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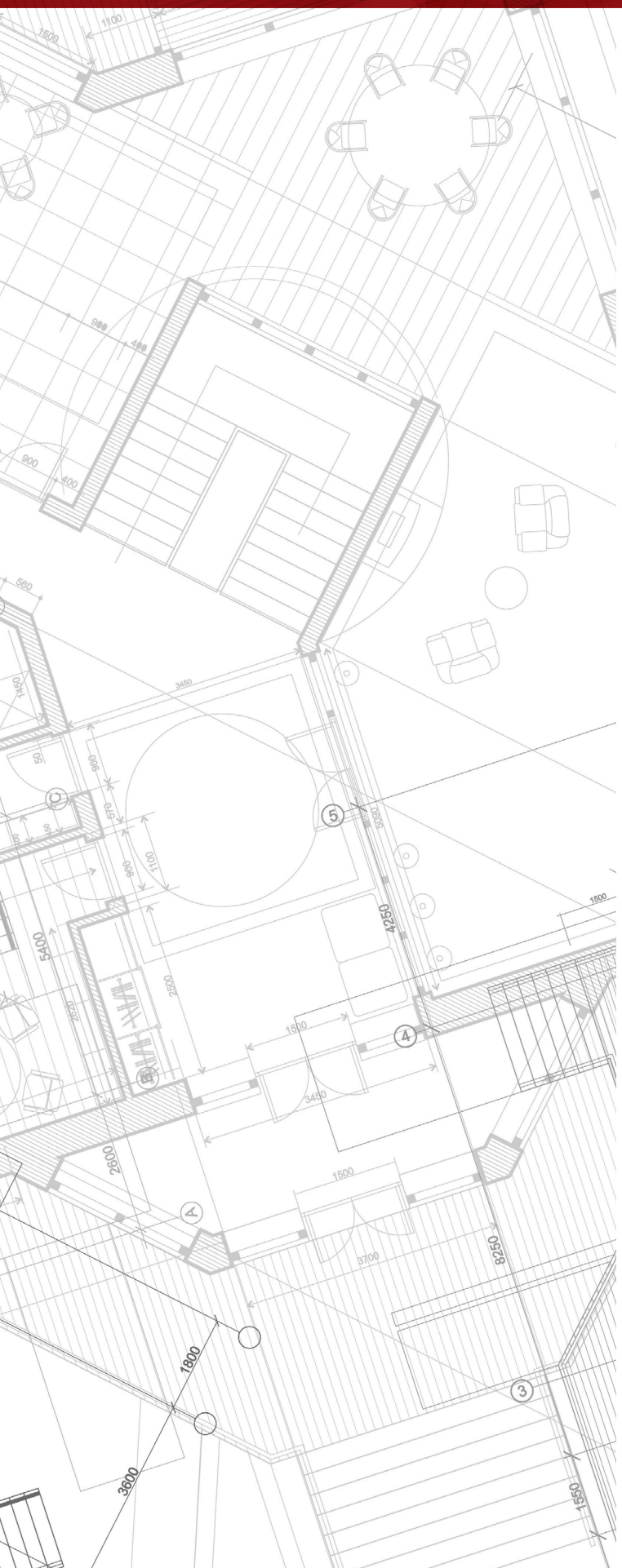

# HOW TO ENHANCE THE VALUE OF RADIOLOGY THROUGH GOOD READING ROOM DESIGN AND SITING

The healthcare delivery changes effecting radiology require department leaders to consider all available tools to convey the value radiologists contribute to patient care. Many feel the diminished radiologist/subspecialist interaction, as a result of PACS, has isolated radiologists and reduced the perceived value of their clinical expertise. Radiologist re-engagement with referring physicians and patients is an opportunity to reinforce expertise and reverse this trend.

Optimization of the radiology reading environment design, location, and ergonomics is a tool that can facilitate such engagement, while also enhancing productivity.

Recent studies provide compelling reasons to consider embedding certain reading environments into sub-specialty clinical areas in order to facilitate efficient communications and improve customer service. This document presents evidence for considering such location-based changes, in addition to optimizing room layout, design, and ergonomics.

## THE READING ROOM EVOLUTION

Radiology continues to be confronted with the ongoing challenges of commoditization and declining reimbursement. Both are forcing changes to many aspects of the practice. Radiologists must not only find opportunities to remind the medical community of the value they provide, but also embrace them; everything from how and where radiologists read to the value that can be provided outside the clinical report can make a significant difference. While the conversion from film to digital drove most reading room design and location decisions over the past 10 years, new concepts in workplace management provide opportunities to further leverage reading room design and location to help radiology solidify it's role in healthcare.

When PACS workstations replaced film alternators, reading room updates were driven primarily by the physical requirements of the new technology. In many cases PACS workstations were placed where alternators and light-boxes once stood. More often than not, new workflows or environmental and ergonomic needs were not accounted for, often because they were not well understood. The focus on increasing productivity, to counter falling reimbursement and payoff new technology, typically limited real reading environment optimization.

Sites that did revamp their reading rooms to take full advantage of the new digital reading paradigm were rewarded with productive, pain free radiologists. Many facilities learned, the hard way, that the heat produced by the numerous PACS computers and displays required enhanced HVAC. The large size of early CRT medical displays placed unusual demands on furniture, room space and room lighting. The advent of digital dictation and voice recognition compounded environmental and space demands. Advances in flat screen displays, ergonomics, computer hardware and software facilitated continuous productivity and work area improvements that enabled reading room consolidation and development of valuable hospital real-estate into revenue generating modality space.

## ADDRESSING TODAY'S CHALLENGES

While these changes were important, the increasingly dark and remote radiology reading rooms inadvertently isolated the radiologist from their customers2. The evolution of PACS, teleradiology, networking and computer hardware enabled ubiquitous clinical image review, further adding to the isolation of radiologists. These advances eliminated the need for subspecialty physicians to visit the radiology reading room to see their patients' imaging studies and discuss findings with the radiologist. In some instances, subspecialty turf battles cut radiologists out of the diagnostic process altogether. These factors, combined with ongoing reimbursement cuts, increased utilization rates, and an increasing focus on productivity, contributed to today's crisis of marginalization that is affecting Radiology[4].

As the ACR Imaging 3.0 initiative highlights, radiologists must play an increasing role coordinating and assessing imaging appropriates, optimizing image acquisition and increasing in-person results reporting. The increased focus on the effective and timely communication of critical results is another opportunity, albeit with compliance implications.

| STAGES OF READING ROOM EVOLUTION | PRIMARY DESIGN DRIVER |
| --- | --- |
| First-generation | Film based reading |
| Second-generation | PACS based reading |
| Third-generation | Communications and customer service |

Delivering this broader range of services requires both appropriate use of technology and frequent in-person communications. As Eliot Siegel, MD, Professor and Vice Chair, University of Maryland School of Medicine, Dept. of Radiology in Baltimore points out, "When radiologists read from film, the reading room was the only place a referring physician could get access to the images. Radiologists used to get as much valuable information from the referring specialists as they provided. This two-way communication contributed to quality of care and reinforced the expertise of the radiologist. Unfortunately, much of this has been lost as PACS has proliferated."

Reading room design and location considerations can help radiologists realize improved patient care goals by facilitating collaboration, communication, and patient encounters. Recent research on this topic presents compelling reasons to consider both redesign and relocation of the Radiology reading environment in order to facilitate the broader role radiologists must play in the shifting healthcare environment[1,2,3]. This document reviews the compelling evidence for reconsidering the location of radiology reading environments as well as optimizing, room layout, design, and ergonomics.

## SECOND-GENERATION ROOM LIMITATIONS

Radiology reading room design and siting, like office ergonomics, is often treated as an afterthought. As our healthcare system seeks opportunities to reduce costs and improve quality, environmental and design factors must be considered as part of the solution. This is even more relevant for radiologists, whose work requires spending significant time in front of a PACS workstation. First-generation reading rooms were often open spaces that supported film-based reading. Radiologists could sit or stand in front of an alternator, and the effects of ergonomics, lighting, noise and environment were not understood. They were inherently noisy and brightly light to facilitate constant transport of film and a steady stream of visiting sub-specialty physicians.

Second-generation reading room layouts were typically driven by the need to accommodate PACS and then voice recognition. Because the room's physical attributes were often maintained, the new digital reading paradigm could not be efficiently supported. At North Mississippi Medical Center, their film-based reading room was adapted for PACS in just such a fashion. Gordon Hollingsworth, Radiology Director, tells us "initially the old reading space supported our PACS reading requirements. As ergonomics and environmental factors became better understood, and more widely available, it became clear just how significant the impact of a full refresh would be; not just on aesthetics but on real productivity and quality of life for the radiologists."

As the industry and technology evolved, and new business models and alternative reading contracts became common, additional technology was often added to already ill-prepared spaces. Today, adding to the design

challenge is the proliferation of Electronic Medical Records (EMR) systems in reading rooms, which are increasingly used by referring physicians to view key medical images along with a radiologist's report. Suddenly the need for larger work areas made reading rooms too small to efficiently accommodate the necessary number of stations, and support efficient workflow. Over time, demands on second-generation reading room layout, ergonomics, and environment have increased, creating the need for new third-generation reading environments. This need is compounded by the emerging healthcare demands affecting the radiologist's role. In this latest generation, both design and siting decisions should be driven by the need to maximize communication, clinical quality, and customer service, as well as productivity and quality of life.

## CURRENT CONSIDERATIONS

# NON-TECHNICAL FACTORS SHOULD DRIVE DECISION-MAKING

The need for confidential physician and patient discussion, which is increasingly important to radiology, requires private space where the imaging studies can be reviewed and care plans refined. This area may need to be separate from the radiologist's routine reading station, yet include the necessary PACS viewing station to enable images to be viewed during the discussion. Location of the reading room also impacts access to radiologists, whether they are being sought out or are the one's doing the seeking. Since most second-generation reading rooms are merely renovated first-generation rooms, location and size may make it inefficient, or entirely impractical, for caregivers and patients to seek out the radiologist and visa versa.  Brian Petersen, MD, Associate Professor of Radiology and Orthopedics at the University of Colorado and Chief of Musculoskeletal Radiology suggests embedding a reading area as close as possible to the sub-specialist work area, to make face-to-face communication as convenient and efficient as possible. "While productivity may be slightly impacted, we found that clinical quality benefitted from the continuous learning (by all parties) facilitated by face-to-face communications."

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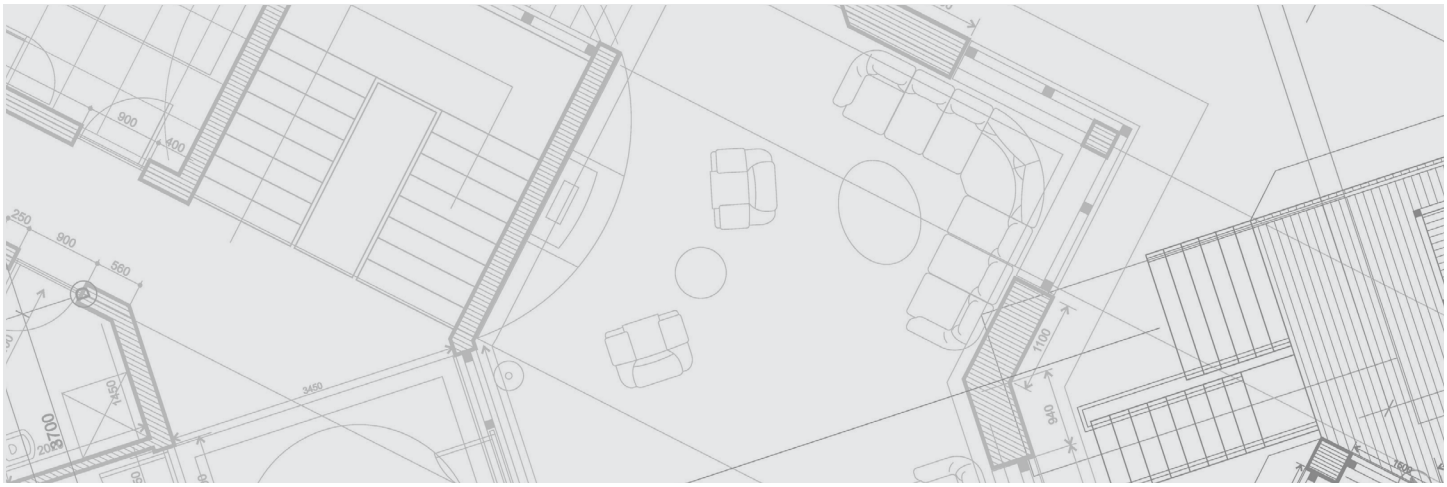
BRIAN PETERSEN, MD
Associate Professor of Radiology
and Orthopedics at the University of Colorado
Chief of Musculoskeletal Radiology

Inadequate designs can also leave referring physicians unclear about whom to turn to when a consultation is needed; consequently, they may decide it is too much trouble to seek a consultation. In today's era of ubiquitous access to clinical images, referring physicians need a reason to visit the reading room. Because second-generation designs focused on technology support and ergonomics, design considerations often did not, and still don't, facilitate the efficient workflow that encourages in person communications.

Elimination of radiologists' offices was sometimes taken into account in second-generation rooms. However, if a room did not sufficiently accommodate the need for office space, clutter, additional noise, and the appearance of unprofessionalism sometimes prevailed. Additionally, without a separate office space, the radiologist's visibility was further reduced;



no longer was it necessary for the radiologist to leave the reading room. As Linda DeVee, Radiology Director at Edward Hospital in Naperville, IL points out, "One of our room renovation goals was to combine the radiologists' offices and reading spaces into a professional and efficient space. This was very important for accommodating the radiologists' schedules, making more efficient use of department space, and ensuring the reading room was welcoming to our referring physicians."

## BEYOND ERGONOMICS

Limiting improvements to ergonomics only, however, misses the opportunity to optimize other factors that impact fatigue and long-term concentration. It also ignores location and space optimization that can facilitate the face-to-face consultations that provides radiologists with opportunities to reaffirm their expertise. Without question, the environment immediately in front of the radiologist, what we will call the "Primary Zone", must be ergonomically optimized to ensure repetitive motion injuries are eliminated, and proper posture is ensured. Because most reading workspaces are shared, they must be easily customizable to accommodate the physical needs and personal preferences of each radiologist. Fortunately, ergonomics are well understood today, and ergonomic accessories are readily available. Many facilities also have an ergonomics specialist on staff, which can ensure ergonomic approaches are followed, and staff is properly trained on their use. Beyond optimizing primary work zone ergonomics, reading area environments should take care to optimize the following:

### 1.TASK AND AMBIENT LIGHTING

Use a combination of task lighting and (non-fluorescent) indirect blue or white ambient lighting that can be individually adjusted to ensure brightness is equivalent to PACS monitor brightness.

### 2. WALL FINISHES

Apply mat finishes to reduce light reflection. Walls may also be covered with sound reducing material to minimize reflected sounds.

### 3. AMBIENT SOUND REDUCTION

Use active and passive sound reduction to minimize distractions caused by conversations.

### 4. CLIMATE

Provide adequate room ventilation that can keep the room at 75 degrees and workspace specific ventilation that can be adjusted by the radiologist.

The area immediately surrounding the radiologist should be considered a "Secondary Zone" of interaction that reinforces the effectiveness of the Primary Zone. Proper lighting is important to avoid eyestrain and fatigue that can reduce interpretive accuracy. Individually adjustable climate control is important to ensure a comfortable environment that facilitates focus and productivity. The effect of sound has been increasingly studied. Some facilities have moved towards active cancellation of ambient sound as an adjunct, or in some cases more cost effective, option to acoustic sound deadening materials. Eliot Siegel, MD, found that using an active noise cancellation system could be a cost effective means

to control ambient noise. "We were pleasantly surprised at the results of a study we conducted, which suggested that at low levels the sound masking actually improved rather than reduced accuracy of speech recognition." Controlling ambient noise, particularly from the human voice, is important as radiologists look to provide more consultations. These conversations, regardless of where in the reading room they occur, can create a distraction. It may also make sense to dedicate a separate consultation area, isolated from individual reading locations.

As reading room updates are considered, a concerted effort should be made to determine what is working well and what is not. Because people unconsciously accommodate for suboptimal circumstances, it is often helpful to bring in an outside specialist in ergonomics, environment and design. It is also valuable to get input from all the radiologists and specialists who use radiology services. Linda DeVee, from Edward Hospital feels the effort to repeatedly sit with radiologists, and have them actually go to clinical service meetings, enabled her department to address both specialists' and radiologists' needs. "We were constrained in our space, so we wanted to make the most of our renovations. As an example, specialists frequently complained they didn't know the radiologists' reading responsibilities on any given day, so we installed a blackboard by the reading room entrance to indicate who is reading what studies on that day."

> We repeatedly met with all our radiologists, and had them meet with specialists, to ensure we understood their needs.
>
> LINDA DEVEE
> Radiology Director
> Edward Hospital, Naperville, IL

## IN-ROOM WORKFLOW OPTIMIZATION

Because of the unforeseen reduction in reading room visits by specialists, second-generation reading room layouts are typically not optimized to encourage collaboration and minimize distractions. Today, we know that PACS reading areas require fully thought-out environments that address the needs of residents, fellows, referring physicians and radiologists. We'll refer to this broader area as the Tertiary Zone. This zone requires an optimized layout of reading stations to ensure privacy, eliminate distractions, maximize capacity, create efficient entry and egress, and enable people to be easily found. Design considerations should also accommodate some radiologists' preferences for private reading space, and others preferences for a more communal space. Movable, sound proof partitions made from translucent materials, in addition to having a variety of configurations radiologists can choose from, can address this need. As Dr. Chase Henson, Diagnostic Radiologist from North Mississippi Medical Center, in Tupelo, MS points out, "we needed to minimize unwanted distractions and disruptive foot traffic that can reduce radiologist productivity. We organized customizable reading spaces, along two long hall-ways, to enable us to be easily found by those who need us."

Film, while all but eliminated for new studies, should be minimally addressed so that historical comparisons can be viewed. This can be accomplished by locating a few light boxes in a centralized area.
More importantly, it is necessary to plan for ingestion of outside studies on DVD. Departments may manage this process centrally, in the file room, while others may leave the process to the radiologist or reading room support personnel. If the radiologist will be responsible for CD import, the PACS CPU must be accessible so the CD-ROM/DVD drive can be easily reached.

Subspecialty reading areas also have their own unique workflow and space usage requirements. Women's Imaging, Nuclear Medicine, and Interventional Radiology, have often had their own reading space for consultation or participation in the imaging process, due to the need for radiologist proximity to the technologist and the patient. While these rooms are typically smaller, accommodating just a couple of radiologists, their efficient and inviting layout is no less important. In fact, the need for these spaces to support patient and physician consultations may be greater, requiring sufficient collaborative desktop space and the ability to review images with patients without disturbing other radiologists.

Regardless of the approach chosen, each space must balance the radiologist's need to concentrate and eliminate productivity reducing distractions; while at the same time facilitate collaboration with specialty physicians and face-to-face consultation with patients. Whether driven by medicolegal decisions, or good business practices, radiology reading areas must facilitate and encourage radiologists to spend more time speaking to their customers in-person1. Simple changes such as removing the lock from the reading room door and posting welcoming signs that clearly identify the reading room can help. Even removing the reading room door altogether sends a strong message that the room is not off-limits.

## THINKING AHEAD

# LOCATION, AND PATIENT CENTERED CARE

As healthcare evolves towards patient centered care, and fee for service reimbursement models are reconsidered, radiology must be ready to demonstrate value beyond rapid report turnaround and low cost. Unfortunately, face-to-face interaction has been marginalized by the combined forces of PACS and teleradiology proliferation, ubiquitous clinical viewing, ever-increasing productivity pressures, and our societal tendency to use email, video chat and text. As a result, many reading rooms are relegated to the basement and other remote locations. This is a practice that must end if radiologists desire to be considered part of the healthcare team.

Reading room location, also part of the Tertiary Zone introduced earlier, can increase a radiologist's visibility and facilitate in-person consultation. Whether relocating the reading areas to central locations in the radiology department, or embedding a reading room in a sub-specialty clinical area, enabling convenient and efficient communication has both clinical and business ramifications. The proximity enables face-to-face communication to occur with less disruption to productivity. Opportunities to speak reinforce expertise and assist in continuous learning. Loyalty is also fostered, creating long-term business relationships that can result in more referrals. Overcoming the technical, societal and political barriers to this behavioral change is a challenge that must be confronted. Until radiologists are paid to consult, options must be explored to efficiently increase a radiologist's visibility, and enable face-to-face consultation, without impacting physician productivity.

Research recently performed at the University of Colorado[3] explores the impact of reading room location on radiologist-referring clinician communications, and highlights possible opportunities. Allison Tillack, PhD, lead researcher on the article indicates, "We wanted to understand the impact of proximity on communications and visibility. We decided to embed breast radiologists in our Breast Center, and musculoskeletal radiologists in the Orthopedic Clinic, and observe bi-directional phone and face-to-face communications with their referring providers. As a point of comparison, we looked at similar communications between body and neuro-radiologists, and their referring providers." In the end, Dr. Tillack observed a statistically significant

increase in the number of visits to the embedded radiology groups vs. the remote groups. The study shows that proximity clearly increases the frequency of interaction. Nonetheless, physician leaders play an important role in changing staff behavior by setting an example for their department.

Quantifying the productivity and workflow benefits of reading room location, may not be practical for every institution. The time consuming nature of workflow timing studies limits the ability to quantify the efficiency gains enabled by good design and location. In lieu of formal studies, feedback should be gathered from a broad range of constituents, including the subspecialty groups, both before and after changes to reading environments are made, so that the effects of any changes can be understood and opportunities for continuous improvement can be identified. Brian Petersen, MD, acknowledges that embedding the reading room may not be practical for all sub-specialties, nor for private practice radiology. "Musculoskeletal radiology, women's imaging and interventional radiology may be great places to start. For others the use of Skype and screen sharing can enable a virtually embedded opportunity that goes beyond the benefits of a phone call."

## PREPARE FOR THE FUTURE

Reading environment renovations should not be viewed as an opportunity to merely purchase new furniture. They must be approached holistically, and address environmental, layout, and location-based considerations to ensure the changes support the strategic goals of a radiology department. Furniture decisions must optimize space and flow requirements, while maximizing ergonomics and customization of the Primary Zone for individual radiologists. Reading environment renovations must address equally the needs of the Primary, Secondary and Tertiary Zones, to ensure they are welcoming to referring physicians and patients, easily accessible, and (of course) productive environments for the radiologists.

## THREE BENEFITS OF OPTIMIZED RADIOLOGY READING ENVIRONMENTS:

1. Enable efficient, healthy, and happy radiologists.
2. Facilitate opportunities to build loyalty and reinforce expertise.
3. Enhance contributions to increased quality of care at lower cost.

The issues impacting radiology today are likely to continue, as the healthcare system continues seeking ways to reduce costs and improve quality. In addition to these industry drivers, enterprise and departmental technology will continue to evolve and converge, as have Electronic Medical Records, PACS, RIS and Voice Recognition. The emergence of the Vendor Neutral Archive and Universal Viewers foretell the day when all imaging studies, including visible light, could be read on a single PACS. If the era of personalized and patient centric medicine is to become a reality, many feel that imaging must become centralized and better integrated into treatment decision making.

Radiology departments and private imaging facilities have difficult choices. They can proceed with the status quo and hope their services are not commoditized, or actively show their customers the full range of clinical expertise and consultative value they can provide. Radiology is a service business and today's reading rooms must make it easy for the radiologist to efficiently provide the highest quality service possible today, while addressing the evolving service needs of tomorrow.

When considering how to meet these needs through redevelopment of reading environments, it is best to engage an organization that understands Radiology and can bring both design and equipment expertise to the table. RedRick Technologies is such a company. RedRick approaches all projects with the goal of first understanding a department's needs and constraints, and only then suggests solutions that support these needs. This collaborative process extends throughout the design, development and implementation phases of all projects, to ensure success is realized. Changing ingrained behaviors takes time, but Radiology must continue to lead the way technologically and behaviorally.

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21624 Adelaide Road, Mount Brydges, Ontario, Canada, N0L 1W0 | T: 519.264.2400 | TF: 1.800.340.9511 | F: 519.264.2404



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