Architects, engineers, designers, and planners all use evidence to inform their design decisions, and they always have. If this is the case then why all the fuss over this apparent trend and new language of so called Evidence-based design? What is Evidence-based design (EBD) and how do we apply evidence in our designs? About what type of evidence are we talking? This special edition of the Berlage Papers will inform you about the Master Class which was held at the beginning of 2008 about Evidence-based design of an Intensive Care unit of a hospital. It will not only inform you about the outcomes of this Masterclass, but it will critically appraise the process of Evidence-based design. But we start with a word from our Master Kirk Hamilton: “I believe spread of EBD can lead to better design decisions, improved outcomes for the owner, provide new knowledge for the field, and increase credibility for design professionals who embrace it. I am delighted that the Berlage Institute (www.berlage-institute.nl) and the Dutch Center for Health Assets (part of TNO (www.tno.nl/ducha) has given us an opportunity to further explore the topic and extend the dialogue to a larger audience. I sincerely hope you enjoy this magazine and that it may be of benefit to you in your professional work.”

Innovative intensive care units through ‘Evidence Based Design’

by Joram Nauta, Researcher, Dutch Centre for Health Assets

To answer these and other questions, a special mix of professionals met at the Berlage Institute in Rotterdam in the first week of January 2008 to take a Master Class on this subject. A group of architects, accompanied by an intensivist and a head ICU nurse, assisted by specialists in other disciplines, was faced with the challenge of designing a new Intensive Care unit for a university hospital. The Master Class was led by Professor Kirk Hamilton, an experienced architect associated with the Center for Health Systems and Design, a division of the Texas A&M University. His process approach to applying insights from science and practice provided the architects with a method with which they can account for the design choices made, based on the best available information. This so-called Evidence-based design (EBD) approach, applied to the design process of buildings, is a variation of the Evidence-based Medicine method dominating the medical sector.

The first part of the week was spent on visits, lectures and training courses to offer the group of architects the same reference framework. Every new piece of information provided, both from literature and by the experts, was subjected to a critical review. Subsequently, the group was divided into three teams, each with the same assignment: to design an Intensive Care unit using the Evidence-based design method. The challenge for the architects is a different design. The first group mainly focused on the patient, the second on the relationship between the family and the patient, and the third group focused on the staff. The staffing-patients ratio was the same for all designs; one staff station oversees four patients.

[1] “Be aware that natural (e.g., organic, irregular, scripty) characteristics may be the most pleasing typefaces. Qualities of “harmony”, “flourish”, and “compressed” may also elicit positive responses.” http://www.informedesign.umn.edu/RS_detail.aspx?rsId=2479

'I believe that all architects are making hypotheses – it is just mental and you never state them – you never write them down'.

— Kirk Hamilton, At the Master Class ‘Evidence Based Design for Critical Care’, Rotterdam, 2008
Evidence-Based Design – process in actual practice

by Sjoerd de Hoogh, Architect, Dutch Centre for Health Assets

How do we apply EBD in the actual design process? Here is a practical guide to the application of EBD. First of all, it was Kirk Hamilton to come to a design based on the best cription of a step-by-step plan drawn up by a team of archi-the lessons learned of the master class will be discussed. will be addressed. [2]

Evidence-Based Design - Process
Nine steps are required for an architect to come to a design based on the best evidence available. The condition for going through the steps is the creation of a chain of logic. This can be realised by letting each step logically follow from the previous one. In other words: each step builds on the previous one. Initially, the steps are followed chronologically. As the design process progresses, one may go back to previous steps to define them in further detail, so as to enable further to limit the research question (step 4) based on the information found (step 5), which is common in research circles.

Evidence-Based Medicine
“Evidence-based medicine is the conscientious, explicit and judicious use of current best evidence in making decisions about the care of individual patients.”

Evidence-based design
“Evidence-based design is the conscientious, explicit and judicious use of current best evidence from research and practice in making critical decisions, together with an informed client, about the design of each individual and unique project.”
— Hamilton, DK (2007) “Evidence-based design Supports Evidence-Based Medicine in the ICU,” ICU Management Journal (Belgium), Autumn, 6(3) 31

Evidence-Based Design
did, however, value the fact that the staff would like to ‘see’ who entered the patient's room. So the family could enter the patient's room through the ward, visually passing the nurses' station. In the room all equipment is connected to the patient's bed, which makes the bed freely movable.

As stated above, the first group of architects focused mainly on the patient, and more specifically on reduction of the patient's stress. The key design issue chosen was like a protective womb (‘Womb Wall').

An interview with Kirk Hamilton
Rotterdam, 9 January 2008 | Kirk Hamilton is an American Evidence-based design expert. He is trained as an architect, an associate professor of architecture at Texas A&M University, associate director of Center for Health Systems & Design and one of the two editors of the journal 'HERD (Health Environments Research & Design) where he writes the column 'Bridging Design and Research'. The Bridging Design & Research column is devoted to building a bridge between practitioners and researchers, and providing a space for open exploration of Evidence-based design as an evolving process. Kirk Hamilton about why he thinks Evidence-based design is important while he was in Rotterdam for the Master Class 'Evidence-based design of each individual and unique project.'

Evidence-based design
Finally, some conclusions on using EBD in actual practice will be addressed.
1 – Identify the client’s goals

Determine the client’s goals for which the design is to offer the solution. Convert the goals into the project and to the building, i.e. concretely indicate how the building will contribute to realizing the goals. This information is usually known but the challenge is to formulate it concisely.

2 – Identify the firm’s goals

Identify the architect firm’s goals and the goals to be realized for this specific project. Here, too, the information is deemed to be known but it is a good idea to indicate the experience gained and the expertise built in the project.

3 – Identify the key design issue

The strength is to find the key design issue with the most crucial contribution to realizing the goals. Finding that key design issue requires setting priorities. Often, more than one solution can be submitted to realize the goal, but the solution needed is the one that offers the best result. After the follow-up steps, it may be advisable to fine-tune the key design issue.

4 – Convert the key design issue into research questions

Converting the key design issue into research questions is necessary for the consultation of information sources. It is impracticable to study everything, so focus on high-impact subjects in respect of which little information is available. An example to illustrate this is the fact that several sources show that daylight has a positive effect on people’s health. Raising the research question of the effect of daylight is unnecessary, as this question has already been answered. Ensuring that there is sufficient daylight will have a high impact on the design. Drawing up research questions is a challenge to architects, for this is uncommon to most of them. This is the first step on the road to Evidence Based Design.

[3] “Be aware that common, highly readable typefaces were highly reassuring but not engaging.”
http://www.informedesign.umn.edu/Rs_detail.aspx?rsId=2479

The nine steps in the EBD process (Kirk Hamilton)

1 Identify the client’s goals
2 Identify the architect firm’s goals
3 Identify the key design issue
4 Convert the key design issue into research questions
5 Gather information
6 Critical interpretation of the evidence
7 Create evidence based design concept
8 Develop hypotheses
9 Select measures

‘The evidence-based model requires the designer to review the best available relevant evidence from credible research. The goal is to create an unbroken chain of logic from research to design concepts, and on to a hypothesis or prediction of an outcome that will result from implementation of the design concept.’
— Brief Master Class ‘Evidence-Based Design for Critical Care’, Rotterdam, 2008
5 – Gather information
The information sources can be consulted using literature, search engines, journals, expertise centres, etc. It is worthwhile to enter search terms and combinations thereof with several sources, as information can be found in various disciplines. Building-related studies can be found in medical sciences and social sciences. Furthermore, researchers with an architectural background are increasingly studying the relation between the medical process and the building. In addition to literature studies, expert opinions may also be used as information.

6 – Critical interpretation of the evidence
A critical review of the information found is necessary, for literature will usually not directly answer the research question. The key is to find the balance and creative interpretation of the information to come to a justified answer.

7 – Create evidence-based design concept
It is not until this step that the architect can pick up his pencil. The creative interpretation of the information found is the basis for development of a concept. As stated above, the design consists of numerous more choices, but it is possible that they are based on general findings or experience. This may be dealt with in a pragmatic way. The concept should be a conversion of the information found and contribute to realizing the goals formulated in steps 1 and 2.

8 – Develop hypotheses
Formulate the expected results of the design. These are connected with the goals. Submit a hypothesis that can be tested when the facility is put into operation. This evaluation will provide knowledge that can serve as information for future designs.

9 – Select measures
Make sure that the results are measurable, both quantitatively and qualitatively. Highly valuable studies are comparing the situations before and after, which provide an invaluable amount of knowledge that can serve as information for future designs.

Evidence-Based Design – Actual Practice
The participants, architects and researchers, in the master class embarked on the experiment of using EBD in actual practice by making a design for an intensive care unit for a university hospital in one week. The recipe for the master class was, first of all, to bring together professionals from various disciplines and, subsequently, to let them go through the EBD process together in an early stage of the design process. The experiment proved successful for these two reasons.

As stated above, the first reason for the success of the master class is the varied composition of the teams. Architects, engineers and users, working together under the supervision of experts for a whole week. The first two days of the intensive week programme were spent on visits to operational units, during which information was provided by directors, managers, medical specialists, nurses and microbiologists in lectures and tours. During these first two field trips a common reference framework was created. Subsequently, three teams of three participants each went to work, assisted by the masters and always in the presence of the users. The last day was used to present the designs and evaluate the process. Experts were able to catch a glimpse of the

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[Note: The text is cut off, but it seems to be discussing the importance of incorporating evidence-based design into architectural practice, along with the challenges and strategies for doing so. The text also references a critical review of the information found, formulating hypotheses, and developing and selecting measures.]

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Class with the EBD methodology clearly reflects the design decisions made and the theories on which they are based. The key design issues in the early design phase (specification of requirements with respect to the unit) are usually leading and can result in a great variety of solutions. The working method forces the designers to be specific about the ‘mediawritability’ of the design. Furthermore, it creates a common shared conceptual framework. The question that remains is: ‘What is good evidence?’ Do we find that in practice, or in literature, has there been any double-blind clinical study as to the effects of the environment on the patient in the ICU? It would be better to speak of Research-Informed Design, designing using the best available information at this time, both from literature and from experts. The most important result of the Master Class is that architects and healthcare professionals can realize a design together, in which the knowledge and expertise of both parties, using this method, can lead to a result, which was basic (medical) principles can be respected by all participants. Both architects and healthcare professionals are challenged to increase their own knowledge domain and apply it actively to the design process.

‘The fact that you use evidence, that you use it based on a critical interpretation, that you use it to develop your concept, that there was a chain of logic that ran through all of this leading you to a particular intended outcome, and that you measured it to determine whether the outcome happened or not—that’s the essence of an evidence-based process. So in some ways the irony is that in order to claim that you used an evidence-based process, in some ways you had better be able to put some evidence on the table at the end. When you finish there should be some evidence that supports your use of evidence’.

— Kirk Hamilton, At the Master Class ‘Evidence-based design for Critical Care’, Rotterdam, 2008

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*Figure 1: Womb Wall*
of each other’s work, which created mutual understanding. The design choices were well considered and based on information from literature and from the experts.

The second reason for the success is the fact that the future users of the building could offer their input at an early stage. The impact on the design is greatest in the development phase. In today’s practice users are often heard when the preliminary design is complete. By then the design has been worked out to such a great extent of detail that implementing changes would delay the progress of the project. Often the preliminary design serves as a cost estimate for the project, which means that any changes will affect the budget adopted.

Conclusions

First of all, it may be concluded that Evidence-Based Design is much more than just a literature study to find evidence. It is about the entire process, the goal of which is to realize a logical substantiation for the design choices to be made. A crucial condition thereby is that the steps be recorded, as fine-tuning of key design issues is inherent in the process. The second conclusion is that EBD distinguishes from today’s practice in two essential steps: conversion of a key design issue into a research question, and evaluation of the design after it has been put into operation. The final conclusion is that the EBD process forces those involved to bring the various disciplines together at an early stage to formulate the tasks. This reduces the implementation of often expensive changes at a later stage to a minimum. The creation of an Evidence-Based Design is a team effort.

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1. The client’s goal is to increase the satisfaction of the family (or loved ones of the patients) by reducing complaints
2. The architect’s firm’s goal is to design a meaningful environment for people
3. The key design issue is to create an environment where family satisfaction is increased
4. The literature is evident that the environment contributes to the involvement of the family so the assumption is made that single rooms increases the
5. One of the quotes found in the literature: “The study found that walls separating patient rooms, rather than curtains, provide more privacy and encourage
6. The architect’s firm’s goal is to design a meaningful environment for people
7. The evidence based design concept is shown in the figure below
8. The amount of complaints of family is dropped to zero
9. The measure is the amount of complaints of family
Design and Research

by Herma de Wijn, Architect, Dutch Centre for Health Assets

Design and research come together in architecture. But how do they influence the outcomes of the design process and (DucHA) explores the intricate relation between design and research.

Designing is a future-oriented activity exploring probable, possible, desirable and useful futures. First and foremost, the design plays a catalyzing role that, based on knowledge and skill, schedules what we can want, forms input and a frame of reference for discussion, and step by step creates support. The design makes conditions, solution directions and possibilities visible, and enables decision-makers to choose from alternatives and, at later stages, from variants. Designs are useful in all phases of a process, because they can be used on every scale level and at any given time – in a first rough analysis, to explore the possibilities, impact and feasibility. They can lead to alternatives and inspire participants to think creatively and set conditions breaking new ground, making it possible to assess the pros and cons of alternatives. Designs are the cyclical elements of a development process. A design is created in a number of repeated steps of progress, analyzing, reviving, supplementing and fine-tuning.

In the AU! book architecture historian Peter Michael Schaap describes how hospital managers think that architecture is nothing more than ‘paint on the cake’. His conclusion is that the wish to prove – in a rigorous way – that the Environment matters neglects the intangible, including the symbolic nature of the designed environment within the Humanities showing that there is no universal subject.

Do you seek the universal? Use critical thinking to interpret the implications of the research to your unique situation.

But then how can you compare evidence? Let’s say I build a hospital in Germany and I build another in France – two different clients, two different cultures.

If we talk about mapping cultural aspects, the question would be what kind of evidence you would find and use – quantitative or qualitative information?

Do you have to use both?

Yes. But in the world of medicine they are accustomed to using quantitative research – hard statistical data. They have a very clear definition of the hierarchy of quality of research. The randomized controlled trial is standard, and if it is not randomized and not controlled, it is thought to be just observations and anecdotal information. There are grades of As, Bs, and Cs for evidence in the world of medicine. And this is what I hope to develop over the next few years. I would like to see people begin to say: ‘Okay, we need some formal experiments that include a control group’.

In the AU! book architecture historian Peter Michael Schaap describes how hospital managers think that architecture is nothing more than ‘paint on the cake’.

The Masterclass on Evidence-based design was organized on the instruction of the Innovation Platform Architecture in Health in cooperation with the Berlage Institute in Rotterdam. The Masterclass used the knowledge and expertise of Masters Kirk Hamilton, Charles Cadenhead and Jaap Wiedenhoff, the Erasmus Medical Center Rotterdam and the University Medical Center Groningen (UMCG). All week Dr. Jaap Tulleken (intensivist) and Leo de Jong (head ICU nurse) of the University Medical Centre Groningen were available to provide the participants with information. Various professionals lectured about specific topics like microbiology and architecture of IC-units. It was their contribution that allowed the architects to realize a realistic design. The Masterclass was attended by nine architects from the Netherlands, Sweden, Canada and the United States.

About the Berlage Institute

Located in Rotterdam, the Berlage Institute is an international postgraduate laboratory for education, research and development in architecture, urbanism, and landscape. Bridging academic education and research with professional acuity, its program is devoted to producing innovative knowledge that is applicable to architectural practice as part of a transnational discourse.

The Berlage Institute provides the next generation of architects and urbanists with tools to better comprehend and intervene in the complexity of contemporary life. Working closely with third-party collaborators, participants directly engage with public authorities, research organizations,
Over the past few decades the research phase, that precedes the design, has somewhat dropped out of use in physical planning, urban development as well as in architecture. Cooperation with researchers, use of study results and reserving sufficient time for analysis and preliminary research were no longer self-evident to principals and designers. That tide has turned over the past few years. Under the influence of, among other things, the Dutch national vision to principals and designers. That tide has turned over the past few years. Under the influence of, among other things, the Dutch national property concepts and scenarios transparent in early a phase as possible, and so to come to an adequate result.

Therefore, interdisciplinary design and research have increasingly been linked over the past few years: government, educational institutions and market parties encourage design-based research and research-based design. The US corporations, real estate developers and municipal planners to develop new architectural and urban strategies through charged political and cultural debate. The broad scope of this work provides a critical global outlook while simultaneously producing locally informed knowledge (www.tno.nl/ducha).

Full publication will become available at request in spring 2009.

Please contact Joram Nauta (joram.nauta@tno.nl), Dutch Centre for Health Assets, Churchillaan 11, 9th floor, 3527 GV, Utrecht, the Netherlands
that facilitates particularly administrative decisions based on input from the discipline in a contemporary way. Based on language, everyone visualizes the design, thus creating spatial pictures. The advantage of the visual approach is that various actors can jointly imagine the same outlined world and discuss it. This will lead to a process of mutual deliberation, in which participants will try to learn from each other and understand the issues, to connect aspects by going into the matter more thoroughly and using their expertise, and to convince each other.

From evidence-based design and healing environment to research-informed design

Evidence-based design, originating from healthcare in the USA and introduced by Kirk Hamilton, propagates the use of the best available study results in the design. This holds true not only for the design process of healthcare institutions, but also for other types of buildings and users. It is about the result of research but it could also be about the experience of the principal or users themselves. Evidence-based design also involves a certain working method, asking questions about the necessity and backgrounds of programme elements, using study results, using various concepts and models, but also evaluating buildings realized.

The link with research is also at the basis of healing environment. Study results have shown that the size and lay-out of rooms and the view play a role in people’s wellbeing and wellness; the positive effect of single rooms, of a pleasant use of materials and colour and of plants and nature. In fact, it is about the careful positioning, lay-out and furnishing of buildings. It is a reaction to the practice in healthcare buildings over the past few decades, with large wards, insufficient privacy, and the use of not very inspiring materials and colour, and is now a necessary aspect of the design practice. Paying attention to the quality of the interior and exterior environment should form part of research-based design.

Kirk Hamilton admits that research-informed design would now be a better name. The point is that research is an inextricable element of the design practice and that each designer, at least in the key focus areas of his design, uses and promotes research and asks questions of various parties.

Each design assignment is unique

No two assignments have the same environment and the same programme. Each project is fitted into a specific environment, requires the spatial lay-out of that programme, has its own balance between public and private rooms, requires a custom-made structure with proper heights and daylight, and optimum living and working conditions.

The challenge is to use a designing method that best fits a certain assignment with ambitions for innovation.

Before Kirk Hamilton leaves I ask him whether or not it would be ‘right’ to call Evidence-based design, Research Informed design or Research-informed design. He answers that I should feel free to do that. At the same time as he started using the Evidence-based design language, Roger Ulrich was using the term Research Informed, and he forced Kirk Hamilton to keep using the term, so when he wanted to call his new book something else than Evidence-based design, his publisher said: ‘No, because Evidence-based design his publisher said: ‘No, because that I should feel free to do that. At the same time as he started using the Evidence-based design language, Roger Ulrich was using the term Research Informed, and he forced Kirk Hamilton to keep using the term, so when he wanted to call his new book something else than Evidence-based design, his publisher said: ‘No, because Evidence-based design, I want this book to come up’. Kirk Hamilton, At The Master Class ‘Evidence-based design for Critical Care’, Rotterdam, 2008.

The challenge is to use a designing method that best fits a certain assignment with ambitions for innovation.