CURVILINEARITY IN ARCHITECTURE:
EMOTIONAL EFFECT OF CURVILINEAR FORMS IN INTERIOR DESIGN

A Dissertation

by

KAYVAN MADANI NEJAD

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

May 2007

Major Subject: Architecture

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ABSTRACT

Curvilinearity in Architecture:
Emotional Effect of Curvilinear Forms in Interior Design. (May 2007)
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People are becoming more aware of the relationships between the built environment and their physical and psychological well-being. This has encouraged numerous studies in the field of environment and behavior, and effects of architecture, urban design and architectural form on human response. In the realm of architectural form, some professionals, from "signature" architects to environmental and organic designers, are strong advocates of free-flowing curvilinear forms. They assume that the use of curvilinear forms is sympathetic to the body, mind and spirit, although there is little empirical research to confirm this claim. There is also little research on the topic of signature / star architects and their design methods.

The purpose of this multi-method study was to investigate the emotional effects of curvilinear forms in interior architectural settings. The research involved qualitative and quantitative methodologies. In the qualitative phase, twelve signature architects, known for their use of curvilinear forms, were interviewed to examine the reasons and processes by which they applied curvature in their work. They were also asked to talk about their design process. In the quantitative phase, two modified interior residential views were ranked on their emotional load by 230 non-architect and 75 architect

students in card-sorting tasks. In each view, architectural forms gradually changed from fully rectilinear to fully curvilinear.

The data from both phases of the research was analyzed. The dissertation concludes by discussing (a) factors that separate signature architects from others (b) how signature architects design (c) how and why designers utilize curvature in the built environment, and (d) different emotional responses of designers and non-designers in response to curvature in architectural settings. In general, quantitative data indicates that non-architects show significant positive response to curvilinear architectural forms. Non-architects found curvilinear forms to be pleasant, elevating and reducing stress. The strongest relationship was recorded between curvature and feminine qualities of architectural space, which was shared by both architects and non-architects.

DEDICATION

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I would like to thank ray, Mardelle and Dean Regan for their unconditional support. I couldn’t have done this thing without your help.

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CHAPTER I

INTRODUCTION

Originally this study was designed to address questions surrounding *architectural form* and its possible effects on users. The focus was on *curvilinear architectural form* because of my personal interest as a designer. Soon I discovered that wherever there is a discussion about architectural form, most prior research differentiates rather heavily between its effects on *architects and non-architects*. In lieu of the original intent, this influenced my thinking to investigate the nature of such differences between these two groups, if such difference exists at all.

As for selecting an appropriate methodology, most previous studies used quantitative approaches. Although such an approach seemed attractive because of precedence and my personal fascination with statistics, I had reservations about the extent of their use in architectural design. This reluctance lead me explore a more qualitative methodology in addition to the conventional statistical methods. At the time it seemed that such multi-dimensional study would be more fruitful.

The qualitative section of this research consisted of 12 interviews with practicing architects. I decided to select my interviewees from the ranks of star or signature architects because they are frequently considered to push the limits on both architectural form and public expectation. If there are differences between architects and non-architects, it was anticipated they would be more pronounced for this elite group.

This dissertation follows the style and format of *the Journal of Environment and Behavior*.

Furthermore, my knowledge of world architecture indicated that signature architects used curvilinear architectural forms more often that other architects, and would be able to provide more information on the subject of curved form in architecture.

During the interview process, the architects talked less and less about architectural form and curvature and more about their design process and projects. Apparently, architectural forms were only a product of their design process. As one architect jokingly responded: "We don't go in a project saying let's do curved building today!" Therefore, it became essential to analyze the design process more closely in this study. The interviewees included some of the most successful and creative architects in the world with four of them recipients of the Pritzker Award. As the interviews progressed, it became clear that there are some shared patterns in regard to their design process which are quite different from the way the "average" architect designs buildings. So inevitably, one of the main focal points of the study turned out to be the architectural design process.

As a result, this is a study that mainly deals with (1) architectural form, (2) differences between architects and non-architects and (3) signature architects and their design process. In the following sections we discuss the need for research on each of the three topics mentioned above.

1.1 Need for Research on Architectural Form

Design begins with an effort to achieve "fitness" between the form and its context (Alexander, 1964). Ask any designing architect and they will tell you:

decisions about form must be made literally from the moment the pen touch paper. They would also tell you that these decisions are among the most demanding and challenging parts of the design process. For instance, one of the interviewed architects stated that his most fearful moment is when he is faced with a clean slate at the beginning of every project. Since the combination of these forms are infinite and to a certain extent unpredictable, what Alexander referred to as "fitness" is not always achieved between form and context. This has, on numerous occasions, resulted in unsuccessful architecture or in extreme cases, just plain eyesores.

To understand "fitness," we must look at how architectural form is perceived by its viewer. But the effect of architectural form on people is a fluid concept where "architectural form" and "people" are constantly transforming one another. Maybe this concept is best explained by Aldo Rossi (1984). In his book, The Architecture of the City, he refers to memory as something that does not reside in architectural form, instead, people's memories shaped by experience of architectural form.

Architects have dealt with form and developed theories of form throughout history because of its importance in defining buildings and the direct impressions it makes on peoples' psyche. To them (architects), form was literally an element that could make-or-break their creations. Thus, such investigations of "architectural form" have potential to increase the depth of understanding of a complex phenomenon that is an inseparable part of the design process.

1.1.1 Rectilinear and Curvilinear Architectural Forms

If we take a look around us, chances are we will not see a curved form in the built environment. Yet, I entered this study with the belief that there is an inherent quality about curvilinear architectural form that is attractive to us. This, I believed, is experienced as much by an average person when confronted with a curved wall, as an architect when going through a set of drawings.

On the other hand, if we take a walk in the natural environment, we would witness quite a different story. In that picture it would be hard to spot a rectilinear form. When in our history did we decide to eliminate curvature from the environments that we build? We look to nature as a source of our inspirations and ideas, from advances in science to inventing airplanes and finding cures to disease, but this muse seems absent in the development of architectural form.

We are in an age were the construction industry, material manufacturers and most importantly, economics as a whole, encourages us to stay away from curvature in design. In this upstream battle, even the most persistent architects throw their hands up at some point and surrender to the ease of the rectilinear.

It is important to note that this study is not intended to increase or prescribe curvature in buildings, but rather to raise understanding about the nature of such form. The aim is to help designers make better-informed decisions in their design process regarding form. The lack of existing research investigating the implications of curvilinear architectural form brings us to address this need.

1.2 Need for Research on Differences Between Architects & Non-Architects

That architects perceive the built environment in a different way than non-architects is not a new debate. Nor is it a surprising one due to the extensive training, learning history and background of an architect. The more important question is: will this possible difference make architects design buildings to their own personal taste and disregard their client aesthetic desires? Will they force people to live in places they dislike?

Throughout history, there has been a long list of buildings that were considered unsuccessful or simply "bad", even some designed by great architects. The fact that this flaw could be traced in their functionality, aesthetics or any other factor is not as important as knowing that even the best of architects are not immune to this phenomenon.

The problem arises when this concept is generalized to architects as a group or as a profession (Crinson & Lubbock, 1994; Duffy & Hutton, 1988; Friedman, 1975; Hubbard, 1995; Symes, Eley, & Seidel, 1995) My understanding of previous studies on this subject is that since architects have different tastes in buildings, they are not fit to design for people. I found this concept to be, at the very least, disturbing. Is our society going through a crisis in architecture and urban design where people are walking in the street and saying: why do we have so many ugly buildings around us? Who is responsible for letting architects design such monstrosities?

To address this issue, some researchers suggest devising "objective" methods by which they can prescribe an "acceptable" design, which includes form, proportions, volumes, texture and color among other details. The problem with such methodologies is that they search for an ideal solution, which then can be replicated and reproduced in large numbers to be used by the masses. "Authorities" would measure the appropriateness of proposed designs by comparing them to the "ideal solution" developed by research. Such approaches threaten some of the most vital aspects of the built environment: its diversity and creativity.

Some researchers take a different approach. They too, test differences between architect and layperson but their conclusions are less prescriptive in nature. Their aim is to raise awareness on this issue for both groups so that each can make better and more informed decisions when it comes to creating new environments. The present study belongs to this school of thought and acknowledges the need for further research on possible differences between architects and non-architects and aims toward more reasonable and practical resolutions.

1.3 Need for Research on Signature Architects and Their Design Process

In every discipline, we have a handful of people that rise above the rest. Architecture is no exception. There are architects that not only design differently, but they do it in manner that is artful, resolved, and adored by the community and their peers. It is imperative to gain understanding of the ways they go about their design process. Design by nature is a mysterious and unpredictable activity, one that signature

architects have been able to master beyond other designers. Such studies can add to the body of knowledge in the field of architectural design, which in turn can help architects design better environments and architectural instructors to educate better designers.

Throughout history, we can see a pattern of creative individuals with outstanding abilities that were sometimes associated with different (or even peculiar) lifestyles and thus looked upon as outsiders, egocentrics, disruptive, rebellious or in the best scenarios, just shy and antisocial. Although this trend is historically more common with the artist / architect community, there are eccentric architects and artists that look and act normal. In addition to personal traits, coveted exceptional abilities by themselves draw a lot of attention, which is not always in the form of admiration. It is easy to dismiss processes we cannot quantify and don't understand as being irrelevant or excessive.[1] This is the very reason we need to study the star architects in more detail. There is a lot we can learn from them that is not researched, in all probability for the above-mentioned reasons.

1.4 Objectives and Questions

The objectives and questions of this study can be divided into two sections -- quantitative and qualitative -- that are listed as follows:

1.4.1 Quantitative Objectives

- How does preference change with an increase in curvilinear architectural form found in residential interior settings? It was originally hypothesized that there

would be an inverted U-shaped relationship as suggested by the research of Berlyne (1960,1971,1974) and his followers. They predicted a balance of curvilinear and rectilinear form in architecture would be most preferred.

- Do architects and non-architects differ in their emotional and interpretive responses to the built environment? Regarding this question, it was hypothesized that there is no significant difference between the two groups.

- How do variables of "mystery" and "visual complexity" change in relation to increase in curvature and, to themselves? Similar to Scott's findings (1989), it was hypothesized that as curvature increases, so will the visual complexity and feeling of mystery in interior settings.

- Does presence of curvature in the built environment make people feel relaxed and elevated, or in other words, does it make them happy? It was hypothesized this indeed is the case. Similar to findings by Hesselgren (1987) and Shepley (1981), it was anticipated people will find the presence of curvature as more serene and joyful. Similar to the measurement of preference, it was predicted that the relationship would be an inverted U-shaped one where at some point people would find curvature overwhelming and no longer relaxing.

- Are interior environments that possess curvilinear form perceived to be more feminine? The answer to this question was expected to be positive. In effect it was hypothesized that rectilinear forms will be perceived as masculine and as curvature increases, they perception moves towards the feminine.

- Are interior environments, that possess curvilinear forms, perceived to be cozier, more personal and safer? It was hypothesized that as curvature increases, interior spaces are perceived to be more personal and safer with an inverted U-shaped relationship.

- Is there any significant difference between the males and females in their response to the built environment? It was expected that no significant change could be traced which was in line with prior research, however, it was hypothesized that women will find curved spaces more "feminine" than men do.

1.4.2 Qualitative Questions

- In their design process, how do architects make decisions relating to building form?

- How are decisions regarding building aesthetics made in the design process? What are the interactions and dynamics between "form" and "aesthetics" as architects develop designs?

- How do artists differ from architects and what is the relationship between art and architecture?

- Why are there so few curvilinear forms found in the built environment and why is it many signature architects employ such forms in their design work more often than others?

- What are some of the inherent qualities regarding curvature in the natural and built environment?

- How and why do architects see the world differently? What are the consequences to the end users of a project?

- What is the nature of relationship between signature architects and their clients? How do they make decisions to resolve design and aesthetic issues?

- What are the patterns of the design process common to star architects that are different from the rest of the architecture community?

- What constitutes a successful architectural design from a star's point of view?

1.5 Plan of the Dissertation

In the introduction chapter we looked at the nature of the problem, the objectives of the study and some of the procedural issues and definitions relevant to the subject at hand. The following chapter (chapter II) will provide a more comprehensive look at prior literature relating to architectural form and differences between architects and non-architects. For the reader's convenience, literature pertaining to methodological issues has been reserved for inclusion in methodology chapters (chapters III and V). Chapter III presents a detailed description of the quantitative methodology. Here we look at how the card-sorting survey was designed and it's relationship to prior studies. Chapter IV contains an in depth review of the quantitative analysis of this study where the relationship of curvature and peoples' response is statistically measured. Chapter V covers the qualitative methodology section, which leads to the methodical qualitative analysis of interviews with signature architects in chapter VI. In chapter VII, the major findings will be interpreted relative to the objectives of this study and their consistency with literature. The final chapter includes an evaluation of the methods employed, assessment of the implications of the study for further research and most importantly, looks at some of the limitations of this research. An overview of the research design is illustrated in Appendix B.

CHAPTER II

LITERATURE REVIEW AND THEORETICAL FOUNDATION

Related literature focuses on four central topics. First, theories on differences between architects and non-architects (laypersons) will be examined, addressing how each group responds to the built environment. The second topic deals with prior findings in the literature on design aesthetics, with particular emphasis on the qualities of curvilinear architectural form. This leads to the third topic, which looks at the architectural design process and the ways in which designers utilize architectural forms to achieve the desired design aesthetics. Finally, we discuss the current status of "design review," which is a governmental process aimed at safeguarding the public's interest on the appearance of buildings from what Jones (2001) refers to as "bad design." (See Appendix A for a diagrammatic review of related literature.)

2.1 Architects & Non-Architects

One of the more important early comparisons between the two groups was done by Michelson (1968) in a paper titled: "Most People Don't Want What Architects Want." He argues that people prefer sprawl and suburban living to the multifamily residential styles of city centers. He concludes people "overwhelmingly prefer a location well away from the center of things" and prefer driving a car rather than using public transportation. Although this study is performed at an urban scale, he finds "project architects and architecturally-oriented city planners" culpable and warns:

> Their [architects] aim is to conserve land and promote efficient development -- the antithesis of suburban sprawl. These plans, naturally, assume the existence of people to live in the developments: people who prefer multiple dwellings over single-family homes; who prefer public open space to private yards; who prefer mass transit to private car; and who want easy access to community facilities (p.37).

With the assumption that architects think "people don't really know what's best for themselves," and their preferences therefore meaningless, Michelson (1968) concludes that our democratic and open societies are at risk. That given a choice, " most people don't want centrality, multiple dwelling housing, parks and sports grounds instead of yards, or dependence on mass transit -- let alone all of them in one package." (p.43) It is also noteworthy that he excludes cities like New York City in his study, claiming that they are "one of a kind".

Since the publication of Michelson's article, there has been a considerable amount of research that compares the aesthetic preferences of architects and non-architects. Some of those studies cite Michelson's research (1968) as a major reference point. Most indicate that these two groups differ in their assessment of the natural and the built environment (e.g., Devlin, 1990; Devlin & Nasar, 1989; Duffy, Bailey, Beck, & Barker, 1986; Friedman, Balling, & Valadez, 1985; Groat, 1982, 1994; Hershberger, 1969; Nasar, 1987a, 1987b, 1989, 1994; Nasar & Kang, 1989; Nasar & Purcell,1990; Purcell & Nasar, 1990; Stamps, 1991a, 1993; Vischer & Marcus, 1986). However, there are some studies that show architects and non-architects reach similar conclusions in their appraisals (Groat, 1994; Hubbard, 1996; Stamps, 1993).

Early empirical evidence suggests that architects and non-architects perceive physical settings in fundamentally different ways. A study compared the semantic

differential ratings of buildings by three groups (registered architects, pre-architects, and laypersons) and found that the architects differed significantly from the other two groups. Differences were attributed primarily to training and experience (Hershberger, 1969).

Understanding the meanings that observers associate with buildings is one of the main focuses of this current study. Groat (1982) used a sorting task to determine which categories architects and a lay group (accountants) use to interpret buildings. She found that the accountants tended to sort buildings on the basis of preference and type, whereas architects used categories such as design quality, form, style, and historic significance.

In another study, Groat (1994) reported that although lay and experts (design review commissioners, some with design training and some without) significantly agreed in their rankings of a common set of infill buildings, the groups differed in the way they conceptualized the proposed buildings.

Devlin (1990) compared users', viewers', and architects' perceptions of two office buildings. Non-architects tended to provide evaluations that were predominantly affect based and descriptive, whereas architects' provided evaluations that were more abstract and conceptual. Gifford et al. (2000) argue that:

> That architects perceive physical settings differently than non-architects is not surprising given the different learning histories associated with the two groups. However, these differences are important because they can often result in severe mismatches between designer and lay preferences. Given that part of the architect's job is to understand client (that is, lay) perceptions, these differences are not trivial. Moreover, one study even suggested that not only do architects have different preferences than non-architects, they do not seem to understand what the public likes (p.167).

Gifford et al. (2000, p.168) further suggest that such research could "be used to educate laypersons about why architects like certain buildings that may seem unattractive to most laypersons." In general, it should promote understanding about the particular bases of lay and architect preferences for various built forms. But the main question remains: If such differences exist, will architects design environments that are not suitable and liked by their clients? One researcher (Nasar, 1988) provided results that showed architects were unable to predict what non-architects like in buildings and overall, if we look at the majority of the environmental behavior research in this area, their answer to the above question is simply "yes".

2.2 Research Related to Design Aesthetics

Historically, it was believed that the aesthetics of buildings were determined by their physical features. Pythagoras believed that the beauty of buildings can be sought in mathematical relationship between its constituent architectural elements (Murphy & Kovach, 1972). It is now believed that in addition to the geometry, many personal and contextual factors influence what an observer might see as architectural beauty. Mehrabian and Russell (1974) consider the "emotional responses of the observer" as the key in establishing architectural beauty. Here it is acknowledged that building characteristics might trigger different aesthetic judgments in different people. Gifford et al. (2000) discuss multiple research approaches that may be taken in the design aesthetics:

> . . . [this] approach examines specific objective features of the built environment as direct predictors of aesthetic appraisals. For example, in

> terms of building interiors, the presence of windows, unusually high ceilings, and square as opposed to rectangular rooms have all been associated with higher preference ratings. Exterior features such as curved lines and decorated articulated facades as well as cleanliness and ornateness also appear to boost preference. Architectural style, age of the building, and visual bulk have all been found to affect preference, although results are mixed: Some studies report that popular styles are preferred over avant-garde styles whereas others find the reverse (p.164).

Gifford's second approach considers the relation of more abstract variables such as cognitive constructs to building preference. Gifford et al (2000) write:

> Preference seems to be greater for buildings that are moderate in complexity. Buildings that appear to be more orderly or coherent are preferred. Aesthetic appraisals depend in part on the degree to which a building appears compatible with its immediate context. However, this study does examine these cognitive concepts or what might be called formal aesthetics (p.164).

Delvin and Nasar (1989) argue that architectural assessments can take two forms: those that refer primarily to the emotional reaction of the respondent (e.g. pleasantness, excitement, relaxingness) are called "affective" and, those that refer primarily to physical character of the building, called "interpretive."

The present research combines approaches outlined by Gifford et al. and methods used by Delvin and Nasar. Following Gifford, "curvature" is designated as the objective feature of the interior built environment for use as direct predicator of aesthetic appraisal. The interpretive assessments outlined by Delvin and Nasar were replicated and tested with the variables of complexity, mystery, femininity and safety. This combined approach is further developed in Chapter III.

Delvin and Nasar's (1989) study also concluded that Architects rated "high style" buildings as more clear, coherent, pleasant, relaxing and meaningful. Models of

preference revealed that both groups favored novelty and clarity, but the non-architects favored simplicity and "popular" attributes, while the architects favored complexity and "high style" attributes. In general, they found that preference results from discrepancy from a recognizable schema. Purcell (1986) argues that varying degrees of typicality result from comparing a particular environment to the prototypical representation for the schema. So for two types of "high" and "popular" residential houses that Delvin and Nasar (1989) tested, preference was related to novelty within recognizable forms.

Another approach is goodness of fit or degree of prototypicality as a key to observer preference. Preference increases with the degree of discrepancy from the "goodness of example" (Purcell & Nasar, 1992). However, this may be true more for architects than for laypersons. Non-architects have been shown to prefer buildings and objects that are better examples of prototypes (Whitfield, 1983). For any research approach, a main concept is that different groups of observers appraise buildings in different ways and, different buildings have differing effects on the observers.

In the following section we focus on the effect of two-dimensional form as a basis for understanding architectural beauty.

2.2.1 Research in Psychology

Hopkins (1976) discovered that subjects have special attention recruiting levels for curvature. He also created four categories of line segments for judging the amount of curvature based on curve radii (see Appendix C). The results showed minimum attraction to the straight line (one of the four categories). On the other hand, data show

that an increase in the intersection of curve contours will make the person experiencing them feel confused and anxious (Roelfsema et al, 1999). Therefore it could be anticipated that too much curvature will be less preferred in an architectural interior setting.

In the psychology of art, experiments indicate that subjects associate adjectives like "serene", "graceful" and "tender-sentimental" to drawings that contain curved lines. In contrast to curve lines, the same drawings with squares and angles have a tendency to suggest sadness and dignity (Hevner, 1935). Using people's response on drawings and paintings, Lundholm (1941) statistically concludes that "beauty in a pure line is expressed by properties like unity of direction, continuity, roundness of curves and lack of angles."

2.2.2 Research in Environmental Behavior and Design

Most researchers in this field believe that architectural form has meaning that the observer creates alongside the perceived object and thus experiences them as properties of the object (Whang, 1998; Weber, 1995). This suggests that by careful, knowledge-based selection of forms, we can create environments that can trigger and predict different emotional responses in users.

Prak (1977) points out that environmental forms hold both denotative and connotative meaning. The denotative aspect refers to cognition or the fact that forms are known or recognizable and can be named. The denotative aspects of the meaning of a form answer such questions as: "What is it?" and "What does it represent?". The

connotative aspect refers to the emotional overtones associated with the forms or the way in which the form is subjectively experienced. Connotative aspects answer questions such as: "how much do I like it?" and "Does it look like I think a church, or office building, etc. should look?"

Most work in this area has relied upon the use of semantic rating scales modeled after the semantic differential rating scale developed by Osgood, Suci and Tenenbaum (1957). Such scales involve soliciting numerical ratings of environments stimuli according to a list of paired opposite adjectives that describe subjective qualities of the environment such as beautiful-- ugly, neat -- messy, and spacious – cramped. Respondents are asked to mark a position on a numerical scale between each pair of adjectives to indicate which adjective they would most apply to the environmental stimulus.

One of the main findings proved to be that subjects associated adjectives like pleasant, cheerful, appealing, inviting and beautiful with aesthetic quality. They also associated adjectives like neat, tidy, organized, coherent, clear, peaceful and quiet to organization and orderliness. There are some complications in this method, primarily the findings that meaning varies with subjects of different past experience, culture and background (Hershberger, 1969, 1972, 1974; Sanoff, 1974). Some advocate a more cross-cultural approach to understanding meaning in architecture to address this problem (Rapoport, 1970, 1974, 1976, 1982).

In regard to curvature, Shepley's (1981) comparison of two different environments revealed that people of different ages tend to prefer object-orienting

interior spaces (curved walls) more frequently than the spatially-orienting characteristics (squared off walls). Similarly Kuller (1980) found that pleasure is more often elicited by rounded-off architectural forms than by square-edged forms. Studies indicate that curvilinear line segments are perceived to be more complex that straight lines (Berlyne, 1960, 1974, 1971; Barrow & Tenenbaum, 1981). Also, positive relationships observed between complexity and preference offer convincing evidence that people prefer higher levels of environmental variety and richness (Scott, 1993), therefore it can be argued that by using curvilinear forms, one would expect an increase in perceived visual complexity and, consequently, visual preference. Hesselgren (1987) evaluated the emotional loading of curved urban outdoor spaces versus rectilinear urban outdoor spaces. She found that a curved street was more positively evaluated than a straight one (see Appendix D).

Given that: (1) the design of an environment can play a critical role in human well-being (Zeisel, 1981; Arnheim, 1966, 1969, 1971); (2) people prefer living spaces that share essential qualities to natural environments and forms (Salingaros, 1998; Tsui, 1999); (3) curvature is one of the most dominant forms in nature (Thompson, 1917; Pearce, 1990); and (4) people respond positively to curvature in two dimensional drawings and art (Hevner, 1935; Lundholm, 1941), it is hypothesized that application of curvilinear surfaces in architectural design has a positive effect on human emotions and well-being.

2.2.3 Theories in Organic Architecture

In the philosophy of organic/green architecture, it is believed that free-flowing curved forms are more compatible to the human body and mind (Pearson, 2001). Salingaros (1998) concluded that buildings, which are subconsciously perceived as sharing essential qualities with natural and biological forms, appear more psychologically comfortable. Rectilinear forms of modern architecture, on the other hand, may lack spatial sense in human terms (Alexander, 1977). Papanek's (1995) phenomenological research indicates that curved shapes of internal spaces invoke feelings of "joy, harmony and well-being" (p.229).

Pearson (2001) notes organic architects cannot provide solid explanations on how curvature might trigger different emotions. Consequently, they associate adjectives like "mystic" and "subtle" when describing this phenomenon. There is little proof on how and to what extent curved forms effect us in interior spaces. On the other hand, there is research showing that architects misjudge peoples' responses to the built environment (Devlin & Nasar, 1989; Gans, 1978; Groat, 1982; Newman, 1972; Ulrich, 2001). The lack of similarities in the preferences of designers and laypersons has lead to numerous expensive eyesores (Nasar, 1999). To understand this phenomenon, we need to take a closer look at the nature of the design process in the following section.

2.3 Architectural Design Process

In this section prior findings on the design process are defined so that they can later be compared to those revealed in the present study with interviews of renowned architects. Im (1983) attempts to describe the architectural design process: "A design process consists of various stages of creative and rational developments, as well as internal and external decision-making." Jones (1970, p.46) has distinguished three aspects of designing: (1) creativity (2) rationality, and (3) control over the design process:

> …from the creative viewpoint the designer is a black box out of which comes the mysterious creative leap; from the rational view point the designer is a glass box inside which can be discerned a completely explicable rational process; from the control viewpoint the designer is a self-organizing system capable of finding short cuts across unknown territory…

It has been hypothesized that in the creative process the emotional component is more important than the intellectual, the irrational more important than the rational (Gordon, 1961). It seems difficult to describe the creative process in a fully rational way. The creative process seems to involve "mysterious" mental mechanisms which generate innovative ideas, concepts or works of art.

Creativity mainly refers to innovative thinking or representation. Innovative thoughts and ideas are gradually transformed into more concrete form of a solution throughout all stages of design. In other words, abstract ideas and concepts are transformed into a final solution which takes a physical and spatial form. Therefore, we may distinguish two stages of innovation in design: (1) ideas or concept development,

and (2) in physical or spatial form development. However, since ideas and thoughts are not totally independent of the spatial representation, the two stages of innovation are closely interrelated (Im, 1983).

Goals and programs are formulated through a creative interchange between designers and clients. Once goals and programs are accomplished, the actual development of a design can follow fairly well-defined rules. However, the generation of aesthetic and spatial forms that meets all the design requirements seem to emerge through the designers creative analysis and synthesis process (Im, 1983).

Control over design refers to both internal and external decision-making and feedback systems. Internal decision-making refers to designer's own decision or self-evaluation. On the other hand, external decision-making refers to client (the public or an individual) input at various stages of the design process, with designers proceeding to subsequent stages of the process only after reaching agreement with the client.

Wade (1977) argues that the design process is made from a series of "action decisions." Action problems (future events) can be contrasted with management problems (present events) and research problems (past events). An action decision refers to bringing about some change that will alter some future conditions of the environment. The decisions can take various forms, according to the nature of the decision situations.

Steiss (1972) presents three types of decision-making. These are programmed, adaptive and innovative decisions. The programmed decision refers to routinized, reproductive, or stereotyped decision styles. The adaptive decision is described as

"adjustments within established expectations". The innovative decision is defined as "accommodations through new expectations". The adaptive decision requires considerable modification of the program details within a set of given premises.

The innovative process, on the other hand, requires substantial changes in the given premises and involves "productive" problem-solving. March and Simon (1958) have distinguished the concepts of productive and reproductive problem-solving:

> When problem-solving consists primarily in searching the memory in a relatively systematic fashion for solutions that are present there in nearly finished form, it is described as reproductive. When the construction of new solutions out of more or less "raw" material is involved, the process is described as productive (p.46).

Designers deal with programmed, adaptive, and innovative decisions through various stages of design process. That is to say, they may follow pre-established goals and programs, may modify program details, or may want to make substantial changes in goals and programs for a completely new solution. Selection of a decision style among the three types, depends on the problem characteristics and the creativity and aspirations of the designer or client. The more complex the problem, the more likely an innovative decision is required. Accordingly, the higher the creativity and aspirations of the designer or client, the more likely an innovative decision will occur (Im, 1983).

It could be agued that one of the most critical stages of the design process is the analysis-synthesis process. Archer (1963) has the following to say about this process:

> A single design problem is a complex of thousand or more sub-problems. Each sub-problem can be dealt with in a characteristic way: operational research, working drawing, value judgments, etc. But

> although each sub-problem can be resolved so as to produce an optimum or even a field of acceptable solutions, the hard part of the task is to reconcile the solutions of the sub-problems with one another (p.54)

In his study, Im (1983) takes a look at this procedure in more detail and first and foremost warns that the boundary between analysis and synthesis is not clear. The analysis step is gradually transformed into the synthesis step. The basic approach in analysis is usually to divide the whole problem into sub-problems. The reconciliation is usually achieved by classification of sub-problems and identification of hierarchical relationships among them. Further, the reconciliation is based on the overall goals and programs of a project.

Analysis in a design process usually considers physical, ecological, behavioral-functional, aesthetic-visual aspects of human environment. The physical ecological aspect refers to various natural environmental characteristics, such as topography, vegetation, soil, climate. The behavioral-functional aspect refers to social and man-made environmental characteristics, such as personal space, territoriality, relationship between people, movement and physical setting, role of artifacts, and so on. Finally, the aesthetic-visual aspect refers to artistic characteristics of the human physical environment. Designers try to create an aesthetically-pleasing environment, as well as well functioning environment (Im, 1983).

Aesthetics are by far the most controversial aspect of design. It is very difficult to generalize the aesthetic quality of an environment. This difficulty stems from the predominant subjectivity and abstractness of many aesthetic characteristics, with designers relying on their own professional judgment in aesthetic decision making.

Aesthetic aspects deal with individual or social values and taste, making it difficult to define universally-agreed-upon aesthetic values (Archer, 1963; Im, 1983).

An inherent aspect of architecture is the relatively limited number of primary users. Thus, the common aesthetic values within a specific client group or user group may well be identified. In his study, Im concludes that successful design is accomplished through designer-user communication, if aesthetic issues of a project are to be resolved.

2.4 Architectural Design Review

> To improve community appearance, we need to identify what design components to control and how to control them (Stamps & Nasar, 1997, p.11)

Empirical research on the process of design review is rare but existing studies generally try to break buildings down into its constituent elements and produce rules and regulations to control those elements. Jones (2001) sees this process as a regulatory mechanism to control the aesthetic quality of the built environment:

> There is an assumption that controversy surrounding attempts to regulate the aesthetics of the built environment stems from varying levels of resistance to such control, particularly by those charged with the design of that environment. Regulatory mechanisms such as design review are often looked upon as limiting the expressive freedom and aesthetic judgment of urban and architectural design professionals (p.24).

Some architects had claimed that review boards are prejudiced in a sense that they tend to equate "good" with traditional architecture and "bad" with modern architecture (Jones, 2001). However, Jones' study produced different results in regard to the design review process. Architects surveyed in Oregon and Massachusetts tended

to have a positive attitude towards the design review process. The study concludes that such results run counter to the anecdotal evidence indicating that design review is considered by architects to be more of a burdensome nuisance than a method to insure that aesthetic standards are met in the development of the built environment. It also warns that too often "the public" is defined in singular terms and juxtaposed with the design professional in matters of aesthetic judgment and values. What is missing in these discussions of design review is an appreciation of "multiple publics" and "variable interests" (Jones, 2001).

Costonis (1982) and Jones (2001) argue that current review practices rely on the visual beauty interest. This method, which has dominated aesthetic legal thought in the U.S. throughout the 20th century, locates a common *a priori* concern underpinning control of the visual appearance of the environment within objectified notions of beauty. Aesthetic standards are seen as having an ontological basis that exists outside the realm of human social construction. Jones goes on explaining that this premise of ontological apriority has been dominant in the legal and planning institutions concerned with aesthetic control of the environment because it coincides with the natural tendency of such institutions.

Another approach is to consider aesthetic responses to the built environment to be socially and culturally influenced. In such an approach, there is no foreseeable objective standard of aesthetic beauty. "No appeal can be made to a universal set of aesthetic principles, for such principles have no priority in lived experience". Any response to an environmental feature such as a building form is dependent upon how its

message is constructed by the responder, and that process is greatly shaped by cultural and historical factors that constitute social experience (Jones, 2001; Knox, 1993; Boys, 1996; Costonis, 1979).

The problem with current design review practices is they more often place any innovative or creative design in the "bad" design category by default. Lightner (1992) describes the status of current design review guidelines in the United States as following:

> The easiest way, perhaps the only way, to reduce offensiveness is to make everything in the customary, accepted way, or in some closely derivative form. Anything that is new and original has the potential to shock and offend, thus conforming to "contextual" values ranks high as a control measure in most guidelines (p.281).

2.5 Summary

When considering possible differences between architects and non-architects, there seems to be a substantial body of research indicating that architects respond differently to the built environment from non-architects or laypersons. On the other hand, theories claiming architects have a tendency to disregard their clients' needs for their own aesthetic taste are limited.

Studies show that architectural form plays a crucial role in people's emotional and interpretive responses to buildings (Bustami, 1981; Lee, 1985; Stamps, 1994). Within the spectrum of architectural form, curvature seems to possess unique qualities. Some researchers have found curvilinear forms to be serene, joyful and relaxing in architecture and various other disciplines. Based on these studies it is reasonable to think

that curvilinear forms might be associated with higher preference levels in the built environment.

Architectural design is a creative process that sometimes cannot be fully explained. Studies that look at the architectural design process were examined. We also looked at design review methods at different governmental jurisdictions. It seemed that current design review processes have inconsistencies when addressing architectural design, specially those designs that are somewhat unique.

In the next chapter, the design of the quantitative section of this study is discussed. The quantitative methods used will be compared and evaluated with those used by other researchers in the field of environmental design.

CHAPTER III

QUANTITATIVE METHODOLOGY

This chapter presents an overview of the comprehensive underlying principles and quantitative procedures employed in the study. Critical issues relating to sampling and representation of the environment are addressed along with discussions of the selection of subjects and the administration of data collection. A detailed review of the analysis techniques used to evaluate the survey data and a presentation of the analysis results will be described in Chapter IV.

3.1 Overview of the Study Design

Two groups, one consisting of architects and one of non-architects, were presented with environmental stimuli and their emotional responses were recorded. The environmental stimuli consisted of perspective views of two residential interiors, where the architectural elements in each interior were gradually transformed from rectilinear to curvilinear forms. One of the main goals of the study was to compare the responses of the two groups to detect any significant differences.

A second goal was to compare the emotional effect of curvilinear forms as opposed to the rectilinear forms on the subjects. Since one of the emotional values was the feminine-masculine quality associated with architectural form, it was also necessary to compare the response of female and male subgroups. Finally, comparisons between the emotional values themselves were studied and results were compared to prior findings from previous studies.

3.2 Design of Sample Views

An inherent problem in environmental preference research is how to adequately sample the environmental situation of interest. The built environment, particularly the interior environment, has so many variables and combinations of variables that its expressions are effectively limitless. When one considers how many interior settings exist, how many are being changed or created, and how many people are involved in creating them, the scope of interior settings appears indefinable. In addition, conceptualizing the built environment as a series of sequentially experienced views, it is even more incomprehensible how many visual expressions of the environment might exist even within a limited domain (Scott, 1989).

When one considers the questions and purposes of environmental preference research, it becomes clear that randomness in the environmental sample is not the central issue (Scott, 1989). The purpose of this research is to establish and understand the relationship between attributes of the visual environment and human preferences. Since the effect of curvature was the central issue and the independent variable, the interior setting was selected to be as generic as possible.

With this in mind, the interior residential views were taken from architectural projects representative of typical suburban Mid-Atlantic upper–middle class American families. These projects were arbitrarily selected from a pool of projects the researcher had designed over the past four years of professional practice. The original architectural designs did not have any curved forms and were then altered in a three dimensional

computer-aided design environment (ArchiCAD) to introduce curvature in the architectural elements. Each view looked at a family / living room setting that contained windows, a fireplace and interior furniture. Plants and human figures were also present to help subjects get a better understanding of the overall scale of the space.

Each view was printed as an interior perspective on four inch by six inch white index cards. Each card presented a single line drawing and intentionally excluded color, texture and lighting to isolate and measure the effect of architectural form alone. The same view was changed in eight approximately equal steps, transforming from rectilinear to curvilinear while all other variables remain constant. The scale of the drawing, perspective viewpoint, relative size and position of architectural elements, location of human figures, and other non-curvature parameters did not change from one index card to the other. For each of the two interior settings, the subjects were given the same eight index cards to compare using a card-sorting task, which is explained in the following sections. (See Appendix J and Appendix K).

One of the key concerns in this study was how to adequately represent the interior environments to subjects. Since the study involved the subjective assessment of visual environments, care was taken to ensure all physical aspects of each environment were represented on each card and line perspectives were sufficiently explicit to assure confidence that all subjects were basing their perceptual responses on the same set of environmental features.

For practical reasons and nature of the study design, it was impractical to base subject responses on actual site visits. Therefore an alternative method of presenting the

environment to subjects had to be selected. Taylor, Zube and Sell (1987) classify representations of the environment in terms of two categories: environmental simulations and environmental surrogates. These are abstractions that are that are similar but lack precision in replicating the environment. Verbal description and graphic representation such as manual or computer generated drawings and models would be examples of environmental simulations. Environmental surrogates are usually regarded as more realistic with examples that include photographs, film and videotape (Scott, 1989).

The next step was to verify the adequacy of perspective line drawings as a simulation method. Previous preference assessments provide supporting evidence that using photographs as surrogates for the environment is reasonably effective (Kaplan & Kaplan, 1972; Herzog & Miller, 1998; Shafer & Richards, 1974). An additional investigation shows that line drawings are effective communication devices between people and recommends architects to use this method in communicating with their clients (Cuff, 1979). There is also significant data showing subjects successfully interpreting line drawings as three-dimensional surfaces and understanding them in their proper specific context (Barrow & Tenenbaum, 1981). Walker (2002) utilized similar methods to study environmental preference, using two-dimensional computer generated line drawings of various house facades as stimuli. Consequently perspective line drawings were used in this study, which would fall in the environmental simulation category. A complete set of drawings are provided in Appendix J and Appendix K, presented at the same scale as they were presented to the subjects.

Another critical aspect of the study was to come up with a method of systematic increase in curvature from one image to another. This proved to be one of the most challenging design aspects of this study. First, consistent incremental increase in curvature in all three dimensions is difficult because it so much depends on the design constraints and the architectural program specific to the project. Secondly, there are virtually infinite choices when it comes to introducing curvilinear forms in a design. After considering many different possibilities with colleagues and advisors, a method was devised to address this problem.

The researcher asked three registered architects to help with introducing incremental curvature in each designs. The criteria set for them were: (1) any change in the perspective must have an architectural plan that is fully functional and resolved within the original program restraints of the project, (2) any introduction of curved architectural elements must be physically visible in the perspective views and numerically more that the previous view, and (3) after adhering to the first two rules, the architects should strive to make such introductions of curvature be aesthetically acceptable. In other words, even if the curved elements are functional in plan they should not be visually unpleasant or uncommon with the standard practice of architecture. After obtaining the design from all three architects, a single design was developed by the researcher for each of the two views. The final design was confirmed with each of the architects.

3.3 Selecting Subjects

Research participants included two hundred thirty-one non-architecture students at Texas A&M University and sixty-two graduate architecture students from Texas A&M and Virginia Tech University. They were recruited through contact with their instructors during the academic years of 2003 and 2004, and did not receive any form of compensation for their efforts.

The number of subjects was based on achieving an acceptably low statistical standard error, thus it was important that no fewer than two hundred (and preferably more) subjects be involved. In the final tally, two hundred sixty-seven undergraduate non-architecture majors completed the card-sorting task, and of those, twenty-nine were eliminated for not meeting the profile requirements while another seven were rejected because the credibility of their responses was highly questionable. As for the architecture graduate students, the main issue was availability of large number of subjects. To generate statistically acceptable analysis of variance (ANOVA) information, seventy graduate students were recruited to participate in the study, with responses from nine eliminated for not meeting requirements.

Each subject was asked to provide his or her personal background information. Prior research shows that some information such as income or age may not be correctly reported by subjects (Sommer & Sommer, 2002). Nevertheless it is reasonable to believe that participants' accounts of race and academic major are reasonably accurate.

There is much discussion as to whether college students are an appropriate sample of the general population. Some studies report that undergraduate students

respond differently than adults, therefore results from these sample populations might not be applicable to the general public (Sears, 1986; Wintre, North, & Sugar, 2001). Other researchers did not find any significant difference between undergraduate students and adults outside of college settings (e.g. Ward, 1993).

Lyons (1983) studied the relationships of between age of subjects and environmental preference. His study finds that preference levels change over the course of a lifespan and a generally negative relationship between age and preference scores. Scores were found to be higher for the very young, decrease until about grade nine, and increase to college age. They then level off for mid-life adults and eventually start dropping for the elderly. Lyons shows college students were closest to mid-life adults and both groups were more stable that the very young or the elderly.

These prior studies all conclude that a comparison between age groups is highly dependant on the type of research issues under investigation. For the purposes of this study with architects and non-architects, it is suitable to use undergraduates since they have been shown to not differ greatly from most people on judgment of visual attractiveness or their preferences with respect to architectural simulations and surrogates (Delvin, 1994; Nasar, 1989).

Groat and Canter (1981) indicates that graduate architecture students' response to the built environment is quite similar or close to that of practicing architects. To strengthen this correlation, the recruited graduate students were asked to provide personal information about prior years of professional design experience and years of

architectural education. Those with less than five years of cumulative design and academic experience were excluded from the analysis.

3.4 Selecting Variables

Nine emotional dimensions were selected for measurement on the basis of prior research (Hesselgren, 1987; Heath, 2000; Scott, 1993) and consultation with advisors. They are pleasant-unpleasant, depressing-elevating, relaxing-irritating, friendly-unfriendly, personal-impersonal, safe-unsafe, mysterious-unmysterious, complex-simple, and feminine-masculine. The selection of these dimensions had to ensure appropriate methods of measurement for the effect of curvilinear architectural form on human emotions.

Environmental complexity, possibly one of the most important dimensions of preference (Berlyne, 1960, 1974; Kaplan, S., Kaplan, R. & Wendt, 1972; Pristo, 1982; Scott, 1989; Wohlwill, 1976), was critical in the design of this study. Wohlwill (1976) discovered a monotonic relationship between complexity and preference in the natural environment, with the higher the index of visual complexity, the more subjects preferring a natural setting. However, these findings did not confirm a similar relationship for man made environments. For scenes representing the built environment, an inverted U-shaped relationship between complexity and preference was demonstrated. Since one of the main objectives of this study was to see how an increase in curved forms affected complexity and eventually preference, this variable was selected for the study in the form of eight point Likert Scale of simple-complex.

Mystery is another critical variable that is closely related to preference. As defined by Kaplan, S. (1975, 1979a, 1979b), mystery is the degree to which a scene suggests the promise that more information might be obtained by venturing further. Their model of mystery suggests that subjects perceive additional information in the extension of one's cognitive map or knowledge of the environment could be gained if one could explore the scene more deeply. This dimension resulted from preferences for a variety of settings where the common feature seemed to be an indication of additional space beyond the immediate perceptual location. Similar to Wohlwill (1976), the Kaplans also studied these relationships in mainly natural environment settings.

Scott (1989) extended this research to include the interior built environment and its context. Her findings indicate that mystery is an indicator of preference in interior settings as well. The emotional dimension of mysterious-mysterious is used in the current study to explore the relationship between curvature and mystery, and consequently, preference in interior architectural settings.

The variables of pleasant-unpleasant, depressing-elevating, relaxing-irritating, friendly-unfriendly and safe-unsafe were selected from a list of bi-polar adjectives that social-psychologists refer to as semantic differentials (Shafer & Richards, 1974; Sanoff, 1974). These specific variables were intentionally selected because they distinctly predict viewer's level of preference. This is based on one of Kant's three major types of mental judgment: "the feeling of pleasure or displeasure" (Kant, 1987). It is logical to assume spaces that are rated as more pleasant, elevating, relaxing, friendly or safe are also considered more preferable.

The final two dimensions are masculine-feminine and personal-impersonal. Although some experiments included these adjectives in the list of semantic differentials (Shafer & Richards, 1974), in the context of this study they are grouped separately. The qualitative interviews with professionally acclaimed architects presented in Chapter VI indicated the presence of curvature in interior architectural spaces made the spaces feel more informal and feminine. While these qualities do not necessarily imply a higher preference for these built environments, the repeated association of these two adjectives with built curvilinear architectural forms suggested their inclusion as the final emotional dimensions of the investigation.

3.5 Obtaining Visual Ratings

Stamps (1980) argues that the system of comparative choice is the best method for predicting aspects of the visual appeal of built environments. The paradigm of comparative choice consists of making a sequence of unambiguous decisions, for known reasons, among different objects. He provides a clear example of having five photographs of different buildings. If we were to determine our preference for those buildings, this method will require us to fist pick the photograph which is preferred most, then the next most preferred photograph, and so on, until there was only one photograph remaining. These successive decisions generate a set of comparative choices. Stamps demonstrates how this set can be analyzed to obtain quantitative estimates of the relative visual appeal of the buildings in a photograph.

He further argues that the main advantage of this paradigm in determining relative visual appeal is that it does not require that we are aware of the grounds of our judgments, but only of the resulting decisions. This turns out to be a substantial advantage in analyzing complex objects when we attempt to deal with environments which appear to be ineffable, or in the case of aesthetics, when we attempt study judgments based on feelings. Another advantage is that mathematical treatment of the sets of comparative choices is quite well established.

This research replicates Stamps' method with the distinction that instead of measuring only preference, it is applied to emotional values that share similar qualities in judgment as subjective preference. Also, perspective drawings are used instead of photographs, with subjects asked to pick the most pleasing line drawing first, then the next most pleasing, and so forth, until all eight drawings were evaluated. A similar method was adopted by Heath, Smith and Lim (2000) when they studied the perceived complexity of tall building facades by asking subjects to perform a comparative card-sorting task.

This study departs from previous research precedents by combining the system of comparative choice with the method of measuring bipolar semantic differentials. After sorting the images based on the specific dimension, subjects had to transfer the judged sequence as Likert scales on the survey paper provided to them. This is a scale in which respondents indicate their level of agreement with statements that express a favorable or unfavorable attitude toward a concept being measured. This was another unique and interesting aspect of this study in which new methods of obtaining emotional ratings

were explored. In retrospect, it added such complexity to the data collection procedure and statistical analysis that its benefits were questionable.

3.6 Data Collection Procedure

Data for the non-architect group was collected in three separate sessions in three consecutive semesters at Texas A&M University, College of architecture. Although these classes were held in the architecture department, all the class participants were non-design majors from other colleges on the campus. The class instructor made the last forty-five minutes of a class session available for this survey and asked the students to cooperate with the researcher.

First, the subjects were asked if they had any design-related experience or prior design education. Those with design exposure were excused from the survey and the rest were given a package containing two copies of the IRB consent forms and an easy-to-understand written description of the procedure (See Appendix E). Subjects were asked to take the time necessary to read and sign the form. At this point, the researcher and his colleagues answered any general questions and concerns about the study and the procedure. Subjects who participated placed one signed copy back in the package and kept the second copy for their records.

Also in the package there were two sets of four by six index cards, with each set presenting eight perspective line drawings, one per card, of the same interior residential view as it changed incrementally from card to card from a fully rectilinear interior space to a curvilinear space. A corresponding data collection sheet was attached to the

matching set with separate colors to avoid unnecessary confusion (See Appendix F). The cards were in random order and each had a random letter of the alphabet inscribed outside the image. Both these measures were employed to avoid the chance of unintentional bias in the card-sorting task. The data collection sheet also asked the subjects to provide personal information such as gender, age, ethnicity, major and years of education. The main body of the sheet contained eight fill-in-the-blank boxes for each of the nine variables.

An easy-to-understand definition of each of the emotional dimensions was explained to the subjects. For example, “visual complexity in a scene is measured by how much is going on there, or how much there is look at" (Kaplan, 1979b) or for mystery, "Does this scene provide opportunity to venture further and learn more?" (Scott, 1993). The remaining dimensions were considered self explanatory, but subjects were encouraged to ask questions before and during the card-sorting task if they did not understand any part of the procedure, terms used, or the variable definitions.

Subjects then proceeded with the card-sorting, generally taking more time with the initial emotional dimensions, but gaining speed as they got more familiar with the procedure. After cards were sorted for each dimension, the letters on each card were transferred to the survey sheet, securing the subject’s rating sequence. The entire process was repeated with the second set of cards that presented the second interior view. When complete, each subject provided one hundred forty-four data units in the ratings, then concluded the survey by placing all the materials back into the package to return to the researcher.

An identical procedure was presented to the architecture graduate students, but administered to smaller groups. Care was taken to exclude career change students from the study for not having accumulated the requisite architectural experience. These are students that have received undergraduate degrees in fields other than architecture but are enrolled in the graduate architecture programs.

This process, where subjects compared and ranked the views with each other, produces statistical data that is ordinal in nature. Ordinal data, as the name suggests, implies a rank order to the data, with one score being better or worse than another. An ordinal scale does not permit the user to determine how far apart the points on a scale are, but only to hierarchically rank each point. Ordinal data is collected around a mean value. Parametric statistics use values such as the mean, median, and, most important, variance to ascribe differences between groups. Analyses of variance and t-tests are examples of common methods of analysis.

Ordinal data analysis is unique in a sense that there is no established baseline for comparison. The interpretation of data is limited and mostly meaningful when compared to one another. Statistical methods employed were compatible with ordinal data and are further discussed in the next chapter.

CHAPTER IV

QUANTITATIVE DATA ANALYSIS AND RESULTS

The purpose of this chapter is to demonstrate the results of the data analysis that was gathered through multiple card-sorting tasks given to test subjects (architects and non-architects). The relationship of each emotional variable is examined with gradual increase in curvature stimuli. Different statistical methods were utilized to examine these relationships which in turn are explained in detail. Finally results for the two sample populations, architects and non-architects, are provided and the outcome analyzed.

4.1 Overview of Analysis Procedure

The card-sorting tasks provided two types of data results. First was the rating data. Two interior residential views were visually manipulated so that level of curvature would increase in each view and, subjects rated each curvature level on an 8-point Likert scale. Subjects provided assessment on 9 emotional variables. The emotional variables were unpleasant-pleasant, depressing-elevating, irritating-relaxing, unfriendly-friendly, impersonal-personal, unsafe-safe, simple-complex, not-mysterious-mysterious and finally masculine-feminine. Second class of data consisted of the demographics: gender, academic major, age, years of architectural design education and work experience (for architect subjects), and ethnicity. The purpose in collecting this data was to profile the subjects, and more importantly, to enable elimination of any subjects having educational or work experience in art or design which could potentially bias their judgments and effect the comparison between architects and non-architects.

There were two stages of quantitative data analysis involved in addressing the questions of this study. In each stage comparison is made between architects' and non-architects' responses. The first stage of analysis addressed the study objective of identifying and defining any relationship, which might exist between different levels of curvature present in an interior architectural view and, each emotional variable, mentioned above. Here curvature was the environmental attribute and therefore the independent variable.

The analysis was accomplished by studying the descriptive statistics, analysis of variance, linear regression, and correlation coefficient for the independent variable (increase in curvature) and each dependent variable. The second stage was focused on the study objective is to learn more about the relationship between several independent or predictor variables and a dependent or criterion variable. In this study pleasantness, privacy and safety have each been studied as dependent variables. Special attention has also been given to extent mystery and complexity affect subjects' preference ratings. Multiple regression was the main statistical method used in the second stage.

4.2 Tools and Methods for Determining Relationships Between Variables

The data was analyzed using SPSS 11 statistical package. The output from this software is in forms of graphs and tables. After responses were coded and entered into a computer data file, a number of different statistical methods where employed. These methods and their importance to this research are each discussed in more detail.

4.2.1 Data Organization

This study produced a relatively large amount of data, which needed to be organized in an acceptable manner. This proved to be very challenging. To begin with, each subject evaluated 2 different card sets. Each had 8 different variations of the same view, which had to be evaluated for 9 different emotional variables. That meant 9x8x2=144 comparative entries from each subject. The Non-architect group (n=236) created 33,984 data entries and the Architect sample (n=61) created 8,784 entries.

The first step of restructuring the data was to stack all entries that belonged to a single variable. A column was added to identify every subject and their corresponding response. This created 9 columns (as apposed to 9x8=72) each representing a single dependent variable. The second step was to average the response of the same subject for different interior views. Since (1) both views were graded by the same person and (2) the "only" controlled factor was the change in curvature and (3) individual statistical analysis of both views were very similar, this proved to be logical step in data reduction. It turned out that there were more advantages to averaging since the combined results were more informative and significant than each individual card set. This could be attributed to reduction of variability. Averaging the responses helped to justify the assumption of normality.

The last step was to create an independent variable column with ordinal scaled data ranging from 1 to 8 which matched their corresponding response in the chart. In this column, the least number (1) referred to the card that did not have any curvature and number (8) was the card that had the most curves.

4.2.2 Descriptive Statistics

Descriptive statistics were used to describe the basic features of the data in this study. They provided simple summaries about different samples and the measures. Together with simple graphics analysis, they formed the basis of quantitative analysis of data. The most important descriptive statistic in this study was the mean. The mean is a particularly informative measure of the "central tendency" of the curvature variable when reported along with its confidence intervals (Ott & Longnecker, 2001). For every emotional variable a chart indicating means and standard deviation for each curvature variable is provided.

An important aspect of the "description" of a variable is the shape of its distribution, which tells you the frequency of values from different ranges of the variable. We need to determine how well the distribution can be approximated by the normal distribution. Histograms are provided as a graphical representation of the frequency distribution of the selected variable(s). Box Plots are also provided as another graphic way to compare medians and measures of variation in 8 curvature groups side by side.

4.2.3 Univariate Analysis of Variance (ANOVA)

One of the main hypotheses of this study is to measure the means of emotional responses change with increase in curvature. In general, the purpose of analysis of variance (ANOVA) is to test for significant differences between means. This was achieved by Univariate ANOVA in SPSS. Tukey's B is chosen in the post hoc option

and tables that indicate the homogenous subsets are provided. Homogeneous Subsets Groups that appear in the same homogeneous subset are not significantly different from each other. This table provides a better understanding of the results with incremental grouping as curvature increases.

4.2.4 Pearson Correlation

Correlation refers to "an association between scores on two variables for the same individuals or cases" (Sommer & Sommer, 2002). Potential problems with interpreting correlations is that even though they are used to find certain relationships between two variables, they do not suggest cause and effect (Ott & Longnecker, 2001). Correlations between independent and dependent variables are important in this study since we are mostly concerned with curvature as the main single independent variable but they also provide insight into the relationship of the 9 emotional dependant variables. These variables are further examined by multiple regression. Pearson product-moment correlation coefficient was produced for all variables using SPSS statistical package.

4.2.5 Multiple Regression

The general purpose of multiple regression models is to predict a dependent variable given certain values of the independent variables (Ott & Longnecker, 2001). This method is used for both qualitative (e.g. mystery rating) and quantitative (gradual increase in curvature) variables. By using multiple regression we try establish to what extent the other measured variables are responsible for preference, privacy, safety and feminine qualities of the built environment.

4.3 Description of the Respondents

Demographic data consisted of four types of information. These were gender, age, academic major and ethnicity. Since both groups of architect and non-architect subjects were university students, the majority of the respondents were relatively young. However as mentioned in the literature review, it has been shown that college students are a good representative of a complete age spectrum. The Race/Ethnicity question provided 6 options: white (not Hispanic), Black (not Hispanic), American Indian, Asian or Pacific Islander, Hispanic and Other. The results are discussed for both subject groups.

4.3.1 Age

The non-architects were mostly young college students at Texas A&M University predominantly aged between 18 and 22. The percentage break down shows that 8.8% of the subjects were 18, 20.8% were 19, 22.7% were 20, 17.6% were 21, 18.1% were 22, 6% were 23, 1.4% were 24, 1.4% were 26 years old and the rest which were below 1% are indicated in Figure 4.1. The mean age for non-architects is 21.11 with s.d.=4.11.

The average age of the architect sample was slightly higher since they were intentionally graduate professional architecture students as compared to the younger undergraduate non-architects. The mean is 25.193 with s.d=3.16. The architects were graduate students at Texas A&M University and Virginia Tech's Washington Alexandria Architecture Center predominantly aged between 23 and 27. The percentage break down shows that 4.8% of the subjects were 21, 9.7% were 22, 16.1% were 23,

16.1% were 24, 14.5% were25, 8.1% were 26, 11.3% were 27, 4.8% were 28, 6.5% were 29 and the rest were 1.6% each and indicated in Figure 4.2.

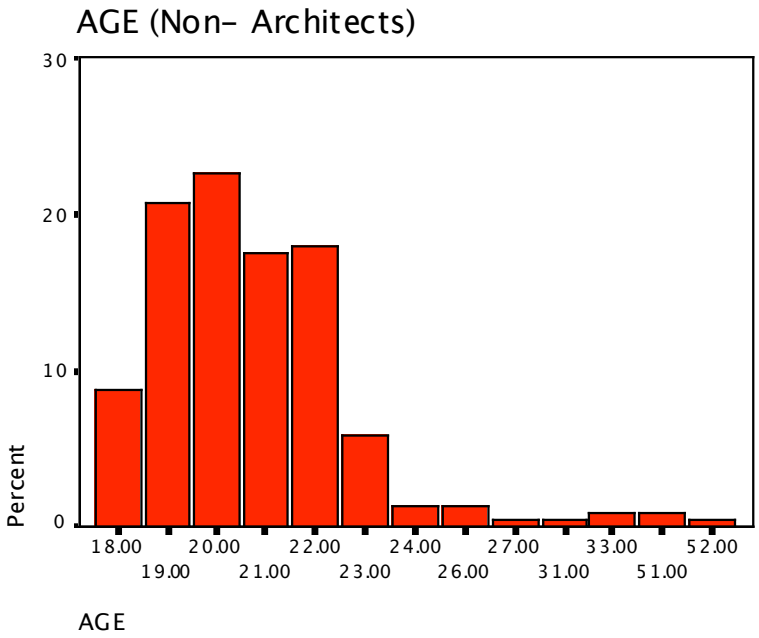


Figure 4.1: Age Distribution for Non-Architects

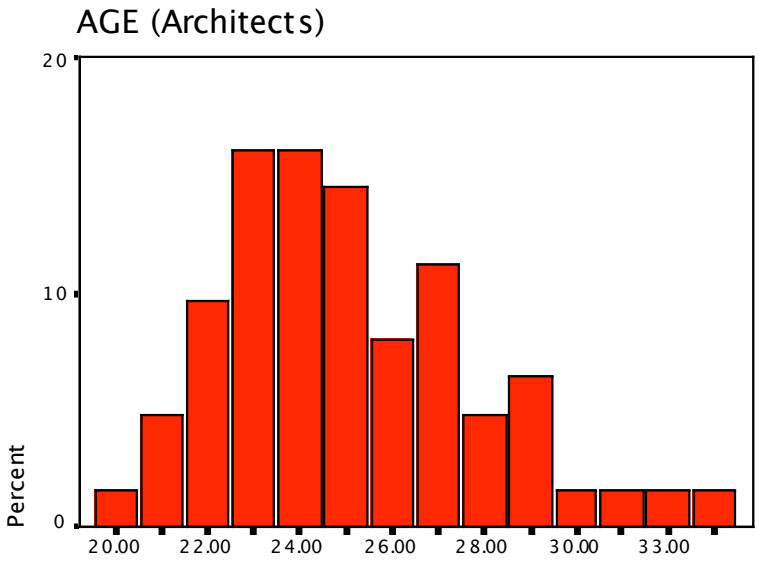


Figure 4.2: Age Distribution for Architects

4.3.2 Gender

Breakdown of the gender for both architect and non-architect groups is examined. In the architects sample (n=61), 50% of the subjects are male and 50% are female. In the non-architect sample (n=236) the distribution is 54.66% male and 45.34% female. It is important to take into consideration the difference between sample sizes when interpreting the Pie diagrams below in Figure 4.3. In general, gender distribution is quite equal in both groups.

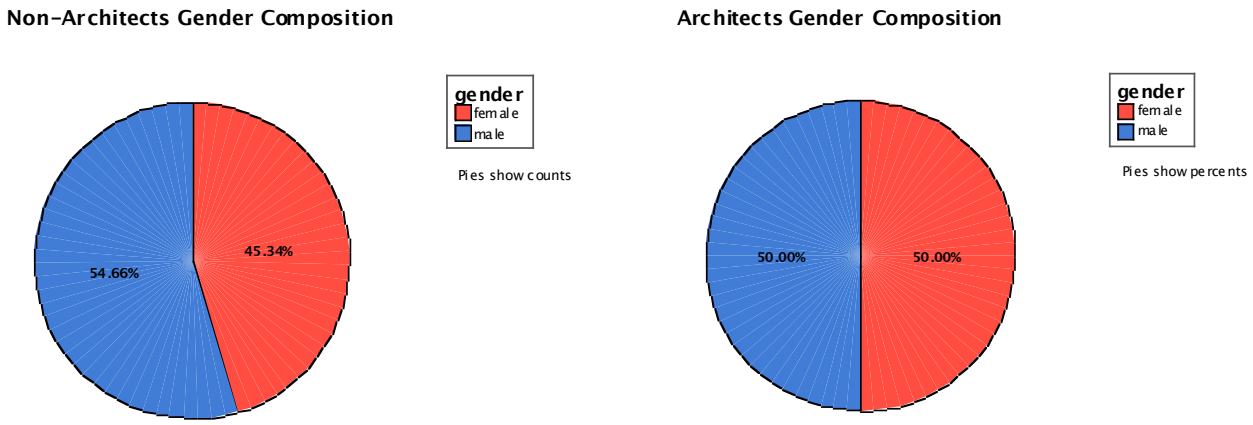


Figure 4.3: Gender Pie Charts for Non-Architects & Architects

4.3.3 Ethnicity

The race distribution for both architects and non-architect sample groups are examined in this section. In the non-architect group, 79.82% of the respondents were white, 10.09% Hispanic, 4.59% Black, 2.75% Asians, 1.83% were "Other" and 0.92% were American Indian. With the architect group, 63.79% of the respondents were white, 17.24% Asian, 8.62% are Hispanic, 1.72% Black and 8.62% were of "Other" race. It is important to note that Whites and blacks in both groups were not of Hispanic origin and pacific Islanders were included in the Asian population. This information is graphically presented in Figure 4.4.

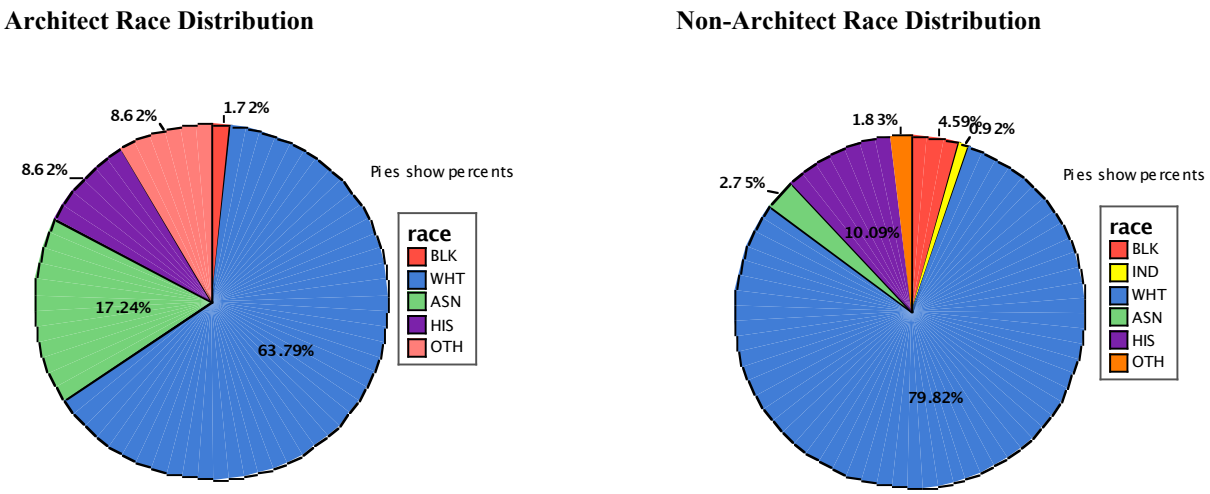


Figure 4.4: Race Distribution for Non-Architects & Architects

4.3.4 Academic Major

Breakdown of the academic majors for non-architect groups is examined. The result shows that almost half of the non-architect subjects are from the college of Liberal Arts (48.57%). 20.95% of the respondents were from the College of Education, 10.95% of the respondents were from the College of Business, 10.48% from the College of Agriculture, 7.62% from Geology and 1.43% from College of Sciences. This information is presented in Figure 4.5.

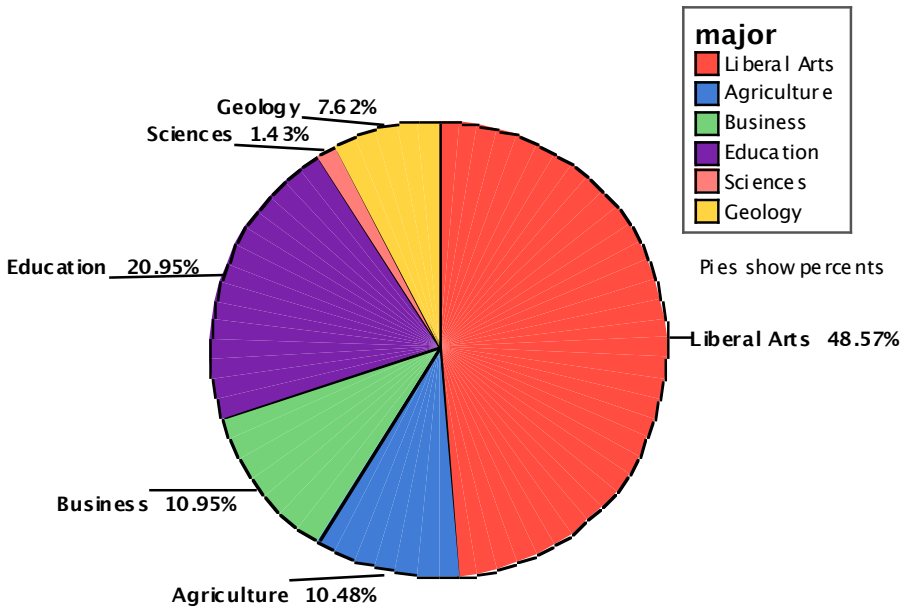


Figure 4.5: Academic Major Distribution & Non-Architect Correlations

4.4 Correlation Between Variables

The main purpose of this study is to understand relationships between architectural form (in this study curvature was the specific architectural form examined) and human emotional and perceptual responses. One of the standard statistical ways to examine this relationship is to use the Pearsons Correlation. In this study we examine correlations between increase in curvature and a series of responses for both architect and non-architect groups. It is also important to explore other correlations between the emotional variables themselves.

The results indicate that overall there is positive correlation between increase in curvature and all 9 dependent variables for both architect and non-architect groups. However, this correlation is much weaker in the architect sample than it is in non-architects. This is true for all variables except the Masculine-Feminine variable for which the architect group had a higher correlation. There were some correlations between dependent variables in the architect group that were actually negative. Although some of these results were not as momentous as correlations between curvature and dependent variables, yet it raises serious questions about these relationships and has potential for further studies.

Figure 4.6 demonstrates these correlations graphically. The z axis is the correlation value and other two axis (x and y) list the ten variables. We can see a visual three dimensional relationship for the architects (right side) and compare it to the non-architects (left side). Some differences stand out instantly. Overall, Architects have lower correlation values specifically where it pertains to curvature.

So in broad terms, there is little change in emotional and perceptual values of architects, as curvature levels change. The yellow section that shows low correlation values (0.00-0.20) does not exist for non-architects and architects have larger zones of blue, indicating stronger relationships between emotional variables themselves. The two tails on each side are indicative of spikes of feminine quality for curvature for both groups with the notion that architects have higher correlations than non-architects. This means that architects perceive a stronger feminine quality for an interior space as curvature increased.

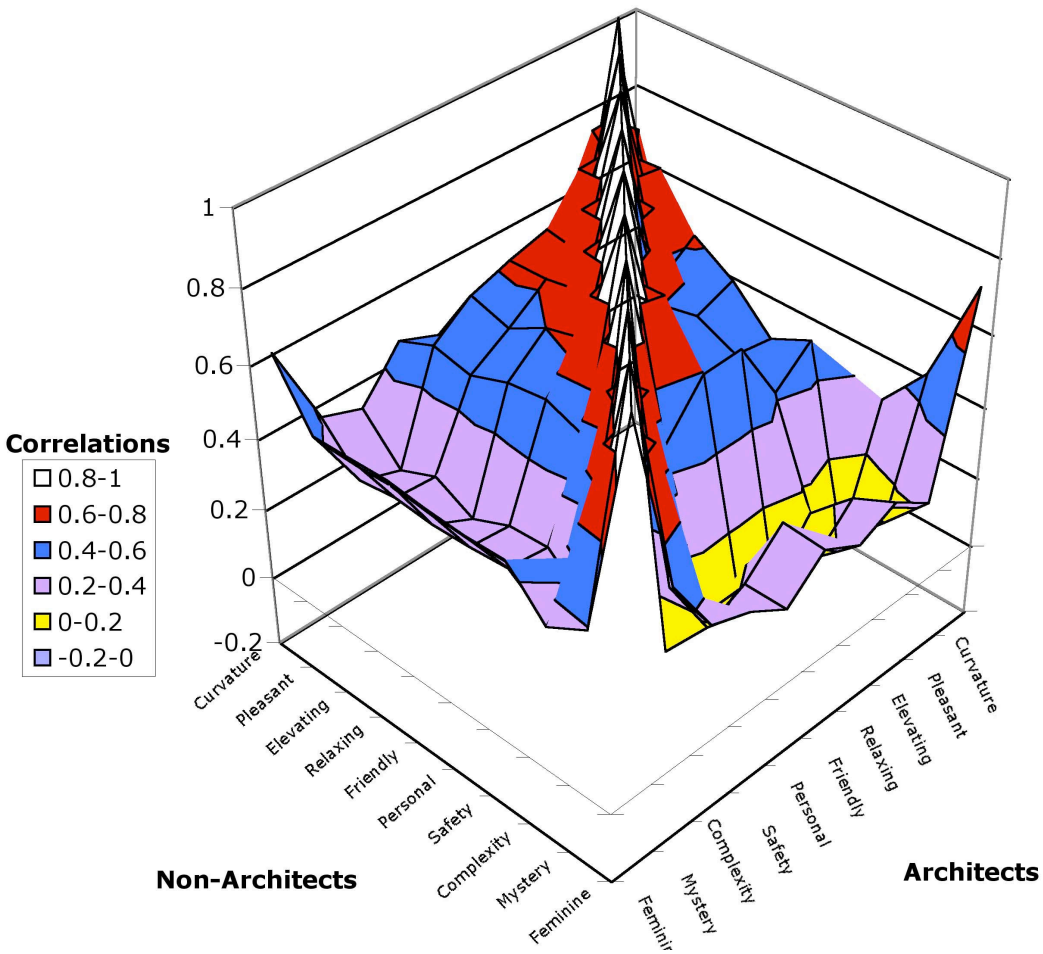


Figure 4.6: 3 Dimensional Representation of Architect & Non-Architect Correlations

4.4.1 Non-Architects

Correlations are a measure of the relation between two or more variables. Correlation coefficients can range from -1.00 to +1.00. The value of -1.00 represents a perfect negative correlation while a value of +1.00 represents a perfect positive correlation and a value of 0.00 represents a lack of correlation. By looking at the correlation table for non-architects (Table 4.1), we can observe several patterns of relationships between our variables. First, we look at correlations between curvature and emotional variables. They are all between 0.4 and 0.5 except for Mystery, Complexity and Feminine quality with the former two being below 0.4 and the latter above 0.5. We can also observe that the variables Pleasant, Elevating, Relaxing and friendly are correlated relatively high. Increase in visual complexity is considered more mysterious and vice versa. However these two variables have relatively a lower correlation to other variables compared to others. The lowest relationship occurs between safety / mystery and safety / complexity. All p-values for this group are less than 0.001.

Table 4.1: Correlations for Non-Architects

	Pearson	CURVE	PLEASANT	ELEVATING	RELAXING	FREINDLY	PERSONAL	SAFE	COMPLEX	MYSTERY	FEMININE
CURVE	Correlation	1									
	Sig.	.									
PLEASANT	Correlation	.473	1								
	Sig.	.000	.								
ELEVATING	Correlation	.471	.652	1							
	Sig.	.000	.000	.							
RELAXING	Correlation	.473	.639	.622	1						
	Sig.	.000	.000	.000	.						
FREINDLY	Correlation	.449	.611	.617	.637	1					
	Sig.	.000	.000	.000	.000	.					
PERSONAL	Correlation	.408	.574	.542	.601	.631	1				
	Sig.	.000	.000	.000	.000	.000	.				
SAFE	Correlation	.451	.497	.474	.515	.531	.490	1			
	Sig.	.000	.000	.000	.000	.000	.000	.			
COMPLEX	Correlation	.322	.209	.256	.201	.250	.257	.158	1		
	Sig.	.000	.000	.000	.000	.000	.000	.000	.		
MYSTERY	Correlation	.362	.247	.264	.255	.260	.271	.191	.442	1	
	Sig.	.000	.000	.000	.000	.000	.000	.000	.000	.	
FEMININE	Correlation	.601	.439	.441	.448	.437	.433	.438	.328	.392	1
	Sig.	.000	.000	.000	.000	.000	.000	.000	.000	.000	.

4.4.2 Architects

Overall, we have low correlations between curvature and other variables except for the feminine variable. Feminine-masculine variable had the strongest correlation achieved in this study ($r=0.754$, $p<0.001$). This result suggests that architects strongly associate architectural curvilinear forms with feminine qualities in that space. Correlations between other variables are considerably lower than observations in the non-architecture group even though correlations between curvature and mystery($r=0.466$, $p<0.001$) or complexity ($r=0.333$, $p=0.001$) are noticeably higher from others in the architect sample. Similar to non-architects we can see that pleasant, elevating, relaxing and friendly are closely correlated with each other. There is a limited relationship between increase in visual complexity and other emotional variables for architects. There is also a high correlation between increase in feminine quality of space and perceived mystery. The results suggest that feminine spaces are perceived to be more mysterious. This information is demonstrated below in Table 4.2.

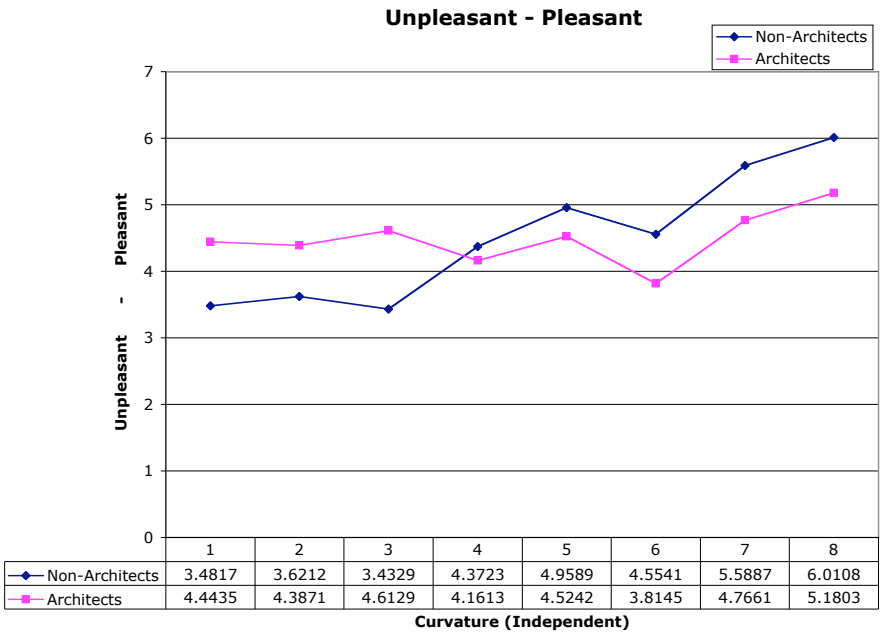
Table 4.2: Correlations for Architects

	Pearson	CURVE	PLEASANT	ELEVATING	RELAXING	FREINDLY	PERSONAL	SAFE	COMPLEX	MYSTERY	FEMININE
CURVE	Correlation	1									
	Sig.	.									
PLEASANT	Correlation	.075	1								
	Sig.	.096	.								
ELEVATING	Correlation	.234	.578	1							
	Sig.	.000	.000	.							
RELAXING	Correlation	.156	.618	.547	1						
	Sig.	.001	.000	.000	.						
FREINDLY	Correlation	.241	.551	.512	.602	1					
	Sig.	.000	.000	.000	.000	.					
PERSONAL	Correlation	.144	.447	.462	.405	.565	1				
	Sig.	.001	.000	.000	.000	.000	.				
SAFE	Correlation	.150	.500	.417	.599	.594	.464	1			
	Sig.	.001	.000	.000	.000	.000	.000	.			
COMPLEX	Correlation	.333	-.012	.138	.001	.034	.056	.026	1		
	Sig.	.000	.794	.002	.974	.455	.211	.561	.		
MYSTERY	Correlation	.466	.107	.248	.149	.320	.218	.171	.357	1	
	Sig.	.000	.017	.000	.001	.000	.000	.000	.000	.	
FEMININE	Correlation	.754	.232	.303	.254	.313	.219	.287	.327	.504	1
	Sig.	.000	.000	.000	.000	.000	.000	.000	.000	.000	.

4.5 Results of Relationships Between Curvature and Emotional Variables

4.5.1 Unpleasant – Pleasant

Pleasantness is one of the most important emotional variables measured since it is directly related to how people make preference judgments about the built environment. In general, non-architects' ratings for pleasantness increases with gradual increase in curvature. This relationship is not demonstrated in the architect group. The rating of architects is somewhat constant (between 4 and 5) as curvature increases with the exception of slight peaks toward higher degrees of curvature (cards 7 and 8). Both relationships are examined thoroughly in subsections 4.5.1.1 & 4.5.1.2. Figure 4.7 illustrates the mean results for both groups.



	1	2	3	4	5	6	7	8
Non-Architects	3.4817	3.6212	3.4329	4.3723	4.9589	4.5541	5.5887	6.0108
Architects	4.4435	4.3871	4.6129	4.1613	4.5242	3.8145	4.7661	5.1803

Figure 4.7: Mean Trends of Unpleasant-Pleasant for Architects and Non-Architects

4.5.1.1 Non-Architects

There were n=231 valid entries for the non-architect group. Box plots (Figure 4.11) indicate that variances are close to each other. The concept of variability is key in this study's findings. In general results are more reliable when groups that are compared have less variability. Outliers are present but since data is ordinal and there are only a few, they are acceptable. The q-q plot (Figure 4.10) shows that the data is normally distributed and the cumulative histogram (Figure 4.9) is bell-shaped. In figure 4.8 we can see histograms for each individual card. They show the rating of each card for the pleasantness emotional variable. We can observe that as we move to cards with higher degrees of curvature, higher degrees of pleasantness are expressed. This effect can be visually detected in figure 4.7 (card 1 and 2 with little or no curvature and cards 7 and 8 with highest degrees of curvature). Table 4.3 shows the mean and standard deviation of pleasantness variable for non-architects.

Table 4.3: Means and Standard Deviation of Non-Architects' Response to Unpleasant-Pleasant Variable

CURVE	Mean	Std. Deviation	N
1	3.4827	1.82308	231
2	3.6212	1.57922	231
3	3.4329	1.36686	231
4	4.3723	1.33999	231
5	4.9589	1.29188	231
6	4.5541	1.40507	231
7	5.5887	1.69132	231
8	6.0108	1.94347	231
Total	4.5027	1.81434	1848

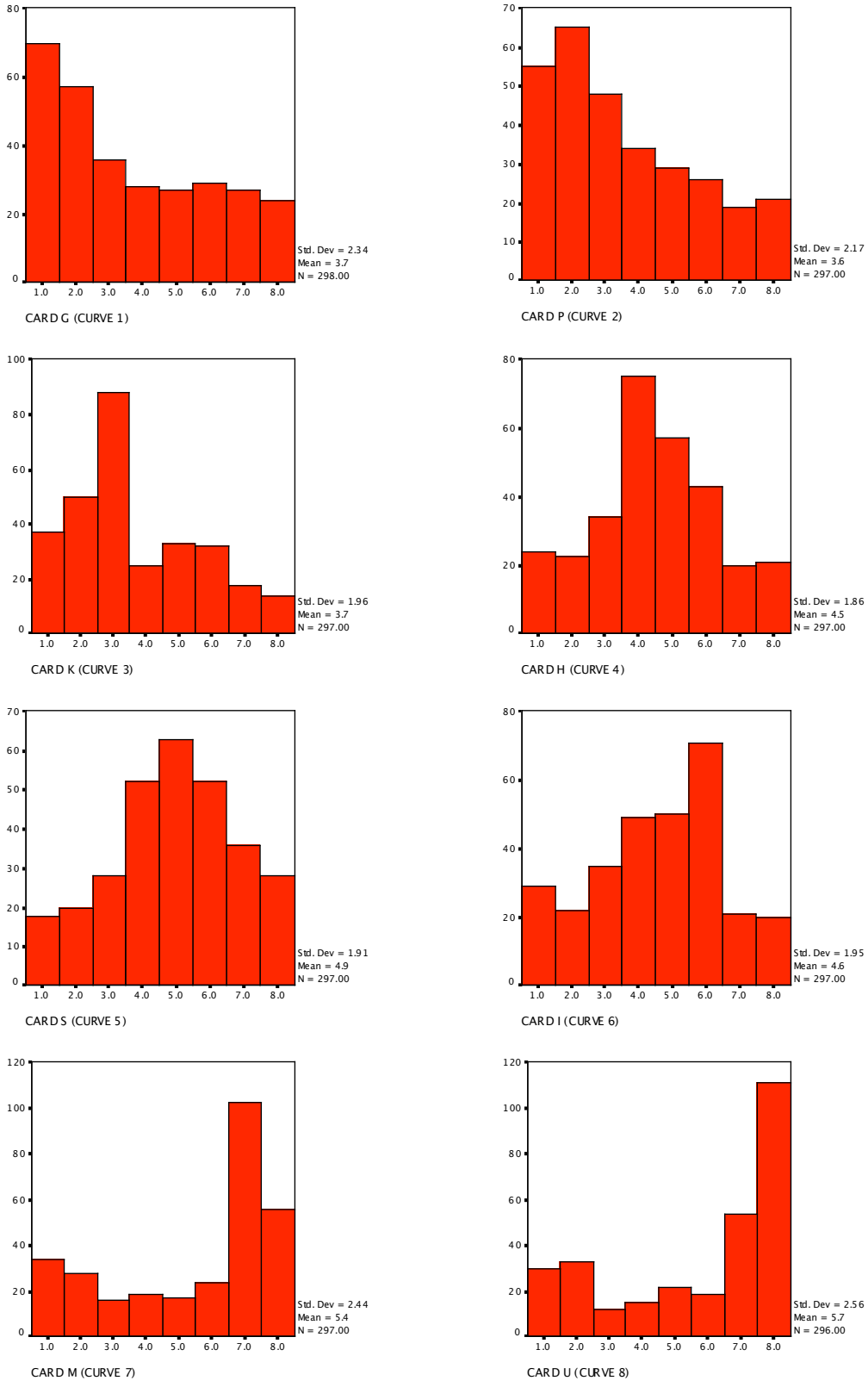


Figure 4.8: Histograms for (Unpleasant-Pleasant) Non-Architects Responses for Different Curvature Levels (1-8)

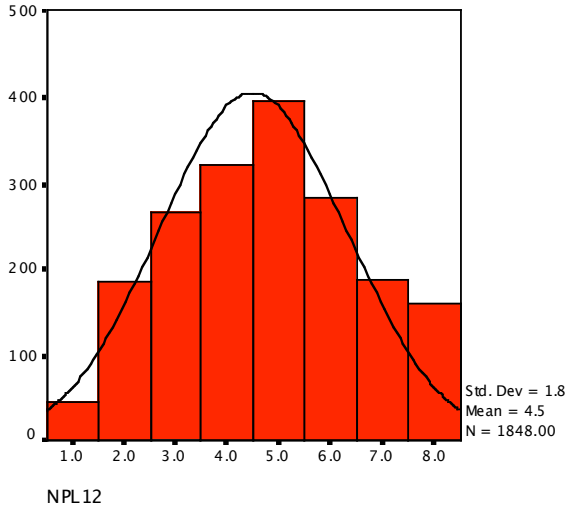


Figure 4.9: Histograms for (Unpleasant-Pleasant) Non-Architects

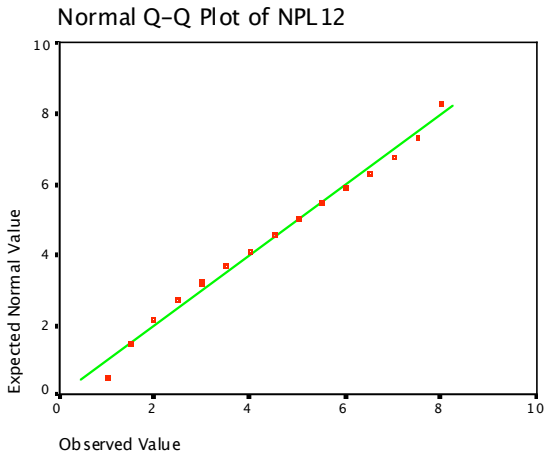


Figure 4.10: Normal Q-Q Plot for (Unpleasant-Pleasant) Non-Architects

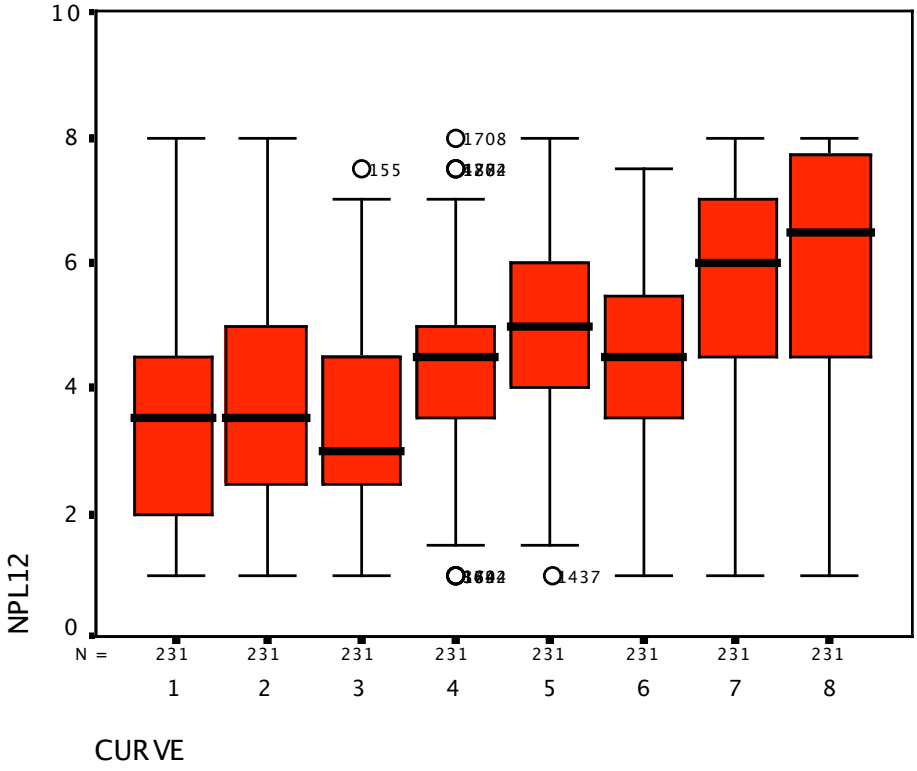


Figure 4.11: Box Plots for (Unpleasant-Pleasant) Non-Architects

Variability of the data has an important role in interpreting the results of the Analysis of Variance. In this case equal variances were not assumed. This was achieved by using the Game-Howell method of statistical calculation (available in SPSS software's post hoc option). Therefore the homogeneity assumption was not violated.

The between group degree of freedom is k-1=7 and total degree of freedom is 8n-1=1847. The ANOVA summary table contains the main information we need to answer the study question, which is whether pleasantness changes with increase in curvature (Table 4.4). We can deduce that a highly significant result has been found $F(7,1847) = 88.751$, $p < .001$. Since we have a significant F-value, we now know that the means are not equal and reject the null hypothesis. However we cannot tell by this chart exactly how these means are different in relation to one anther. Tukey's B, is the treatment used for this purpose.

Multiple comparison tables were studied and the result is summarized in the homogeneous subsets table provided in Table 4.5. We can observe that there are 5 separate subsets of curvature groups. Group 1 has the first 3 cards with the least curvature and card 4 and 6 fall into the second group, then cards 5, 7 and 8 are respectively in their own separate groups. Even though the sequence of cards (representing a sequential increase in curvature) is not all in order, we can clearly see a pattern with the subsets.

Table 4.4: ANOVA F-Test Unpleasant – Pleasant (Non-Architects)

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1534.670	7	219.239	88.751	.000
Within Groups	4545.316	1840	2.470		
Total	6079.986	1847			

Table 4.5: Homogeneous Subsets Unpleasant – Pleasant (Non-Architects)

Tukey B

	N	Subset				
CURVE		1	2	3	4	5
3	231	3.4329				
1	231	3.4827				
2	231	3.6212				
4	231		4.3723			
6	231		4.5541			
5	231			4.9589		
7	231				5.5887	
8	231					6.0108

Alpha = .05.

Linear regression models tested “Unpleasant-Pleasant” as the dependant variable and “Curvature” as the independent variable. The results indicate that increase in curvature explains pleasantness through 22.4% of the variations for non-architects (R^2=.224, p<.001).

4.5.1.2 Architects

There were n=62 valid entries for this group. Box plots (Figure 4.15) indicate that variances are somewhat equal and the outliers are limited. The q-q plot (Figure 4.14) shows that the data is normally distributed and the cumulative histogram (Figure 4.13) is somewhat bell shaped. Table 4.6 shows the mean and standard deviation of

pleasantness variable for architects and Figure 4.12 shows the individual histograms for each curvature level.

Table 4.6: Means and Standard Deviation of Architects' Response to Unpleasant-Pleasant Variable

CURVE	Mean	Std. Deviation	N
1	4.4435	2.08056	62
2	4.3871	1.74483	62
3	4.6129	1.44976	62
4	4.1613	1.35735	62
5	4.5242	1.32575	62
6	3.8145	1.67976	62
7	4.7661	2.03800	62
8	5.1803	2.32743	61
Total	4.4848	1.81014	495

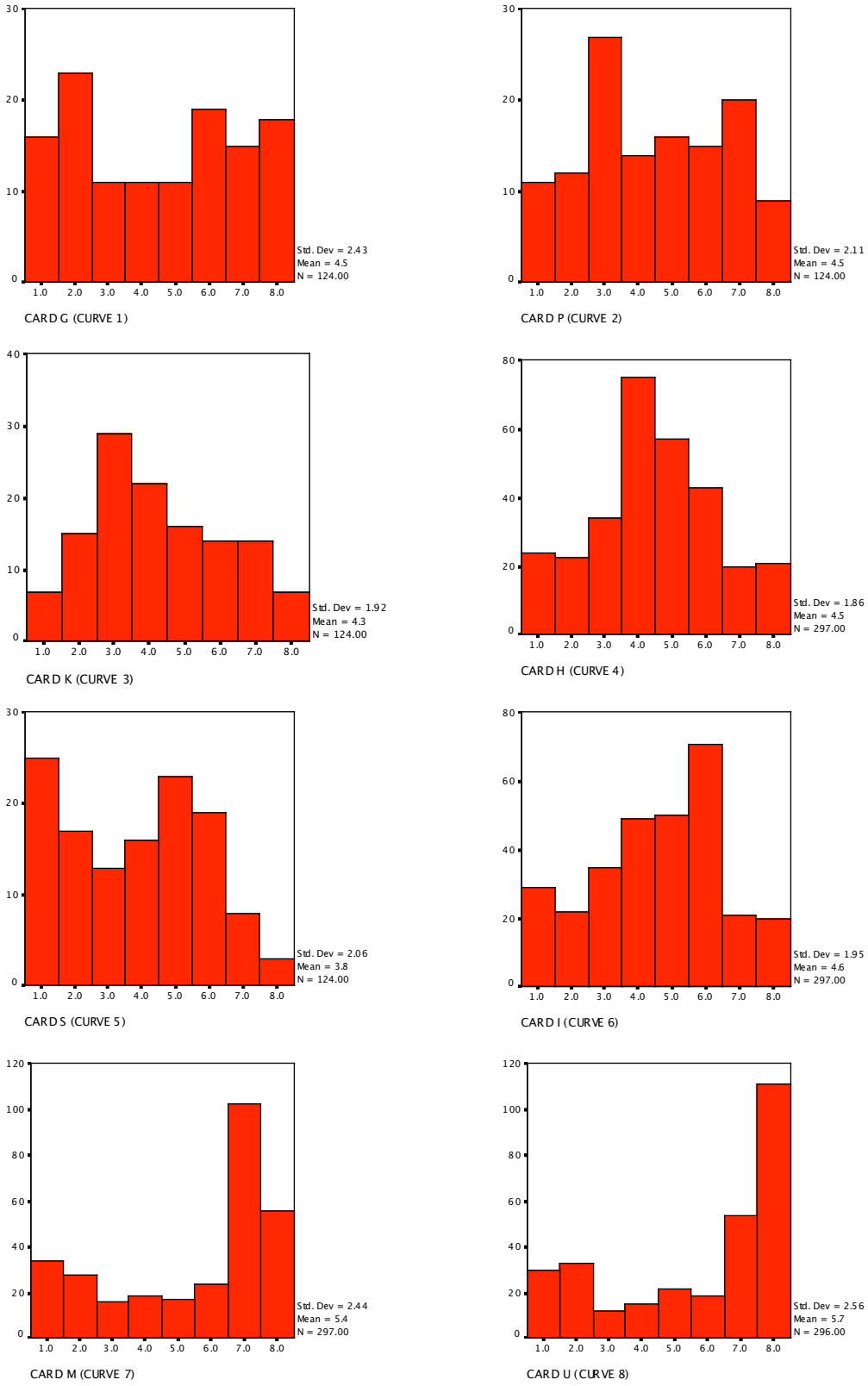


Figure 4.12: Histograms for (Unpleasant-Pleasant) Architects Responses for Different Curvature Levels (1-8)

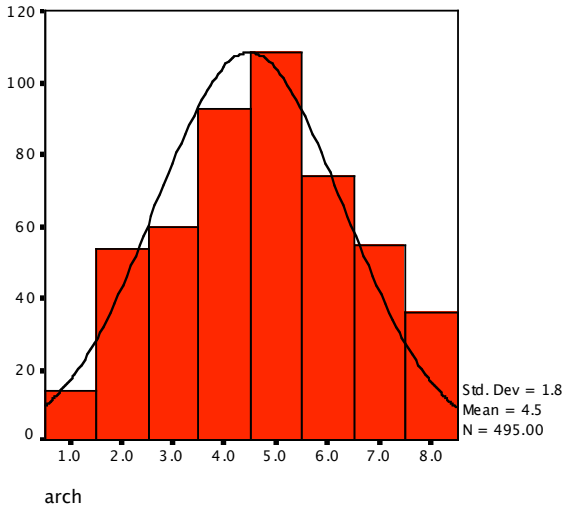


Figure 4.13: Histograms for (Unpleasant-Pleasant) Architects

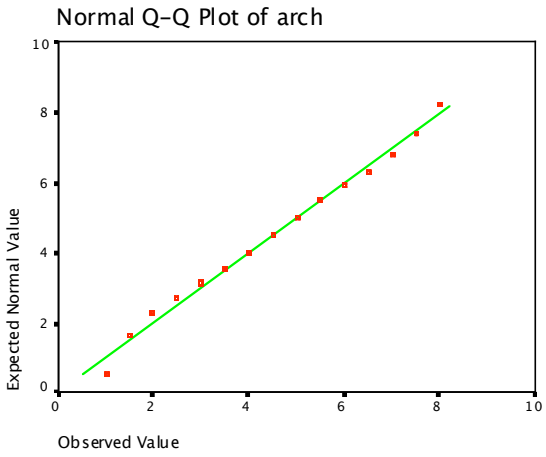


Figure 4.14: Normal Q-Q Plot for (Unpleasant-Pleasant) Architects

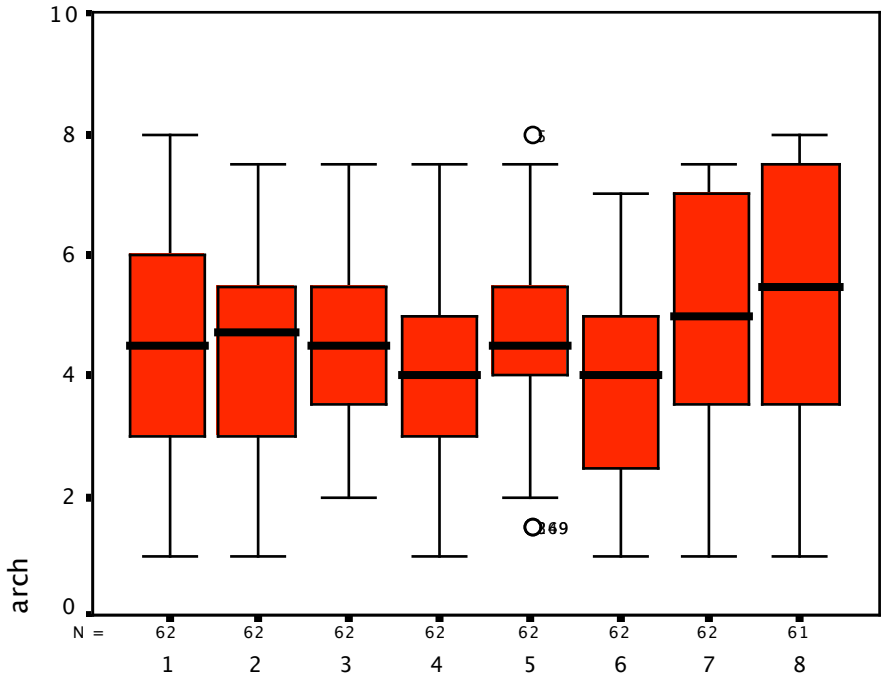


Figure 4.15: Box Plots for (Unpleasant-Pleasant) Architects

In the analysis of variance, equal variances were not assumed. This was achieved by using the Game-Howell option on the SPSS post hoc option, therefore the homogeneity assumption was not violated. The between group degree of freedom is k-1=7 and total degree of freedom is 8n-1=495. The summary Table 4.7 contains the main information we need to answer our research question. When we compare it to the F-table we can deduce that significant result has not been found $F(7,495) = 3.172$, $p < .001$. Therefore we cannot reject the null hypothesis.

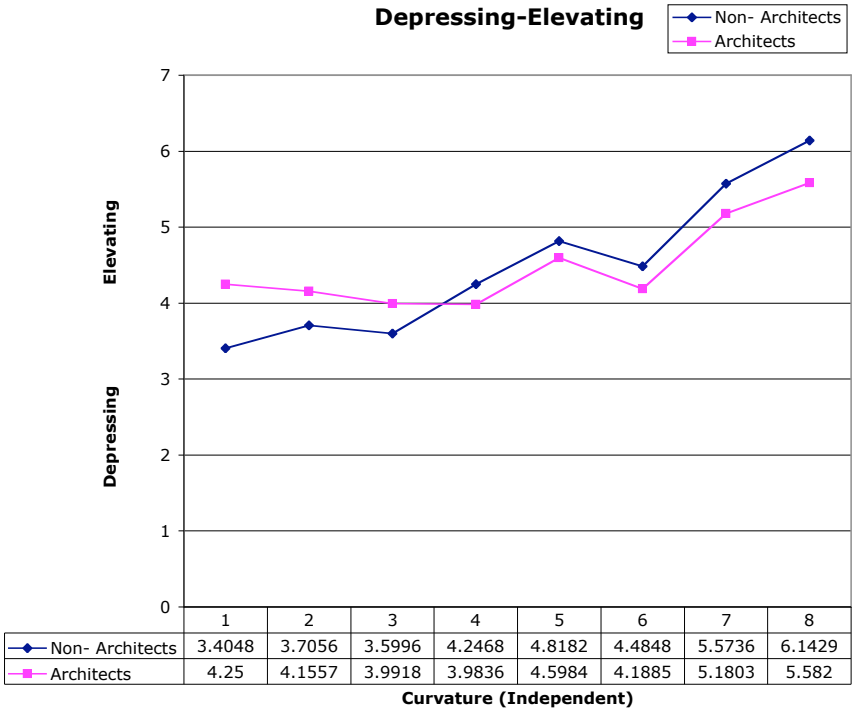
Table 4.7: ANOVA F-Test Unpleasant – Pleasant (Non-Architects)

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	70.572	7	10.082	3.172	.003
Within Groups	1548.065	487	3.179		
Total	1618.636	494			

Linear regression models tested “Unpleasant-Pleasant” as the dependant variable and “Curvature” as the independent variable. The results indicate that increase in curvature explains pleasantness only for less than 1% of the variations for architects (R^2=.006, p<.1). Overall we can see that both the regression model results and ANOVA results point to the same direction. We do not see major changes in means of pleasantness as curvature rises for the architects.

4.5.2 Depressing – Elevating

Another emotional variables measured was Depressing – Elevating. This variable was similar to pleasantness in terms of subject response since it is reasonable to believe spaces that are felt to be elevating are considered pleasant. In general, non-architects' ratings for Depressing – Elevating increases with gradual increase in curvature. This relationship is not significant for the architect group. Their rating is somewhat constant (between 4 and 5) as curvature increases with the exception of slight peaks toward higher degrees of curvature (cards 7 and 8). Both relationships will be examined thoroughly in the following sub sections. Figure 4.16 illustrates the mean results for both groups.



	1	2	3	4	5	6	7	8
Non- Architects	3.4048	3.7056	3.5996	4.2468	4.8182	4.4848	5.5736	6.1429
Architects	4.25	4.1557	3.9918	3.9836	4.5984	4.1885	5.1803	5.582

Figure 4.16: Mean Trends of Depressing–Elevating for Architects and Non-Architects

4.5.2.1 Non-Architects

There were n=231 valid entries for this group. Box plots (Figure 4.19) indicate that variances are close to each other. We can see a number of outliers but since data is ordinal and there are only a few of them, they are acceptable. The q-q plot (Figure 4.18) shows that the data is normally distributed and the histogram for accumulative data (Figure 4.17) is bell shaped. The data shows effects similar to pleasantness variable in the higher curvature levels for both non-architect and architects. The means for both groups are closer to each other as compared to pleasantness (Figure 4.16). The histograms for each individual curve level are consistent with the mean plot chart and standard deviations. Table 4.8 shows the mean and standard deviation of pleasantness variable for non-architects.

Table 4.8: Means and Standard Deviation of Non-Architects' Response to Depressing-Elevating Variable

CURVE	Mean	Std. Deviation	N
1	3.4048	1.89840	231
2	3.7056	1.67589	231
3	3.5996	1.45020	231
4	4.2468	1.24488	231
5	4.8182	1.37266	231
6	4.4848	1.45467	231
7	5.5736	1.78794	231
8	6.1429	1.77884	231
Total	4.4970	1.83750	1848

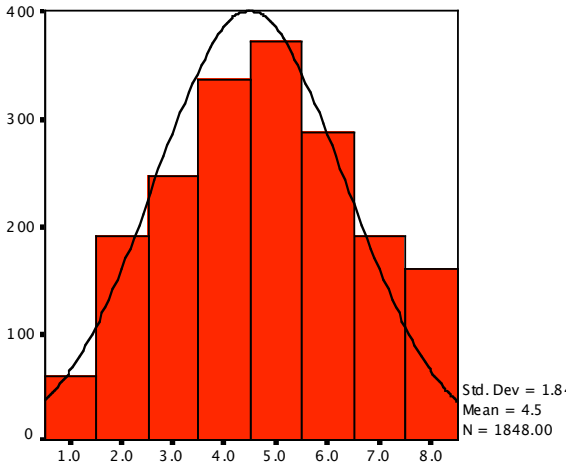


Figure 4.17: Cumulative Histograms for (Depressing-Elevating) Non-Architects

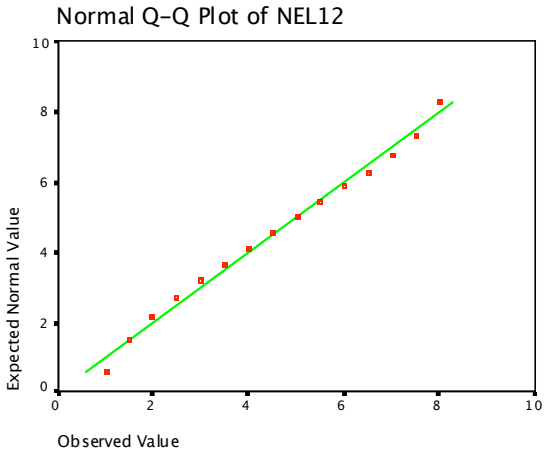


Figure 4.18: Normal Q-Q Plot for (Depressing-Elevating) Non-Architects

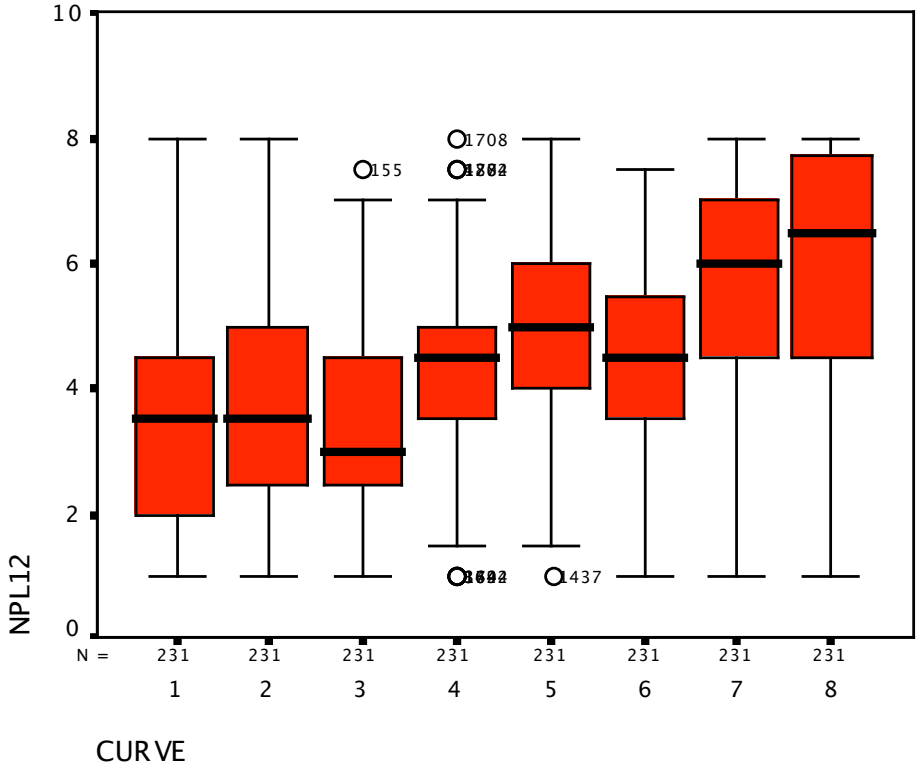


Figure 4.19: Box Plots for (Depressing-Elevating) Non-Architects

In the analysis of variance, equal variances were not assumed, therefore the homogeneity assumption was not violated. The between group degree of freedom is k-1=7 and total degree of freedom is 8n-1=1847. The summary Table 4.9 contains the main information we need to answer our research question. When we compare it to the F-table we can deduce that significant result has been found $F(7,1847) = 86.056$, $p < .001$. Since we have a significant F-value, we now know that the means are not equal and reject the null hypothesis. However we cannot tell by this chart exactly how these means are different in relation to one anther.

Tukey's B is a statistical process for ANOVA and it was used for this purpose. Multiple comparison tables were studied and the result is summarized in the homogeneous subsets table provided below in Table 4.10. We can observe that there are 5 separate subsets of curvature groups. Group 1 has the first 3 cards with the least curvature and card 4 and 6 fall into the second group, 5 and 6 in the third, then cards 7 and 8 are respectively in their own separate groups. Even though the sequence of cards (representing a sequential increase in curvature) is not all in order, we can clearly see pattern with the subsets.

Table 4.9: ANOVA F-Test Depressing-Elevating (Non-Architects)

	Sum of Squares	df	Mean Square	F	Sig.
Bet.Groups	1538.106	7	219.729	86.056	.000
Within Groups	4698.128	1840	2.553		
Total	6236.234	1847			

Table 4.10: Homogeneous Subsets Depressing-Elevating (Non-Architects)
Tukey B

	N	Subset				
CURVE		1	2	3	4	5
3	231	3.4048				
1	231	3.5996				
2	231	3.7056				
4	231		4.2468			
6	231		4.4848	4.4848		
5	231			4.8182		
7	231				5.5736	
8	231					6.1429

Alpha = .05.

Linear regression models tested "Depressing-Elevating" as the dependant variable and "Curvature" as the independent variable. The results indicate that increase in curvature explains this emotional variable for 22.1% of the variations for non-architects (R^2=.221, p<.001). Overall we can see that both the regression model results and ANOVA results point to the same direction. There is a distinct change in means of Depressing- Elevating as curvature rises for the non-architects.

4.5.2.2 Architects

There were n=61 valid entries for this group. Box plots (Figure 4.22) indicate that variances are relatively equal and only 2 outliers are present. The q-q plot (Figure 4.21) shows that the data is normally distributed and the histogram (Figure 4.20) is somewhat bell shaped. Table 4.11 shows the mean and standard deviation of Depressing-Elevating variable for non-architects.

Table 4.11: Means and Standard Deviation of Architects' Response to Depressing-Elevating Variable

CURVE	Mean	Std. Deviation	N
1	4.2500	2.02840	60
2	4.1557	1.81783	61
3	3.9918	1.48181	61
4	3.9836	1.17957	61
5	4.5984	1.41956	61
6	4.1885	1.59469	61
7	5.1803	1.96009	61
8	5.5820	2.28980	61
Total	4.4918	1.82798	487

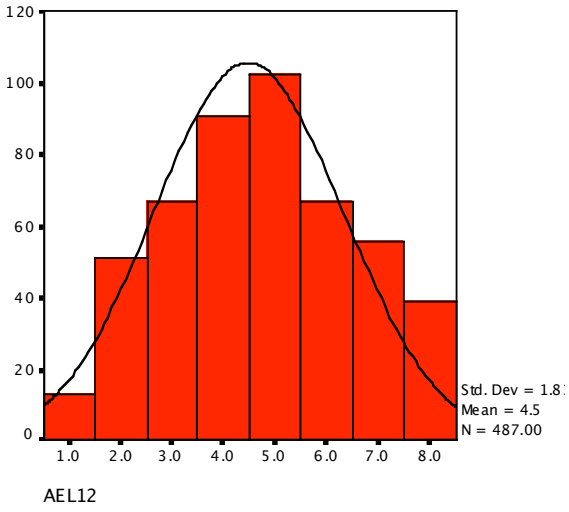


Figure 4.20: Cumulative Histograms for (Depressing-Elevating) Architects

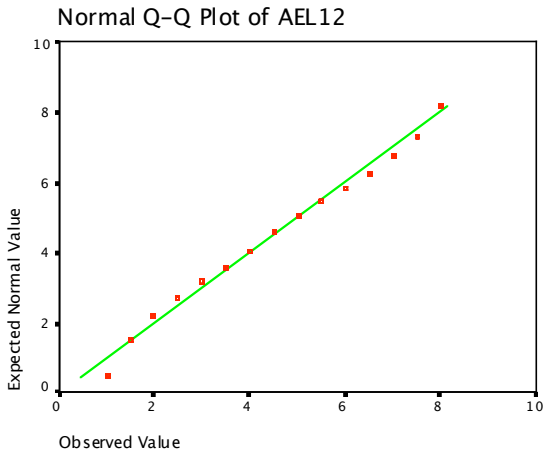


Figure 4.21: Normal Q-Q Plot for (Depressing-Elevating) Architects

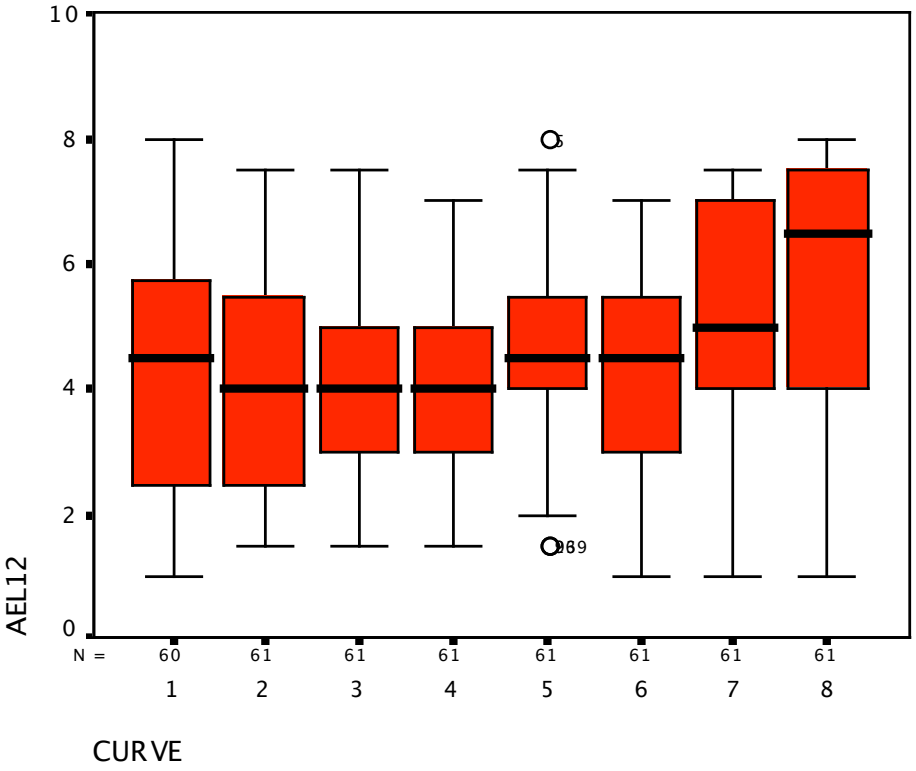


Figure 4.22: Box Plots for (Depressing-Elevating) Architects

In the analysis of variance, equal variances were not assumed, therefore the homogeneity assumption was not violated. The between group degree of freedom is k-1=7 and total degree of freedom is 8n-1=487. The summary Table 4.12 contains the main information we need to answer our research question. When we compare it to the F-table we can deduce that significant result has been found $F(7,487) = 6.919$, $p < .001$. Since we have a noteworthy F-value, we now know that the means are not equal but we need to be careful in rejecting the null hypothesis. We have a relatively low F-value. Multiple comparison tables were studied and the result is summarized in the homogeneous subsets table provided below in Table 4.13. We can observe that there are

only 3 subsets and some of the cards overlap in each group. The only card in a group of it's own is card 8 which limits our claim for any substantial difference in the mean.

Table 4.12: ANOVA F-Test Depressing-Elevating (Architects)

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	149.119	7	21.303	6.919	.000
Within Groups	1474.848	479	3.079		
Total	1623.967	486			

Table 4.13: Homogeneous Subsets Depressing-Elevating (Architects)

Tukey B

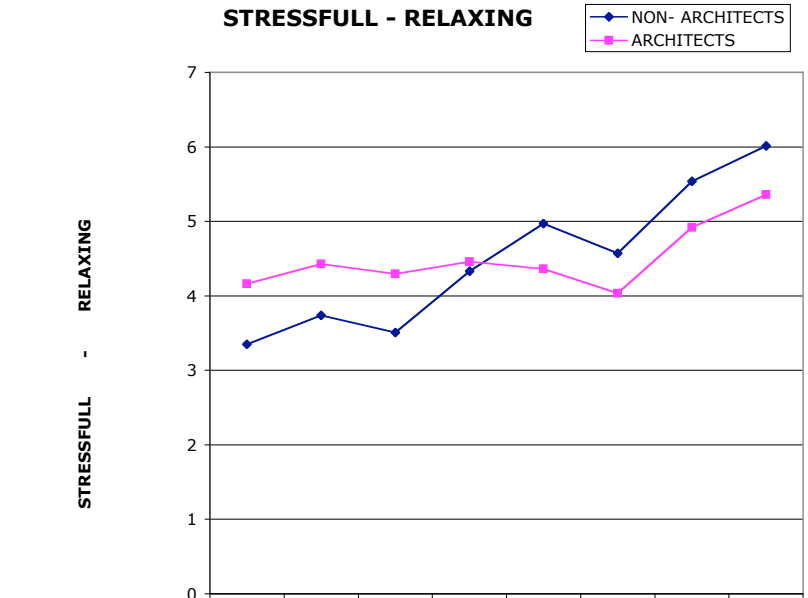
	N	Subset		
CURVE		1	2	3
4	61	3.9836		
3	61	3.9918		
2	61	4.1557		
6	61	4.1885		
1	60	4.2500		
5	61	4.5984	4.5984	
7	61		5.1803	5.1803
8	61			5.5820

Alpha = .05.

Linear regression models tested "Depressing-Elevating" as the dependant variable and "Curvature" as the independent variable. The results indicate that increase in curvature explains this emotional variable only for less than 1% of the variations for architects (R^2=.005, p<.1). Overall we can see that both the regression model results and ANOVA results point to the same direction. We do not detect major changes in means of the elevating quality of space as curvature rises for the architects.

4.5.3 Stressful – Relaxing

The third emotional variable measured was Stressful – Relaxing. Overall this variable was similar to the pleasantness and elevating variables in terms of subject response. Non-architects' ratings for Stressful – Relaxing increases with gradual increase in curvature. This relationship again is not as strong for the architect group. Their rating is somewhat constant (between 4 and 4.5) as curvature increases with the exception of peaks toward higher degrees of curvature (cards 7 and 8). Both relationships will be examined thoroughly in subsections 4.5.3.1 & 4.5.3.2. Figure 4.23 illustrates the mean results for both groups.



	1	2	3	4	5	6	7	8
NON- ARCHITECTS	3.3506	3.7403	3.5065	4.329	4.9675	4.5736	5.5368	6.0108
ARCHITECTS	4.1639	4.4262	4.2951	4.459	4.3607	4.0328	4.918	5.3607

Figure 4.23: Mean Trends of Stressful – Relaxing for Architects and Non-Architects

4.5.3.1 Non-Architects

There were n=231 valid entries for this group. Box plots (Figure 4.26) indicate that variances are close to each other. Outliers are present but since data is ordinal and there are only a few of them, they are acceptable. The q-q plot (Figure 4.25) shows that the data is normally distributed and the histogram for accumulative data (Figure 4.24) is bell shaped. The non-architect ratings follow the architects much closer, compared to the pleasantness variable, in the higher curvature levels. The histograms for each individual curve level are consistent with the mean plot chart and standard deviations. Table 4.14 shows the mean and standard deviation of Stressful – Relaxing variable for non-architects.

Table 4.14: Means and Standard Deviation of Non-Architects' Response to Stressful – Relaxing Variable

CURVE	Mean	Std. Deviation	N
1	3.3506	1.79988	231
2	3.7403	1.62443	231
3	3.5065	1.32901	231
4	4.3290	1.34729	231
5	4.9675	1.29213	231
6	4.5736	1.41460	231
7	5.5368	1.70987	231
8	6.0108	1.96792	231
Total	4.5019	1.81490	1848

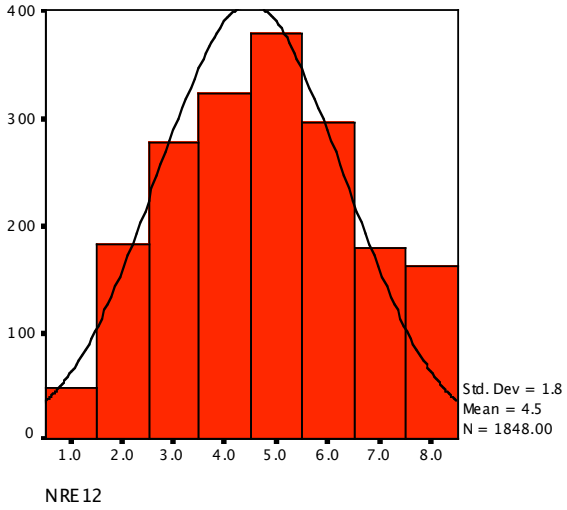


Figure 4.24: Cumulative Histograms for (Stressful – Relaxing) Non-Architects

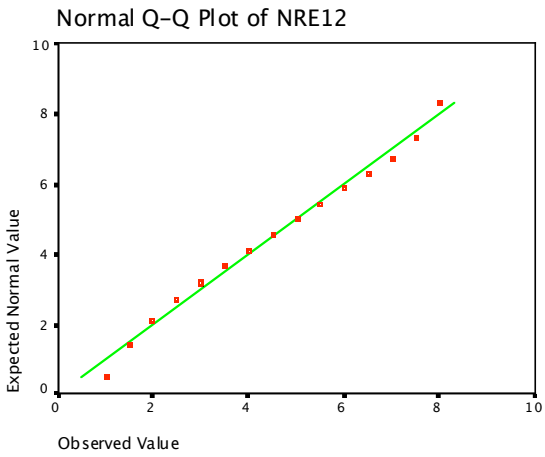


Figure 4.25: Normal Q-Q Plot for (Stressful – Relaxing) Non-Architects

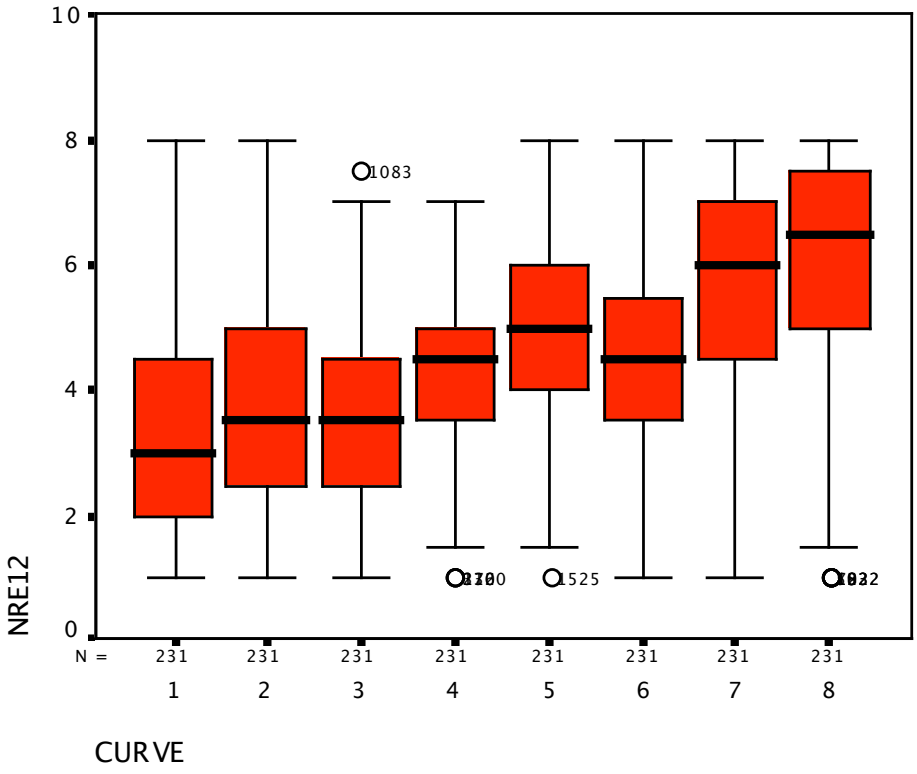


Figure 4.26: Box Plots for (Stressful – Relaxing) Non-Architects

In the analysis of variance, equal variances were not assumed, therefore the homogeneity assumption was not violated. The between group degree of freedom is k-1=7 and total degree of freedom is 8n-1=1847. The summary Table 4.15 contains the main information we need to answer our research question. When we compare it to the F-table we can deduce that significant result has been found $F(7,1847) = 86.062$, $p < .001$. Since we have a significant F-value, we now know that the means are not equal and reject the null hypothesis. However we cannot tell by this chart alone exactly how these means are different in relation to one anther.

Tukey's B is used for this purpose. Multiple comparison tables were studied and the result is summarized in the homogeneous subsets table provided below in Table 4.16. We can observe that there are 5 separate subsets of curvature groups. Group 1 has the first 3 cards with the least curvature and card 4 and 6 fall into the second group and then 5 ,7 and 8 are respectively in their own separate groups. Even though the sequence of cards (representing a sequential increase in curvature) is not all in order, we can clearly see pattern with the subsets.

Table 4.15: ANOVA F-Test Stressful – Relaxing (Non-Architects)

	Sum of Squares	df	Mean Square	F	Sig.
Bet. Groups	1500.579	7	214.368	86.062	.000
Within Groups	4583.165	1840	2.491		
Total	6083.743	1847			

Table 4.16: Homogeneous Subsets Stressful – Relaxing (Non-Architects)

Tukey B

	N	Subset				
CURVE		1	2	3	4	5
1	231	3.3506				
3	231	3.5065				
2	231	3.7403				
4	231		4.3290			
6	231		4.5736			
5	231			4.9675		
7	231				5.5368	
8	231					6.0108

Alpha = .05.

Linear regression models tested "Stressful – Relaxing" as the dependant variable and "Curvature" as the independent variable. The results indicate that increase in curvature explains this emotional variable for 24.7% of the variations for non-architects (R^2=.247, p<.001). Overall we can see that both the regression model results and ANOVA results point to the same direction. There is a distinct increase in means of Stressful – Relaxing as curvature rises for the non-architects.

4.5.3.2.1 Architects

There were n=61 valid entries for this group. Box plots (Figure 4.29) indicate that variances are relatively equal and a few outliers are present. The q-q plot (Figure 4.28) shows that the data is normally distributed and the cumulative histogram (Figure 4.27) is somewhat bell shaped. Table 4.17 shows the mean and standard deviation of pleasantness variable for non-architects.

Table 4.17: Means and Standard Deviation of Architects' Response to Stressful – Relaxing Variable

CURVE	Mean	Std. Deviation	N
1	4.1639	1.95942	61
2	4.4262	1.65287	61
3	4.2951	1.47867	61
4	4.4590	1.30159	61
5	4.3607	1.36055	61
6	4.0328	1.56223	61
7	4.9180	1.91307	61
8	5.3607	2.22698	61
Total	4.5020	1.74445	488

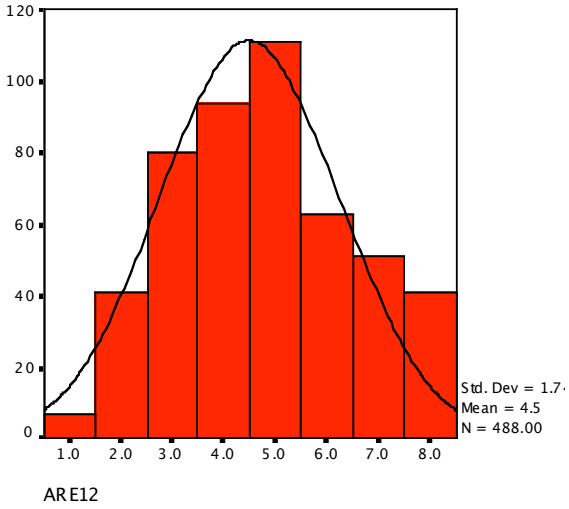


Figure 4.27: Cumulative Histograms for (Stressful – Relaxing) Architects

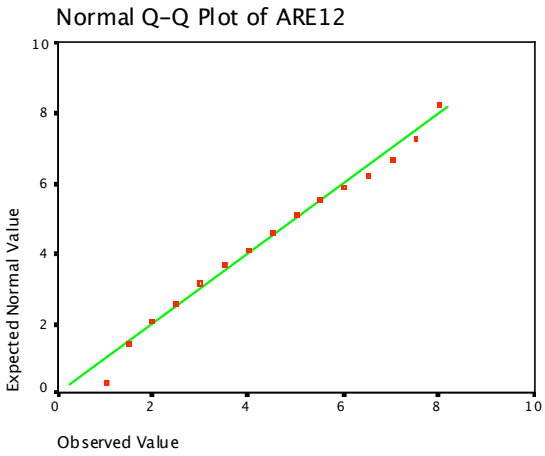


Figure 4.28: Normal Q-Q Plot for (Stressful – Relaxing) Architects

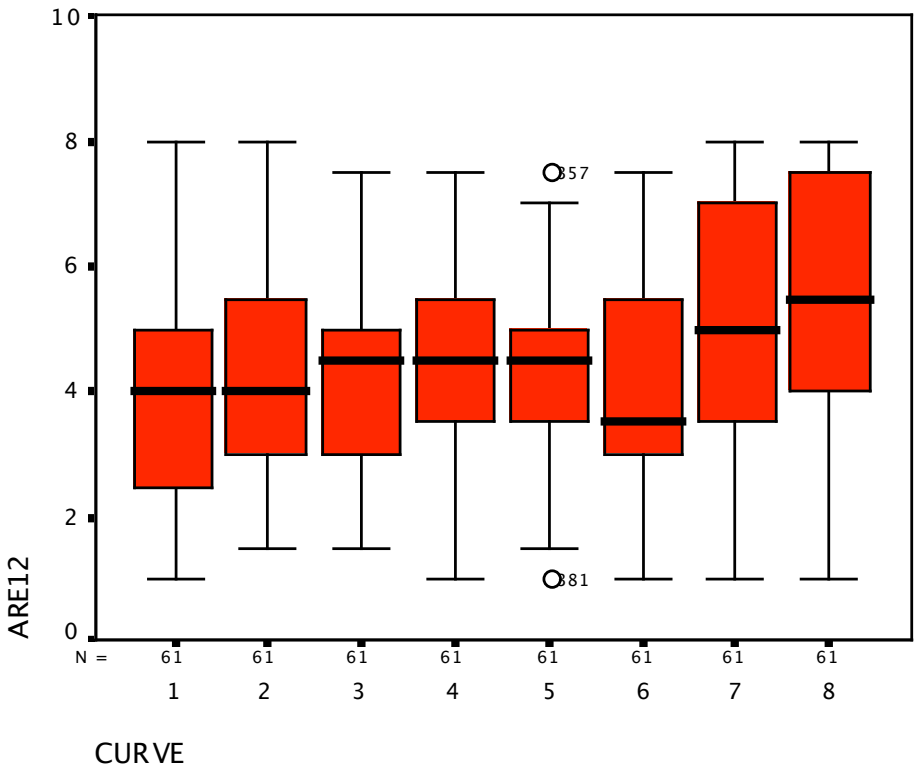


Figure 4.29: Box Plots for (Stressful – Relaxing) Architects

In the analysis of variance, equal variances were not assumed, therefore the homogeneity assumption was not violated. The between group degree of freedom is k-1=7 and total degree of freedom is 8n-1=487. The summary Table 4.18 contains the main information we need to answer our research question. When we compare it to the F-table we can deduce that significant result has been found $F(7,487) = 3.925$, $p < .001$. The F-value is marginal. Multiple comparison tables were studied and the result is summarized in the homogeneous subsets table provided below in Table 4.19. We can observe that there is no pattern with the results. The only distinctive information is about card 8 which makes it different from the others.

Table 4.18: ANOVA F-Test Stressful – Relaxing (Architects)

	Sum of Squares	df	Mean Square	F	Sig.
Bet. Groups	80.227	7	11.461	3.925	.000
Within Groups	1401.770	480	2.920		
Total	1481.998	487			

Table 4.19: Homogeneous Subsets Stressful – Relaxing (Architects)

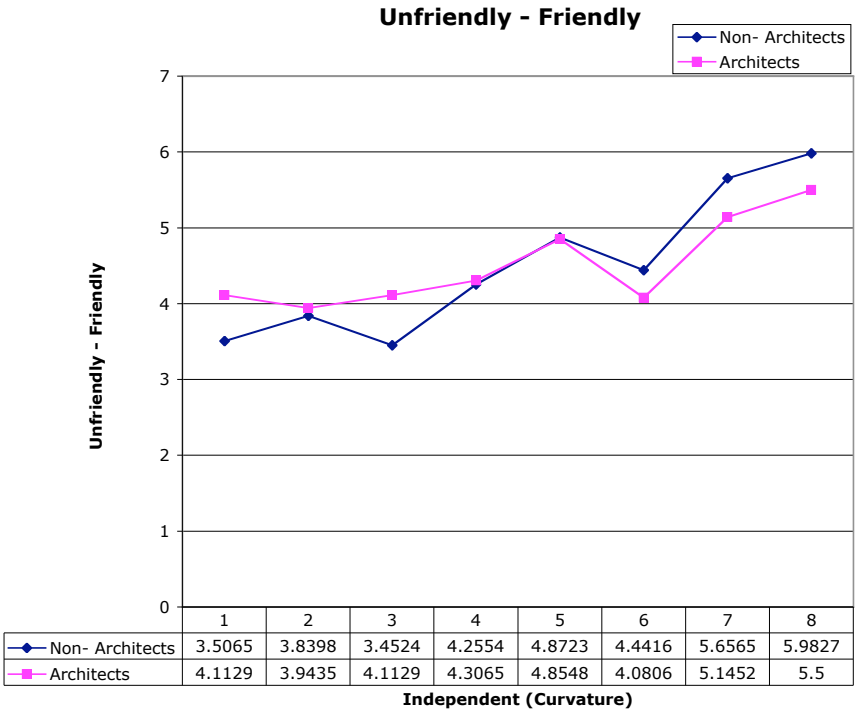
	N	Subset	
CURVE		1	2
6	61	4.0328	
1	61	4.1639	
3	61	4.2951	
5	61	4.3607	
2	61	4.4262	
4	61	4.4590	
7	61	4.9180	4.9180
8	61		5.3607

Alpha = .05.

Linear regression models tested “Stressful – Relaxing” as the dependant variable and “Curvature” as the independent variable. The results indicate that increase in curvature explains this emotional variable only for less than 3% of the variations for architects (R^2=.024, p=.001). Overall we can see that both the regression model results and ANOVA results point to the same direction. We do not see changes in means of the elevating quality of space as curvature rises for the architects

4.5.4 Unfriendly – Friendly

The fourth emotional variable is Unfriendly – Friendly. This variable is increasing significantly with the increase in curvature. The increase is more distinct in the non-architect sample. In general, non-architects' ratings for Unfriendly – Friendly increases with gradual increase in curvature. This relationship is not as strong for the architect group. Their rating is somewhat constant (between 4 and 5) as curvature increases with the exception of peaks toward higher degrees of curvature (cards 7 and 8). Both relationships will be examined thoroughly in the following sub sections. Figure 4.30 illustrates the mean results for both groups.



	1	2	3	4	5	6	7	8
Non- Architects	3.5065	3.8398	3.4524	4.2554	4.8723	4.4416	5.6565	5.9827
Architects	4.1129	3.9435	4.1129	4.3065	4.8548	4.0806	5.1452	5.5

Figure 4.30: Mean Trends of Unfriendly – Friendly for Architects and Non-Architects

4.5.4.1 Non-Architects

There were n=231 valid entries for this group. Box plots (Figure 4.33) indicate that variances are close to each other. Outliers are present but since data is ordinal and they are in limited numbers, they are acceptable. The q-q plot (Figure 4.32) shows that the data is normally distributed and the histogram for accumulative data (Figure 4.31) is bell shaped. The non-architect ratings follow the architects much closer, compared to the pleasantness variable, in the higher curvature levels. The histograms for each individual curve level are consistent with the mean plot chart and standard deviations. Table 4.20 shows the mean and standard deviation of friendliness variable for non-architects.

Table 4.20: Means and Standard Deviation of Non-Architects' Response to Unfriendly – Friendly Variable

CURVE	Mean	Std. Deviation	N
1	3.5065	1.96739	231
2	3.8398	1.77430	231
3	3.4524	1.30630	231
4	4.2554	1.27677	231
5	4.8723	1.29964	231
6	4.4416	1.46993	231
7	5.6565	1.60426	230
8	5.9827	1.91212	231
Total	4.5003	1.82402	1847

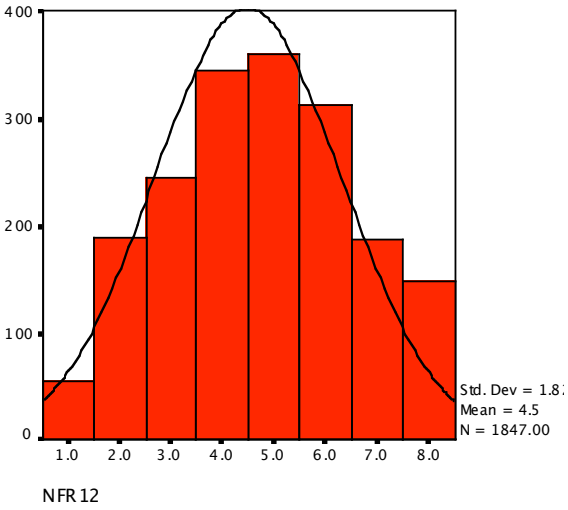


Figure 4.31: Cumulative Histograms for (Unfriendly – Friendly) Non-Architects

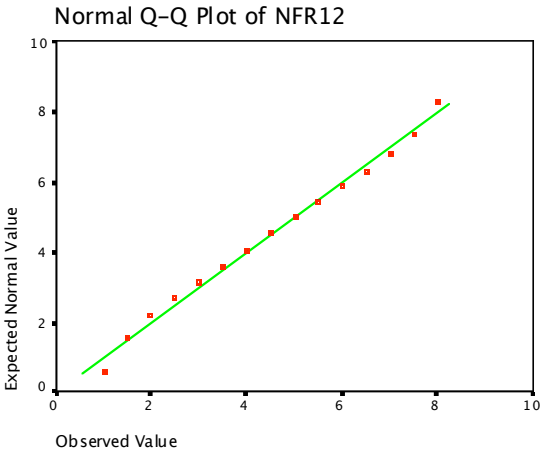


Figure 4.32: Normal Q-Q Plot for (Unfriendly – Friendly) Non-Architects

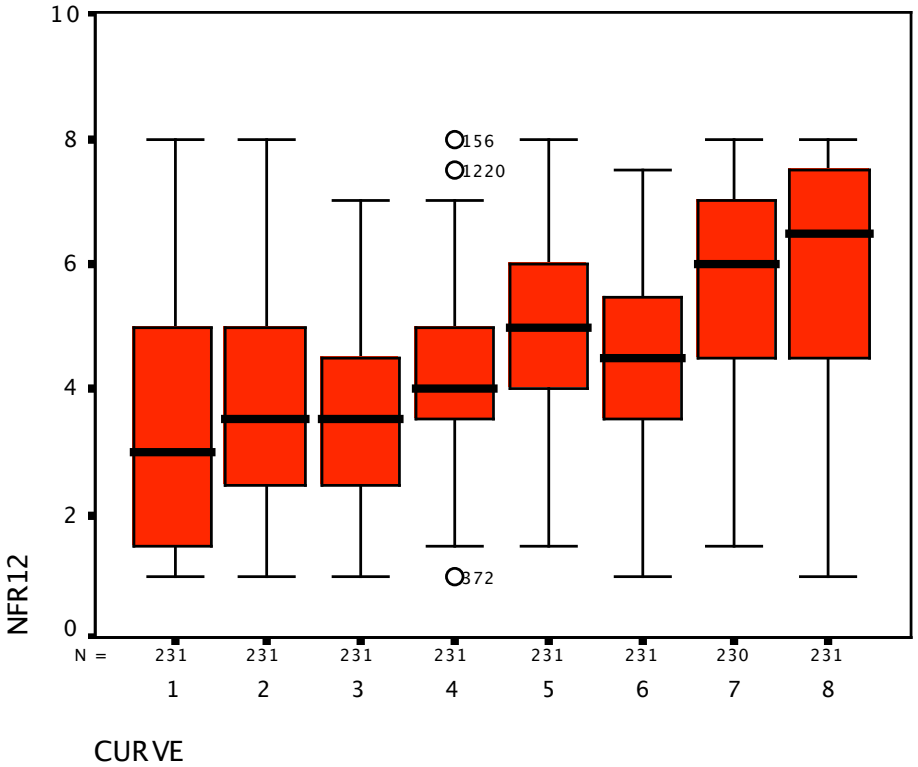


Figure 4.33: Box Plots for (Unfriendly – Friendly) Non-Architects

In the analysis of variance, equal variances were not assumed, therefore the homogeneity assumption was not violated. The between group degree of freedom is k-1=7 and total degree of freedom is 8n-1=1847. The summary Table 4.21 contains the main information we need to answer our research question. When we compare it to the F-table we can deduce that significant result has been found $F(7,1847) = 80.775$, $p < .001$. Since we have a significant F-value, we now know that the means are not equal and reject the null hypothesis. However we cannot tell by this chart exactly how these means are different in relation to one anther.

Tukey's B is used for this purpose. Multiple comparison tables were studied and the result is summarized in the homogeneous subsets table provided below in Table 4.22. We can observe that there are 4 separate subsets of curvature groups. Group 1 has the first 3 cards with the least curvature and card 4 and 6 fall into the second group, 5 in the third, then cards 7 and 8 are in the last groups. Even though the sequence of cards (representing a sequential increase in curvature) is not all in order, we can clearly see pattern with the subsets.

Table 4.21: ANOVA F-Test Unfriendly – Friendly (Non-Architects)

	Sum of Squares	df	Mean Square	F	Sig.
Bet.Groups	1444.289	7	206.327	80.775	.000
Within Groups	4697.460	1839	2.554		
Total	6141.750	1846			

Table 4.22: Homogeneous Subsets Unfriendly – Friendly (Non-Architects)

Tukey B

	N	Subset			
CURVE		1	2	3	4
3	231	3.4524			
1	231	3.5065			
2	231	3.8398			
4	231		4.2554		
6	231		4.4416		
5	231			4.8723	
7	230				5.6565
8	231				5.9827

Alpha = .05.

Linear regression models tested "Unfriendly – Friendly" as the dependant variable and "Curvature" as the independent variable. The results indicate that increase in curvature explains this emotional variable for 20.1% of the variations for non-architects (R^2=.201, p<.001). Overall we can see that both the regression model results and ANOVA results point to the same direction. There is a distinct change in means of Unfriendly – Friendly as curvature rises for the non-architects.

4.5.4.2 Architects

There were n=62 valid entries for this group. Box plots (Figure 4.36) indicate that variances are relatively equal and only 1 outlier is present. The q-q plot (Figure 4.35) show that the data is almost normally distributed and the cumulative histogram (Figure 4.34) is somewhat bell shaped with some reservations for the first rating. Table

4.23 shows the mean and standard deviation of pleasantness variable for architects. Individual histograms for each curvature level were studied and they corresponded with the data in the mean trends.

Table 4.23: Means and Standard Deviation of Architects' Response to Unfriendly – Friendly Variable

CURVE	Mean	Std. Deviation	N
1	4.1129	2.10078	62
2	3.9435	1.71327	62
3	4.1129	1.47220	62
4	4.3065	1.39188	62
5	4.8548	1.34404	62
6	4.0806	1.76299	62
7	5.1452	2.05934	62
8	5.5000	2.07641	62
Total	4.5071	1.83497	496

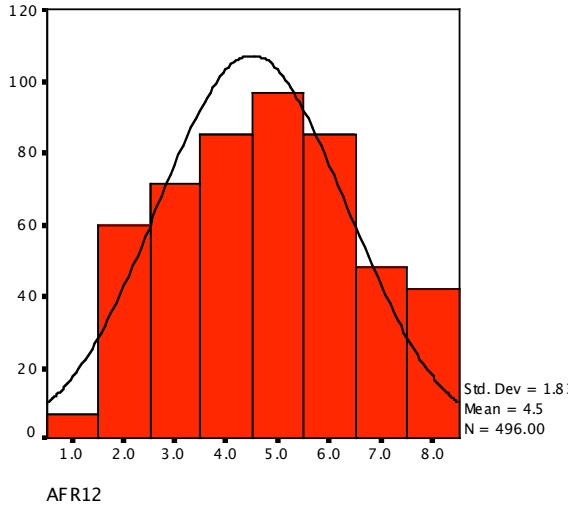


Figure 4.34: Cumulative Histograms for (Unfriendly – Friendly) Architects

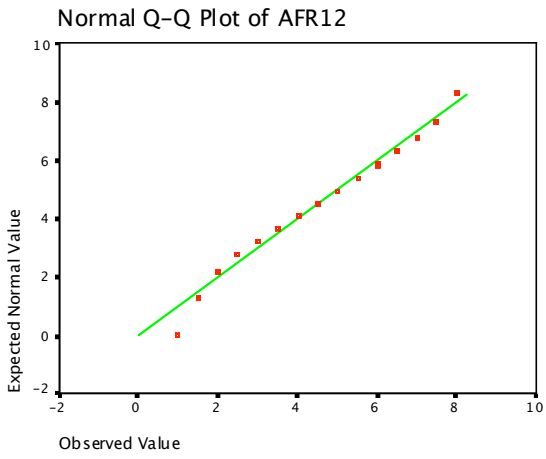


Figure 4.35: Normal Q-Q Plot for (Unfriendly – Friendly) Architects

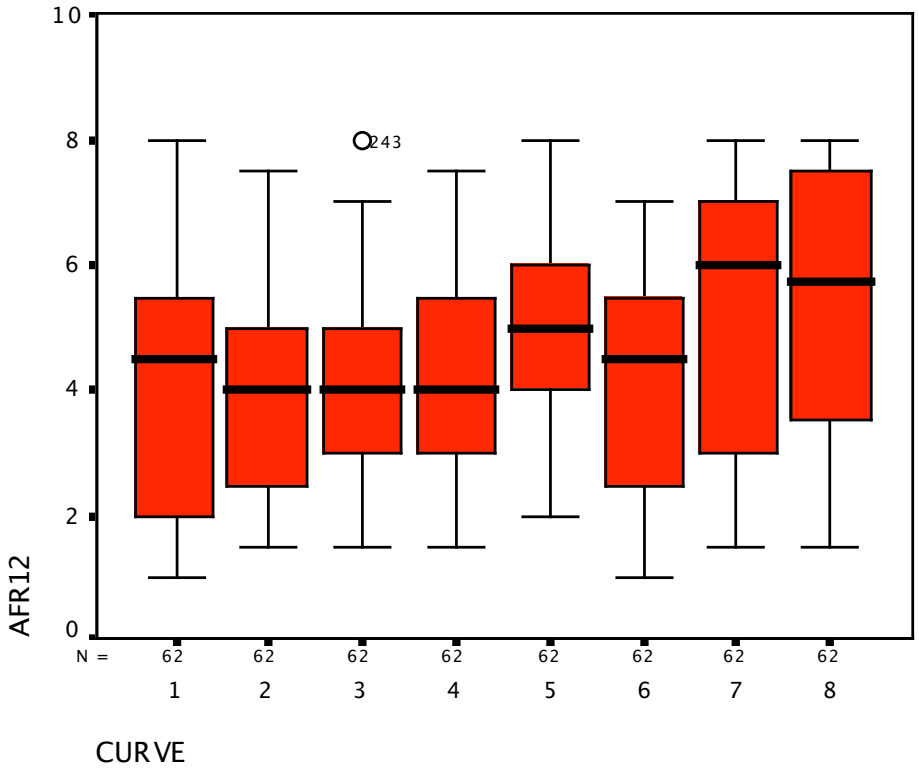


Figure 4.36: Box Plots for (Unfriendly – Friendly) Architects

In the analysis of variance, equal variances were not assumed, therefore the homogeneity assumption was not violated. The between group degree of freedom is k-1=7 and total degree of freedom is 8n-1=495. The summary Table 4.24 contains the main information we need to answer our research question. When we compare it to the F-table we can deduce that there is difference in means. $F(7,487) = 6.723$, $p < .001$. Since F-value is very low, we have to be cautious about rejecting the null hypothesis. Multiple comparison tables were studied and the result is summarized in the

homogeneous subsets table provided below in Table 4.25. We can observe that there are only 3 subsets and some of the cards overlap in each group. No cards have their own groups and the curvature sequence is seriously out of order.

Table 4.24: ANOVA F-Test Unfriendly – Friendly (Architects)

	Sum of Squares	df	Mean Square	F	Sig.
Bet. Groups	146.592	7	20.942	6.723	.000
Within Groups	1520.133	488	3.115		
Total	1666.725	495			

Table 4.25: Homogeneous Subsets Unfriendly – Friendly (Architects)

Tukey B

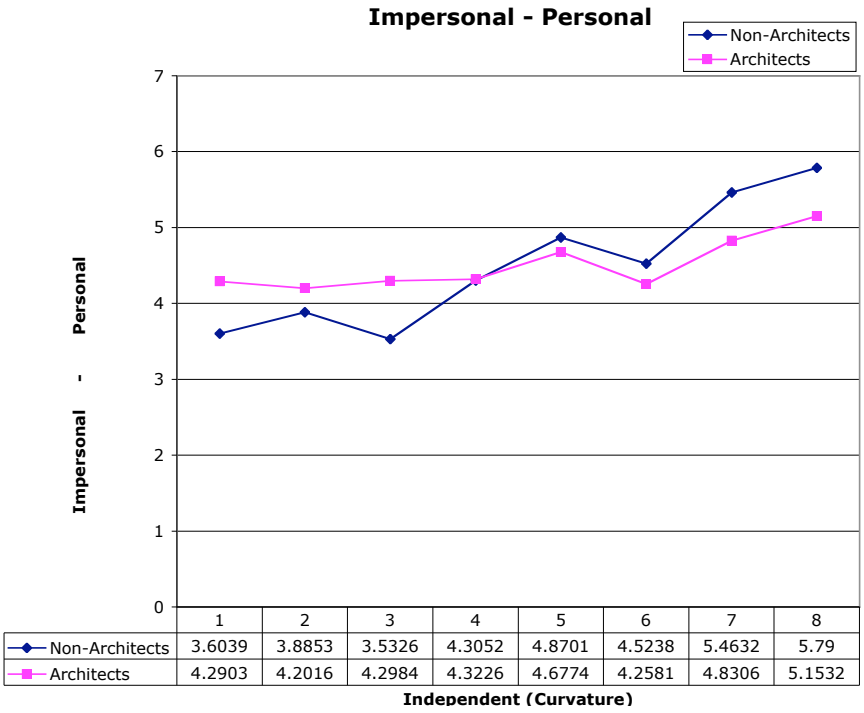
	N	Subset		
CURVE		1	2	3
2	62	3.9435		
6	62	4.0806		
3	62	4.1129		
1	62	4.1129		
4	62	4.3065	4.3065	
5	62	4.8548	4.8548	4.8548
7	62		5.1452	5.1452
8	62			5.5000

Alpha = .05.

Linear regression models tested “Unfriendly – Friendly” as the dependant variable and “Curvature” as the independent variable. The results indicate that increase in curvature explains this emotional variable only for less than 6% of the variations for architects (R^2=.058, p<.1). Overall we can see that both the regression model results and ANOVA results point to the same direction. We do not see changes in means of the friendliness quality of space as curvature rises for the architects.

4.5.5 Impersonal - Personal

The fifth variable in this study is Impersonal-Personal. This variable changes significantly with the increase in curvature. The increase is more distinct in the non-architect sample. In general, non-architects' ratings for Unfriendly – Friendly increases with gradual increase in curvature. The same relationship cannot be interpreted for the architect group. Their ratings are somewhat constant (between 4 and 4.5) with the increase in curvature with the exception of peaks toward higher degrees of curvature (cards 7 and 8). Both relationships will be examined thoroughly in the following sub sections. Figure 4.37 illustrates the mean results for both groups.



	1	2	3	4	5	6	7	8
Non-Architects	3.6039	3.8853	3.5326	4.3052	4.8701	4.5238	5.4632	5.79
Architects	4.2903	4.2016	4.2984	4.3226	4.6774	4.2581	4.8306	5.1532

Figure 4.37: Mean Trends of Impersonal-Personal for Architects and Non-Architects

4.5.5.1 Non-Architects

There were n=231 valid entries for this group. Box plots (Figure 4.40) indicate that variances are close to each other (card 4 has a variance that is lower than others but it is not alarmingly high). There are 4 outliers but since data is ordinal and there are only a few of them, they are acceptable. The q-q plot shows (Figure 4.39) that the data is normally distributed and the histogram for accumulative data (Figure 4.38) is bell shaped. There is a considerable difference between non-architect ratings mean as curvature rises. The histograms for each individual curve level are consistent with the mean plot chart and standard deviations. Means and medians rise consistently with increase of curvature in the cards. Looking at the box plots we can visually group the responses into 3 different sets of low, medium and high curvature. This is further confirmed with the analysis of variance. Table 4.26 shows the mean and standard deviation of Impersonal-Personal variable for non-architects.

Table 4.26: Means and Standard Deviation of Non-Architects' Response to Impersonal-Personal Variable

CURVE	Mean	Std. Deviation	N
1	3.6039	1.85391	231
2	3.8853	1.71275	231
3	3.5326	1.39401	230
4	4.3052	1.31585	231
5	4.8701	1.33287	231
6	4.5238	1.53880	231
7	5.4632	1.69774	231
8	5.7900	1.90830	231
Total	4.4973	1.78617	1847

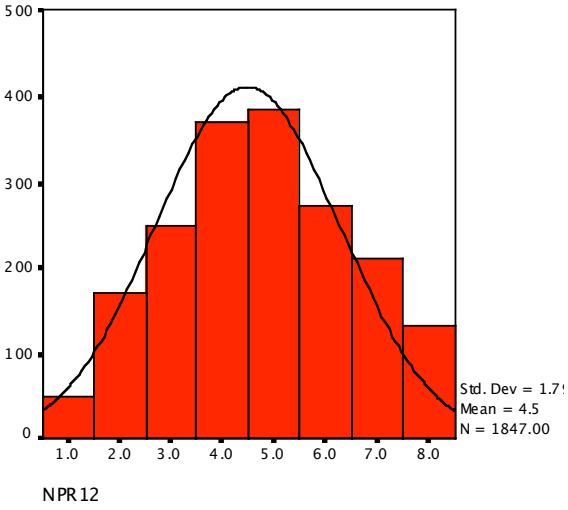


Figure 4.38: Cumulative Histograms for (Impersonal-Personal) Non-Architects

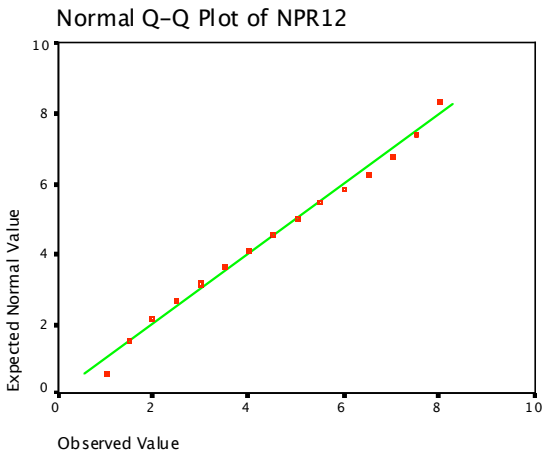


Figure 4.39: Normal Q-Q Plot for (Impersonal-Personal) Non-Architects

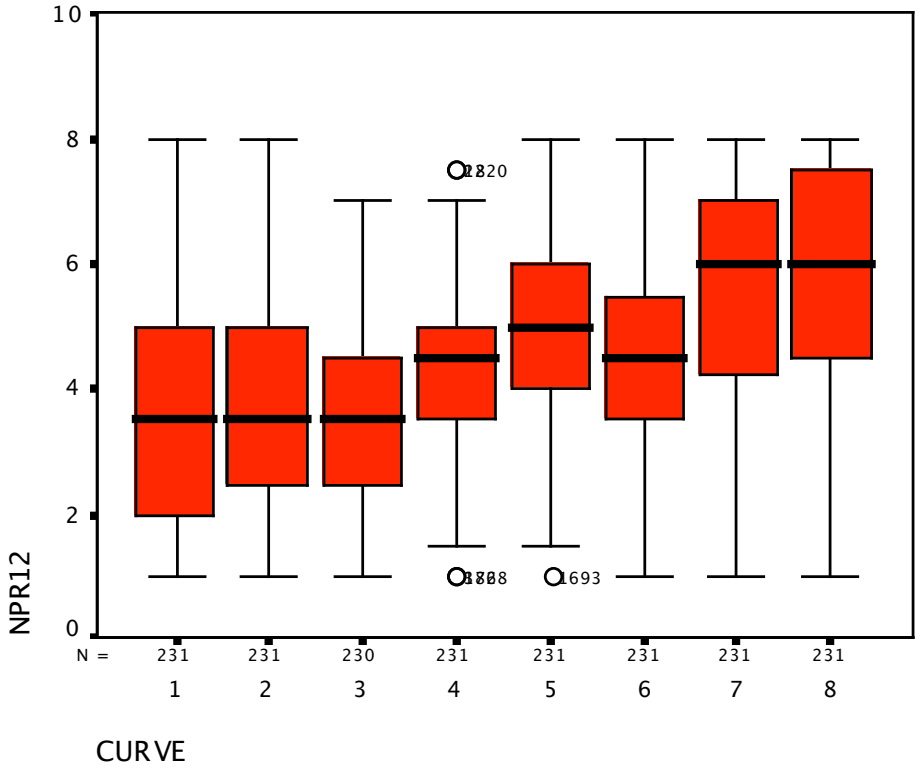


Figure 4.40: Box Plots for (Impersonal-Personal) Non-Architects

In the analysis of variance, equal variances were not assumed, therefore the homogeneity assumption was not violated. The between group degree of freedom is k-1=7 and total degree of freedom is 8n-1=1847. The summary Table 4.27 contains the main information we need to answer our research question. When we compare it to the F-table we can deduce that significant result has been found $F(7,1847) = 62.190$, $p < .001$. Since we have a significant F-value, we now know that the means are not equal and reject the null hypothesis. However we cannot tell by this chart alone exactly how these means are different in relation to one anther.

Tukey's B is used for this purpose. Multiple comparison tables were studied and the result is summarized in the homogeneous subsets table provided below in Table 4.28. We can observe that there are 4 separate subsets of curvature groups. Group 1 has the first 3 cards with the least curvature and card 4 and 6 fall into the second group, 5 and 6 in the third, then cards 7 and 8 are in the last groups. Even though the sequence of cards (representing a sequential increase in curvature) is not all in order, we can clearly see pattern with the subsets.

Table 4.27: ANOVA F-Test Impersonal-Personal (Non-Architects)

	Sum of Squares	df	Mean Square	F	Sig.
Bet.Groups	1127.304	7	161.043	62.190	.000
Within Groups	4762.183	1839	2.590		
Total	5889.486	1846			

Table 4.28: Homogeneous Subsets Impersonal-Personal (Non-Architects)
Tukey B

	N	Subset			
CURVE		1	2	3	4
3	230	3.5326			
1	231	3.6039			
2	231	3.8853			
4	231		4.3052		
6	231		4.5238	4.5238	
5	231			4.8701	
7	231				5.4632
8	231				5.7900

Alpha = .05.

Linear regression models tested “Impersonal-Personal” as the dependant variable and “Curvature” as the independent variable. The results indicate that increase in curvature explains this emotional variable for 16.7% of the variations for non-architects (R^2=.167, p<.001). Overall we can see that both the regression model results and ANOVA results point to the same direction, even though we are getting lower regression values compared to previous emotional variables. Still, there is a distinct change in means of Impersonal-Personal as curvature rises for the non-architects.

4.5.5.2 Architects

There were n=62 valid entries for this group. Box plots (Figure 4.43) indicate that variances are relatively equal and only 1 outlier is present. The q-q plot (Figure 4.42) show that the data is almost normally distributed and the cumulative histogram (Figure 4.41) is somewhat bell shaped with some reservations for the first rating. Table 4.29 shows the mean and standard deviation of Impersonal-Personal variable for architects.

Table 4.29: Means and Standard Deviation of Architects' Response to Impersonal - Personal Variable

CURVE	Mean	Std. Deviation	N
1	4.2903	2.02959	62
2	4.2016	1.73314	62
3	4.2984	1.49167	62
4	4.3226	1.28706	62
5	4.6774	1.53937	62
6	4.2581	1.49245	62
7	4.8306	2.09594	62
8	5.1532	2.26446	62
Total	4.5040	1.78885	496

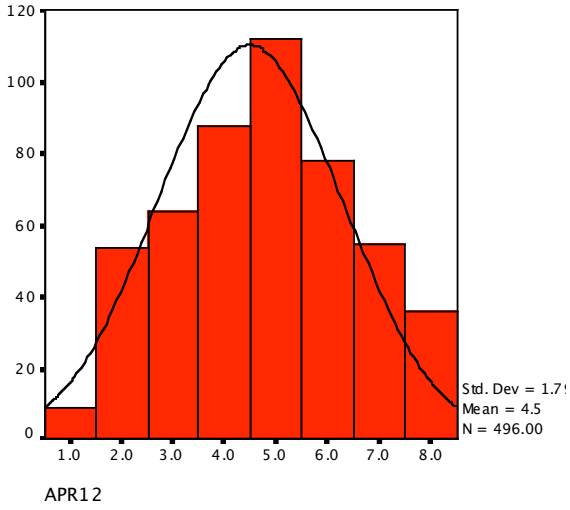


Figure 4.41: Cumulative Histograms for (Impersonal - Personal) Architects

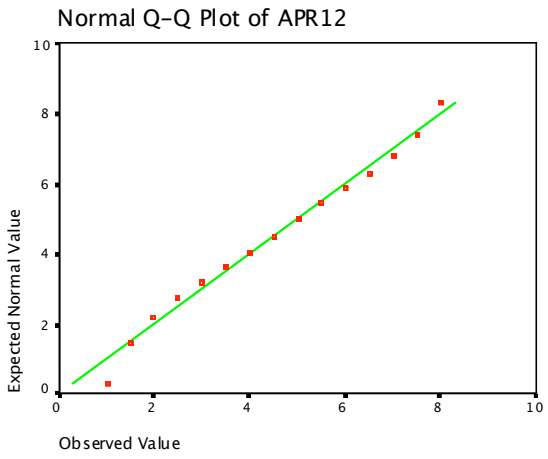


Figure 4.42: Normal Q-Q Plot for (Impersonal - Personal) Architects

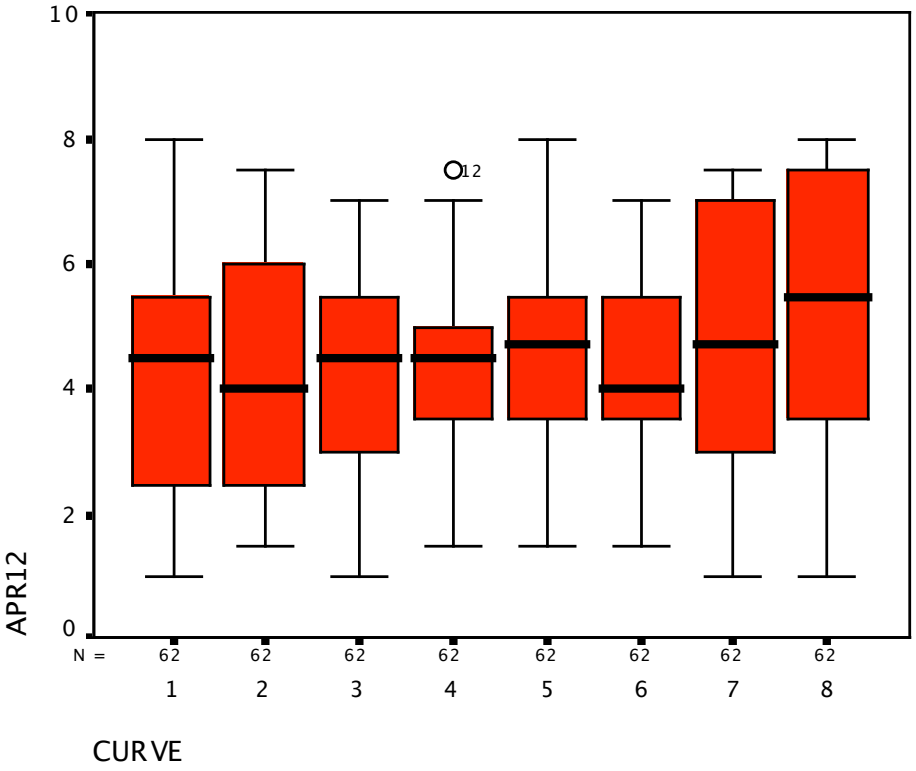


Figure 4.43: Box Plots for (Impersonal - Personal) Architects

In the analysis of variance, equal variances were not assumed, therefore the homogeneity assumption was not violated. The between group degree of freedom is k-1=7 and total degree of freedom is 8n-1=495. The summary Table 4.30 contains the main information we need to answer our research question. When we compare it to the F-table we can deduce that there is no difference in means. $F(7,487) = 2.344$, $p < .001$. Here we cannot reject the null hypothesis. Multiple comparison tables were studied and the result is summarized in the homogeneous subsets table provided below in Table 4.31. We can observe that there all the cards are in one group and the sequence of curvature is

very irregular and out of sequence. A change of mean cannot be deduced from our architect sample.

Table 4.30: ANOVA F-Test Impersonal - Personal (Architects)

	Sum of Squares	df	Mean Square	F	Sig.
Bet. Groups	51.524	7	7.361	2.344	.023
Within Groups	1532.468	488	3.140		
Total	1583.992	495			

Table 4.31: Homogeneous Subsets Impersonal-Personal (Architects)

Tukey B

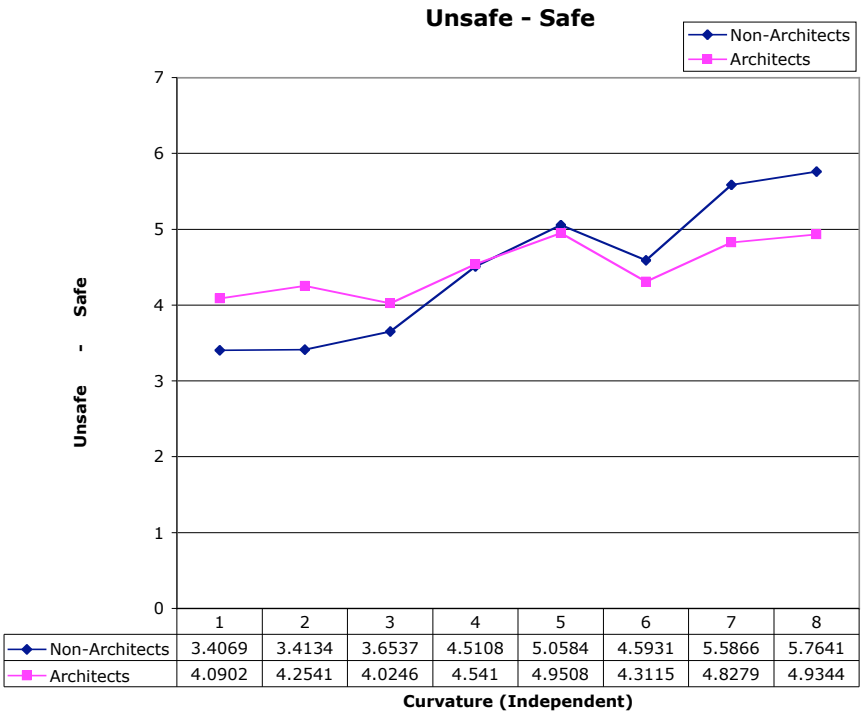
	N	Subset
CURVE		1
2	62	4.2016
6	62	4.2581
3	62	4.2903
1	62	4.2984
4	62	4.3226
5	62	4.6774
7	62	4.8306
8	62	5.1532

Alpha = .05.

Linear regression models tested “Impersonal - Personal” as the dependant variable and “Curvature” as the independent variable. The results indicate that increase in curvature explains this emotional variable only for about 2% of the variations for architects (R^2=.021, p<.1). Overall we can see that both the regression model results and ANOVA results point to the same direction. We do not see changes in means of the personal quality of space as curvature rises for the architects.

4.5.6 Unsafe - Safe

The sixth variable in this study was Unsafe-Safe which has direct application in architectural design. Perception of safety changes significantly with the increase in curvature. The increase is more distinct in the non-architect sample. In general, non-architects' ratings for Unsafe-Safe increases with gradual increase in curvature. The same relationship can not be interpreted for the architect group. Their rating is somewhat stuck (between 4 and 5) with the increase in curvature without exception. This is by far the cleanest visual comparison between two subject groups. Both relationships will be examined thoroughly in the following sub sections. Figure 4.44 illustrates the mean results for both groups.



	1	2	3	4	5	6	7	8
Non-Architects	3.4069	3.4134	3.6537	4.5108	5.0584	4.5931	5.5866	5.7641
Architects	4.0902	4.2541	4.0246	4.541	4.9508	4.3115	4.8279	4.9344

Figure 4.44: Mean Trends of Unsafe-Safe for Architects and Non-Architects

4.5.6.1 Non-Architects

There were n=231 valid entries for this group. Box plots (Figure 4.47) indicate that variances are close to each other (card 4 has a variance that is lower than others and consistent with previous cards). There are 5 outliers but since data is ordinal and there are only a few of them, they are acceptable. The q-q plot (Figure 4.46) shows that the data is normally distributed and the histogram for accumulative data (Figure 4.45) is bell shaped. There is a considerable difference between non-architect ratings mean as curvature rises. The histograms for each individual curve level are consistent with the mean plot chart and standard deviations. Means and medians rise consistently with increase of curvature in the cards. Looking at the box plots we can visually group the responses into 3 different sets of low, medium and high curvature. This is further confirmed with the analysis of variance. Table 4.32 shows the mean and standard deviation of safety variable for non-architects.

Table 4.32: Means and Standard Deviation of Non-Architects' Response to Unsafe-Safe Variable

CURVE	Mean	Std. Deviation	N
1	3.4069	1.96905	231
2	3.4134	1.71536	231
3	3.6537	1.49753	231
4	4.5108	1.31418	231
5	5.0584	1.32281	231
6	4.5931	1.33229	231
7	5.5866	1.76410	231
8	5.7641	2.01450	231
Total	4.4984	1.85732	1848

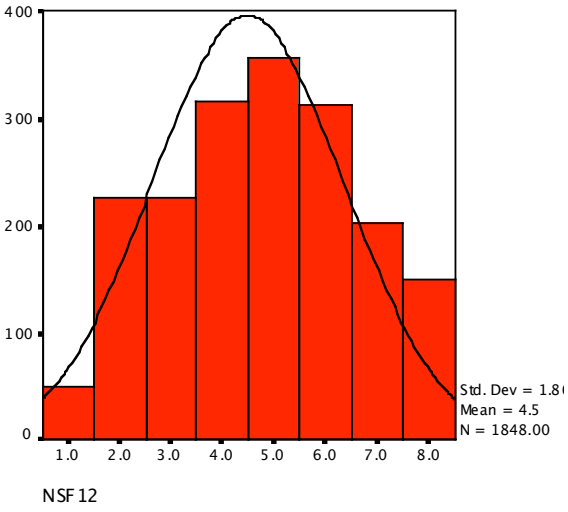


Figure 4.45: Cumulative Histograms for (Unsafe-Safe) Non-Architects

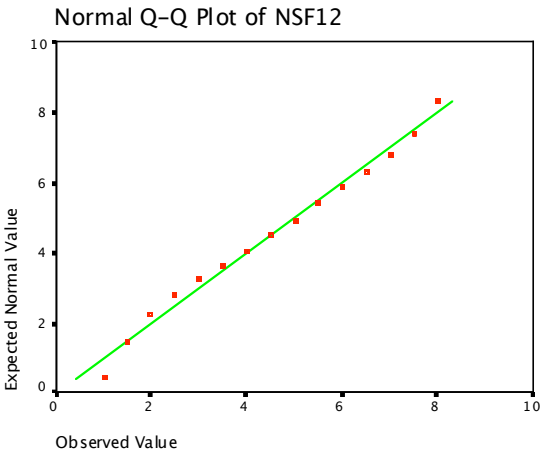


Figure 4.46: Normal Q-Q Plot for (Unsafe-Safe) Non-Architects

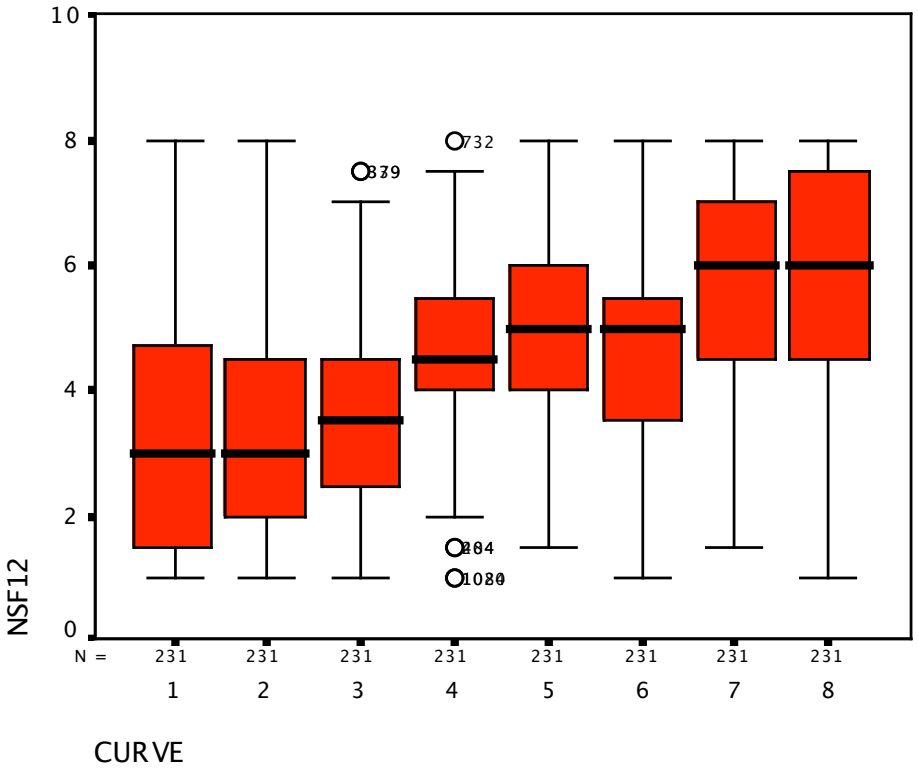


Figure 4.47: Box Plots for (Unsafe-Safe) Non-Architects

In the analysis of variance, equal variances were not assumed, therefore the homogeneity assumption was not violated. The between group degree of freedom is k-1=7 and total degree of freedom is 8n-1=1847. The summary Table 4.33 contains the main information we need to answer our research question. When we compare it to the F-table we can deduce that significant result has been found $F(7,1847) = 76.073$, $p < .001$. Since we have a significant F-value, we now know that the means are not equal and reject the null hypothesis. However we cannot tell by this chart alone exactly how these means are different in relation to one anther.

Tukey's B is used for this purpose. Multiple comparison tables were studied and the result is summarized in the homogeneous subsets table provided below in Table 4.34. We can observe that there are 4 separate subsets of curvature groups. Group 1 has the first 3 cards with the least curvature and card 4 and 6 fall into the second group, 5 in the third, then cards 7 and 8 are in the last groups. This result for the non-architects is impressive since the sequence of curvature is well respected.

Table 4.33: ANOVA F-Test Unsafe-Safe (Non-Architects)

	Sum of Squares	df	Mean Square	F	Sig.
Bet. Groups	1430.090	7	204.299	76.073	.000
Within Groups	4941.405	1840	2.686		
Total	6371.495	1847			

Table 4.34: Homogeneous Subsets Unsafe-Safe (Non-Architects)

Tukey B

	N	Subset			
CURVE		1	2	3	4
1	231	3.4069			
2	231	3.4134			
3	231	5.0584			
4	231		5.5866		
6	231		5.7641		
5	231			5.0584	
7	231				5.5866
8	231				5.7641

Alpha = .05.

Linear regression models tested "Unsafe-Safe" as the dependant variable and "Curvature" as the independent variable. The results indicate that increase in curvature explains this emotional variable for 20.4% of the variations for non-architects (R^2=.204, p<.001). Overall we can see that both the regression model results and ANOVA results point to the same direction with regression values in line with previous emotional variables. Therefore the conclusion is that a distinct change in means of Unsafe-Safe exists as curvature rises for the non-architects.

4.5.6.2 Architects

There were n=61 valid entries for this group. Box plots (Figure 4.50) indicate that variances are relatively equal and only 1 outlier is present. We can also see that the medians are not so different from each other. Means and medians alike, are located between 4 and 5 rating value for safety variable. The q-q plot (Figure 4.49) show that the

data is almost normally distributed and the cumulative histogram (Figure 4.48) is quite bell shaped. Table 4.35 shows the mean and standard deviation of safety variable for architects.

Table 4.35: Means and Standard Deviation of Architects' Response to Unsafe-Safe Variable

CURVE	Mean	Std. Deviation	N
1	4.0902	2.32291	61
2	4.2541	1.82260	61
3	4.0246	1.58489	61
4	4.5410	1.30159	61
5	4.9508	1.40744	61
6	4.3115	1.31391	61
7	4.8279	2.09938	61
8	4.9344	2.26656	61
Total	4.4918	1.83003	488

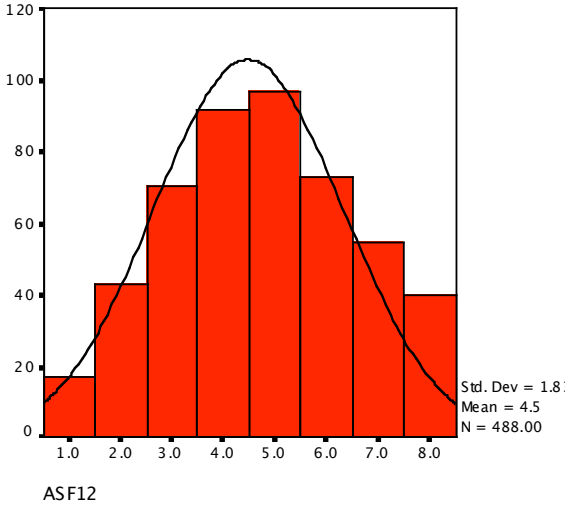


Figure 4.48: Cumulative Histograms for (Unsafe-Safe) Architects

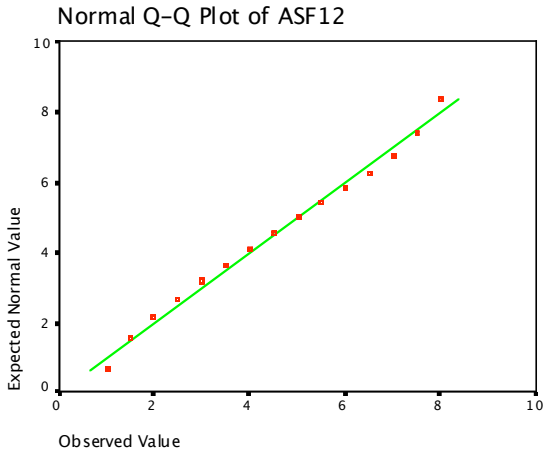


Figure 4.49: Normal Q-Q Plot for (Unsafe-Safe) Architects

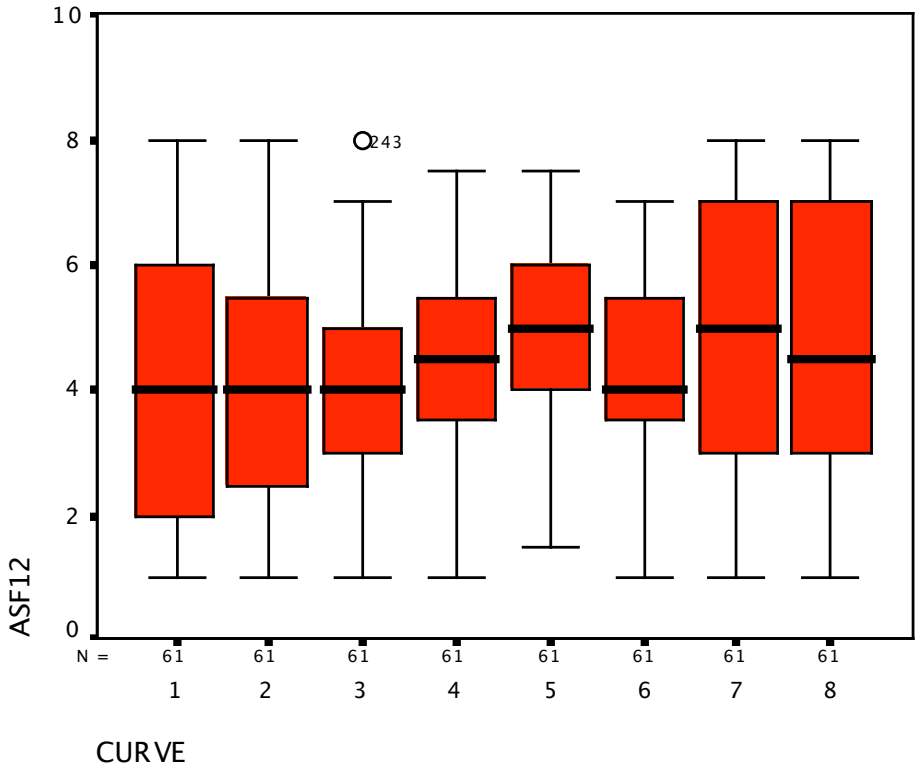


Figure 4.50: Box Plots for (Unsafe-Safe) Architects

In the analysis of variance, equal variances were not assumed, therefore the homogeneity assumption was not violated. The between group degree of freedom is k-1=7 and total degree of freedom is 8n-1=487. The summary Table 4.36 contains the main information we need to answer our research question. When we compare it to the F-table we can deduce that there is no difference in means. F (7,487) = 2.638, p = .011. Here we cannot reject the null hypothesis. Multiple comparison tables were studied and the result is summarized in the homogeneous subsets table provided below in Table 4.37. We can observe that all the cards are in one group and the sequence of curvature is very irregular and out of sequence.

Table 4.36: ANOVA F-Test Unsafe-Safe (Architects)

	Sum of Squares	df	Mean Square	F	Sig.
Bet. Groups	60.426	7	8.632	2.638	.011
Within Groups	1570.541	480	3.272		
Total	1630.967	487			

Table 4.37: Homogeneous Subsets Unsafe-Safe (Architects)

Tukey B

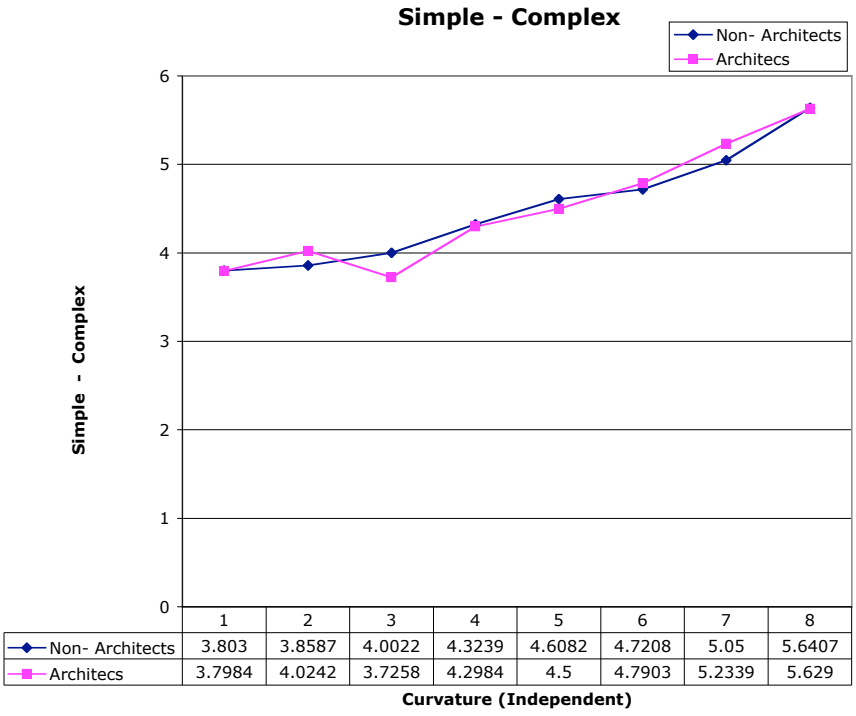
	N	Subset
CURVE		1
3	61	4.0246
1	61	4.0902
2	61	4.2541
6	61	4.3115
4	61	4.5410
7	61	4.8279
8	61	4.9344
5	61	4.9508

Alpha = .05.

Linear regression models tested “Unsafe-Safe” as the dependant variable and “Curvature” as the independent variable. The results indicate that increase in curvature explains this emotional variable only for about 2% of the variations for architects (R^2=.022, p=.001). Overall we can see that both the regression model results and ANOVA results point to the same direction. We do not see changes in means of the Unsafe-Safe quality of space as curvature rises for the architects.

4.5.7 Simple - Complex

This section discusses the Simple-Complex variable. This is a variable with a lot of applications for designers. This variable changes with the increase in curvature. The increase is true for the non-architects as well as the architect sample. In general, ratings for Simple-Complex increases with gradual increase in curvature with a few exceptions being the cards of lower curvature degrees. The mean and medians in the rest of the cards almost overlap and create a straight line with a positive slope. This is one of the few variables that produce similar results for both subject groups. Both relationships will be examined thoroughly in the following sub sections. Figure 4.51 illustrates the mean results for both groups.



	1	2	3	4	5	6	7	8
Non- Architects	3.803	3.8587	4.0022	4.3239	4.6082	4.7208	5.05	5.6407
Architecs	3.7984	4.0242	3.7258	4.2984	4.5	4.7903	5.2339	5.629

Figure 4.51: Mean Trends of Simple-Complex for Architects and Non-Architects

4.5.7.1 Non-Architects

There were about n=230 valid entries for this group. Box plots (Figure 4.54) indicate that variances are close to each other (card 4 has a variance that is lower than others and consistent with previous cards). There are 4 outliers but since data is ordinal and there are only a few of them, they are acceptable. The q-q plot (Figure 4.53) shows that the data is normally distributed and the histogram for accumulative data (Figure 4.52) is bell shaped. There is a considerable difference between non-architect ratings mean as curvature rises. The histograms for each individual curve level are consistent with the mean plot chart and standard deviations. Means and medians rise consistently with increase of curvature in the cards. Looking at the box plots it is difficult to visually group the responses. This is further analyzed with the analysis of variance. Table 4.38 shows the mean and standard deviation of pleasantness variable for non-architects.

Table 4.38: Means and Standard Deviation of Non-Architects' Response to Simple-Complex Variable

CURVE	Mean	Std. Deviation	N
1	3.8030	2.09740	231
2	3.8587	1.79295	230
3	4.0022	1.60342	230
4	4.3239	1.16371	230
5	4.6082	1.32746	231
6	4.7208	1.45996	231
7	5.0500	1.83569	230
8	5.6407	2.09054	231
Total	4.5014	1.80044	1844

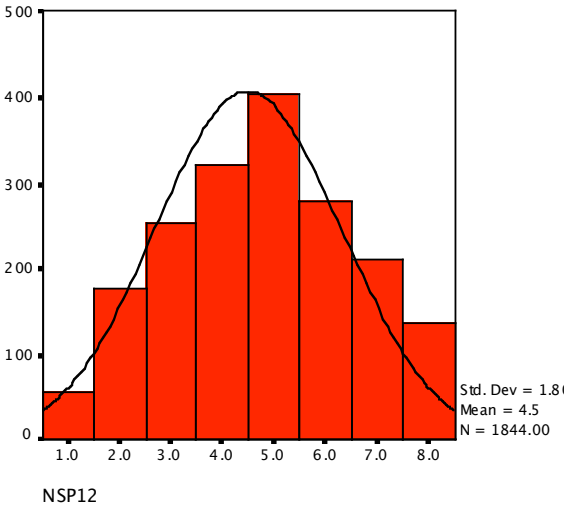


Figure 4.52: Cumulative Histograms for (Simple-Complex) Non-Architects

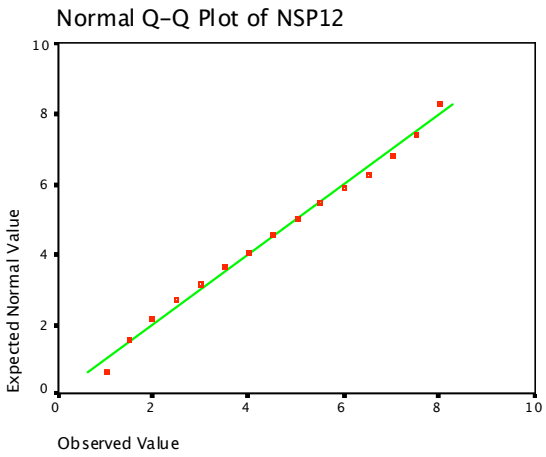


Figure 4.53: Normal Q-Q Plot for (Simple-Complex) Non-Architects

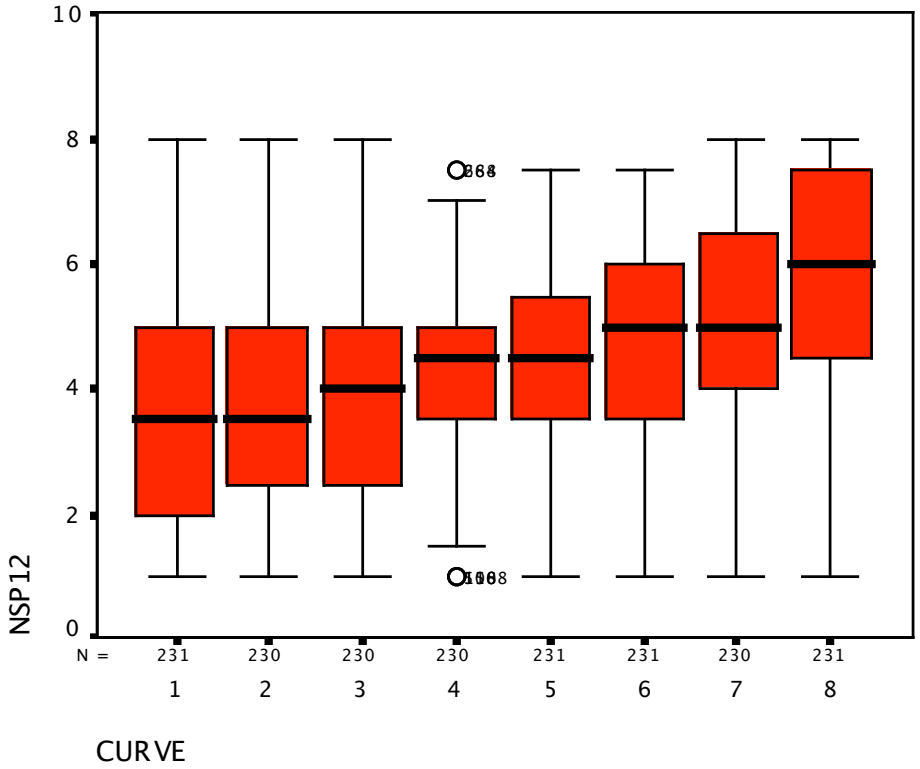


Figure 4.54: Box Plots for (Simple-Complex) Non-Architects

In the analysis of variance, equal variances were not assumed, therefore the homogeneity assumption was not violated. The between group degree of freedom is k-1=7 and total degree of freedom is 8n-1=1847. The summary Table 4.39 contains the main information we need to answer our research question. When we compare it to the F-table we can deduce that significant result has been found $F(7,1847) = 32.300$, $p < .001$. Since we have a significant F-value, we now know that the means are not equal and reject the null hypothesis. This value is almost half the previous F-values which confirms what we can visually detect with graphs. The means are closer together than other emotional variables. Tukey's B produces similar results. Multiple comparison tables were studied and the result is summarized in the homogeneous subsets table provided below in Table 4.40. We can observe that there are 5 separate subsets of curvature groups. Even though there is a lot of overlapping in groups, the sequence of curvature increase is perfect.

Table 4.39: ANOVA F-Test Simple-Complex (Non-Architects)

	Sum of Squares	df	Mean Square	F	Sig.
Bet. Groups	655.047	7	93.578	32.300	.000
Within Groups	5319.200	1836	2.897		
Total	5974.247	1843			

Table 4.40: Homogeneous Subsets Simple-Complex (Non-Architects)

Tukey B

	N	Subset				
CURVE		1	2	3	4	5
1	231	3.8030				
2	230	3.8587				
3	230	4.0022	4.0022			
4	230		4.3239	4.3239		
5	231			4.6082		
6	231			4.7208	4.7208	
7	230				5.0500	
8	231					5.6407

Alpha = .05.

Linear regression models tested “Simple-Complex” as the dependant variable and “Curvature” as the independent variable. The results indicate that increase in curvature explains this emotional variable for 10.4% of the variations for non-architects (R^2=.104, p<.001). Overall we can see that both the regression model results and ANOVA results point to the same direction with regression values in line with previous emotional variables. The regression results are weaker than previous findings. The conclusion is that a distinct change in means of Simple-Complex exists as curvature rises for the non-architects.

4.5.7.2 Architects

There were n=62 valid entries for this group. Box plots (Figure 4.57) indicate that variances are questionable and there are a lot of outliers as compared to others. We can also see that the medians are not so different from each other. Means and medians are located between 4 and 5 rating value for complexity variable with the exception of

cards with high curvature (7,8). The q-q plot (Figure 4.56) shows that the data is almost normally distributed and the cumulative histogram (Figure 4.55) is quite bell shaped. Table 4.41 shows the mean and standard deviation of pleasantness variable for architects.

Table 4.41: Means and Standard Deviation of Architects' Response to Simple-Complex Variable

CURVE	Mean	Std. Deviation	N
1	3.7984	2.48349	62
2	4.0242	1.72595	62
3	3.7258	1.22366	62
4	4.2984	1.24617	62
5	4.5000	1.00409	62
6	4.7903	1.45858	62
7	5.2339	1.94329	62
8	5.6290	2.15569	62
Total	4.5000	1.82630	496

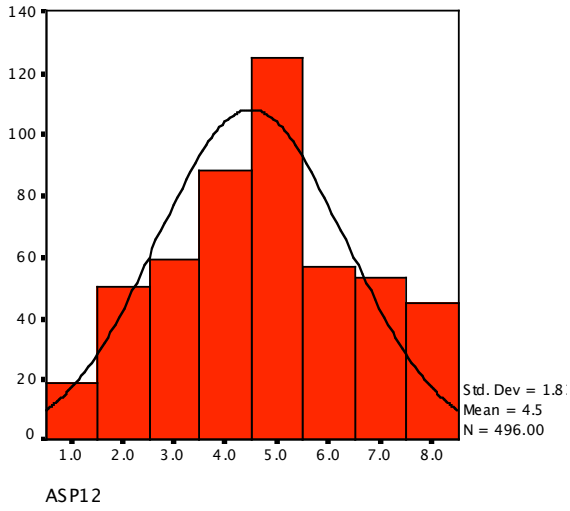


Figure 4.55: Cumulative Histograms for (Simple-Complex) Architects

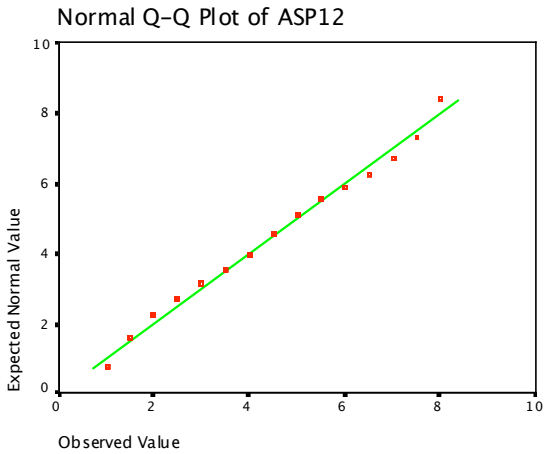


Figure 4.56: Normal Q-Q Plot for (Simple-Complex) Architects

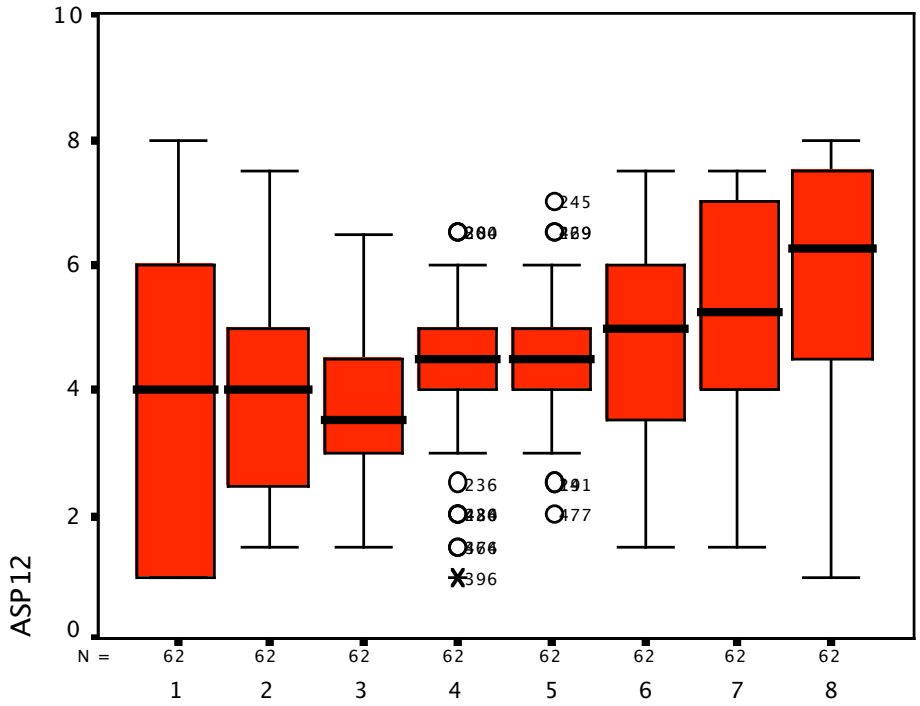


Figure 4.57: Box Plots for (Simple-Complex) Architects

In the analysis of variance, equal variances were not assumed, therefore the homogeneity assumption was not violated. The between group degree of freedom is k-1=7 and total degree of freedom is 8n-1=495. The summary Table 4.42 contains the main information we need to answer our research question. When we compare it to the F-table we can deduce that there is no difference in means. F (7,487) = 2.638, p = .011. Here we cannot reject the null hypothesis. Multiple comparison tables were studied and the result is summarized in the homogeneous subsets table provided below in Table 4.43.

We can observe that there are four groups but each have multiple overlapping cards, even card 8 which is almost always rated separate, shares column with card 7. The results from the Tukey's test are not that helpful since they don't provide specific patterns.

Table 4.42: ANOVA F-Test Simple-Complex (Architects)

	Sum of Squares	df	Mean Square	F	Sig.
Bet. Groups	60.426	7	8.632	2.638	.011
Within Groups	1570.541	480	3.272		
Total	1630.967	487			

Table 4.43: Homogeneous Subsets Simple-Complex (Architects)

Tukey B

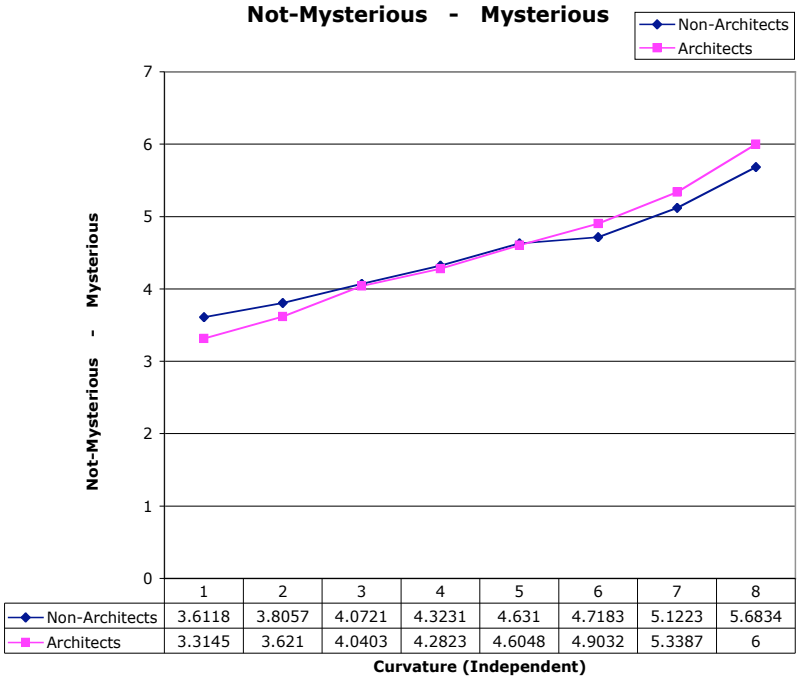
	N	Subset			
CURVE		1	2	3	4
3	62	3.7258			
1	62	3.7984			
2	62	4.0242	4.0242		
4	62	4.2984	4.2984		
5	62	4.5000	4.5000	4.5000	
6	62		4.7903	4.7903	
7	62			5.2339	5.2339
8	62				5.6290

Alpha = .05.

Linear regression models tested “Simple-Complex” as the dependant variable and “Curvature” as the independent variable. The results indicate that increase in curvature explains this emotional variable for about 11% of the variations for architects (R^2=.111, p=.001). The R-square value is relatively low but it considerably higher than similar variables rated by architects. Overall we can see that regression model parts slightly with the ANOVA results since the latter dose not find any meaningful change in the means. The results match the trend figure for the means. Therefore we cannot confirm changes in means of the Simple-Complex quality of space as curvature rises for the architect’s sample.

4.5.8 Not-Mysterious - Mysterious

This section discusses the mystery emotional variable. This is yet another variable with a lot of applications for designers. This variable changes with the increase in curvature. The increase is true for in the non-architect as well as the architect sample. In fact the architects have a larger contrast in mean changes than non-architects do. The mean and medians in the rest of the cards almost overlap and create a straight line with a positive slope. This is one of the few variables that produce similar results for both subject groups. Both relationships will be examined thoroughly in the following sub sections. Figure 4.58 illustrates the mean results for both groups.



	1	2	3	4	5	6	7	8
Non-Architects	3.6118	3.8057	4.0721	4.3231	4.631	4.7183	5.1223	5.6834
Architects	3.3145	3.621	4.0403	4.2823	4.6048	4.9032	5.3387	6

Figure 4.58: Mean Trends of Not-Mysterious-Mysterious for Architects and Non-Architects

4.5.8.1 Non-Architects

There were about n=229 valid entries for this group. Box plots (Figure 4.61) indicate that variances are close to each other (card 4 has a variance that is lower than others and consistent with previous cards). There are 4 outliers but since data is ordinal and there are only a few of them, they are acceptable. The q-q plot (Figure 4.60) shows that the data is normally distributed and the histogram for accumulative (Figure 4.59) data is bell shaped. There is a considerable difference between non-architect ratings mean as curvature rises. The histograms for each individual curve level are consistent with the mean plot chart and standard deviations. Means and medians rise consistently with increase of curvature in the cards. Looking at the box plots it is difficult to visually group the responses. This is further analyzed with the analysis of variance. Table 4.44 shows the mean and standard deviation of mystery variable for non-architects.

Table 4.44: Means and Standard Deviation of Non-Architects' Response to Not-Mysterious - Mysterious Variable

CURVE	Mean	Std. Deviation	N
1	3.6118	1.88010	228
2	3.8057	1.69053	229
3	4.0721	1.58814	229
4	4.3231	1.26714	229
5	4.6310	1.32299	229
6	4.7183	1.40032	229
7	5.1223	1.79922	229
8	5.6834	2.01507	229
Total	4.4965	1.76002	1831

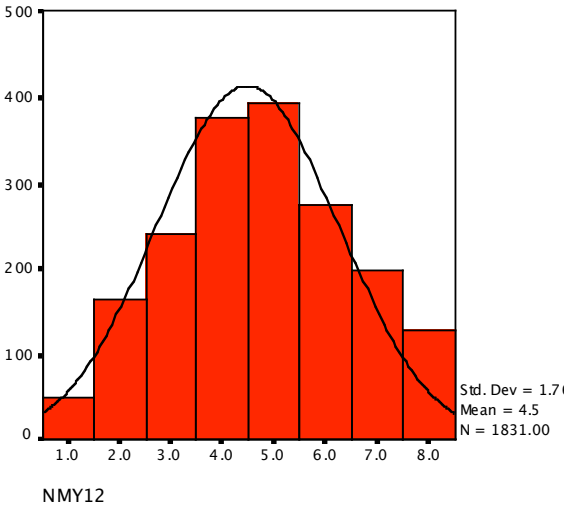


Figure 4.59: Cumulative Histograms for ((Not-Mysterious-Mysterious)) Non-Architects

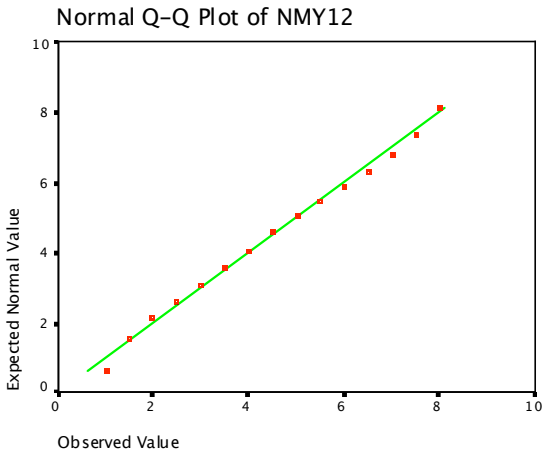


Figure 4.60: Normal Q-Q Plot for (Not-Mysterious-Mysterious) Non-Architects

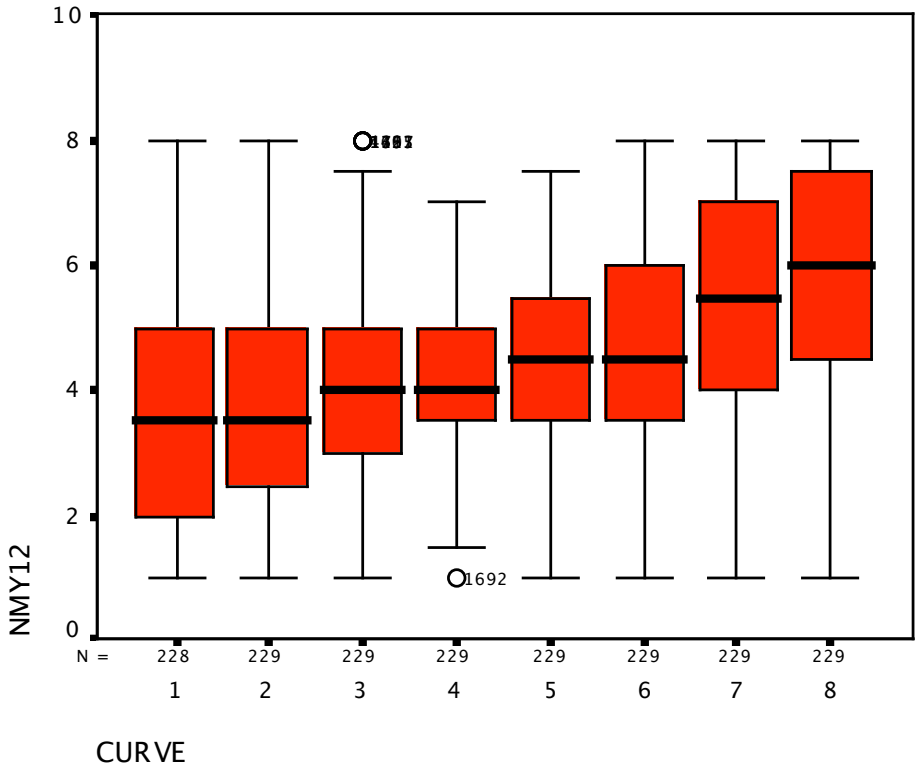


Figure 4.61: Box Plots for (Not-Mysterious-Mysterious) Non-Architects

In the analysis of variance, equal variances were not assumed, therefore the homogeneity assumption was not violated. The between group degree of freedom is k-1=7 and total degree of freedom is 8n-1=1831. The summary Table 4.45 contains the main information we need to answer our research question. When we compare it to the F-table we can deduce that significant result has been found $F(7,1847) = 40.539$, $p < .001$. Since we have a significant F-value, we now know that the means are not equal and reject the null hypothesis. This value is still less than previous F-values which confirms what we can visually detect with graphs. The means are closer together than other emotional variables.

Tukey's B produces similar results. Multiple comparison tables were studied and the result is summarized in the homogeneous subsets table provided below in Table 4.46. We can observe that there are 6 subsets of curvature groups. Even though there is a lot of overlapping in groups, the sequence of curvature increase is perfect.

Table 4.45: ANOVA F-Test Not-Mysterious-Mysterious (Non-Architects)

	Sum of Squares	df	Mean Square	F	Sig.
Bet. Groups	763.552	7	109.079	40.539	.000
Within Groups	4905.175	1823	2.691		
Total	5668.727	1830			

Table 4.46: Homogeneous Subsets Not-Mysterious-Mysterious (Non-Architects)
Tukey B

	N	Subset					
CURVE		1	2	3	4	5	6
1	228	3.6118					
2	229	3.8057	3.8057				
3	229		4.0721	4.0721			
4	229			4.3231	4.3231		
5	229				4.6310		
6	229				4.7183		
7	229					5.1223	
8	229						5.6834

Alpha = .05.

Linear regression models tested “Not-Mysterious-Mysterious” as the dependant variable and “Curvature” as the independent variable. The results indicate that increase in curvature explains this emotional variable for 13.0% of the variations for non-architects (R^2=.130, p<.001). Overall we can see that both the regression model results and ANOVA results point to the same direction with regression values in line with previous emotional variables. The regression results are weaker than previous finding. The conclusion is that a distinct change in means of mystery exists as curvature rises for the non-architects.

4.5.8.2 Architects

There were n=62 valid entries for this group. Box plots (Figure 4.62) indicate that variances are relatively equal and there are 5 outliers. We can also see that the medians are different from each other and increasing with curvature. The q-q plot

(Figure 4.61) shows that the data is normally distributed and the histogram (Figure 4.60) is quite bell shaped. Table 4.47 shows the mean and standard deviation of mystery variable for architects.

Table 4.47: Means and Standard Deviation of Architects' Response to Not-Mysterious-Mysterious Variable

CURVE	Mean	Std. Deviation	N
1	3.3145	2.07884	62
2	3.6210	1.76646	62
3	4.0403	1.35592	62
4	4.2823	.99020	62
5	4.6048	1.28400	62
6	4.9032	1.35755	62
7	5.3387	1.73388	62
8	6.0000	1.75831	61
Total	4.5101	1.77160	495

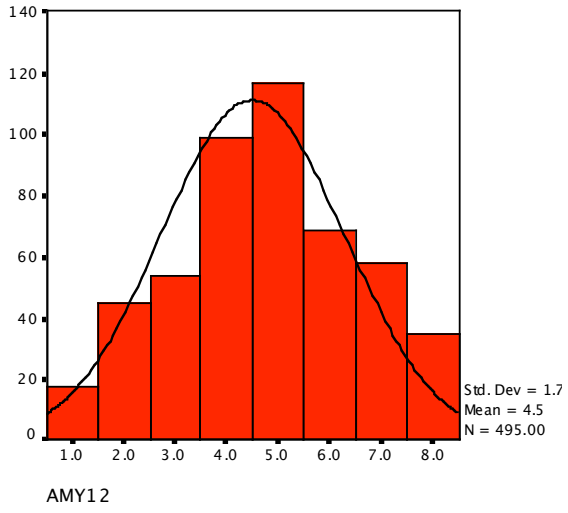


Figure 4.62: Cumulative Histograms for (Not-Mysterious-Mysterious) Architects

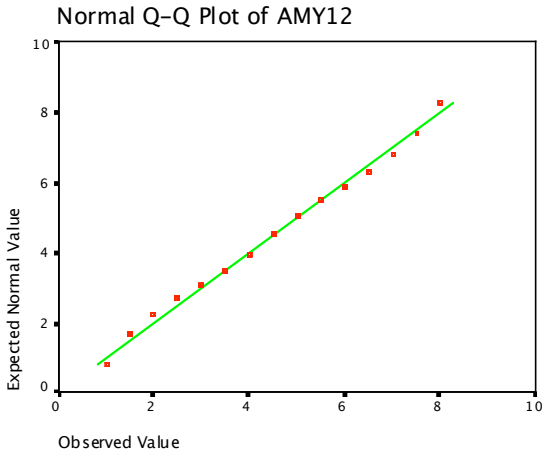


Figure 4.63: Normal Q-Q Plot for (Not-Mysterious-Mysterious) Architects

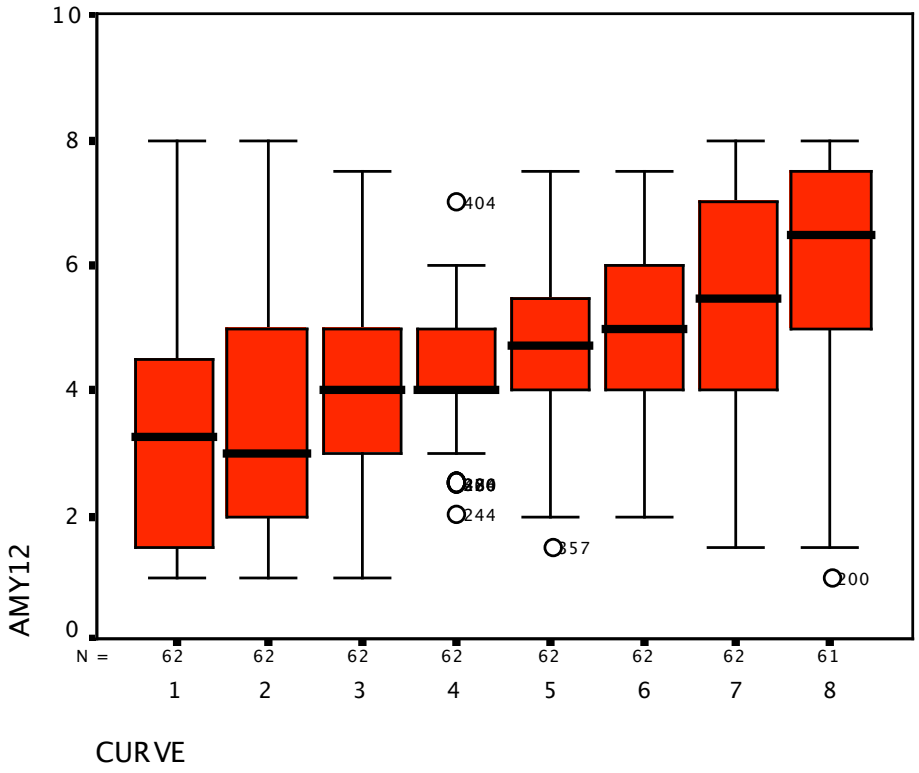


Figure 4.64: Box Plots for (Not-Mysterious-Mysterious) Architects

In the analysis of variance, equal variances were not assumed, therefore the homogeneity assumption was not violated. The between group degree of freedom is k-1=7 and total degree of freedom is 8n-1=493. The summary Table 4.48 contains the main information we need to answer our research question. When we compare it to the F-table we can deduce that there is a big difference in means. F (7,493) = 19.738, $p < .001$. Here we can reject the null hypothesis. This is by far the largest F-Value compared to other ratings by architects. Multiple comparison tables were studied and the result is summarized in the homogeneous subsets table provided below in Table 4.49. We can observe that there are six groups but each have multiple overlapping cards. The Sequence of curvature is also accurate.

Table 4.48: ANOVA F-Test Not-Mysterious-Mysterious (Architects)

	Sum of Squares	df	Mean Square	F	Sig.
Bet. Groups	342.655	7	48.951	19.738	.000
Within Groups	1207.794	487	2.480		
Total	1550.449	494			

Table 4.49: Homogeneous Subsets Not-Mysterious-Mysterious (Architects)

Tukey B

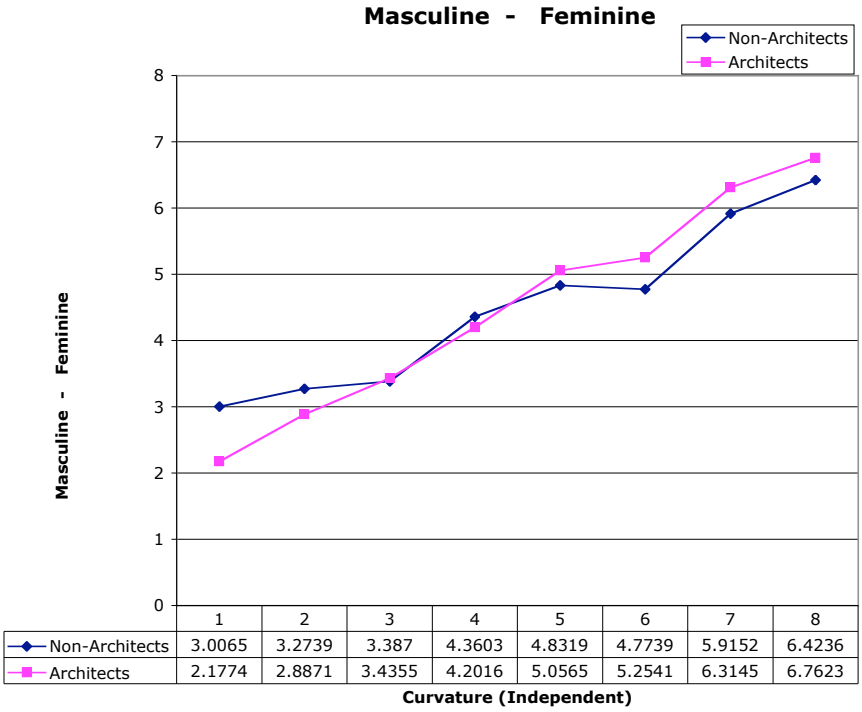
	N	Subset					
CURVE		1	2	3	4	5	6
1	62	3.3145					
2	62	3.6210	3.6210				
3	62	4.0403	4.0403	4.0403			
4	62		4.2823	4.2823	4.2823		
5	62			4.6048	4.6048	4.6048	
6	62				4.9032	4.9032	
7	62					5.3387	5.3387
8	61						6.0000

Alpha = .05.

Linear regression models tested “Not-Mysterious-Mysterious” as the dependant variable and “Curvature” as the independent variable. The results indicate that increase in curvature explains this emotional variable for 21.7% of the variations for architects (R^2=.217, p=.000). The R-square value has clearly jumped for architects and is considerably higher than similar variables rated by architects. Overall we can see that regression model complements the ANOVA results. The results match the trend figure for the means. Therefore we can confirm changes in means of the mystery quality of space as curvature rises for the architect sample.

4.5.9 Masculine - Feminine

This variable is the last variable discussed and it is quite different from others. It is more of a perceptual quality associated with different genders than an emotional variable. This provides a lot of opportunities for designers. This variable changes dramatically for non- architects and has even a stronger contrast for architects. This is the only variable where changes in curvature trigger higher significant results for architects. Both relationships will be examined thoroughly in the following sub sections and then we compare the male and female responses and try to explore if any variations in means exist between the gender subgroups. Figure 4.63 illustrates the mean results for both (architect and non-architect) groups.



	1	2	3	4	5	6	7	8
Non-Architects	3.0065	3.2739	3.387	4.3603	4.8319	4.7739	5.9152	6.4236
Architects	2.1774	2.8871	3.4355	4.2016	5.0565	5.2541	6.3145	6.7623

Figure 4.65: Mean Trends of Masculine–Feminine for Architects and Non-Architects

4.5.9.1 Non-Architects

There were about n=230 valid entries for this group. Box plots (Figure 4.66) indicate that variances are close to each other. There are higher number of outliers than any other variable but since data is ordinal, they are acceptable. The q-q plot (Figure 4.65) shows that the data is normally distributed and the histogram for accumulative data (Figure 4.64) is bell shaped. There is a considerable difference between non-architect ratings' mean as curvature rises. The histograms for each individual curve level (Figure 4.67) are consistent with the mean plot chart and standard deviations (Figure 4.63).

Means and medians rise consistently with increase of curvature in the cards. Looking at the box plots, responses can be grouped into 3 levels of low, intermediate and high curvature even though they are close to each other. This is further analyzed with the analysis of variance. Table 4.50 shows the mean and standard deviation of Masculine-Feminine variable for non-architects.

Table 4.50: Means and Standard Deviation of Non-Architects' Response to Masculine-Feminine Variable

CURVE	Mean	Std. Deviation	N
1	3.0065	1.70824	230
2	3.2739	1.52167	230
3	3.3870	1.41044	230
4	4.3603	1.26184	229
5	4.8319	1.28806	229
6	4.7739	1.21534	230
7	5.9152	1.58265	230
8	6.4236	1.85483	229
Total	4.4954	1.89458	1837

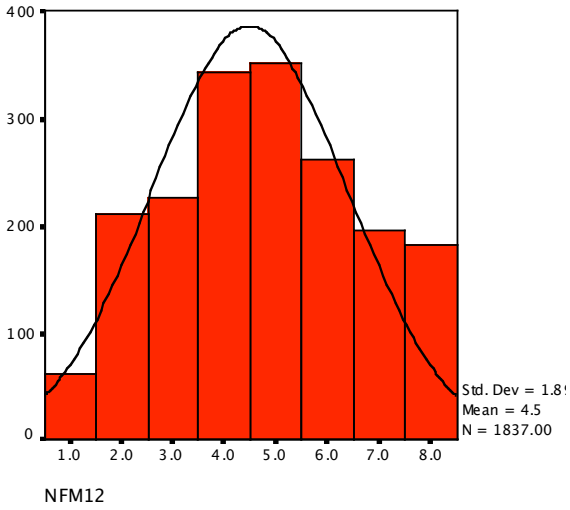


Figure 4.66: Cumulative Histograms for (Masculine-Feminine) Non-Architects

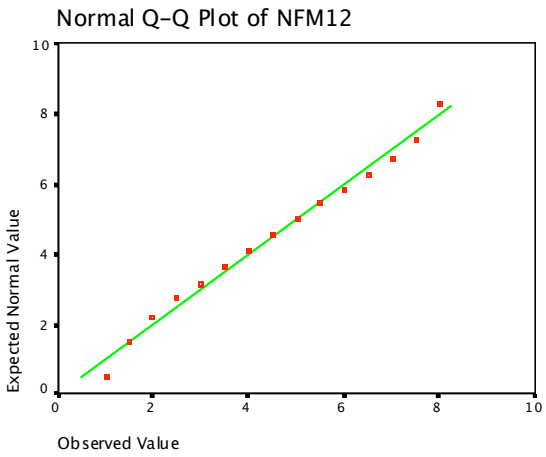


Figure 4.67: Normal Q-Q Plot for (Masculine-Feminine) Non-Architects

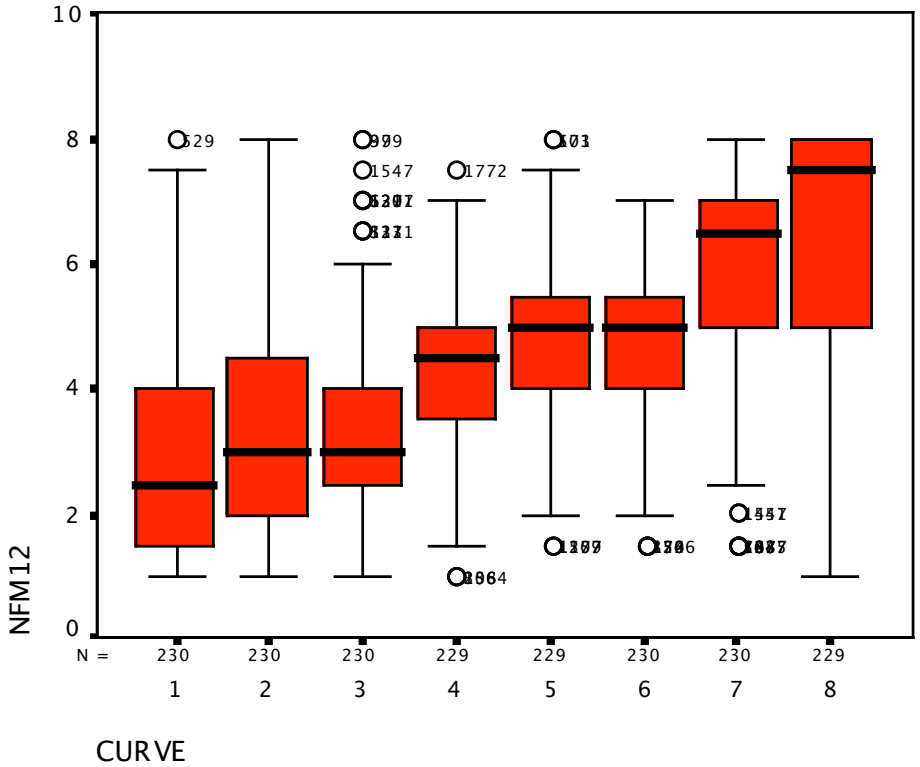


Figure 4.68: Box Plots for (Masculine-Feminine) Non-Architects

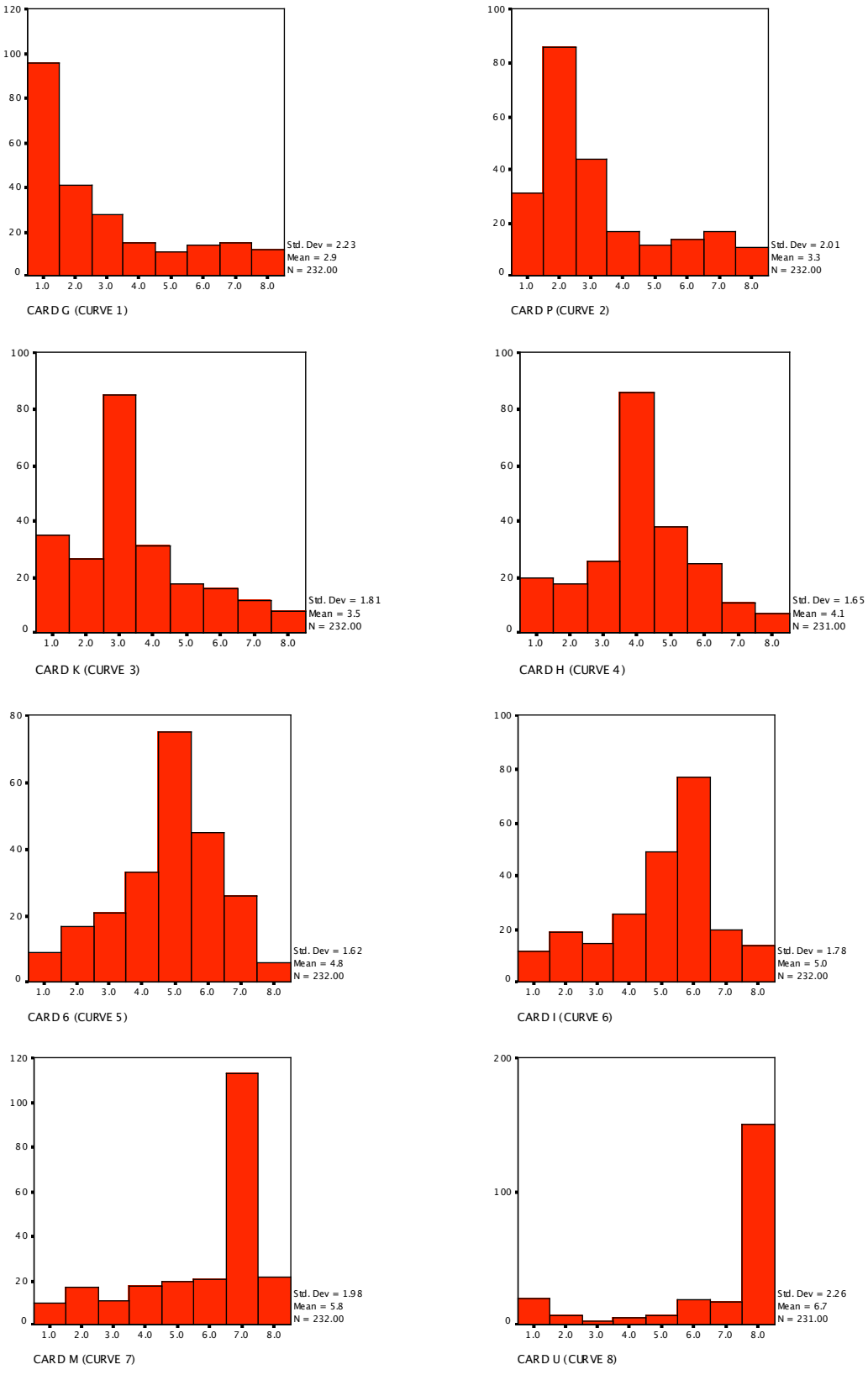


Figure 4.69: Histograms for (Masculine-Feminine) Non-Architects Responses for Different Curvature Levels (1-8)

In the analysis of variance, equal variances were not assumed, therefore the homogeneity assumption was not violated. The between group degree of freedom is k-1=7 and total degree of freedom is 8n-1=1837. The summary Table 4.51 contains the main information we need to answer our research question. When we compare it to the F-table we can deduce that significant result has been found $F(7,1837) = 159.559$, $p < .001$. Since we have a significant F-value, we now know that the means are not equal and reject the null hypothesis. This is the highest F-values of all which confirms with what we can visually detect with graphs.

Tukey's B produces similar results. Multiple comparison tables were studied and the result is summarized in the homogeneous subsets table provided below in Table 4.52. We can observe that there are 6 subsets of curvature groups. There is only one overlapping card in groups, the sequence of curvature increase is very good.

Table 4.51: ANOVA F-Test Masculine-Feminine (Non-Architects)

	Sum of Squares	df	Mean Square	F	Sig.
Bet. Groups	2498.608	7	356.944	159.559	.000
Within Groups	4091.603	1829	2.237		
Total	6590.211	1836			

Table 4.52: Homogeneous Subsets Masculine-Feminine (Non-Architects)

Tukey B

	N	Subset					
CURVE		1	2	3	4	5	6
1	230	3.0065					
2	230	3.2739	3.2739				
3	230		3.3870				
4	229			4.3603			
6	230				4.7739		
5	229				4.8319		
7	230					5.9152	
8	229						6.4236

Alpha = .05.

Linear regression models tested “Masculine-Feminine” as the dependant variable and “Curvature” as the independent variable. The results indicate that increase in curvature explains this emotional variable for 36.2% of the variations for non-architects (R^2=.362, p<.001). Overall we can see that both the regression model results and ANOVA results point to the same direction with regression values higher than previous emotional variables.. The conclusion is that a distinct change in means of sexual quality of space exists as curvature rises for the non-architects.

4.5.9.2 Architects

There were n=62 valid entries for this group. Box plots (Figure 4.71) indicate that variances are almost satisfactory but there are more outliers than any other set. We can also see that the medians are different from each other and increasing with curvature. The q-q plot (Figure 4.69) shows that the data is normally distributed and the cumulative histogram (Figure 4.68) is quite bell shaped. The histograms for each individual curve

level (Figure 4.70) are consistent with the mean plot chart and standard deviations (Figure 4.63). Table 4.53 shows the mean and standard deviation of Masculine-Feminine variable for architects.

Table 4.53: Means and Standard Deviation of Architects' Response to Masculine-Feminine Variable

CURVE	Mean	Std. Deviation	N
1	2.1774	1.52061	62
2	2.8871	1.58998	62
3	3.4355	1.08069	62
4	4.2016	.81210	62
5	5.0565	1.01668	62
6	5.2541	1.22346	61
7	6.3145	1.37075	62
8	6.7623	1.71903	61
Total	4.5051	2.01074	494

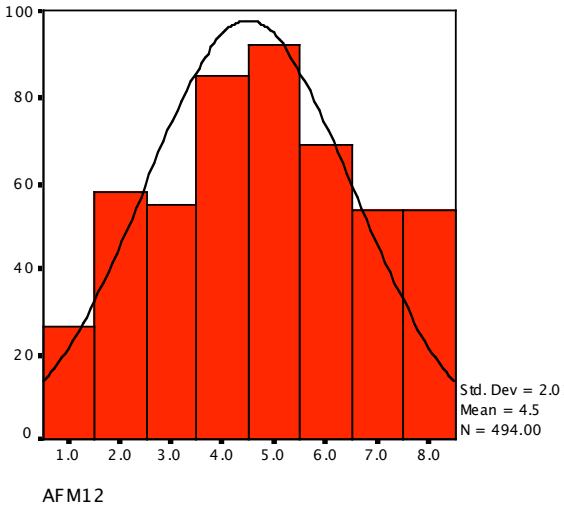


Figure 4.70: Cumulative Histograms for (Masculine-Feminine) Architects

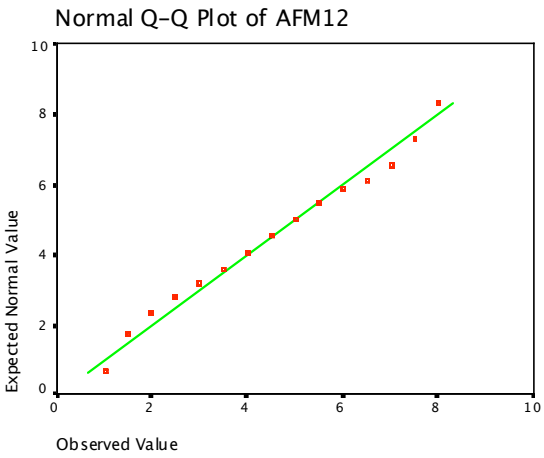


Figure 4.71: Normal Q-Q Plot for (Masculine-Feminine) Architects

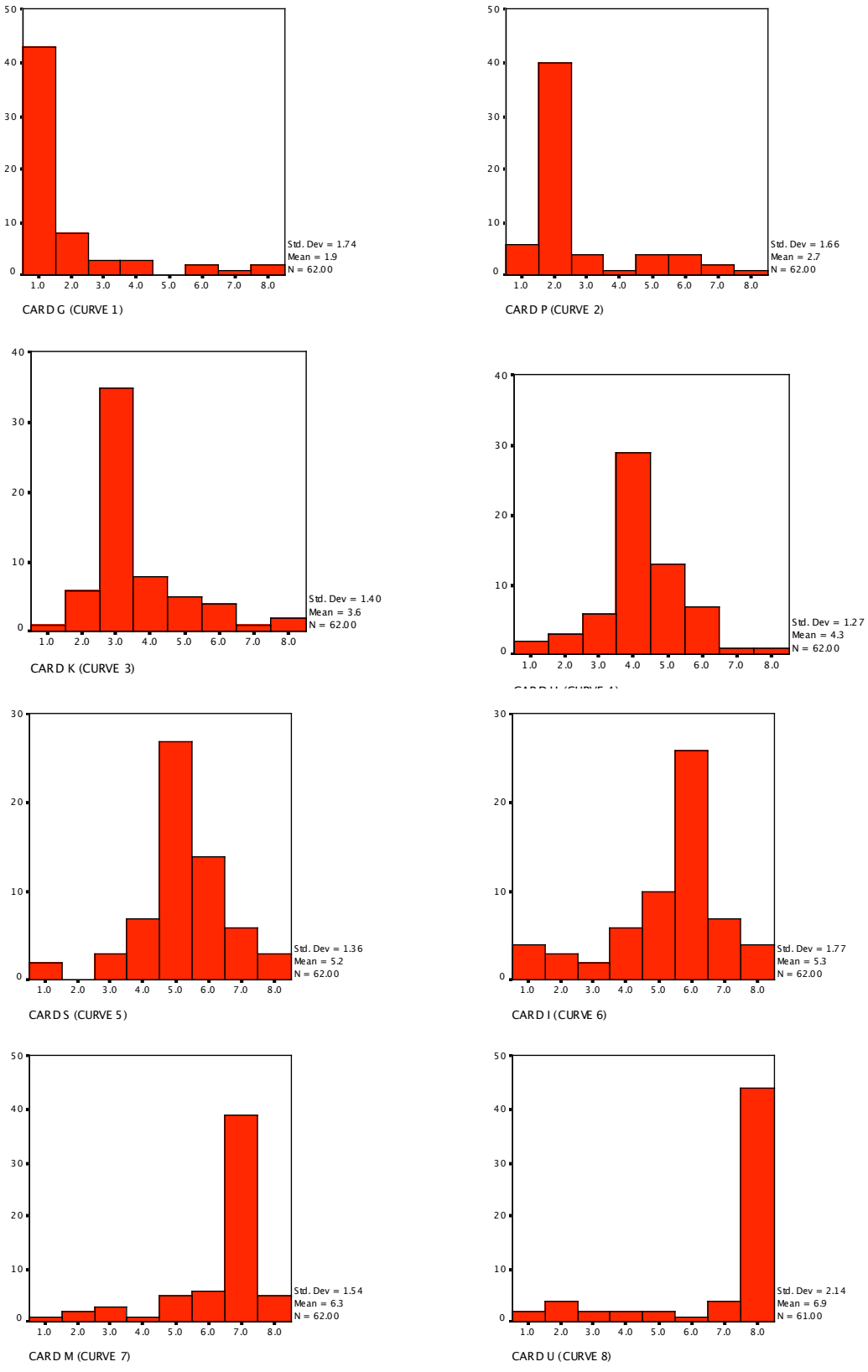


Figure 4.72: Histograms for (Masculine-Feminine) Architects Responses for Different Curvature levels (1-8).

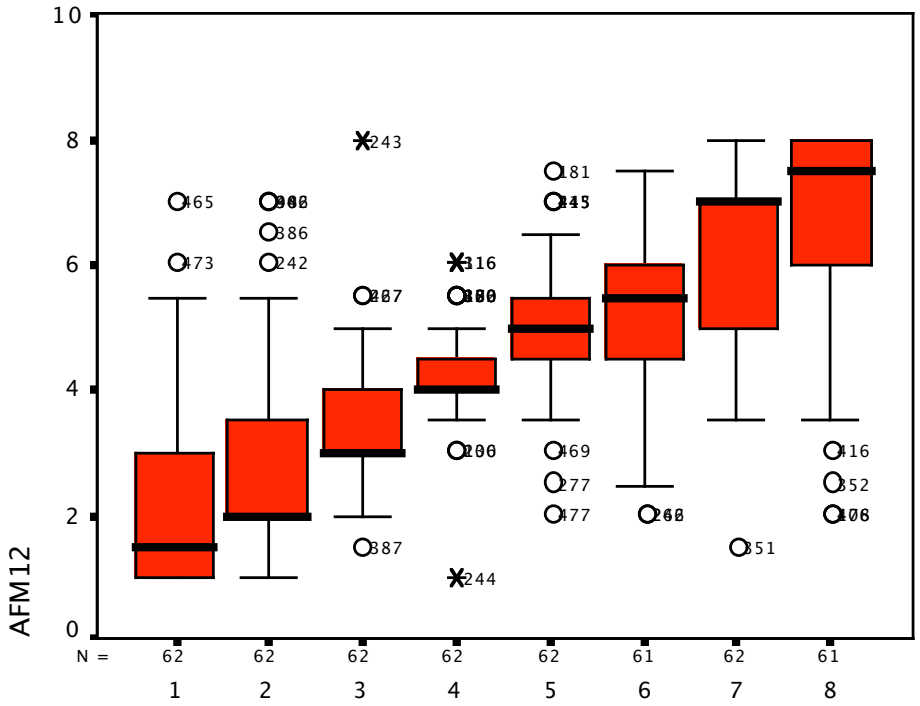


Figure 4.73: Box Plots for (Masculine-Feminine) Architects

In the analysis of variance, equal variances were not assumed, therefore the homogeneity assumption was not violated. The between group degree of freedom is k-1=7 and total degree of freedom is 8n-1=495. The summary Table 4.54 contains the main information we need to answer our research question. When we compare it to the F-table we can deduce that there is a big difference in means. F (7,495) = 93.091, $p < .001$. Here we can reject the null hypothesis. This is by far the largest F-Value compared to other ratings by architects. Multiple comparison tables were studied and the result is summarized in the homogeneous subsets table provided below in Table 4.55. We can observe that there are five groups and none of them have multiple overlapping cards. The Sequence of curvature is perfect. The results from the Tukey's test are helpful since they provide an instantly recognizable pattern.

Table 4.54: ANOVA F-Test Simple-Complex (Masculine-Feminine)

	Sum of Squares	df	Mean Square	F	Sig.
Bet. Groups	1141.723	7	163.103	93.091	.000
Within Groups	851.514	486	1.752		
Total	1993.237	493			

Table 4.55: Homogeneous Subsets (Masculine-Feminine) Architects

Tukey B

	N	Subset				
CURVE		1	2	3	4	5
1	62	2.1774				
2	62		2.8871			
3	62		3.4355			
4	62			4.2016		
5	62				5.0565	
6	61				5.2541	
7	62					6.3145
8	61					6.7623

Alpha = .05.

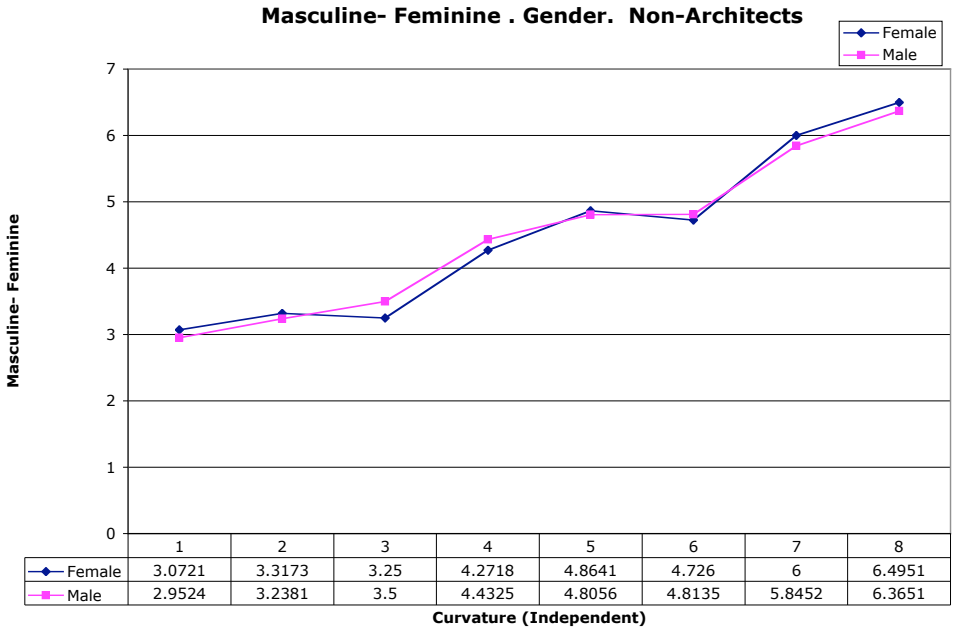
Linear regression models tested “Masculine-Feminine” as the dependant variable and “Curvature” as the independent variable. The results indicate that increase in curvature explains this emotional variable for 56.8% of the variations for architects (R^2=.568, p=.000). The R-square value has clearly jumped for architects and is the highest among architects and non-architects. Overall we can see that regression model complements the ANOVA results adequately. The results match the trend figure for the means. Therefore we can confirm changes in means of the sexual quality of space as curvature rises for the architects’ sample.

4.5.9.3 Gender Specific Response

Responses for both genders were analyzed for the Masculine-Feminine variable. Figures 4.72 and 4.73 show the changes in means for both sample populations (architects and non-architects). We can see that in each group, both males and females respond quite the same to the stimuli. The non-architects produce a cleaner diagram which is due to the larger number of subjects (n=231) relative to the architects (n=62). Analysis of variance and linear regression were employed to help better understand gender trends as the next logical step.

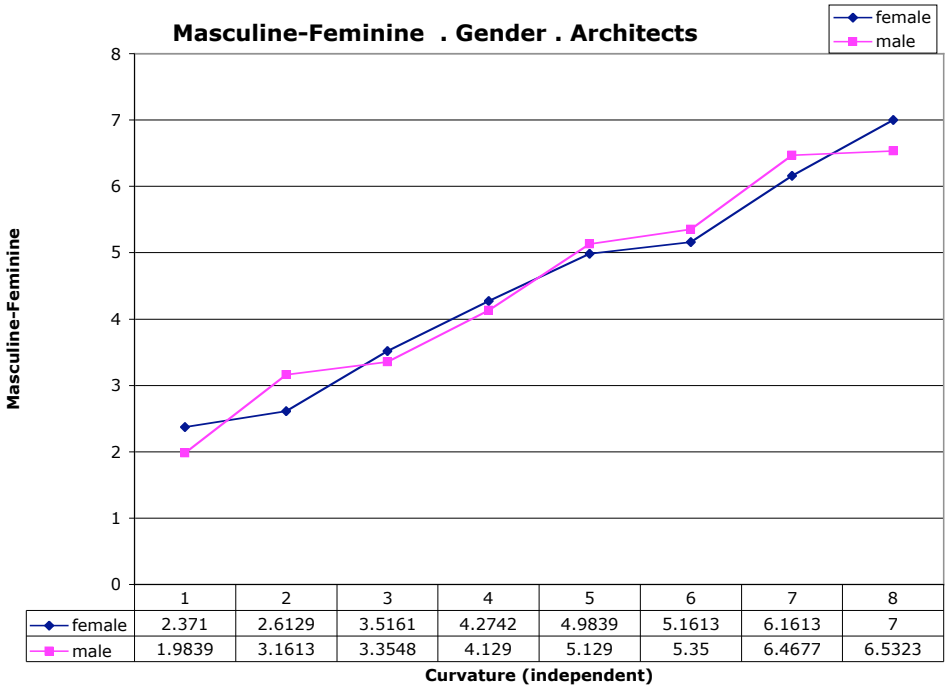
ANOVA results for non-architects indicate that indeed means are different for both genders. Comparing it to the F-table we can deduce that there is a highly significant difference in means. $F(7,828) = 3.54$, $p =< .001$ for females. Further analysis of Tukey's Homogeneous Subset tables show that there are four distinct subsets and the sequence of curvature is acceptable. Stronger differences were produced for the non-architect males $F(7,1007) = 3.51$, $p =< .001$. Box plots for both genders were studied and they show a healthy variance with increase in medians as ratings means rise.

ANOVA results for architects also indicate that means are different for both genders. Comparing it to the F-table we can deduce that there is a significant difference in means. $F(7,246) = 3.65$, $p =< .001$ for females. Further analysis of Tukey's Homogeneous Subset tables show that there are four distinct subsets and the sequence of curvature is acceptable. Stronger differences were produced for the non-architect males $F(7,247) = 3.65$, $p =< .001$. Box plots for both genders were studied and they show a acceptable variances with increase in medians as ratings means rise.



	1	2	3	4	5	6	7	8
Female	3.0721	3.3173	3.25	4.2718	4.8641	4.726	6	6.4951
Male	2.9524	3.2381	3.5	4.4325	4.8056	4.8135	5.8452	6.3651

Figure 4.74: Gender Mean Trends of Masculine–Feminine for Non-Architects



	1	2	3	4	5	6	7	8
female	2.371	2.6129	3.5161	4.2742	4.9839	5.1613	6.1613	7
male	1.9839	3.1613	3.3548	4.129	5.129	5.35	6.4677	6.5323

Figure 4.75: Gender Mean Trends of Masculine–Feminine for Architects

4.6 Emotional Variables as Predicators Using Multiple Regression

The regression model is used to learn more about the relationship between several independent variables and a dependent variable. The general linear model can be used for the case in which a dependent variable is related to both qualitative and quantitative independent variables. For the purpose of this study, we are looking at 4 different variables that are valuable to designers. These variables are pleasant, privacy, safety and masculine-feminine qualities of space. We want to know what group of emotional variables, among the ones measured in this study, are predicators of such qualities in space.

4.6.1 Pleasantness

For non-architects, there were four main variables that described pleasantness through 55% of the variations (R^2=0.550, p<0.001). These variables were relaxing, elevating, friendliness and privacy. This value was about the same for architects with (R^2=0.49, p<0.001).

4.6.2 Privacy

For non-architects, there were three main variables that described pleasantness through 43.5% of the variations (R^2=0.435, p<0.001). These variables were relaxing, elevating, and safety. This value was a weaker for architects with (R^2=0.375, p<0.001).

4.6.3 Safety

For non-architects, there were five main variables that described pleasantness through 38.5% of the variations (R^2=0.385, p<0.001). These variables were relaxing,

pleasant, friendliness, privacy and masculine-feminine. This value was stronger for architects with (R^2=0.464, p<0.001).

4.7 Summary of Results

These findings are important for answering two of the main questions of this study: (1) whether architects respond differently to the built environment measured by its corresponding architectural forms and (2) How does specifically curvilinear forms affect people emotionally and perceptually.

In broad terms, we can detect a clear rise in most studied variables (emotional and perceptual) as level of curvilinear architectural forms increase in interior spaces. This relationship is much stronger for non-architects than architects. In the case of architects we cannot see any sizable relationships at all. Both groups however expressed strong associations for feminine quality of spaces as curvature rose with architects having a higher reaction. This is the only variable in which architects had a higher rating compared to that of non-architects.

It was also predicted that curvilinear forms increase the level of complexity and perception of mystery in architectural space. Furthermore, architects and designers were expected to express higher ratings as curvature was increased since it was assumed that spaces that were more complex and mysterious would be more preferred by this group. This was not the case. In fact their responses suggest that they do not associate curvilinear forms with increase in complexity or mystery.

Besides curvature, correlations between dependent variables showed interesting results. Data suggests that pleasantness, relaxing, elevating and friendliness variables are correlated. If we assume that spaces that are considered pleasant are inherently more preferred, mystery had a much lower correlation to preference as was found in previous studies by Kaplan & Kaplan (1972) and Scott (1993). Architects produced a relatively high correlation between feminine qualities and mystery. Non-architects had relatively lower correlations between safety and respectively complexity and mystery.

CHAPTER V

QUALITATIVE METHODOLOGY

In this chapter we discuss the methodology for the qualitative section of this study, which is predominantly exploratory and descriptive in nature. Twelve renowned architects were interviewed separately in their cities of practice. The unstructured interviews revolved around their perception of the role of the architect and client, and the design process of each architect. The aim was to provide a clear and accurate portrayal of the beliefs of the architects who were interviewed regarding these topics. However, it is critical to understand that the goal was not to draw generalizable conclusions. The methodology chapter is primarily based on Lincoln and Guba's (1985) Naturalistic Inquiry and prior qualitative dissertations at Texas A&M University chaired by Dr. Yvonna Lincoln (Gonzalez, 2004; Leffel, 2002).

5.1 The Researcher

Lincoln and Guba (1985) state the advantages of using humans as instruments. Some of these advantages are the ability to respond to multiple cues, to incorporate expanding knowledge into the research base, and to obtain clarification and summarization. The most useful of them in this study was the ability of the researcher to remain flexible, adaptable, and sensitive to the research and the participants as their stories unfolded. Guba and Lincoln (1994) suggest that the only way to capture the knowledge inherent in lived experiences is to use another human being as the data

collecting "instrument." In this process the study of human experiences must include subjective experiences of the researcher.

The researcher cannot enter the study and leave his own personal beliefs and ideologies behind, "like baggage left at front door." My interest in the study was quite straightforward. I was an architect curious about the inherent qualities of architectural form, specifically curvilinear forms. The choices designers make regarding architectural form seemed to be ranging from the simplest and easiest approach all the way to completely whimsical choices. In all cases, most choices were curve free. I wanted to know the reasons behind these decisions.

As I was forming my research, discussions brewed among faculty members concerning inherent differences between architects and non-architects. Such differences were supported by prior research (e.g., Devlin, 1990; Devlin & Nasar, 1989; Duffy, Bailey, Beck, & Barker, 1986; Friedman, Balling, & Valadez, 1985; Groat, 1982, 1994; Hershberger, 1969; Nasar, 1989; Nasar & Kang, 1989; Nasar & Purcell,1990; Purcell & Nasar, 1990; Stamps, 1991a, 1993; Vischer & Marcus,1986). More specifically, sometimes architects create spaces that, even though they find them fulfilling, their clients might feel quite the opposite. Some researchers went as far as claiming that architects and artist are sensation seekers and thus separating them from the general public from a physical perspective. Although when looking at the published papers they seemed very legitimate and followed a clear line of reasoning, I found such claims at odds with my own experience as an architect in the profession.

Since this personal experience played a central role in the qualitative section of this research, choosing an effective style and method of writing became very important. In her book Hertz (1997) suggests having an "ongoing conversation about the experience while simultaneously living in the moment." In this method, reflexivity is a process of self-conscious awareness, of learning who we are as researchers, and who we are becoming as we interact with other participants. As I proceeded with the first few interviews and subsequent transcriptions, follow-ups, and memos it became evident that if the process is followed as prescribed, reflexivity is almost automatic.

5.2 Theoretical Paradigm

In order to select the correct method of inquiry, the researcher needed to focus on the nature of the issues at the core of this investigation. Do architects react differently to building forms compared to non-architects? How and why do architects use curvilinear forms in their designs? Why is there so little of it in the built environment? What separates star architects from other? After considering the problem and the questions it raised, and taking into account the end product, the naturalistic paradigm was selected to design this section of the study. It is critical to understand that such a method requires us to accept different constructions of reality. Just as the inquirer carries a unique perspective of the world created through his experience and knowledge, so do others in making sense of the world.Lincoln and Guba (1985) developed five axioms, or basic beliefs, that are central to the naturalistic, or qualitative, paradigm. The following sections explores each axiom and its bearing on this study.

Table 5.1: Contrasting Positivist and Naturalist Axioms

Axioms	Positivist Paradigm	Naturalistic Paradigm
The nature of reality	Reality is single, tangible, and fragmentable	Realities are multiple, constructed, and holistic.
The relationship of knower and known	Knower and known are independent, a dualism.	Knower and known are interactive, inseparable.
The possibility of generalization	Time-and context-free generalizations are possible.	Only time- and context-bound working hypotheses are possible.
The possibility of causal linkages	There are real causes, temporally precedent to or simultaneous with their effects.	All entities are in a state of mutual simultaneous shaping, so that it is impossible to distinguish causes from effects.
The role of values	Inquiry is value-free	Inquiry is value-based

(Lincoln & Guba, 1985, p. 37)

In the first axiom, it is argued that multiple constructed realities "can only be studied holistically" (Lincoln & Guba, 1985). When considering the complexities of the architects, their clients, their design process, architecture profession, and the construction industry, only a holistic research approach can provide meaningful concepts.

The constructivist approach also assumes that the researcher and the researched interact to influence one another, which brings us to the second axiom (Lincoln and Guba, 1985). For instance, there were many situations in which the respondents thought that the research questions had inherent flaws, which in turn steered the researcher in another direction. There were also situations were the interviewee was pressured to address an issue that he or she had never approached before, consequently both parties

(interviewee and interviewer) developed new understandings towards a certain subject matter. These emergent interactions were continuous and consistent throughout this study.

In the third axiom, Lincoln and Guba (1985) state that "only time-and-context-bound working hypothesis are possible." This rejects any expectations of generalizations for the outcomes of this study. For example, finding the design method and process of a architect is unique to that architect and within the context of a specific project. Some architects even explained how their design process has changes at different stages of their career. While these findings should not be construed as representative of all architects, some of them may be transferable to other, similar situations.

"All entities are in a state of mutual simultaneous shaping, so that is impossible to distinguish causes from effects" (Lincoln and Guba, 1985).

It is not the aim of this study to link curvilinear forms to good architectural design. Nor is it to claim any direct cause and effect relationship between such forms and one particular emotional feeling. Instead the focus is on the dynamics of the space experienced, the individual experiencing it, and the context in which such encounter takes place. The assumption is that linear causality cannot explain such relationships and would not be in alignment with the dynamism implied in qualitative research. This summarizes the concept of the fourth axiom in relation to this study.

The fifth axiom revolves around the question of value. Research conducted within the natural setting recognizes that qualitative research is "value-bound" through the interaction of subject and researcher (Lincoln & Guba, 1985). Having this in mind,

care was taken to minimize the researcher's own values when engaged in data collection activity. For example, an attempt was made to not express personal design beliefs, attitudes and opinions during interview. This turned out to be one of the most challenging parts of the qualitative data collection.

In broad terms, the spirit of such methodology is best explained in the following paragraph. It was only through such a vantage point that the researcher could synthesize the data, whether it was qualitative or quantitative, throughout the life of this research project.

> Constructions come about through the interaction of a constructor with information, context, setting, situations, and other constructors (not all of whom agree), using a process that is rooted in the previous experience, belief system, value, fears, prejudices, hopes, disappointments, and achievements of the constructor. To fall back on the terminology of the philosophy of science, constructions come about by the virtue of interaction of the knower with the already known and the still-knowable or to-be-known (Lincoln & Guba, 1985, p.143).

5.3 Research Design

The first step in designing this research was selecting architects to be interviewed. Since the focal point of the study was about architectural form, the potential architects had to posses a portfolio of built work that predominantly used "expressive" architectural forms or in other words, architecture with forms that stood out and was beyond the ordinary. Moreover, since the researcher was more interested in curvilinear architectural form, selecting architects that used curvature in their designs, further narrowed the number of potential interviewees.

By using expressive forms, such architects' buildings would visually stand out from the rest, which brings us to one of the main research questions. It is reasonable to assume that such buildings would attract more attention, discussion, and controversy from the public or their clients. So in fact by sharing their experiences with their clients, we can attempt to see the "non-architects" perspective.

Purposive sampling is a nonrandom method of choosing respondents (Lincoln & Guba, 1985). The researcher "begins with the assumption that context is critical" (Lincoln & Guba, 1985, p. 200) and purposely selects a sample (people to interview, events to observe) which are expected to provide a rich array of information. The object of purposive sampling is to assure that a multitude of points of view is experienced (Manning, 2000). This is central to this research since it is difficult to find architects that agree with each other on design issues. Several factors determine the purposive sample of the architects. The criteria for selection for the study included: style of design, fame, expertise in the field, diversity, and accessibility to the researcher, the latter which proved to be one of the most difficult characteristics of the interview process.

Purposive sampling was used to identify signature architects all over the United States (See Appendix I) After the first few interviews, respondents were asked to suggest other potential respondents, thus creating a loop of purposive "snowball" sampling that identified participants who otherwise might have been overlooked (Lincoln & Guba, 1985; Patton, 1990). There were two female architects among the 11 architects interviewed. Female architects make up a very small percentage of the United States general architect population and even fewer are considered "signature architects." For

this reason it was exceedingly hard to create a gender-balanced sample. Even with the two female architects mentioned, one was a Dutch architect practicing in the United States and the second architect worked as part of a husband and wife team.

Researcher used personal contacts to generate the first few interviewees. These personal contacts were senior architects that worked closely with him in professional practice and during the length of the research. At the same time, about 40 candidates were selected based on their work and degree of fame. This process involved examination of prominent US architectural magazines and recommendation from interviewed architects themselves. Letters were written and mailed to them introducing the researcher and the topics under study. This resulted a total of 11 interviews.

The media frequently mentions the architects who were interviewed and their work is largely respected by their peers and sought after by clients. Among those who were used in this study, four have received the Pritzker Architecture Prize, which is the most prestigious architecture award that an architect can receive.

The investigator was the primary data-gathering instrument, in accordance with the constructivist methodology that states, "the researcher, by necessity, engages in a dialectic and responsive process with the subjects under study" (Lincoln & Guba, 1985, p. 44-45). The researcher entered the inquiry as a learner as well as an architect. This provided a unique perspective on the architects that he interviewed and observed. Flexibility and training in constructivist research allowed the researcher to adjust to the respondents' varied and numerous realities, evaluate the interactions, consider respondents' tacit values and beliefs, and guide the study as it took place.

A general and broad interview protocol was developed early on as the study developed. This was used more as a guide, since the nature of the interview was unstructured. A sample of this protocol was mailed to each participant before the interview (Appendix G) with an overall explanation of the study objectives. On numerous occasions the direction of the interviews digressed considerably from the designed protocol. Here, the researcher adapted willingly as the interview progressed to unfold new perspectives on the subject at hand.

The constructivist method requires us to look for new questions as they are continuously emerging as the interaction between the researcher and phenomenon begins. Some of the original questions of this study were:

1. How do you think curved forms affect people emotionally?
2. Why and when do you use curve forms?
3. How do you clients respond to such forms in the design process?
4. Do you think that regarding architectural form, architect might have a different response than non-architects?
5. Why don't we have more buildings with curvilinear forms?

During the course of the interview, existing questions were modified and new questions emerged. For example, questions tended to move away from a focus on curved forms per say and instead include a larger category of unusual or unconventional forms. Some of the new questions were:

1. When comparing your work to other architect, it looks different. What makes it so different?

2. When you utilize such forms and materials, how do you go about controlling the cost?
3. Have you ever had a disagreement with a client? How was it resolved?
4. What was your design process in this project and how did you make decisions regarding architectural form?
5. How do you involve the client in the design process?
6. There are some researchers that claim architects respond differently from non-architects to the built environment both psychologically and physically; what are your thoughts on that?

Besides the actual interviews performed by the researcher, other sources were used to provide the qualitative data in this study. These sources were books and articles written by the interviewed architects as well as architectural journals and previous documented interviews that they had done. Also, there were two architects whose work and insights were particularly valuable to this study, but were not available for interview with the researcher. In these two instances, their documented recorded interview was obtained on video and were transcribed and then analyzed in the same process as the rest of the interviews.

5.4 Data Collection

The qualitative data was collected from four sources. The first source, which made up the majority of the data, was produced through interviews with the selected architects. Participant observation was used as the second source. Relevant records and documents

comprised the third source and finally previously recorded documented interviews with architects (by others) represented the last source of data.

Spradley (1979) discusses the advantages of unstructured interviews for the inquirer. Such interviews provide control over direction of questioning, spontaneity of the participant, length of the interview, overall flexibility and the level of complexity. One of the most precious advantages proved to be the prospect of observing non-verbal behavior. How did the architects operate in their working environments? How did they interact with their employees and colleagues? How did they react to the subject being discussed?

The interviews enabled the researcher to elicit responses that corresponded with the interviewees' actual thoughts, opinions, beliefs and experience concerning architectural form, design process, and architect-client relationship. An attempt was made to end each interview with an informal member check. This is the process in which the participant was asked to verify, amend, and extend the constructions, reconstructions, and speculations offered.

On average, the interviews took about an hour to complete, although some lasted as long as two hours. All interviews were audio-taped with the consent of the architect. Participants were given the option to remain anonymous. Most participants chose to remain anonymous. As a result, names, place names, and other potential identifying factors have been omitted or broadened to respect the participants' wishes. The location of the interviews was left to the participants to choose. Most were in an office setting, but some were performed in more informal settings, such as a private home, workshop,

or a coffee shop. Eleven interviews took place in 8 different cities in the United States.

While interviews were progressing, the open-ended interview protocol was continuously being revisited and revised. Demographic information were also obtained from the architects such as their professional timelines, their first encounter with architecture, their mentors, their professional experience, architectural education, and experience teaching architecture. Such data was essential in understanding the framework and context of the data obtained from the interviews.

Observations of architects helped the researcher in understanding the various differences between the architects interviewed. These differences ranged from things like manner of conversation, overall world perspective, and line of reasoning to more professionally linked activities like going about daily design routines. In reality, the respondents provided a plethora of information. Digesting the information was difficult as some feedback was contradictory, some irrelevant, and much was politically laden. For example sometimes interviewees seemed to talk more about their professional agendas rather than the subject of this study. Participant observations helped sort through such data, and increase ease and confidence.

These observations were kept in a reflexive journal, which included in addition to researcher's experiences while conducting the research project, a description of the works by the architects, a description of the architect's buildings experienced by the researcher, a description of the people associated with the interview, and location of the interview and culture of the location (for example architects interviewed in California were different from those in the east coast).

Two peer debriefers were selected for this study. One was a doctoral candidate and the other a partner at the architectural firm of the researcher. Both were registered architects with more than 30 years of experience as designers. Furthermore, they were quite familiar with the work of the interviewees and the subject matters under investigation. A debriefer must be "someone who is in every sense the inquirer's peer, someone who knows a great deal about both the substantive area of the inquiry and the methodological issues" (Lincoln & Guba, 1985, p. 308).

Confidentiality was important in assuring that information was freely given. It was provided in compliance with the consent form signed by each respondent (see appendix H). The researcher followed these standards to assure confidentiality: 1) identification of all participants by a code; 2) omission of details that could attribute quotations to specific individuals; and 3) omission of details that could identify any of the participants.

Even though all the necessary measures were taken to assure anonymity, it is still possible that readers might associate participant comments with specific buildings and eventually indirectly discover the identity of the interviewed architect. The main problem was that the interviewees, their designs, and viewpoints towards architectural design are published and taught in numerous schools of architecture. After referring to literature and consulting with advisors, such risk was considered acceptable for the purposes of this research.

5.4 Data Analysis

After the interviews were audio-taped and completed, each interview was

transcribed. At this point the content analysis method of Lincoln and Guba (1985) was adapted to analyze the data. This method emphasizes that the investigator should continuously interact and interpret the data thus leading to what Lincoln and Guba referred to as "emergent design." Understanding the concept of emergent design proved to be key in performing the analysis process. During the initial interviews, the researcher was overwhelmed with the unpredictable nature of the interviews and its corresponding data. At some point during the struggles, it was accepted that changes were inevitable (main characteristic of emergent design). This was a major turning point in the qualitative section of this study.

Another critical word that applied to almost every architect and each subject discussed was "context" (see Lincoln & Guba, 1985). Context was imperative in understanding their thought processes, decision-making, design, and buildings. Indeed it was discovered that judgments about building forms are critically dependent on the context in which the building was perceived.

From this point, the analysis of data was performed with the step-by-step procedure explained by Lincoln and Guba (1985). After transcription of interviews into Microsoft Word computer files, the data was then broken down into units of information. These units were the smallest piece of information that could stand alone and still remain comprehensible. The units were numbered and coded by initials of the architect interviewed, location of the interview and date. A code was also created for indicating the categories in which they would later be placed. Then, each unit of information was printed on a 4x6 white index card. Although this process produced approximately 1900

index cards, the coding helped immensely in organizing and tracking the data.

Next came the difficult process of categorization. The naturalistic inquiry process is illusively straightforward and simple. The first card is studied and put aside. The same process is replicated for the second card with the caveat that if the contents are similar or relevant to the first card, it joins the first card forming a group. Otherwise, it is set aside to create its own possible group or category. This process keeps repeating in a loop until all cards are consumed in stacks of different categories. Some cards did not belong anywhere. There went into a category dubbed "dark matter" by the researcher for miscellaneous cards. A name was assigned to each category to identify the essence of the properties that linked the cards.

As suggested by a Lincoln and Guba (1985), set of rules started to develop for each category as the card-sorting progressed. These rules, along with the name assigned to the category, were printed on a colored index card and placed on top of each stack. If an index card about to be processed was in tune with the establish rules, it was placed in that stack, otherwise, either the rules were modified or the card belonged somewhere else. By and large, a high tolerance for flexibility and change were the two qualities that made this task possible for the researcher. For example, the set of rules evolved at least three times for each category. Cards that once seemed to belong to one stack, appeared as if they were misplaced the next day. A lot of cards belonged to multiple stacks at the same time. Such cards were duplicated and each copy was placed in corresponding categories. On multiple occasions the decision about unitizing the data was made incorrectly. The apparent meaning of the cards in question were out of context. In such

scenarios, immediate cards in the vicinity of the card in question were tracked and stapled to the original card.

The researcher wrote more memos in card-sorting stage of the qualitative process than the rest. These memos were mostly in form of ideas and concepts as new categories emerged and provided potentials for new insights and perspectives in the field of architecture and design process in particular. A lot of these ideas were shared with the peer debriefers and discussed regarding their importance for analysis or interpretation.

5.5 Trustworthiness

To ensure the study's integrity and aptness of the methods employed, Lincoln and Guba (1985) introduce four criteria or strategies for qualitative researchers. The strategies are: credibility, transferability, dependability, and conformability.

Credibility assesses the "truth value" of the inquiry and is a concept compatible with the positivist view of internal validity. For the purposes of this study, credibility was achieved by employing multiple peer debriefers, long lasting interviews and observations, audio-taping to ensure constant access to original source and using a triangulation method. The latter is accomplished by using multiple resources such as biographies, documented interviews, critiques, and prior body of architectural work.

Transferability is a method by which working hypothesis and findings may be applicable in other settings if the fit between settings is appropriate (Lincoln & Guba, 1985). This relates to the positivistic view of generalizability. Here, the second-generation researcher using this study must be attentive and sensitive of the original

context as he or she seeks transferability. “Thick description” was provided to establish transferability among contexts. Such description included all biases related to the researcher such as an architect, educational background, cultural background, opinions and emotions. This way the burden of transferability relies on the reader as she or he judges all possible personal biases for appropriateness of context.

Peer debriefers and advisors provided dependability as the study progressed. The design, interview protocol questions, question revisions, architect selection, and finally making sense of data was discussed with these two groups at phase of the design, data collection and analysis. The methodology selected for such research was executed as closely as possible to what the literature had provided and reviewed by advisors. This provided another layer of protection for assuring credibility.

The last criterion is confirmability, which is somewhat congruent to the positivist notion of objectivity. This study is far from objective but as far as confirmability is concerned, triangulation, peer review and reflexivity of researcher were factors that helped achieve this goal.

"If you want people to understand better than they otherwise might, provide them information in the form in which they usually experience it" (Lincoln & Guba, 1985, p. 120). The audiences of this study are more likely to be designers and architects. Therefore, it was important for the researcher to use a writing style that was simple and flowing. Care was taken to include as many quotes as necessary to portray the right “context” in which all discussions and subjects took place.

CHAPTER VI

QUALITATIVE DATA ANALYSIS

In this chapter each emergent category from the interviews is individually discussed. The categories evolved through the process of content analysis as discussed in the qualitative methodology section. The chapter is comprised of thirteen categories with some divided further into multiple subcategories. While reading this chapter, it is essential to note that in this section we only look at the interviewees' perspectives on the topics discussed. Moreover, almost all the interviewees were among those who are referred to as "signature or star architects" and their views are not necessarily that of ***all*** architects. Some concerns were raised with the research questions by the architects interviewed, which is discussed at the last section of this chapter.

6.1 History of Architects

Most of the architects had some background in the construction industry before they ever started getting officially involved with architecture. This background could be anything from being from a builder's family to a having an early side job as a carpenter. It is interesting to note that in addition to a construction background, there was generally some exposure to art early on as they were growing up. Having a musician as a parent, growing up with friends that became artists and early obsessions with art in school are a few examples of this exposure.

> …I myself [am] a son of a builder, and I was growing up in the family where quality construction, quality is a fundamental element. And Chicago architecture is, is basically about well-done, solid, robust, well-crafted

> architecture. I mean the history of Chicago is there. It's more than that, of course, I realize. But it's also about that…
>
> …I was born in Genoa, it is a sister city of Venice. I had been studying in Florence. When you grow up like that, you have under the skin that sort of struggle for beauty…

Most of them have gone to very prominent architectural schools in the US and abroad. More than half of the architects interviewed had some sort of association with GSD at some point in their life. This created an environment that was very nourishing to creativity, which was the core emphasis in these establishments. Later on in their careers, they all continued this relationship in academia by teaching design in the same group of prestigious architecture schools.

After formal architectural education, most of them tend to seek apprenticeship with star architects of their time. This was another critical step in their evolution into sophisticated designers. At this stage they got exposed to how leaders in the field were operating, resulting to a hands-on experience with real-life architecture.

> …Following the death of Frank Lloyd Wright in 1959, [he] sought out Goff and obtained a position with his office, to the thorough grounding in creative compositional technique gained at Taliesin, [he] added the experimental, highly creative attitude toward building materials that was such a prominent characteristic of designs by Bruce Goff. …

The next stage is to become recognized on their own merit. Most of the interviewees had more of a "polymath" quality rather than being just architects. In a sense they did a little bit of everything. They had a good sense of the business side of architecture and made sure they could handle the number of jobs they accepted and maintain quality. They slowly created "credibility" leading to bigger financial support as they went along in their career. This meant starting with smaller projects (mostly houses) and forcing

oneself to work within the fees given. All through these "tough" times, they did not loose sight of their passions, be it music, sculpture, engineering or painting. This was one important source for their inspirations. This is how one famous architect describes one of the interviewees:

> …[he] is a polymath, a kind of genius. These long jumps he makes into the unknowns of structure and imagery... I find his personal capabilities for problem solving to be similar to the great minds I have known in physics, chemistry and biology. However he has a more pleasant personality, an ability to transmit enthusiasm, and a personal magnetism that many of the scientists did not have…

One common characteristic among them is that they are never satisfied with the buildings that they see around them and even their own work. Their career seemed to be driven by not what they see and like in buildings but rather what seems to be missing.

> I didn't think it was that good when I finished it…I didn't. No but I think that's the engine that makes me go. If I thought it…if I did any other, I wouldn't be able to do it…

As they begin to mature in the profession, the type of projects they undertake is highly affected by their overall approach towards architecture. In short they rarely take jobs that are against their principles in design. For some, their work has been more about the "psychic issues" (psychological affects of space) that they have been trying to work through by means of architectural design. For all these reasons, projects that involve more artistic activity like museums and concert halls seem to be more attractive battlegrounds to exhibit their creativity. With the right client, residential architecture is another common type of project among their portfolios. This is due to ease of program, small scale and efficiency of such projects.

> …he said, do you like this house you're in? I said, yeah, I do. He said, well, if you like this, you can't possibly like the place you did for us. And I said, yeah, it's not as good, but, you know, I did it. He said, don't do that anymore. So we had a drink and we decided that we weren't going to work together anymore. I was going to stop and start it over again…

Architectural historians may argue that only time can seal a building's worth, that what may seem appealing today may fade in tomorrow's daylight. Just like buildings, decades of experience are required for a designer to develop "a language and the technical proficiency" enabling him or her to create architecture of significant value. It is not a coincidence that most celebrated architects created their important work very late in their career.

> …I didn't drop out of a tree one day and there it was. It's taken years to do… It's strange how some kids can manipulate the system and, and become rock stars in their thirties, but I don't know whether it lasts. I don't know, I hope it does. I mean there's lots of ways to skin the cat, I don't think my way was the only way it just happened to be my time and the cards that were dealt me and I just worked with them.

6.2 Stars

> …Often their work seems willful or unrealistic, while your responsible work is bathed in regular, laborious effort to meet client needs or match excruciatingly tight budget…

There seems to be some debate about what is known as signature or star architects. One architect believes "architecture sculpture" is what star architects are interested in. Another interviewed architect sees it as a design approach that is very "personal." One distinct aspect of their work is that it certainly stands out from all the surrounding architecture. This mainly due to using engaging shapes, forms and materials in their

designs. “Formal exploration” is the term often associated with the design process of star architects.

> …You know that he is after a complex form that isn’t going to just simply draw a complex form or it has to be a kind of intellectual way that gets you there...

Sometimes you can recognize a specific star’s project from the form composition and material used in a building, causing some critics to state that their buildings look quite the same. Stars themselves don’t see this necessarily as a negative outcome. They approach the issue more from an artist’s point of view. One architect compared this phenomenon to works of the sculptor Richard Serra. His sculptures are very distinctive and tend to be very recognizable. This fact does not devalue or degrade his sculptures.

> …In addition, often star architects bring a sense of courage that most other architects lack, exploring ideas, testing new systems, voyaging first where most of us dare not go…

Taking risks is a big part of being a star architect as is the case with creating anything that defies convention. But risk alone does not guarantee great buildings; star architects have a never-ending struggle for “well crafted work”. They can elevate the building to another plane by their craft, skill and experience. They are very focused when it comes to their design process and sometimes their behavior portrays an image of “arrogance” to outsiders.

Almost all stars are interested in the architectural theory and try to explain their designs based on its principles. In numerous instances these are the people that advance and create new theoretical concepts. . There is very little interest in their work in looking back to architectural history and preserving a continuum, rather, they tend to be more

progressive and on the look for new unexplored fronts in architecture. They are also known to have their own “vocabulary” or “design language”, although there is not a tangible definition of what these phrases mean. When asked about his “identifiable style” one architect responded:

> … I think -- you see, I pay a lot of attention by creating my own vocabulary. Indeed, many of those sculptures and the whole work by drawing and painting has to do with that. Because indeed, you see, you mature by working in abstract terms, you see, and getting into the problem of giving form to things And these create a vocabulary, you see, like a language And I apply this language in my architecture, because that probably, the architecture, is easy to be identified …

Another star architect talks about the importance of “playing” in his design. He believes that most people tend to stop playing at some point in life as they turn into adults but most “creative entrepreneurs” maintain a spirit that allows them to not loose touch with this basic activity that originated in their childhood. In an architectural sense, this translates with stars that have offices with a relatively informal structure that allows architects to engage in “playing” in the design process.

It is noteworthy that stars are more interested in designing buildings that can showcase their artistic abilities in shaping buildings. For example you are not likely to find numerous healthcare facilities designed by star architects, but you would expect a lot of familiar names when commissioning architects to design museums. Their projects tend to be located mostly in large metropolitan centers in the United States; rarely you would find their work in an unfamiliar small town in Middle America.

We must not loose site of the fact that these architects are nevertheless human and they themselves admit that occasionally they make buildings that are “bad.”

Sometimes for every one project that gets recognized many star designs never get mentioned. This is the reality of such architecture and should not be regarded as a weakness.

In a sense, they are our explorers. They keep looking for new ways to advance the discipline of architecture and are continually interested in "asking question, in not accepting conventional solutions, and investigating architecture as to its possibilities". For example in designing an educational facility, more effort goes into the larger, iconographic discussion of what the building means as a social cultural statement and how it participates with the broad envisions of the campus and university environments.

> …and this makes me a certain type of architect that is interested in certain type of issues and pushing things and looking at things and that's the architect that I am known by and anybody who know architecture, knows which architects those are and there are more exploratory and that's interesting for them and that's where I fit when I am put in shows or magazines and people connect me to the same people and again, there is not very many people like that, maybe a hundred or so in every given time in the world and they know what those architects do…

Lately there has been a growing demand for buildings that have an image of power and idiosyncrasy that allows companies and businesses to represent themselves with unusual architecture. Such clients are searching for an architecture that distinguishes their product and their vision. They are looking for architecture that serves as an "icon". Some consider this a new trend since most radical and experimental architecture recently existed outside the conventional business world.

Stars make up a very small percentage of the architecture profession, yet they get most of the media attention while other hard working architects stay in the sidelines. "The world is much more interested in the spectacular building than the urban

development". But their fame is not by coincidence; they keep producing buildings worth examining. Although some have earlier works in their careers that are not as mature or resolved as needed to be which drew some criticism, It would not be surprising in general to know their designs attract a lot of resistance.

Overall their work tries to change the way we think about architecture in a positive way. They are looking for the possibility to entice or encourage people who normally don't pay attention to this "type of subject matter".

> …you see, so they survive us, and they are -- they -- let's say we should have started also thinking that we are doing a legacy, you see, to the next generation. We are not only receiving, you know, a legacy, but we're delivering a legacy, very important part of it goes by the built environment and the quality of the building environment that we deliver…

6.3 Links to Architectural Theory

Even the most renowned architects struggle with the question of "what is architecture and what does it do?" In this section we discuss a number of different perspectives provided by the interviewed architects. The general understanding among the architects is that architecture is about "making space" by "humans". Therefore we can associate all inherent qualities applicable to human activities, to architecture.

> …Architecture is not imposed, it doesn't fall from heaven, it doesn't rise from ground spontaneously, architecture is a physical embodiment of human idea and the idea can rise from a number of places…it [architecture] is our creation and therefore questionable and arguable and imperfect…

You can take every rule in the universe and apply it to a project; you can follow all the classical and neoclassical cannons and still make "atrocious" buildings. There is an

element in architecture that involves human talent and the ability to combine component parts.

In many ways architecture is about "asking questions and figuring things out," but the product of this investigation affects "how we live, how we work [and] the kind of people we are." It is also ironic that definitions of architecture, like any other human construct, keeps changing through time. Architecture is regarded as a "very conservative field" and there is usually a lot of controversy when changes come about. Currently, the driving force in changing architecture is "more invention and exploration". These inventions are not necessarily technological, they can be social developments as in "pleasure to think or project a different world, a better one."

> …We're starting to understand how important the role of architecture is in determining the quality of our life…the configuration of our environment, the quality of our cities…

Replicating (copying, extracting, mimicking, using motifs, etc.) from past history is not highly regarded among some of the interviewed architects. History is useful if it guides us, focuses on a comprehensive perspective to allow us to solve our problems in the present but the honor accorded to simply "old" is "ludicrous." "The world is made of more and more new and less and less old". Our cities have been reinvented with people spending most of their time in spaces that did not exist a few decades ago and at the same time the power of history has become weaker since there is less of it affecting our daily lives. And yet some still yearn for a colonial style house.

> …Promoted as the only cultural value capable of finding a viable constituency in the public realm, "nostalgia" is imbued in the hope that the

> social relationships and accompanying values, the simplicity and security that took place in some historic context, can be evoked again…

Architecture can be a main source of attraction and this concept has been used throughout history. It is not a new idea for someone to use monuments and buildings to designate political prowess. One architect believes the difference is that in the last century this phenomenon has been evolving and accelerating due to new human advancements. People are drawn to cities that they perceive from afar on a freeway "like bees to a hive" and the city projects an image that constantly changes as they approach from an automobile or a train. "These things don't require an architect to know they are there" but architects use this "attraction" as a powerful tool to absorb people to museums, town centers and places they want to revitalize.

> …And it's obvious that buildings are becoming billboards all around the world. You go to China, you go to Japan. And Venturi was right about learning from Las Vegas, or you go to Time's Square. And it's all there… …because there is energy and power and movement and social interaction and all those things that aggregate works of architecture can provide…

It seems that these qualities are more intensified with buildings that are regarded as an "object". Some refer to it as "sculpture architecture" or "monumental buildings", nevertheless all interviewed architects were trying hard get the "object-ness" quality in to their design. It is important to note that monumental buildings "survive us". This timelessness is an inherent quality of architecture and it this feature that fascinates the architects. One architect is cautious about such approach. She warns that attraction at any cost could have devastating affect on architecture, what is referred to as the "theme park museum" affect in recent years. These are carefully recreated buildings and scenes

that you can go a few steps or miles to see instead of the real thing. One architect talks about creating timeless designs:

> …Phillip Johnson gave a lecture once that I attended where he said the greatest buildings in history are one room buildings, and that resonated with me that of course because the one room, the program is, is not paramount, a one room building I mean it's going to be a shelter, it's going to be for something, but the program isn't complicated so that the creation of the space isn't hampered by a bunch of toilets and circulation and stuff like that. It's pretty powerful. It's as close to the moment of truth that I believe a painter has when he faces a white canvas…

Interviewees believed that one of the most important roles of architecture is to educate people. They create environments that somehow "engenders or inspires thinking, optimism for future." One architect gave an example of how a curved path guided people and students who are not necessarily interested in arts, media, or architecture and the likes, "to experience the very things they don't give a damn about".

6.4 Myth and Meaning

> It's kind of a miraculous place actually...

Oftentimes we come across great architecture where design decisions that lead to it did not follow any rational logic. What architects create (or clients demand) is an outcome generated, among many considerations, by their beliefs and convictions, their attractions and aversions, and priorities dictated by their needs and abilities. Nowhere is this self-awareness more tangible than in the things we make. One architect was explaining how he positioned a series of shapes in a circle. When asked "what is the significance of it put in a circle?" this was his response:

> …Yeah, what happens here, it is that the figures relate to each other because they came all from the same -- let's say -- the same abstract thought. Imagine, for example, many things here move in the exhibition, but imagine when something moves, you see, let's say a line is moving into space, develops a shape. They are like a crystallized movement...

Lack of clarity and logic on some design decisions has made critiques claim that effort and money is put into design aspects that are not noticed and even if detected, they are irrelevant. Some of these design decisions are driven purely by a client's personal beliefs as well. They are as important as any other function requirement of the program.

> …You know some people are really sold on Feng Shui, and whether it means anything to anybody else, it means a lot to them...and whether it's right or wrong, it's something that if it is not incorporated in their design, it's going to bother them and it's very important and unless you know that, you are not really ready to design for them…

Architects discover, sustain, and impart symbolic meaning in the choice of form and material and therefore their buildings transmit identity. This is a very powerful tool in architecture that has been used throughout history over and over again. It is no coincidence that the star architects interviewed were able to utilize it skillfully in their designs. In almost all the interviews they attached meanings to the building forms they created. For example one architect talked about the "contrast between this flow of tension and compression" to be "erotic" and "vertical." The same architect talked about his design for skyscrapers so that they have a "sense of twisting and growing" like very tall trees. The list goes on: buildings that make you feel "embraced", "feel like moving fingers," a knife cutting through the sky or wings of a bird.

> … Symbolic content refers to the fact that student need more that the right square footage area, playground, appropriate restroom and other pragmatic needs. But costs bring them down most of the time to just that…

If groups of people start attaching similar symbolic meanings to a building, soon that building will have what is referred to as “autonomous life” or “monumentalized existence”. Examples of such buildings are all around us. Eiffel tower, Sydney opera house or world trade center twin towers are just a few examples that come to mind. This is a distinct characteristic of great architecture where the blue print for design is not necessarily in the shape of plans and forms but it is a series of mythologies, with every vantage point providing a chain reaction of different meanings.

Meaning and myth in architecture are intimately related to time. The context of architectural form changes through time and history has shown us that humans have adjusted to new architecture in time. Some refer to an architecture that has “memory”:

> …the challenge particularly in this project was, in the middle of all those conditions, you know, to achieve something who is pure, who is clean, who is understandable, who is easy to be seen and to move inside, and who preserve the monumentality in terms of monument for or the memory, you see, that we wanted to give to this building…

6.5 Architect or Artist: The Relationship Between Art and Architecture

“So there is no doubt that architecture is an art.”

All the architects interviewed agreed that architecture is art. Some were cautious with the wording and some very explicit but at the end, there is no debate here. They all unanimously agree that architects are artists. In fact they consider architecture an art with added layers of complexity. Artists normally don’t have to deal with issues like program, functionality, budget, setting and alike, whereas architects wrestle with these constraints every step of the way. One of the main reasons that people sometimes separate architecture from art is that the social purpose of architecture is being largely

forgotten. It is a social humanistic art, which creates environments, and it is the ultimate art because people are actually in it.

> Of course… Of course they're artists. But they have a much tougher role than most artists, because they have to make things that work. And it still has to be art…

If architects are artists, how does that reflect on what they produce? They have to be beautiful. Architecture creates beautiful and useful objects and at the same time, employs theoretical science and practical wisdom. The architects cite quality and beauty as main objectives. The complication is in the definition of beauty.

> …what is ugly and what is beautiful? I used to ask that all the time when I was kid. And it's still hard to define. I mean, there's people that write about that endlessly. And I don't think there is any—I mean, it's something you get attuned to. You see something that is new and when you first see it, it's off-putting…

The reality is that not everyone responds to great art in the same way but in the case of successful signature architects, people are able to see some kind of formal resolution of disparate parts in their work. This is at the core of understanding art of architecture. People respond to their buildings with a sense of "joy", "satisfaction" and "excitement". It makes them feel good. Such architecture had disappeared from the scene in the United States lately even though it kept flourishing in Europe. In the US, people didn't feel worried about how buildings are made, how they age and change. This process is part of their beauty.

> …People believe that beauty is just a romantic emotion like love, you know. I don't think they understand what they are talking about. Beauty is immensely intense emotion. It's so immense that is probably only one that can compete with power, money, victory, fight and all that without all the terrible consequences of those emotions….

> …is all a dream…it's wonderful, they are all wonderful challenges. They are buildings from a spirit of contributing with something new, but at the same time inspired by the idea of delivering something beautiful…

It seems that the trend is changing in the United States. Institutions and politicians have started to see that there is more to architecture than the functional approach. They are realizing that the artistic approach has a very important impact on people, and architecture has a tremendous capacity to transform their life and their living environment. An inspiration of a building is just as important as the building itself, if not more and we must not forget the beauty and inspiration in the interest of convenience, efficiency and productivity. We are seeing cities competing for an architecture that inspires and, has qualities of an artistic landmark that passes the test of time.

Looking at the larger picture, not every project needs to proclaim individual art. Some clearly need to engage collaborative effort. Some need to be at the level of shelter. There is room for all that. The profession includes a full spectrum of architects that design simple shelters to spectacular museums but the extent to which they use art, is what sets them apart. Like artists they take big risks with their designs. Artists take risks to do something new that no one has seen before.

> …But in my opinion, if you don't do it, you are not going to know. You are not going to. And you may not know why you are alive. We've had a lot of history of art has shown that as well. So—but it's comforting. Isn't it? And so I think it's a comforting thought...

Sometimes this can become a slippery slope and only experienced architects can pull it off. They need to have the construction and technological expertise to make it work, or it will look like it's " stumbling upon itself." The majority of architects are

somewhere in between, where they balance the art and the risk factor in a "rational" way. They do make compromises in favor of art, but they have to be "good ones, … give you a lot more."

> …It is incredibly important to have the rational philosophy behind your aesthetics…

But the inevitable question is how do they utilize art in their design process? As with anything involving design, everyone does it differently. It would be naïve to seek out a holly grail approach in finding the answer. However, there are similar patterns in their design process. They all personally engage in free spirited schematic drawings rather than words. This is believed to be a very spontaneous way of expressing themselves. They regard the product of their design more as an "object," which in turn influences decisions in the design process. For one interviewee it was a known fact. "You see, Indeed the sculpture precedes, without any doubt, the architecture."

> …I have never done a sculpture thinking it could become a building. It has always been working, you know, the sculpture for sculpture, as an independent discipline. What happens is that, you see, that once you stay in front of any sculpture, it can suggest to you, it can deliver to you the suggestion, this could be a building. Which is different. Do you understand?

As for their drawing technique, according to one account the architect starts with a white sheet and tries to bring a hidden building to life through series of graphic undulations. Mostly they are not involved with the daily business aggravations of the average architect. They don't spend time on developing the designs and going over details. Instead, they spend hours making drawings,

sketches, sculptures and models. More often, they are the only ones that can decipher them apart from a series of trusted and gifted lieutenants that work with them. This is how they explore architectural design, which they refer to as "research" and "formal exploration"

> …I say that and it feels like that. You know the Michelangelo slaves where you see the raw marble and these beautifully refined figures emerging from the rock and you could imagine Michelangelo chip chipping with chisel and creating this image and chiseling away and it's very similar…It's very powerful. It is as close to the moment of truth that I believe a painter has when he faces a white canvas…

Art enters at the earliest stages of the project, beginning from the programming, otherwise it will be too late and the artistic value of the design will equal that of "gift-wrapping." We will not see good designers stopping their design team at some point and telling them: it's time for art, start injecting it into the project. It is also important to note that most architects keep their clients updated with the artistic developments of the design on a regular basis so that there are "no sudden surprises" and avoid misunderstandings. They help their clients get a feel for the proposed space and formal composition so that by the end of design development they are excited about the art and uniqueness of their project.

> …So first part of the art comes in the initial decision making as to what the building is, what it is made out of? And how you manipulate the program? How you work with the clients to get a building form that makes artistic sense with the site… So even in the early stage there is already something logical and artistic happening. The programming stage for me is where a lot of art begins and I will have a site that has a very particular feelings…

"When I started in practice, I hung around a bunch of artists for many years…" Architects who use art in their design, associate with a lot of artists and take part in a

variety art activities. This could range from musical instruments to painting, sculpture and even poetry. Feedback from artists "is like food to them" and their architecture is largely influenced by it.

> you know just keep writing and damn it something will come out of it or go to a concert, or go look at a painting. It's just it does evolve and, and quite often, I'm sure what happened to me with the Morandi is I was struggling with this thing and then I all of a sudden I went and saw the, I went to a museum, saw the Morandi painting and said I see…
> … I just fell into the hall and started looking at all those churches and looking at the sculpture, and before I knew it I was studying the art of the time, the music of the time, the like I want to do, and I was totally captivated by that and I think underlying my work is a big chunk of inspiration from that.

6.6 Architects and Their Design Process

The design process is one of the most mysterious elements of architecture. There is no set method, technique or rule that ensures the outcome is a "good" piece of architecture. If anything, the interviewees steer us to the old cliché that the only rule is that there is no rule. Still, there are patterns and we will take a detailed look at them in the following sections.

6.6.1 Physical Models

> …If you just hold the model, I think you can know even the tiny amount…I think there is something tactile, not just purely tactile, but there is something about having a model, a pre-dimensional model, and as much as I admire something like AutoCAD… it is so complex that a computer can't do it..

All the architects interviewed, without exception, make physical models in their design process. Few make an effort to find time to make models personally and pass

them on to their design team for refinement. For every project they create multiple models at each stage of design. In some instances there were whole rooms dedicated to models for a single project. This is not the norm with the majority of architectural firms. The profession employs a variety of three-dimensional softwares as a fast and efficient tool to visualize their designs and convey them to their clients but “it’s just not the same”.

The clients understand physical models better. One architect explained how he starts with multiple massing models and, at this stage, they negotiate the overall “gross shaping” of the model with the client. Then they inch their way towards more detailed models like the proportions of interior spaces and volumes and eventually they make physical models of cabinet and built-ins. At this point, most other designers would agree with superiority of physical models to any two-dimensional medium. The immediate reaction of other architects would be to dismiss such approach due to excessive time and cost implications. So how do the interviewed architects work around such problems?

A common dilemma in the design process is that the final approved design is usually over budget. The architects do their best to do cost estimations but they are not the ones that actually build the project and therefore it is an educated guess at best. Three of the interviewed architects used models during design to engage contractors and keep the cost in line. Another advantage of using models is that both the client and the contractor can understand it much better than abstract two-dimensional drawings. Lets face it, in reality no human being will ever see plans and elevations the way they are drawn. Architects are trained to analyze buildings in such manner and even they

sometimes get confused. This avoids costly misunderstandings on all parties involved specially with designs that push the conventional boundary.

6.6.2 Design State of Mind

Successful architects wrestle with the same aggravations that the rest of the profession deals with. What makes them different is that most of the interviewed architects had a distinct "thought process" of their own which affects their design procedure. This intellectual exercise is regardless of the client, site or other constraints. It is very personal and is not tainted by works of other architects or contemporary architectural debates.

> …The beginnings of this kind of ephemeral image, and it's the way from those drawings I organize…., it's strange what I do, I organize the space of a building….I don't go in saying, this is a slam dunk, I don't know what I am going to do. If I knew what I was going to do, I wouldn't do it.

Most of them have a private refuge where they can spend time making hand drawings and models. Sometimes they create an office within an office as was the case with one particular architect. They have a few people with whom they feel comfortable working and explore preliminary ideas concepts. They also look for an "osmosis" affect from other arts and social issues. Music, paintings and sculpture are examples of activities that they try to extract ideas for their "thought process".

> … But more than that, you see, it is also a very spontaneous way to express yourself. Even in my studio as an architect, I have also a corner where I can -- where I can paint or draw…I continue doing that almost several hours a day every day. Very often you see that -- you see when you look at the amount of drawings I have done, that for sure, you know, it's a way to think ..... to think graphically.

Design is treated mostly as a "cyclical" exercise. Each designer can have numerous factors or requirements (objective and / or subjective) that start shaping the building from when the project initiates. They revisit these factors over and over again resulting in further refinement each time. They continuously try to come up with imaginative solutions that are not the lowest common denominator, by doing so their projects do not end up as a non-distinct washed-out version of their original vision. This process involves a lot of patience, stamina and most importantly self criticism.

> … You have to know what would happen if you just raise this you know..raise this a little bit or squeeze that a little bit…to do that you almost have to get to a certain number of mistakes…well I should have made this tall, I should have colored this different, I should have just used a different material or something so there is a lot of self criticism…

6.6.3 Site, Environment and Landscape

"Site" is another word that keeps surfacing when architects talked about their design process. Some argue that star architects design buildings regardless of location and site considerations. The interviewees seriously disagree; in fact landscape and topography are where they get a lot of their inspirations.

> …and I could imagine what that site…what things are missing from that place what the building could add to it and always I had this great sense that buildings can add to the landscape then don't have to just kinda have to occupy the space they can really you can leave the place a better place after you have done the building…

One architect goes as far as claiming that he designs "in partnership with nature" so the fist question is how would nature of the site solve this problem. It is also imperative that the landscape is not being damaged in any way by new design, especially

from an artistic point of view. The new composition needs to be in balance and have an overall coherence in scale and visual appearance.

> … this was a very difficult job for me, because it was in such a beautiful landscape. You can see here behind the mountain. And you see, I thought that through this form of the wave, I could create, you see, a way to approach a landscape in a soft way and integrate the building in the landscape.… and also to fit in this tremendous landscape and to find the right scale. You see, because in this place, if we have done a shallow building, it will almost disappear…

6.6.4 Materials and Methods in Design

It is quite evident that most of their buildings exploit different materials. It is important to note that their design does not stop at the spatial level but progresses in more focused details such as materials and methods. They bring a higher level of novelty and creativity in material selection and composition. One architect's design objective was to recognize (or not recognize) the different material, and their functions and their relationships to other materials.

> …and thinking as well about new contemporary materials and methods that are all around you.. you are reading about all the time and someone is exploring something new and switching with a new material with a new product those are all equally important to try … there is also ways of buildings cheaper buildings smarter buildings more powerfully because there is a difference you know..

New advancement in technology also play an important role in material selection. Some of the interviewed architects were always on the look for new engineered material. They wanted to know how they could push the existing design limits with new materials.

> …we are finally solving tremendous, demanding engineering problems. Using another material, not only steel and concrete and glass, or stone or ceramics, we are also using another material, which is light…

6.6.5 Concept and Idea

The dominating factor in the design of successful architects in this study was their devotion "to architectural concepts". This is considered to be rather a "simplified" or basic principle that all the design decisions have to adhere to. This is by far the most important element affecting the form and shape of the final architectural product. Ideas can originate from almost anywhere from art and science to social, historical and political issues so that the building is not only standing up and serves its function but also reflects some aspect of intellectual contemporary issues. Innovative concepts are responsible for great works of architecture but they do have their downfalls, specially when the architect is the only one who can perceive these concepts.

> …once a great plan appears, every juror or fellow student can acknowledge the power of idea, no matter how errant the method: Great ideas attract us with their own energy…

After a discussion about the use of form in his famous buildings, one of the architects anxiously made it clear that this is not the important issue. "I am not sure ideas originate in that form". He thinks instead of picking up what he referred to as "paraphernalia," it would be better to explain the project in an elementary way. All discussions bounced back to the original architectural concept or the "elementary way" as he put it. Most of these concepts are aimed to create an intense emotional experience

for the user. Some architects provide examples that provide an insight to their strategy for the integration of concept and design:

> ….I went and looked at it. And I had this idea. I looked at what the possibilities were. There were setbacks that -- and I could build out to it. I liked the two-story house. It was the only two-story house in this vicinity, so it had a presence. And I got turned on by the idea of letting it be intact from the outside. And that's how I started it. So I built a house around it…..

Another architect provides an example of a concept that has roots in sociological and educational domain. He believes that the majority of public schools are designed as "dull" buildings that are not engaging the students intellectually. In his view it should be exactly the opposite because a high school is shaping young minds that are very delicate at a time that is the most crucial in a person's life, which is between 13 and 17. So he designed a public school (with all the budget limitations of a public project) that looks unlike anything that students could have expected. At the post occupancy evaluations, he says they saw that the design concept triggered students' curiosity and made them more engaged. They wanted to come to this "cool" school and spent time in it.

A good concept is also what they believe brings that "timelessness" quality to their buildings. This is a very important part of the design process since every architect wants its creation to stand the test of time. This is one of the qualities that outstanding architecture must possess. There is a caveat though, it happens when the architect is the only one who is able to observe his or her concept.

> …Then I started moving on this thing, for example, twisting it, you see, so almost I will turn that, or making exercise like that, with the same number of element, you see, doing the idea of balancing into the front, you know…

6.6.6 Teaching Design

> …Because indeed, you see, you mature by working in abstract terms, you see, and getting into the problem of giving form to things…

All the interviewed architects were associated with teaching architectural design in academia. This is a very important in the whole process where they not only pass on the knowledge, but also absorb a lot ideas and methods from the academic settings. "One primary lesson from the design studio comes hard for the diligent: The best plans do not always follow the rules." There is also a lot of uncertainty among students. Design is unlike any other process that they have learned before in their life. The unlimited solutions, the uncertainty of its process and the unpredictability of a good design sometimes overwhelm them. In this situation one of the logical tendencies is to replicate their instructor, after all they are the star architects.

> ….Well, what I say to students is I give them a comforting story, that their signature, whatever they think of, whatever they are playing with that is theirs, that's not copying or that's not, where they try things on their own, that they are the only experts in that. So it's an unassailable expertise. Nobody can shake them, because it's theirs...

It is the same story repeated by architects. Young designers must "be themselves." Not every person has the same kind of talents and abilities. The aim is to discover one's talents and work with them. On the actual design technique, the message from the architects is to "keep going". Like everyone else they struggle and have "designer blocks" but there are so focused and experienced that they can get themselves out of it. The fact is that designing is a very personal intellectual exercise for them and each has developed his or her own mental strategy to reach the finish line fruitfully.

> ...Yeah, I don't think of it that way. I know I draw without taking my pen off the page. I just keep going, and that my drawings I think of them as scribbles. I don't think they mean anything to anybody except to me…
> …You find yourself searching for the image. Quite often I'll just go over and over and over and I'll draw twenty sketches, sort of searching for something, so it all doesn't come just like that…

6.6.7 A Different Style?

…We certainly don't have a style…

One of the shared qualities among star architects is their claim of not having a style. "Style" is a word that is looked down upon in the elite design community. It triggered considerable negative reaction among the interviewees and they go out of their way to make sure you understand they don't have style. If the designer is responding to the specific program requirements (location, environment, climate, culture, etc.), he is bound to create a different building with every job. In fact one architect believed that having no style is the only way to create "thoughtful architecture."

Most architects are forced to follow some other kind of "stylistic rule" by their clients and the communities they work in. As an architect, if you can avoid or resist this and have a reasonably sound design, your work will stand out from others. There is also a word of caution that such approach is a process that takes time and is bound to attract opposition.

> ….I don't think you have to pander, I think you have to stand up and, and let people know where you stand and you have to be patient...

An interesting observation was that overall the interviewed architects did not feel that their buildings were different or unusual. Their buildings are a result of the natural

logical sequence of decisions. By this line of reasoning, every building becomes special. What they don't want is to design "a general building" that is non-descript and basically a building that apart from serving a function, it's existence (or lack of it) would not make a difference in peoples' lives. The result becomes a specific building "by that architect, for that client, in that place" which is not according to a formula, a rule book or a collaborative prescribed playbook.

For architectural work, there is always some precedence. This is another important reality that every designer must grasp. "Design evolves from past designs"

> ….One thing I've learned is, everything you come up with , everything any of us does, there is already somewhere in history a model for it of some kind...

6.7 The Role of Nature

Most architects emphasized on the relationship between the natural environment and the built environment in some fashion. In their view human beings cannot properly grow and develop and be nurtured in an environment that is devoid of nature, and therefore architecture should be able to address such relationship. In general interviewees believed that contact with nature will have a "calming, soothing and holistic" effect on people. They thought that today's built environment not only lacks such links with nature but it is actually moving towards destroying it.

> …The greatest meaning that life has is in nature and insights of nature. If we are feeling badly, where do we go? We don't go to a building when we feel bad, we go out into the open air and lakes and streams and oceans and beaches…

The focus then turned on what exactly these natural elements are and how they make such difference in our daily lives. At the top of the list was presence or proximity to water. That somehow any water feature in our surrounding makes us feel more comfortable and happy. Equally important was existence of greenery, landscape and flowers, not only as a picture or a view from a window, but "bringing in the real thing" in our living environments. They want to promote designing environments that encourages people to care for plants and animals and by doing so it elevates their wellbeing as well as protecting the environment. One architect stressed on the significance of natural sound, smell and light on human behavior.

> …We kind of destroyed the circadian rhythms that we had. The melatonin levels in our body don't work to a natural rhythm of the earths cycle anymore. You and I don't know whether it's raining outside or not… we are in environments that are lighted whether it's day or night. It has the same light intensity...

In conclusion the conversation circled around methods by which architecture could address or change the current trend of disjunction between man and nature. One of the main recommendations was "to respect nature" and to avoid disturbing nature as much as possible. This disturbance includes visual intrusions well as physical obstructions. One architect passionately explained how his biggest challenge was to integrate a building in the vast Texas plains in such way that it integrates with the surrounding landscape. Use of environmentally friendly material was also highly regarded. Not all architects shared the same view. One warned about the threat of commercializing nature by using clichés such as "organic architecture" for promoting products rather than focusing on advancing architecture:

> …Is a bunch of crap. You can make all kinds of claims. I can't dispute that or confirm it. I don't think it's useful to me to say that something that is curvilinear has sexual connotations. I don't think that the term organic is useful anyway… Instead of picking up all this paraphernalia it would be better to explain the project in an elementary way…

6.8 Cost and Budget

Star architects design projects that on average cost more to build than other architects. This majority of the extra cost is not necessarily due to unconventional forms but other factors play a big role. First, the time and effort that designers spend on such projects is "many times more" the average building of similar scale. This cost directly gets transferred to the client, adding to the overall budget. In addition, there has been a growing pattern of corporate clients that approach stars to create an image for their business and they expect to set themselves apart. It is not surprising that such objectives are directly related to increase in project cost.

One architect called attention to the difficult task of the developers. He wanted architects to be more realistic and conscious of cost and timing in their design process. This group of clients is historically empathetic to unconventional or artistic side of architecture:

> … You have to understand what drives people to build buildings. There's a big economic imperative in it and you have to respect that You have to respect it not just say the dirty old developer or the greedy developer, because I've been through it a lot with them and quite often they go broke these greedy developers and they do play thin, close to the edge, and you have to respect that they are as surprised at the end when the thing makes money sometimes as, as everybody, but they don't know it until they get there.…

This warning brings us back to the overall role of the designer in the process. The first line of defense against unexpected additional costs is the architect. They hold all the elements that decide and control the budget. Some of these include the use of local material, scale and footprint, climate control and methods and details of construction. There must be a method of "constant check" to make sure that the design is within the confines and parameters of the budget and program. In larger projects only the most experienced architect can come close in controlling all these factors, which must be resolved before it is put out for pricing:

> Because when you do -- when you're -- usually you do a building, client loves you, design is done, everybody's happy, you put it out to bid, and guess what, it's over budget. The builder says, if you straighten out this wall, I can save you a million bucks, and you know if the guy doesn't have the million, he has to go that way, and all of a sudden the architect is marginalized …

Not all their projects are expensive, cost issue is less of a concern with public projects. Some signature architects, who actively accept commissions for schools or other federal and state funded projects, have no choice but to adhere to the strict budget and project guidelines. Since the rules are the same for everyone, they can set themselves apart by producing better results.

By and large interviewees agreed that when something goes wrong the process, "it is so convenient to blame the architects" But fear of responsibility must not discourage designers in perusing alternative and creative solutions.

> …becoming parental, the issue I was talking about earlier. If you want to stay in the race and not be marginalized when the costs go whacko and the client says, turns it over to the contractor and says sweetie get out of the way…

6.9 Architects and Non-Architects

One of the main questions that was put forth to the interviewed architects focused on the difference between the responses of architects and non-architects to the built environment. As mentioned in chapter II, researchers had suggested architects' response is biased because of their training, education and background. Some even have suggested physiological differences between architects and non-architects. Overall we see a rather strong resistance to these theories from the architects, which we will examine in the following sections.

6.9.1 The Role of Architectural Education in Perception of Built Environment

> …The fact that a surgeon knows what the constituents of the body are doesn't mean that he lives a fuller or better life or appreciates it any more…

One architect made the argument that maybe people are not able to articulate their architectural experience as well as a trained architect but most people will feel the same sense of "uplift" when they walk into a sacred building as an example. They are able to respond to "harmonious proportions" at a very elementary level and to identify this; they don't need any formal architectural education. Another architect was more forthright and thought that responses to buildings are the same for both groups and that such discussions "do not have to be intellectualized." Architecture that is "resolved" brings a certain amount of satisfaction to human consciousness and doesn't require education to do so.

> … I think these are things that are troubling. These are the things that don't require formal architectural education certainly to appreciate and I don't think that they require an enhanced vocabulary to be able to understand. They may benefit by it from a greater ability to deconstruct and dissect the component parts which an architectural education gives us but I know from personal experience that liberal art student not architecture student that go into Ronchamp are equally moved …

Nevertheless architectural education does have an affect on architects' awareness of the built environment. Although the human responses are "innate", architects develop a broader understanding of the nuances and details that they perceive in buildings which enhances their experience.

> …but studying architecture can enhance those innate "things", where you have a more wholesome and more sophisticated experience. And that comes from experience, and literally the act of making it gets clearer the more you do. You begin to understand how to make that space more clear the more space you make and that's part of what lies at the core of architecture: making space. But I still think there is this fundamental core appreciation that's human and I cant be argued out of that…

6.9.2 Architect / Client Relationship

> … then you see first of all to understand a lot about the people, because you are part of them, you understand them.

One way to examine possible differences between architects and non-architects is to study the relationship of architects and their clients. In general all interviewees agreed that the client feedback and input in the design process is essential and "agreement" is needed to go forward with a caveat that each must recognize the boundaries and expectations to the other party. Most architects witnessed "positive surprises", if any, as their designs materialized. So in their view, the client's response (the non-architect) has been quite predictable by the architect. This is achieved by having numerous design progress sessions with the client. The emphasis here is on

collaborative effort to achieve client's desires but this does not mean that it is a uncomplicated process.

> … Now we question them, I mean, if a guy, if a person has a program that seems wrongheaded, or we can question them, but in the end, they are putting up the money, you have to...

"Bringing them along" is a critical part of this process. As one architect put it, designers should not "slam clients with some new art form". In some instances (rare though) architects and clients discover that they are not fit for each other and should part ways. This however does not mean that they respond differently to same environments, but rather that they have misinterpreted or mis-communicated with each other.

Moreover, when approaching an architect it is vary common (if not essential) that the client does extensive research about their work, design process and personality. So in some sense the client can have an overall understanding of what to expect.

> …but they don't really want you to lean over backwards, they want you to be parental and they came for a parent and I'm going to deliver one but in having said that I'm not, I don't arrogantly say take it or leave it. I never do that. I always work with them to evolve so by the time the building is designed they are a part of it enough that they love every part of it as much as I do, and quite often I get asked can't you push it a little further…

6.9.3 How Do Non-Architects Respond to Built Environment?

The first reaction of almost all the interviewees was to the word "non-architects". They thought that the idea of grouping everyone else as non-architects is inherently an incorrect assumption to begin with. Since people have different needs and understandings, the word "people" should not be used in generic terms when it comes to response to architecture, "some people just don't give a damn."

> …maybe there are qualities like that, but I think there are particular people who have particular responses that are particularly acute, and I think those people are important…

One architect believed that we are more susceptible to liking things we understand, but we must not use methods that market researchers study clients, users or political polls to arrive at our conclusions. This architect was confident that in the case of the unique school he designed, the majority of the public were apathetic. "We could have built a very stupid school and they wouldn't have even noticed". When the project was complete, students were very excited with the design. They thought of it as a "cool" place where it enticed them to engage in educational activities but the faculty on the other hand saw it differently. They thought the design had over reached and was more appropriate for a college setting rather than a school. The point is that there are numerous sub-categories with different responses in the group we call "non-architects".

Interviewed architects believed that they indeed know how different groups of people will respond to their designs. They first explore the "audiences" for their architecture with the understanding that there will be a large variety of responses.

> …I don't care if you like it. The issue is we tried to solve something, and actually it does fit in a world of architecture that we can connect…

Architecture is very conservative by nature and people (assuming we can group everyone together) are more comfortable with forms that have cultural, local or historic precedence. These buildings are more likely to be understood by the public. When architects create buildings with form compositions that are new and unique, the "shock of the new" will make some find it "disquieting". This also is not exclusive to architecture and is common across various disciplines. However, we must differentiate

between buildings that people don't like because of their appearance, with buildings that are not well liked because they don't work well. As mentioned before star architects sometimes produce buildings that are not well conceived and do not function well.

> …When that model went on the exhibit (-) in New York , there again ordinary people, an by that I mean those with enough intellectual curiosity to go into a museum, nevertheless when they saw this thing that they had wondered about or heard about or perhaps they hadn't, found it, I think satisfying…

We know for a fact that public view toward architecture changes with time. We have a catalogue of architecture in our minds which keeps building up as time goes by and it is human nature to adjust to the new. There are numerous examples of public spaces whose appearance defied tradition and yet as time passed they turned into an integral part of the tradition and culture of a community.

> … so when Pompidou went up, all hell broke loose but it took them some time to readjust and now it's the most famous building and has had seven times the population of France (visiting it)…

A prominent architectural critique tries to explain why designs that stand out by star architects might experience resistance in the United States:

> …what you're hearing now is an articulation of beliefs and attitudes that are currently intellectually unpopular. They're not populist ones. They involve quality, beauty, excellence, standards, judgments. None of that is popular today. It's not part of our culture…

6.9.4 Do Architects Respond Differently?

Reactions to this question varied. More interviewees thought that emotional responses are basically the same for this group but there were few who thought that architects, by appreciating and enjoying the technical and artistic details in buildings, can have a more intense response. One architect compared it to a composer listening to

music by another composer. They would understand the technique, nuances and the compositional complexity that the normal listener isn't picking up.

> …They have no idea technically what's going on, they simply respond to kind of their own level so I think that it is probably true that architects see buildings …quite differently and might even have a different emotional response…as a result of kind of seeing it with so many more layers of understanding…

It is also important not to focus all our attention only on architects and non-architects. Some interviewees suggested that there might be another way of looking at this dilemma. Maybe studying responses would be less relevant if different projects only portray different client taste. If unique buildings were created because the client demanded an extraordinary design, a design that would push the limits of architecture and art, the role of the architect is only that of an instrument. It really doesn't matter how they respond or if it is any different from any other group.

> …people ask why your buildings are so interesting or different? How come? Well, our clients are interesting. Our clients are different. If I had an average boring client, our buildings might start look that way, but we haven't had to deal with that yet…

The interviewees were among those architects that are known for their unique designs. They create buildings that stand out. Yet there was this sense of genuine surprise when asked about the differences between architects and non-architects. The general feeling was: is there such problem to begin with? Are people in various cities voicing concern or becoming outraged with extraordinary buildings that they don't like? Are these the questions that shape the challenges of architecture today?

6.9.5 Architect's Agenda

We must explore all the different goals that architects have in designing buildings. Some are more obvious and some require further scrutiny. One objective they all agree upon is achieving client satisfaction. They strive not to only provide requirements of the program but penetrate the client's psyche so they can feel and see the same as the client. "We architects, by nature and by training, almost by definition, listen carefully and we care." If the architect is in disagreement with the client, whether in personality, style or methods, they will not accept the job. This negates the idea that architects accept any commission only to manipulate the client and the situation and achieve personal objectives.

> …The reason why we are building, as architects, is to enhance the lives of the people that we are building for. It is not just the utilitarian needs that we have to respond to. That is a good part of it but again we want to address the spiritual needs …I am trying to satisfy the mission of the client, if I was in complete disagreement with it, I wouldn't do the home…

Another key goal of the architect is to educate people through architecture. Architecture and urban design are inseparable components of what constitutes a shared culture. They are a part of how we define ourselves as a community and architects feel the commitment to educate people in this discipline. One of the ways to achieve this is to invite people to question their place and experience in the built environment. "People will become more self reflective"

It is equally important for people to understand that there is no formula for what this world actually is and should look like or what the people who are actually making it, say it is. If people see these contrasts, in this case through buildings, this could be a start

for seeing things differently. “If you suggest to people that this world could go on a different way, they would indeed pick that up.”

> …The school has the opportunity to be didactic, so when we finish the school, I don’t care if anybody likes it. The questions you are posing are totally meaningless…that if they are frightened, they hate it, shocks them, or they think it’s the ugliest thing in the world, all these things are fine and I couldn’t care less…what I am interested in is that will it make the students think?… …Will they scratch their head and say why does it do this? Why does the wall go like this? How does it behave? …sometimes in something like a school, my job is to make them uncomfortable if anything. So I go back to the premise and say, if they are all uncomfortable, then that’s a good thing…so in the article some say it looks really weird, strange, looks like a stealth fighter, and one said it looks like a penitentiary!

Some objectives are more tacit. For instance there is this natural feeling of ownership that architects have towards their creations. One architect was always worried if the client might “abuse” the buildings he designed. Some architects believe that they are idealist by nature and they try to communicate the save-the-world attitude in their designs. Beyond functionality, there is the desire to make a statement, a symbol, to make a building that will be “like a fire in the night”. . Others yearn to advance architectural theory while some try to focus on the art of architecture.

> …Despite adversity or stringent markets, our work begins in hope and is sustained by optimism: the long life of a project, translating ideals into concrete reality, may require years of support; architecture demands it…

6.9.6 Choice in Selecting Architects

We must not forget that it is the clients that choose their architect. This selection happens freely without any restriction or pressure from a legal body or organization. If they choose to go with an architect who has a strong personal profile, a strong ego, a

strong signature style, they go to that person for a specific reason. One architect referred to this as the Frank-Lloyd-Wright approach. “I am the genius and I am going to solve your problem my way because you are coming to me.”

Yet a better way to look at this issue is understand that the marketplace is a broad and fertile field. If there are consistently people who are making big investments in such architects with designs that stand out, then there is a need for such architecture. It is because people like it and demand it. One prominent architect provides the following example:

> …All you have to do is to walk down Fifth Avenue. You can go to Brooks Brothers on Madison Avenue or you can go to the couture area which you are going to get a weird suit. It’s going to be something that nobody else has and it maybe quite wonderful. It could be something that might fall apart, there is no guarantee that it will last longer…

All architects had a very negative reaction to the idea of “design by committee” or a supervising body in the design process. It would totally “absurd” for a group of people, as client, to be involved in every design decision and make it a collective determination. One architect thought this problem is an American phenomenon where some try to apply democracy and polls to anything that they don’t like or comprehend. Art and architecture are not democratic activities by nature. He thought contrary to Americans; Europeans tend to have no confusion about the role of the architect. They are far more educated about the culture of art and architecture.

> …(they) come to people like me because the love architecture and they believe in its value, its intrinsic value, that they are going to get something out of it, get into it, and become a part of it and complicit and that’s when it’s most exciting, in the end that’s the best part…

6.10 Environmental Research and Architectural Form

Not all interviewees were interested in this subject. In fact, there were only two architects that tried to directly address “scientific” research in architecture and even then, they sometimes provided contradictory information. Overall there were a lot comments on how people might respond to color, texture, light, and to a lesser extent, architectural form. There was no mention of utilizing a particular architectural form to trigger a specific effect on the end user. However, most architects studied “client behavior” in extensive detail before initiating design.

Some thought that this subject is rather a new development in architecture and there is a growing demand for such research, but mostly in “public projects”. The interviewed architects were interested mostly in “meaning” in design. That is to understand how their clients associate meanings to form compositions of their design proposals. One architect believed that we digitize a model in our minds of memories of places we have been to, and it is important for architects to use this concept in the design process.

Architects have different views when it comes to what constitutes research in architecture. For some is merely engineering new structures and building systems, others believe research to mean “artistic discovery”. Most regard it as a kind of “social analysis”, for instance to examine sprawling cities worldwide for clues to their messy vitality. Since human behavior is complex and unique to the individual and so is each specific piece of architecture, the interviewees raised a lot of concern for the methods of

"scientific research" where large number of people were tested and the result generalized for all people and all buildings.

> …I don't know what happened to you as a child, maybe you are frightened by a horse or a wild boar. You never know what people went through, maybe there were in a house that burned down and you are absolutely frightened of fire and you are not comfortable in a space unless you know you can get out of it, you can't be trapped in a space. All these experiences that we have, build up this really complex fabric, the more you understand it, the more you can see these complicated threads and the better you can design for somebody…

As expected they were quite adept on issues like feeling of compression in low spaces or the uncomforting feeling of narrow places. They believed theses to be qualities of human behavior that are the same for all, including the fear of the new. Study of social behavior is their science of choice.

> …I think most human beings when they see something brand new, they run away from it. They tend to reject it. That's the first -- the first instinct is get out of here. And it takes a while to build a resonance with a language that's new and to understand it. I mean, history of art, music, everything, proves that true. That is the way humans act…

All architects were curious how their clients live their lives. The general "attitude is to listen to people" and to create buildings that "pleases" them. The aim is to decipher patterns that respond to users needs. Are they left-handed? Where is their favorite place in the house or favorite furniture? Where would they sit in a restaurant? What is their favorite time of the year? What type of music they listen to? What is it they watch on television? What building they hate or like? What is their favorite food? What is it they do in their office?

> …I had a woman tell us that the only time she had any peace of mind to get away from her brothers was when she could climb out the window

> outside her room and sit up there…where she could overlook everything and no one would bother her…

6.11 Curvilinear Forms in Architecture

One of the questions presented to the architects was about the use of curvilinear forms in architecture. Conventionally, it is extremely hard to find a curved form in designs. This is mainly due to difficulties in programming, construction, materials and cost. The architects interviewed are among those who have abundant curved forms in designing buildings. The aim was to gain more insight on the qualities and methods by which curvilinear forms are used successfully in architecture. Not all architects were interested in this discussion, some thought that curved forms by themselves are somewhat irrelevant.

6.11.1 Uniqueness

In reality they are extremely hard to find and this could be why people might find it interesting. When the curve becomes an "exception to the rule", people find it attractive. One architect thought that today the square boxy buildings is "so damn predictable" and they provide no visual stimulation. He employs curved forms as emphasis or centerpiece to make more mentally engaging spaces. To some designers the curve offers another way to see the world, as soon as you utilize it, you know you are in a category which is distinguished by what everybody else is doing. Some architects warn that the conclusion should not be superficial in a sense that curved lines are regarded as departure from the norm and consequently, straight lines are affirmation of the norm.

Curvature is considered a more “expressive and extreme” form and is used in balance with rectilinear to create a contrasting experience. This contrast is believed to appear very novel to the viewer. Use of curves in buildings tend to make them more sculptural.

> …The accumulation of such understanding yields the essence of the moment. Resulting architectural design is not only practical in terms of economy and environment, but possesses the vital spark of originality that simultaneously integrates and exalts the worth of the individual or enterprise…

6.11.2 Ancient Cultures

In prehistoric times most shelters made by humans were not as rectilinear as the squares we live in today. We can see clear examples in tipis and igloos and primitive tents. Even Mesopotamian structures, known to be first buildings that came close to the concept of a village, were following the terrain and curvilinear in form. A lot of the architectural forms of this period had roots in mythical beliefs and rituals of the people of the time and curved and circular forms were a big part of that.

> …Black Owl Kook was a great Indian leader from the great Lakota territory, and he said one of the worst atrocities that he experienced was when Europeans came here and took their land from them and put them in these gray square houses, gray boxes and destroyed their spirit. To them their whole world was made out of spherical and round objects. The moon and the cycles of the sun were round, their tipi were round and the spirit had freedom to roam around in a circle, life is cyclical in birth and death. So they saw everything including the seasons round. These boxes they thought just stifled the spirit. It stopped that and he said it just killed the spirit of their people…

6.11.3 Curves and Function

It seems that whenever curved forms are specified in design, there is always some concern over functionality, construction method and eventually cost. The architects interviewed had numerous built projects with curvilinear forms and therefore ideal candidates to shed more light on this matter. Some thought if the designer is experienced enough to specify the right materials and methods of construction, such projects should not become more costly or complicated to build. In fact one thought of many situations that it will be more "efficient, economical and effective" to use curved forms:

> …curved forms are the most efficient geometry for minimizing the use of materials and maximizing the structural strength, it maximizes the volume but minimizes the surface area and allows for flexibility… Curve things become very strong and light weight themselves. That means less time for construction and less man-hour. This inherent stability, specially in an earthquake region or windy areas, is very important…

Another argument was made on the relationship between the human body and curved forms in the built environment. Our body and topography of landscapes are made out of curves and arches for a purpose and we can trace this, for example, in human walking patterns. "We don't walk around and make perpendicular turns" so the question is: why do we need to walk like that in our homes and outdoor pedestrian walkways? In the case of this architect he claimed that curved forms in his buildings respond to the "natural and human forces". This could be a reason why architects associated curves with "movement systems", thinking that somehow curved forms in buildings are reminiscent of movement.

So what are the functional restrictions that prohibit more use of curves in buildings? One architect thought that from property dimensions to city zoning

restrictions, gridlines, pipelines and infrastructure, force the designer to be rectilinear. Some of it is simply precedence, maybe if the Greeks had not come with the post and lintel, or the Romans with the gridline, we may have ended up with completely different forms comparing to what we see today.

Majority of the construction materials are designed for the rectilinear system, which makes the architect's job even more difficult. Some have started experimenting in personal workshops to discover the bending tolerance of different material. Some rely on the experience and feedback of contractors and sub-contractors to come up with more efficient methods. In theory, it makes a lot of sense to use curvilinear forms in buildings, but the reality of constructing it remains challenging. That is why architects must make sure that the designed is well thought out and prepared otherwise an unresolved product will be blamed on the use of curves.

> …once the buildings are put out to bid and the prices are inevitably higher and the client says I can't afford it, and the contractor says don't worry, I can save you a million dollars if you just straighten those bloody lines…

There is only one way to make a straight line but in the case of curvature there are limitless. It gets even more complicated when it is transformed into the third dimension which adds another layer of complexity to the discussion. How do you make a decision on what type of curve to use? Is it a segment of a circle or is it a double curve? Does it go up vertically or does that curve too? These questions would never come up in a rectilinear building.

6.11.4 Psychological Quality of Curvilinear Form

Architects believe that there are some inherent qualities about curvilinear forms in buildings that make you feel "good and overjoyed." These forms bring about a feeling of "serendipity" and "dynamism" to the space that would be "soothing and relaxing" to the viewer. "It is not so restrained and contrived that everything else is". They use curved forms in their design whenever they want to achieve a sense of mystery and surprise. They claim that produced spaces have an intense visual complexity both on the interior as well as the exterior, which is more attractive to their clients. "There is this sense of consanguine between the human body and the curved surface." One architect had an interesting theory that curves and circular forms trigger a feeling of "infinity," just like a meandering path disappearing into the horizon.

> …what you are going to find in these cards is that when you have all straight geometries, again it becomes a little bit boring and predictable. That's why most interior designers would like to use round tables. It just breaks that up and gives you a breath of fresh air…

Few architects had noticed that kids are very fond of curvilinear spaces. To children, curves have an intrinsic playful quality. Some people carry this attitude to adulthood. As an example, one architect explained that the curvilinear grammar of the plan derives from a philosophical affinity of the client, expressed to the architect in their memories of childhood and special vacation spots.

> …to me it represents this: the first time the children are away from their home environment and parents, so it is an embracing form, like as your parents put their arms around you. So it's a very embracing form to kids and the kids respond to that better and round things to kids represent balls and balloons and very happy things…

Some believed that existence of curved forms in architecture give a feminine quality to space. They believed that it brings a sense of beauty and comfort to mind that is directly associated with sexuality.

> … If we remove the visual and experiential history of our lives and are allowed to start from the beginning that I think….you know we come out of our mother's womb and anything that is going to give us that same womb like vocabulary to space, is going to be comforting…

6.11.5 Intuition

Use of curvilinear forms in architectural design is more of an intuitive decision. Most architects cannot justify why they make choices regarding form. One famous architect stated in a very honest way that "I am sure I have a set of criteria in my head but they are not verbal, There are things that I like and things that I don't so I pick." This becomes a very creative process and it seems that it is more likely to find curved forms in building designed by those architects that are known for their originality, creativity and artistic approach to design. As mentioned before these concepts are not currently popular in the United States, "art is no longer seen as originality but seen as a part of elected social work."

> … I went to school in the sixties when the pedagogy was highly rational. We were taught to devalue intuitive form-making. Our interests were directed away from the intuitive toward the pragmatic solution of whatever was being questioned; quasi-scientific ideas of program and function. Of course that wasn't the best approach because there is a much more complicated and tangential relationship between form and function that wasn't being addressed… This system of teaching design is still prevailing. Intuition is devalued…

6.11.6 Technology

Apart from willingness of the clients, architects heavily rely on new technologies to build their unconventional designs. This includes two distinctive sets of technologies, one is the new advancements in construction technology and the other is the technology architects use to produce their designs. The latter is mainly computers and various computer software. The interviewed architects strived to keep up to date with both technologies and in some cases they themselves had created software that helped them realize their designs. In this instance they were the ones advancing the technology.

> …Well, when I started doing curved shapes and I couldn't figure out how to draw them to make them legible to the builder, I turned to the computer which I still don't know how to turn on, but -- but I had, luckily I had a partner who was interested in that. We led us to the French guys, and their software. And the last 25 years, 30 years since we've started with that, we have changed that software for ourselves so that it manages the process for us…

There are also two groups of architects. Majority use the current digital technology to help them in speed, precision and efficiency of their productions but basically they are doing the same process as before the advent of computers. The interviewed architects claim to use the computers "for the purpose of imagining, to extend and create whole new series of investigations."

On architect was explaining how he was using the computer as the interpreter for the construction industry. The computer is putting the architect in charge of more information and he thought that this is very promising for the profession since it gives "back" the architect a more responsible role like that of a "master builder."

> … The AIA and its wonderful structure has infantilized us by overprotection. And so I think the computer gives us a chance to recoup our role, to take more responsibility so we're not...

There are some caveats with the use of computer in architectural offices. It is important to understand that "technology is not driving the design". Means must not be confused with ends and that seems to be a common temptation in architectural studios. "It's a fantastic instrument, but sometime it's very dangerous, because then people, they find it so easy to push button and to find credible composition".

6.12 Case Specific Responses

We seem to have this inherent tendency to seek patterns and formulas for things that work well thus by replicating them we insure that the outcome remains consistent and of high quality. Indeed this has long been the pattern especially in the industrial and technologically advance age that we live. All of the interviewees agreed that this system does not always work for architecture.

> You've got to simply understand that these are entirely different talents and sensibilities, of equal value, of equal genius, and that's the beauty of architecture. You're going to get a lot of different results….

These results are all valid and acceptable. In fact they are all considered successful works of architecture; nevertheless most architects use different processes to achieve the final result. The consensus is that works of architecture are almost impossible to compare and each must be judged on it's own merit. This is even more true in residential commissions. Residential design focuses more on the individual rather than the public, which adds another layer of complication to the problem. Every client

has a distinct set of criteria that is unique to that project which it may very well be useless to everyone else. This is how one architect puts it:

> All of us have different things that we appeal to and we don't, and it isn't that one is better than the other but it's the case of one that is more applicable to a client. That's why these houses are all different because you rarely see two clients alike….

The same architect believes that we all carry an "Ideal Blueprint" within us and it's up to the architect to find out what that blue print is. Therefore the program and the solution are case specific. Case specific was the word that was reiterated by all architects in one way or the other.

> I had some clients that I asked if they have to evacuate their house, what would they take with them?….Both of them said that they would take these two glass goblets that their children got them for their wedding anniversary. It was the first time that the kids celebrated their anniversary and it meant so much to them. We obviously put it in a very nice place but we designed a small clerestory in one part of the house so that the only time that the sun ever hit those goblets, was on 5 pm June 7th which was the time of their wedding.

Responses to larger public projects are also case specific. With the assumption that all the functional and programmatic issues are addressed correctly and, the building is architecturally resolved, still, there would always be people that would not like a certain design. So should we set a detailed set of aesthetic design rules that all public buildings adhere to? They all strongly disagree. Even though some people have criticized his work he believes that is part of architecture's natural process

> What I can tell you is that innumerable people who pass that building stop and are moved by it in someway. That is an act that is unique to that project…

One architect drew an interesting comparison to works of the famous Japanese director Akira Kurosawa. In his movie Roshamon, different people had different depictions of the same incident. Whatever the outcome, it could be debated. He had found this relationship to architecture so important that he had made a building program for graduate students based on this movie. Responses to a specific design in architecture are similar in his view and somewhat irrelevant. When asked how he thought people would respond to architectural forms used in his designs (which are considered unusual and extreme by many), he goes back to the premise behind the question:

> I think the language you are describing in order to pigeonhole a certain category of work.... Where it originates and what inspires it what connotations it has, could be one aspect of a specific project.. but I wouldn't insist on it...I would leave room for that discussion...I think the discussion is possible...but it doesn't explain it.

"Case Specific" is a phrase that has the boomerang effect whenever people's response is brought up in all interviews. Indeed this phrase is more true for star or signature architects. The volume of their work is small that we have to be specific about the project that we would like to evaluate. And even then, maybe studying people's responses to come up with design generalizations is not helpful in making better architecture.

6.13 Architects' Concern With Research Question

Some of the interviewed architects had deep-seeded concerns regarding research, specifically the statistical methods of inquiry. They thought that such methods are more

in tune with other areas of research rather than architecture, especially in the topic of architectural form. For example, they believed that curvature cannot be isolated in order to be researched but it is only meaningful in the overall architectural context. Furthermore, they questioned the premise that there is a growing difference of opinion or dispute between architects and non-architects, and the fact that architects respond differently. One architect was so disturbed that he suggested that such research is more in tune with psychology rather than architecture and it is "immature to address such discussions in a monotonous fashion" . Others suggested that such approach to research belongs to that of a "fundamentalist", that a proper approach would be to "start articulating the relationship between a broad intellectual construct or concept of the building and it's reality."

> …This opens a broad philosophical discussion that your professors don't want to talk about. People are terrified of me as an architect. But what they are terrified with is the same sort of thing that I have gotten over with my judge. And that is the capability of the human being to think originally and be free... You have to start with the premises that establish the research you are about to do…

CHAPTER VII

INTERPRETATION

In this chapter we focus on ways in which the various results can be interpreted to be most useful to researchers and more importantly, to architects. The interpretation of the results can be classified in three distinct categories: (1) differences between architects and non-architects, (2) signature architects and their design process, and (3) effects of curvilinear architectural form on people's response to the built environment.

It is important to note that the following findings are insufficient for public policy formation or design guidelines, especially, in regard to the role of curvature in architectural form. Instead, it is hoped that the findings derived from this empirical study encourage their application in architectural design practice in a more informed manner.

In a given *culture, society and timeline*, there are some relatively stable patterns, prototypes, or relationships between people and settings. These relationships have a tendency to repeat themselves and give the essential characteristics of locality (Marcus, 1985). Observation of such patterns or relationships has led to the concept of *design guidelines* in architecture, which are defined as "descriptions of form, process, or relationships between environment and behavior which are recommended patterns to follow as references in the design process" (Whang, 1998, p.42).

There are different definitions of the phrase "design guidelines." In this study it is referred to as a tool which architects use to take empirical findings and apply them to a specific situation or design problem *using their own interpretation*. Such guidelines

must provide the architect enough room to maneuver in the problem-solving process since they are faced with many unique variables at each stage. If design guidelines become prescriptive in nature, then they are unlikely to be effective with designers and architects. After all, identical buildings and identical users do not exist. Furthermore, any design guideline must take into consideration that architecture is a combination of science and art, with neither one dominant. The artistic side of architecture resists rigid and dogmatic rules or regulations to design, which is sometimes associated with prescriptive design guidelines.

I summarize the research results and implications of the research questions in the following sections.

7.1 Differences Between Architects and Non-Architects

The question as to whether there are differences between architects and non-architects in their emotional and interpretive responses to the built environment was examined using both quantitative analysis and qualitative analysis. Regarding the quantitative analysis, the results from the card-sorting task given to architecture and non-architecture students showed more dissimilarities than similarities.

There were significant differences between the two groups across all tested variables except feminine-masculine quality of interior architectural space. This latter variable aside, data shows that as the number of curvilinear forms increased, the architects' responses did not change significantly. Contrary to architects, the laypersons positive response increased with an increase in curvature.

There are certain aspects of this finding that are fairly different from prior studies. For example, both groups demonstrated a linear relationship between the independent variable (increase in curvature) and dependent variables (emotional and interpretive variables). Based on Berlyne's research (1964, 1971), some would have expected an inverted U-shaped relationship for non-architects and a linear relationship for architects with a higher base start. In this study both groups had a linear relationship (the results for architects were also linear even though the slope was negligible as compared to that of non-architects). These relationships are shown graphically in Figure 7.1.

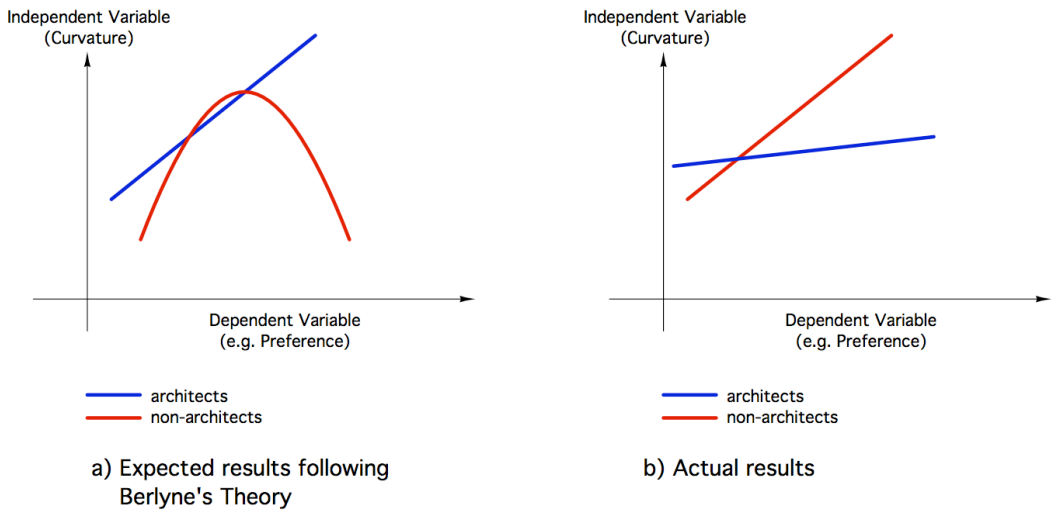


Figure 7.1: Conceptual Presentation of the Expected and Actual Results for Architects and Non-Architects

The qualitative approach examined possible differences between architects and non-architects by interviewing prominent architects. Two sub-categories emerged that

provided insight on this subject. One was discussions regarding the relationship between the architects and their clients and the second was opinions shared regarding perceptions of inherent differences between architects' and laypersons' response to the built environment.

One thing they all seemed to agree upon is that you can *not* divide people into groups of architects and non-architects. This argument questions the original premise of this inquiry. It is easy to draw a line and divide people into factions and examples are all around us: friends or foes, communist or capitalist, liberal or conservative and in the case of this study, architect versus the non-architect. The problem is that our societies are so complex and people and their ideas so diverse that any dividing line would easily get blurred and disappear. Yet such assumptions are very attractive due to their illusive theoretical simplicity, and in turn, proved to be one of the shortcomings of this study.

Most architects design their buildings to address the needs of their specific "audience," having in mind that they cannot possibly please everyone in the communities for whom they design. This argument leads us to the second subcategory. When we explore star architects' relationships with their clients, we see that they did not perceive that they entered into frequent disagreements with their clients. Qualitative analysis of the interviews showed that, in general, disputes on aesthetic matters are resolved in what the architects perceived to be a non-confrontational and progressive manner with the client having the final say on such issues. This is an important finding since star architects are more likely to design architecture that is unique and novel, and by doing so, create friction between the layperson-client and the designer.

When we look at both the data and results from card-sorting survey and interviews with architects, we can see that there seem to be differences between the two groups. At the same time, it seems logical that the human instinct trumps any training or educational background that architects may have, making possible differences diminutive. This original premise was endorsed by the majority of the interviewees. The key point raised by the architects seemed to be that even if such differences are present, that doesn't necessarily mean that architects neglect client needs or desires and indulge in their own wishes.

7.2 Signature Architects and Their Design Process

One of the central questions in this study was to explore how star architects make use of *architectural form* in their design. When asked about curvature, or use of any other architectural form, most architects believe that their decisions are very intuitive and depend on the specific project they are working on. A similar approach is applied to matters of aesthetics and beauty in buildings. Generally speaking, their decisions on architectural form and aesthetics could be summarized in a quote from an interviewed architect: "there are things that I like and there are things that I don't, so I pick."

"What is the relationship between art and architecture?" was another question that was posed to the interviewed architects. They all agreed that architecture is an art and the architect is an artist, who has to address additional issues of functionality, structural integrity and other building and social sciences. The fact that they can create masterful buildings by just doing "what feels right," in and of itself, is a strong

indication that their design revolves more around art than hard science. Design and its architectural form emerge through a powerful feeling of an undeniable internal drive that, for the most part, is not intellectualized or rationalized.

The assumption that architecture is strongly intertwined with art is bound to disappoint or aggravate different groups of people. The intertwining of art is an abundant characteristic of buildings designed by signature architects. Just because a group of people don't like a building, doesn't mean that the architecture is "bad," nor does it mean that the architect is guilty of designing an eyesore. On the other hand, you can incorporate all art in the world, but if the building does not work or respond to the program, it is bad architecture. So far, there is no evidence that the artistic work of star architects violates the programmatic requirements of the buildings they design.

One important feature that sets the signature architects' designs apart from other architects is that the majority of them have the ability to knit a complex and powerful assembly of mythological references into their buildings. Basically, they intuitively or intentionally drive people to associate strong meanings with the designs they are experiencing. Previous research on the topic of meaning in architecture (discussed in Chapter II) stresses the importance of this phenomenon when experiencing the built environment.

Why and when do they use curvilinear forms? Signature architects generate idiosyncratic ideas and then build them. It seems that one reason curvilinear forms are often employed by them is that it helps them reach that idiosyncrasy. Since there is little curvature in the built environment, it facilitates the creation of a novel or sculptural

design to a given program. This explanation, however, is personal conjecture since they generally refused to explain (or couldn't explain) how they make formal decisions in architectural design.

The most important aspect of the star architects' work that makes them different from other architects is the nature of their clientele. In an average architectural office you would expect the client to demand a solution or a design that is rather conservative and conformist. It is quite the opposite in the case of signature architect where the client will demand and push the architect for an extraordinary design. This reality gives the signature architect a degree of freedom rarely afforded a typical architect. The remainder of stars' architectural activities and processes are quite similar to the rest of the architecture community.

It also seems that both groups (stars and typical architects) look at the final result (the built piece of architecture) to evaluate its success, and the individual constituent elements (e.g. forms) are not as significant. To them, curvilinear forms are just another form and not capable of representing the whole experience of a building. This could be one of the reasons that architects in general had lower ratings of curvature in the quantitative section of this study.

For the interviewed architects, a successful architectural design goes beyond responding to the programmatic and functional issues. Design is a testament to the power of human imagination or a reflection of a social phenomenon. The star architect shows us this self-expression by manipulation of the built environment.

The study of signature architects and their design process is helpful in the sense that it provides a portrait of their activities and the ways in which these architects go about doing the art and business of architecture. In this regard, Williamson's (1991) research took an in-depth look at how architects have reached fame in the nineteenth and twentieth centuries. She concludes that apprenticeship with other famous architects (at the peak of their career), family and media connections / resources, and powerful self-promotional skills are some of the necessary tools for becoming a famous architect. Although her observations are helpful in understanding the mechanics of fame, there is little discussion about the quality of famous architects' work. In addition to all of the factors that Williamson (1991) suggests, one of the conclusions of the current study is that famous architects consistently create unique buildings that are often well built with a lot of emphasis on architectural detail. Their relentless and excessive focus on architectural design and theory was another pattern that was observed.

It is not the intention of this study to provide readers with a prescriptive design methodology or to encourage them to use certain architectural forms. This study is a tool that architects can use to compare their own practices, design methodologies and thought processes to those of an elite group of architects and gain in-depth understanding of a complex and perplexing subject.

7.3 Affects of Curvilinear Architectural Form on People's Response to the Built Environment

The survey results show positive values significantly increase as curvature increases in interior architectural settings. This increase is in a linear relationship format for the non-architect group. Some of these variables (e.g. pleasantness, relaxedness or friendliness) are strong indicators of preference in the built environment. Therefore it could be construed that as we introduce more curvilinear elements in an interior residential setting, it would increase the preference rating of its users. The prediction that subjects prefer a balance of curvilinear and rectilinear forms was not supported by the results. It might be concluded that because curvature in buildings is relatively uncommon, and its presence suggests that someone cared enough to produce an interesting design. This may be the reason the lay-public responds positively to curvature.

The two dependent variables, visual complexity and mystery, increased significantly as levels of curvature were raised in the interior settings. As discussed previously, these two variables play an important role in predicting preference, and the relationships found here were somewhat weaker that those found by Scott (1989, 1991) or the Kaplans (1982). It is also noteworthy that, in general, the numerical correlations and regression values of mystery and complexity were lower when compared to the other emotional variables (see table 4.1). The relationship between the dependent variables of mystery and complexity was also significant ($r=0.442$), implying that

increases in visual complexity in an interior setting result in user perceptions of the space as being more mysterious, and vise versa.

The interview data showed that some architects believe curved forms are “fun” and “joyful.” A handful of other studies also found positive results in the same direction where data demonstrated such forms to be “serene” and preferred in both 2-dimesional and 3-dimensional spaces by a variety of subjects, especially children. To a large extent, this study confirms and compliments these previous results. It would be logical to theorize that adding curvature to design creates spaces that are felt to be more pleasant, relaxing or calming, making such spaces (if designed well) joyful and serene.

Quantitative results also indicate that curvilinear form tends to make observers feel safer and perceive the space as more private. When tested in the two residential living rooms, this relationship was approximately linear but relatively lower than the corresponding emotional variables (See Table 4.1). In comparing the dependent variables with each other, there is some indication that friendly ($r=0.531$) and personal ($r=0.490$) spaces are perceived to be safer.

Designing spaces with features that have the potential to reduce stress is usually a critical objective of the designers, particularly in health care facilities. Although very limited, the results of this study show that curvilinear forms in interior residential architectural settings are perceived as less stressful ($r=0.473$). This theory needs much further investigation in other architectural settings to widen its application in architectural design.

One of the most interesting and surprising results in the analysis of the card sorting surveys was the response to the feminine-masculine variable. The correlation and regression values were far higher than all the other variables. Intriguingly, this was the only variable that the architect subjects scored higher than non-architects. Both groups strongly perceived the interior settings as more feminine when curvature increased, following a linear relationship. Accordingly, both groups associated rectilinear and angular forms with masculine qualities. The results were similar for both male and female candidates in both groups.

The concept that curved forms in buildings are perceived as feminine was not suggested by previous studies, but some of the interviewed architects had strong instinctive feelings that this was the case (see 6.11.4). It seems that such intuitions (amplified with years of experience) are widespread among architects. For instance, architects instinctively try to increase the window openings, create views toward landscapes and greenery or avoid feelings of compression and unease in low spaces. Some of these instinctive strategies (mentioned above) have already been researched and confirmed by environmental behavior researchers. In view of that, relationship between architectural form and perception of gender shows a promising venue where more research is needed.

Assuming that people intrinsically view places with curvilinear forms as feminine or just fun, implications for design are immense. Design features could be utilized for places where small children study or play. Women's health care facilities could be designed with a free palette of architectural forms that does not *exclude*

curvature. With the same reasoning we can begin to understand where curvilinear forms might not be appropriate. As an example, programs that require the environment to portray a solid, firm and impersonal quality might not find much use for curvature.

At this point, care must be taken to not to oversimplify or generalize the results to other situations and settings. This study was focused on one specific setting with a restricted group of subjects in addition to the inherent limitations of the research design. Furthermore, the results could be misunderstood to someone not adept in statistics. For example, architects observed the strongest relationship between curvature and feminine qualities of space among all measured variables of this study ($r=0.754$). However, when we look at regression and ANOVA models, we detect a relatively low R^2 ($R^2=0.568$). The latter is the value that measures the relative prediction power of the statistical model, which in this case it means that only 56% of the variability is explained. Knowing that this is the best-achieved result, it should encourage the readers not to rush to judgments and postulate design guidelines.

The nature of the card-sorting task is based on a comparative process. Thus, it is critical to study the statistical relationships together, as well as studying them individually. In this study the nuances between variables are as important as the individual numerical values themselves. For example, even though results show increase in curvature significantly raises the perception of mystery and complexity, the observed relationships were distinctly lower that those observed for other variables (see Table 4.1 & 4.2).

7.4 Summary

When we look at all the data as a whole, some overall patterns can be detected. The three data sources as discussed in previous chapters were: (1) previous literature, (2) card-sorting data, and (3) interviews with architects.

On the question of whether architects are different from laypersons, the cumulative results indicate that they possibly are. Whether this occurrence will lead architects to design buildings based on their own personal preference rather than a client's needs seems highly questionable, but needs further research. The card-sorting data implies that as we increase curvature in interior architectural settings, the layperson's preference significantly increases. Curvilinear forms tend to make architects and non-architects alike perceive the space as more feminine. This statistical relationship was highly significant.

We focused on the subculture of signature architects by analyzing interviews with twelve renowned architects. The results showed how they look at the profession and more importantly engage in the design process. The researcher explored differences between the interviewed star architects and average architects in the profession. Similar to what one might expect from an average architect, interviewed architects stated that they put their client needs above anything else and questioned the theory that architects and non-architects respond differently to the built environment. Most felt that architectural form emerges from the unique combination of variables specific to a project and is not imposed a priori.

CHAPTER VIII

CONCLUSION

This chapter is focused on the general conclusions that could be drawn from this research. We also look at the study limitations and review opportunities for further research.

8.1 Recommendations for Further Research

The quantitative research undertaken here needs to be applied to other exterior and interior settings, as well as with a variety of subject groups. Although this study found no significant differences in tested variables based on gender, it is unknown how any other individual or group differences might influence the result. It is also likely that differences in purposes of spaces, and/or differences in users might alter the patterns observed here.

Different classifications of curvature need to be studied, especially those curving in all three Cartesian axes. As mentioned, the curvilinear forms in this study were rather conservative. It would be helpful to explore the affects of more radical and drastic curvilinear forms and compare results.

Above all, better methodological approaches must be devised for the study of architectural forms and architectural design in general. Existing methodologies, specifically statistical approaches, are quite alien to what goes on in the reality of

architecture profession; the way in which people perceive architecture should be regarded as a human construct and heavily dependent on time and context.

Although the architectural profession is continuously undergoing change, the architect-client relationship has always been the subject of controversy. It is critical for architects to learn more in this area and improve their communication skills if the professions is to maintain its credibility. Any study on this topic would be very useful for architects.

Finally, there is very little research on the architectural design process itself. This study of signature architects is important in the sense that they consistently produce interesting and creative designs. Creativity is the integral element in architectural design, which gives it its somewhat mystical qualities. As with all human creativity, there is much we don't comprehend, so researchers who study design methods must be realistic in their expectations for findings.

8.2 Limitations

There were two types of data collection in this study and results produced by each method had their corresponding set of limitations. The first data collection method looks at architecture as an "object" and focuses on the phenomena of perception. In this approach, architecture is impersonal rather than interpersonal, with architectural information purely formal and having no meaning (Wang, 2001). As we saw in Chapter II (literature review), a number of studies challenge such a viewpoint and indicate the

meanings people associate with architectural form plays a vital role on how they respond the built environment (e.g. Groat, 1988).

Moreover, subjects were looking at two *living rooms* of a typical upper-class American suburban family house. Some might argue that the houses studied are not good representations of an American family home, nor were the subjects in the study, the majority of which were young college students in Texas. Also, we cannot overlook the fact that architectural elements such as color and texture have been omitted to reduce the intervening variables, and measure the isolated effect of "form." Limitations also surround the curved form itself. In this study, only curvilinear forms in the x-y axis were utilized and the z-axis was kept constant and rectilinear.

As for the qualitative data, the study is limited to star architects. Stars are known for their individuality and uniqueness, so it was difficult to find patterns among the interviewees, let alone find general applications for the architectural profession and architectural education. For similar reasons, interviewees all had different and contradicting viewpoints to subject matter. The extent of their designs with curvilinear form varied from one architect to another and so did their degree of stardom.

Nevertheless, these limitations are inherent to each methodology and were expected. At times it was difficult not to be overly influenced by the precision of the quantitative results as opposed to the simple emergent irony of the qualitative themes. It was at this time that the researcher had to remind himself of the *limitations* associated with each method.

The quantitative findings are based on an exploratory approach chosen for its ability to identify potentially interesting relationships between visually perceived attributes of a physical environment and human preference. These observations do not show causal relationships nor do they indicate the relative importance of attributes. The original objective was to create a controlled condition where only curvature was measured. In retrospect, it seems that such a controlled approach seriously compromises the transferability of the findings to other situations. The nature of the environmental attributes explored and the language with which they were described only allows for *indirect* interpretation of results for application to architectural and interior design problems.

The methodological approach and techniques employed in this study were *relatively* successful in meeting the study's objectives. Towards that end, the quantitative results were so narrow and the qualitative findings so broad-brush that it was hard to bridge the gap between the methodological approaches. Nevertheless, when we look at the data as a whole, the multi-dimensional nature of the results is very informative and promising. The interviews which formed the basis for the qualitative study proved to be invaluable to the researcher. They produced interesting and emergent findings that are potentially very useful to practicing architects. Considering the limitations of each research method in architecture, the employment of a combined quantitative and qualitative approach provided a thoroughness and value to this exploration.

The methods used to sample and represent the environment appeared to have been reasonably fruitful in this study. The stimuli were random interior residential settings that people might experience in everyday activities. The curvilinear architectural forms employed in the views, although very conservative and subjective, were a rational and prudent method to devise a sequential increase in curvature. There are few precedents in the study of curvilinear form or in the subculture of signature architects, and that this study ventured into uncharted water.

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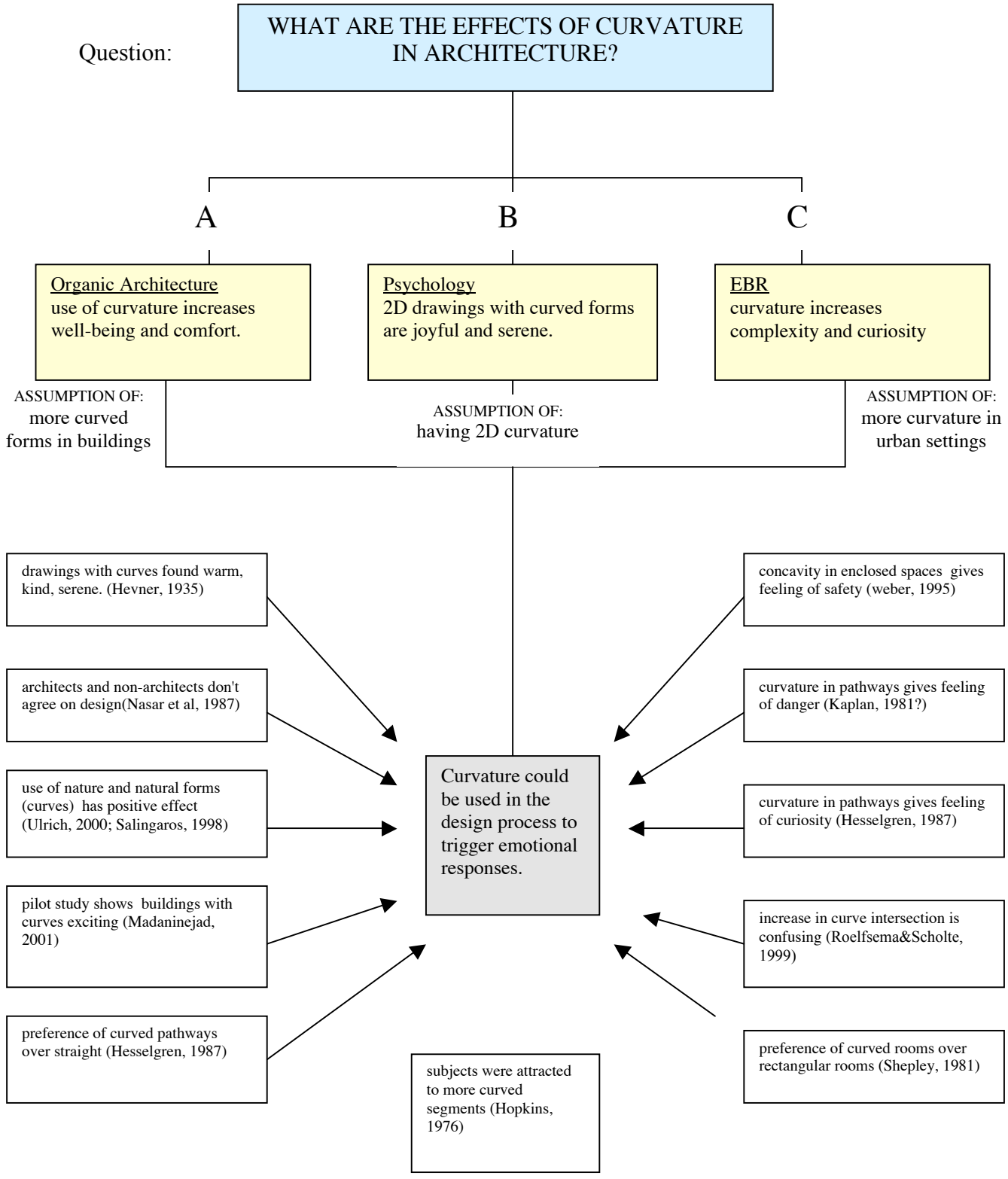
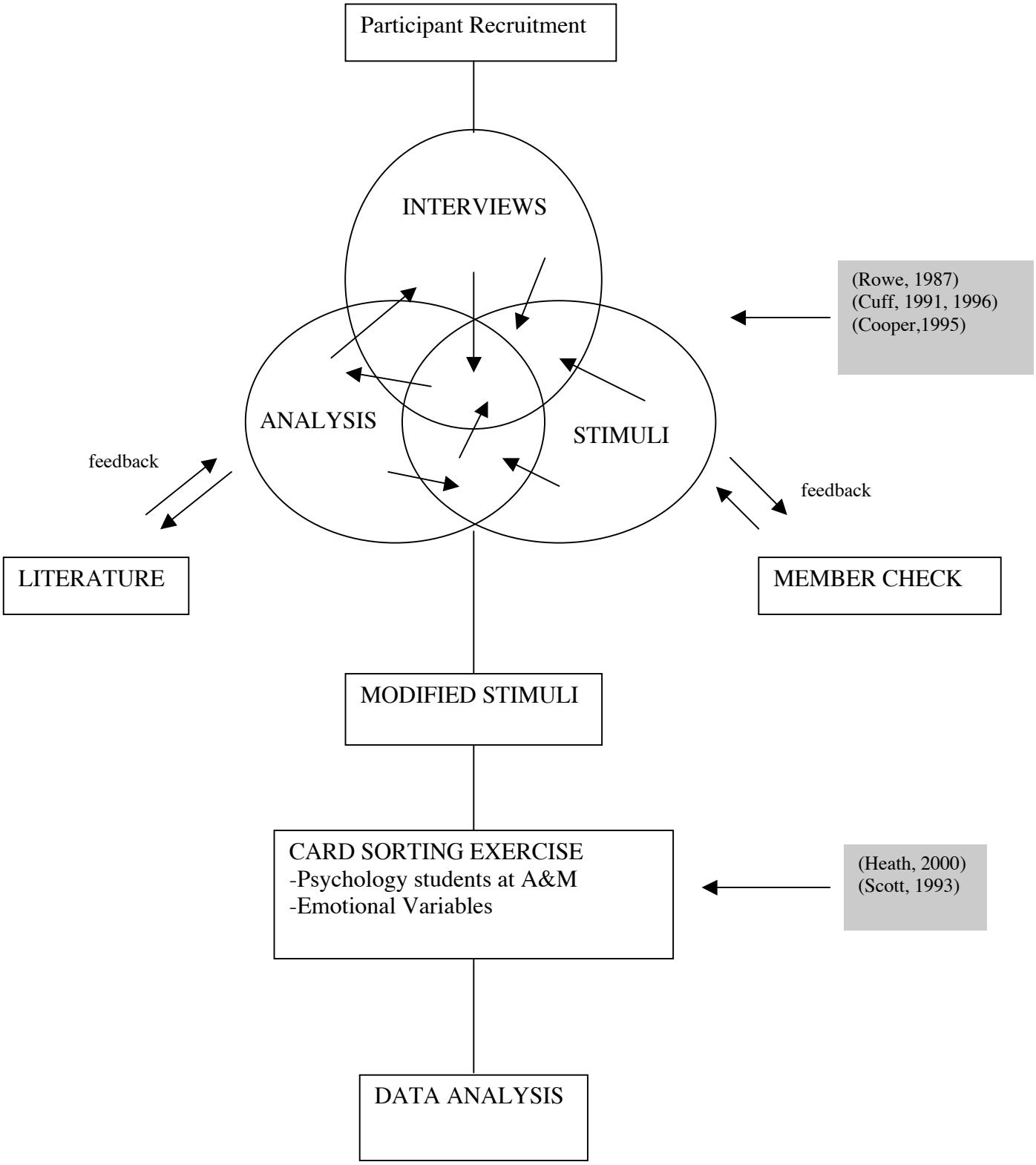
APPENDICES

APPENDIX A: OVERVIEW DIAGRAM OF RELATED LITERATURE



APPENDIX B: OVERVIEW OF RESEARCH DESIGN



APPENDIX C: FIGURES SHOWING JUDGMENTS ON CURVES OF VARYING RADII

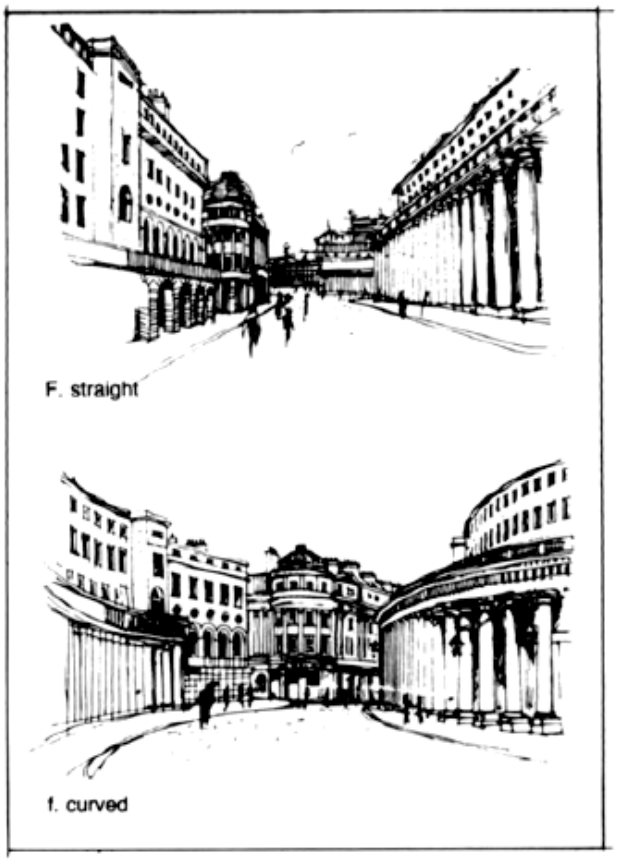
ADULT JUDGMENTS OF THE EIGHT LINE SEGMENTS FROM WHICH THE FOUR STIMULI WERE CHOSEN

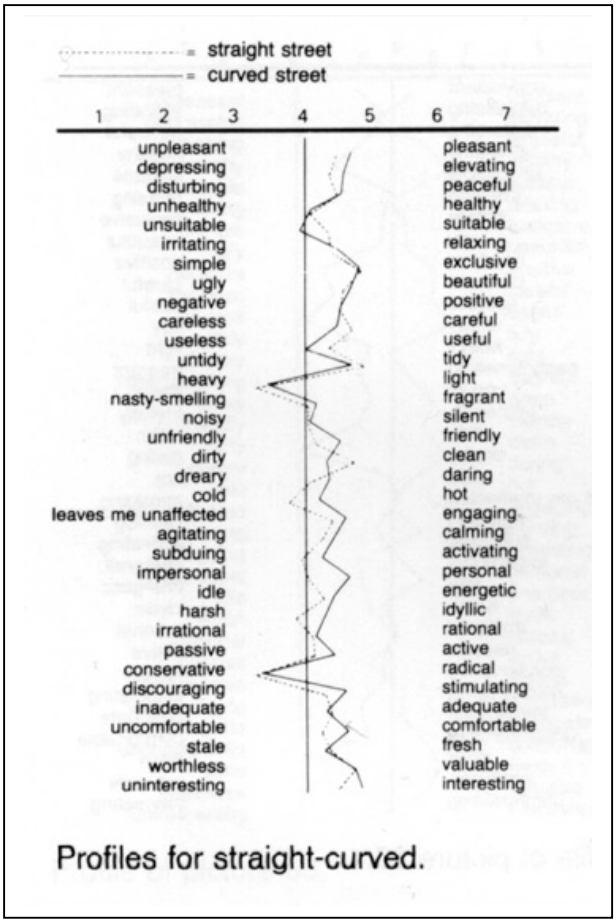
Radius (Inches)	Inverse of Radius	Median Adult Judgment[a]
3*	.33	0.00
4	.25	1.75
4½*	.22	2.25
6	.16	3.00
7½	.13	3.00
9*	.11	4.75
12	.08	5.25
Straight line*	.00	7.50

NOTE.—* = four three-dimensional orange wooden line segments (see text).

[a] Adult judgments were gathered in a psychophysical scaling technique in which the judge assigned a number to indicate "how curved" the line segments appeared.

APPENDIX D: HESSELGREN' FINDINGS ON CURVATURE





Profiles for straight-curved.

APPENDIX E: CONSENT TO PARTICIPATE IN A RESEARCH STUDY (CARD-SORT)

Consent to Participate in a Research Study (Card-Sort)

Title: Curvilinearity in Contemporary Architecture: Emotional Effect of Curved Form in Interior Architecture.

Purpose:
The purpose of this research study is to examine the relationships between the visual forms of the built environment and their emotional effect on people who use them. This study relates to the Ph.D. dissertation of Kayvan Madani Nejad, graduate student of Texas A&M University. The Study involves multiple card sorting exercise performed by approximately 130 students at Texas A&M University. The subjects are students in Design Process class in the College of Architecture. The study takes place in room 105 at the College of Architecture, Texas A&M University and will take approximately 30 minutes. This study begins on February 2003 and ends on December 2003.

Procedure:
I will be asked to arrange two sets of cards according to different emotional variables. Each set containing 8 drawings of an interior view of a residential house and they are randomly placed in a stack of cards and handed to me. There are 8 emotional variables and I will be given a definition for each emotional variable to help me sort the cards if I have problems understanding them. After sorting the cards, I will fill out the corresponding forms.

Benefits and Risks:
This study may help architects create better quality living environments. The results may enhance the emotional well-being of residents and families living in residential houses. As a participate I understand that the research study will not cause any harm. It will not have any physical or emotional risk. There are no personal benefits to me.

Compensation:
I will not be compensated for my participation in this project.

Confidentiality/ Privacy:
Any information obtained in connection with this study that can identify me by name will remain strictly confidential. Records and data will also be confidential and they will be placed in principal investigator's locked secure storage for three years after the completion of the study. My name will not be published.

Participation:
I understand that I will participate in a research study. I am one of approximately 130 individuals who will participate in this research study. My participation is entirely voluntary and I may decide to withdraw from participation in this research at anytime if I feel uncomfortable. If I have questions regarding this study, I should contact the principal

subject's Initials_____

date: _____

investigator, Kayvan Madani Nejad (703) 5193915, or advisors of the investigator Dr. Shepley (979) 845 7877 and Dr. Seidel (979) 845 6584.

I understand that this research study has been reviewed and approved by the Institutional Review Board - Human Subjects in research, Texas A&M University. For research-related problems or questions regarding subject's right, I can contact the Institutional Review Board through Dr. Michael W. Buckley, Director of Support Services, Office of Vice President for Research at (979) 458-4067.
I have read and understand the explanation provided to me, I have all my questions answered to my satisfaction, and I voluntarily agree to participate in this study.

I have been given a copy of this consent form.

_____ _____
Signature of the Participant Date

_____ _____
Signature of the Investigator Date

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APPENDIX F: CARD-SORTING DATA FORM

CARD-SORTING DATA FORM

CARD SET "1"

Gender: ☐ Female
☐ Male

Age: .....

Major: .....

Race/Ethnicity:

☐ American Indian ☐ Asian or Pacific Islander
☐ Black, not of Hispanic origin ☐ Hispanic
☐ White, not of Hispanic origin ☐ Other .....

UNPLEASANT									PLEASANT
DEPRESSING									ELEVATING
IRRITATING									RELAXING
UNFREINDLY									FRIENDLY
IMPERSONAL									PERSONAL
UNSAFE									SAFE
SIMPLE									COMPLEX
NOT MYSTERIOUS									MYSTERIOUS
MASCULINE									FEMININE

APPENDIX G: PROTOCOL FOR INTERVIEWS

Protocol for Individual Interviews
With Architects

Purpose of the Interview

The main purpose of the interviews is to understand the methods architects use to take advantage of curve forms in the design of the built environment and, the expected emotional effect of such forms on people.

Interviews Protocol

1. How did your interest in curve forms begin?
2. In what ways do you think curve forms in your projects affect people?
3. In your previous work, How did clients generally respond to use of curved form in your design proposals? How was this any different than what originally expected?
4. When using curvature in your projects, what are some issues that emerge in the design process that otherwise would not have existed in a project without curved forms?
5. Under what circumstances would you expect use of curved forms in buildings could have negative effects on the end users?
6. Even with today's technology, building curved forms are much more difficult and expensive comparing to rectilinear forms. What is so special about curves that justify their use?
7. Some researchers claim that public preference of architectural form is quite different than that of architects. Sometimes they are even opposite. What are your views in regard to this issue? How would "your view towards this issue" relate to curvilinear forms?
8. In general, how would you recommend designers apply curvature in their proposals successfully?

APPENDIX H: CONSENT TO PARTICIPATE IN A RESEARCH STUDY (INTERVIEW)

Title: Curvilinearity in Contemporary Architecture: Emotional Effect of Curved Forms in Architectural Design

Purpose:

The purpose of this research study is to examine the relationships between the visual forms of the built environment and their emotional effect on people who use them. This study relates to the Ph.D. dissertation of Kayvan Madani Nejad, graduate student of Texas A&M University. The Study involves interviewing approximately fifteen registered architects at their place of choice (home, office, restaurant, etc.). The participants are selected from a pool of experienced senior designers. This study begins on February 2003 and ends on December 2003.

Procedure:

I will be interviewed about the use of curved forms in architectural design during which I will discuss the use of curvature in my projects. I will be asked questions focused on my previous experiences in the use of curved form in design, and interpreting their effect on people and, propose possible methods of utilizing curvature in the design process. This interview will take approximately 45 minutes and will be recorded by audio tape. I will be mailed a transcript of the interview to review and check.

Benefits and Risks:

This study may help architects create better quality living environments. The results may enhance the emotional well-being of residents and families living in residential houses. As a participate I understand that the research study will not cause any harm. It will not

have any physical or emotional risk. There are no personal benefits to me.

Compensation:

I will not be compensated for my participation in this project.

Confidentiality/ Privacy:

Any information obtained in connection with this study that can identify me by name will remain strictly confidential. Records and data will also be confidential and they will be placed in principal investigator's locked secure storage. My name will not be published. The cassettes will be coded so that no personally identifying information is visible on them and will be kept in a secure place (a locked file cabinet in the investigator's office). They will be heard only for research purposes by the investigator and his or her advisors.

Participation:

I understand that I will participate in a research study. I am one of approximately 10 individuals who will participate in this research study. My participation is entirely voluntary and I may decide to withdraw from participation in this research at anytime if I feel uncomfortable. If I have questions regarding this study, I should contact the principal investigator, Kayvan Madani Nejad (703) 5193915, or advisors of the investigator Dr. Shepley (979) 845 7877 and Dr. Seidel (979) 845 6584

I understand that this research study has been reviewed and approved by the Institutional Review Board - Human Subjects in research, Texas A&M University. For research-related problems or questions regarding subject's right, I can contact the Institutional Review Board through Dr. Michael W. Buckley, Director of Support Services, Office of Vice President for Research at (979) 458-4067.

subject's Initials_____

date: _____

I have read and understand the explanation provided to me, I have all my questions answered to my satisfaction, and I voluntarily agree to participate in this study.

I have been given a copy of this consent form.

_____ _____

Signature of the Participant Date

_____ _____

Signature of the Investigator Date

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APPENDIX I: RECRUITMENT MEDIA FOR INTERVIEW SUBJECTS

Potential candidates will be selected using American Institute of Architects (AIA) resources from Washington D.C., Baltimore, New York City, New Jersey and Philadelphia areas. An email will be sent to them explaining the research study and asking for their participation. Below is the sample email for recruiting qualified registered architects.

Dear Madame/Sir,

I am a graduate student at Texas A&M University working on my doctorate degree in architecture. I am performing a study on the emotional effect of curvilinear forms in the built environment on users. My research design involves interviewing 15 senior registered architects as a part of my data collection. Interviews will take approximately 45 minutes at your place of choice. A transcript of the interview will be mailed to you. There are no benefits and compensations to the interviewees.

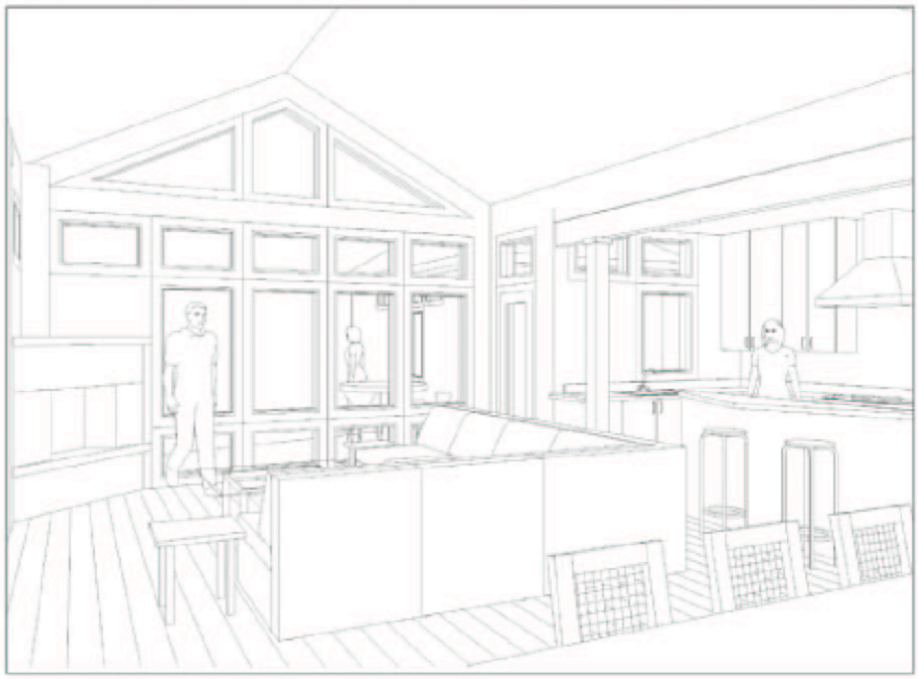
You have been chosen through AIA national resources. If you decide to take part in this research please reply to this email or contact me directly at:

Larson / Koenig Architects
2107 Mt. Vernon Avenue Suite 100
Alexandria, VA 22301
Tel. 703 519 3915

Sincerely,

Kayvan Madani Nejad

APPENDIX J: STIMULI SET I



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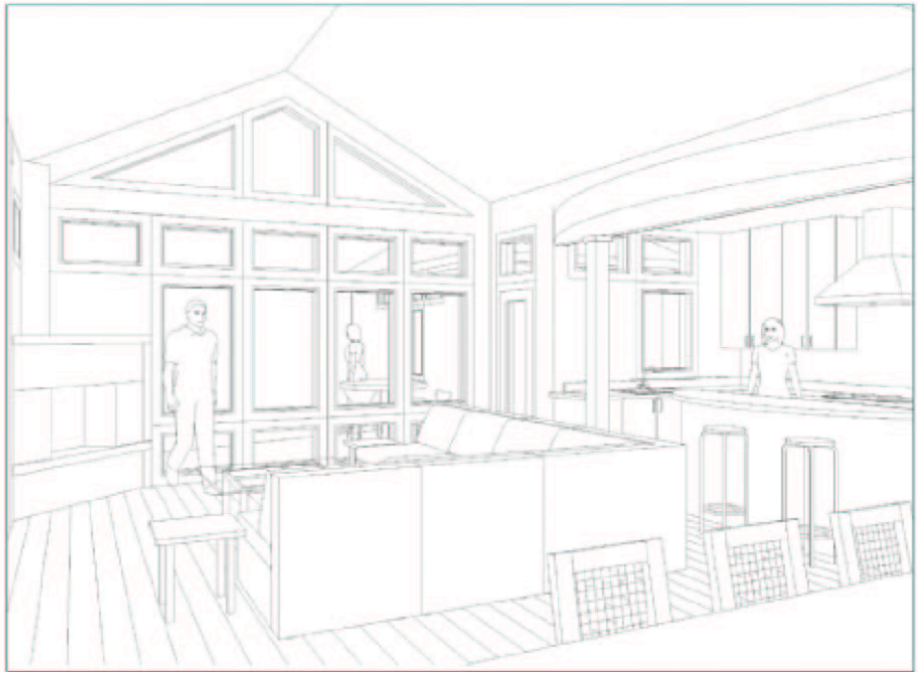

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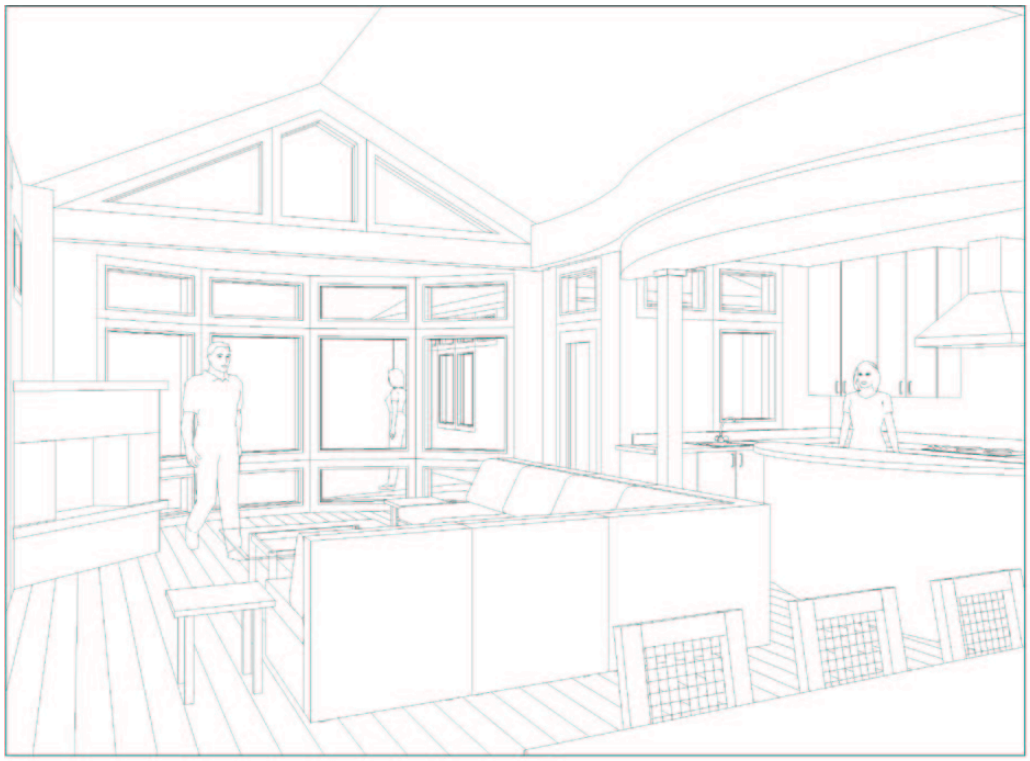

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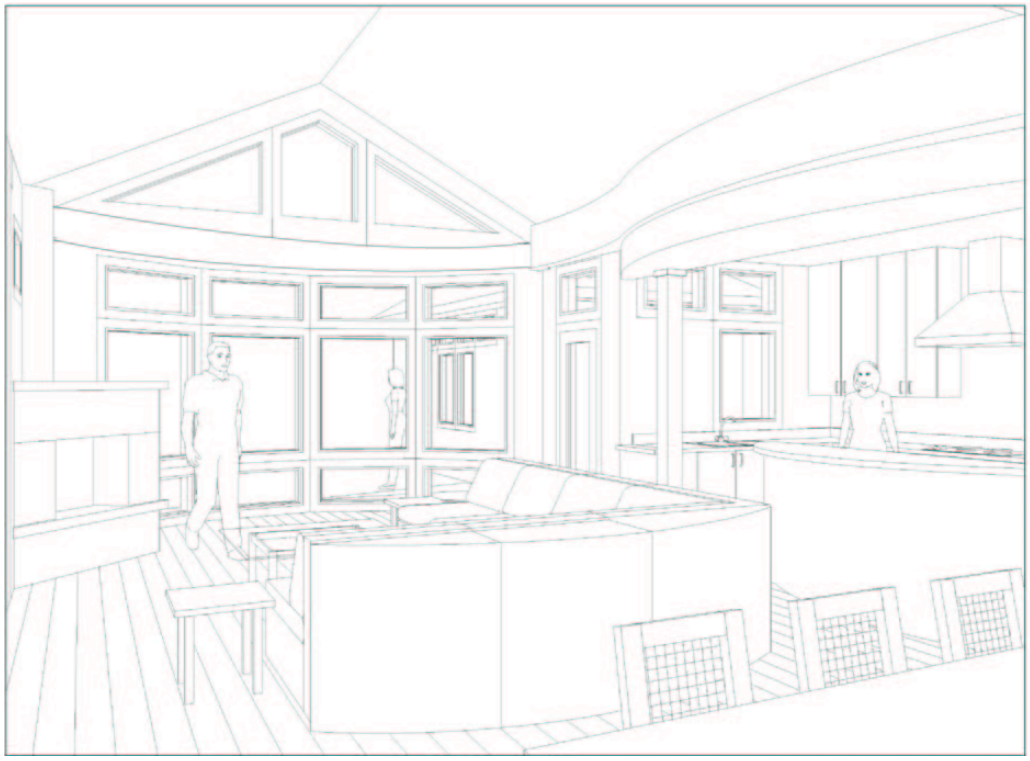

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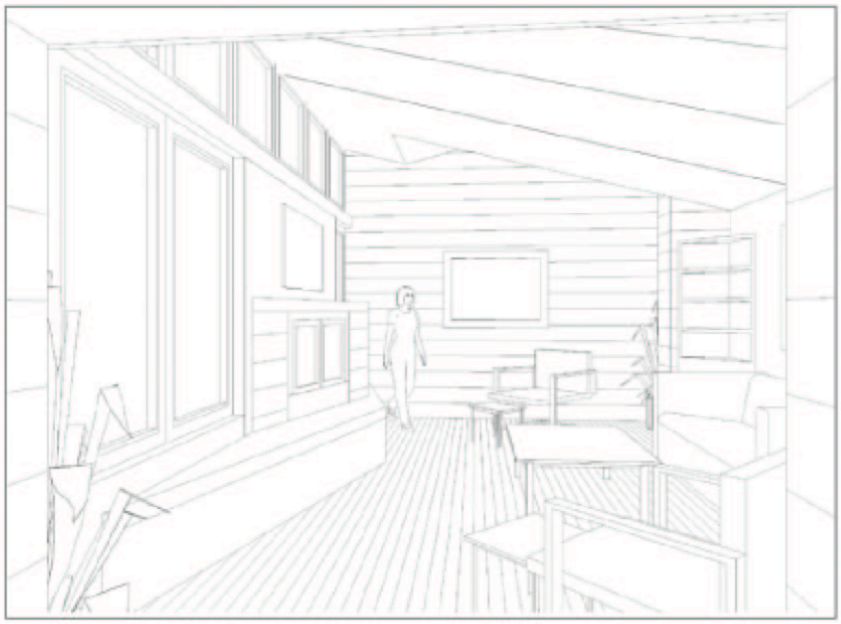
APPENDIX K: STIMULI SET II



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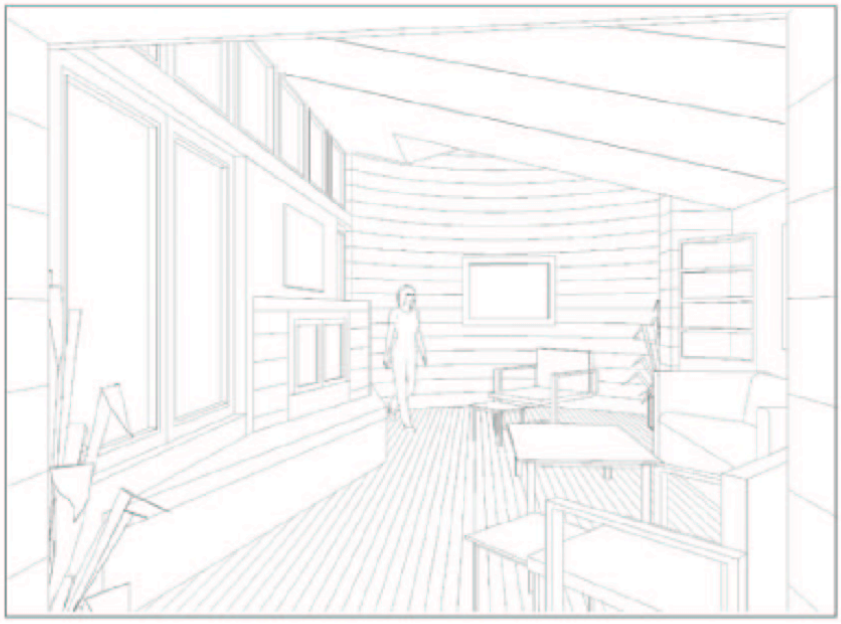

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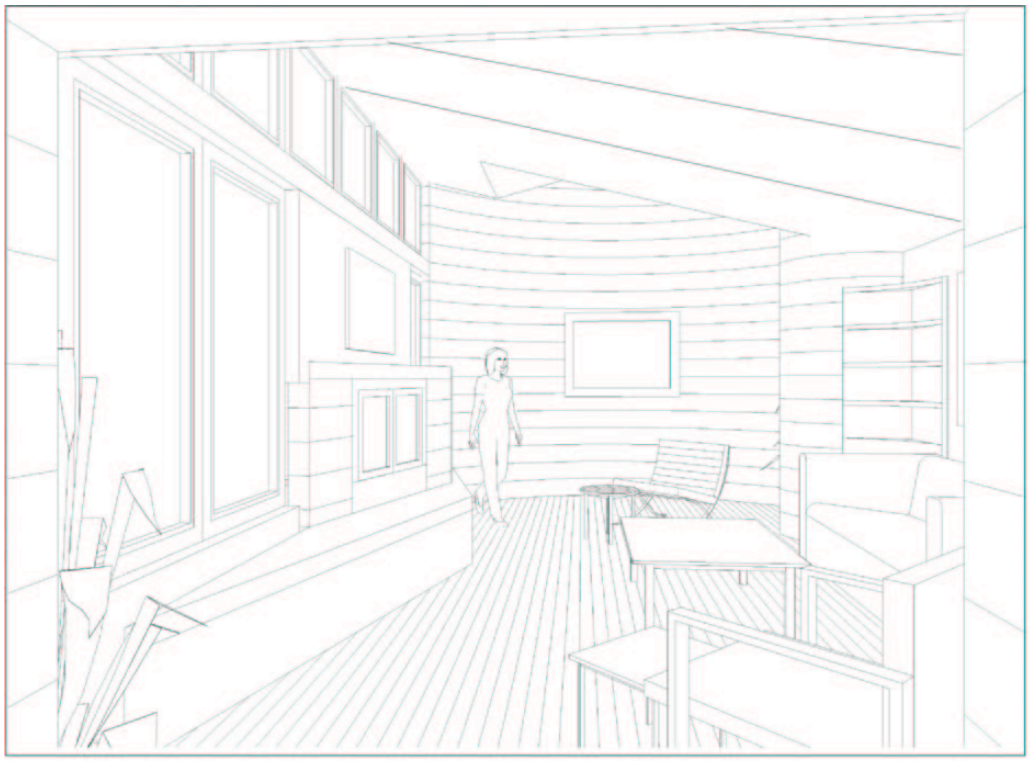

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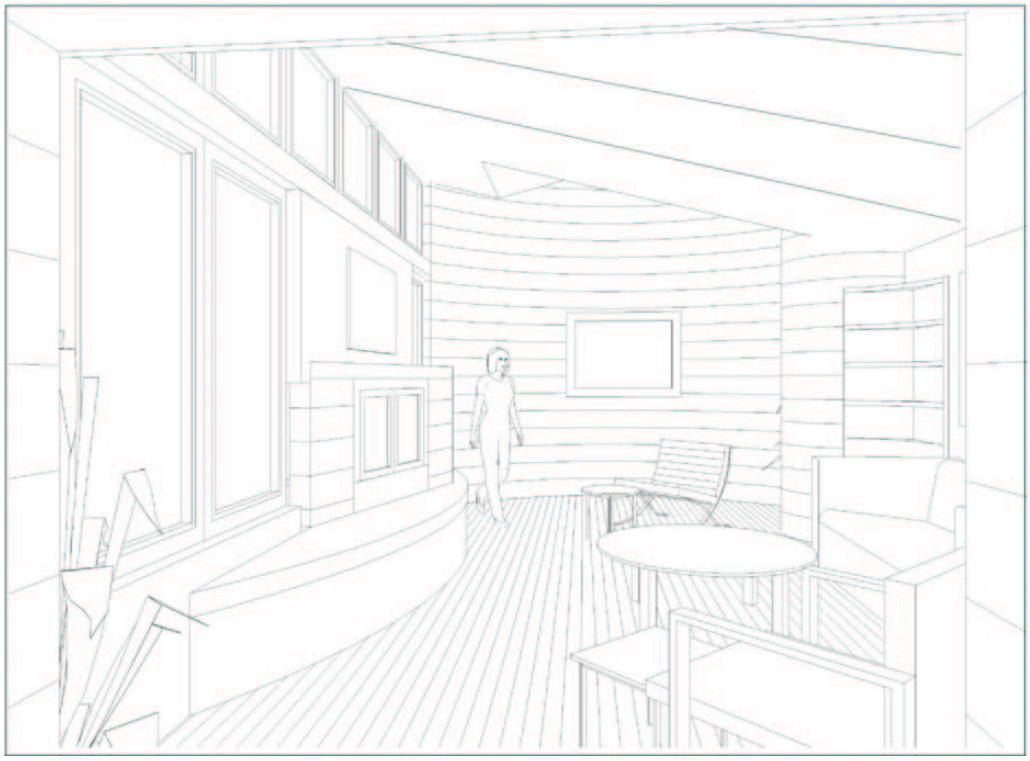

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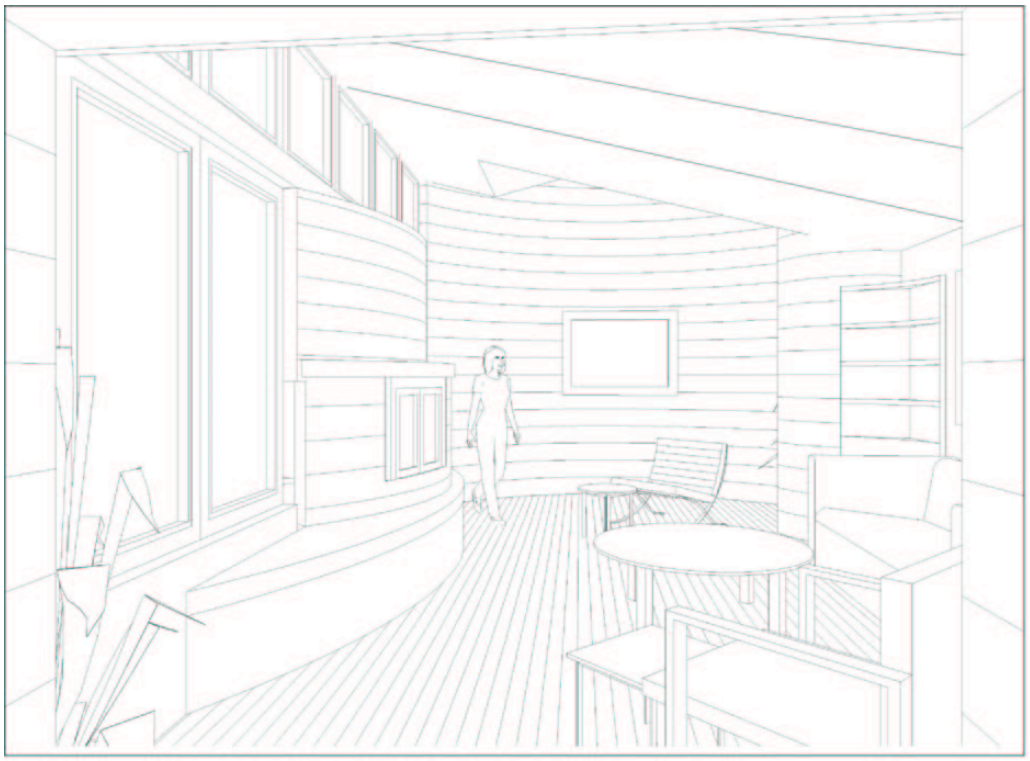

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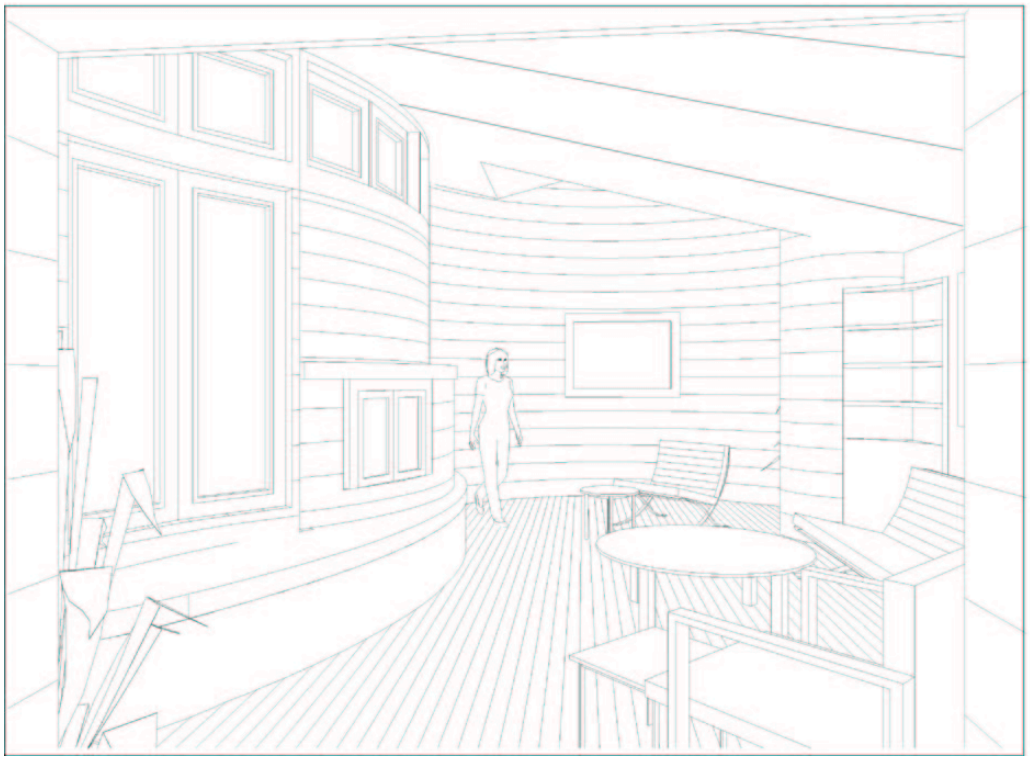

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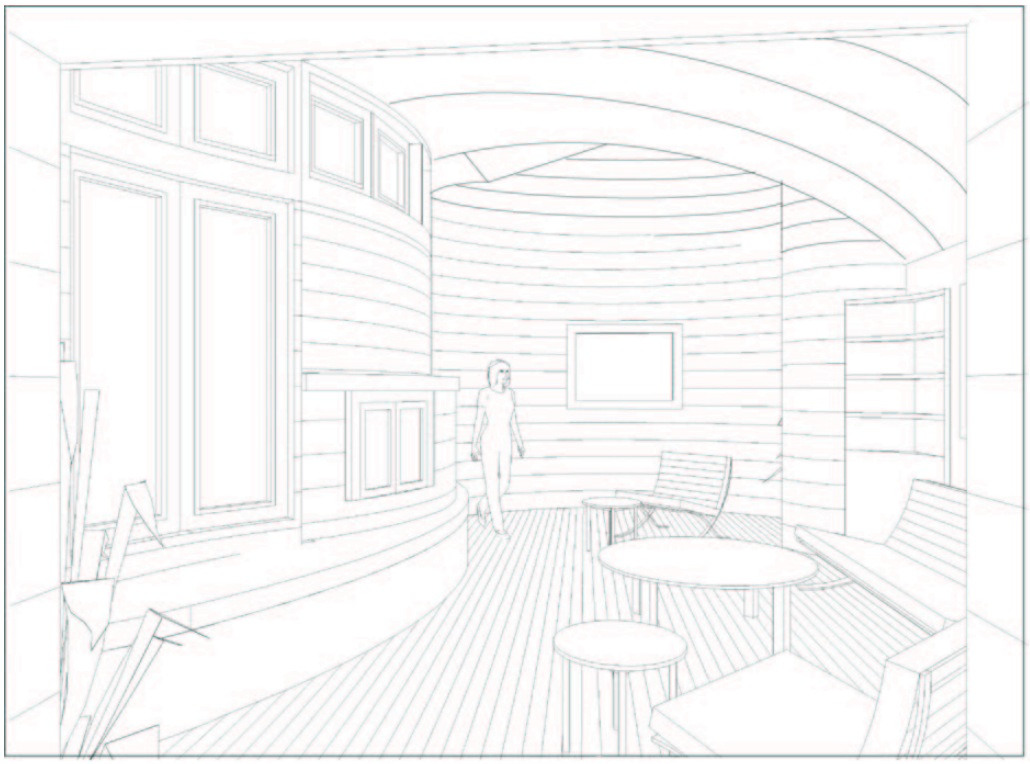

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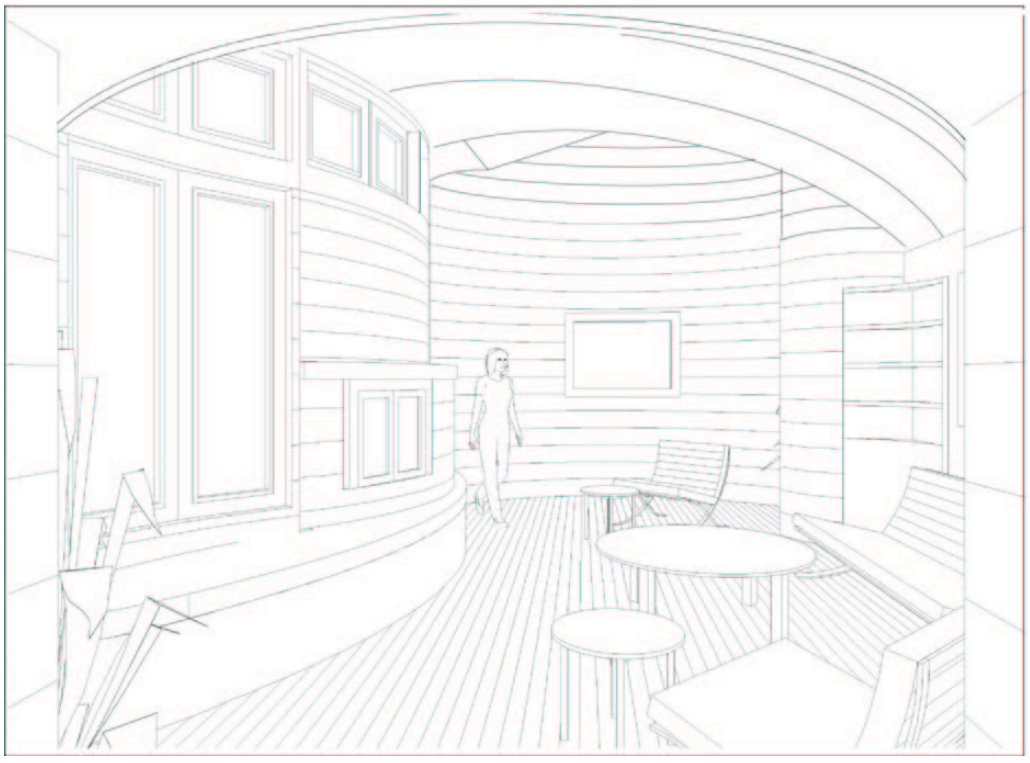

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VITA

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