Magnetic resonance imaging center

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A Thesis Submitted to the Faculty of

The College of Imaging Arts and Sciences

In Candidacy for the Degree of

MASTER OF FINE ARTS

MAGNETIC RESONANCE IMAGING CENTER

by

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Date: April 11, 1994
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PART 1

INTRODUCTION
Healthcare costs are rising, the quality of patient care is decreasing, doctors and nurses are burning out, interior designers and architects are left with the task of creating efficient, comfortable and functional environments. Stark, antiseptic environments do not function better for employees or patients than environments which have warmth and charm. Compassionate design can be combined with technology to produce more positive results. By designers creating pleasant environments, employees find work less stressful, job burnout and patient recovery time reduces, and therefore cuts healthcare costs. These statements may not be supported by facts, as of yet, but it is a better approach than the past, which resulted in healthcare facilities being “ominous technological mausoleums.” The healthcare industry and designers need to explore ways to enhance healthcare environments which will benefit employees and patients alike. Doesn’t it make sense that healthier environments make healthier people?

“Magnetic resonance imaging (MRI), which uses magnetic fields and radio waves to obtain clear, cross-sectional images of the body’s internal tissue, is widely considered to be the most advanced imaging technology available today.”\(^1\) MRI is becoming a more popular diagnostic tool because of its’ effectiveness, safety, and variety of diagnostic capabilities. It is a very lengthy and expensive procedure, which can be difficult for some people. The equipment is very expensive to purchase, maintain and operate. The machine itself is large, heavy, and potentially dangerous, thus there are many limitations and restrictions in designing and building a MRI center. My purpose for this thesis was to re-evaluate the design aspects and needs surrounding the use of Magnetic Resonance Imaging. I intended to design a space specifically for the equipment, technicians,
and patients; making it a more comfortable, less intimidating environment.

The MRI procedure is very effective and safe, but as with most new technology, it can be intimidating and frightening, thus diminishing its diagnostic capabilities. The primary technical design problem of an MRI facility is the electromagnetic properties of the equipment. The machine contains a highly powerful magnet, which can attract any nearby object containing ferrous metal. The magnetic force can also penetrate ordinary walls. This also brings up concerns for patient safety. Metal implants in their skull or other parts of their body, pacemakers, and schrapnel could potentially be drawn out of the body by the magnetic force. Once the designer combats all of the technical aspects of this technology, he/she must try to disarm the psychological problems that arise. The scan itself is painless, but the environment and machine can be very ominous looking. Panic attacks due to claustrophobia are a major problem. The patient is physically immobilized and introduced into a long narrow chamber core for this procedure. It is essential for the patient to remain completely still for up to one hour. Any movement could require the entire procedure to be repeated. A calm, reassured patient is more cooperative. More and more health care providers are turning to interior design to help reduce stress to the patient.

There is more awareness of the importance of interior design in health care facilities overall. More money is being spent for interior design to avoid losing money later from patient dissatisfaction with the facilities. The reason I chose to do this particular project was to combine the restrictive technical qualities with the psychological problems of the patient/client into one comprehensive, workable and pleasing design.
Because I wanted to create as close to the ideal solution as possible, I chose not to consider a budget. I also feel that more money should be spent on interior design in any health care facility. It is really important to create a positive environment when spending so much money on equipment. Reducing patient and employee stress saves money in the end. In turn, this can also benefit the patient. Having a calm, reassured patient ensures smooth operation of the scan resulting in less mis-scans and scheduling problems. Positive environments help to reduce stress in patients, therefore they feel more comfortable and relaxed.
PART 2

ADVANTAGES OF MRI
“Contrast resolution is the principle advantage of MRI. Contrast resolution allows visualization of low-density objects with similar soft tissue characteristics such as liver-spleen or white matter-grey matter.”3 A second advantage of MRI is multiplanar imaging. Multiplanar imaging is the ability to obtain images from various anatomic planes: sagittal, coronal, and oblique. The MRI allows for views of anatomic planes that have never been imaged before. A third advantage to MRI is the possibility of doing in vivo spectroscopy. “It is possible that one could make an MR image, see a suspicious lesion, put the cursor on that lesion, and encompass it within a region of interest (ROI). One could then retrieve the MR spectrum from the lesion for analysis. An interpretation of the MR spectrum then would tell whether the tissue is normal or abnormal.”4 MRI does not use radiation, or more specifically, no ionizing radiation. Therefore there are no side effects or long term effects from radioactivity. There are some known negative side effects of magnetic fields, but they do not occur at the low intensities of MRI.


PART 3

HOW THE MAGNET WORKS
COMPONENT PARTS

1. The Magnet

2. Shim and Gradient Coils: control the intense static magnetic field.

3. Transmitter: generates the high-power radio frequency pulses that are required to excite the nuclear spins.

4. Probe: generates a high power transmitter field and it receives the very weak NMR signal.

5. Receiver: amplifies the signals and changes the frequency of signals for computer interpretation.

6. Computer: used for experimental control, spectrometer control, data control and processing and data display.

7. Power Supplies and Ancillary Equipment
Magnetic Resonance Imaging does not use x-rays or radioactive materials to produce images of the brain, spine, and certain body joints. MRI uses magnetic fields and radio waves to obtain clear images of the body's internal tissue. Currently, a typical MRI scan takes about 45 minutes including set-up time for the patient. MRI use is increasing as new diagnostic uses are being found and as it replaces 70% to 80% of the diagnosis of CT (computed tomography) scanning and myelography.

"MRI works by means of a powerful magnet that surrounds a patient lying in the machine's cylindrical chamber. The magnetic field excites the body's hydrogen nuclei to emit radio frequencies. These 'signals' are captured by a system consisting of antennas and a 'gradient coil', driven by an amplifier, which relays them to a computer that transforms the signals into images."\(^5\)\(^6\)
PART 4

VISITS AND INTERVIEWS
In starting my research for this project I visited two MRI centers and interviewed professionals who worked with the equipment and/or studied the technology of Magnetic Resonance Imaging. The first place I visited was University Medical Imaging (UMI) on South Clinton Ave. in Rochester, NY. I interviewed Debbie Carns, the head technician, and Craig Acheson, a technician. This facility was 2 years and 5 months old at the time of the visit. UMI also had CT scanning equipment, x-ray equipment and a mammography suite. Overall, it was a somewhat pleasing environment due to the colors and materials used. I felt most of the areas were a little cramped, especially the waiting areas and the changing areas. UMI also had the current MRI imaging equipment. This facility, not being adjacent to a hospital or having doctors on staff, could not use any type of medication for sedation of patients. It is strictly an out-patient type of facility.

The second place that I visited was the MRI Center at Strong Memorial Hospital in Rochester, NY. (see fig. 8.1 and 8.2) The supervisor, Connie White, was very friendly and helpful. I was really impressed with this particular center. The space where the center was located had previously been an alley between the old part of the hospital and the new part of the hospital. That was the major drawback to the space. It was long and narrow, not allowing for the appropriate space relationships. Most areas are cramped. The atrium was created within an area that was dead space. The dead space is needed because it shields the public from the magnetic fringe field creating a distance separation. Additional shielding comes from copper within the glass. Storage is located in an outside hallway. Because of the long, narrow configuration, rooms are end-on-end rather than being located next to each other.
The layout resulted in communication problems. The most impressive feature was the atrium, which separates the magnet room from the main waiting room. Patients can sit in the waiting room and look into the atrium. It was very pleasant and soothing. Another advantage that this center has over UMI is that it has full medical and financial support from Strong Memorial Hospital. It services in-patients and out-patients. It can use sedation and other necessary MRI compatible medical equipment if needed.

My other interviews were with people who studied magnetic resonance imaging and who have had the procedure performed on themselves. I was informed about some of the technical problems concerning MRI equipment and some of the psychological problems about the procedure. The main technical design problems occur because the specialized equipment is very sensitive to static electricity, and the electromagnetic properties of the imaging equipment are very intense. This limits design possibilities and restricts the area surrounding the machine. Designing for all of the technical restrictions can result in a stark, antiseptic and foreboding environment. This causes stress in patients. Also, patients may have varying ranges of claustrophobia due to the nature of the procedure. Elderly patients and children have a difficult time staying still long enough to have a scan done. If a patient moves, the entire scan has to be redone. This causes scheduling problems either by delaying other appointments or by having the patient return on another day. By reducing stress and soothing the patient, the process of having an MRI scan can be smooth and uninterrupted, and can alleviate scheduling problems and cut costs in the end.
PART 5

HIERARCHY AND DESCRIPTION OF AREAS
HIERARCHY OF AREAS IN ORDER OF FUNCTIONAL IMPORTANCE

1. Magnet Room
2. Control Room
3. Computer Room
4. Cryogen Storage
5. Print Area
6. Reception
7. Main Waiting Area
8. Restroom
9. Nurses Station
   a. clean utility
   b. dirty utility
10. Sedation Room
11. Changing Rooms
12. Secondary Waiting Area
12a. Training Area
13. Conference/Break Room
GENERAL DESCRIPTIONS OF AREAS

1. MAGNET ROOM (EXAMINATION ROOM)

This room contains the superconducting magnet. It is the heart of the facility. A patient is brought to this room and placed within the magnet for the MR scan. The magnet room should include storage for smaller coils, foam and cushions, emergency medical equipment and any type of linens used. Access to this room is somewhat limited. Patients are able to enter from the waiting area accompanied by an employee, or through a larger entrance if they are incapacitated on a stretcher or in a wheelchair. Access should be unimpeded between the control room and the computer room. Direct viewing is required from the control room into the magnet room.

2. CONTROL ROOM

This must be adjacent to the magnet room with direct viewing of the patient. This room is where the computer that controls the MRI scan is kept. The specialist, who conducts the scan and talks to the patient through an intercom, sits in this room controlling the scan through the computer terminal. There is always someone in the control room if there is someone undergoing a scan in the magnet. There should be enough room in the control room for at least two people and some file storage. Access to the magnet room, computer room and dark room from this area is necessary.
3. COMPUTER ROOM

This room houses all of the computers needed to run the magnet and store the files. It should have a raised computer floor for access to cables powering the computers and a controlled environment.

4. CRYOGEN STORAGE

This area is used for the storage of the cryogens (liquid helium and nitrogen). These are used to power the magnet. It can be inside or outside the magnet room. The storage area needs to be locked at all times for safety reasons.

5. PRINT AREA

This area is where the film developer is stored. The film develops prints from the MRI scan. It should be accessible to the control room. There also should be room for some storage.

6. RECEPTION

A reception area is needed where out-patients can check in and out. This should be directly adjacent to the main waiting area and a file storage room.

7. MAIN WAITING ROOM

This is where everyone waits initially. Friends or family accompanying a patient may wait here throughout the scan depending on the comfort level of the patient. The main waiting room could also include a children's play area.
8. RESTROOMS

Restrooms need to be accessible to patients, friends/family and staff members.

9. NURSES STATION

This is where the nurses work and keep their files. There should be enough space for two to three nurses. This station needs to have direct access to the in-patient entrance, the magnet room, and the sedation room. The nurses station should include clean and dirty utility areas for the storage of clean and dirty linens.

10. SEDATION AREA

This area should be secluded from noisy, high-traffic areas. It is used in cases where a patient needs to be sedated in order to conduct the scan. Monitoring of this area is necessary from the nurses station.

11. CHANGING ROOMS

There should be a few changing rooms for patients to change out of their street clothes. Including a few changing rooms (approximately three to four) will ensure the patient’s privacy while changing without interruptions from other patients. The changing areas should be equipped with lockers and locks to store clothes and valuables during the scan.

12. SECONDARY WAITING ROOM

This is a smaller waiting room for the patients to wait in after they have changed. It should be away from high-traffic areas to maintain patient’s dignity while sitting in a gown or robe.
If the patient is extremely nervous or disabled, he/she may have one person accompany them to this waiting area. This area may also have a television or reading material to pass the time.

12a. TRAINING AREA

This area is used to acquaint the patient with the procedure and what is about to occur. This can be done through the use of slides, videos, or literature. It can be a separate area or combined with the secondary waiting room.

13. CONFERENCE ROOM/BREAK ROOM

These areas are for staff use. They can be combined into one area or two separate areas. The conference area is used for conferences and/or staff meetings. The break room should be equipped with a small kitchenette for preparation of meals eaten at work.
PART 6

DESIGN ASPECTS
There are many factors to take into consideration in designing a MRI facility. Because this is a medical facility, the health and safety of the patient is important. The more comfortable the patient is, the fewer chances of a mis-scan, therefore creating better results. This inevitably leads to fewer scheduling problems and lower costs. Also, in planning a MRI facility, the most important consideration is the nature of the equipment. The size and strength of the magnetic field has many effects on the surrounding environment. A well-planned MRI facility should allow for the most efficient use of current and future MRI devices, keeping the human scale of the environment in mind.

"The facility design and furnishings should be planned to optimize patient comfort and at the same time positively affect throughout."6 The environment should not be intimidating. Patients may be apprehensive about the new technology or the spatial confinement during the scan. Other problems concerning patient safety are:

1. difficulty communicating with the patient during scanning because of the noise and the necessity of eliminating all extraneous radio frequency sources from the exam room.
2. transportation of non-ambulatory patients and the availability of MR-compatible transportation devices.
4. safety of MR exams in patients with aneurysm clips, metallic prostheses, metallic implants and pacemakers.

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Although difficult to achieve in this environment of technological advances, the patient's sense of well-being, safety and comfort should be preserved.

Everything within the facility revolves around the magnet. If there wasn't a magnet, there wouldn't be a facility. The importance of the magnet goes beyond powering the equipment. The magnet is very powerful and potentially very dangerous. Not only can metallic implants in patients and employees be pulled or shifted within a person's body, but metal objects not securely fastened can also be pulled into the magnet causing damage to the equipment or anyone standing in the path of the projectile. Most facilities have a superconducting magnet, which cannot be turned off, therefore the danger is always present. Shielding is necessary to reduce the fringe fields. Radio-frequency shielding is always necessary. This type of shielding prevents external frequencies from interfering with the MRI process. It is usually constructed of copper or aluminum. The other type of shielding, magnetic shielding, is sometimes required. It is accomplished by installation of a partial or a complete sheet steel enclosure. If possible, it is important to try to eliminate the need for magnetic shielding, since it is very costly, very heavy, requires special construction needs, and adds time to the construction of the facility. Overall, shielding is very important to keep the environment from affecting the magnet and the magnet from affecting the environment.

Location of the magnet room in relation to the other areas is important. Functionally it is the center of the entire facility. There are some areas that need to be directly adjacent to the magnet room. These are: the control area, computer room, cryogen storage, and the nurses station. Proper shielding is imperative especially when there is so much sensitive equipment and staff in direct contact with the magnet. Warning
devices and metal detectors should be located at every entrance to the magnet room. All patient care and staff areas should be separate whenever possible. The control room, computer room, print area, nurses station, conference room and storage should only be accessible to the staff. The sedation room needs to be accessible to the staff but also a few patients. The reception also needs to be accessible to the staff and to the patients. The reception, the waiting areas, and the restrooms need to be accessible to the patients, but the patients should not be allowed to roam the facility freely. They should be accompanied by a staff member at all times for their own safety.

Safety of the staff and patients in the MRI facility is very important. There are many restrictions and guidelines to follow when designing a facility of this nature. Although seemingly impossible at times, there are ways to work within limitations and still design a comfortable, pleasing environment. The next section will explain my design.
MY DESIGN 24
In trying to design an ideal MRI center I found it very difficult to change a cold, sterile and frightening environment into something more comfortable and relaxing. It is important to create a non-intimidating atmosphere and to maintain human scale, within an area full of high-tech equipment, to preserve the patient’s comfort and sense of dignity. Overall, I used function and aesthetic considerations to generate a level of comfort. More specifically, the layout of the entire center is designed for safety, comfort and efficiency.

The evaluation of a site for a center of MRI is important to the success of the center. I chose to design a non-site-specific prototype. My design is versatile enough to be a separate building adjacent to, or attached to, a hospital. This center is designed to service in-patients and out-patients. Also a determining factor in placement of a center is the size and strength of the magnetic field, its effects and the factors affecting it. Future expansion plays an important role in design of an MRI center. Important considerations are the addition of another magnet and support areas, replacement with new technology, cryogen storage, delivery and maintenance routes.

Literally and figuratively, the magnet is the heart of the facility (see fig. 8.3). I located the magnet room in the middle of the building. This location aids in protecting the equipment from outside influences. There is also the necessary shielding within the walls of the magnet room. This shielding reduces the magnetic fringe field which allows for locating other important areas accessible to the magnet room. The control room is an important area that needs to be easily accessible to the magnet room, but it also needs the most shielding from the magnet. The magnet will adversely affect the computer and the computer can interfere with the MRI scan. The computer used to operate the magnet is in the control room.
The distance between the magnet, and computer, and the shielding in the walls protects the computer and magnet, keeping them both running properly. Although the two rooms cannot be combined, there needs to be direct visual and verbal contact. There is a window between the two areas and an intercom for communications.

Many details important to the design of the magnet room were addressed. Every entrance to the magnet room needs to be locked, accessible only by using a key. There are warning signs and, ideally, metal detectors at each entrance. This is for protection from anyone mistakenly walking into the magnet room. Other necessary protection for the surrounding areas is auditory. The machine makes a loud, constant banging that can be heard throughout the facility. Sound absorptive materials are used inside the magnet room to deaden the sound. Carpeting is used in the surrounding staff areas to absorb any sound that reaches those areas. The entire center will have soft music playing to help relax the patients and to mask the sound. The atrium, which is located between the magnet room and waiting areas, is large enough so that combined with everything else, it keeps the sound from reaching the public access areas. There are fountains with gently falling water to cover any sound that may still be heard. As for the magnet room itself, I used a wood parquet floor. It absorbs sound more readily than a harder substance, yet it is maintained more easily than carpet; it does not generate static electricity like carpet, and is easily replaced. Another important aspect of the interior of the magnet room is the amount of storage. I have included plenty of storage recessed within the walls. Storage is needed for braces, bridges, clamps, root canals, coils, blankets, linens, foam cushions, MR compatible earphones, ear plugs and MR compatible life-support equipment. I have included two methods of lighting within the magnet room. (see fig. 8.4)
One method is recessed incandescent for lower, soothing levels of light. The second is fluorescent for brighter lighting levels needed during maintenance and examinations. They can be used together if necessary. Another very important design aspect is the venting required to quench the magnet in an emergency situation. Quenching the magnet involves releasing the gases that power the magnet in order to shut it off. This venting must be directly to the outside. Controls to activate the quenching should be inside the magnet room and inside the control room. Other design details that I have added are fabric wall hangings, floor plants, a chair for someone accompanying the patient and a window for viewing the plants in the atrium from the treatment room. In general, the materials and finishes used require easy maintenance and contain non-ferrous materials. (see fig. 8.10)

The control room is adjacent to the magnet room, within direct visual contact. The control room is at the far end of the area restricted to the staff. (see fig. 8.3) There is direct viewing access into the magnet room and indirect, but quick physical access to the magnet room. Included within the control room are: the computer that controls the magnet, a desk with overhead storage and seating for two staff members. The print area is located off the control room to the left. The printer is in this room, as well as a desk and some overhead storage. As you continue to the left through the doorway you will enter the nurses’ station. Within the nurses’ station, you have separate clean and dirty utility rooms and a large wrap-around desk with overhead cabinets to accommodate two to three people. The entire area, from the control room to the nurses station, is carpeted. This is to provide comfort and some sound absorptive material to protect the people who have to work there. With the exception of the print area and the utility rooms, which are lighted by fluorescent
lamp fixtures, that area is lighted by recessed incandescent lamp fixtures. This is for the comfort of the staff also. They can raise or lower the lighting level according to their tasks. It doesn’t necessarily have to be a brightly lit, stark, antiseptic environment.

Located next to the nurses station is the sedation room. The sedation room is located off the main traffic path to make it easier for patients who need to be sedated to relax. It is next to the nurses station for monitoring reasons. The in-patient, non-ambulatory entrance (if applicable) is located next to the sedation room. In-patients may use the sedation room as a waiting area if there isn’t a need for them to change clothing. There is an entrance to the magnet room across from the in-patient entrance for in-patients or sedated patients. This protects the dignity of these patients so they are not brought through the atrium and put on display for everyone to see. The flooring used for this entrance and throughout the atrium is polished concrete.

As you start through the atrium, the first room on the right is the conference/break room. This is used for staff meetings and breaks. There is a large table with enough seating for eight people at one time. There is a kitchenette located in this room, with a refrigerator, sink, coffee pot, and a microwave. This room is carpeted for comfort and sound absorption. The room is lighted with fluorescent lamp fixtures to keep the room brightly lit, producing a work atmosphere. Next to the conference/break room is the staff restroom. It is mostly used by the staff but it is located close enough to the main waiting area that it can also be used by patients.

The atrium is in the center of the building (see fig. 8.3). It functions directly as a merger of the public areas and the staff areas. Located in the middle, it separates the public from the staff, but functions as a common ground where both sectors come together and cross
paths. It also protects everyone, to some extent, from the magnetic fringe field. Aesthetically, the atrium will create a light, airy, soothing atmosphere which patients will physically pass through on the way to the magnet room. Patients may be concerned with the spatial confinement during the scan. By having them walk through the atrium, they may let go of their claustrophobic feelings and become more comfortable. The atrium is full of live plants and trees. Passing through this open vegetated area will simulate the feeling of walking through a garden. Also located within the atrium are softly running waterfalls and fountains of water. The moving water will create a relaxing, background sound to soothe nerves and to mask any noise created by the machine. Polished concrete is used for the floor, the fountains and the planters. This material is used for a natural coloration, but its' smooth and polished surfaces create a sense of refinement. Subtly, it says that this is still a place of business and not a park (see fig. 8.9).

Located at the front of the building are the reception and the waiting areas. Adjacent to the reception is file storage. Across from the reception is the main waiting area. This is where everyone waits when they first enter. There is enough seating for twelve people. Once the patient is called, he/she can walk through the atrium to the secondary waiting area. The secondary waiting area is used to separate gowned patients from staff and public activity. This helps to retain their dignity by giving them a little privacy. It is separate from the traffic flow, but still open to a pleasant view of the atrium. There is a large screen TV with a VCR in the secondary waiting area for entertainment and patient orientation. The changing rooms and another restroom are located directly off the secondary waiting room. There are three changing rooms, an adequate number to prevent delays and insure against schedule
overlapping. Each changing room has a chair, table, mirror and a locked cabinet to protect valuables. Also, the patients will be provided with a full-length terry cloth robe to wear during their exams. Comfort is important in the operation of this center.

The design and furnishings of the waiting areas are used to optimize patient comfort. Interior furnishings and aesthetics are important in order to enhance a patient’s sense of well-being. Neutral colors are used with brighter colors as accents to produce a “timeless” solution. I used royal blue and teal as the accent colors against a soft white wall, green plants and a warm grey concrete floor. Neutral colors lend the timeless quality. The cooler colors that I have chosen as accents have a calming effect. (see fig. 8.8) The waiting rooms and changing rooms are carpeted, whereas the main traffic flow areas within the waiting rooms are concrete. The ceilings in the waiting rooms are dropped and lighted with recessed incandescents. Lighting levels are low to induce relaxation. Walls and ceilings are bathed in pools of light to create a feeling of warmth. The walkways through the waiting rooms are lit by valances to allow some light to reflect up and some to reflect down. These lights highlight the walkways without glaring into the waiting areas. The changing rooms are lit by both recessed incandescent and fluorescents for flexibility. There are planters within the waiting areas to extend the atrium atmosphere to the patients. There will be soft music playing in the background. The more comfortable and at ease the patient is, the more efficient the center will run. The little luxuries the patients sense when visiting this center will give them a feeling of being well cared for.

There is a separate entrance to the magnet room for out-patients across from the secondary waiting room. There is also a locked entry to
the back of the building next to this entrance. This entry is for staff only for access to the computer room and cryogen storage if necessary from the atrium. The computer room stores all of the scans. Because it is a sensitive area, it is locked and climate controlled. It is raised on a computer floor for access to the cables powering the computers. Next to the computer room is the cryogen storage. The storage room has a 4’-0” opening in order to fit the cryogen dewar into it. There is also enough space in the cryogen storage to store a few oxygen tanks. The cryogen storage is accessible to outside maintenance in order to service the magnet. There is an entry to the outside of the center located next to this storage area. The entry to the magnet room in this hall is for maintenance of the magnet or for quick access as needed from the control room. This hall is strictly for staff use only.

I feel that the MRI center that I have designed is more comfortable and less intimidating than previously designed centers. I did not pick an existing structure; I formed my own space in order to design an ideal center. This design shows a solution that will stand the test of time. It is a pleasing space to be in. It is a space that will make patients and employees comfortable. Patients who are treated well will leave with a general feeling of well-being even though they have just visited a medical center. People should not always dread visiting medical facilities. This design is also versatile enough to accommodate new technology by allowing enough space for its installation and use. This proposal is an innovative approach to designing a facility of this type. Using aesthetics and patient comfort as a driving force in the design of this facility is a new method of designing a medical facility. Hopefully, we will see more design applications like this in the future.
PART 8

FLOOR PLANS AND OTHER DRAWINGS
MAGNETIC RESONANCE IMAGING FACILITY
UNIVERSITY OF ROCHESTER
STRONG MEMORIAL HOSPITAL
ROCHESTER, NEW YORK

HLM Hansen Lind Meyer
FIGURE 8.2
FIGURE 8.3

(for Key see page 15)
FIGURE 8.4
FIGURE 8.7
PART 9

BIBLIOGRAPHY
BIBLIOGRAPHY


