CUSTOMER BEHAVIORAL RESPONSES TO THREE LIGHTING TECHNIQUES IN A RETAIL AUDIO/VIDEO STORE'S SIMULATED HOME ENVIRONMENT

by

John Tiffany

Thesis submitted to the Faculty of the
Virginia Polytechnic Institute and State University
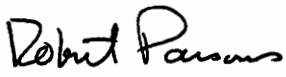in partial fulfillment
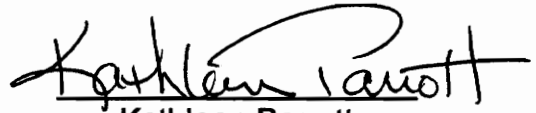of the requirements for the degree of

Master of Science

in

Housing, Interior Design, and Resource Management

Approved:

Jeanette Bowker
Jeanette Bowker, Chair

Robert Parsons
Robert Parsons

Kathleen Parrott
Kathleen Parrott

April, 1993

Blacksburg, Virginia

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(ABSTRACT)

Store lighting is a combination of art form and function that contributes to a retail store's sales and prosperity. The quantity, quality, and effect of the light reaching the merchandise are the determining factors in the success of the sale of merchandise. There are three basic merchandise lighting techniques used in retail stores. They include the low-end, mid-market, and high-end lighting techniques. However, retailers are developing merchandising techniques that do not have a clear cut lighting solution. A new merchandising technique for the audio/video retailer is the simulated home environment (SHE). It is a series of rooms and vignettes that present audio/video products in a home setting.

Studies have shown that lighting has an affect on human behavior. In a retail store, three customer behaviors are linked to increased sales: customer communication with store personnel; customer interaction with displays and merchandise; and length of time in the store. The purpose of this study was to determine which of the lighting techniques was most effective in stimulating the customer behaviors linked to increased sales in an audio/video store's SHE.

The study was conducted in an audio/video store's SHE equipped with a lighting system that could produce the three lighting techniques. Each day the

SHE's lighting system was set up for one of the lighting techniques and customer behavior was unobtrusively observed and recorded.

A convenience method of sampling was used in the study. The subjects were the customers shopping in the SHE. The study's experiment was done twice using two methods for selecting the observation days for the experiments. One method used the same day of the week in three successive weeks (SDW), the other used three different days within the same week (DDW). The sample size for the SDW method was 123, and 47 for the DDW method.

To assess the effectiveness of the lighting techniques in stimulating customer behavior, two behavior rating scales were created. The Customer Communication Rating Scale and the Customer Display and Merchandise Interaction Rating Scale assigned values to observed customer behavior. The third customer behavior, length of time in the SHE, was measured in minutes.

Data was analyzed using Chi Square tests for the Customer Communication Rating Scale and the Customer Display and Merchandise Interaction Rating Scale. An ANOVA was used to analyze the length of time in the SHE.

The results indicated that both the mid-market and high-end lighting techniques were significantly better than the low-end lighting technique in stimulating customer display and merchandise interaction, and longer customer visits in the SHE. However, the results indicated that all three lighting techniques were equally effective at stimulating customer communication with store personnel. The study concluded that store lighting designs that include highlighting of displays and merchandise will stimulate customer display and merchandise interaction and longer customer visits.

Acknowledgments

There were many people who assisted me with this study and thesis. My committee members were very supportive and helpful throughout this study. Dr. Jeanette Bowker served as chair and provided me with guidance in developing this study and writing the thesis. I am very grateful to her for always having time to help. Dr. Kathy Parrott's expertise and insight helped evolve this thesis into a viable environment-behavior study. Mr. Bob Parsons was invaluable in helping develop the lighting system and securing assistance from the lighting vendors. Another faculty member who played an important part in this study was Dr. Rebecca Lovingood who helped me develop the original lighting research concept.

A debt of gratitude is due Mr. John Selby, the owner of Stereo One. Without his friendship, hard work, and support, this study would not have been possible. The help and understanding of the entire staff at Stereo One was also greatly appreciated.

The lighting system used in the study required the help of many people. Ted Ake and John Palembus of Hubble Lighting were supportive of this study in many ways. They helped in the design of the system, the selection of the fixtures, and the procurement of the fixtures at greatly reduced prices made this study possible. Dave Creek at State Electric Supply was also of great help in selecting the lamps and dimmers used in the lighting system and securing them at a reduced price.

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Chapter I.

Introduction

Retailing can be defined as all the activities associated with the sale of products and services for final consumption, (James, Walker, & Etzel, 1981) and a retail store is a space designed to display, house, and sell merchandise (Novak, 1977). Retail stores use atmospherics, which are physical components of the store that can be detected through the senses, to create buying environments that stimulate purchase behaviors in customers. One of the key elements used in creating store atmospherics is lighting (James, et al., 1981). Store lighting is a combination of art form and function that contributes to a retail store's sales and prosperity (Barr & Broudy, 1990; Meredith, 1991).

Inconsistent lighting quality in retail stores evidently is the result of improper or nonexistent lighting design. Successful and unsuccessful retail lighting designs done by architects, interior designers, lighting designers, builders, and contractors are based on established lighting principles and previous successful designs (Erhardt, 1987). For store owners designing their own lighting system, intuitive judgment may be the guiding force.

In today's volatile economy, many retailers are emerging with new merchandising and marketing techniques. Many of these retailers are targeting a select narrow segment of consumers for their products and services. To present their products in a unique way to their target market, retailers are using new innovative display methods.

The new products and innovative display techniques retailers are using present a challenge for the designers of lighting systems. Many designers are

unfamiliar with these new marketing techniques, subsequently they are uncertain as to which type of lighting will make the new products desirable to the intended consumer. Designers must carefully reconsider their normal practices when designing a lighting plan for businesses and products they have never encountered before. There are very few "standard" lighting solutions that can be applied to the changing retail environment. Successful lighting strategies can only be accomplished by thoroughly analyzing the products and marketing techniques of retailers (Barr & Broudy, 1990).

Audio/video retailers have been in existence for many decades. They have their roots in the 1920s when the first radio receiving sets were offered to the public. Over the years the product offerings from these retailers expanded to include phonographs and televisions. Radio and phonographs later gave way to stereo components. Today, audio/video retailers no longer have simple stores with basic stereo components and televisions. The rapid change in technology in the 1980s and 1990s has brought forth many new product categories that audio/video retailers are now merchandising. With the introduction of car stereo, cellular telephones, computers, satellite dishes, camcorders, video components, home theater, home automation, custom installation products, audio/video furniture, and multi-room audio/video systems, the complexity of merchandising for these retailers has greatly increased (Electronics Industries Association, 1992).

A new merchandising technique that is being widely adopted by audio/video retailers is the "simulated home environment" (SHE). The SHE is an arrangement of vignettes that are designed to represent the most common rooms where audio/video components are found in the home. These types of

displays perform various functions. They are used to exhibit new audio/video products designed to harmonize with home interiors. These products include custom installation products, audio/video furniture, home automation, multi-room audio/video systems, and the home theater. The SHE helps the customer visualize the equipment as it would appear in their home. Another important function of the SHE is to aid in explaining the complexities of many of the products, and how they will operate in the home setting.

Statement of Problem

The SHE creates a unique problem for the lighting designer, in that it is a simulated residential setting that is part of a retail store. The SHE presents audio/video products in a home setting, but they must appear as if they are for sale.

Research Objective

The objective of this study was to determine how the SHE should be lighted to create the most positive shopping environment.

Justifications for Study

The justifications for this study are varied and numerous. There are many different groups that could benefit from the knowledge gained in this study.

- Lighting designers, interior designers, and architects, might be helped in designing more effective merchandise lighting systems.
- Store owners may be able to develop lighting systems that create better shopping environments in their stores. Better shopping environments ultimately may result in more customer purchases.
- The manufacturers of the products displayed in shopping environments could see their products presented in a way that would make them more desirable

to customers, resulting in more sales of their products. The successful lighting techniques could be passed on to other dealers that carry their products.

- Researchers doing merchandise lighting studies may be able to use the knowledge gained from this study. There is very little empirically based information available on the merchandise lighting-behavior relationship. Whether accepted or refuted, this study could serve an important purpose for lighting research by providing the impetus for future research on merchandise lighting.

- Educators teaching lighting or merchandising may be able to use the results of this study to further enhance the merchandise lighting principles that they teach students.

- Lighting equipment designers and lighting manufacturers may be able to design, manufacture, and sell new lighting products that optimize the type of lighting found to be most effective in this study.

Limitations of the Study

There are limitations associated with any quantifiable empirical research done in a retail setting which could limit the generalizability to larger populations. There are intervening variables involved that are difficult to isolate.

- The location where this study took place was in a small mid-western city. Generalizations about customer behavior in other geographic regions may not necessarily be appropriate.

- Time of year may have an impact on customer behavior. The observations for this study were done during the Christmas shopping season. Customer behavior may be different during other times of the year.

- The display area used as the test site within the store is a unique merchandising concept. Customers may react differently to the same merchandise in a different display setting.

- The type of merchandise displayed in the test site may have an impact on customer behavior. Products displayed in this study were audio/video products. Consumer behavior may vary significantly using other types of products.

- One of the criticisms of research done in retail settings is the lack of a randomized sample. A convenience method is most commonly used method of sampling in retail research. This method allows the observation of people who are shopping, but because they are not randomly assigned they are not considered necessarily representative of a larger population.

Definition of Terms

The following list of terms and definitions are specific to this study:

Accent lighting system - Lighting system used to highlight merchandise and displays. Displays and merchandise are made brighter than the surrounding environment.

Color rendering - The ability of lighting to portray the true color of an object it is illuminating.

Custom installation audio/video products - Products that are designed to adapt more harmoniously into interiors of the home.

Footcandle - A unit measure of the amount of light on a surface. One footcandle is the amount of illuminance on a surface one square foot in area on which there is one lumen uniformly distributed.

General lighting system - The lighting system that delivers substantially uniform illuminance throughout an area.

Home automation - Micro-processor control system that operates electrical and mechanical systems throughout the home, providing more convenience and improved efficiency. Systems that can be controlled include audio/video systems, heating and air conditioning, lighting, automated window treatments, security, and telephones.

Home theater - A home audio/video system that is designed to recreate the experience of viewing a movie in a theater. It includes a large screen television and an audio system that provides the same surround sound used in theaters.

Lumen - A measure of light output emitted from a source.

Multi-room audio/video systems - Audio/video system that has speakers and video components in several rooms throughout the home. The rooms are linked to the main audio/video system by infrared sensors that allow its operation via remote control.

Perimeter lighting system - Lighting system that is used to light the walls and perimeter areas. Perimeter lighting is used to highlight wall displays and architectural elements.

Wall washing - A method of lighting the walls of a room. The walls are washed with a uniform amount of light.

Chapter II.

Review of Literature

Chapter II includes a review of literature for the elements and
relationships of this study. The chapter begins with the role merchandise
lighting has in the retail store, followed by descriptions of the most commonly
used merchandise lighting techniques, and lighting effects on various types of
human behavior. The chapter concludes with research questions and a
description of the study's research design including the theoretical and
operationalized models used to test the research questions.

Merchandise Lighting

Lighting plays an important role in a retail store. Merchandise lighting
used in stores has three primary objectives. The first is to attract customers to
merchandise and merchandising spaces. Light attracts, and the quantity,
quality, and effect of the light reaching merchandise are determining factors in
the success of the sale of merchandise. The second objective of merchandise
lighting is to initiate the sale. Buying decisions start when a customer is visually
intrigued. The actual purchase is not accomplished until the customer can
visually evaluate the merchandise and read labeling through adequate
illumination. The third objective is to provide sufficient light to complete the sale.
Proper lighting and color rendering at the point of sale are necessary to
complete the transaction. It should enable the customer to make the final
purchase decision. Proper merchandise lighting should also allow sales
personnel to quickly and accurately complete the sale. This would include

reading prices, preparing sales slips, registering sales, retrieving the merchandise, using sales and transaction tools, and packaging (Illuminating Engineering Society, 1985; Cranendonk & van der Harst, 1988; Barr & Broudy, 1990).

Retail Lighting Techniques

There are three basic lighting techniques employed in retail stores. These strategies are designed to enhance the desirability of merchandise, attract the target customer, and project the retailer's desired image. Each technique is named for the type of retailer who typically uses them. They include the low-end (mass merchandiser) technique, the mid-market (specialty) technique, and the high-end (exclusive) technique (Cranendonk & van der Harst, 1988; Philips Lighting Guide, 1991) (presented in Table 1).

The low-end technique is designed principally to meet the requirement of safe movement in and around the store, and the need for good visual performance so that merchandise can easily be seen. The low-end lighting technique uses only general lighting. It consists of tubular fluorescent lamps in rather simple fittings. Illuminances are usually above 75 footcandles. When luminaires with a very diffused distribution, like fluorescents, are used in such a lighting system, the luminous environment is rather flat, and without contrasting features. The walls, ceiling, floor, and merchandise are experienced as of equal importance (Cranendonk & van der Harst, 1988; Philips Lighting Guide, 1991).

The mid-market technique uses a variety of lighting systems. A general lighting system provides good lighting uniformity and accurate color rendering. Incandescent lighting or fluorescent lighting with accurate color rendering are most commonly used for a general lighting system. Lighting levels will range

between 30 and 50 footcandles. Wall washing and perimeter lighting systems are used to highlight wall displays and architectural elements. Both of these lighting systems typically use fluorescent lighting with accurate color rendering or incandescent lighting. Perimeter and wall washing lighting levels are one and a half to three times the illumination of the general lighting. An accent lighting system, with strong contrast to the general lighting, is used to highlight special displays and merchandise. Lighting levels are at least five times the illumination of the general lighting. Incandescent or low voltage quartz halogen spots are most commonly used for accent lighting systems. (Cranendonk & van der Harst, 1988; Philips Lighting Guide, 1991; Illuminating Engineering Society, 1985).

The high-end technique establishes a store's identity and creates the ambiance or atmosphere associated with exclusive shops. High contrasts are required to emphasize the qualities of the articles displayed. To create high contrasts, the general lighting levels are kept to a minimum. They range between 15 and 30 footcandles. Incandescent lighting is most commonly used, however fluorescent lighting with accurate color rendering that can be dimmed is also effective. Using bright accent lights against the low general lighting creates a theatrical contrast. Accent lighting levels are at least ten times the illumination of the general lighting system. Incandescent or low voltage quartz halogen spots are most commonly used for the accent lighting system (Cranendonk & van der Harst, 1988; Philips Lighting Guide, 1991; Illuminating Engineering Society, 1985).

Table 1. Lighting techniques used in retail stores. (Cranendonk & van der Harst, 1988; Philips Lighting Guide, 1991)

LIGHTING DESCRIPTION	LOW-END LIGHTING TECHNIQUE	MID-MARKET LIGHTING TECHNIQUE	HIGH-END LIGHTING TECHNIQUE
GENERAL LIGHTING	bright illumination for lighting merchandise and performing tasks	medium illumination for even lighting of merchandise	low illumination for creating ambiance and contrast with accent lighting
TYPE	fluorescent in simple fittings	fluorescents with good color rendering	fluorescents with good color rendering or incandescents
LIGHTING LEVEL	greater than 75 footcandles	30 - 50 footcandles	15 - 30 footcandles
PERIMETER LIGHTING	not used	highlights wall displays and architectural elements	not used
TYPE	N/A	fluorescents with good color rendering or incandescents	N/A
LIGHTING LEVEL	N/A	1.5 - 3 times the general lighting	N/A
ACCENT LIGHTING	not used	highlights displays and merchandise	highlights displays and merchandise
TYPE	N/A	incandescent or low voltage spots	incandescent or low voltage spots
LIGHTING LEVEL	N/A	5 times the general lighting	10 times the general lighting

Behavior Studies and Store Lighting Design

The role lighting plays in affecting behavior is being integrated into lighting designs. Some designers are using concepts from studies done on the interaction between the individual and the physical environment to develop lighting designs that stimulate the desired behavior of customers (Erhardt, 1987). According to Kalff (1971), people are motivated to exert themselves by high illuminances that are cool or neutral colored, whereas relaxation will be encouraged in an atmosphere created by low illuminances of a warm color. These principles can be applied to a store's lighting based on it's marketing and products merchandised (Cranendonk & van der Harst, 1988).

Products classified as exclusive are typically expensive and take a more detailed analysis before a purchase decision can be made. A relaxed atmosphere created by warm colored low illumination in a store allows the customer to take their time and contemplate the decision carefully. Stores with higher levels of cool colored illumination may be effective in stimulating impulse purchases, but for purchases requiring high customer involvement, it can cause the customer to feel hurried. As a result the customer may leave the store without making a purchase decision because they feel they do not have an adequate amount of time to make an informed decision (Cranendonk & van der Harst, 1988).

Lighting's Affect on Display and Merchandise Interaction

Merchandise displays are the heart of a retail store. Effective displays attract customers, permit evaluation of merchandise, and stimulate sales (Green, 1986). Store displays present merchandise in an eye catching arrangement with intention of stimulating customer purchases (Barr & Broudy, 1990). Motivating a

customer to walk through a store and inspect displays and merchandise is an intricate task. To determine how lighting affects such behavior, several studies were examined. The study by Donovan and Rossiter (1982) postulates that a willingness or desire to interact with or explore a retail environment is directly related to the level of arousal.

Lighting's Affect on Arousal

The effect of lighting on arousal has been well documented. Mehrabian (1976) argues that lighting affects arousal state directly and positively. He concluded that brightly lit rooms are more arousing than dimly lit rooms. The findings were supported by Gifford (1988). The study also concluded that light serves as an arousal agent, with human activity increasing in bright light and decreasing in dim light. The study by Donovan and Rossiter (1982) states that in-store stimuli such as bright lighting increases arousal which in turn induces customers to spend more time in the store interacting with merchandise, thus resulting in increased sales.

Additional studies postulate that a different type of lighting stimulates arousal. Nuckolls (1983) states that stimulation can be improved when appropriate brightness variations (contrast) are sensitively introduced. Monotony and boredom, may result when there is no stimulation from spatial elements. Mintz (1986) states that arousal and excitement are created by developing lighting with highs, lows, and contrast. He states that an adequate general lighting level should be established and accent lights should create visual excitement.

Lighting's Affect on Communication and Sales

Successful personal selling is an important element in the success of a retail organization. Personal selling is defined as the activities of retail employees in helping shoppers buy satisfying offerings (James et al., 1981). Sales effectiveness is directly related to the ability of store employees to communicate with customers (Williams, Spiro, & Fine, 1990; Miles, Arnold, & Nash, 1990; Pace, 1962). Communication is a customer behavior that often is difficult for store personnel to stimulate. Lighting has been postulated to have a direct relationship with communication. In the study by Gifford (1988), it was concluded that bright lighting encouraged both general and intimate communication. It was also concluded that lower light levels dampened both general and intimate communication. A study done by Sanders, Gustanski, and Lawton (1974) found that when the lighting level in a corridor was reduced, the noise level from people talking reduced significantly.

Contrary to the studies by Gifford (1988) and Sanders et al. (1974), a study by Veitch and Kaye (1988) found that conversational sound levels decreased in high illumination conditions. Veitch and Kaye contend that the notion that low light leads to more quiet conversation appears more frequently in the lighting practices of architecture and interior design, and is not backed by empirical data.

The review of literature demonstrated that there were inconclusive and inconsistent finding for the effect lighting has on behavior. There were contradictory results for which type of lighting stimulates arousal. Several studies proposed that high levels of lighting stimulate arousal. Additional studies indicated that contrasting light levels stimulated arousal. Lighting's

effect on communication was also in dispute. Various studies indicated that communication was stimulated by high lighting levels, yet other studies stated that communication decreased in high lighting. The literature review for the type of lighting needed to stimulate purchases was also in conflict. One study stated that low levels of light were needed to allow the customer to make a purchase decision. Other studies indicated that high levels of light were needed to stimulate purchases. The disparities of results from the literature review made the application of the existing lighting principles dubious.

Research Questions

Considering the inconsistent results on the effects that lighting had on behavior, and the three lighting techniques used in retail stores, three research questions were posed.

1. Of the three lighting techniques (low-end, mid-market, high-end), which is most effective in stimulating customer communication with store personnel in a simulated home environment (SHE) within a retail audio/video store?

2. Of the three lighting techniques (low-end, mid-market, high-end), which is most effective in stimulating customer interaction with displays and merchandise in a simulated home environment (SHE) within a retail audio/video store?

3. Of the three lighting techniques (low-end, mid-market, high-end), which is the most effective in stimulating longer customer visits in the simulated home environment (SHE) within a retail audio/video store?

Research Design

The research design of this study was a quasi-experiment. There was manipulation of the independent variables; however, due to the lack of randomization of the sample, the study can not be considered a field experiment.

The independent variable was lighting. Three different lighting techniques were the levels of the independent variable. Included were the low-end (mass merchandiser) technique, the mid-market (specialty) technique, and the high-end (exclusive) technique.

The dependent variables were the behavioral responses of the customers. Included were the customer's communication behavior, the customer's merchandise and display interaction behavior, and the length of time the customer spent in the SHE.

Theoretical Model

The theoretical model used to test the research questions was proposed by the environmental psychologists Mehrabian and Russell (1974). Their model suggests that environmental stimuli effects emotional state that in turn mediates behavior responses (presented in Figure 1).

Operational Model

To operationalize the Mehrabian - Russell model, the independent variable, lighting, was used as the environmental stimulus. The three levels of the independent variable were the low-end technique, mid-market technique, and high-end technique.

The emotional state element from the Mehrabian - Russell model was not used in the operationalized model for this study. Though emotional state does effect behavior, for this study it was not necessary to know the customer's

emotional state, but to determine which type of lighting stimulated customer behavioral responses.

The behavioral responses of the model were operationalized by the dependent variables that were the observed customer behaviors. They included customer communication behavior, customer display and merchandise interaction behavior, and the length of time the customer spent in the SHE (see Figure 2).
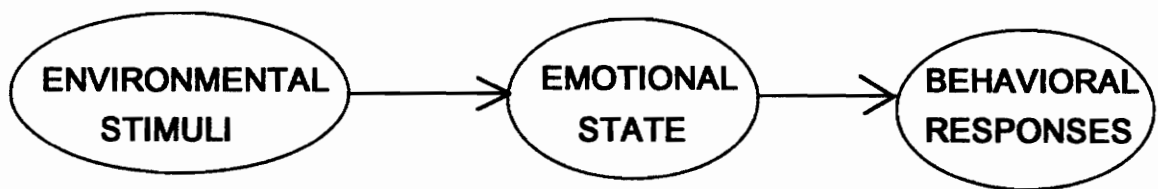
MEHRABIAN - RUSSELL MODEL

Figure 1. The Mehrabian and Russell (1974) Theoretical Model used in testing the research questions.

ENVIRONMENTAL
STIMULI

BEHAVIORAL
RESPONSES

LIGHTING TECHNIQUES

1. low-end

2. mid-market

3. high-end

CUSTOMER BEHAVIORAL RESPONSES

1. customer communication behavior

2. customer display and merchandise
   interaction behavior

3. length of time customer spent in
   the SHE.
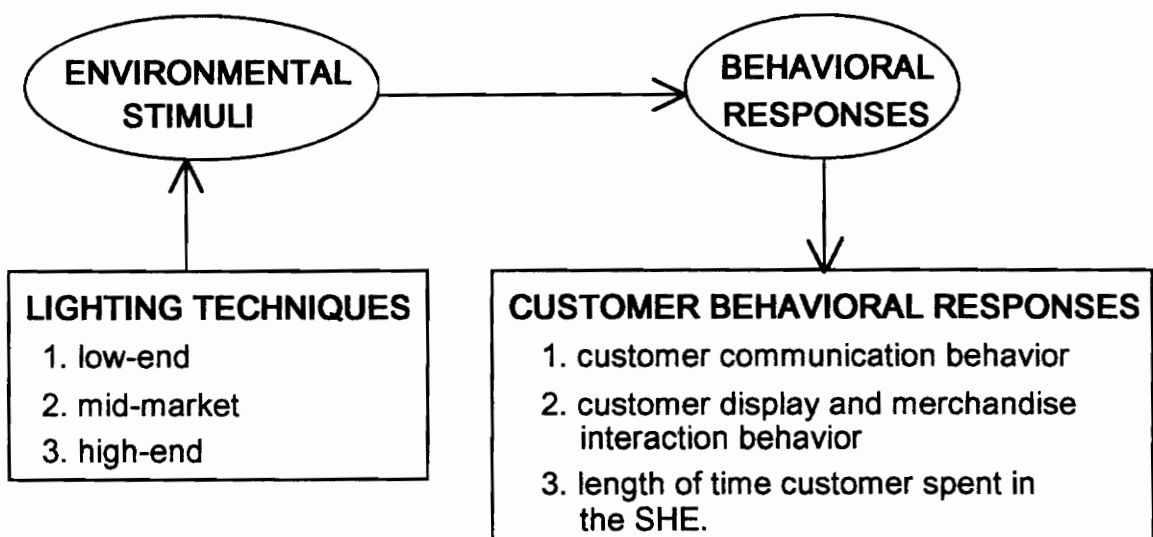
OPERATIONAL MODEL

Figure 2. This study's operationalized version of the Mehrabian and Russell
(1974) Model.

Chapter III.

Method

Chapter III is a description of methodology used in this study. Included is the criteria used in selecting the sample, an explanation of why this study's experiment was conducted twice, a description of the two methods used in the selection of observation days, the instruments used in collecting and quantifying data, a description of the location of the study, and the lighting system used to produce the three lighting techniques. The chapter concludes with a detailed account of the procedure used in the experiment.

Subjects

Subjects for this study were selected using a convenience sampling method. As qualified shoppers entered the SHE, they were selected as subjects. The sample was not randomized. Only customers who were in the SHE to shop or look around were observed. People in the SHE while waiting to consult with the service departments or management were not included in the sample. When couples or groups (families or friends shopping together) entered the SHE, each individual, except children under 12, were observed. Customer behavior was observed during three time blocks 10am - 12pm, 2pm - 4pm, 6pm - 8pm. By using three different time blocks, customers who shop during different hours were observed. Customer behavior was observed and recorded until a minimum sample of ten was achieved for each of the behaviors being studied, or until the observation time block expired. As a result, sample size varied for each observation time.

Selection of Observation Days

A problem associated with convenience sampling is that there is no way of knowing how representative the sample is of a larger population. Different samples taken on different days could represent different populations. Some researchers argue that there is no good reason for assuming that subjects included in a convenience sample are not representative of the general population. They suggest that if investigations using convenience sampling are repeated using different subjects and the results are consistent, confidence is gained in the generalizability of the results (Touliatos & Compton, 1988).

To maximize the generalizability of the results of this study, the observations for each lighting technique were conducted twice. To minimize bias in the sample, two different methods were used in selecting the days that the observations were performed. This was done to attain a more representable sample of the population. The first method involved doing the observations on the same day of the week (SDW), but in three successive weeks. The second method used three different days of the week (DDW) within the same week .

SDW observation method.

Experience based knowledge indicates that in retail stores, Saturday is the day with the most traffic and the most evenly distributed customer demographics. It is the day when most people are not working, and have the time to shop. Therefore, each of the SDW observation method's lighting techniques were studied on Saturdays in three successive weeks.

There is a disadvantage in doing observations on the same day in successive weeks. Shopping behavior can be affected by various extraneous

factors from week to week. Sales promotions, pay days, weather conditions, special events, and many countless factors can change shopping patterns.

There is one time during the year when consumer shopping is not effected by as many extraneous factors. This time occurs during the Christmas shopping season. During this period the shopping population is the largest. For all retailing industries, December is the busiest month. One quarter of all retail sales take place in the month of December (Cutler, 1989). The shopping patterns during this period indicated that Saturdays during the Christmas season were the best days to conduct the SDW observations for this study.

The first part of the Christmas season is best for observing shoppers because they are investigating products. During the last part of the Christmas season people have done investigative shopping and made purchase decisions. Many customers at this time are likely to be in the store or SHE only to pick up their purchase. Since the Christmas shopping season starts the day after Thanksgiving, the best times for the SDW observations were the Saturday after Thanksgiving, and the two successive Saturdays in December, The dates of the SDW observations were November 28, December 5, and December 12.

DDW observation method.

The DDW method of selecting days of observation involved selecting three days within the same week. To ensure that samples for each lighting technique were comparable, a demographic survey was conducted to identify types of customers for each day of the week. The demographic profile of customer age and sex was compiled the week of November 30 through December 5. By interviewing ten people from three time periods, 10am. - 12pm., 2pm - 4pm, 6pm - 8pm, a total of 30 people were surveyed for each day. The

age profile was broken down into six categories, under 20, 21 - 30, 31 - 40, 41 - 50, 51 - 60, and over 60. The customer demographic questionnaire is presented in Appendix A, and the data collection form is presented in Appendix B. After the demographic information was compiled by day, Chi Square tests were done to select the three days with the most comparable demographic mix of customers. The days with the most comparable demographic mix were Monday, Wednesday and Thursday. The DDW observations were done the week immediately following the demographic profile, on the days of December 7, 9, and 10.

The DDW method's demographic profile and observations were conducted during the same time frame as the SDW method's observations in order to achieve comparable samples. By doing the observations of both methods during the same time frame, both samples were subject to the same intervening variables present in the marketplace

Instrument

Data collection form.

Due to the nature of the behavior studied, and the environment in which behavior was observed, there was not a preexisting instrument that was appropriate for this study. An instrument, the data collection form, was developed for use in this study (presented in Appendix C). It was used by the researcher to record the behavioral responses of customers who were observed in the SHE..

Observed behavior for each customer was recorded on a checklist of various possible behaviors. The data collection form was broken down into the following four categories: Description, for recording descriptive information of

each subject for later identification; Length of Stay in SHE, used to record entry and exit times of each subject; Communication, to record observed customer communication behavior; and Display Interaction, to record customer display and merchandise interaction behavior. Though much of the data collection form was in checklist form, additional space was allocated to record behaviors that were not listed in the instrument.

A pretest of the data collection form was performed in the SHE at Stereo One in Cape Girardeau, Missouri on November 7. All three lighting techniques were tested. The pretest included a sample of 10 subjects for each of the three lighting techniques. After data was collected and analyzed, it was determined that no changes to the form were necessary.

Customer behavior rating scales.

To measure the effectiveness of the three lighting techniques in stimulating customer behavior, the customer behavioral responses had to be quantified. For customer communication, and display and merchandise interaction behaviors , two customer behavior rating scales were created. The third customer behavior, length of time the customer spent in the SHE, was measured in minutes and needed no further quantification.

The Customer Communication Rating Scale assigned values to different customer communication behaviors (see Appendix D). A value of one indicated the customer was greeted by store personnel but did not respond to the greeting. A value of two indicated that the customer was greeted by store personnel and did return a brief response. A value of three indicated that the customer asked a few questions of store personnel. A value of four indicated that the customer participated in a product presentation, and there was

extensive conversation between the customer and store personnel. The level recorded for the customer was the highest level they achieved.

The Customer Display and Merchandise Interaction Scale assigned values to different customer display and merchandise interaction behaviors (see Appendix E). A value of one indicated that the customer walked through the SHE without looking at or paying any attention to the displays or merchandise. A value of two indicated that the customer walked through the SHE and just glanced at the displays and merchandise. A value of three indicated that the customer stopped in front of a display or merchandise and looked at the products. A value of four indicated that the customer walked up to a display or merchandise and carefully inspected the products. The value recorded for the customer was the highest level they achieved.

Location

This study was conducted at Stereo One Incorporated located in Cape Girardeau, Missouri. Cape Girardeau is located on the Mississippi River in southeast Missouri, 120 miles south of St. Louis, Missouri, and 150 miles north of Memphis, Tennessee. It is a town of 40,000 permanent residents with an additional 8,000 students enrolled at Southeast Missouri State University. The surrounding market is primarily rural encompassing southeast Missouri, southern Illinois, western Kentucky, northwest Tennessee, and northeast Arkansas. Though a rural area, there are many small towns with manufacturing facilities with an abundance of good paying white and blue collar jobs. Cape Girardeau has a large regional medical community with a large population of affluent physicians, and well-paid support people. It serves as a central shopping area for a diverse population located within a 100 mile radius.

Stereo One is an audio/video specialty retailer that has been in business for over twelve years and is very well respected in the community. They market a wide variety of audio/video products ranging from the very inexpensive to the most elaborate available. Included are home stereo components and systems, home theaters, custom install audio/video products, audio/video furniture, car stereos, cellular phones, car security systems, televisions, projection televisions, video components, camcorders, and portable stereo products, Stereo One also has a full array of support services including a complete audio/video repair department, a car stereo installation department, and an audio/video custom installation department

Less than one year before the study took place, Stereo One built a new 10,000 square foot free-standing facility. The new store is not the type found in smaller markets like Cape Girardeau, but would rather typify the stores found in large urban areas. Because Stereo One does business with a diverse range of consumers, the store was designed to serve this customer base. A major merchandising area incorporated into the new Stereo One store is the simulated home environment (SHE). The SHE includes a foyer, living room, kitchen, dining room, boy's bedroom, master bedroom, master bath, workshop, deck, yard, and home theater. It is used to display and demonstrate custom installation audio/video products, home theaters, multi-room audio/video systems, and audio/video furniture (see Appendix F).

Lighting System Used in Study

Stereo One did not have a well developed lighting system for the SHE. Lighting was done as it would be in the home, with table lamps, floor lamps,

sconces, and hanging chandeliers. The result was a dimly lit area where the displays and merchandise blended into the background of the room.

In order to carry out this study a lighting system had to be designed for the SHE that could produce all three lighting techniques. The guidelines suggested by Cranendonk and van der Harst (1989) were used in the design of the lighting system. Calculations for the number of fixtures needed for the specified general lighting levels of each lighting technique was done using the zonal cavity method to calculate the average maintained illumination. To attain the proper light levels for the perimeter and accent lighting systems, distances of the fixtures to the surfaces to be lit were calculated. By using the distance and the lighting technique guidelines for illumination, the proper wattage lamps and beam spread were selected.

The Hubble lighting fixtures used in this study were three basic types, fluorescent, incandescent downlights, and low voltage track lights. Fluorescent lighting was used for the general lighting system. The fixtures were designed for recessed mounting in suspended ceilings and were fitted with 32 cell parabolic louvers. Each fixture used (4) 48", T - 12, 40 watt lamps and was equipped with a dimming ballast. Perimeter lighting was done using downlight fixtures designed for recessed mounting in a suspended ceiling. The fixture had a clear Alzak inner cone and used 75 watt R - 30 lamps. Accent lighting was done with low-voltage quartz halogen track lights. The track head fixtures used 75 watt MR - 16 lamps and had the 12 volt transformer built in. Track was mounted on the suspended ceiling grid and was configured in straight line runs, Ls, and Ts.

The lamps and dimmers used in the lighting system were obtained from State Electric Supply Company. The general lighting system utilized Phillips

model Ulralume XF 40/30, T -12, 40 watt fluorescent lamps, operating at 3000 degrees Kelvin, with a 3300 lumen output, and a color rendering index (CRI) of 85. Dimmers for the general lighting system were Lutron model FLR - 12. Fixtures for the perimeter lighting system were equipped with Phillips model X75R30SP130, 75 watt, R-30 incandescent spots with a beam spread of 30 degrees. Dimming for the perimeter lighting system was done with Leviton model LEV6681, rotary type 600 watt dimmers. Accent lighting track heads employed the Phillips model XEYF75W, 75 watt, MR - 16, quartz halogen narrow spots, with a beam spread of 19 degrees, an output of 12,500 lumens, and a CRI of 100.

Installation of the lighting system in the SHE at Stereo One occurred over a two week period. Each room or vignette had independently controlled general, perimeter, and accent lighting systems. Both the general and perimeter lighting systems could be dimmed and turned on and off. Accent lighting systems could only be turned on and off. Fluorescent fixtures were centrally placed in the suspended ceiling to give the broadest even coverage. Downlights were mounted in the suspended ceiling 18 inches from the side wall with 24 inches between fixtures. This placement produced a scalloped lighting effect on the walls. Tracks for the accent lighting system were mounted on the suspended ceiling grid and were located so that the angle to the displays and merchandise being highlighted was between 30 and 45 degrees (see Appendix G).

Procedure

Each of the two observational procedures used in this study were conducted over three days, for a total of six observation days. Each day, one of

the three lighting techniques was used in the SHE. Customer behavior was observed and recorded for each lighting technique.

The first day of each observation method the SHE's lighting was set for the low-end technique. The general lighting system's level was set at 100 footcandles with a light meter and dimmers. No perimeter or accent lighting systems were used.

The second day of each observation method the SHE's lighting was set for the mid-market technique. A light meter and dimmers were used to set the general lighting system's level at 50 footcandles and the perimeter lighting system's level at 75 footcandles. The accent lighting system was used to highlight the displays and merchandise. Lighting levels on the displays and merchandise were 250 footcandles .

The third day of each observation method the SHE's lighting was set for the high-end lighting technique. The general lighting system's level was set at 25 footcandles using a light meter and dimmers, while perimeter lighting was not used. The accent lighting system was used to highlight the displays and merchandise. Lighting levels on the displays and merchandise were 250 footcandles .

At the beginning of each day the observer set up in an inconspicuous location in the store. Directly across from the SHE was a "customer conference room" that was walled with tinted glass (see Appendix H). It provided a clear view into the SHE's living room window as well as the home theater's window. The area was the ideal location to make unobtrusive observations of customer behavior in the SHE. The "customer conference room" also had visibility to the store's front door and sales counter. This enabled the observer to identify

people who were in the store to shop rather than for other purposes such as visiting the service departments, or consulting with management. This was necessary because only people who were shopping were included in the sample. The observer did not have direct contact with the customers while they were in the SHE, and acted strictly as an unobtrusive observer.

The store personnel were briefed that a study was being conducted. They were informed that to ensure the validity of the study, no details could be divulged until the study was completed. The store personnel were advised to respond to customer questions about the lighting by telling them new lighting methods were being examined.

Video camcorders were used to supplement the researcher's direct observations. This was necessary due to the isolated merchandising areas in a SHE. Subjects were hidden from view in some of the isolated areas, making it impossible for the observer to see all behavior. Supplemental video equipment was also useful for this study because more than one customer was in the SHE at the same time, and observation of the behavior of each subject became more difficult. Small hand held 8 mm camcorders equipped with wide angle lenses were used to record the observations. Three camcorders were needed to cover the SHE effectively (see Appendix I). They were placed inconspicuously behind displays and on counters. In order to prevent detection, all lights on the camcorders were covered with tape and the auto focus was turned off. A separate video tape was used in each camcorder for each observation time period. At the end of each day, the researcher viewed the video recordings. Any customer behavior that was missed in direct observations was recorded in the data collection form.

As customers identified as shoppers entered the SHE, the researcher recorded a basic description and assigned a subject number. Basic descriptions were used to identify subjects on the video recordings which supplemented observations done by the researcher. Entry and exit times were also noted. If the subject reentered the SHE after leaving, the reentry time and exit time were also recorded. The researcher recorded all relevant behavioral responses being studied while the subject was in the SHE. At the end of each time block, the researcher coded the behavioral responses for each subject using the customer behavior rating scales.

Chapter IV.

Results

Chapter four is a report of the findings from the study and the statistical tests used to analyze the data collected during the observations of customer behavior at Stereo One. The data for each of the three research questions were analyzed and the findings are reported. Also included is a comparison of results between the two observation methods. The chapter concludes with a discussion of the results and some possible explanations for the outcomes.

Methods of Data Analysis

The data collected during the observations of customer behavior were analyzed on the Number Cruncher Statistical System. Several different tests were used to analyze the different forms of data. Descriptive Statistics were used to acquire basic statistical data employed in the analysis of all three research questions. Chi Square tests were used to determine if there were any differences among the three different lighting techniques for the Customer Communication Rating Scale and the Customer Display and Merchandise Interaction Rating Scale. Chi Square tests were used because the data from the customer behavior rating scales were categorical and values were arbitrarily assigned to observed customer behavior. An One Way Analysis of Variance (ANOVA) was used to determine if there were any differences among the lighting techniques in stimulating longer customer visits in the SHE. An ANOVA was used because the data was continuous. The data was the actual length of time a customer spent in the SHE measured in minutes. A Newman/Keul's Range Test was used as a post-hoc test on ANOVAs if there were any statistical

differences among lighting techniques. The Newman/Keul Test was used to isolate the lighting technique that was the most effective at stimulating longer length of stays in the SHE.

Sample

Because of the sampling method used, in which data was collected until a minimum sample of ten was achieved for each behavior during a time period, sample size varied. Two different problems occurred that effected the sample size. The first problem occurred primarily during the SDW observation method and effected only the sample size for customer communication behavior. During the observations the store was so busy that store personnel were unable to approach all the customers in the SHE. Customers would enter the SHE, investigate the products, and then exit before store personnel could approach them. The customer's display and merchandise interaction behavior was recorded, and length of time spent in the SHE, but because the customer was not approached by store personnel before exiting, no communication behavior was recorded. Observations were recorded until the end of each time block. For customer communication, the minimum sample size of ten was attained only three times for the eighteen observation periods (sample distributions among the three time periods for both the SDW and DDW observation method's lighting techniques are presented in Table 2).

The second problem that effected sample size occurred primarily during the DDW method of observation. The DDW method's observation days came during week-days. The days selected were Monday, Wednesday, and Thursday. Customer traffic in the store and SHE during these days was not as strong as it was on Saturdays, resulting in a substantially smaller sample size

Table 2. The sample distribution for customer communication with store personnel. The distribution is broken down for the three observational time blocks and the three lighting techniques of the SDW and DDW observation methods.

Time Period	SDW low-end n=	SDW mid-market n=	SDW high-end n=	DDW low-end n=	DDW mid-market n=	DDW high-end n=	Total n=
A (10 -12)	10	8	4	2	1	3	28
B (2 - 4)	8	10	10	6	2	5	41
C (6 - 8)	5	6	8	2	5	0	26
Total n=	23	24	22	10	8	8	95

for the DDW observation method. For customer display and merchandise interaction and length of time spent in the SHE, a minimum sample size of ten was achieved only one time for the nine time blocks during the DDW observation method. While the SDW observation method attained a minimum sample of at least ten in eight of the nine observation time blocks (see Table 3).

SDW Results Compared to DDW Results

To determine if the samples of the SDW and DDW observation methods had similar characteristics, two comparisons were made. The samples were analyzed to determine if they had similar characteristics for distribution among the three different time periods in which observations were made and gender composition.

The distribution of the samples among the three time periods was analyzed using a Chi Square test. The null hypothesis tested in the analysis was, " there was no difference in the distribution of the samples among the three time periods for the SDW and DDW observation method's lighting techniques". Alpha for the test was ρ = .05.

$$H_o : \mu SDW \text{ low-end} = \mu SDW \text{ mid-market} = \mu SDW \text{ high-end} =$$
$$\mu DDW \text{ low-end} = \mu DDW \text{ mid-market} = \mu DDW \text{ high-end}$$

The Chi Square with 10 degrees of freedom was 6.140. The probability level was .803. Subsequently the null hypothesis was retained. There was no significant difference in the distribution of samples among the three time periods for the SDW and DDW observation method's lighting techniques. The SDW method's total sample distribution was somewhat uniformly distributed with the fewest observations (26.1%) made during the evening time period (see Table 4). In contrast to the SDW distribution, the highest proportion (51.1%) of the DDW

Table 3. The sample distribution for customer display and merchandise interaction and length of time spent in the SHE. The distribution is broken down for the three observational time periods and the three lighting techniques of the SDW and DDW observation methods.

Time Period	SDW low-end n=	SDW mid-market n=	SDW high-end n=	DDW low-end n=	DDW mid-market n=	DDW high-end n=	Total n=
A (10 -12)	17	12	13	5	4	3	54
B (2 - 4)	18	12	19	8	6	10	73
C (6 - 8)	9	10	13	2	5	4	43
Total n=	44	34	45	15	15	17	170

observations fell during the 2 - 4pm time period (see Table 5).

The distribution of the sample for gender was analyzed using a Chi Square test. The null hypothesis tested in the analysis was, "there was no difference in the distribution of the sample between male and female for the SDW or DDW observation method's lighting techniques ". Alpha for the test was $p = .05$.

$$H_o : \mu \text{SDW low-end} = \mu \text{SDW mid-market} = \mu \text{SDW high-end} =$$
$$\mu \text{DDW low-end} = \mu \text{DDW mid-market} = \mu \text{DDW high-end}$$

The Chi Square with 5 degrees of freedom was 5.267. The probability level was .384. Subsequently the null hypothesis was retained. There was no significant difference in the distribution of the samples between male and female for the SDW and DDW observation method's lighting techniques. The SDW method's total sample distribution was largely weighted in males, 61.8% with 38.2% females (see Table 6). While the DDW total sample distribution had even a larger portion of males 76.6% with 23.4% females (see Table 7).

To determine if there were any significant differences in the data between the SDW and DDW observation methods, Chi Square tests were conducted comparing the data from like lighting techniques for customer communication with store personnel and customer display and merchandise interaction. An ANOVA was used to compare like lighting techniques for the length of time the customer spent in the SHE. The comparisons included SDW low-end versus DDW low-end, SDW mid-market versus DDW mid-market, and SDW high-end versus DDW high-end.

The results from the Chi Square tests indicated that for the Customer Communication Rating Scale, there was no significant difference in the data

Table 4. SDW observation method's sample distribution for the three lighting techniques and the three observational time periods. n = 123

TIME PERIOD	LOW-END TECHNIQUE n= & % of technique total	MID-MARKET TECHNIQUE n= & % of technique total	HIGH-END TECHNIQUE n= & % of technique total	METHOD TOTAL n= & % of total
A (10 am - 12)	n=17 38.6%	n=12 35.3%	n=13 28.9%	n=42 34.1%
B (2 - 4 pm)	n=18 40.9%	n=12 35.3%	n=19 42.2%	n=49 39.8%
C (6 - 8 pm)	n=9 20.5%	n=10 29.4%	n=13 28.9%	n=32 26.1%
TOTAL	n=44 100%	n=34 100%	n=45 100%	n=123 !00%

Table 5. DDW observation method's sample distribution for the three lighting techniques and the three observational time periods. n = 47

TIME PERIOD	LOW-END TECHNIQUE n= & % of technique total	MID-MARKET TECHNIQUE n= & % of technique total	HIGH-END TECHNIQUE n= & % of technique total	METHOD TOTAL n= & % of total
A (10 am - 12)	n=5 33.3%	n=4 26.7%	n=3 17.6%	n=12 25.5%
B (2 - 4 pm)	n=8 53.3%	n=6 40.0%	n=10 58.8%	n=24 51.1%
C (6 - 8 pm)	n=2 13.4%	n=5 33.3%	n=4 23.6%	n=11 23.4%
TOTAL	n=15 100%	n=15 100%	n=17 100%	n=47 100%

Table 6. SDW observation method's sample distribution for the three lighting techniques and gender. n = 123

GENDER	LOW-END TECHNIQUE n= & % of technique total	MID-MARKET TECHNIQUE n= & % of technique total	HIGH-END TECHNIQUE n= & % of technique total	METHOD TOTAL n= & % of total
MALE	n=27 61.4%	n=22 64.7%	n=27 60.0%	n=76 61.8%
FEMALE	n=17 38.6%	n=12 35.3%	n=18 40.0%	n=47 38.2%
TOTAL	n=44 100%	n=34 100%	n=45 100%	n=123 100%

Table 7. DDW observation method's sample distribution for the three lighting techniques and gender. n = 47

GENDER	LOW-END TECHNIQUE n= & % of technique total	MID-MARKET TECHNIQUE n= & % of technique total	HIGH-END TECHNIQUE n= & % of technique total	METHOD TOTAL n= & % of total
MALE	n=10 66.7%	n=11 73.3%	n=15 88.2%	n=36 76.6%
FEMALE	n=5 33.3%	n=4 26.7%	n=2 11.8%	n=11 23.4%
TOTAL	n=15 100%	n=15 100%	n=17 100%	n=47 100%

between like lighting techniques for the two methods. The means for the low-end techniques were 3.696 for the SDW method and 3.800 for the DDW method. For the mid-market techniques, the means were 3.375 for the SDW method and 3.875 for the DDW method. Means for the high-end technique were 3.910 for the SDW method and 3.750 for the DDW method. The Chi Square probability levels for all comparisons were above the alpha level of $p =. 05$ (presented in Table 8), indicating there was no significant difference between the data for like lighting techniques and the method of collecting data.

The results of the Chi Square tests for the Customer Display and Merchandise Interaction Rating Scale, indicated that there was no significant difference in the data between like lighting techniques for the two methods. The means for the low-end techniques were 3.181 for the SDW method and 3.400 for the DDW method. For the mid-market techniques, the means were 3.735 for the SDW method and 4.000 for the DDW method. Means for the high-end techniques were 3.689 for the SDW method and 4.000 for the DDW method. The Chi Square probability levels for all comparisons were above the alpha level of $p =. 05$ (presented in Table 9), indicating there was no significant difference between the data for like lighting techniques.

To determine how similar the data of the two observation methods were for length of time spent in the SHE, an ANOVA and a post-hoc Newman/Keul's Range Test were conducted. The results indicated that there was no significant difference in the data between like lighting techniques for the two methods. The means for the low-end techniques were 3.659 minutes for the SDW method and 4.933 minutes for the DDW method. For the mid-market techniques, the means were 8.706 minutes and 11.333 for the DDW method. Means for the high-end

Table 8. The Customer Communication Rating Scale Chi Square and probability levels for comparisons of like lighting techniques between the SDW and DDW observation methods. Alpha for the test was ρ = .05.

LIGHTING TECHNIQUE (SDW:DDW)	TOTAL n =	DEGREES OF FREEDOM	CHI SQUARE	PROBABILITY LEVEL
low-end	33	2	3.118	.2104
mid-market	32	2	1.974	.3727
high-end	30	2	3.485	.3408

Table 9. The Customer Display and Merchandise Interaction Rating Scale Chi Square and probability levels for comparisons of like lighting techniques between the SDW and DDW observation methods. Alpha for the test was $\rho = .05$.

LIGHTING TECHNIQUE (SDW:DDW)	TOTAL n =	DEGREES OF FREEDOM	CHI SQUARE	PROBABILITY LEVEL
low-end	59	2	5.240	.073
mid-market	49	2	4.218	.121
high-end	62	2	4.504	.105

techniques were 7.311 minutes for the SDW method and 11.176 minutes for the DDW method. The Newman/Keul's post-hoc test did not indicate any significant difference between any of the like lighting techniques.

Because the statistical analysis between the SDW and DDW observation methods indicated that there was not a significant difference between them for either sample characteristics or data for the research questions, the data was collapsed. Combining the two observation methods yielded a larger sample size. The larger sample gave more power to the statistical analysis of the research questions.

Results for Research Question 1

The results of the data analysis for the first research question, which sought to determine which lighting technique would be most effective in stimulating customer communication with store personnel, indicated that there was no significant difference among the three lighting techniques in stimulating customer communication.

A Chi Square test was conducted on the data. The null hypothesis tested in the analysis was, "there is no difference among the three lighting techniques in stimulating customer communication with store personnel" Alpha for the tests was $\rho = .05$.

$$H_o : \mu_{low\text{-}end} = \mu_{mid\text{-}market} = \mu_{high\ end}$$

The Chi Square with 4 degrees of freedom was 5.054. The probability level was .282. Subsequently the null hypothesis was retained. There was no significant difference among the three lighting techniques in stimulating customer communication with store personnel. All Customer Communication

Rating Scale means were 3.500 and above, indicating there was a high level of communication for all lighting techniques (presented in Table 10).

Results for Research Question 2

The results of the data analysis for the second research question, which sought to determine which lighting technique was most effective at stimulating customer interaction with displays and merchandise, indicated that there was a significant difference among the lighting techniques in stimulating customer interaction with displays and merchandise.

A Chi Square test was conducted on the data. The null hypothesis tested in the analysis was, "there was no difference among the three lighting techniques at stimulating customer interaction with displays and merchandise." Alpha for the tests was $\rho = .05$.

$$H_o : \mu_{\text{low-end}} = \mu_{\text{mid-market}} = \mu_{\text{high end}}$$

The Chi Square with 4 degrees of freedom was 27.071. The probability level was .0000. Subsequently the null hypothesis was rejected and the alternate hypothesis was accepted.

$$H_a : \mu_{\text{low-end}} \neq \mu_{\text{mid-market}} \neq \mu_{\text{high end}}$$

There was a significant difference among the three lighting techniques in stimulating customer interaction with displays and merchandise.

To determine which lighting technique was most effective in stimulating customer interaction with displays and merchandise, three additional Chi Square tests (all possible pairs) were done comparing two lighting techniques at a time. The first test compared the low-end lighting technique with the mid-market lighting technique. The null hypothesis tested in the analysis was, " there was no difference between the low-end lighting technique and the mid-market lighting

Table 10. Customer Communication Rating Scale means and standard deviations for the three lighting techniques and the total. n = 95

STATISTIC	LOW-END TECHNIQUE	MID-MARKET TECHNIQUE	HIGH-END TECHNIQUE	TOTAL
Customer Communication Rating Scale means ($\overline{X}$)	3.727	3.500	3.867	3.695
standard deviations (s)	.626	.803	.434	.654

technique in stimulating customer interaction with displays and merchandise".
Alpha for the test was $\rho = .05$.

$$H_0 : \mu_{low\text{-}end} = \mu_{mid\text{-}market}$$

The Chi Square with 2 degrees of freedom was 17.103. The probability
level was .0002. Subsequently the null hypothesis was rejected, and the
alternate hypothesis was accepted.

$$H_a : \mu_{low\text{-}end} \neq \mu_{mid\text{-}market}$$

There was a significant difference between the low-end lighting technique and
the mid-market lighting technique in stimulating customer interaction with
displays and merchandise.

The second test compared the low-end lighting technique with the high-
end lighting technique. The null hypothesis tested in the analysis was, " there
was no difference between the low-end lighting technique and the high-end
lighting technique in stimulating customer interaction with displays and
merchandise". Alpha for the test was $\rho = .05$.

$$H_0 : \mu_{low\text{-}end} = \mu_{high\ end}$$

The Chi Square with 2 degrees of freedom was 17.953. The probability
level was .0001. Subsequently the null hypothesis was rejected and the
alternate hypothesis was accepted.

$$H_a : \mu_{low\text{-}end} \neq \mu_{high\ end}$$

There was a significant difference between the low-end lighting technique and
the high-end lighting technique in stimulating customer interaction with displays
and merchandise.

The third test compared the mid-market lighting technique with the high-
end lighting technique. The null hypothesis tested in the analysis was "there

was no difference between the mid-market lighting technique and the high-end lighting technique in stimulating customer interaction with displays and merchandise". Alpha for the test was $\rho = .05$.

$$H_0 : \mu_{\text{mid-market}} = \mu_{\text{high end}}$$

The Chi Square with 2 degrees of freedom was 1.679. The probability level was .432. Subsequently the null hypothesis was retained. There was no significant difference between the mid-market lighting technique and the high-end lighting technique in stimulating customer interaction with displays and merchandise.

By analyzing the results of the Chi Square tests and the Customer Display and Merchandise Interaction Rating Scale means , it was determined that the mid-market and high-end lighting techniques were significantly better than the low-end lighting technique in stimulating customer interaction with displays and merchandise. However, there was no significant difference between the mid-market and the high-end lighting techniques in stimulating customer interaction with displays and merchandise. The means for the mid-market and high-end techniques (presented in Table 11) were approaching 4.000 which indicates that their subjects carefully inspected displays and merchandise, while the low end technique's mean was closer to 3.000 indicating that its subjects only stopped and looked at the displays and merchandise.

Results for Research Question 3

The results of the data analysis for the third research question, which sought to determine which lighting technique was the most effective in stimulating longer customer visits in the SHE, indicated that there was a significant difference among the lighting techniques in stimulating customers to

Table 11. Customer Display and Merchandise Interaction Rating Scale means and standard deviations for the three lighting techniques and the total. n = 170

STATISTIC	LOW-END TECHNIQUE	MID-MARKET TECHNIQUE	HIGH-END TECHNIQUE	TOTAL
Customer Display and Merchandise Interaction Rating Scale means ($\overline{X}$)	3.237	3.816	3.774	3.600
standard deviations (s)	.817	.441	.556	.683

spend more time in the SHE.

An one way analysis of variance (ANOVA) was done on the data. The null hypothesis tested in the analysis was, " there was no difference among the lighting techniques in stimulating longer customer visits in the SHE. Alpha for the tests was $\rho = .05$.

$$H_o : \mu_{low\text{-}end} = \mu_{mid\text{-}market} = \mu_{high\ end}$$

The ANOVA F probability level was .0004. Subsequently the null hypothesis was rejected and the alternate hypothesis was accepted.

$$H_a : \mu_{low\text{-}end} \neq \mu_{mid\text{-}market} \neq \mu_{high\ end}$$

There was a significant difference among the lighting techniques in stimulating longer customer visits in the SHE.

To determine which lighting technique was the most effective at stimulating longer customer visits in the SHE, a Newman/Keul's Range test was performed. The results indicated that the mid-market and high-end lighting techniques were significantly different than the low-end lighting technique in stimulating longer customer visits in the SHE. However, there was no significant difference between the mid-market lighting technique and the high-end lighting technique in stimulating longer customer visits in the SHE. By using the results of the Newman/Keuls Range Test and the means for the Length of Time Spent in the SHE , it was determined that the mid-market and high-end lighting techniques were significantly better than the low-end lighting technique in stimulating longer customer visits in the SHE. The means for the mid-market and high-end lighting techniques were both over twice as long as the mean for the low-end technique (presented in Table 12).

Table 12. Means and standard deviations for Length of Time Spent in the SHE for the three lighting techniques and the total. n = 170

STATISTIC	LOW-END TECHNIQUE	MID-MARKET TECHNIQUE	HIGH-END TECHNIQUE	TOTAL
Means ($\overline{X}$) for Length of Time Spent in the SHE	3.983 min.	9.510 min.	8.371 min.	7.176 min.
standard deviations (s)	2.880	10.815	6.579	7.573

Discussion

The data analysis indicated that there was no difference among the lighting techniques in stimulating customer communication with store personnel. The analysis also indicated that the mid-market and high-end lighting techniques were better than the low-end lighting technique in stimulating customer display and merchandise interaction and longer visits in the SHE. However, there was no difference between the mid-market and high-end lighting techniques in stimulating customer display and merchandise interaction and longer visits in the SHE.

Customer communication with store personnel.

The results for the research question on customer communication suggest that none of the lighting techniques were better than the others in stimulating customer communication with store personnel. The results were unable to support or refute any of the conflicting studies concerning lighting's effect on communication. The studies of Gifford (1988) and Sanders et al. (1974) found that brighter lighting levels encouraged communication. In contrast the study by Veitch and Kaye (1988) found that high illumination decreased conversational sound levels. Though these studies were not in agreement, they had one thing in common. All found differences in communication at different lighting levels. There is a major difference between this study and the studies in the literature review that may help to explain the contrasting results. In the studies from the literature review, the subjects being observed were acquainted with each other and communication was between two or more subjects. Subjects in this study were not acquainted with their communication partners who were the store personnel. The different

relationship between communication partners in the literature may alter the subject's behavioral response. However, in this study, the behavior observed was the communication encounter that typically occurs in a retail store.

<u>Customer display and merchandise interaction and length of time spent in the SHE</u>.

There were two significant findings in the study. The first significant finding was that both the mid-market and high-end lighting techniques were the most effective in stimulating customer display and merchandise interaction. The second significant finding was that both the mid-market and high-end lighting techniques were the most effective in stimulating longer customer visits in the SHE.

A possible explanation of why both the mid-market and high-end lighting techniques were equally effective in stimulating customer behavior may involve a lighting method both employed. Although substantially different, both the mid-market and high-end lighting techniques use high output spot lights to highlight the displays and merchandise. The strong contrast between the displays and merchandise and their surroundings appear to be a successful means for attracting and holding customers in a display area.

The supposition that both lighting techniques were equally effective in stimulating customer behavior because of a lighting method both employed may be explained by the studies on lighting's affect on behavior from the review of literature. Mintz (1986) states that arousal and excitement are created by developing lighting with highs, lows, and contrast. Nuckolls (1983) suggests that stimulation can be improved when appropriate brightness variations (contrasts)

are sensitively introduced. Contrasts were created in both lighting techniques by highlighting the displays and merchandise, thus resulting in customer arousal.

The result of increased arousal in a retail environment is addressed in the study by Donovan and Rossiter (1982). They postulate that a willingness or desire to interact with or explore a retail environment is directly related to the level of arousal. Later in the same study, Donovan and Rossiter (1982) state that arousal induces customers to spend more time in the store interacting with merchandise, thus resulting in increased sales.

In this study, the results for the research questions for the mid-market and high-end lighting techniques were strong indications of customers interacting with displays and merchandise and spending more time in the SHE. These behaviors can thus be linked to high levels of arousal. The studies on arousal help explain why the mid-market and high-end lighting techniques were equally effective at stimulating customer display and merchandise interaction and longer customer visits in the SHE. The findings also support the studies from the review of literature that found contrasting lighting stimulates arousal, and refutes the studies that stated that high levels of general lighting increases arousal. However, the results neither support or refute any of the previous studies done on lighting's effect on communication.

Chapter V.

Summary and Conclusions

Summary

Merchandise lighting plays an important role in a retail store. A store's success can be directly linked to the success of its lighting plan (Barr & Broudy, 1990). Previous studies have found that there are three basic merchandise lighting techniques used in retail stores: low-end, mid-market, and high-end (Cranendonk & van der Harst, 1988; Philips Lighting Guide, 1991).

Retailers are emerging with new marketing concepts that require lighting plans tailored to the their product mix, merchandising, and target customer. A new merchandising technique for an existing retailer is the simulated home environment (SHE) found in audio/video stores. The SHE is a series of rooms and vignettes that present audio/video products in a simulated home setting. The purpose of this study was to determine which type of merchandise lighting would create the most positive shopping environment in the SHE.

Studies have shown that lighting has an effect on human behavior. In a retail store three customer behaviors are linked to increased sales. They include customer communication with store personnel (Williams, et. al., 1990; Miles, et al., 1990; Pace, 1962), customer interaction with displays and merchandise, and length of time in the store (Donovan and Rossiter, 1982). The research questions tested in this study sought to determine which of the three merchandise lighting techniques was most effective at stimulating the three customer behaviors linked to increased sales.

The study was conducted in an audio/video store's SHE. The SHE was equipped with a lighting system that could produce all three lighting techniques. The study tested each of the lighting techniques twice. At the beginning each day the SHE's lighting system was set up for one of the lighting techniques and customer behavior was unobtrusively observed and recorded.

A convenience method of sampling was used in the study. In order to make the results of a study using a convenience sampling method more generalizable, the experiment was done twice. If the results were the consistent between the two experiments, then the results could be considered more generalizable (Touliatos & Compton, 1988). Two methods were used in selecting the observation days for the experiments. One method used the same day of the week in three successive weeks (SDW), and the other used three different days within the same week (DDW). The subjects were the customers who entered the SHE and were shopping or looking around. The sample size for the SDW method was 123, and the sample size for the DDW method was 47.

To assess the effectiveness of the lighting techniques in stimulating customer behavior, two behavior rating scales were created. The Customer Communication Rating Scale assigned values to observed customer communication behavior. The Customer Display and Merchandise Interaction Rating Scale assigned values to observed customer display and merchandise interaction behavior. The third customer behavior, length of time in the SHE was measured in minutes and did not require any further quantification.

Data was analyzed using Chi Square tests for the Customer Communication Rating Scale and the Customer Display and Merchandise Interaction Rating Scale. An One Way Analysis of Variance (ANOVA) was used

to analyze the length of time in the SHE. Chi Square tests and an ANOVA were also used to analyze the similarity of sample characteristics and results for the SDW and DDW observation methods.

The analysis of the SDW and DDW observation methods indicated that there was no significant difference in sample characteristics or data for like lighting techniques. As a result the data for both samples were collapsed to analyze the research questions.

The results indicated that the mid-market and high-end lighting techniques were significantly better than the low-end lighting technique in stimulating customer display and merchandise interaction, but there was no significant difference between them. In addition, both the mid-market and high-end lighting techniques were significantly better than the low-end lighting technique in stimulating longer customer visits in the SHE, but there was no significant difference between them. The results also indicated that there was no significant difference among the lighting techniques in stimulating customer communication with store personnel.

Conclusions

Both the mid-market and high-end lighting techniques were equally effective in stimulating customer display and merchandise interaction. This behavior is linked to the lighting method of highlighting the displays and merchandise that both techniques employ. The results support the studies from the literature review that postulated that contrastive lighting was arousing.

Longer customer visits in the SHE were stimulated equally well by the mid-market and high-end lighting techniques. This behavior is linked to more customer display and merchandise interaction, which was stimulated by highlighting the displays and merchandise. The results of this study indicate that highlighting of the displays and merchandise ultimately leads to longer customer visits in the SHE.

There was no significant difference among the three lighting techniques in stimulating customer communication with store personnel. Even though the sample size for this customer behavior was smaller than the other two customer behaviors, the results and data were consistent.

Based on the results, this study concludes that store lighting designs that incorporate the highlighting of displays and merchandise will stimulate customer display and merchandise interaction, and longer customer visits, which other recent studies have found result in increased sales.

There are not many existing studies that have been done testing the environment - behavior relationship in the retail store. The common belief is intervening variables make it nearly impossible to achieve accurate results. Methods used in this study were successful in controlling a number of the typical intervening variables.

The unique opportunity of installing a lighting system in an operating retail store, where the researcher could manipulate different lighting affects, and observe customer behavior, made this study and its findings important for both the lighting and retail world.

Implications

The potential for using the lighting techniques from this study to influence human behavior in a retail setting holds implications for store owners, store planners, lighting designers, or any profession involved in the design of stores. For the store owners, more customer interaction with merchandise and more time spent in the store will ultimately lead to more sales. For the professionals involved in store design or lighting design, specialized designs could bring about more productive stores for their clients and successful projects could attract additional design business

Recommendations for Further Study

The following recommendations for further research are made based on the results of this study.

1. Select a site for the study that has the potential for a large sample size. Stores in larger metropolitan area that do a substantial business would be the most appropriate. They would have sufficient customer traffic to allow a large sample size to be attained

2. In studies where a behavior is tested that requires contact with store personnel, a dedicated store personnel member should be assigned to make contact. This would ensure that all customers could be tested and none would be missed because store personnel was unavailable.

3. Create an environment that can simulate a retail store. It would still need to be placed in an area where there are people shopping. A possible location could be in the center areas of shopping malls. If this scenario is possible, multiple retail environments could be created

to test all levels of the independent variable simultaneously instead of one at a time over an extended period. Then all levels of the independent variable would be subject to the same intervening variables present in the marketplace.

4. To make the results more generalizable, studies should be repeated during different times of the year, with different types of products, and in different market locations. If the results are consistent over these changing situations then the results could be generalized to a much wider base of retailers.

Much of retail design is based on influencing the behavior of the customer. However many store designs are ineffective and can even stimulate undesirable customer behavior. Most of the design principles used in stores are intuitive or based on past designs. This may be due to the lack of empirically based knowledge on how the retail environment effects customer behavior. If more retail environment - behavior research can be done, and the results disseminated to retail designers, perhaps the end result will be retail stores that are more profitable for store owners, and more pleasant for the customers.

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APPENDICES

Appendix A

Customer Demographic Questionnaire

Appendix A

Customer Demographic Questionnaire

WHICH AGE GROUP DO YOU BELONG TO ?

A.	under 20	D.	41 - 50
B.	21 - 30	E.	51 - 60
C.	31 - 40	F.	over 60

Appendix B

Demographic Data Collection Form

Appendix B

Demographic Data Collection Form

Date:_____

	Period A		Period B		Period C	
	SEX	**AGE**	**SEX**	**AGE**	**SEX**	**AGE**

Daily Totals

SEX:

    Male _____

    Female _____

AGE:

    A. under 20 _____

    B. 21 - 30 _____

    C. 31 - 40 _____

    D. 41- 50 _____

    E. 51 - 60 _____

    F. over 60 _____

Appendix C

Data Collection Form

Appendix C

DATA COLLECTION FORM

Date: **Time Period:**

Subject	1	2	3	4	5
DESCRIPTION	xxxxxxxx	xxxxxxxx	xxxxxxxx	xxxxxxxx	xxxxxxxx
sex					
clothing					
physical features					
LENGTH OF STAY IN SHE					
entry time					
exit time					
Re-entry time					
exit time					
COMMUNICATION	xxxxxxxx	xxxxxxxx	xxxxxxxx	xxxxxxxx	xxxxxxxx
not approached					
Salesman					
ignores greeting					
acknowledges greeting					
seeks help - store personnel					
no interaction					
just looking					
asks a few questions					
participates in presentation					
leaves without assistance					
DISPLAY INTERACTION	xxxxxxxx	xxxxxxxxx	xxxxxxxx	xxxxxxxx	xxxxxxxx
taken into SHE by salesman					
walks through without stopping					
no attention paid to displays					
glances at displays					
stops in front of display					
inspects displays					
requests demonstration					

Appendix D

Customer Communication Rating Scale

Appendix D

Customer Communication Rating Scale

VALUE	BEHAVIOR
1	ignores greeting
2	acknowledges greeting
3	asks a few questions
4	participates in a presentation

Appendix E

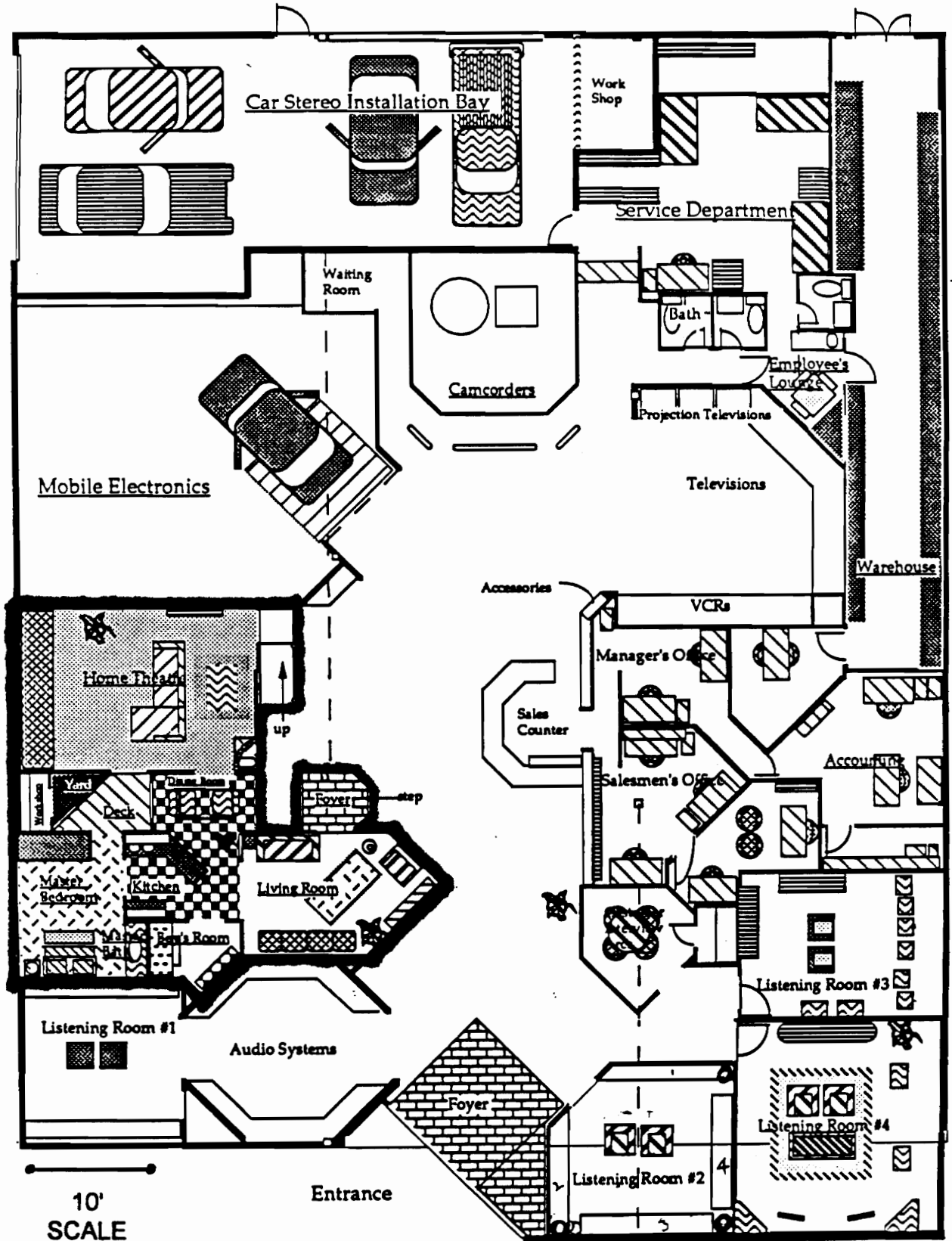Customer Display and Merchandise Interaction Rating Scale

Appendix E

Customer Display and Merchandise Interaction Rating Scale

VALUE	BEHAVIOR
1	no attention paid to displays or merchandise
2	glances at displays
3	stops in front of display
4	inspects display

Appendix F

Stereo One Floor Plan

Appendix F

Stereo One Floor Plan

Car Stereo Installation Bay

Work Shop

Service Department

Waiting Room

Camcorders

Bath

Employee's Lounge

Projection Televisions

Televisions

Mobile Electronics

Warehouse

Accessories

VCRs

Manager's Office

Sales Counter

Home Theatre

up

Salesmen's Office

Accounting

Yard

Dining Room

Workshop

Foyer

step

Deck

Master Bedroom

Kitchen

Living Room

Master Bath

Ben's Room

Listening Room #3

Listening Room #1

Audio Systems

Foyer

Listening Room #4

Listening Room #2

10'
SCALE

Entrance

Appendix G

SHE Lighting Plan

Appendix G

SHE Lighting Plan

SYMBOL LEGEND

2'x4' CEILING MOUNT FLUORESCENT	(symbol)
CEILING MOUNT INCANDESCENT DOWNLIGHT	(symbol)
LOW-VOLTAGE TRACK LIGHTS	(symbol)
INCANDESCENT WALL SCONCE	(symbol)

ENTRY

LIVING ROOM

KITCHEN

BOY'S ROOM

DINING ROOM

HOME THEATRE

DECK
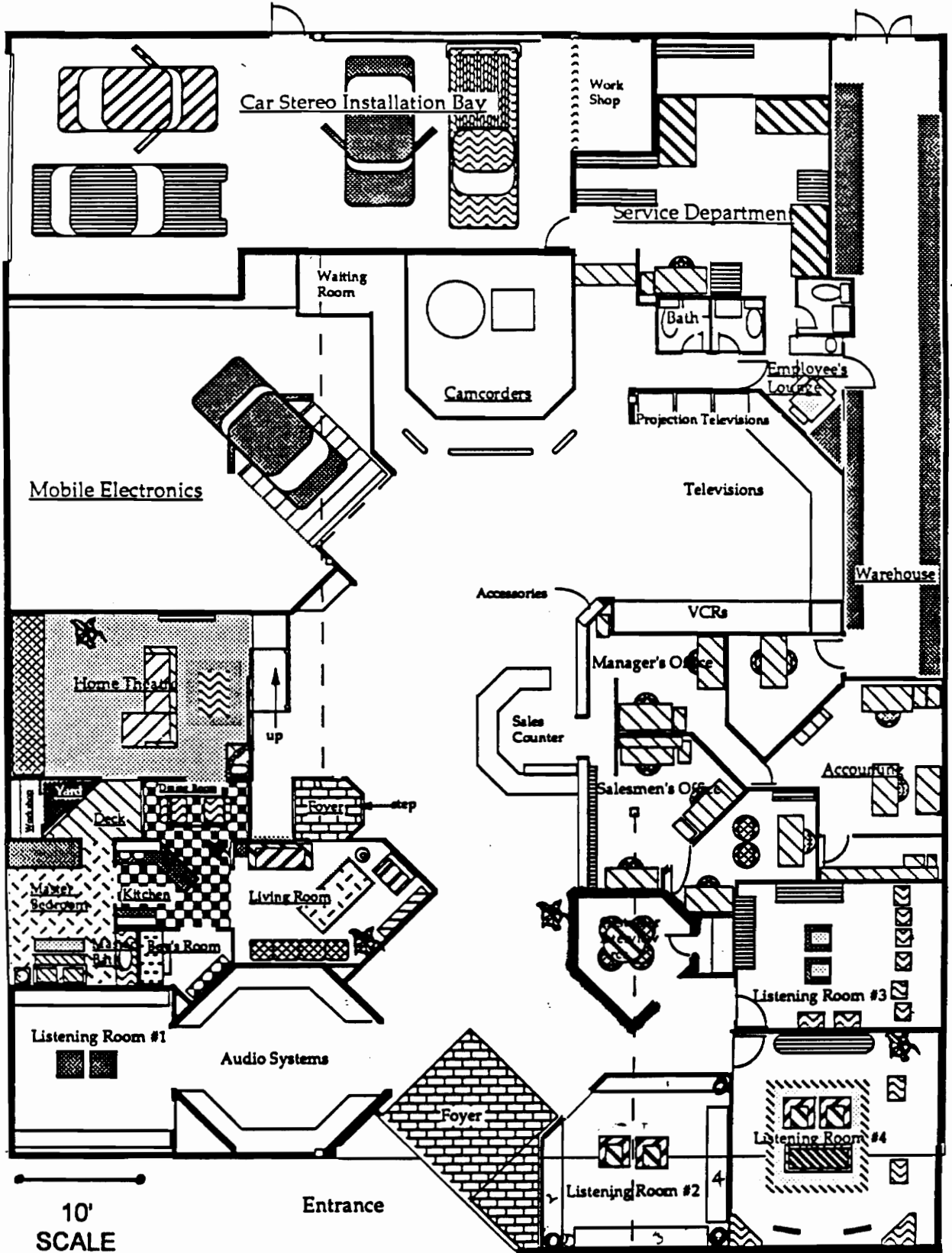
YARD

SHOP

MASTER BEDROOM
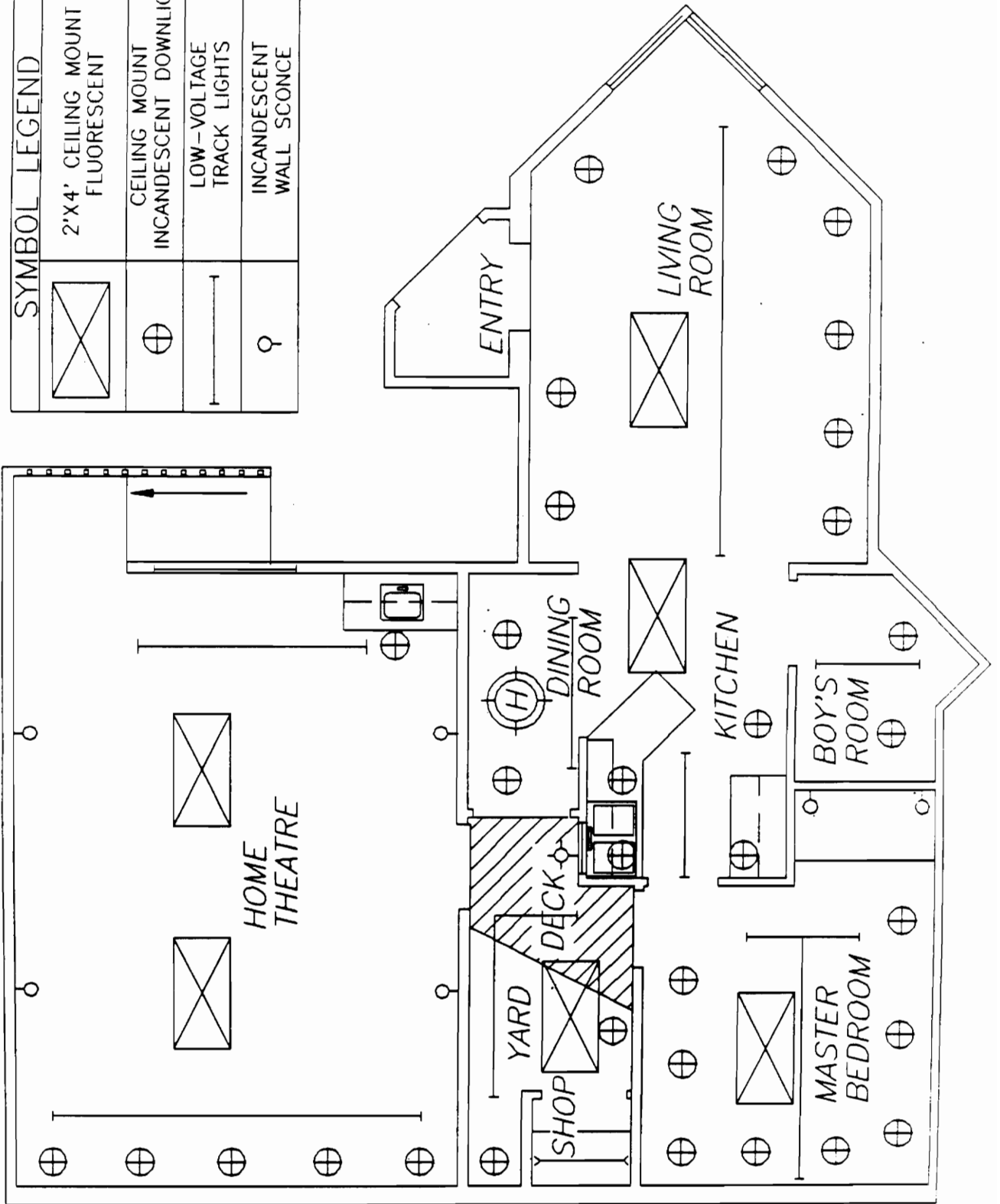
Appendix H

Location of Customer Conference Room

Appendix H
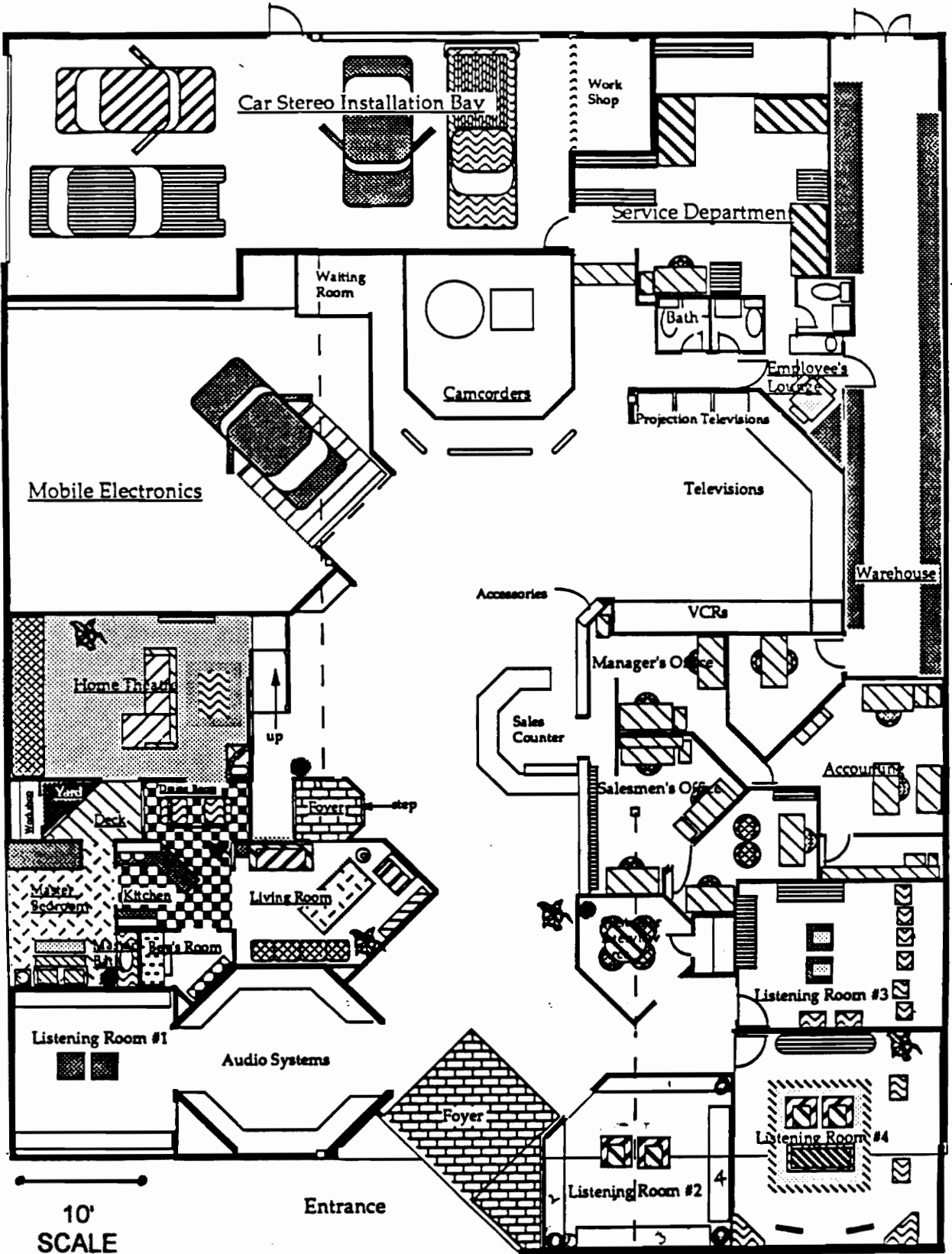
Location of Customer Conference Room

Appendix I

Camcorder Locations During Observations

Appendix I

Camcorder Locations During Observations

VITA

John Michael Tiffany, son of Kenneth W. and Madalen M. Tiffany, was born in Janesville, Wisconsin on September 15, 1949. He graduated from Genoa - Kingston High School in Genoa, Illinois in 1967. John was enrolled in Rock Valley College in Rockford, Illinois from 1967 to 1969. He also attended Milton College in Milton, Wisconsin for one semester during 1969.

John worked as an accountant for a public accounting firm in Genoa, Illinois while attending college. After leaving school in 1969 he worked as an accountant in the home office for a consumer finance company located in Sycamore, Illinois.

In 1971 John left the accounting profession and began a career in retail store management. He worked as a store manager and general manager in the audio/video industry for over twenty years. John started his career in Illinois, but later worked for companies in Washington, Colorado, and Missouri.

In 1989 John returned to school as an interior design student at Southeast Missouri State University in Cape Girardeau, Missouri. While attending Southeast Missouri, John served as the president of the American Society of Interior Designers student chapter. In 1991 he graduated with a Bachelor of Science degree in Human Ecological Studies. Later in 1991, John was accepted into the Master of Science program in the Housing, Interior Design, and Resource Management department at the Virginia Polytechnic Institute and State University. He held a graduate assistantship at Virginia Tech and taught Applied 3 - D design for three semesters.

John has been inducted into Kappa Omicron Nu honorary fraternity. He is an Allied member of the American Society of Interior Designers, and a student member of the Illuminating Engineering Society, and the Institute of Store Planners.

John Michael Tiffany