keyboard (home row)		1.50	
PC Stand		8.00	
Table Top	29.50	26.75	26.50
Arm Rest	28.00	28.00	28.00
Underside of Table	25.50	25.50	23.00

Table Four: Ergonomic Video Analysis Checklist

Body Part	Problem Area
Head/ Neck	Flexion/Abduction
Back	Flexion/Twist
Shoulder/Upper Arm	Left Abduction; Right Abduction
Hand/Wrist	Left Flexion; Right Flexion
Elbow/Forearm	Left Flexion; Right Flexion
Static Loading	Head-Neck, Back-Trunk, Left Upper Arm, Leg and Foot, Right Upper Arm, Leg and Foot
Pinch Grip	Right-Medium
Force	Left-Medium; Right-Medium
Frequency	<700 DWM/hour
Extended Reaches	Left-Occasional; Right-Occasional
Duration of Task	8 hours
Work Surface Orientation	Horizontal
Stand/Sit/Stand-Sit	Adjustable Chair-Yes Lumbar Backrest-Yes Footrest-Yes

Table Five: Body Part Pain and Discomfort Survey Results

Neck Discomfort	1-2 Just noticeable to moderate Reversible Condition
Back Discomfort	1-2 Just noticeable to moderate Reversible Condition

- II. The before and after layouts are presented in Figure One.
- III. The following are the calculations tabulated to determine how the office fits Glenda. The body part measurements are in reference to the neutral body position.
- From the floor to the top of the computer screen:
 $13.2 \text{ in.} + 8.5 \text{ in.} + 26.75 \text{ in.} = 49.0 \text{ in}$
 In comparison with her eye height at 46 in.. In addition, due to bifocals, three inches should be subtracted from eye height. Therefore,

- 49.0 in. - 46.0 in. + 3.0 in. = 6.0 in.
2. Table top at the writing desk is 29.5 in. Glenda's elbow height is 26.0 in.
29.3 in. - 26.0 in. = 3.5 in.
 4. Thigh height is 25.5 in., while the underside of the table is 25.0 in.
25.5 in. - 25.0 in. = 0.5 in.
 6. Home row at the computer: 1.5 in. + 26.75 in. = 28.25 in. Elbow height is 26.0 in.
28.7 in. - 26.0 in. = 2.25 in.
 8. Home row at the typewriter is 31.0 in.. Elbow height is 26.0 in.
31.9 in. - 26.0 in. = 5.0 in.

Implications of Data

Due to Glenda's Carpal Tunnel Syndrome in her left wrist and the results of her body part pain and discomfort survey, these areas were focused on during the ergonomic video analysis checklist. The checklist helped determine problem areas. Since Glenda spends 50% of her time at the writing desk, this location was broken down into two tasks: typing and filing. The remaining 50% of her time is spent at the typewriter and computer in small increments dispersed throughout the day. Therefore, these tasks do not pose as serious a problem as the writing desk, where Glenda could spend 2-3 hours at a time writing or filing. The following list compiles the problem areas identified with the use of the previous information.

Writing Desk - 50%

Filing - 10%

Neck Flexion

Twisting and Flexion in Back

Left and Right Wrist Flexion

Static Loading in Back, Legs and Upper Body

Writing - 40%

Neck Abduction and Flexion

Back Flexion and Occasional Reaches

Right Wrist Flexion

Left and Right Shoulder Abduction

Static Loading in Neck, Back and Shoulders

Pinching Right Hand

Computer and Typewriter Desks - 50%

Neck Extension

Medium Forces Left and Right Upper Arm

Elbow Flexion

Static Loading in Back, Upper Arms and Legs

The biggest contributor to Glenda's back flexion and shoulder abduction problem is that her writing table is too high. To compensate for her inadequate writing surface, Glenda has incorporated a clip board for writing, which she rests on the edge of her table and holds with her right hand. This pinching force is a concern

due to the Carpal Tunnel Syndrome in her left wrist. In addition, Glenda's farsighted condition, which encouraged Glenda to flex her back compounded the problem. At the filing cabinet, Glenda would situate her chair some distance from the cabinet at an obscure angle. This would make Glenda extend and twist her back. Glenda files often for approximately 20 minute intervals. Since the foot rest is not available when she moves her chair to file, there is static loading in the lower body to keep her chair stationary.

Due to Glenda's bifocals, she needs to extend her neck to see the top of the computer screen. Glenda has a personal preference to move the typewriter to the center of her work area. Glenda may do this up to 10 times a day. Currently, there is no foot rest at the typewriter and therefore, leads to static loading in the lower body. Static Loading occurs when body postures are held and require muscle contraction for more than a short time. During static loading, muscles contract and blood flow to muscles is reduced.

Recommendations and Conclusions

I. Recommendations

First, the desk should be lowered 3". This is the maximum space available before the desk is on the ground. In order to do so, a new office layout is needed, due to the fact there are electric busses underneath the primary cabinet and personal drawer. The primary cabinet will now be located to her immediate left. This is beneficial for her flexing and twisting that occurs when she files. The primary cabinet will be in a position where Glenda can pull out of her desk, turn 90 degrees and she is now perpendicular and directly in front of her cabinet. The pen and pencil tray will be moved to the right of Glenda to accommodate thigh room. Her primary working tools (books, paper caddie, etc.) will be moved to her maximum working area, which is an imaginary arc created by her arm length, on her desk. A new ergonomic chair with adjustable arm rests, made specifically for smaller individuals should be purchased, to better support Glenda. Finally, the inclined writing surface will help eliminate unnecessary flexing of the back to get a better glance at the reading material. The material will now be brought to Glenda.

We recommend that the computer monitor stand be removed. The typewriter should remain stationary and incorporate a permanent foot rest at that area.

Training is an important factor in our recommendations. Training of proper use of the wrist rest pad, and avoiding awkward body motions will be emphasized. A summary of the recommendations is as follows:

Writing Desk

Filing

New office layout

Training: Avoid twisting, extended reaches and awkward body motions

Writing

Lower desk 3"

New desk chair with adjustable arm rests

Move pen and pencil tray

Move paper caddie to maximum work area

Incorporate inclined writing surface

Transfer forms to computer

Computer and Typewriter Desk

Keep typewriter stationary

Foot rests at all work stations

Lower monitor-removing 8" stand

Wrist rest training

II. Cost Analysis

Table Six: Cost Analysis

New Desk Chair	\$ 398.00
New Office Layout	No Cost
Training	No Cost
Lowering Monitor	No Cost
Inclined Writing Surface	\$ 100-200.00

The chair information was obtained from Ergonomic Concepts, Inc.. The cost of the inclined surface was estimated from the cost of materials to build. No structure could be found in the office equipment magazines obtained through the research. The office layout is changed by the company that sells the office modules and is scheduled for a maintenance visit in May.

It is our conclusion that the recommendations should be followed due to the severity of the oversized equipment assigned to Glenda. Glenda has already shown discomfort and therefore, changes need to be made as soon as possible to eliminate any further discomfort that may progress to an injury. We have recommended easy, fast and low cost solutions that would be beneficial for management, in terms of health and worker's compensation costs and employee productivity and to the employee in terms of health and safety.

References

1. Fernandez, E. Jeffrey. IE 549 Human Factor Engineering class notes. Industrial Engineering Department, WSU, Wichita, KS, Spring 1996.
2. Walpole, E. R., and Myer, R. H. Probability and Statistics for Engineers and Scientists. McMillan Publishing Co., New York, 1989.
3. Pheasant, S. Bodyspace: Anthropometry, Ergonomics and Design. Taylor and Francis, London and Philadelphia.
4. Kreighbaum, E., and Barthels, M. K., Biomechanics: A Qualitative Approach for Studying Human Movement. Simon & Schuster Co., Boston, 1996.

Use of Non-Elliptic Lift Distribution to Reduce Life Cycle Cost of a Business Jet

Chau Huynh, McNair Scholar
Dr. Kamran Rokhsaz, Faculty Scholar

Abstract

Of special interest in the aircraft design process is the life-cycle cost of an aircraft. Since the cost is known to depend on the aerodynamic efficiency and the gross take-off weight, the current research undertakes a multi-disciplinary optimization with the goal of reducing the gross take-off weight of a typical small business jet. In this research, the use of non-elliptic spanwise lift distribution on the wing is investigated as a means of obtaining an optimum combination of induced drag and root bending moment. A vortex lattice code is developed which allows specifying spanwise lift distribution on a wing of given geometry to solve for the corresponding twist. The gross take-off weight is estimated using published statistical relations. Results show that a small business jet can benefit from non-elliptic lift distribution, while the total wing twist required is no more than 4°. Statistical weight calculations reveal that aircraft having higher aspect ratios can weigh less than those with lower aspect ratios.

Introduction

The concept of multidisciplinary design has been taken on by many creative engineers throughout history. It can be argued that the first such study was carried out by the designers of the first successfully powered and controlled aircraft in history. This feat was achieved when the Wright brothers combined several disciplines in their studies of propeller design and propeller efficiency, drag-lift ratio (D/L), and so on to arrive at the Wright Flyer. Some would go so far as to say that multidisciplinary design and optimization are one and the same.¹

For the modern small transports and business aircraft, multi-disciplinary design has traditionally not been carried out extensively. Whenever optimization is done, it is often performed for one particular area at a time--for instance to obtain elliptic lift distribution (aerodynamics), to minimize weight (structures), or to maximize the flutter speed (aeroelasticity). It has been shown repeatedly that combinations of individually optimized parts do not necessarily yield an optimum configuration.

Recently, multidisciplinary studies have again attracted more attention and begun to appear more frequently in technical literature. In today's cost conscious world, multidisciplinary design is often targeted at reducing cost, in particular the

life-cycle cost of an airplane. A significant factor affecting the life-cycle cost is the direct operating cost which most often depends on the fuel consumption which in turn is influenced by the aerodynamic efficiency of the aircraft along with the gross take-off weight. Some relevant literature is described below.

In Reference 2, the authors address the suppression of aeroelastic instabilities associated with forward sweep, using an active control system. The major goal of the article is in taking advantage of the beneficial aspects of a forward swept wing while alleviating the adverse structural characteristics using an active control system. While this technology is very promising with respect to military application, its employment on current business jets is not very realistic yet.

Another aeroelastic optimization method is presented in Reference 3. In this study, the authors successfully formulate the problem of minimizing the mass while maximizing the flutter speed for a high aspect ratio wing. Unlike Reference 2, the authors do not rely on active flutter suppression. Instead, they structurally tailor the wing for the given objective. However, the article does not mention the effects on the aerodynamic efficiency.

Reference 4 describes an effort in the area of drag reduction subject to practical constraints, including the structural weight. Although this article concerns an exploratory study, it concludes that such multidisciplinary optimization can potentially reduce the drag by 15%. The aerodynamic model used in this article is the classical Prandtl's method which employs a Fourier series to describe the spanwise distribution of lift.

Another exploratory study is presented in Reference 5. In this case, the authors model a transonic transport wing and try to strike a balance between minimizing the drag and maximizing the range. However, the results presented in this paper are not very general. Therefore, their applications to a business jet are not directly possible.

Another aerodynamic/structural optimization effort is presented in Reference 6. In this case, the constraints are minimum structural weight and maximum lift. The optimization process is carried out through variations in the planform shape. Although the authors successfully demonstrate the application of this method, their optimum planform shapes prove to be inappropriate for application to business jets.

It is somewhat surprising that little or no effort has been made at either optimization studies or benefits of non-elliptic lift distribution. For this reason, the current research concentrated on non-elliptic lift distribution with the specific purpose of investigating the possibility of reducing the gross take-off weight of a business jet.

It is known that the magnitude of the wing root bending moment depends upon the lift distribution as well as the total lift. Larger and heavier structures are required to withstand the higher stress and the root bending moment for wings that have more lift outboard. Therefore, concentrating the lift distribution near the wing center line allows using higher aspect ratios without a weight penalty. It is also known that elliptic lift distribution minimizes induced drag. Yet shifting the lift

distribution inboard will deviate from the elliptic distribution and thus reduces the aerodynamic efficiency of the wing which in turn increases the induced drag. In light of this, a cost function is used to weigh the effects of the induced drag versus root bending moment for different lift distributions on the wing. Preliminary results of statistical weight estimations are also discussed.

Method of Analysis

A. Aerodynamic Model

The size and shape of the wing depends upon the mission of the aircraft. This research focuses on the wing of a typical light business jet, as can be found in Jane's All the World's Aircraft⁷, in its cruise segment of the mission is where the aircraft spends most of its time.

In order to minimize the root bending moment (M_{root}), the lift distribution must be shifted toward the wing center line. To do this, the spanwise distribution of circulation is adjusted. This physically means that a nonlinear twist is added to the wing. The more concentrated the lift is toward the wing center, the more twist is needed on the wing.

Because the optimum distribution of circulation is unknown, equation (1) is developed to approximate it along the wing span. This equation is selected because it relates the solution to the fundamental challenge of the problem which is to explore the benefits of non-elliptic lift distribution. This equation represents the circulation by an elliptic term plus a "shaping" term. The second term allows the distribution of circulation to deviate from elliptic whenever the value of A_1 is not zero. The relationship between A_0 and A_1 , derived in Appendix A, is represented by equation (2).

$$\Gamma(y) = A_0 \sqrt{1 - \left(\frac{2y}{b}\right)^2} + A_1 \left(1 - \left(\frac{2y}{b}\right)^2\right) \quad (1)$$

$$A_0 = \frac{1.5\bar{\Gamma}}{A_{ratio} + .375\pi} \quad (2)$$

Where,
$$\bar{\Gamma} = \frac{W}{b\rho U_\infty}$$

and
$$A_{ratio} = A_1/A_0.$$

Choosing spanwise distribution of circulation, the lift distribution of the wing can be easily calculated. A simple vortex lattice method (VLM)⁸ is then used to determine the induced drag and the twist of the wing. In this method, the wing is divided into an even number of equal-length segments. Each segment is

represented by a horseshoe vortex. To simplify calculations and particularly to avoid turning the research into a three problem optimization by including the effects of aeroelasticity, wing dihedral is not considered. The resulting equation can be expressed as,

$$[k]\{\Gamma\} = -U_\infty\{\alpha\} \quad (3)$$

Since the accuracy of the results depends on the definition of the wing, a convergence study was made to determine the number of segments or panels to be used in the VLM. Figure 1 shows a plot of the span efficiency factor, e , versus the number of panels. The plot shows that this parameter converges at about 30 panels. For the current research, 40 panels were used.

The influence coefficient matrix $[k]$ is determined from the wing geometry. All the spanwise values of circulation of the matrix $\{\Gamma\}$ are defined by equation (1). With all the terms on the left hand side known, equation (3) is solved for the spanwise local geometric angles of attack $\{\alpha\}$. The induced drag is then calculated using the relations developed in Appendix B.

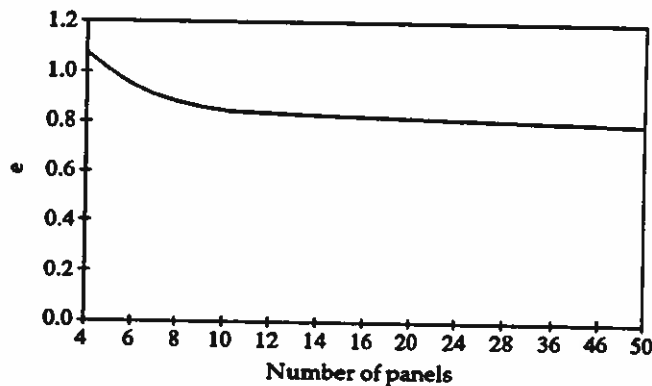


Figure 1. Number of wing panels for convergence.

B. Trade-off Study

The M_{root} can be calculated using either of two different methods. The numerical method can be used as shown in equation (4), by simply summing the moments.

$$M_{root} = \sum_{n=1}^{N/2} \rho U_\infty \Gamma_n y_n \quad (4)$$

The analytical method, derived in Appendix C and represented by equation (5), requires less computational effort in order to obtain the magnitude of M_{root} . Note that equation (5) shows only two wing parameters affecting the M_{root} which are the wing span, b , and the wing twist which is indirectly defined by the magnitude of A_0 and A_1 .

$$M_{root} = b^2 \rho U_\infty \left(\frac{1}{12} A_0 + \frac{1}{16} A_1 \right) \quad (5)$$

The cost function is represented by equation (6).

$$J = (1 - \sigma) \frac{M_{root}}{M_{elliptic}} + \sigma \frac{C_{Di}}{C_{Delliptic}} \quad (6)$$

The basic logic behind this equation was that the M_{root} is a major contributor to the structural weight of the wing. Depending on the relative importance of induced drag and structural weight of the wing. Depending on the relative importance of induced drag and structural weight, σ could be fixed at a value between zero and unity. Therefore, the magnitude of σ weights the effects of M_{root} and C_{Di} on the design requirements of the airplane. Within the realm of these assumptions, a variety of combinations of the induced drag and wing root bending moment could be found to result in the same cost.

The actual value of σ depends upon the type of aircraft and its mission. When σ is zero, the effect of induced drag is seen as not being very important. High performance aircraft having large power or thrust to weight ratio will fall within the range of σ closer to zero. General aviation and commercial aircraft will fall within the larger range of σ closer to 1.0 since the induced drag is a more significant factor on their performance. The actual evaluation of σ however, is beyond the scope of this study. For this reason, its determination is left as a topic for later studies.

C. Weight Estimation

To estimate the gross take-off weight, the following statistical relation that defines the ratio of empty weight to gross take-off weight, as given by Ref 9, is used,

$$\frac{W_e}{W_o} = a + b W_o^{c_1} A R^{c_2} \left(\frac{T}{W_o} \right)^{c_3} \left(\frac{W_o}{S} \right)^{c_4} M_{max}^{c_5} \quad (7)$$

Since the values of the constants in this expression are not given explicitly for business jets, values for transport aircraft were used in this analysis. The results were then scaled using the empty weight fraction of a known aircraft. This ratio is related to the gross take-off weight through,

$$W_o = \frac{W_{crew} + W_{payload}}{1 - \left(\frac{W_f}{W_o} \right) - \left(\frac{W_e}{W_o} \right)} \quad (8)$$

Knowing the fuel fraction, the above expression could be solved iteratively for the gross take-off weight. In equation (7), thrust-to-weight ratio was estimated from cruise condition. Fuel fractions for the warm-up, taxi, climb, and landing were assumed to be constants. Therefore, fuel fraction was determined from,

$$\frac{W_f}{W_o} = 1 - (0.970)(0.985)(0.995) \left(\frac{W_{end}}{W_{beg}} \right)_{cruise} \quad (9)$$

where from the range equation,

$$\left(\frac{W_{end}}{W_{begin}} \right)_{cruise} = \exp \left[\frac{-Rc}{0.866 U_{\infty} (L/D)_{max}} \right]. \quad (10)$$

In this equation, $(L/D)_{max}$ and U_{∞} correspond to the condition required for achieving maximum range. This condition requires the induced drag to be one-third of the total form drag of the airplane. Therefore,

$$C_{Do} = 3C_{Di} \quad (11)$$

$$C_L = \sqrt{\frac{\pi e A R C_{Di}}{3}} \quad (12)$$

$$U_{\infty} = \sqrt{\frac{2W}{\rho S C_L}} \quad (13)$$

Having placed the emphasis on the cruise segment of the mission, thrust-to-weight ratio was also determined as follows,

$$\left(\frac{T}{W_o} \right) \approx \left(\frac{1}{W_o} \right) \left(\frac{T_{cruise}}{0.75} \right) \left(\frac{\rho_{sea\ level}}{\rho_{altitude}} \right). \quad (14)$$

In the last expression, 0.75 in the denominator represents the throttle fraction used for cruise.

To estimate the weight savings of the aircraft, the wing aspect ratio, AR, is changed and the wing twist is adjusted so as to keep the M_{root} . A reference wing with elliptic lift distribution is used to estimate the value of ARC^2 . This wing has a

because despite varying aspect ratio, the wing root bending moment is maintained at its values corresponding to elliptic lift distribution.

Results and Discussion

A. Trade-Off Study

Using the aircraft data from Table I, the magnitudes of A_1 and A_0 as functions of the A_{ratio} becomes larger. Figure 2 shows that both curves of A_1 and A_0 approach their corresponding asymptotes as A_{ratio} becomes larger. This behavior suggests that equation (1) as a model for spanwise circulation has a range within which the combination of values of A_0 and A_1 is most effective. It is observed from Figure 2 that the slopes for the two curves are fast approaching zero for the A_{ratio} of 1.8. Beyond 1.8, the magnitudes of A_0 and A_1 do not change significantly. This behavior also means that the operating range of A_{ratio} associated with equation (1), as shown in Figure 2, limits the amount of control over how much the lift distribution can be shifted toward the center.

Parameter	Value
Wing Area	240 ft ²
Aspect Ratio	9.2
Average weight during cruise	9000 lbs
Maximum range	2000 miles
Cruise Altitude	25,000 ft
Number of Seats	8

Table I. Data for typical small business jet.

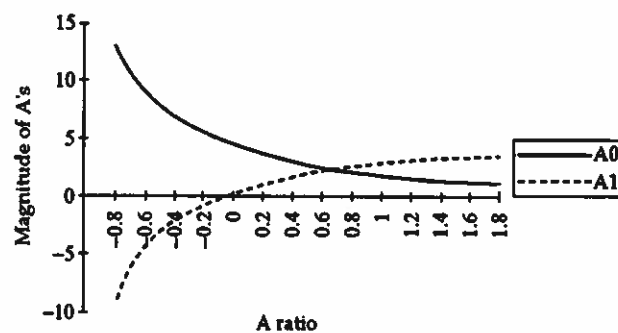


Figure 2. Asymptotic behavior of A_0 and A_1 functions of A_{ratio}

For the taper ratio of unity, Figure 3 shows different distributions of circulation resulting from equations (1) and (2). This figure shows that the higher values of A_{ratio} shift the lift distribution toward the wing root. Conversely, negative values of A_{ratio} allow for shifting the lift distribution out toward the wing tips. This figure also shows the characteristic of the "asymptotic limit" discussed above. Note the larger difference between the A_{ratio} of 1.8 and 0.6 produces the "same" amount of change in the maximum magnitude of circulation as for the smaller difference between the A_{ratio} of -0.04 and -0.2. Obviously, the A_{ratio} of zero in this figure corresponds to the elliptic lift distribution.

For varying taper ratios, fixing the lift distribution affects the distribution of lift coefficient. Figure 4 shows the different shapes of the C_1 distributions corresponding to the elliptic lift distribution ($A_{ratio} = 0$) for the various taper ratios. It is observed that wings

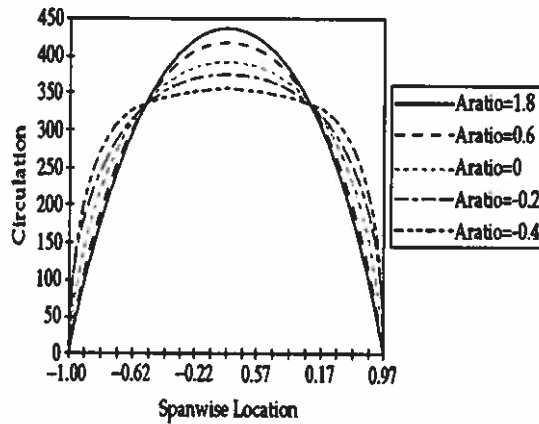


Figure 3. Spanwise distribution of circulation for wing of taper ratio=1.0.

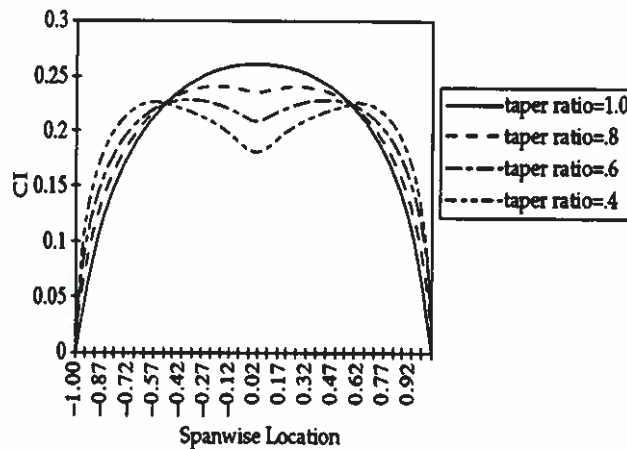


Figure 4. Spanwise distribution of C_1 corresponding to elliptic lift distribution for wing of various taper ratios.

with higher taper ratio have the distribution of the coefficient of lift shifted more toward the center. This observation suggests that for an unswept wing, higher taper ratios are preferred since the inboard of the wing will stall first and the outboard part where the ailerons are placed remains effective. This also implies that lower taper ratios should be used with increasing aspect ratio, while maintaining the root bending moment fixed.

Figure 5 shows the variation of total washout due to taper ratio and A_{ratio} . This parameter is defined as the difference between the geometric angles of attack of the root and the tip. For high values of A_{ratio} , the wings with larger taper ratios require a larger amount of total wing twist. The plot shows a maximum twist under 4° . From the manufacturing point of view for this particular aircraft, this amount of twist is quite acceptable within the entire range of values of A_{ratio} considered.

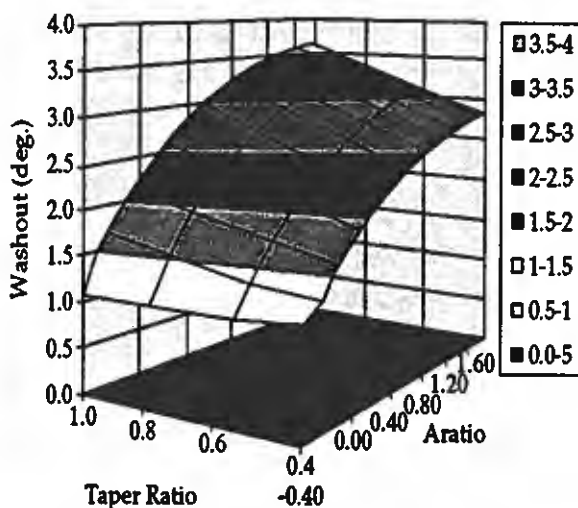


Figure 5. Variation of total washout due to A_{ratio} and taper ratio.

Figure 6a shows the D_{ratio} for wing taper ratio of 0.6. The plot shows that, as expected, the drag is lowest for the elliptic lift distribution ($A_0=0$). The induced drag ratio increases rapidly for deviations away from the elliptic lift distribution. Figure 6b shows that, for the same taper ratio, the root bending moment diminishes for increasing A_{ratio} . This means that as more lift is shifted toward the wing center, the induced drag increases while the root bending moment decreases.

Figure 7a shows the magnitude of the cost, J , for the various combinations of the root bending moment and drag ratios for σ of 0.8. This plot is obtained by using equation (6) for a range of the ratios of root bending moments and induced drag. It is observed that any increase in either the root bending moment or induced drag increases the cost, and the increase in both together will increase the cost more severely. The "data curve" on Figure 7b shows the cost associated with this particular business jet. Each data point used in drawing the curve corresponds to a

specific A_{ratio} or wing twist.

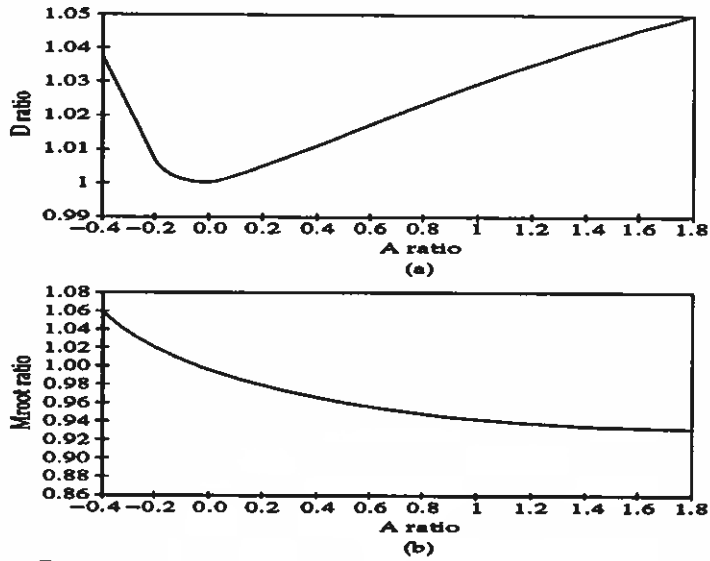


Figure 6. Variation of induced drag and root bending moment for wing with taper ratio of 0.6.
 (a) $D_i/D_{i,elliptic}$ versus of A_{ratio} .
 (b) $M_{root}/M_{elliptic}$ versus A_{ratio} .

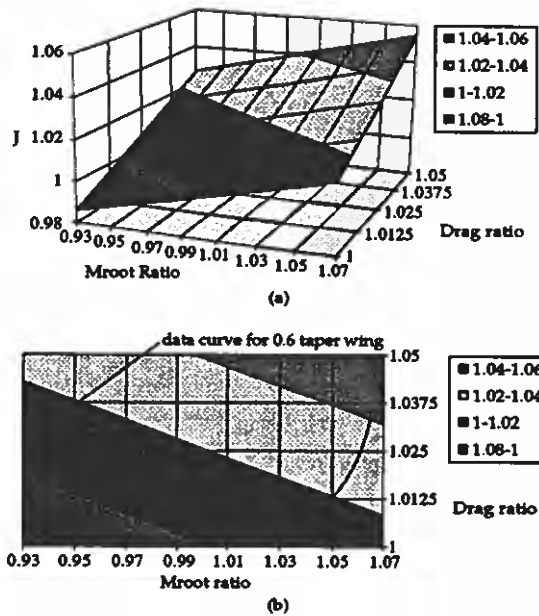


Figure 7. Variation of the cost function with $M_{root}/M_{elliptic}$ and $D_i/D_{i,elliptic}$ for $\sigma=0.8$.
 (a) Surface plot.
 (b) Contour plot showing wing data.

The optimum configuration can be seen to be that which produces the root bending

moment ratio of .98 and an induced drag ratio of 1.0. The "data curve" shifts *slightly* upward for the taper ratios higher than 0.6 and *slightly* downward for the taper ratios lower than 0.6 which suggest that taper ratio is not a significant factor affecting cost.

Figure 8 shows the cost, J , in terms of σ and A_{ratio} for a wing having a taper ratio of 0.8. The figure shows that the cost heavily depends on the type of aircraft considered. For high performance aircraft, the highest A_{ratio} yields lowest cost which means that induced drag is not as large a factor as the M_{root} . For another aircraft such as business jet, the optimum A_{ratio} is about 0.2 since the induced drag has a larger impact on the cost than root bending moment.

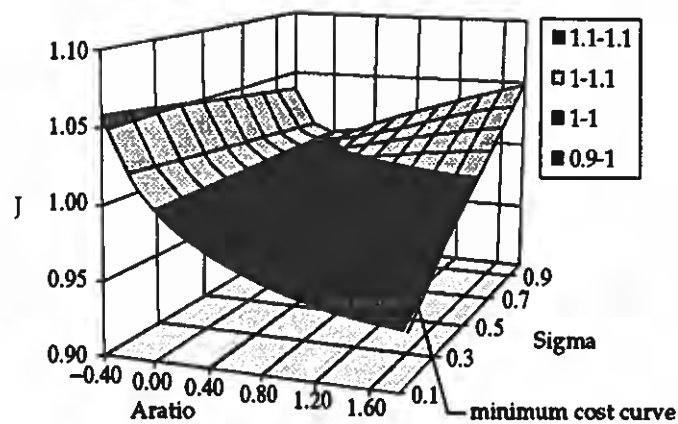


Figure 8. Variation of the cost function with A_{ratio} and σ .

It is observed from Figure 8 that for aircraft with low ratios of thrust-to-weight, represented by the values of σ closest to unity, the wing configuration that has minimum J is one with elliptic lift distribution, Non-elliptic lift distribution only affects aircraft with σ less than 0.9. In this figure, the "minimum cost curve" defines a value of A_{ratio} for each specific σ and thus a wing configuration for a specific type of aircraft.

B. Weight Estimation

The initial study performed using equations (7) through (14) shows large differences in the gross take-off weight. The results, summarized in Table II below, reflect a scale factor of 2.5. They show the limitations of adapting the statistical weight estimates of transports to the business jet. The total weight difference of over 1,000 lbs, between the aspect ratio 7 and 10.5, a little larger than expected.

A few complications were discovered in this part of the analysis. It was noticed that the $(C_L/C_D)_{\max}$ required for maximum range corresponds to a particular value of U_∞ in equation (13). Therefore when C_{D0} is assumed constant, the wing aspect ratio is the only factor affecting the fuel weight ratio, W_f/W_0 . With C_{D0} fixed, equation (11) specifies a value of induced drag. It is found that given the velocity, U_∞ of equation (11) thus overestimating the total airplane C_L/C_D . This result suggests that the induced drag from the fuselage and horizontal stabilizer is sufficiently large and that the induced drag of the wing alone is not representative of the total aircraft induced drag.

Aspect Ratio	GTOW (lbs)
7	10,900
7.5	10,600
8	10,300
8.5	10,200
9	10,000
9.5	9,900
10	9,850
10.5	9,800

Table II. Weight estimations from statistical relations.

Another complication involves M_{root} . Since equations (11) through (13) specify the flight condition that corresponds to a specific induced drag and cruise velocity, they also indirectly fix a value for M_{root} because the wing design from the VLM is a function of this flight condition. For this induced drag and velocity, the M_{root} was found to be different from that of the original reference wing. This behavior contradicts the original assumption, that by keeping the M_{root} constant, the value of ARC^2 of equation (7) can also be kept constant.

The fact that there are too many variables in the analysis makes the weight estimation very difficult. The use of constants for transports, rather than business jets, in equation (7), also makes it difficult to determine the reliability of the results obtained. However, the most useful trend noticed in Table II is that the weight is more sensitive to aspect ratio at the smaller values of this parameter.

Conclusion and Recommendations

This research investigated the use of non-elliptic lift distribution to reduce the gross take-off weight of a business jet. A "shaping" equation was developed to specify the spanwise lift distribution over the wing. This function was also used to evaluate the root bending moment. A cost equation was used to weigh the effects of root bending moment and wing induced drag.

Results showed that the "shaping" equation has a limited usable range outside of which it does not significantly affect the lift distribution. For the particular aircraft analyzed, the twist required to shift the lift inboard, using the "shaping" equation, is below 4° . The lowest cost, as given by the cost equation, is for a wing with the root bending moment slightly lower than that of a reference wing with elliptic lift distribution. This wing has the lift slightly shifted toward the center.

The weight analysis using statistical relations indicates that a wing having higher aspect ratio has lower gross take-off weight than one with lower aspect ratio. Other results were inconclusive due to the number of variables involved. These variables include wing loading, aspect ratio, C_{D0} , and Oswald efficiency factor, assuming that the range and thrust specific fuel consumption are constants.

From the above conclusion, further research can be performed in the following areas:

- To determine a function for σ : Two of the factors that may affect this variable include thrust-to-weight ratio and wing loading.
- To further the weight analysis by varying the assumed constants of this research: These include the average cruise weight, wing loading, C_{D0} , and Oswald efficiency factor.
- To develop a new weight analysis method: Instead of estimating the entire gross take-off weight, one can consider the relative weight reduction between wings of different aspect ratio.

References

1. Ashley, H., "On Making Things the Best-Aeronautical Uses of Optimization," *AIAA Journal of Aircraft*, Vol. 19, No. 1, January 1982, pp. 5-25.
2. Noll, T. E., Eastop, F. E., and Calico, R. A., "Active Suppression of Aeroelastic Instabilities on a Forward-Swept Wing," *AIAA Journal of Aircraft*, Vol. 21, No. 3, March 1984, pp. 202-208.
3. Lillico, M., Butler, R., Banerjee, J. R., and Guo, S., "Aeroelastic Optimization of High Aspect Ratio Wings Using an Exact Dynamic Stiffness Matrix Method," AIAA-94-4401-CP, *Proceedings of the AIAA 5th Symposium on Multidisciplinary Analysis and Optimization*, Tampa, FL, September 1994, pp. 1301-1309.
4. McGeer, T., "Wing Design for Minimum Drag with Practical Constraints," *AIAA Journal of Aircraft*, Vol. 21, No. 11, November 1984, pp. 879-886.
5. Borland, C. J., Benton, J. R., Frank, P. D., Kao, T. J., Mastro, R. A., and Barthelemy, J-F, M., "Multidisciplinary Design Optimization of a Commercial Aircraft Wing-An Exploratory Study," AIAA Paper 94-4305CP, *Proceedings of the AIAA 5th Symposium on Multidisciplinary Analysis and Optimization*, Tampa, FL, September 1994, pp. 509-519.
6. Wakayama, S. And Kroo, I., "Subsonic Wing Design Using Multidisciplinary Optimization," AIAA-94-4409-CP, *Proceedings of the AIAA 5th Symposium on Multidisciplinary Analysis and Optimization*, Tampa, FL, September 1994, pp. 1358-1368.
7. *Jane's All the World's Aircraft*, Edited by Lambert, M., Jane's Information Group, Inc., Virginia, 1994.
8. Bertin, J. J. , and Smith, M. L., *Aerodynamics for Engineers*, Second Edition, Prentice-Hall, New Jersey, 1989, pp. 261-282.
9. Raymer, D. P., *Aircraft Design-A Conceptual Approach*, American Institute of Aeronautics and Astronautics, Washington DC, 1989.

VI. APPENDIX A

Relationship between A_0 and A_1 :

$$\Gamma(y) = A_0 \sqrt{1 - \left(\frac{2y}{b}\right)^2} + A_1 \left[1 - \left(\frac{2y}{b}\right)^2\right]$$

$$L = \rho_\infty U_\infty \int_{-b/2}^{b/2} \Gamma(y) dy$$

$$L = 2\rho_\infty U_\infty A_0 \int_{-b/2}^{b/2} \sqrt{1 - \left(\frac{2y}{b}\right)^2} dy + 2\rho_\infty U_\infty A_1 \int_{-b/2}^{b/2} \left[1 - \left(\frac{2y}{b}\right)^2\right] dy$$

Let $\eta = \frac{2y}{b}$, $d\eta = \frac{2}{b} dy$, and set lift equals weight,

$$\frac{W}{2\rho_\infty U_\infty} = A_0 \int_0^1 \sqrt{1 - \eta^2} \left(\frac{b}{2}\right) d\eta + A_1 \int_0^1 (1 - \eta^2) \left(\frac{b}{2}\right) d\eta$$

Let $\bar{\Gamma} = \frac{W}{b\rho_\infty U_\infty}$, the integration yields

$$\bar{\Gamma} = \frac{\pi}{4} A_0 + \frac{2}{3} A_1$$

Solving for A_0 ,

$$A_0 = \frac{15\bar{\Gamma}}{A_{ratio} + 3.75\pi} \quad \text{where} \quad A_{ratio} = \frac{A_1}{A_0}$$

VII. APPENDIX B

Calculation of induced drag coefficient C_{di} and span efficiency factor e :

$$C_{Di} = \frac{1}{S} \sum_{n=1}^N (C_{di})_n \cdot c_n \cdot (\Delta y)_n$$

$$C_{di} = C_l \alpha_i = C_l (\alpha_g - \alpha_{ef})$$

$$C_{di} = C_l \left(\alpha_g - \frac{C_l}{C_{l\alpha}} \right) = C_l \left(\alpha_g - \frac{C_l}{2\pi} \right)$$

$$C_{Di} = \frac{1}{S} \sum_{n=1}^N (C_l)_n \left((\alpha_g)_n - \frac{(C_l)_n}{2\pi} \right) c_n (\Delta y)_n$$

$$e = \frac{C_L^2}{\pi A R C_{Di}}$$

VIII. APPENDIX C

Calculations of Root Bending Moment

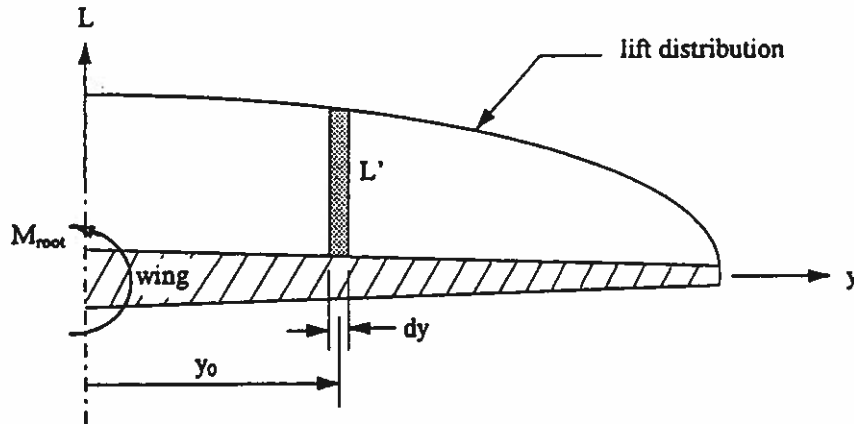


Figure C1. Simplified wing model for root bending moment analysis.

$$\Gamma(y_0) = A_0 \sqrt{1 - \left(\frac{2y_0}{b}\right)^2} + A_1 \left(1 - \left(\frac{2y_0}{b}\right)^2\right)$$

$$L' = \rho U_\infty \Gamma = \rho U_\infty \left\{ A_0 \sqrt{1 - \left(\frac{2y_0}{b}\right)^2} + A_1 \left(1 - \left(\frac{2y_0}{b}\right)^2\right) \right\}$$

$$M_{root} = \int_0^{b/2} y_0 L' dy = \rho U_\infty \left\{ A_0 \int_0^{b/2} y_0 \sqrt{1 - \left(\frac{2y_0}{b}\right)^2} + A_1 \int_0^{b/2} y_0 \left(1 - \left(\frac{2y_0}{b}\right)^2\right) dy \right\}$$

$$\text{Let } \frac{2y_0}{b} = \cos \theta, \sin \theta = \sqrt{1 - \left(\frac{2y_0}{b}\right)^2}, dy = -\frac{b}{2} \sin \theta d\theta$$

$$M_{root} = -\rho U_\infty \left\{ A_0 \int_{\pi/2}^0 \left(\frac{b}{2}\right)^2 \cos \theta \sin^2 \theta d\theta + A_1 \int_{\pi/2}^0 \left(\frac{b}{2}\right)^2 \sin^3 \theta \cos \theta d\theta \right\}$$

The result of the integration is:

$$M_{root} = b^2 \rho U_\infty \left(\frac{1}{12} A_0 + \frac{1}{16} A_1 \right)$$

A Cross-Cultural Perspective of Parenting Stress by Mothers with Young Chronically Ill Children

Janice E. McCoy, McNair Scholar
Dr. Bonnie Holaday, Faculty Scholar

Abstract

The purpose of this study is to examine the determinants of parenting stress of mothers with chronically ill children from a cross-cultural perspective. This study reports on data collected from three countries: the United States (U.S.), Israel, and Japan. The sample consisted of 30 mothers and their hospitalized children aged 4-36 months old. Data was collected using Abidin's 120 -item Parenting Stress Index (PSI) and the 14-item Tel Aviv Social Support Scale (TASSS). Preliminary analysis indicates that the U .S. and Israeli mothers have significantly greater levels of stress as compared to Japanese mothers in isolation, parental health, and acceptability. This finding indicates that mothers in countries with differing values of family and maternal role vary markedly in the amount of parenting stress.

Introduction

The purpose of this study is to examine the determinants of parental stress and social support in mothers of young, chronically ill children from a cross-cultural perspective. This multinational study involves nurse researchers from five diverse countries, however, for the purpose of this paper, the results from data analysis of Israel, Japan, and the United States (U.S.) will be described.

It has been shown that dimensions of parenting stress and social support are universal phenomena which are relevant to the health of children and families (Norbeck & Tilden, 1988) and are important considerations for health care providers when developing interventions for chronically ill children and their families. Even though advances in health care technologies have decreased the rates of morbidity and mortality, further examination of global problems faced by individuals living with chronic conditions need to be examined, including changes in technologies and accessibility to services (Meleis, 1989). Developing a global model for interventions is increasingly becoming a necessity as diversity in communities increase. Much of the research has focused on western thought and research, however, with an ever-shrinking global community, it has become imperative to change this focus to a broader cross-cultural perspective. This shift in focus will allow health care professionals to develop interventions that acknowledge the varying nature, constraints and resources found in a global community.

Significance

For families with a chronically ill child, child-rearing experiences are challenged by the increased demands and restrictions imposed by the illness. Families may experience an increase in the burdens of caretaking, numerous contacts with the health care system, altered plans for family outings and vacations, parental fatigue, depression and financial difficulties (Hobbs, Perrin, & Ireys, 1985; Holaday, 1978; Holaday & Turner-Henson, 1991; Lucca & Settles, 1981; Marcenko & Meyers, 1991). The unpredictable nature of the illness, the accessibility of health care, and the demanding treatment regimens also have been identified as constraints impinging upon the family (Turner-Henson, Holaday & Swan, 1992). Delays in cognitive and psychological skill development (Schlomann, 1988), increased incidence of behavioral and psychological adjustment (Austin, 1990), and an increased dependency on parents (Wasilewski, 1988) have been documented to constitute threats to the child's development and socialization.

Parental responses to chronic illnesses in children have long been considered to play an integral part in the children's and families' well-being (Kazak & Marvin, 1984). Parenting stress is the result of a series of appraisals made by the parent in the context of his or her level of commitment to the parenting role. Conceptually, parenting stress is viewed as a motivational variable which energizes and encourages parents to use the resources available to them to support their parenting (Abidin, 1992). Differences in parental response, such as depression, a lower sense of competence, marital problems and poor health, are seen with greater frequency in mothers as compared to fathers of chronically ill children (Goldberg, Morris, Simmons, Fowler & Levison, 1987). The determinants and implications of parenting stress for the parent-chronically ill child dyad and subsequent child development are important areas for intervention by the health care provider. The task of parenting a chronically ill child is a highly complex one that often must be performed within very demanding situations. This study is a step closer in developing a more comprehensive understanding of the stresses associated with parenting a chronically ill child from a cross-cultural perspective.

Specific Aims/Hypotheses

The specific aims of this study are (from a cross-cultural perspective) to:

1. Identify sources of parenting stress for mothers of young, chronically ill children.
2. Identify mothers who deal successfully with the demands and stress of rearing a young, chronically ill child and those who do not.
3. Use a standardized measure to tap maternal characteristics allowing for the assessment of the combinations of factors that influence their parenting stress.
4. Describe the relationship between the mother's parenting stress and selected demographic variables.
5. Identify the relationship between parenting stress and perceived maternal competence.

Hypotheses

1. Mothers in countries without national health insurance (e.g. the U.S.) will experience more total parenting stress than those countries with national health insurance (Israel, Japan).
2. It is hypothesized that in testing Abidin's model (Figure 1) that parenting stress is influenced by a number of demographic and child variables.

Theoretical Framework

Parenting stress is the result of a series of appraisals made by the parent in the context of his or her level of commitment to the parenting role. Conceptually, parenting stress is viewed as a motivational variable which energizes and encourages parents to use the resources available to them to support their parenting (Abidin, 1990B). The variety or paucity of resources available plays a role in the ultimate parenting behavior. The dynamics of this model are quite similar to those suggested by Lazarus and Folkman (1984) in their transactional model of stress. The current model represents an explication of a specific application of Lazarus and Folkman's general theory (See Figure 1).

Lazarus and Folkman (1984) conceptualized psychological stress in general as being heavily dependent on the cognitive processes of the individual. They emphasized the appraisal process of a specific motivation as the intervening process in psychological stress analysis, as the precursor of the stress reaction. Their research has shown that a stressful event will produce symptoms of emotional distress if the appraisal of the harmful significance of the events portrayed is altered. In other research relating to cognitive processes to emotional reactions, Peterson and Seligman (1984) have shown that reactions of helplessness and depression following bad events are the result of the type of interpretation given to the events, the subjects. The focus on appraisal and interpretation adds the dimension of interactions between stimulus factors and characteristics of the individual. Much of the research to date with mothers of young, chronically ill children has emphasized either of these factors alone in predicting stress reactions. Additional research has looked at the variance accounted for by variations either in the stimulus conditions or in the characteristics of the individual. It appears, however, that it is the combination of the stimulus and environmental conditions with personal characteristics that determines one's reactions to stressful events. Use of appraisal is one way of seeing the effects upon the person as caused by a transaction of a particular environment with particular individual characteristics. The concept of appraisal focuses on the information concerning the environment that is relevant to how the individual will cope with the situation.

Lazarus and Folkman (1984) described several factors that research has shown to be important to the appraisal process. They listed: 1) the importance of the goal that is threatened, 2) the way a person evaluates the present and future significance of the event for his or her well-being, 3) the degree to which the stressful event can be identified and escaped, 4) the social or situational constraints of the situation, and

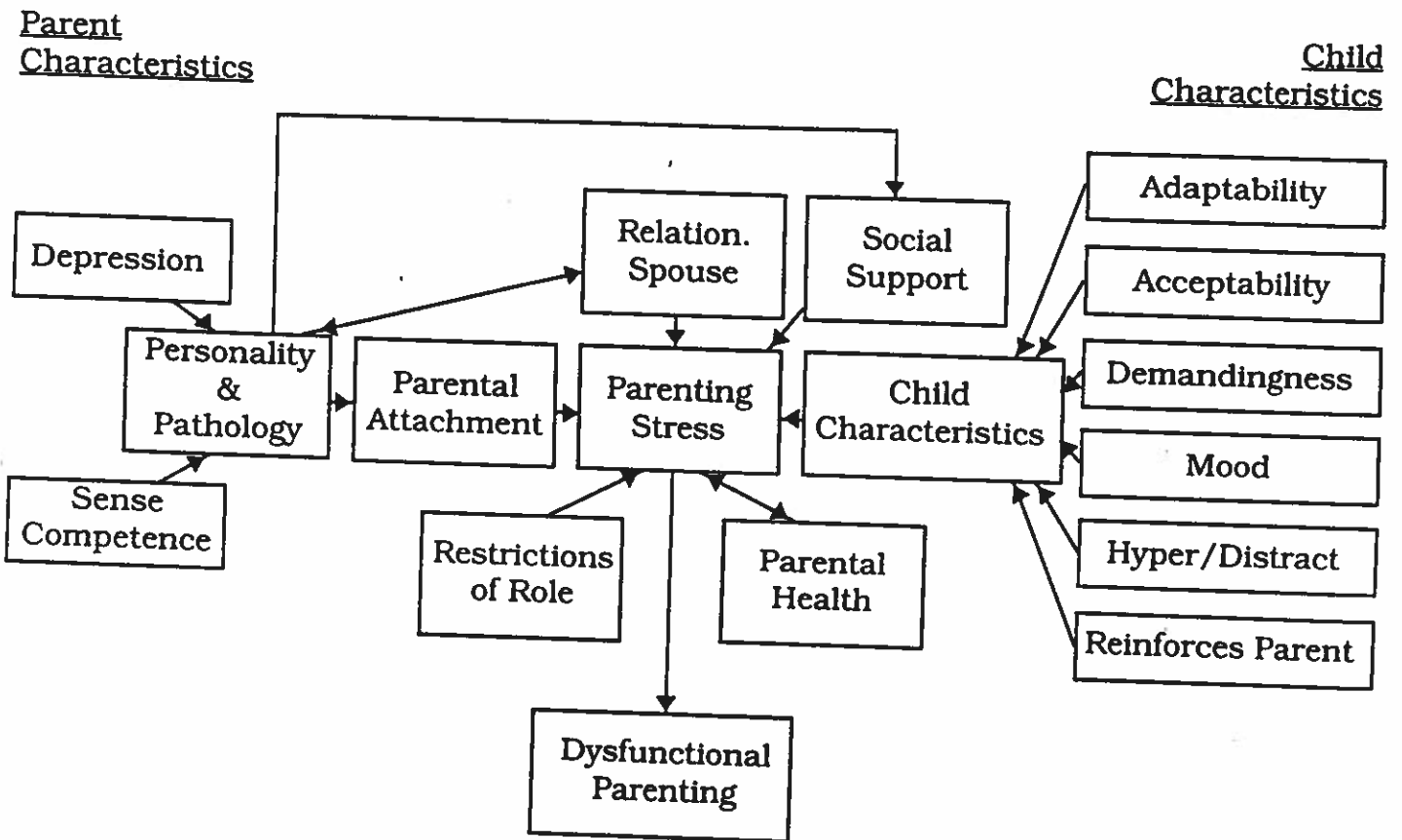


Figure 1. Parenting stress model (Abidin, 1990)

5) the viability of alternative actions. Each of these can be related to mothers of chronically ill children. The "goal" that is threatened is that of having a normal child who will fulfill parental expectations. Mothers' plans and hopes for their own future as well as for their children's futures, will need to be reassessed. Mothers' dreams and aspirations may have to be redefined. The degree of disappointment felt by the mother is a reflection of how discrepant she views the child to be from her expectations. The characteristics with the mother values for the child may influence the mother's feelings of disappointment and pessimism.

For all of these mothers, the stressful event has already been identified (i.e., they know their children are chronically ill), and there is little hope for "escape," to put it in Lazarus' terms. However, individual mothers may differ in the degree to which they view their children as disrupting their family lives.

In summary, Lazarus describes appraisal as the cognitive process of evaluating the event with respect to one's personal and social resources and options. All mothers of chronically ill children are subject to increased stress that for many, will continue for a long time. And thus these mothers are at risk for breakdown in functioning. Previous studies have shown that mothers of chronically ill children experience more stress.

In the stress literature, the concepts of "appraisal," "mediating variable," and "stress" can hold different meanings. For the purposes of this research, they will be defined. The "mediating variable" of appraisal is seen as a cognitive process influenced by characteristics of the stressor. "Appraisal" of this specific situation is defined as the perception of the chronically ill child and how having a chronically ill child impacts on the mother. "Stress" is defined as the individual's physiological and psychological reactions to the stressful event. The term "stress" has been used throughout this study to refer to the mother's emotional state because the same terminology has been used in research with mothers of chronically ill children. "Social support" is defined as supportive assistance from important others that addresses perceived needs.

The design of the Parenting Stress Index (PSI) acknowledges the appraisal component involved in the experience of stress (Abidin, 1990). The PSI examines some of the principle parent characteristics, family context variables, and child characteristics which have been identified as impacting upon the mother's ability to cope and to function as competent caregiver to her child.

Method

An ex post facto research design was selected because the research is being conducted after variations in the independent variable (chronic illness) have occurred. In this research, we are attempting to understand relationships among phenomena as they occur naturally, without any intervention (Polit & Hungler, 1995). Limitations of this design include difficulties in revealing causal relationships and the inability to determine if the groups were comparable before the birth of the ill child, however, this design allows the researchers to address a problem that is not amenable to experimentation.

Subjects and Setting

This cross-cultural study was composed of mothers of young, chronically ill children from four countries, the United States (Birmingham, AL), Israel, Taiwan, and Japan: though for the purposes of this paper, I will focus only on the analysis of the Japan, Israel, and U.S. comparisons. The subjects (total sample size=102; Japan=38, Israel=30, U.S.=34) were mothers (mean age=30.8, ranging from 16 to 47 years; Japan mean age=31.2, Israel mean age=34.1, and U.S. mean age=27.2). The chronically ill children (mean age=23.2 months; Japanese mean age=15.2 months, Israel mean age=35.0 months, and U.S. mean age=11.3 months) had a variety of chronic conditions (see Table 1). A noncategorical approach was selected for this study, rather than a disease specific approach, since most health professionals recognize that children with chronic illnesses have many needs in common with each other, irrespective of what disease they have (Pless, 1984; Perrin, et al, 1993). The noncategorical approach views that children with chronic illnesses can be considered as a class for the purpose of organizing and allocating services (Hobbs, et al, 1985). In terms of methodological and conceptual issues, this approach is useful for researchers, clinicians, program directors, and policy makers to specify appropriate choices for their particular needs (Perrin, et al, 1993). The children in the sample had chronic conditions such as chronic respiratory conditions (e.g., bronchopulmonary dysplasia), congenital heart disease, neuromuscular disorders, spina bifida, or gastrointestinal disorder were included, as well as children with multiple conditions, and motor or cognitive delays (e.g., Down's syndrome). Children in the Japanese sample were from both inpatient and outpatient settings and their conditions were relatively stable, whereas, children in the U.S. sample (100% of the children were hospitalized) had more unstable conditions (level of illness severity was greater as compared to the Japanese data set) and were generally hospitalized for serious life-threatening health problems.

Table 1 Comparison of Ages

Group	Child's Age	Mother's Age	Father's Age
United States	11.3	27.2	27.5
Japan	15.2	31.2	33.5
Israel		34.1	36.5
Mean		30.8	32.5
P-value	.0001	.0001	.0001

Educational level for the Japanese sample was much higher as compared to the U.S. and Israel samples (Japan: college graduate/professional degree=42.1%, Israel: college graduate/professional degree=26.7% and U.S.: college graduate/professional degree=11.7%, see Table 2). The majority of the U.S. sample had an educational level below high school graduate (9-12 grade 58.8%), whereas the

majority of the Israel sample consisted of vocational training (vocational 43.3%). A greater percentage of the U.S. and Israeli mothers were employed outside the home (U.S.=38.2%, Israel=53.3%) as compared to the Japanese mothers (13.5%) (see Table 3). Subjects were from intact families, or families where a maternal (e.g., aunt or grandmother with legal custody) and paternal (e.g., uncle or grandfather with legal custody) figure head were present.

Table 2 Mother's Education (in %)

Group	United States	Japan	Israel
N	34	38	30
1-8th Grade	2.9	0	23.3
9-12th Grade	58.8	31.6	6.7
Vocational	29.4	26.3	44.3
College Graduate	8.8	36.8	16.7
Graduate/Profes.	0	5.3	10.0

P-value=.013

Table 3 Mother's Education (in %)

Group	United States	Japan	Israel
N	34	37	30
White Collar/College	5.9	8.1	10.0
White Collar/No College	8.8	2.7	30.0
Blue Collar	23.5	2.7	13.3
No Profession	2.9	86.5	3.3
Homemaker	58.8	0	43.4

P-value=.017*

*The last two categories are based on cultural perception. The p-value should not be interpreted as a difference among these countries.

Subjects in the United States were recruited from mothers whose children are hospitalized at The Children's Hospital of Alabama. This hospital, the only children's hospital in the state, serves children from the southeastern area of the country. Subjects in Japan were recruited from two university hospitals, one children's hospital, and one city hospital, including both in-patient and out-patient

unit, in Chiba and Tokyo. In Israel, subjects were recruited from the Tel Aviv Sourasky Medical Center.

Study Instruments

The Parenting Stress Index (PSI) (Abidin, 1990) is a 120-item questionnaire used to assess the amount of stress in the parent-child system and to identify parents who are at risk for dysfunctional parenting behaviors. The parent is asked to rate items on a 5-point Likert scale ranging from strongly agree (1) to strongly disagree (5) according to how accurately they describe her/his feeling. The questionnaire measures stress from two sources: child characteristics and parent characteristics. Items regarding child characteristics are summed to yield a Total Child Stress Scale as well as six subscale scores: Adaptability, Acceptability (how acceptable the parent finds the child), Distractibility, Mood, Demandingness and Reinforcingness (how reinforcing the parent finds the child). The Child Domain consists of 54 items. The Parent Domain consists of 47 items and is divided into seven subscales: Depression, Attachment, Restriction to Role, Competence, Isolation, Spousal Relationship, and Health. The two total stress scores, Child and Parent, are then summed to yield a total stress score for the parent-child relationship. The Total Parenting Stress score is obtained by summing 101 of the items with scores ranging from 101 to 325. Across child and parent scales, higher scores reflect more problematic outcomes.

The PSI was normed using 534 subjects in the Virginia area (Loyd & Abidin, 1985). The Cronbach's Alpha reliability coefficients are .95 for the total stress score, .93 for the Parent Domain, and .89 for the Child Domain. Test-retest reliability coefficients are .82 for the Parents Domain and .71 for the Child Domain (Abidin, 1990). Normative information is available for children, in the U.S. culture, ages 1 to 12 years. Dr. Holaday traveled to Japan, Taiwan and Israel to work on instrument translation. The PSI was initially translated into Japanese, Mandarin and Hebrew by a bilingual nurse researcher. Three additional bilingual nurse faculty were also asked to translate the instrument. The researcher (Dr. Holaday) and each independent translator revised the PSI using words that were common to each of the three languages. This ensured that item translation was acceptable to all. This translation technique is similar to the committee approach described by Breslin, Lonner & Thorndike (1973). A back translation was then performed by a fourth bilingual faculty member (Breslin, 1970). Copies of all translated instruments have been shared with Dr. Abidin. The same process was used with the Tel Aviv Social Support Scale (TASSS).

The demographic questionnaire consisted of 34 items and asked about characteristics of the mother, such as age, education, occupation, income, number of children and housing arrangements.

Data Collection

Interviews in the U.S. were conducted by the nurse investigator (Turner-Henson) and a graduate doctoral student (Sharon Deneham). Staff nurses in Japan were used to administer the questionnaires to the mothers, though since their

mothers' reading level was deemed to be of greater consistency, mothers filled out their own questionnaires. In Japan, the staff nurses reviewed each questionnaire and clarified responses with the mothers when necessary.

Results

Overall, Israel showed significantly more stress with the U.S. showing the second highest level of stress. (table 4) All of the countries exhibited higher levels of stress in the child domain than in the parent domain. According to Abidin (1990) this can be interpreted that child characteristics are a major influence in contributing to overall stress in the parent-child dyad. This is typical for parents of disabled children and the data in this study and past research indicates the same for chronically ill children.

Israel and U.S. scored significantly higher than Japan in the parent domain with competence being the major contributor to this score. According to Abidin, parents who score high on the competence subscale are often overwhelmed by feelings that the child is "more than I bargained for." Elevated scores in this area are often reflected by parents of disabled and chronically ill children.

There is a significant difference in the total stress scores when comparing the three countries. However, all three countries scored above 260 which indicates the necessity of intervention (Abidin).

	Japan	United States	Israel	P-value
Distractibility	25.6149	28.4118	28.8999	0.0026*
Adaptability	30.2396	30.8029	33.3185	0.0176*
Reinforces	11.4757	16.7353	18.2036	0.0001*
Demandingness	24.3144	28.7059	33.0543	0.0001*
Mood	10.6316	11.9705	13.1494	0.0013*
Acceptability	17.3108	15.6471	16.3753	0.3797
Child Domain	119.5869	132.2735	143.0009	0.0001*
Competence	37.5793	42.6764	43.8500	0.0001*
Isolation	14.0474	16.7882	16.4567	0.0098*
Attachment	16.8869	17.7059	18.6548	0.0235*
Health	13.4671	15.0882	16.5583	0.0003*
Role Restriction	22.5351	21.0882	24.6389	0.0452*
Depression	23.1353	21.4412	23.6096	0.2399
Spouse	17.3739	19.6471	18.7738	0.1474
Parent Domain	145.0241	154.4353	162.5421	0.0068*
Total Stress	246.6110	286.7088	305.5430	0.0001*

Table 4

Conclusion

The present study was guided by the premise that mother-child relationships should be viewed within the context of broader life events and circumstances. Previous research in primarily Western populations has carefully documented the increase in parenting stress in families with young chronically ill children. This cross-cultural study of parental stress validates the increase in parenting stress and provides preliminary pilot findings to validate the differences from a cross-cultural perspective in understanding the differences in parental stress in families with a young chronically ill child. Therefore, this study revealed that maternal perceptions of parenting stress in mothers of young children with chronic conditions, appear to be sensitive to the social ecological niches (e. g., country of origin), as well as to child and family factors.

The design of the Parenting Stress Index acknowledges the appraisal component involved in the experience of stress (Abidin, 1990). The PSI examines some of the principal parent characteristics, family context variables and child characteristics which have been identified as impacting upon the mother's ability to cope and to function as competent caregiver to her child. These results indicate that for mothers of young chronically ill children, parenting experiences vary markedly from a cross-cultural perspective. Differences in values of family and maternal roles and responsibilities, health care access and other societal values and beliefs account for these findings. However, the hypothesis that countries with a national health insurance system would exhibit lower stress was not supported in this study, as can be seen by the higher stress found in Israel. This higher stress level can be attributed to the decreased inhibitions of speaking about personal problems by the Israeli people, however at this time, data is not conclusive (Holaday, 1996).

The experiences of parenting a young chronically ill child, as seen in this study, reflect the demands and challenges of child rearing from a cross-cultural perspective. Caregiver characteristics, such as maternal employment (highest in Israel followed by the U.S.) appear to influence the amount of parenting stress. In addition, parenting responsibilities and sources of support reflect the shifting societal values on maternal parenting expectations and roles.

Severity of illness in the chronically ill child and health care delivery systems are seen as two major influences on parental stress when viewing differences between the mothers. For the United States' mother, the severity of the child's illness, increased demands of intensive caregiving in the home, and the financial insecurities (many lack health insurance) all contribute to the higher levels of parenting stress. Whereas in Japan, it would have been an insult to the parent to conduct the survey while the child was extremely ill, no such cultural consideration is expected in the United States (Turner-Henson & Maru, 1996).

When viewing the overall pattern of stress on the raw data table, it can be seen that overall, the patterns of stress are similar. This would indicate that the areas of higher stress are similar throughout all three countries. The differences in stress levels can very well be contributed to cultural differences. In this study, stress levels were compared to normative data collected on mothers of healthy children in

the United States, therefore, current data on mothers of healthy children in Japan and Israel is being collected so that intra-cultural comparisons can be made (Turner-Henson & Maru, 1996; Holaday, 1996).

Increasingly, cross-cultural international research is becoming an essential component for health science to gain a greater appreciation for the nature, constraints, and resources present in today's global community. Much of the current knowledge of clinical practice and theory relies heavily on Western thought and research. In order to move beyond the Western perspective, we must broaden the repertoire of interventions which acknowledges the cultural and linguistic similarities and differences to facilitate communication within the global collective (Wake & Miller, 1992). It is essential that health sciences develop strategies which are culturally sensitive in order to develop interventions for a worldwide application. While etiologies and cultural perspectives may differ, and intervention developed from a global perspective may be more powerful, the development of knowledge in this and related fields must have a worldwide interest, sensitivity, and application in order that strategies and interventions needed to resolve issues for culturally diverse populations may be enhanced (Meleis, 1980).

PSi Profile

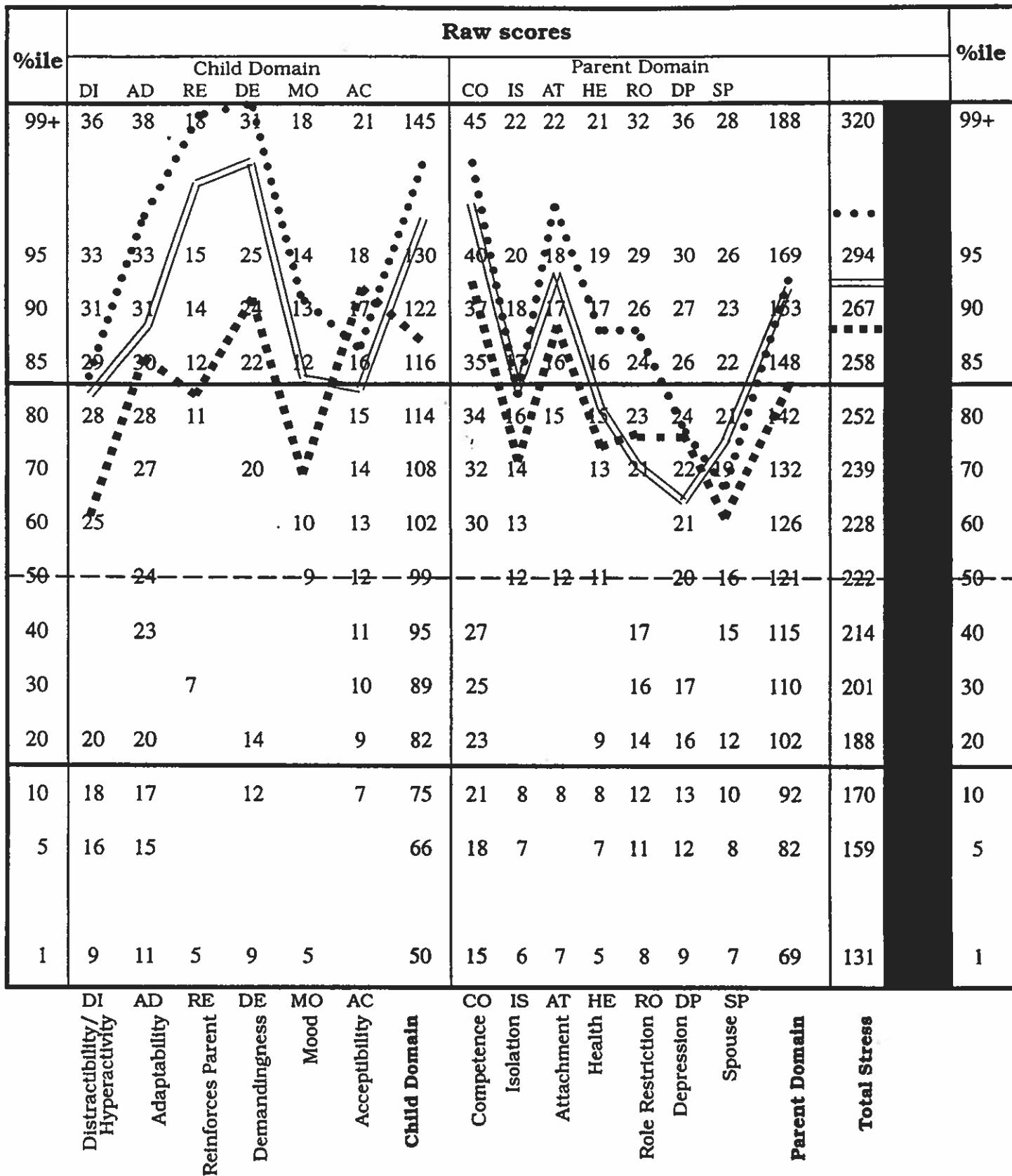


Table 5: Mean profile for parents with chronically ill children

BIBLIOGRAPHY

- Abidin, R.R. (1990). Parenting Stress Index (Third Edition). Charlottesville, VA; Pediatric Psychology Press.
- Abidin, R.R. (1990b). Introduction to the special issue: The stresses of parenting. Journal of Clinical Child Psychology, *19*, 298-301.
- Abidin, R.R. (1992). The determinants of parenting behavior. Journal of Clinical Child Psychology, *21*, 407-412.
- Austin, J. (1990). Assessment of coping mechanisms used by parents and children with chronic illness. Maternal Child Nursing, *15*, 98-102.
- Breslin, R.W. (1970). Back translation for cross-cultural research. Journal of Cross-Cultural Psychology, *1*, 185-216.
- Breslin, R.W., Loner, W., & Thorndike, R. (1973). Cross-cultural research methods. New York: Wiley.
- Goldberg, S., Morris, P., Simmons, R.J., Fowler, R.S., & Levison, H. (1990). Chronic illness in infancy and parenting stress: A comparison of three groups of parents. Journal of Pediatric Psychology, *15*, 347-358.
- Hobbs, N., Perrin, J., & Ireys, H.T. (1985). Chronically ill children and their families. San Francisco: Josse-Bass.
- Holaday, B. (1978). Parenting the chronically ill child. In P. Brandt P. Chinn, & V. Hung, Current practice in pediatric nursing (pp. 101-112). St Louis: C.V. Mosby.
- Holady, B. & Turner-Henson, A. (1991). Growing up and going out: A survey of chronically ill children's use of time out-of-school. (Final report of project supported by Grant Number MCJ 060550, Maternal and Child Health Program [Title V, Social Security Act, Health Resources and Services Administration, Department of Human Services]).
- Kazak, A. E. & Marvin, R. S. (1984). Differences, difficulties and adaptation: Stress and social networks in families with a handicapped child. Family Relations, *33*, 67-77.
- Lazarus, R.S., Folkman, S. (1984). Casual explanations as a risk factor for depression: Theory and evidence. Psychological Review, *91*, 347-374.
- Lloyd, B. & Abidin, R. (1985). Revision of the Parenting Stress Index. Journal of Pediatric Psychology, *10*, 169-201.
- Lucca, J., & Settles, B. (1981). Effects of children's disabilities on parental time use. Physical Therapy, *61*, 196-201.
- Marcenko, M.O., & Meyers, J.C. (1991). Mothers of children with developmental disabilities: Who shares the burden? Family Relations, *40*, 186-190.
- Meleis, A.I. (1989). International research: A need or a luxury, Nursing Outlook, *37*, 138-142.
- Norbeck, J.S. & Tilden, V.KP. (1988). International nursing research in social support: Theoretical and methodological issues. Journal of Advanced Nursing, *13*, 173-178.

- Polit, D.F. & Hungler, B.P. (1995). Nursing research: Principles and methods. Philadelphia: J.B. Lippincott (5th Ed).
- Schlomann, P. (1988). Developmental gaps of children with a chronic condition and their impact on the family. Journal of Pediatric Nursing, 3, 180-187.
- Turner-Henson, A., Holaday, B., & Swan, J. (1992). When parenting becomes caregiving: Caring for the chronically ill child. Family & Community Health, 15, 19-30.
- Wasilewski, Y., Clark, N., & Evans, D. (1988). The effect of parental social support on maternal disruption caused by childhood asthma. Journal of Community Health, 13, 33-42.

The Native American Graves Protection and Repatriation Act Affiliation Study

Marcus Monenerkit, McNair Scholar
Dr. David Hughes, Faculty Scholar

Abstract

This study's main concern has been with the different habitations and migrations that have taken place within the area of Scotts Bluff and the Agate Fossil Beds National Monument in Northwest Nebraska. The purpose of the research was to come to a conclusion, or at least a good estimation about the Native American tribes which formally occupied the above mentioned region. The importance of this study derives from the recent concern of the United States government which is now trying to cultivate a congenial relationship with the Native American community. With this understanding, the Government has begun the process of returning the artifacts that have been excavated throughout the Anglo-American occupation of the North American continent. This research, which is sponsored by the National Park Service, is only one step in the process of developing a harmonious relationship between the Native Americans and the United States government.

Native American Graves Protection and Repatriation Act Background

On November 16, 1990, President George Bush signed into law the Native American Graves Protection and Repatriation Act (NAGPRA). The law came under final rule on January 3, 1996. Public law 101-601, can be summed up in three provisions: 1) To increase protection for Native American graves and provide for the disposition of cultural remains inadvertently discovered on tribal and Federal lands, 2) To prohibit traffic in Native American human remains, 3) To require museums to provide summaries of their collections of Native American sacred objects, and cultural patrimony within three years, and repatriate them if it is demonstrated that the museum does not have right of possession.

This study examined the possible tribal habitation and migrations within the area of Scotts Bluff and Agate Fossil Beds National Monument in northwest Nebraska. The research examined the various primary journals from individuals having first-hand knowledge of the area in question, as well as the many diaries, articles, and government documents that pertain to the specific locale. The multitudes of secondary materials that pertain to the area were of considerable help as well.

Introduction

The issue of repatriation and graves protection has been a concern of the Indians since the first Europeans came to the "New World." It should be known that over the years, a double standard has emerged regarding the treatment of human graves. There have been laws established protecting the disturbance of Anglo-American graves, but Indian graves have been dug up freely all over the western hemisphere in the name of science. It is estimated that over 600,000 individuals are held by museums, historical societies, universities, and private collectors. Indian people, as well as all people, attach great religious importance to their ancestors and their burials. Human remains are the primary issue of NAGPRA; however, items such as funerary, sacred, and/or objects of cultural patrimony are also of concern.

History

The issue of NAGPRA is one of human rights legislation. Therefore we can find the beginnings rooted within the historical context of the American civil rights movement of the 1960s. In 1968, congress passed the Indian Civil Rights Act; this act ensured that the American Indian can be assured the same broad constitutional rights which all Americans possess. Granted, this law was passed to provide for the protection of people under tribal jurisdiction in order to protect them from unjust actions of tribal governments, but it became the catalyst of Native American rights issues.

In 1974, a group called American Indians Against Desecration, began its quest to put an end to the continued violations on native grave sites. President Carter signed the American Indian Religious Freedom Act in 1978 guaranteeing Native Americans rights to pursue their Native religion without penalty from the government. Finally in 1989, congress passed the first act of the National Museum of the American Indian (NMAI) which was to transfer the material of the George Gustav Heye foundation/collection to the Smithsonian Institution. This first act called for the return of human remains and funerary objects which were to be offered to the groups where cultural affiliation could be established. In 1990, NAGPRA was passed, extending the context to sacred objects and items pertaining to cultural patrimony. This act also extended the applicability of this mandate to all federally funded museums, institutions, and agencies. The Smithsonian, however, remained exempt from the latter because it was already covered by the NMAI Act.

Determinants

The issues of NAGPRA will make it necessary to develop consistent methods and standardized techniques for the process of repatriation. The repatriation claims must meet certain standards that are provided within the act. In any event, all of the claims made by the tribes will have to be proven so that the object in question is undeniably their property. It also implies that any funerary or sacred object is in question until it can be proven to have a connection to the religious organization of

the specific tribe making the repatriation claim and is unquestionably an object of religious pertinence.

Prelude to Conquest

Throughout the eons of human occupation, the North American continent has seen many migrations. Whether it was for the procurement of food or to escape an enemy, the "prehistoric" people travelled and found a new home. Eventually, these people became known as the North American Indians. Of course, Columbus was in the Western Hemisphere in 1492, but it took another century before the conquest of the center of the continent would take place.

After the French and Spanish had figured out there would be no discovery of the "city of gold," their enthusiastic interest in conquest ended in a limited expansion. The various wars that took place within the conquest of the continent also had something to do with it, but their defeat would eventually lead the way for the British and American empires to expand and explore the possibilities of the northern fur trade and complete the conquest of the North American continent. By the 1800s, the conquest of the American continent was in full swing. Now the Native population and land base were experiencing a catastrophic decline, and by 1900 they had reached their nadir point in demographics.

The Emergence of Comanches

The Comanches were one of the many tribes that had spent many generations migrating from their ancestral homelands before the European conquest. It could be said they were officially recognized as the Comanche in 1706, by Juan de Ulibarri, then the governor of the Taos Pueblo. However, it has been documented that before the Comanche had made their way to the Southern Plains, they were a part of the Shoshone Indians of the Great Basin region of North America.

It is believed that the Ute Indians were the first of the North American Indians to obtain horses and the Comanches soon followed. After the introduction of the horse, the migrations that had formerly been slow and tedious began to increase. Now that the Comanches had more mobility, they were able to travel over large tracts of land in search of food, which was mainly buffalo. The Comanche adapted very well to the plains-type organization and subsistence. It is believed that they were once hunters of buffalo, but only being able to travel by foot left them in more local regions of habitations. Before the Comanche separated from the Shoshone, they lived in the area known as Yellowstone and east of the Rocky Mountains in present day Wyoming. This locale, being so close to the proximity of the area in question, leads most scholars to believe that they once inhabited the region of northwestern Nebraska. Once the Comanche received the horse, they were able to travel and keep up with the buffalo for a much longer period. The advent of the rifle also made the hunt function more efficiently and the Comanche began to thrive out on the open plains, becoming a model for the plains Indian-type organization.

By examining the former habitations through the available documents, both historic and contemporary, it is very evident that the Comanche had once occupied the area of northwest Nebraska. Taking into consideration the amount of mobility that the horse brought, it becomes unquestionable that they had either lived in the area or made frequent visits.

Conclusion

The aim of this paper was not only to give the background and history of NAGPRA, but to evaluate the habitation and migration of the Comanche and how they pertain to the area in question. It has been cited throughout the literature that they once inhabited the area of northwest Nebraska which is now known as Scotts Bluff and Agate Fossil Beds. And so it is that the Comanche should be considered possible descendants of remains and material wares which are discovered within the particular region.

The battle over human remains is without a doubt the foremost argument in the issue of NAGPRA, however it is going to take more than just an act of congress to bring the objects of sacredness and cultural patrimony back to their rightful owners. It is an issue of cultural differences and it must be resolved. Unfortunately, it has taken nearly five centuries to get to this point of understanding. Let us just hope that we can resolve our differences in beliefs before it is too late. We reside in an era of great historical precedence. We, as a nation, hold the key to social harmony but it is going to take more than just a few laws to change the consciousness of the people.

References

- Hoebel, E. A. (1952). The Comanches: Lords of the Southern Plains. Norman.
- Nassatir, A. P. (1952). Before Lewis and Clark. St. Louis.
- Price, H. M. (1991). Disputing the Dead: U.S. Law on Aboriginal Remains and Grave Goods. University of Missouri Press. Columbia.
- Wishart, J. D. (1994). An Unspeakable Sadness: The Dispossession of the Nebraska Indians. University of Nebraska Press. Lincoln.

Urban Renewal and Impact on 1st National Black Historical Society Area

Michael Munoz, McNair Scholar
Dr. Anna Chandler, Faculty Scholar

Abstract

In the mid 1960's, the city of Wichita was divided racially into regions. The purpose of this report is to provide preliminary research and a description of the neighborhood that had 3rd street as the south border, 9th street as the north border, Main street as the east border, and Waco street as the west border. The above area was commonly known to be heavily populated by an African-American population, prior to Urban Renewal. This location consisted of businesses, churches, and residences. Currently, this area is the home of various structures ranging from a television station to a veterinarian clinic. Additionally, this area shows little evidence of any African-American existence, residential or commercial, that was there in the past. This study provides data deemed useful in future examinations of the area noted.

Testing the Validity of an Epistemological Questionnaire

Julie Rhoads, McNair Scholar
Dr. Marlene Schommer, Faculty Scholar

Abstract

Testing the validity of a questionnaire, that measures the epistemological beliefs of individuals, was done by comparing the responses of the written form of the questionnaire to the verbal responses of ten selected questions from that same questionnaire. There was not significant support for validity at this time due to the small number of participants. Verbal explanations of the participants' responses were categorized from naive to sophisticated. Each child was charted by age and category in an effort to reflect movement towards epistemological sophistication as a child grows older. Due to the lack of equal amounts of children in each group, the support for such movement was insignificant. However, the variables of experience and environment may be more prominent in the movement towards sophistication.

Introduction

Epistemology is the study of the nature or attitudes of knowledge. Many researchers have studied the effects of an individual's epistemological beliefs upon his or her learning. One such researcher is Dr. Marlene Schommer in the Administration, Counseling, and Educational and School Psychology Department at Wichita State University. Although the views of the exact structure or system of epistemological beliefs differ, Dr. Schommer proposes that this belief contains five dimensions that have a range of possible values: Certainty of Knowledge, Structure of Knowledge, Source of Knowledge, Control of Knowledge Acquisition, and Speed of Knowledge Acquisition (Schommer, 1994).

An individual's belief can be discovered by responding to a variety of questions that reveal either a naive or a sophisticated belief in the acquisition of knowledge. For instance, if you were asked the following question,

"Successful students learn things quickly?"

how would you respond? If you stated something to the extent of "I agree," then your belief would lean toward the naive end of the continuum. However, if you stated something to the extent of "People learn at different speeds, therefore a person can be a successful student but not necessarily learn things quickly" then your belief would lean toward the sophisticated end. According to Schommer (1994), naive individuals believe most knowledge is absolute while other knowledge is temporarily unknown. These individuals are more likely to fall for gimmicks and scams that promise financial growth, for example. On the flip side,

she describes sophisticated individuals as believing that there are few things in this world that are certain, there are some things temporarily uncertain, while most things are either unknown or constantly evolving. These individuals tend to question everything they hear, see, or read and are constantly looking for all the facts.

Dr. Schommer developed a questionnaire to measure the epistemological beliefs of college students then decided to expand her research to include adolescents. A revision was made of the original questionnaire to be distributed to local middle-schoolers. A test of validity was needed to ensure the instrument's accuracy appropriateness. After the revised forty-item questionnaire was distributed to a group of nineteen children, I was asked to administer a ten-item questionnaire verbally to these same children. The verbal questions were identical to ten of the written questions and contained two questions from each dimension. The purpose was to compare the responses from the verbal questions to those of the corresponding written questions. It was presumed that the responses would have a high ratio of consistency to help support the validity of the questionnaire.

While checking for the validity of the instrument, there was a need to hear and record verbal explanations for the given responses by each of the participants. Each participant was asked to give reasons for his or her responses to each question. These responses would then be analyzed for common categories and for reasons for the beliefs. The idea was that the older children would fill the sophisticated categories while the younger children would stay within the naive; thus further verifying the idea that a movement towards epistemological sophistication relies upon the variable of age.

Method

Participants--

Prior to this research project, another research assistant had distributed a written questionnaire to nineteen children located in a middle-class neighborhood. They were not randomly selected subjects but rather friends and/or neighbors of the individual. These nineteen children ranged in age from eight to thirteen years during the distribution of the written questionnaire. Only seventeen of the nineteen were available during the distribution of the verbal questionnaire and most of these had aged almost one year. Consent had been given by the children's parents prior to administration of the written questionnaire, and it was not required to seek further consent. Each child was assigned a number that would correspond to his/her name and age. These numbers would be used as identification within publications, as well as being used for other purposes.

Materials--

The written questionnaire utilized was titled Attitudes about Education developed by Dr. Marlene Schommer in 1990 to measure the epistemological beliefs of adolescents. The forty questions provided the degree of adolescents' epistemological beliefs toward the naive end of the continuum: 1) fixed ability, b) simple knowledge, c) certain knowledge, d) quick learning, and e) authority (Schommer 1994). Each question was to be answered with a given scale numbered 1-6. The participants had the option of choosing a number on the scale to correspond with the degree of agreement or disagreement, one being strongly disagree and six strongly agree.

The second questionnaire developed consisted of ten questions chosen from the forty-item questionnaire. These ten questions covered all five dimensions with two questions from each dimension. They were to be administered verbally to each participant. Each child was required to respond by agreeing or disagreeing and to follow-up with an explanation for the response. The collected responses would then be compared to the corresponding written responses.

Procedure

The ten-item questionnaire was delivered verbally to each participant individually. Each child was informed that his or her responses would be recorded "to prevent writer's cramp" and for the ease of administration purposes. Stress was placed upon the importance of getting their responses correct without any misunderstandings or mistakes. Each child was asked to answer each question with "agree" or "disagree" then to follow-up with a verbal explanation of his or her response. Each child was allowed as much time as he or she deemed necessary to respond to each question. They were told to ask for any clarification for any question they did not understand. Explanations or examples were provided for any incomprehensible questions. If it was believed that a child was misunderstanding a given question, it would be rephrased and a comparison of the responses was made.

Results

Test Validity--

Using the IBM mainframe on the Wichita State University campus, the collected responses from both the written and verbal questionnaires were entered. Using correlational analysis, a comparison was made between the responses received from the ten verbal questions and the corresponding responses from the written questionnaire. Unfortunately the scores were not significant enough to show validity of the developed instrument at this time. Chart 1.A was then developed to provide a closer look at the possible consistency percentage of the responses from the written questions to those of the verbal questions, ranged from 30% to 80% consistency. It is believed that the low correlational scores and the modest consistency percentages are due to the low number of participants and the lapse of time between distribution of the questionnaires. Because most of the participants had gained one year in age when responding to the ten verbal

questions, their epistemological beliefs chartered a differing course. Movement from Naive to Sophisticated--

The ten verbal questions were divided into the five epistemological dimensions with each dimension containing two questions. Four categories were then developed for each dimension by analyzing the given responses. Chart 2.A shows that only 50% of the responses received by the eight year olds questioned were sophisticated in their beliefs of fixed ability while 100% of the responses received by fourteen year olds were sophisticated. However, the responses of these nine, ten and thirteen year olds also showed sophisticated beliefs in fixed ability. Therefore, because the high sophisticated beliefs were random among the various ages, enough evidence was not available to support a definite movement towards sophistication according to age alone. Charts 2.B, 2.C, 2.D, and 2.E reveal similar findings.

Discussion

A variety of factors need to be considered when analyzing the results of this experiment. The participants were not of a random, unbiased selection. These children represented the majority, middle-class America; which presented the question of experience and environment influencing the epistemological growth more so than age (Schommer, 1994). In addition, the age range of these children was not equal, some age groups had one child while others had four, for example. Therefore, a concrete theory that the growth or movement of epistemological beliefs corresponds with age could not be supported in this experiment. To further complicate the situation, the instrument was developed to measure the epistemology of adolescents, but many of these children had not yet reached an adolescent age and/or developmental stage. However, the one year lapse between the distribution of the two questionnaires showed signs of epistemological change. Whether or not these changes were advancements towards sophistication has yet to be analyzed.

The small number of participants played a large factor in the lack of support for instrument validity. However, of the responses collected and compared, 59% of the participants showed 70-80% consistency. Excluding the two outliers and considering the consistent responses from all other participants, a 69% consistency was calculated. Although 69% is quite modest, one would hope to have a slightly higher percentage of consistency in the responses when testing the validity. Knowing this, the research assistants for Dr. Schommer have accepted the opportunity to further this testing with a new group of children. A local summer program for adolescents has given consent to allow distribution of both the written and verbal questionnaires. This new group of children will consist of approximately two hundred at-risk adolescents from a wide range of backgrounds with a narrower range of ages. The new data will be analyzed for instrument validity and possibly used to continue research on the question of experience and environment as a greater variable in epistemological beliefs.

Even though this experiment did not provide the substantial support needed to validate the current instrument, some imperative information was gathered for future administration of the instrument. This experiment served as a good reminder of the importance of time. Recording the changes in the adolescents' responses after approximately one year could contribute to the research of the experience and environment factors, however for instrument validity, this information is of no use. The researchers have begun to stress a narrower time factor when distributing the instrument to the new group of participants. It has been suggested that another reason for the differing responses and modest consistency from the participants in this experiment was due to human-to-human contact. During this experiment, the participants were expected to give a verbal response to an adult by agreeing or disagreeing with each of the ten questions; each participant was then expected to explain his or her responses. Is it possible that the participants, being children, gave the responses they felt the adult wanted to hear? With this question in mind, the researchers are considering a different approach to gathering the responses from the ten-item questionnaire. In addition, it was noted that several of the children did not fully understand some of the questions as they were written or verbally stated. For instance, some children believe a "know-it-all" to literally be a person who knows everything, however it was intended to mean a "smart-aleck." Age differences between the developers of the questionnaires and culture are two strong players in the miscommunication in this experiment, some of the questions will be revised before further distribution.

Schommer, M. (1994). An emerging conceptualization of epistemological beliefs and their role in learning. In R. Garner & P. A. Alexander (Eds.), Beliefs about Text and Instruction with Text (pp. 25-40). Hillsdale, NJ: Lawrence Erlbaum Associates.

Chart 1.A--Consistency of Responses Collected From Epistemological Questionnaires

Participant #	Quest. #	Written	Interview	Consistency
Participant #1	1	0	0	0.1
	2	1	1	0.1
	3	0	0	0.1
	4	0	0	0.1
	5	0	0	0.1
	6	0	0	0.1
	7	1	0	0
	8	0	1	0
	9	1	1	0.1
	10	0	1	0
				70%
Participant #2	1	1	1	0.1
	2	1	0	0
	3	1	1	0.1
	4	0	1	0
	5	0	0	0.1
	6	0	0	0.1
	7	0	0	0
	8	1	1	0.1
	9	1	1	0.1
	10	1	1	0.1
				70%
Participant #3	1	0	0	0.1
	2	1	1	0.1
	3	1	0	0
	4	0	0	0.1
	5	0	0	0.1
	6	0	0	0.1
	7	0	0	0.1
	8	1	1	0.1
	9	1	1	0.1
	10	1	0	0
				80%
Participant #4	1	1	1	0.1
	2	1	1	0.1
	3	0	1	0
	4	0	0	0.1
	5	0	0	0.1
	6	0	0	0.1
	7	0	0	0.1
	8	1	0	0
	9	1	1	0.1
	10	0	0	0.1
				80%
Participant #5	1	1	0	0
	2	1	1	0.1
	3	1	1	0.1
	4	1	1	0.1
	5	1	0	0
	6	0	0	0.1
	7	0	0	0.1
	8	0	1	0.1
	9	1	1	0.1
	10	0	0	0.1
				80%
Participant #6	1	1	0	0
	2	1	0	0
	3	1	0	0
	4	1	0	0.1
	5	0	1	0.1
	6	0	0	0.1
	7	0	0	0.1
	8	0	0	0
	9	1	0	0
	10	0	0	0.1
				50%

0 = a "disagree" response or no consistency 1 = an "agree" response 0.1 = 10% consistency for each consistent response

Chart 1.A--Consistency of Responses Collected From Epistemological Questionnaires

Participant #9

Quest. #	Written	Interview	Consistency
1	0	0	0.1
2	0	0	0.1
3	no answer	1	0
4	0	1	0
5	0	0	0.1
6	0	0	0.1
7	no answer	0	0
8	0	0	0.1
9	1	1	0.1
10	no answer	0	0
			60%

Participant #8

Quest. #	Written	Interview	Consistency
1	0	0	0.1
2	1	1	0.1
3	0	0	0.1
4	0	1	0
5	0	0	0.1
6	1	1	0.1
7	0	0	0.1
8	1	1	0.1
9	1	1	0.1
10	1	0	0
			80%

Participant #11

Quest. #	Written	Interview	Consistency
1	0	1	0
2	0	0	0.1
3	1	1	0.1
4	0	1	0
5	0	0	0.1
6	0	0	0.1
7	0	0	0.1
8	0	0	0.1
9	1	1	0.1
10	0	0	0.1
			80%

Participant #10

Quest. #	Written	Interview	Consistency
1	1	0	0
2	0	0	0.1
3	1	1	0.1
4	1	1	0.1
5	0	0	0.1
6	0	0	0.1
7	0	0	0.1
8	0	1	0
9	1	1	0.1
10	0	0	0.1
			80%

Participant #13

Quest. #	Written	Interview	Consistency
1	0	1	0
2	1	0	0
3	1	1	0.1
4	1	1	0.1
5	1	0	0
6	0	1	0
7	0	1	0
8	0	1	0
9	1	1	0.1
10	0	1	0
			30%

Participant #12

Quest. #	Written	Interview	Consistency
1	1	1	0.1
2	0	1	0
3	1	1	0.1
4	0	1	0
5	0	0	0.1
6	1	1	0.1
7	0	0	0.1
8	1	0	0
9	1	1	0.1
10	0	0	0.1
			70%

0 = a "disagree" response or no consistency 1 = an "agree" response 0.1 = 10% consistency for each consistent response

Chart 1.A--Consistency of Responses Collected From Epistemological Questionnaires

Participant #14

Quest. #	Written	Interview	Consistency
1	1	0	0
2	1	0	0
3	0	1	0
4	1	1	0.1
5	0	0	0.1
6	1	0	0
7	0	0	0.1
8	1	0	0
9	1	0	0.1
10	0	0	0.1

50%

Participant #15

Quest. #	Written	Interview	Consistency
1	1	0	0
2	1	0	0
3	1	0	0
4	0	1	0
5	1	0	0
6	0	0	0.1
7	1	1	0.1
8	1	1	0.1
9	1	1	0.1
10	0	0	0.1

50%

Participant #16

Quest. #	Written	Interview	Consistency
1	0	0	0.1
2	1	1	0.1
3	0	1	0
4	1	0	0
5	0	0	0.1
6	0	0	0.1
7	1	0	0
8	1	1	0.1
9	1	1	0.1
10	0	1	0

60%

Participant #17

Quest. #	Written	Interview	Consistency
1	0	0	0.1
2	1	1	0.1
3	1	1	0.1
4	1	1	0.1
5	0	0	0.1
6	0	0	0.1
7	0	0	0.1
8	0	1	0
9	1	0	0
10	0	0	0.1

80%

Participant #18

Quest. #	Written	Interview	Consistency
1	1	1	0.1
2	0	1	0
3	1	0	0
4	1	0	0
5	0	0	0.1
6	0	0	0.1
7	1	0	0
8	0	1	0
9	1	1	0.1
10	1	1	0.1

50%

Total Number of Consistent Answers 112/170
 Percentage of Consistent Answers 66%
 Percentage of Consistent Answers (Excluding Outliers--Participants 9 & 13) 69%
 (Participants number 7 and 19 were not available)

0 = a "disagree" response or no consistency 1 = an "agree" response 0.1 = 10% consistency for each consistent response

Chart 2.A: Fixed Ability--

Question 5I & 18W: Working hard on a difficult problem only pays off for the really smart students?
 Question 7I & 21W: An expert is someone who is really born smart in something?

	Unable to Explain	Born Smart	Age and Experience	Work/Study to Learn
8 yr.		12.50%	37.50%	50%
9 yr.				100%
10 yr.				100%
11 yr.	25%	25%	25%	25%
12 yr.		25%		75%
13 yr.				100%
14 yr.				100%
Totals	3%	9%	12%	76%

Chart 2.B: Simple Knowledge--

Question 1I & 4W: The best thing about a science course is that most problems have only one right answer?
 Question 2I & 9W: Being a good student generally involves memorizing facts?

	Unable to explain	"Good Student" means good behavior, etc.	Only facts or one answer	Many answers, many ways
8 yr.		12.50%	62.50%	25%
9 yr.			50%	50%
10 yr.			25%	75%
11 yr.	25%		50%	25%
12 yr.			50%	50%
13 yr.				100%
14 yr.			50%	50%
Totals	3%	3%	44%	50%

Chart 2.C: Certain Knowledge--

Question 3I & 29W: Today's facts may be tomorrow's fiction?
 Question 9I & 26W: Scientists can get to the truth if they just keep searching for it?

	Unable to explain	Truth never found	No new truths, things can't change	New truths, things do change
8 yr.				75%
9 yr.	50%		25%	50%
10 yr.	13%	12%		75%
11 yr.				100%
12 yr.				100%
13 yr.		50%	50%	
14 yr.			17%	83%
Totals	6%	6%	12%	76%

% of Naive to Sophisticated Responses According to Age

Chart 2.D: Quick learning (Speed of Knowledge Acquisition)--
 Question 41 & 16W: Learning is something that takes a long time?
 Question 81 & 22W: Successful students learn things quickly?

	Just listen, think, pay attention & memorize	Only takes a short time	Takes a long time and must work & study	People learn at different speeds
8 yr.	25%			
9 yr.	100%		25%	38%
10 yr.		25%		
11 yr.	50%		37.50%	37.50%
12 yr.			25%	25%
13 yr.			50%	50%
14 yr.			50%	50%
Totals	18%	9%	41%	15%
				32%

Chart 2.E: Authority (Knowledge is gained from an authority figure)--
 Question 61 & 20W: You can believe almost everything you read?
 Question 101 & 31W: People who challenge authority are know-it-alls?

	Unable to explain	Authorities are always right	Some authorities can be challenged	Authorities not always right, ok to challenge
8 yr.				
9 yr.	50%	50%		50%
10 yr.				50%
11 yr.	25%			100%
12 yr.		25%	25%	25%
13 yr.	50%		25%	50%
14 yr.				50%
Totals	9%	18%	33%	67%
			12%	61%

The Research Process

Charolette Loraine Simmons, McNair Scholar
Dr. Saliwe Kawewe, Faculty Scholar

Abstract

An African American undergraduate senior in Social Work provides a detailed description of the many preliminary research-related activities engaged in within a three month time span. The paper focuses on the steps taken to advance and broaden in scope a pilot study that was previously started by Dr. Kawewe.

The Process

How does one proceed to conduct scholarly research without previous experience beyond the classroom? How much will I be expected to know? One by one, my questions were answered during a semester of meeting once per week with Dr. Saliwe Kawewe, my faculty mentor. During these one-on-one sessions, which lasted between one hour and two, she and I discussed, in addition to the questions that I had, my concerns about lack of professional research practice including the next steps needed in order to advance the research pursuit. Although the majority of allotted time was spent on specific issues in research, she also exhibited concern and empathy when I found myself facing specific life problems which had developed after the onset of my commitment to do scholarly research that threatened my ability to stick with the project to the completion of my objectives.

A little about my faculty mentor, Dr. Saliwe Kawewe. Dr. Kawewe came to America from Zimbabwe, Africa. She came to the States first as a student. After receiving her Doctorate degree, she remained to share her experience, knowledge, and perspective with students through instruction as a professor. While we worked together on the research project, she was a professor in the undergraduate Social Work program at Wichita State University. Since then, she has accepted a position at Southern Illinois University as Director of the Social Work graduate program. She and her daughter relocated during the summer of 1996 from Wichita, Kansas to Illinois.

Initially, Dr. Kawewe and I engaged in an interview session to assess whether she was involved in a research project that would be of interest to me. I had also interviewed with one other WSU faculty member with the same objective in mind. I also needed to gain a better idea regarding our ability to work successfully together, since our relationship was previously strictly teacher and student. The idea of working together to accomplish a task was, at first for me, rather intimidating because of her advanced level of acquired knowledge. Also, from a student's perspective, I perceived her to be a person who might be too demanding as a Mentor. Thankfully, my assumption was later proven incorrect. Similarly, I am sure that she also used the initial interview to assess whether she wished to proceed with forming a working partnership with me.

Dr. Kawewe explained to me a pilot study that she had already began work on, in which she was attempting to gather information on persons living with HIV and AIDS in Kansas and Zimbabwe. The purpose of her inquiry consisted mainly to ascertain what overall and specific similarities and differences there are in order to improve the quality of care for victims themselves, and their families. She had already acquired information from some Zimbabweans and some Wichitans, so my purpose was to expand the data collection to include persons living in other parts of Kansas, as well as to do a thorough Literature Review. I had previously had a minimal amount of knowledge in the area of HIV/AIDS, and because I plan to eventually work with inmates and their families, and also recovering persons, some or perhaps many of whom will have been directly affected by the HIV/AIDS epidemic, I decided that this would be an excellent project to work on.

All potential and actual research projects should begin with a Literature Review. The review consists of seeking to find out if there are other comparable works that have been published in order to determine whether one has a researchable idea worthy of further pursuit. By use of the word researchable, I mean that there may be extensive research already conducted on a given topic, and if so, the time to find this out is before a significant amount of time has been invested in research. If there is already a significant amount of published research on the topic of interest, then the researcher must determine if there is any new information that can be contributed.

Through the Literature Review that was conducted, no other published studies similar to the pilot study we were engaged in were found. Out of all the many reports that I have turned in for class credit, I have always found something published that was comparable to the project being worked on. As a student scholar involved in this pilot study, I found the lack of other published material, related to our topic of inquiry, to be very surprising.

Upon completion of the Literature Review, I decided that my next task would be to arrange to have a stable location on campus in which to do long-distance calling and anything else that would develop related to the research. A room in which to work was obtained without any problems.

Next, a listing of all service providers to HIV/AIDS patients and consumers throughout the state of Kansas needed to be obtained. In order to obtain this listing, several calls and a site visit were made. The University of Kansas School of Medicine located on the Wichita campus provided direction on other sources to contact, one of them being the Sedgwick County Health Department. A Health Department employee made available a listing of several Wichita-based individuals, groups and agencies involved in providing care and/or information to HIV/AIDS positive individuals. From calling the providers on the list, it was learned that the Kansas Department of Health and Environment could make available to us a copy of a state-wide listing of caregivers to HIV/AIDS clients and consumers.

Several days later, upon receipt of the state-wide listing, the providers were called and permission was requested to mail surveys to them. It was explained that the surveys would need to be distributed by those cooperating agencies to their

clients and consumers, and then would be sent by return mail to us in separate, uncoded envelopes. Securing provider permission, especially when dealing with a super-sensitive issue such as HIV/AIDS, was not easy. It required more "no" responses than this student scholar anticipated. Provider caution was one obstacle. Another major obstacle was confidentiality, which all of the professionals took care not to breach. Having worked through the entire state-wide listing, the calling was completed within a time frame of approximately five weeks. The length of time it took to complete this phase is noteworthy due to the fact that this project proceeded on a part-time only basis, which made progress in securing permissions-to-distribute stretch out to a painfully slow rate. No calls were attempted on Monday, Wednesday, or Friday. Also no calls were made on weekends due to the unavailability of contact persons.

There were other mini-steps in the process as well. Several days were invested in typing the recoded questionnaire format and revised accompanying cover letter. Approval by Dr. Kawewe of the revised drafts was required, and sometimes this necessitated more retyping. The new forms were then taken to a printing center on campus to be mass-copied. Survey packets and individual return envelopes were addressed and taken to be weighed. Mail rates were obtained, then the Social Work Department secretary had to walk with me over to the campus post office to authorize postage for mailing the surveys. Due to class scheduling, Social Work Practicum, and child-rearing, none of these mini-steps were accomplished quickly.

As Dr. Kawewe and I met weekly for progress reviews and updates, I was helped to tie together what I was reading in research textbooks to what was being accomplished in our project. She helped me refine and select information about the project to be shared with service providers. This continual communication and feedback was perhaps the most vital aspect of the project, in my opinion. Without it, there surely would have been more uncertainty on my part.

One major lesson learned is that research does not necessarily fit well into preconceived notions of time, especially research that requires information collection from other sources.

Periodicals Reviewed

1. Social Work, Volumes 35, 36, 37, and 38.
2. Health and Social Work, Volume 17.
3. Social Casework (Families in Society), Volumes 68, 69, and 70.

Suggested Supplemental Readings

1. Survey Research Methods, by Babbie, Carl R. : Wadsworth Publishing Co., Inc.
2. Methods of Social Research, by Bailey, Kenneth D. : The Free Press (A division of Macmillan Publishing Co., Inc.)

C

C

C

C

C

C

C

C

C

C

..

C

Possible Reaction Pathways to a Symmetrical Spheroid of Zinc Oxide

Tony V. Smith, McNair Scholar
E. C. Behrman, Faculty Scholar

Abstract

It has been proposed that some divalent metal oxides and sulfides might be stable as hollow spheroids, analogous to the carbon fullerenes. Spheroid configurations spontaneously evolve from some cluster configurations investigated with the general purpose semi-empirical molecular orbital package (MOPAC) program. Here, we attempt to identify possible reaction pathways for the formation of spherical zinc oxide. Initial and final relative energies are evaluated and compared, with relative reaction kinetics deduced. Implications for synthesis are discussed.

Introduction

In previous work [1,2] it was proposed that some divalent metal oxides and sulfides might be stable as hollow spheroids analogous to the carbon fullerenes or buckminsterfullerenes. Colloquially called 'buckyballs,' these are spherical carbon configurations of hexagons and pentagons that resemble a soccer ball with the carbon atoms located at the corners. The fact that these hollow spheroids are stable does not tell us how they can actually be synthesized. The number of different possible arrangements of even as few as 24 atoms is enormous, and the number of ways of rearrangement in transition to another is even greater. Thus identifying a single preferred route, or reaction pathway, is a very difficult problem, even in the gas phase where many-body interactions are minimal. Indeed, the route by which the well-known carbon fullerenes are formed is still an open question. It has been argued that the formation of fullerenes is by the growth of building blocks in curved sheets that then fold over and form the spheroid. One such proposed route is called the isolated pentagonal road model [3], in which the limiting factor is the requirement that no two pentagons share an edge. This leads to the requirement that the smallest number of atoms necessary to close a spheroid is sixty, hence the stable C₆₀ 'buckyball.' However, results of experiments [4] in which a graphite mixture of two pure carbon isotopes, ¹²C and ¹³C, were ablated with a laser, seem to show that fullerenes are formed in the gas phase and the initial precursors are atoms rather than clusters or lattice fragments. Since zinc oxide (ZnO) is not isoelectronic with carbon molecules, the carbon pathways are not necessarily the same as the possible ZnO pathways. Still, they can suggest potential models. Therefore, these original hypothetical formation techniques are evaluated for possible reaction pathways.

One well-known method for investigating reaction pathways is the molecular dynamics (MD) method in which atoms are approximated as classical particles interacting with (usually semi-empirical) potentials, and Newton's second law is integrated to give the trajectory (path as a function of time) for each atom. Indeed,

initial work [1] using this method, showed clusters in a variety of starting configurations (including wurtzite, hexagonal prism and cubic) evolving spontaneously to the hollow spheroid.

MD is not an exact method, because atoms are not classical particles, and therefore the quantum mechanical interactions used are only approximately represented by the semi-empirical potentials therein. Thus we wished to confirm and broaden, if possible, the classical results, by quantum mechanical calculations. Using a semi-empirical molecular orbital program, the 3x4x2 cubic cluster configuration which formed a spheroid with the MD methods was also found to optimize in the hollow spheroid. Note that a molecular orbital calculation does not give us any actual time evolution of the atom; merely, it takes the system down the energy slope in a vast many-dimensional space. Simple kinetic theory says that the rate of a reaction is proportional to the Boltzmann factor, $e^{-\beta E^\ddagger}$; where β is the inverse temperature in units of Boltzmann's constant and E^\ddagger is the activation energy. This first approximation assumes that there is a simple pathway from reactants to products with a single energy "hump" of height E^\ddagger between; this simple picture is rarely correct. However, the activation energy, E^\ddagger , does represent the potential energy barrier that the reactants will have to overcome in order for the reaction to occur.

Molecular orbital theory is concerned with predicting the properties of atomic and molecular systems. It is based on the fundamental laws of quantum mechanics and uses a variety of mathematical transformation and approximation techniques to solve its fundamental equations [5]. When quantum theory is used to determine the structure and properties of molecules, the process is called electronic structure analysis. This type of analysis is significantly more accurate (and considerably more computational intensive) than the classical method of molecular mechanics. In this research, we use a general-purpose semi-empirical molecular orbital package program called MOPAC [7] to investigate a variety of geometries with perturbations for spontaneous evolution into spheroids. MOPAC has been successfully used to study carbon fullerenes [6]. Given an initial configuration of atoms, MOPAC computes the quantum mechanical potential energy and attempts to minimize it to find the most stable state. The idea here is to find a configuration or transition state, that will optimize or 'roll down' the energy 'hump' to the spheroid as a product and to a known starting geometry as a reactant, thus defining a complete pathway. The semi-empirical method of MOPAC uses parameters derived from experimental data to simplify the computation of solutions to the quantum mechanical wave equations. Thus MOPAC does "exact" quantum mechanics on four valence (outer) orbital electrons per atom plus an empirically determined core-to-core interaction potential. The Hamiltonians (mathematical expressions for the kinetic and potential energy terms of the electrons) used herein are the AM1 (Austin Model 1) and PM3 (Parametric Model 3). Atomic parameters are optimized, via the Hamiltonians, so that calculated results reproduce successfully the heats of formation, geometry, dipole moment, and ionization potentials of the elements investigated herein. *Ab initio* calculations (first principles' calculations which use

no experimental data) were attempted but not pursued due to hardware and time limitations. For example, an explorative test run on the DEC Alpha platform, see below, with the PM3 optimized $(\text{ZnO})_{12}$ spheroid structure using Gaussian 92, Revision G software [8] (a first principle calculation program) with a low-level basis set (3-21G), took approximately 122 hours to complete. A MOPAC calculation using a high quality basis set (Hamiltonian) can in fact produce better numbers than a low-level *ab initio* calculation, and the savings in time is exponential.

Geometries evaluated are clusters or chunks, of the solid state structures of wurtzite, zincblende, rock salt lattice, and hexagonal prism. In addition, a cube was constructed by the placement of six rhombic $(\text{ZnO})_2$ molecules centered and oriented on the cube's faces to match the stable spheroid configuration. The idea of using the known solid state configurations of wurtzite, zincblende, and hexagonal prism or stacked hexagons (an idealization of wurtzite) as starting points in the gaseous stage comes from the fullerene production technique of laser ablation of solid state material. Wurtzite and zincblende are the equilibrium solid state forms of zinc oxide and zinc sulfide respectively. The cubic lattice or rock salt configuration comes from envisioning the flattening or squashing of the spheroid, and the space placement of rhombi on the faces of a cube from the results of an optimized run of a hexagonal prism at a bond length of 3.25 Å (angstroms). The separation of the spheroid into hemispheres was investigated, to decide at what separation distance the recombination of the spheroid would cease.

Not surprisingly, given the enormous number of possible pathways, few of these clusters evolved to the spheroid. However, of the various optimized and nonoptimized configurations studied, the spheroid was always the lowest in energy (and therefore the energetically preferred state), and we remain confident that pathways to that lowest energy can be found.

Methodology

The platform is a DEC Alpha workstation using the OpenVMS AXP Operating System Version 1.5. DRAW, an editing and graphical presentation program for MOPAC is executed on a personal computer for figure generation and analysis. DRAW will not display the chemical symbol Zn, for zinc, therefore the symbol Cl was chosen to indicate zinc atoms in the figures printed herein.

Correlation of Hamiltonians

The optimized geometries of the zinc oxide spheroid, $(\text{ZnO})_{12}$, from previous experiments [2] under the AM1 and PM3 Hamiltonians were evaluated to verify that if symmetry constraints were removed the spheroid configuration would remain. These optimized results from AM1 and PM3 in Z-matrix (spherical) coordinates were optimized with the same Hamiltonian respectively in Cartesian (x,y,z,) coordinates. The resulting configurations changed only negligibly. Using the same starting geometries again, the PM3 Hamiltonian was used on the AM1 configuration and vice versa to verify correlation between the two methods. That is, the optimized AM1 spheroid was optimized under the PM3 Hamiltonian, which

then optimized the structure to the PM3 structure with only negligible changes. Therefore correlation of stability exists between Hamiltonians for the spheroid structure.

Wurtzite - Methodology

The grouping of selected atoms or clusters from the wurtzite geometry named for this experiment are Strip, Bowl, Valley and Void. All maintain the stoichiometry of $(\text{ZnO})_{12}$, and were optimized under the PM3 and AM1 Hamiltonians. The location of atoms in wurtzite can be visualized as a stacking of buckled hexagons. These hexagons have two opposing corners bent out of the plane, one up at 45 degrees the other down at 45 degrees (chemically these are called 'chair' structures). Strip, (Figure 2-a) a planar configuration, consists a central hexagon with six hexagons surrounding it. Bowl, (Figure 1-a) an adaptation of Strip, gives the appearance that Strip has been stretched and cupped as if to form a large shallow bowl. Valley consists of a narrower cut with additional layers of atoms thereby giving the general appearance of a capital "Y", see Figure 3-a. Valley and Bowl can be thought of as curved regions of Strip. Void (Figure 4-a) consists of a double layer of three adjacent hexagons, from which a pair of atoms is taken; the idea is that the ablated piece may have contained a void or vacancy (not uncommon in crystals).

Wurtzite - Results and Discussion

Bowl, optimized under AM1, maintains its initial concave curve with some rhombic connections between the interior atoms and the exterior atoms. Under PM3 the atoms clustered together in a "u" shape, see Figure 1-b.

Strip, optimized under AM1, curves slightly overall with some reverse curve in the center. Under PM3, there is a buckling of the sheet laterally that creates a hook appearance, see Figure 2-b.

Valley, optimized under AM1 and PM3, creates a "T" looking shape which is visualized as an ellipse with its minor diameter connecting to the major axis a buckled ellipse for the vertical support, see Figure 3-b.

Void, optimized under AM1, separates out an oxygen pair and generally maintains the wurtzite structure, see Figure 4-b. Under PM3, it appears to remain similar to the wurtzite structure itself with some expansion of the void or vacancy location. PM3 results are very similar to the optimization results of the virgin wurtzite structure in the hexagonal prism experiments below.

All of the optimized geometries have gradients (∇) of between four and eight, as indicated in Table 1. These are quite large, indicating that the geometries found are not in fact stationary points on the potential energy surface (whereas the spheroid is).

Table 1: Wurtzite Cluster Results

Configuration		Heat of Formation, kcal/mole/pair			
Initial	Final	AM1		PM3	
		Initial	Final	Initial	Final
Bowl	curved sheet	65.18	17.70 Ⓣ 2.5		
	'u' shaped cluster			50.54	-7.32 Ⓣ 2.3
Strip	curved sheet	54.98	18.84 Ⓣ 2.3		
	buckled sheet			31.36	-7.09 Ⓣ 3.1
Valley	'T' shaped orthogonal ellipses	83.52	20.71 Ⓣ 2.3		
				71.23	-6.45 Ⓣ 2.1
Void	hexagonal stack with a free O ₂ pair	75.39	14.85 Ⓣ 2.4		
	similar to Wurtzite structure			67.75	-6.32 Ⓣ 2.7

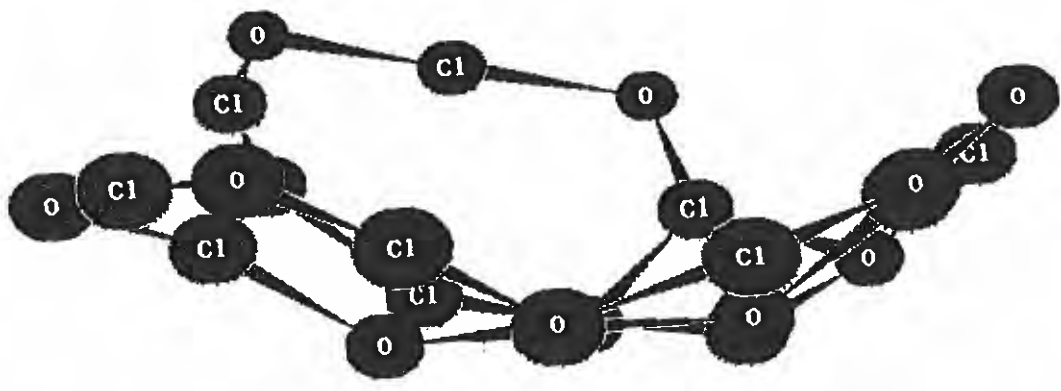


Figure 1-a. Initial Wurtzite Configuration - Bowl

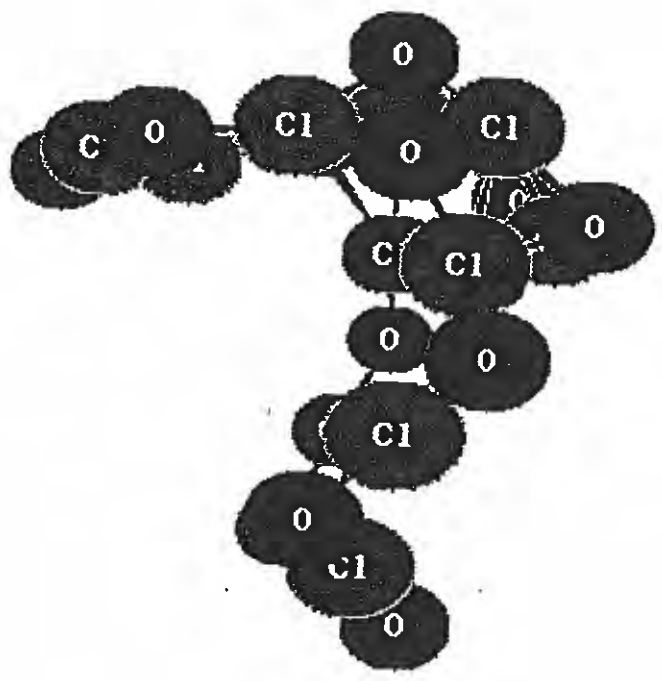


Figure 1-b. Final Wurtzite Configuration - Bowl (PM3)

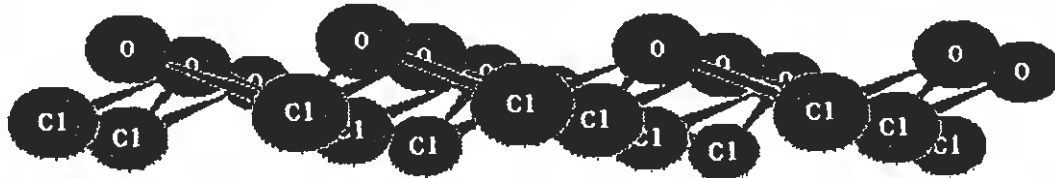


Figure 2-a. Initial Wurtzite Configuration - Strip

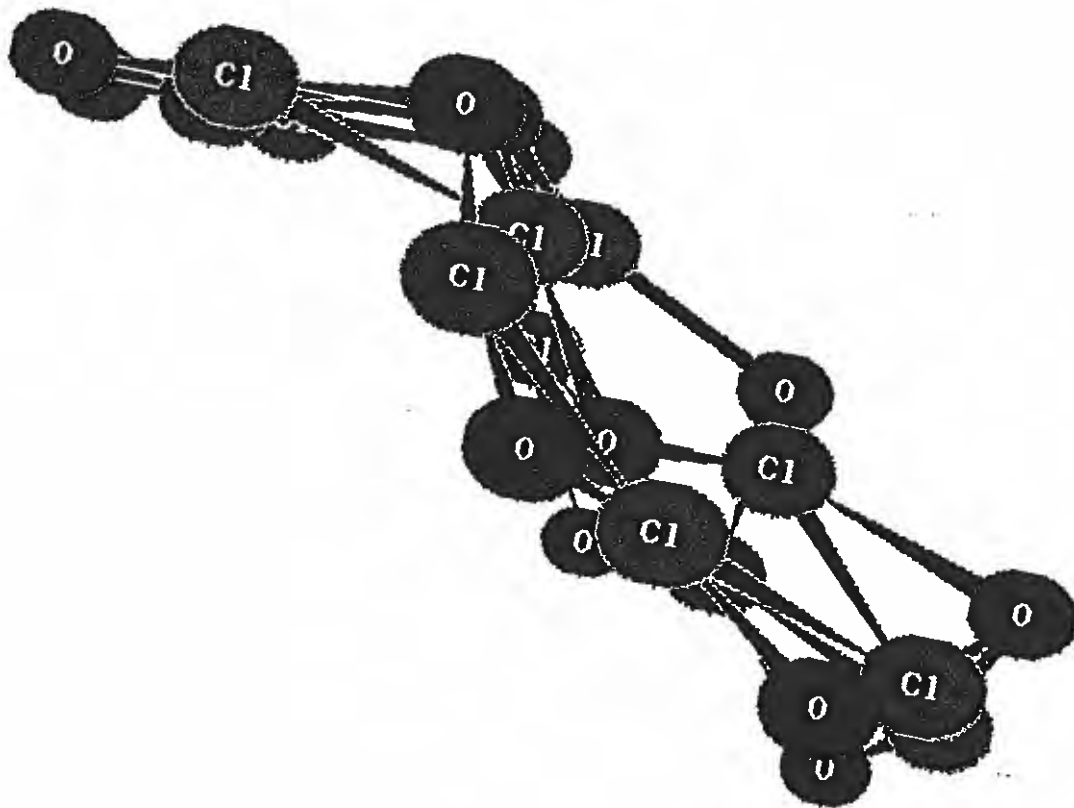


Figure 2-b. Final Wurtzite Configuration - Strip (PM3)

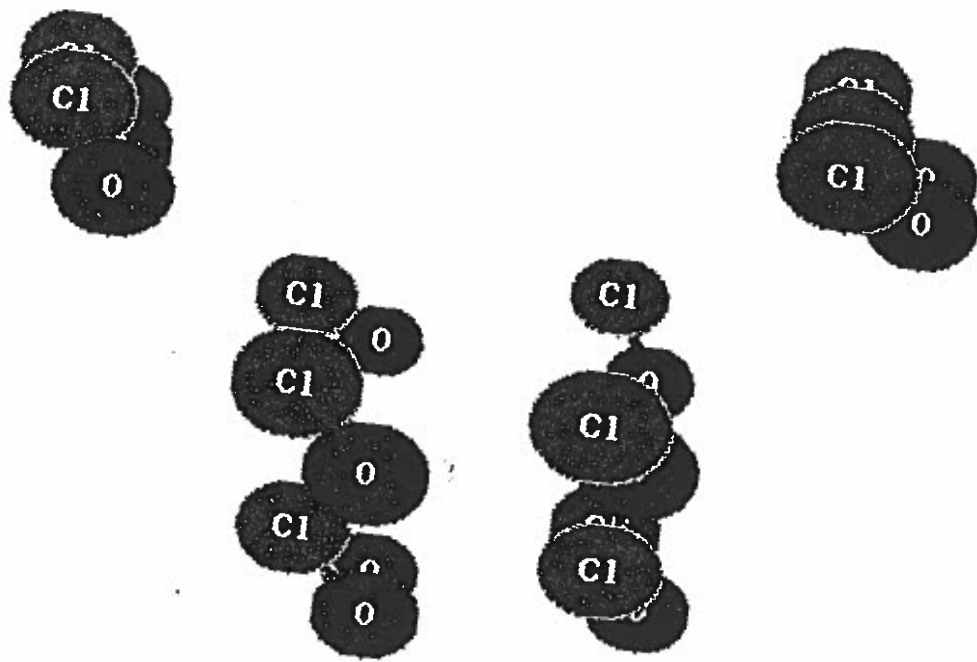


Figure 3-a. Initial Wurtzite Configuration - Valley

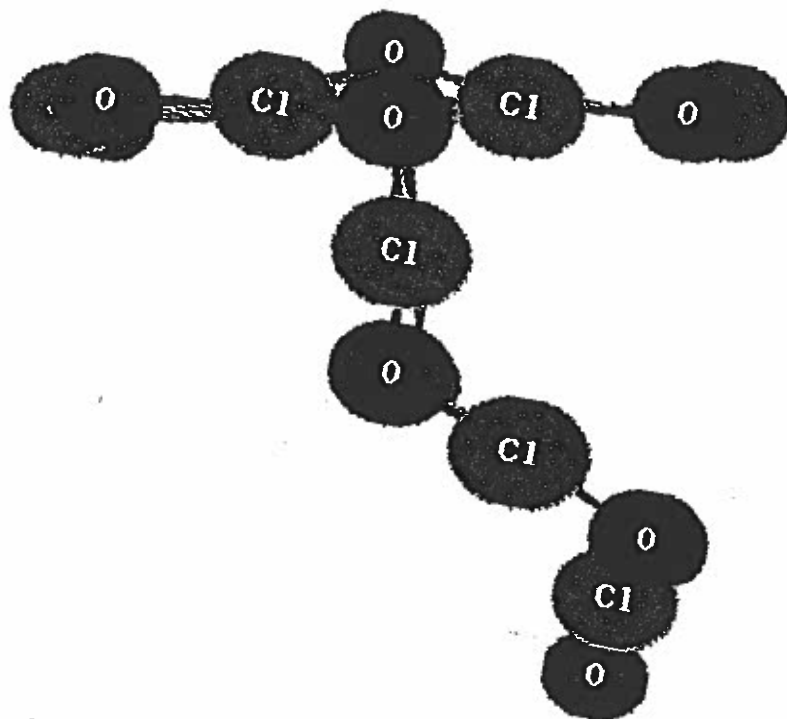


Figure 3-b. Final Wurtzite Configuration - Valley (PM3)

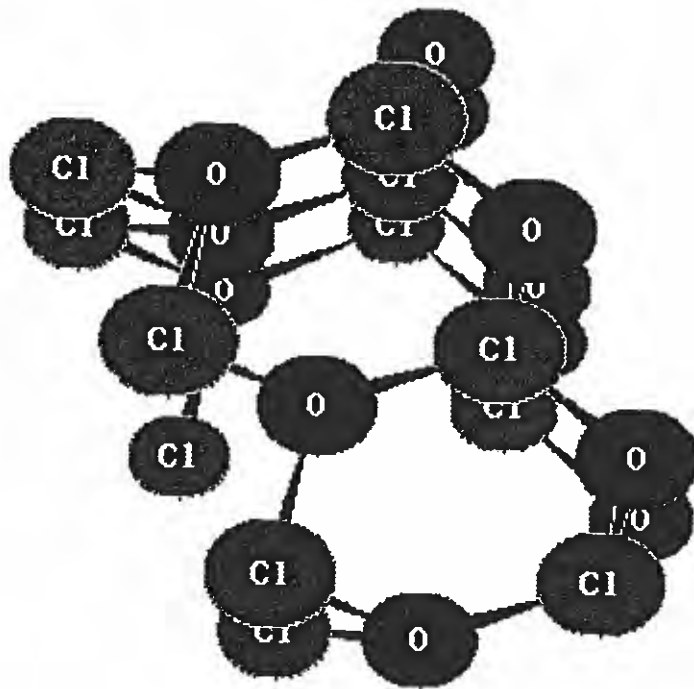


Figure 4-a. Initial Wurtzite Configuration - Void

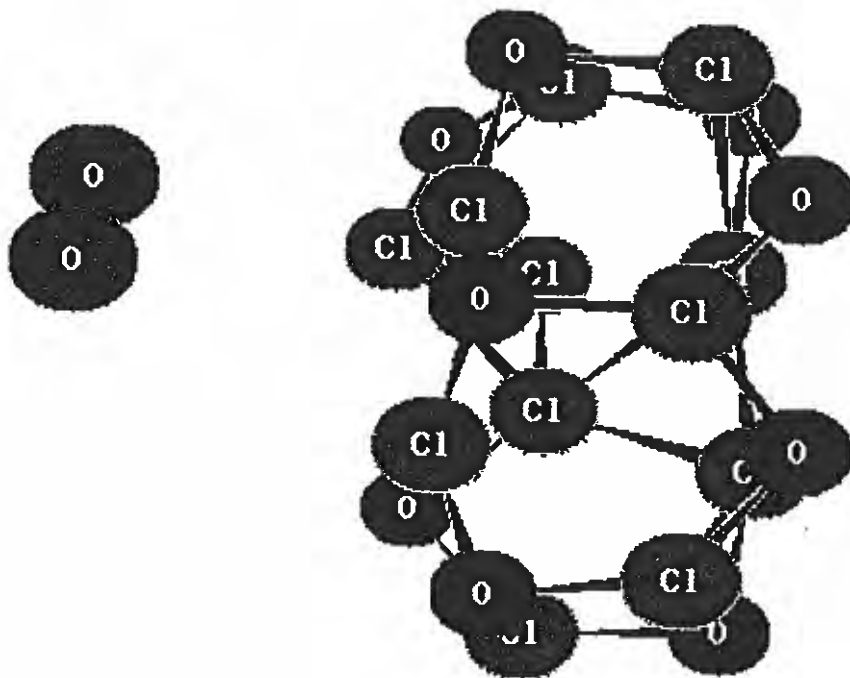


Figure 4-b. Final Wurtzite Configuration - Void (AM1)

Zincblende - Methodology

The zincblende structure is stoichiometrically equivalent to $(\text{ZnO})_{14}$. It can be visualized as two superimposed face centered cubes (fcc) translated about three-fourths of their respective end diagonals, see Figure 5. This structure was optimized along with three other altered configurations to be stoichiometrical with the $(\text{ZnO})_{12}$ spheroid. These perturbations are the removal from the zincblende structure of the two left front oxygen atoms and the back two rear zinc atoms (Blend), the removal of the two right rear vertical zinc atoms and front top two oxygen atoms (Oblen), and the removal of rear bottom two zincs atoms and the front two left vertical oxygen atoms (Znblen).

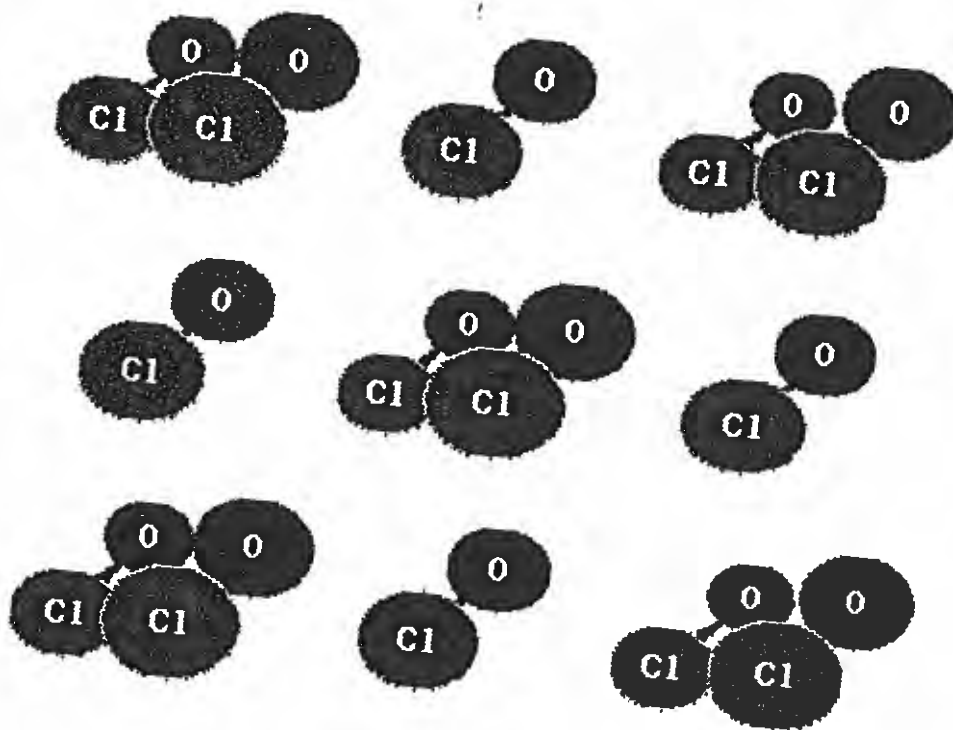


Figure 5. Zincblende Structure

Zincblende - Results and Discussion

The optimized (but nonstationary) geometries of zincblende separate out one or two atoms as the remaining conglomerate, see Table 2. The optimized geometry of virgin zincblende did form a highly similar spheroid to $(\text{ZnO})_{12}$ with an oxygen positioned outside the spheroid.

Table 2: Zincblende Results

Configuration		Heat of Formation, kcal/mole/pair			
Initial	Final	AM1		PM3	
		Initial	Final	Initial	Final
Blend; removed right rear vertical Zn pair; left front vertical O pair		134.79	26.21 Ⓣ 3.8		
	lone ZnO pair away from cluster			114.65	7.13 Ⓣ 3.6
Oblen; removed right rear vertical Zn pair; front top O pair	lone ZnO pair and an O atom from cluster	139.78	27.32 Ⓣ 6.9		
	lone ZnO pair away from cluster			119.53	12.22 Ⓣ 3.2
Znblen; removed rear bottom Zn pair; front left vertical O pair	lone O atom away from cluster	139.57	33.16 Ⓣ 6.2		
	2 lone Zn atoms away from cluster			119.56	22.88 Ⓣ 4.3
Zincblende	lone O atom away from cluster	138.72	25.71 Ⓣ 6.6		
	lone O atom away from cluster			115.86	2.79 Ⓣ 2.9

Cubic cluster - Methodology

The stable $(\text{ZnO})_{12}$ spheroid, see Figure 6, can be visualized as an inflation of a $3 \times 4 \times 2$ cubic cluster into the spheroid configuration or vice versa as the flattening of the spheroid into a cubic cluster. Initial $3 \times 4 \times 2$ cubic cluster bond lengths, see Figure 7, investigated are 1.6 Å, 1.8 Å, 2.0 Å, 2.1 Å, 2.2 Å, and 2.4 Å. In the similar formation assumption the $(\text{ZnO})_{16}$ spheroid is investigated in the $4 \times 4 \times 2$ cubic cluster configurations at 1.8 Å, 1.9 Å, 2.0 Å. Also investigated are the cluster configurations of $2 \times 6 \times 2$ (cubic) and 4×6 (planar) at 2.0 Å.

Cubic cluster - Results and Discussion

The spontaneous stable spheroid formation from the $3 \times 4 \times 2$ rock salt structure at 2.0 Å begs the question if a slight perturbation will also form the spheroid. It was discovered that spontaneous spheroid formation occurs only if the bond length is

less than or equal to 2.0 \AA , see Table 3, and under the PM3 Hamiltonian. At increasingly longer bond lengths, under PM3, the optimized structures ranged from a hollow structure, see Figure 8, to an alternating stack of hexagons, to a tubular cluster. The alternating stack can be visualized as the elongation of one corner of the hexagon with the hexagon on top of it having its elongation on the opposite corner, see Figure 9. From this perspective, the peak or elongation is alternating up through the stack. The PM3 optimization of the 2.0 \AA $2 \times 6 \times 2$ cubic cluster is the closest in energy with a heat of formation difference of $3.19 \text{ kcal/mole/pair}$ to the stable spheroid. Under AM1 the spontaneous formation is a hexagonal prism or stack of aligned hexagons, see Figure 10, which is investigated below.

The differences in the heat of formation, under PM3, for an optimized zinc oxide structure of 24 atoms and the $(\text{ZnO})_{12}$ spheroid is $3.19 \text{ kcal/mole/pair}$, and between an optimized zinc oxide structure of 32 atoms and the $(\text{ZnO})_{16}$ spheroid is $1.19 \text{ kcal/mole/pair}$. Under AM1, the difference in heat of formation between the $3 \times 4 \times 2$ optimized cubic cluster structures was basically $4.54 \text{ kcal/mole/pair}$ overall.

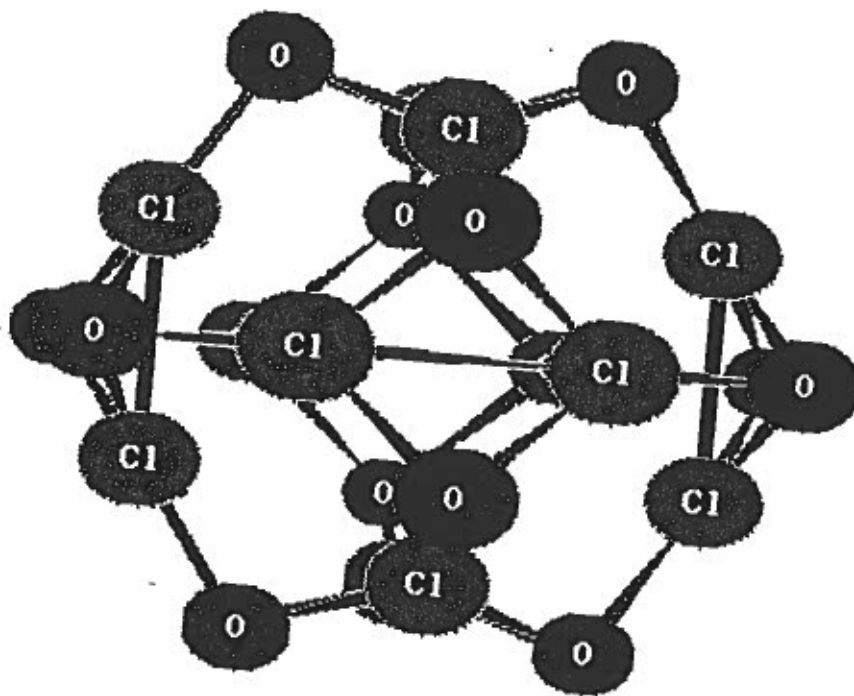


Figure 6. $(\text{ZnO})_{12}$ spheroid (PM3)

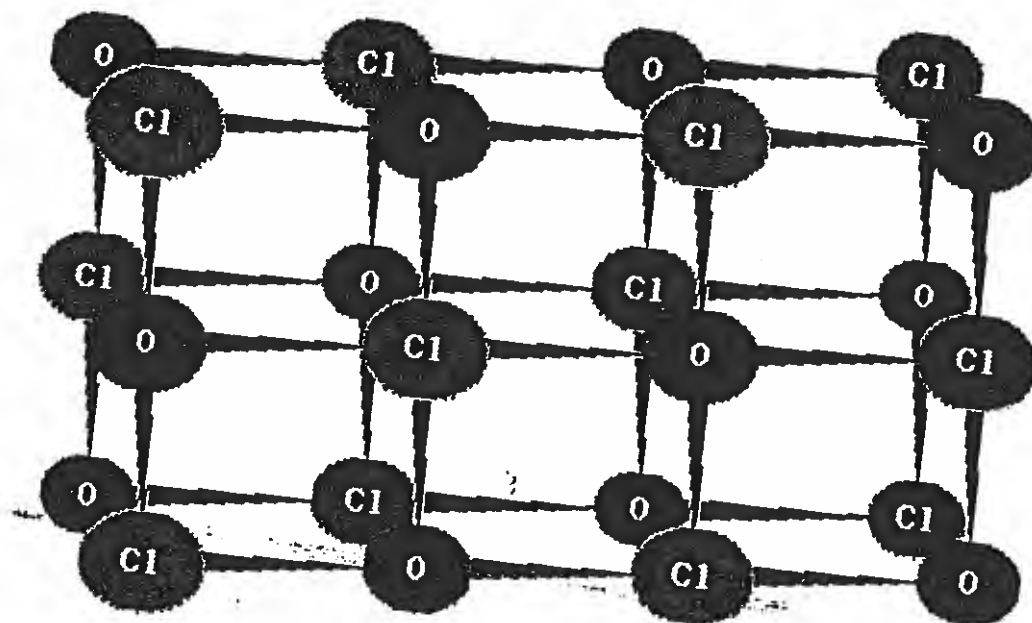


Figure 7. Initial Cubic Cluster Configuration - 3x4x2

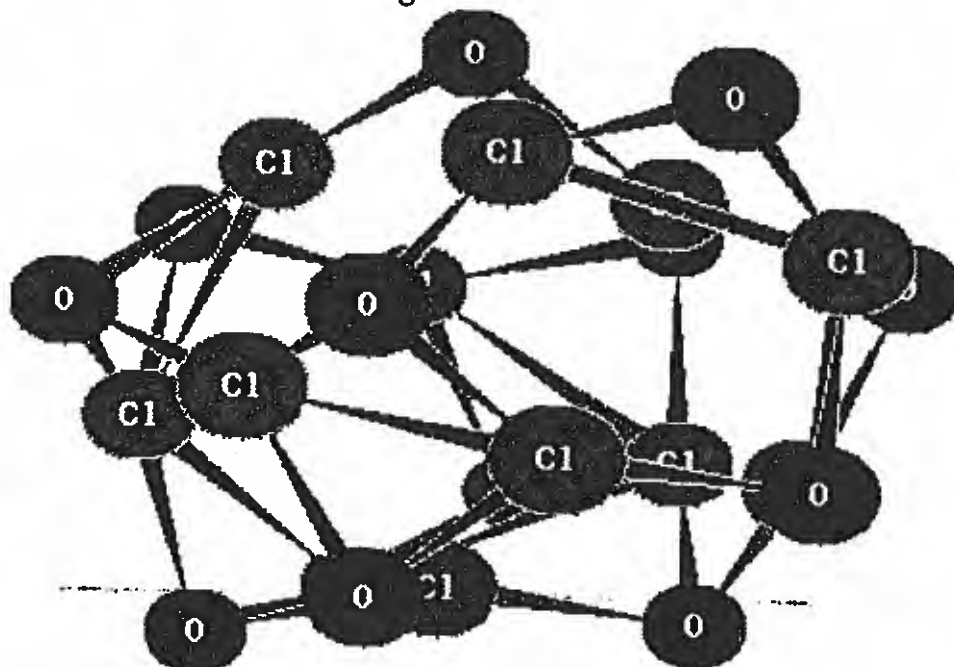


Figure 8. PM3 Optimization of a 2.1 Å 3x4x2 Cubic Cluster

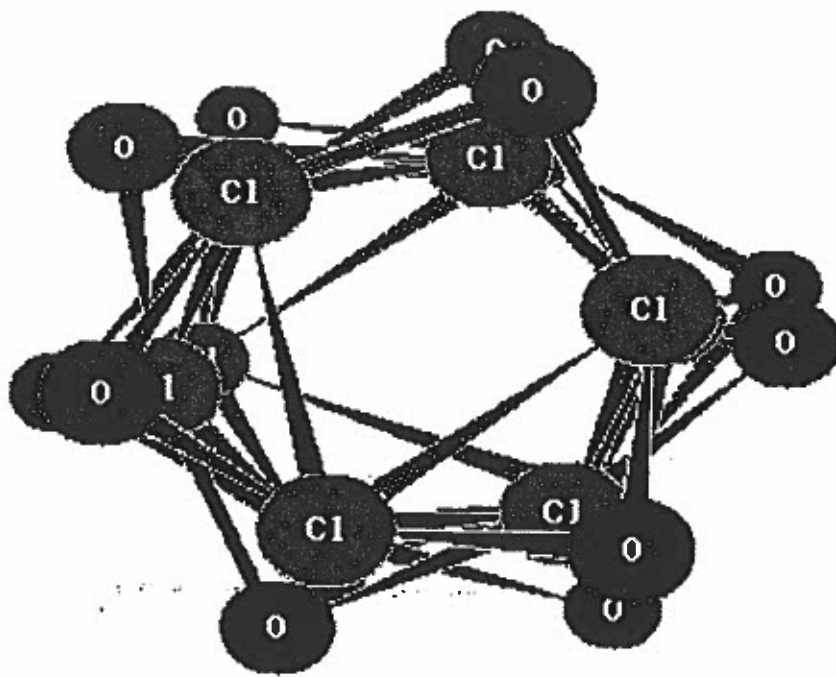


Figure 9. PM3 Optimization of a 2.2 Å 3x4x2 Cubic Cluster

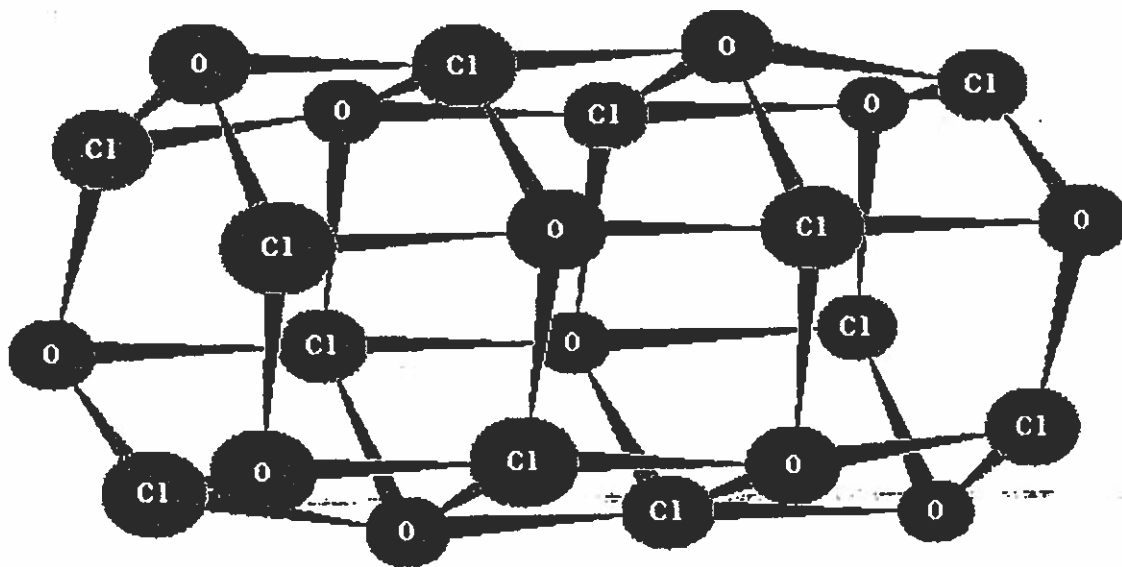


Figure 10. AM1 Optimization of a 2.0 Å 3x4x2 Cubic Cluster

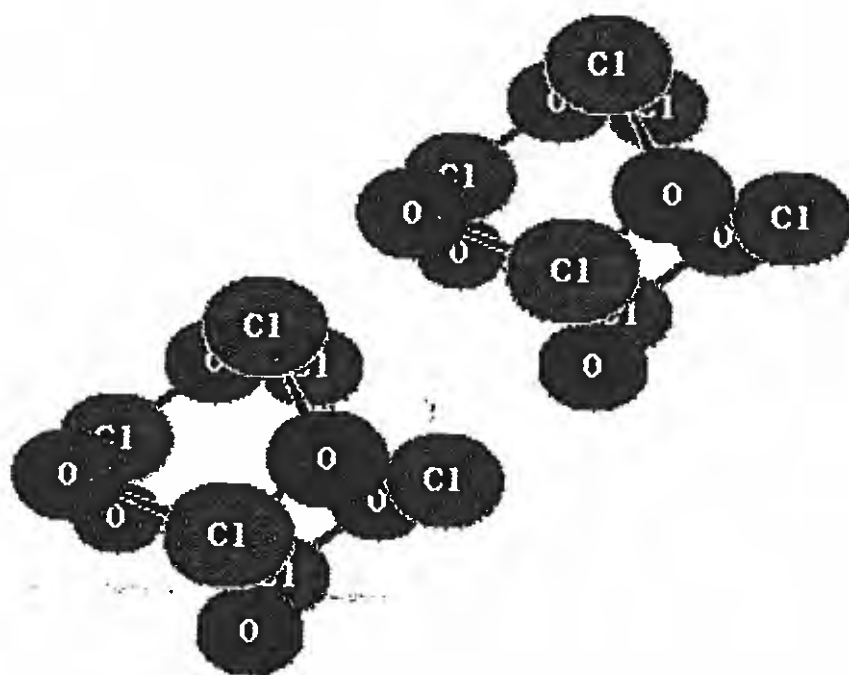


Figure 11. Wurtzite Structure

Table 3: Cubic Cluster Results for (ZnO)₁₂

Configuration		Heat of Formation, kcal/mole/pair			
Initial - 3x4x2	Final	AM1		PM3	
		Initial	Final	Initial	Final
1.6 Å	bulged hexagonal prism in second tier	343.85	14.46		
	spheroid			295.40	- 14.11
1.8 Å	hexagonal prism	119.59	14.05		
	spheroid			85.87	- 14.11
2.0 Å	hexagonal prism	34.39	14.05		
	spheroid			20.31	- 14.11
2.1 Å	hexagonal prism	24.44	14.06		
	hollow structure			15.71	- 9.88
2.2 Å	hexagonal prism	28.10	14.06		
	hexagonal alternating			21.43	- 7.94
2.4 Å	hexagonal prism	59.41	14.06		
	tubular cluster			51.80	- 9.57
2.0 Å 2x6x2		30.24	20.09		
	rhombic alternating			13.90	- 10.93
2.0 Å 4x6		25.43	19.74 *		
				13.08	- 6.84
	Stable spheroid [2]		9.51		- 14.12

* indicates nonstationary results

The optimized structures of the 4x4x2 cluster for (ZnO)₁₆ formed tubular clusters and a prolate spheroid, or potato shape. Optimization reached a minimum heat of formation at the bond length of 1.9 Å with a difference of 1.19 kcal/mole/pair with the stable spheroid. See Table 4. With increasing or decreasing

bond lengths the heats of formation began to rise with none of the optimized structures having the necessary symmetry for a stable spheroid.

Table 4: Cubic Cluster Results for $(\text{ZnO})_{16}$

Configuration		Heat of formation, kcal/mole/pair	
Initial 4x4x2	Final	PM3	
		Initial	Final
1.8 Å	tubular cluster	98.63	-9.48
1.9 Å	tubular cluster	47.95	-12.66
2.0 Å	flattened spheroid	23.67	-9.93
2.0 Å	Stable spheroid [2]		-13.85

Hexagonal Prisms - Methodology

The idea of using a stack of planar hexagons comes from the idealization of the wurtzite structure (see Figure 11) and the AM1 results of the optimization of the 3x4x2 cubic cluster at various bond lengths from above. Initial bond lengths investigated are 2.0 Å, 2.25 Å, and 3.25 Å with the respective layering or separation distances of 2.0 Å, 3.25 Å, and 3.25 Å. The extended bond length of 3.25 Å (the parallel width of a wurtzite hexagon) is investigated as possible simulation of thermal excitation due to the effects of laser ablation [3].

Hexagonal Prisms - Results and Discussion

The spontaneous formation of hexagonal prisms from the cubic clusters under AM1 did not optimize into the stable spheroid under PM3 or AM1 Hamiltonians, but instead the structures remained as general hexagonal prisms. At a starting bond length of 3.25 Å the stacked hexagons under PM3 formed a cubic space displacement of six rhombic $(\text{ZnO})_2$ molecules, see Figure 12. This configuration is investigated below as the geometric modeling of the sphere. The minimum heat of formation difference, under PM3, between the stable spheroid and the 3.25 Å bond length hexagons with 2.25 Å separation distance is 4.34 kcal/mole/pair.

Table 5: Hexagonal Prism Results

Configuration		Heat of Formation, kcal/mole/pair			
Initial	Final	AM1		PM3	
		Initial	Final	Initial	Final
Wurtzite	hexagonal stacks with one end opened door	63.92	17.08		
	alternating hexagons			41.93	- 7.94
2.00 Å	hexagonal prism	22.22	14.09 Ⓢ 8.5		
	hexagonal alternating			11.54	- 7.91 *
3.25 Å with 2.25 Å layering	hexagonal prism	104.51	14.06		
				102.44	- 9.78
3.25 Å	spatial rhombi	160.58	109.33		
				159.5	21.58

* indicates nonstationary results

Geometric Modeling of Sphere - Methodology

The idea of geometric modeling of the spheroid came from the spontaneous optimization of the 3.25 Å bond length of stacked hexagons above. This optimized configuration formed two polar and four equatorial symmetrical displacement of rhombic (ZnO)₂ molecules on the surface of an ~10.0 Å diameter sphere. The diametrical separation distance is investigated at ~8.0 Å and ~9.0 Å.

With cubic modeling, where the curved nature of the rhombic molecules (from the center of the sphere perspective) is removed by placing them on the surfaces of a cube. The cube lengths investigated are 6.0 Å, 7.0 Å (see Figure 13), and 10.0 Å.

Table 6: Geometric Modeling Results

Configuration		Heat of Formation, kcal/mole/pair			
Initial	Final	AM1		PM3	
		Initial	Final	Initial	Final
~8.0 Å spherical	two curved sheets	65.24	27.24		
	returns to the spatial orientation of rhombi			36.31	5.76 Ⓢ 2.6
~9.0 Å spherical	closure beginning	51.30	37.74		
	returns to the spatial orientation of rhombi			23.52	21.65 Ⓢ 3.2
6.0 Å cubic	spheroid	377.19	9.52 *		
	spheroid			347.03	-14.04 Ⓢ 4.2
7.0 Å cubic		84.06	18.88		
	p a r t i a l hemisphere			79.96	- 7.96 Ⓢ 5.7
10.0 Å cubic		139.76	23.60		
				137.53	21.60 Ⓢ 2.4

* indicates nonstationary results

Geometric Modeling of Sphere - Results

Only if the distances are picked precisely does the cubic model optimize to the spheroid, see Table 6. The reduction of the optimized hexagonal prism structure from above at ~10.0 Å to ~8.0 Å and ~9.0 Å did not progress in a favorable manner. The heat of formation deviated greater than ~20 kcal/mole/pair difference in reference to the stable PM3 spheroid. The optimized 7.0 Å cube has a 6.16 kcal/mole/pair difference and the optimized ~8.0 Å spherical spacing has 19.88 kcal/mole/pair difference.

Separation of the spheroid - Methodology

Separation of the zinc spheroid hemispherically by 0.5 Å, 1.0 Å, 1.5 Å, 2.0 and 3.0 Å was explored to see if recombination or building blocks would spontaneously form. This is analogous to trying the evolution from the product (back) end or reverse engineering. One hemisphere, the First, contains eight zinc atoms and four oxygens and the Second contains four zinc atoms and eight oxygen atoms. The two hemispherical configurations are also optimized to determine if any building block configurations might form spontaneously or be implied.

Table 7: Spheroid Separation Results

Configuration		Heat of Formation, kcal/mole/pair			
Initial	Final	AM1		PM3	
		Initial	Final	Initial	Final
≤2.0 Å separation	stable spheroid	62.89	9.51	32.46	- 14.12
3.0 Å separation	very close to spheroid	65.90	22.48		
	collapsed hemisphere			39.20	- 9.84
First 12 hemisphere		50.76	20.97		
				37.09	- 40.59
Second 12 hemisphere		112.20	17.09 ⓧ 4.3		
				91.97	58.88 ⓧ 2.4

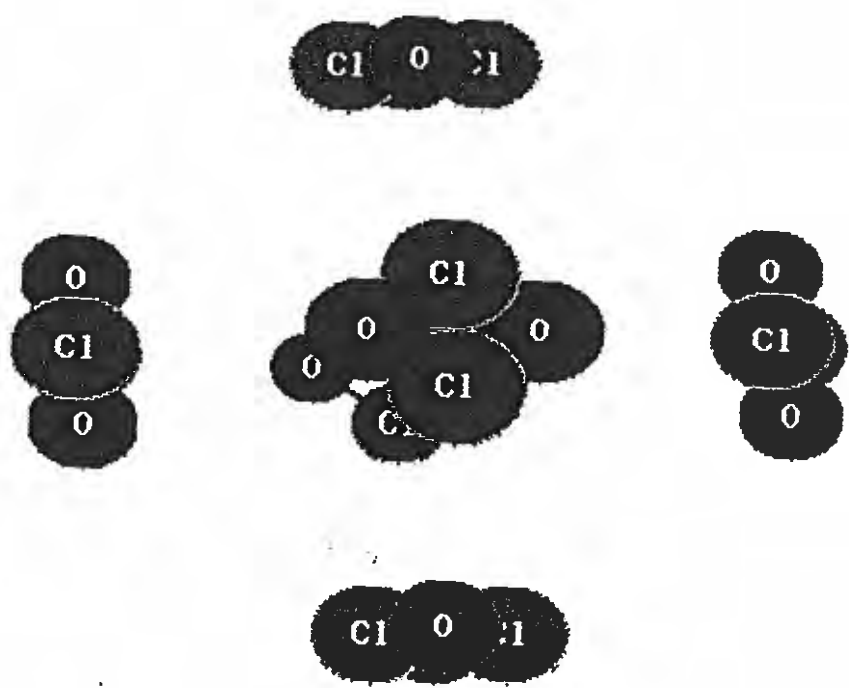


Figure 12. PM3 Optimization of 3.25 Å hexagons

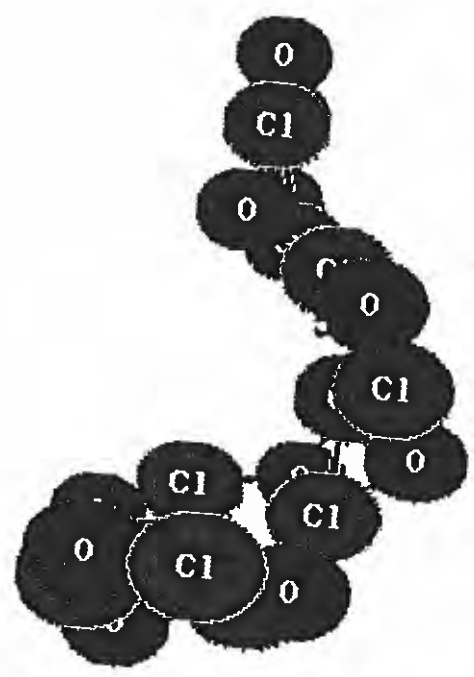


Figure 13. PM3 Optimization of 7.0 Å cube model

Separation of the spheroid - Results

The recombination of the spheroid under PM3 to its original configuration occurred until the hemispheres were separated to a distance of 3.0 Å, for a total pole-to-pole separation distance of 9.0 Å or 150% of the stable spheroid's polar diameter of 6.0 Å. This structure partially collapses into one hemisphere, but when subjected to AM1 optimization and then PM3 optimization a generalized recovery of the spheroid will occur. The partial recovered geometry is the spheroid with an oxygen from the bottom of the spheroid placed on top of the spheroid, see Figure 14. Before recovery, the optimized structure's heat of formation is -9.84 kcal/mole/pair for a 4.82 kcal/mole/pair difference to the spheroid, see Table 7.

Carbon comparison - Methodology

Carbon is optimized to determine what structural types, if any, are formed from the processes used above. For the 3x4x2 cluster configuration 24 atoms of carbon are investigated with PM3 and AM1 at bond lengths of 1.4 Å, 1.5 Å, 1.6 Å, and 2.0 Å. For the hexagonal prism configuration the bond lengths of 1.5 Å, 2.0 Å, and 3.2 Å with the respective bond lengths also used for the layer separation distance.

Carbon comparison - Results

The initial cubic structures formed a wide variety of configurations, see Table 8. The optimized 1.4 Å indicate enclosed configurations (see Figure 15), but at greater starting bond lengths small polygonal clusters or possibly building blocks are forming. Then at 2.0 Å under AM1, a hexagonal prism is formed.

Table 8: Cubic Cluster Results for C₂₄

Configuration		Heat of Formation, kcal/mole/pair			
Initial - 3x4x2	Final	AM1		PM3	
		Initial	Final	Initial	Final
1.4 Å	hollow cluster with polyhedra surfaces	280.14	97.35		
	hexagonal bulge in center			249.43	139.05 *
1.5 Å	cup with 3 rhombi and a tail	201.37	95.55 [?] 9.7		
	hexagons perpendicular to pentagons			176.83	92.70 [?] 9.3
1.6 Å		177.91	89.31 *		
	octagon with handle			160.90	104.15 [?] 7.3
2.0 Å	hexagonal prism	262.72	98.05 [?] 19.2		
				251.33	87.88 *
	C ₂₄ spheroid [2]		75.94		65.51

* indicates nonstationary results

The initial hexagonal prism structures remained as tubular structure until the initial bond length exceeded 2.0 Å, then the structures broke apart and formed short chains of carbon atoms, see Table 9.

The heat of formation difference between the C₂₄ spheroid and the optimized hexagonal and cubic structures was ~25 kcal/mole/pair at a minimal average with no general form evolving toward the carbon spheroid from either Hamiltonian.

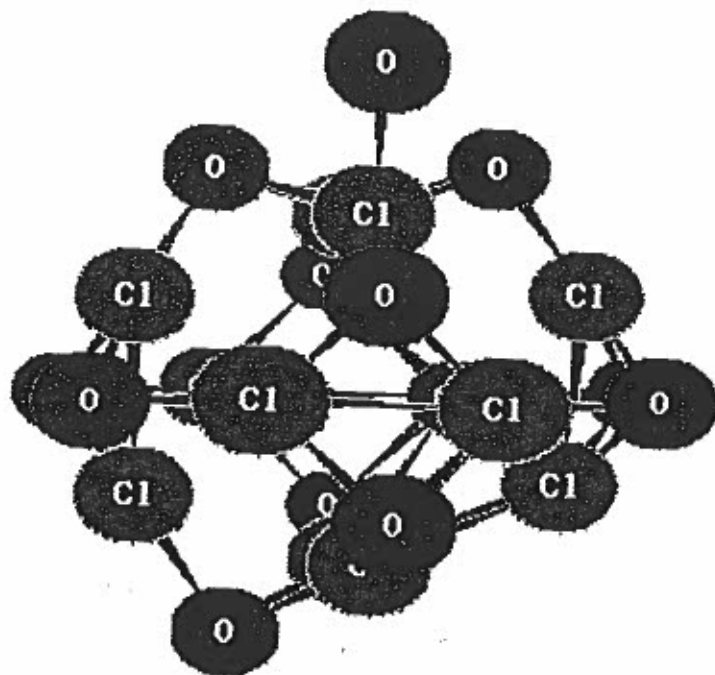


Figure 14. PM3 Recovered Spheroid

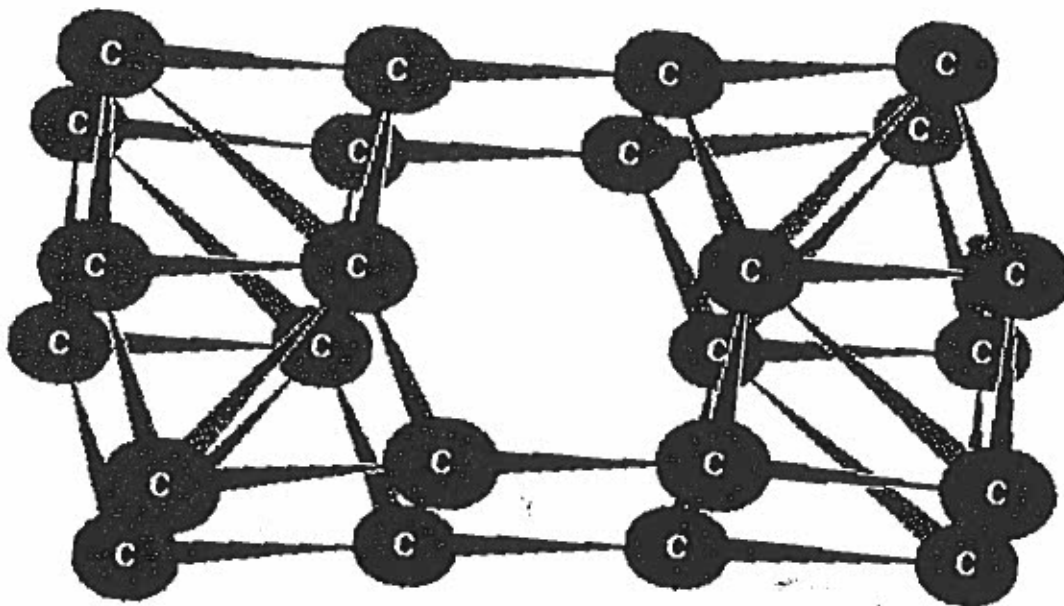


Figure 15. PM3 Optimization of 1.4 Å Cubic Cluster of Carbon

Table 9: Hexagonal Prism Results for C₂₄

Configuration		Heat of Formation, kcal/mole pair			
Initial	Final	AM1		PM3	
		Initial	Final	Initial	Final
1.5 Å		170.24	134.50 *		
				155.19	94.62 *
2.0 Å	tube hex sides	274.00	98.48 Ⓢ 4.9		
	stack top split			262.74	98.25
3.2 Å	long chain	425.71	117.83		
	two chains			461.36	125.35 Ⓢ 10.7
	C ₂₄ spheroid [2]		75.94		65.51

* indicates nonstationary results

Discussion - Conclusions

Present results confirm that the symmetrical spheroid clusters of zinc oxide are indeed both the lowest in energy and most stable. Actual time evolution calculations, of course, would yield the correct reaction pathways. Here we can only get indications of possible clues to a successful synthesis. The optimized configurations studied herein suggest that long hollow configurations or tubular structures at 24 atom concentrations may be precursors in the spheroid synthesis. Cubical clusters easily evolved into the spheroids, but only when the bond lengths were sufficiently small. A reaction pathway that follows a building block or implied geometrical progression is that of a hexagonal prism breaking longitudinally into separate rhombic molecules that then recombine in a cubic cluster (rock salt), which expands into a spheroid.

Results of the optimized configurations when listed digressing from the spheroid by heat of formation difference, see Table 10, under the PM3 Hamiltonian, show this general trend. Compared with the spheroid the differences in heat of formation of the general cubic cluster configurations (rock salt, cubic, and cube modeling) are less than 6.2 kcal/mole/pair. Larger differences occur respectively with increasing initial bond lengths in the cubic clusters structures, the hexagonal prisms and the solid state form of wurtzite and its perturbations. Optimized zincblende structures have a minimal difference of greater than 17 kcal/mole/pair. Therefore the heat of formation deviation is probably too great for serious

consideration. Comparative analysis of the digression pathway of PM3 to the digression results under AM1 suggests similar reaction pathways for both methods, see Table 10.

The carbon calculation done for comparison yielded similarly inconclusive but indicative results. Since we do know in fact that the carbon buckyballs are successfully synthesized, the fact that the clusters failed to metamorphose into the spheroid shape shows, again, more the weakness of the method than the nonexistence of the reaction pathway. As with ZnO, the optimized clusters are higher in energy than the hollow spheroids, and the heat of formation progression for the C₂₄ spheroid is analogous to that for zinc oxide. This pathway may require synthesis by laser ablation under high pressures [3], or in a caged or condensed environment. For example, it is possible that zinc or zinc oxide can be ablated into atoms that would form rhombic molecules that then recombine under pressurization, possibly in oxygen gas, to form spheroids. Most recent consensus in the carbon fullerene research is that synthesis proceeds in an atom-by-atom accumulation, rather than the fold over sequence proposed.

To explore this properly a quantum mechanical time dependent calculation, like a path integral molecular dynamics simulation, should be done.

Table 10: Heat of Formation Progression

PM3			AM1		
Starting Geometry	ΔH_F , Heat of Formation	ΔH_F with Spheroid	Starting Geometry	ΔH_F , Heat of Formation	ΔH_F with Spheroid
	kcal/mole/pair			kcal/mole/pair	
2.0 Å 3x4x2	-14.12	0.00	2.0 Å 3x4x2	9.51	0.00
6.0 Å cube	-14.04 (2) 4.2	0.08	6.0 Å cube	9.52 *	0.01
2.0 Å 2x6x2	-10.93	3.19	1.8 to 2.4 Å 3x4x2 & 2.25 Å hex.	14.06	4.55
2.1 Å 3x4x2	-9.88	4.24	2.0 Å hexagons	14.09 (2) 8.5	4.58
3.0 Å separation	-9.84	4.28	1.6 Å 3x4x2	14.46	4.95
2.25 Å hex separation	-9.78	4.34	Void	14.85 (2) 2.4	5.34
2.4 Å 3x4x2	-9.57	4.55	Wurtzite	17.08	7.57
7.0 Å cube	-7.96 (2) 5.7	6.16	Bowl	17.70 (2) 2.5	8.19
2.2 Å 3x4x2 & wurtzite	-7.94	6.18	Strip	18.84 (2) 2.3	9.33
2.0 Å hexagons	-7.91 *	6.21	7.0 Å cube	18.88	9.37
Bowl	-7.32 (2) 2.3	6.80	2.0 Å 4x6	19.02	9.51
Strip	-7.09 (2) 3.1	7.03	2.0 Å 2x6x2	20.09	10.58
2.0 Å 4x6	-6.84	7.28	Valley	20.71 (2) 2.3	11.2
Valley	-6.45	7.67	3.0 Å separation	22.48	12.97
Void	-6.32 (2) 2.7	7.80	10.0 Å cube	23.60	14.09

* indicates nonstationary results

References

- [1] E.C. Behrman, R.K. Foehrweiser, J.R. Myers, B.R. French and M.E. Zandler, *Physical Review A*, Vol. 49; No. 3, R1543, 1994.
- [2] M.E. Zandler, E.C. Behrman, M.B. Arrasmith, J.R. Meyers and T.V. Smith, *Theochem*, 362, pp. 215-224, 1996.
- [3] R.E. Haufler, in *Recent Advances in the Chemistry and Physics of Fullerenes and Related Materials*, K.M. Kadish and R.S. Ruoff, editors, Fullerenes Group, Vol. 94-24, pp 50-67, The Electrochemical Society, Pennington, NJ, 1994.
- [4] J. Cioslowski, *Electronic Structure Calculations on Fullerenes and Their Derivatives*, pp 69-71, Oxford University Press, New York, 1995.
- [5] J. Foresman and Æleen Frisch, *Exploring Chemistry with Electronic Structure Methods: A Guide to Using Gaussian*, p 203, Gaussian, Pittsburgh, 1993.
- [6] J.J.P. Stewart and M.B. Coolidge, *Journal of Computational Chemistry*, 12, 1157, 1991.
- [7] J.J.P. Stewart, *Quantum Chemical Program Exchange Program*, 455, 1983.
- [8] M.J. Frisch, G.W. Trucks, H.B. Schlegel, P.M.W. Gill, B.G. Johnson, M.W. Wong, J.B. Foresman, M.A. Robb, M. Head-Gordon, E.S. Replogle, R. Gomperts, J.L. Andres, K. Raghavachari, J.S. Binkley, C. Gonzalez, R.L. Martin, D.J. Fox, D.J. Defrees, J. Baker, J.J.P. Stewart and J.A. Pople, *Gaussian 92/DFT (Revision G.2)*, Gaussian Inc., Pittsburgh, PA 1993.

Valued Contributions Suggested for Financially Unprepared Adolescent Minority Fathers

Vanessa Souriya, McNair Scholar
Dr. JohnL Jackson, Faculty Scholar

Abstract

The United States has one of the highest pregnancy rates involving teenagers in the industrialized world. Invariably, unplanned births and child-rearing often mean lack of preparation for both the teen mother and father. Initially, most of the child-caring and support responsibilities are assumed by the teen mother, with limited, if any at all, significant supportive contributions coming from the teen father (Hardy, 1988). The main question is how can adolescent fathers assume greater nonfinancial responsibilities in the care and support of their children?

Proposed is a research initiative designed to achieve the following objectives: 1) to determine the availability and the extent to which local and statewide programs and services specifically target, train, and support adolescent minority teen fathers to become more effective parents; and 2) to elicit, from a variety of community, educational, religious, social and governmental sources, suggestions and plans for improving child care and rearing involvement of minority teen fathers.

The research plan will entail identifying, selecting, and interviewing multistratified pools of subjects representing cross-generational and gender groups, religious, community-based, educational, social, and governmental organizations located across the state of Kansas. The instrumentation for data collection will consist of the combined methods of structured interviews and self-administered customized questionnaires.

It is expected that the results of this research will contribute to the broader social science and education literature. Further, the anticipated suggestions of valued nonfinancial contributions of minority fathers will serve as an important reference and support source for parents of teenagers, adolescent parents, teachers, counselors, community-based organizations, and other social service agencies for training, counseling, and advising of teen fathers and fathers-to-be.

It seems urgent and potentially beneficial to pursue theories and initiative strategies to help financially unprepared minority and other teen fathers to become more contributing and dynamically involved in the lives of their children as proposed by this research in process. The continuation of the research to completion is vitally important.

Pre-Introduction

My presentation reflects a study that is designated as research-in-process. This basically means that the research is on-going and the final results are pending. Presently, the study is about 60% completed. Remaining to be completed are instrument finalization, data collection, data analysis and results reporting.

The focus of my presentation will entail sharing with you the theoretical foundation of the study, purpose, objectives, employed methods, expected outcomes, and the research significance and benefactors.

Introduction

The United States has one of the highest pregnancy rates involving teenagers in the industrialized world. Invariably, unplanned births and child-rearing often mean lack of preparation for both the teen mother and father. Initially, most of the child-caring and support responsibilities are assumed by the teen mother, with limited, if any at all, significant supportive contributions coming from the teen father (Hardy, 1988). Most often teen fathers are unable to provide financial and other parental support. The main question is in what ways can adolescent minority fathers assume greater nonfinancial responsibilities in the care and support of their children?

A clear picture is painted of a teenage male who is virtually unprepared financially, emotionally, psychologically, and socially to assume the weighty responsibilities of parenting. Unlike the female, most males in the United States, regardless of ethnic background and culture, have not been required to, expected to, or socialized early on to acquire parenting-type skills, attitudes, and behaviors (Redmond, 1985).

Whether in the schools, homes, churches, or elsewhere, certainly programs and services of all sorts aimed at educating minority teen fathers are needed and welcomed (Robinson & Barret, 1985).

There is no question that long-held male unassuming attitudes and behaviors are very difficult to change. Assuredly, even the most modest individual, who shows promise of contributing to aiding teen fathers to become better fathers, deserves serious attention and wide support.

Purpose

The purpose of this study is to determine the availability of local and statewide programs and services designed specifically to train and support adolescent minority teen fathers in their efforts to become effective parents. Additionally, this research will provide suggestions and plans for improving childcare and rearing involvement of minority teen fathers.

Proposed is a research initiative designed to achieve the following objectives: 1) to determine the availability and the extent to which local and statewide programs and services specifically target, train, and support adolescent minority teen fathers to become more effective parents and 2) to elicit, from a variety of community, educational, religious, social and governmental sources, suggestions

and plans for improving childcare and rearing involvement of minority teen fathers.

Methods

The subjects of the research will be a select combination of people and organizations. In terms of people, the subjects will include select samples of teen fathers and teen nonfathers; teen mothers and teen nonmothers; parents, teachers, ministers and school counselors. Organization subjects will include those which are identified, locally and statewide, having programs and services designed to support effective adolescent parenting such as Planned Parenthood of Kansas, Family Center Resources, Family and Children Enrichment, Family Life Services, Parents without Partners and other related organizations. Most of the subjects will be located in the Wichita and Sedgwick County areas of Kansas.

The research plan will entail identifying, selecting, and interviewing multi-stratified pools of subjects representing cross-generational and gender groups, religious, community-based, educational, social and governmental organizations located across the state of Kansas. The instrumentation for data collection will consist of the combined methods of structured interviews and self-administered customized questionnaires. The customization and testing of the data collection instruments are in the process of finalization.

Expected Outcomes

The anticipated and expected outcomes are expected to provide significant and relevant information with regard to the availability, preparedness, and accessibility of local government, social, community and religious organization which sponsor and manage programs targeted to educate and support parenting abilities of minority adolescent fathers. Additionally, it is anticipated that the results of this research will provide paternal and attitudinal suggestions and strategies enabling many minority adolescent fathers to improve their parental abilities and assume a more active contributing role in the lives of their children.

It is expected that the results of this research will contribute to the broader social science and education literature. Further, the anticipated suggestions of valued nonfinancial contributions of minority teen fathers will serve as an important reference and support source for parents of teenagers, adolescent parents, teachers, counselors, community-based organizations, and other social service agencies for training, counseling, and advising of teen fathers and fathers-to-be.

Benefactors and Significance

The benefactors of this research will be primarily adolescent minority fathers and fathers-to-be, especially between the ages of 15-17. Also, it is expected that other teen fathers will benefit as well. Additionally, schools, colleges, and other people-helping organizations and agencies, whose primary responsibilities are to support the well-being of young adults, are expected to benefit from this research in terms of relevant information for counseling, advising, teaching, and simply face-to-face

encouragement. The financially unprepared adolescent fathers are raised ultimately to be confident, motivated, and in possession of certain acquired parenting skills, which may enable them to significantly contribute to the support of their children.

Lastly, it is urgent and potentially beneficial to pursue theories and initiative strategies to help financially unprepared minority and other teen fathers to become more contributing and dynamically involved in the lives of their children as proposed by this research in process. The continuation of the research to completion is validly important.

Works Cited

- Redmond, M. A. (1988, July). Attitudes of adolescent males toward adolescent pregnancy and fatherhood. Family Relations, 34, 337-342.
- Robinson, B. E. & Barrett, R. L. (1993, September). Should we think the unthinkable? (Time to abolish welfare for teen mothers). Newsweek, 43.

Transformations: Women and Recovery, Women Changing Research

Christine Taylor, McNair Scholar
Dr. Carol Wolfe Konek, Faculty Scholar

Abstract

Dr. Carol Wolfe Konek is a professor of women's studies and assistant dean at Wichita State University. Her book, Transformations: Stories of Women in Recovery is nearing completion. My job as her research assistant was to help with Transformations. Not only did I learn a great deal about the narrative as a research method, I also learned the value of qualitative research and a great deal about myself. Transformations is a collection of narratives, stories told to Dr. Konek by women in recovery. Each narrative is an intimate look at one woman's battle with addiction, and the road back. As social research, Transformations shows us women's lives at the individual level, the micro level. The women's voices come through as they tell their own stories. Each woman uniquely told her story, recreating and re-defining her life with her own words, her own vision. Often these women seemed to gain insight into their addiction and recovery by telling their stories. What I learned as a researcher is how difficult it can be to tell another's story without damaging their voice, their truth. With the women's voices in mind, Dr. Konek decided to do little with each story, but rather concentrate on finding research that supports our assumptions about the similarities and differences between the women and review the most recent literature concerning addiction and recovery. The following article is an experiential look at Transformations and the process of qualitative research.

Introduction

Dr. Carol Wolfe Konek is a professor of Women's Studies and Assistant Dean at Wichita State University. Her book Transformations: Stories of Women in Recovery is nearing completion. My job as her research assistant was to help with Transformations. Not only did I learn a great deal about the narrative as a research method, I also learned the value of qualitative research and a great deal about myself.

Transformations is a collection of narratives, stories told to Dr. Konek by women in recovery. Each narrative is an intimate look at one woman's battle with addiction, and the road back. As social research, Transformations shows us women's lives at the individual level, the micro level. The women's voices come through as they tell their own stories.

Dr. Konek collected these narratives through interviews with the women. When revising and refining the text, I asked Dr. Konek if she wondered about the danger in changing any of the text for fear of damaging the women's stories. We

agreed that the stories these women told were important in their form. Each woman uniquely told her story, recreating and redefining her life with her own words, her own vision. Often these women seemed to gain insight into their addiction and recovery by telling their stories.

I'd like to say that doing this interview is helping me. Until I offered to be a participant in your study, I'd never said I was alcoholic to anyone in my life. You are the first person I've said that to. I've been thinking about it ever since you told me about the study. I've been thinking about telling you that I would like to participate in the study, but until yesterday, I didn't know if I would actually say it. So, this is going to give me a chance to think it through (Diedre, 1).

What I learned as a researcher is how difficult it can be to tell another's story without damaging their voice, their truth.

With the women's voices in mind, Dr. Konek decided to do little with each story, but rather concentrate on finding research that supports our assumptions about the similarities and differences between the women and review the most recent literature concerning addiction and recovery. Purely objective research is a myth. Just the act of doing research is a political one, affecting the women involved, their ideas about addiction; the researcher and her ideas about research. I learned a great deal about research as an agent of social change.

I began my process as research assistant by reading Dr. Konek's text. Each story had its similarities and differences. However, all the women wanted to tell their stories and by doing so, they were changing, their lives and their perceptions of themselves. The power of insight and self-reflectivity became overwhelming to me. These women were changing as they spoke, creating new identities and new lives. Each telling of the story resulted in new insight into the process of recovery.

One reason I agreed to do this interview was that there is so much I have left to disclose. I thought if I could tell one other person about some of my past, I might find it easier to write my story. If I could tell the whole story of all I grew up with (there was always sexual or physical abuse, and there was always verbal abuse or neglect). I might make progress in getting better (Shandra).

The telling of the story changed the story.

Dr. Konek called recovery "creative imagining." These women imagine new lives and make their lives new. Dr. Konek writes:

In recovery, she makes whole that which is scattered asunder, restoring her power to imagine, to look at one thing and see another, to make whole what is greater than the sum of its parts, to experiment with points of view, and to compare and choose ways of seeing.

This whole idea of creative imagining changed how I see research and the process of that research.

I see research as creative, ever-changing, ever-evolving. Research has become for me a way of seeing more clearly, telling stories and sharing histories. No longer is research merely massive amounts of numbers, but it defines real people, real lives.

Over the years, qualitative forms of research have often been looked upon as semi-research, not "real" research because the data cannot be quantified, or the sample is not "large" enough. One of the questions I began to ask myself as a researcher was, "How large does the sample have to be?" Or, "Do we lump individuals into piles of numbers that create a blur of addition overpowering the good of our research?" Must good research be scientific?

The women in Transformations came to life for me through their stories, revelations, and insights into addiction and recovery. Dr. Konek asked me to think about the patterns, the histories, and the places these women had come from and where they were going. She asked that I look at ways in which their stories could benefit those in the recovery process. We also did extensive Internet and Library research to update the literature concerning addiction and recovery. I found massive amounts of theories, and statistics that all told the same story. The battle against substance use and abuse is not new, nor is it subsiding. I frequently asked myself, "Why?" Why with all of those statistics, is it so hard to convince people of the harm that occurs to oneself and one's family and friends? I began to believe that perhaps all of those statistics that tell us just how bad these things are for us do not really show us much about the human condition.

As a researcher, I cannot risk losing sight of the people affected by my research. This awareness is the most important thing I have learned from Dr. Konek. We can learn to study responsively. We can learn to be scholarly agents of social change. We have to. The women of Transformations not only change their own lives through the telling of their stories, but they affect the lives of everyone who reads their stories. This is how change is affected and how research is effective. "A woman whose story is witnessed by those who have agreed to disrupt the worlds of others with their transgressive telling is a woman becoming dangerous" (Konek).

Using Portfolios in Teacher Education

Jessica Tinsmon, McNair Scholar
Dr. Frank Kline, Faculty Scholar

Abstract

While there is much research describing the use of portfolios in teacher education programs, there is little work describing the format that portfolios may take. It was noted that most of the described portfolio entries were paper-based, allowing little opportunity for the expression of non-verbal intelligences. This discussion of portfolio formats seeks to answer the questions: What type of entries are found in student portfolios? Why do students choose those entries? Is it possible (or necessary) to encourage a wider variety of portfolio entries?

Introduction

It has been over a decade since our nation's colleges and universities first began to utilize portfolios as a means of assessment in teacher education programs (Tierney, 1994). This effort toward alternative assessment has led to the creation of a number of different portfolio programs. These programs all contain some common elements--a focus on teacher education, some elements of student selection, and an expectation of reflection by the students. However, each program is unique in its scope and demands. For the purposes of this discussion, *portfolio* will be defined as the total display used to demonstrate a student's abilities and *entry* as the individual parts which make up a portfolio.

Many colleges of education have developed program-wide portfolio requirements that culminate at the end of the student teaching semester (Biddles, 1992; Douglas & Fennerty, 1994; Jensen & Shepston, 1994; Pedras, 1994; Tierney, 1994). Others have chosen to implement portfolio assessment at the graduate level (Mathies & Uphoff, 1992; Tierney, 1992). In many cases however, it is the individual professor in the context of an individual class who takes the initiative to use portfolio assessment with teacher education students (Niles & Bruneau, 1994; Rafferty, 1994; Tierney, 1994; Vogt, 1994).

Despite, or perhaps because of, the wide variety of programs that exist, many students and evaluators are confused about different formats a portfolio can take, and what might be included within a portfolio. This confusion may also be related to the nature of a portfolio which, because it often includes an element of student selection of entries, defies standardization. In spite of these forces toward diversity, if teacher educators are asked to describe a portfolio, that description often begins with the mention of some type of notebook. Occasionally, the answer is much more inclusive--"a display case of selected contents,... A case for competence" (Biddle, 1992 p.2).

The question that has become a focal point for those attempting to implement a portfolio assessment program is, how do students make a case for competence? Probably in an effort to deal with this ambiguity, many portfolio program documents begin with a list of specific requirements. At the University of Idaho, for example, the portfolio project in the Introduction to Teaching course consists of seven specific requirements. The first six are non-negotiable:

- 1) Teacher Resume--based on guidelines presented in class
- 2) Lesson Plan(s)--refined from the class presentation including:
 - a. The plan used for class delivery, and
 - b. Modified plan based on your reflection for improvement
- 3) Self Enhancement Plan--as discussed in class including:
 - a. Original submitted in class, and
 - b. Evidence suggesting your progress by the end of class
- 4) Educational Philosophy--a brief discussion of your perceived contribution to the institution of education
- 5) Professional Growth--a brief discussion of your perceived contribution to the institution of education
- 6) Reflection Question-- select one reflection question assigned during the semester. Comment on how you would readdress the same issue after having completed most of the course (Pedras, 1991 pgs. 8-9).

For the final portfolio entry, the student may complete an activity in one of five areas: 1. Education issue, 2. Interview, 3. Discipline, 4. Case Study, or 5. Extra Curricular Activity.

Other programs have a list of outcomes or program goals which shape the portfolio contents. The special education program at Central Washington University has devised criteria by which it evaluates teacher education students. At the end of their time in teacher education courses, students' portfolios must indicate competency in three critical areas:

1. All special education teacher candidates should have mastery of course competencies established for effective teaching.
2. The competencies established are important and necessary for effective teaching.
3. All special education teacher candidates should be able to generalize information learned into any diverse situation (Douglas & Fennerty, 1994 pg. 3).

These critical areas are also broken down into specific program goals and students are expected to explain how their portfolio meets these program requirements.

A few have left the decision making to the student, though the student must reflect upon and justify each entry. At the University of Dayton, students work under the advisement of a faculty member, who applies a constructionist approach to the portfolio process. With their portfolios, students show their progress toward reaching the Teacher Education Department theme of "Teacher as Reflective

Decision Maker in a Pluralistic Democracy"(Biddle, 1992 pg.5).

These three programs represent points on a continuum of specificity of portfolio requirements. This continuum ranges from tight specification of entries with a minimum amount of student choice to very loose specification of entries and a great deal of student choice. Many other programs are at other points on this continuum providing a great variety of portfolios. This continuum is important to this article because the more tightly contents are specified, the more uniform the portfolios become and the less variety in format and type of entry naturally occur.

Whether formally stated or informally implied, it seems as though many programs are situated toward the more tightly specified end of the continuum. The common thread that runs through the vast majority of final portfolios is the fact that, with the exception of videotape, most portfolios are simply a collection of papers, written projects, and assignments that the student has completed and reflected upon.

Encouraging students to move away from being verbally linguistic in their entries has several important advantages. So students are pushed toward a diversity of expression as they showcase their own personal strengths, they are exposed to their own nonverbal expressive abilities, and leave the teacher education program with a more complete understanding of both their own abilities and those of the children they will serve. It is possible to demonstrate competence using nonverbal methods (i.e., visual, musical, etc.), but teacher education programs and their students often seem to find it difficult to move away from the concept of black print on white paper in a three ring binder to alternative portfolio formats. This paper intends to detail current portfolio formats and encourage the broadening of focus for portfolios to include more alternative (i.e., non-verbal) entries.

Review of Literature

The search for descriptions of portfolio formats began by using the key words "portfolios," "teacher education," and "format" in a search of ERIC. This produced a grand total of three articles, only one of which would help us to document the variety of different portfolio formats currently used in teacher education programs. Broadening the search to "teacher education" and "portfolios" as key words produced 139 results. Through a review of the abstracts, seventeen articles were selected that seemed related to portfolio formats. Two of these articles were later eliminated, because they did not contain a single mention of portfolio format.

It is startling how few articles are available that discuss the possible formats or shapes a portfolio may assume. A minority of the articles dealt with the subject directly, either in whole or part. For the remainder of the articles, format descriptions were extracted bit by bit, finding them hidden here and there within the context of other subjects. The reader must recognize that because there are no formal studies of portfolio formats, this is an extremely limited view of what formats might actually exist within different teacher education programs. Because each program referred to in the articles could not be visited, it was assumed that if the article stated students included these particular items in their portfolios, that is

what was included. One has no way of knowing what items may have been included if they were not specifically referred to within the article.

As we reviewed the final selection of articles, a few consistent formats began to emerge. We decided to track the incidence of eighteen entries/formats--introduction/cover letter, philosophy statement, lesson/unit plans, poetry, literature review, student work, photographs, artwork, video tape, audio tape, justification for entries, personal reflections, class notes, miscellaneous writing, case studies, teaching evaluation, resume, and computer/software. Table 1 matches the various formats with the articles which mention them. This allows a quick appraisal of how frequently each format is used.

The vast majority of identified portfolio formats are print-oriented and paper-based. Though video and audio tape are also frequently used, it is often within the context of the student teaching semester and not unique to programs using portfolio assessment. Only one article truly began to touch on the wide range of possibilities for portfolio formats. Lasley & Tillman (1994) focused on how each of seven intelligences (linguistic, logical-mathematical, spatial, musical, bodily-kinesthetic, interpersonal, and intrapersonal) could be assessed using portfolios, thus noting a wide variety of possible portfolio formats and entries.

No single element was mentioned in all fifteen articles, though miscellaneous writing appeared in fourteen. The miscellaneous writing category references all written work students put into their portfolios that does not fit into one of the other categories. Examples include personal growth plans (Pedras, 1994), research projects (Douglas & Fennerty, 1994), journals (Touzel, 1993), theories of classroom management (Folio, 1994; Touzel, 1993), observations of a teacher or class (Touzel, 1993; Vogt, 1994), et cetera.

Other elements that appear in at least seven articles are a philosophy statement, lesson/unit plans, photographs, videotape, audiotape, and personal reflection. A philosophy statement may be used as evidence of professional responsibility (Mathies & Uphoff, 1992) or as a means to outline the pre-service teacher's goals for future students (Touzel, 1993). A philosophy statement may also simply be a student's personal philosophy of teaching (Pedras, 1994)

Lesson/Unit plans can be garnered from a variety of different sources. Students often include lesson plans developed in methods courses or for student teaching (Biddle, 1992; Niles & Bruneau, 1994). The student may also include modifications of a lesson used in a regular education classroom for use with a class of special education students (Douglas & Fennerty, 1994). A closely related possibility is for the student to create a unit outline with corresponding lesson plans for some or all of the unit (Pedras, 1994).

Students often wish to include photographs of their experiences in the classroom, thus enabling others to get a two dimensional picture of what they have accomplished (Lasley & Tillman, 1994). These pictures can be of the pre-service teacher in action in front of the classroom (Follo, 1994) or used as part of a larger visual exhibit, demonstrating what the student feels s/he has learned during the portfolio process (Niles & Bruneau, 1994). Photographs can also be used to showcase

the progression and finished product of a large, unwieldy project (Hauser, 1993).

Establishing teaching competency is often easier using video. Videotapes have been used for some time in teacher education. Capturing a lesson delivery on tape is an easy way for pre-service teachers to present their teaching technique (Pedras, 1994). In several teacher education programs, audiotape was also used as evidence of teacher competency. The audiotapes can be used to document experience in a standard classroom setting (Follo, 1994) or for those student teachers in a music education field experience (Lasley & Tillman, 1994).

The personal reflection can take on a variety of different meanings. A pre-service teacher may reflect over which pre-established competency a piece of work fulfills (Biddle, 1992). The pre-service teacher may also wish to reflect on a lesson plan just taught (Mathies & Uphoff, 1992) or on an article that they have read (Niles & Bruneau, 1994).

In summary, although there is apparently no literature describing portfolio formats, a few generally descriptive pieces give us clues as to what portfolios might include. In these program descriptions, there were no types of entries common to all portfolios. Miscellaneous written works were common to most of the articles and several formats were common to about half of them.

The articles reviewed contained very little mention of the shape of the students' final products. There are a couple of possibilities to explain this conspicuous deficit. One is that it is difficult for students and teachers to even comprehend the many options that are available to them as they create portfolios. Another possibility would be that those involved in teacher education programs simply assumed that portfolios come in a notebook. Whatever the reason, there is a true absence of literature describing various portfolios and their entries.

References

- Biddle, J. (1992). Portfolio Development in Teacher Education and Educational Leadership. Dayton, OH: University of Dayton, Department of Education. (ERIC Document Reproduction Service No. ED 342 732).
- Douglas, L. D. & Fennerty, D. C. (1994). Teacher Candidate Performance-Based Assessment. Central Washington University. (ERIC Document Reproduction Service No. ED 367 634).
- Follo, E. (1994). Career Portfolios: Helping Beginning Teachers Help Themselves. Oakland University. (ERIC Document Reproduction Service No. ED 382 611).
- Hauser, J. (1993). College Student Portfolios: A Representational Format for "Best Profile" Dimensions. De Pere, WI: St. Norbert College (ERIC Document Reproduction Service No. ED 362 090).
- Jensen, R. A. & Shepston, T. J. (1994). Combining Professional Development Plans and Portfolios for Use in Preservice Teacher Education: Early Childhood and Elementary Education Perspectives. Peoria, IL: Bradley University. (ERIC Document Reproduction Service No. ED 374 078).
- Lasley, T. J. & Tillman, B. (1994). Portfolio Development: Enhancing

Professional Intelligence. Dayton, OH: University of Dayton, Department of Teacher Education. (ERIC Document Reproduction Service No. ED 372 061).

Mathies, B. & Uphoff, J. K. (1992). The Use of Portfolio Development in Graduate Programs. Dayton, OH: Wright State University, College of Education and Human Services. (ERIC Document Reproduction Service No. 343 855).

Newman, C. & others (1993). Administrative Responses to Portfolios Prepared by Teacher Candidates. The University of Akron. (ERIC Document Reproduction Service No. ED 357 019).

Niles, K. & Bruneau, B. (1994). Portfolio Assessment in Preservice Courses: Scaffolding Learning Portfolios. Kent, OH: Kent State University. (ERIC Document Reproduction Service No. ED 379 616).

Pedras, M. J. (1994). Portfolio Development and Assessment in a Teacher Preparation Program. University of Idaho, College of Education. (ERIC Document Reproduction Service No. ED 382 571).

Rafferty, C. D. (1994). Portfolio Assessment and Secondary Methods Classes: What Happens When the Twain Meet? Terre Haute, IN: Indiana State University, School of Education. (ERIC Document Reproduction Service No. ED 367 608).

Tierney, D. S. (1994). Teacher Portfolios: Would an Assessment by Any Other Name Smell as Sweet? San Jose State University, College of Education. (ERIC Document Reproduction Service No. ED 373 093).

Touzel, T. J. (1993). Portfolio Analysis: Windows of Competence. Conway, SC: University of South Carolina-Coastal. (ERIC Document Reproduction Service No. ED 356 207).

Vogt, M. (1994). Individual Goal-Setting Preservice Teachers Developing the Agenda. California State University at Long Beach, College of Education. (ERIC Document Reproduction Service No. ED 378 560).

Zelazek, J. R. & others (1993). Assessing Teaching Behaviors through Video Portfolios in Field Experiences. Warrensburg, MO: Central Missouri State University. (ERIC Document Reproduction Service No. ED 364 543).

0
0
0
0
0
0
0
0
0
0
0
0
0
0

