Section 2

Information ARCHITECTURE

DEFINITION

Information ARCHITECTURE stands for making the invisible visible in the form of digital information extracted from and applied to physical architecture, to better understand and design physical architecture.

Information is a central property of architecture, as it is defined by data and their relation, and at the same time is a crucial ingredient to build and maintain architectural knowledge. We can think of information as the building blocks of future architecture. Looking at such a building block, we can decompose it into its facts (data) and into the relations connecting the different facts. Looking at knowledge, we can decompose into information and into the relations connecting the different sets of information. But it is much more difficult to reverse this process.

Information ARCHITECTURE describes the information IN architecture.

Architecture and information

Far too often, we take built architecture for granted. We are satisfied by looking at the surface of a building, of a city, or of a landscape. For those who want to merely enjoy and experience architecture, this may suffice. But for those who want to design buildings, urban quarters or territorial structures, this is not enough. We need information to understand and design architecture, and as we shall see later, we need the architectural metaphor to understand and design information. But what is information? And what is the relation between data, information, and knowledge?

Think of a simple brick wall: in the distant past, it was sufficient to know about the bricks ability to protect and to bear loads. In the information age, the brick wall can tell us an entire story: the origins of its materials, the process of their transportation to the production site, the production of the bricks and the mortar, the transportation to the building site, the construction process, the position of each brick in three-dimensional space, the thermal properties of the wall, its colour, its acoustic properties, its health related qualification, and many other invisible, yet existing properties. In fact, the wall informs us of the entire history about its life-cycle. If we know all these properties and also how to handle them, it should be possible, in the future, to design and build new architecture, which fulfils its specifications much better than today.

Data in ARCHITECTURE

All scientists need data, and all architects need data. Often, we see the value of data only when we have no access to them. As history is an important aspect of architecture, historic data are valuable and the precondition for many design decisions. Future data – which by definition cannot exist – come from architectural simulation and design exploration.

Gallery 2.4 Data in ARCHITECTURE

Lim, K. 2011. *What do these numbers mean? This data might be important, but make no sense without knowing the context.* [Photograph]. Science Park 2, Singapore.

Information in ARCHITECTURE

Looking at architecture, we see the obvious. But there is more invisible information in architecture than meets the eye. Consider, for example, of the past, present, or future temperature of the room; the weight of the wall resting on a floor; the age of the wooden beams in the ceiling; the hidden pipes and cables behind the plaster; the acoustic properties of materials surrounding you; the cost per square metre or per cubic metre of the space you look at; or the CO2 embedded in the material and the energy needed to heat and cool the space.

Gallery 2.5 Information in ARCHITECTURE

Schmitt, G. 2010. *Old or new? Original or reconstructed? We need historical information to decide.* [Photograph]. Vicinity of Riyadh.

Knowledge in ARCHITECTURE

Combining information, experience and insights can lead to architectural knowledge. This knowledge is necessary to design new buildings that fulfil certain properties; and it is necessary to understand the function and meaning of buildings in the first place. Knowledge is associated with people, in this case with architects. Knowledge increases with the experience of architects in their practical and theoretical work.

Gallery 2.6 Knowledge in ARCHITECTURE

Schmitt, G. 2011. *The Architect Franz Oswald in Singapore as Leader of the Future Cities Laboratory.* [Photograph].

Data, information, knowledge, architecture

The design of architecture is built on knowledge, knowledge is built on information, and information is derived from data. Yet there is no straight and automatic way from data to information, to knowledge, to architecture. The structures, frameworks, hierarchies, ontologies and mechanisms that relate those entities are mostly interesting for research. One of these structures we refer to as models. Models in architecture, urban design and territorial planning are an abstraction of the real object with its functions and behaviours. Models are also the base for simulation, an activity and abstraction that includes the important parameter of time.

Information ARCHITECTURE uses simulation for more than creating images or artefacts based on geometric constraints, rules, or cases. Rather, non–geometric factors such as light, energy, structure, behaviour or systems knowledge become available for integrated direct modeling. Information Architecture helps to formalise and generalise design principles.

Few design principles in architecture, urban systems or territorial planning are context-free. Those are the ones based on known constraints, such as gravity, temperature ranges, or material properties. Most other design considerations depend on the context.

Modeling in ARCHITECTURE

When we think of architectural models, physical models of proposed designs or existing buildings come to mind. Yet in the context of information ARCHITECTURE, **modeling** builds on abstractions of physical architecture that explicitly show the connections between the parts and the whole. This normally involves simplification and formalization. To simulate a building's cooling demand, for example, we apply a formalised physics model to a specific, yet simplified geometric model.

Simulation in ARCHITECTURE

Simulation in Architecture requires the existence of a model, representing the most important characteristics of the proposed solution. In the past, the words «model» and «simulation» were often used interchangeably in architecture, i.e., an architectural model was seen as a design scenario for a given time in the future. Increasingly, the factor time and with it the dynamic aspects of design proposals become important parts of simulation in architecture.

Gallery 2.7 Modeling in Architecture

Schmitt, G. 2010. *Physical models of buildings in Singapore.* [Photograph]. URA Gallery.

Gallery 2.8 Simulation in Architecture

Chair of Information Architecture. 2009. *Simulation of future buildings and land use in the Value Lab Zurich with Antje Kunze and Jan Halatsch.* [Photograph].

Projection in ARCHITECTURE

Projections are a special type of information ARCHITECTURE. They either project images that have nothing to do with the content of the projection area, or – more interesting – they project abstractions of information of functions or events that occur behind, in, or in front of the projection surface. This way, facades can become large information displays. The chair of information architecture has established a tradition in projection exercises with Christian Schneider. He started with projecting complex adaptive code generating geometries onto facades, respecting the particular qualities of each facade in terms of openings and proportions. He then began using infrared cameras to detect people and heat emitting objects, as they were moving in front of the building, resulting in dynamic changes in the projections.This was a convincing example of making the invisible – in this case sources of heat – visible. Lukas Treyer extended the experimental exercises towards dynamic design projected on more complex geometry. Students learned programming and at the same time gained experience in visualising information in previously unthinkable ways.

Gallery 2.9 Projection in Architecture

Treyer, L. 2012. *Architectural projection by Lukas Treyer on the facade of a parking garage.* [Photograph]. City festival of Baden, Switzerland.

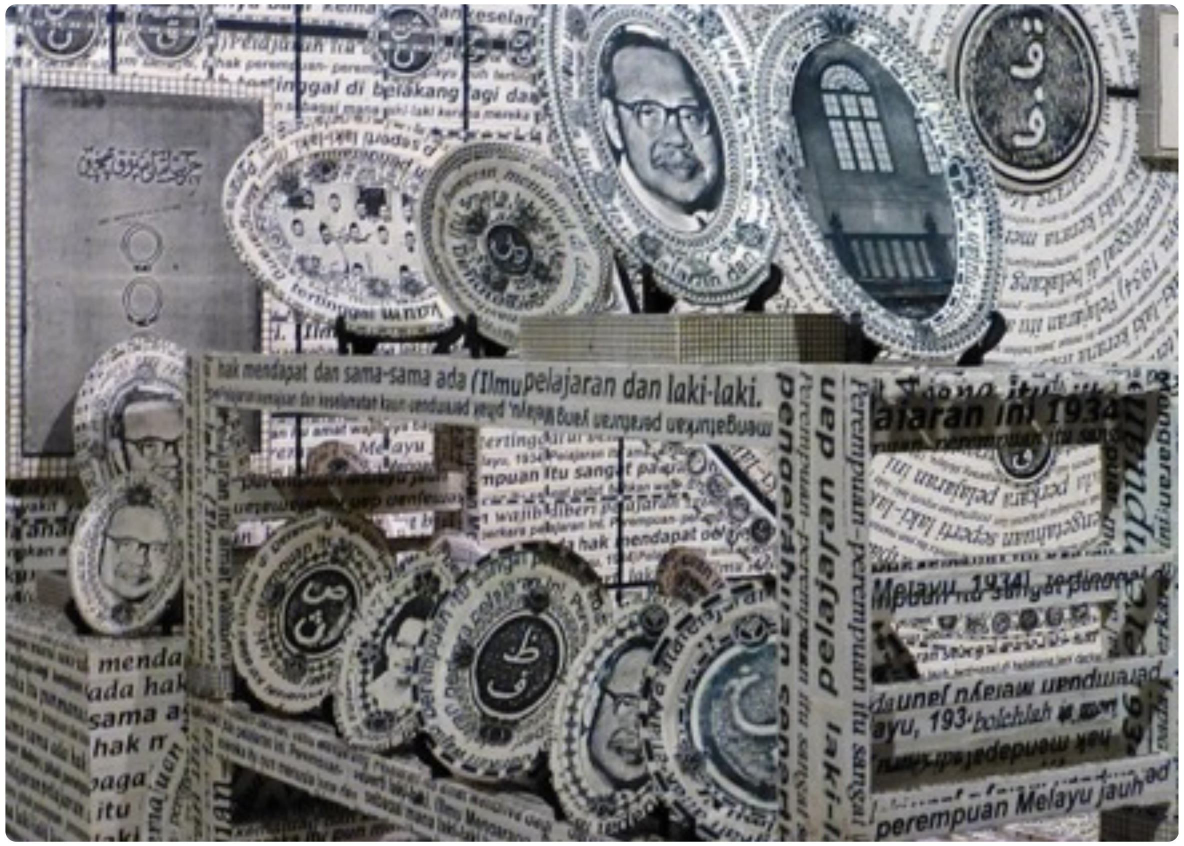
Movie 2.1 Projection in architecture

Treyer, L. 2012. *Video of the architectural projection by Lukas Treyer for the Stadtfest Baden, Switzerland.* [Video].

Art Information ARCHITECTURE

In art, architectural spaces and furniture can be used as information carriers. Most of the time, spaces are used as an empty shell in the background, to allow art to be perceived separately. Information can also be displayed from furniture and other surfaces, giving the impression of interaction between the viewer or user of the space and the art installation.

Gallery 2.10 Art information space



Schmitt, G. 2013. *The shaping of cultural memory by historical texts. Zulkifli Yusoff, collage embossed dye printed on canvas.* [Photograph]. Exhibition in the Singapore Art Museum.

Curricula in ARCHITECTURE

Architectural education is about integrating data, information and knowledge with the ability to design and to arrive at buildable, affordable, and sustainable architecture. The same applies to urban design education and territorial planning education. Each architectural curriculum represents the present view of what the institution in charge considers to be necessary for the education of architects, urban designers and planners. Over the years, courses covering topics from other disciplines and sciences are added to and dropped from the curriculum, with the ultimate goal to improve the final product, be it architecture, urban design or territorial planning. Every addition of a new topic and every elimination of an existing topic cause heated discussions in faculties and among students. Yet as the total time for education is limited, and as the body of knowledge of architecture is growing exponentially, this process is necessary and unavoidable. Rather than merely dropping and adding courses, it is worth looking at a higher level of abstraction to find out if some topics could be combined into one, and if there is an underlying structure, grammar and language to these topics. Data, information, and knowledge might be a first step in this direction.

Section 3

INFORMATION Architecture

DEFINITION

INFORMATION Architecture describes metaphors and principles of physical architecture applied to digital data and information, to create an architecture of information, with the use of information as raw material.

INFORMATION architecture describes the architecture OF information.

In the Internet, **INFORMATION architecture** describes the organisation and the labelling of websites, online communities, and intranets. But there is the potential to organise and structure not only the obvious, but the entire information space. The key to these possibilities is the understanding of the architectural metaphor.

The architectural metaphor is an abstraction that is used in various fields. Think of expressions such as computer architecture, financial architecture, security architecture, or political architecture. In each case, the word architecture is meant to describe a structure and an order, and not the physical construct itself. These expressions and descriptions use the abstract power of architecture and apply it to other fields.

Richard Saul Wurman is the person who originally used the term information architecture. As an architect and graphic designer, he clearly broadened architectural concepts into the world of information with the intention to make it better understandable to everyone. He also invented the Technology, Entertainment and Design (**TED**) conferences.

INFORMATION architecture is very powerful in placing emphasis on certain information by using the architectural metaphor. It is, at the same time, also a dangerous instrument, as it might lead to overlooking other, less structural prominent pieces of information that might be essential.

Architectural and planning metaphors shaping the structuring of data

Even in the digital age, everybody knows a stack of books, or a stack of dishes. Placing a book on top of the stack or taking a plate from the top of the stack are activities in a building that we perform almost daily. In computer science, a **stack** is described as an abstract data type or collection with one main operation: to add one entity to the collection, described as push, or to remove one entity, described as pop. With the stack,the connection between the physical world and the abstract world of computation is still visible: the most recent item is pushed on top, and it will also be the first to be retrieved. One can almost feel the effect of gravity in this description, although it is a completely virtual analogy in information space, were the metaphor of the physical stack is helpful to describe a particular ordering principle.

Moving closer to the building, computer science uses the expressions of **barriers** and **fences**. Fences are used as metaphors and stand for guaranteeing that storage and cache have the same state. In analogy to an animal herd, fencing in computer science can also describe the process of separating entities from the rest. In computer science, this is necessary when nodes or sense of nodes in large computational clusters feel and need to be isolated to protect the overall performance of the system.

Sounding similar, but not necessarily related is the expression of computer farms. In an analogy to physical farms, usually in the hinterland of urban systems and supplying them with food, computer farms have specialised meanings. There are the **server farms** or server clusters, tying together logically and physically dozens, hundreds, thousands or even millions of individual computers. These server farms are the core of most operations in the Internet today. The analogy to farming does not stop here: the individual servers are usually stacked on top of each other in metal racks, which evokes the analogy to vertical farming. They also generate large amounts of heat as a result of the significant electricity consumption. As a matter of fact, server farms and the associated storage devices become so significant in terms of electricity requirements and cooling loads, that in temperate climates can be used to heat entire buildings, and in hot climates need to be placed faraway from the city – in previous farmland – to avoid the overheating of the urban environment. In some cases, the analogy goes even further, in that gigantic server farms are placed directly in the vicinity of huge cattle farms, to make use of the electricity generated by burning biogas. A special type of computer farms are render farms, in which several thousand CPUs are connected to produce the animations for the movie industry.

The function of a **firewall** in architecture is well known: its main purpose is to protect from a threat, specifically to prevent the spread of fire. In computer science, firewalls will most likely not protect from the spread of fire, but they are designed to prevent unauthorised access to information. Today, this software concept is installed on almost every computer we carry around, but nobody seems to be aware of this particular irony. It does however clarify the absolute virtual character of the “firewall” expression.

Further expressions in computer science, using the architectural metaphor are: Roof-line model, Data vaults, Data warehouse, Data highway, Data mining, Portal, Software architecture (Mary Shaw, CMU), Windows, Control plane, Back pressure, Pipeline, Staging, Tiling (so that data fit in the cache), B-trees, quad trees, oct-trees, grids.

Section 4

INFORMATION ARCHITECTURE

DEFINITION

INFORMATION ARCHITECTURE describes objects and buildings that are both expressions of information and at the same time use the architectural metaphor or the architectural object itself to bring structure and order into information.

INFORMATION ARCHITECTURE is architecture built for data and information gathering, storage, display, access, and experience.

A good example for this type of information architecture is the **Jantar Mantar** in New Delhi. The structures are not only architecturally attractive, but serve a specific scientific purpose. They are a perfect merger of form and function. Although construction started in 1724, they still form an impressive information architecture park in the centre of the capital.

Certain cathedrals and temples could also be considered INFORMATION ARCHITECTURE. The condition would be that the physical architecture rationally supports and enhances the information to be conveyed. This applies particularly to the use of orientation and windows to guarantee particular lighting effects at given times of the year. Sound enhancing interior space quality, achieved by geometry, surfaces and material, enable the transmission of sound information to the listeners with emotional effects in mind. Text integrated on the wall, on the floor, or on the ceiling, as well as sculptures conveying messages, are additional pointers. As such, the pre-calculated effect of light, sound, written, painted and sculptural information is a indication for INFORMATION ARCHITECTURE.

In general, also buildings that successfully convey messages (intended, not by accident) and were designed for this purpose, can be considered as INFORMATION ARCHITECTURE. Examples are light towers, old bank buildings, hospitals, skyscrapers or Apple stores.

Example Atacama telescopes

INFORMATION ARCHITECTURE is probably the easiest way to explain the relation between information and architecture in a practical sense. There are structures, whose only purpose is to collect data. Those could be telescopes in Atacama desert, displaying fixed and dynamic parts. The fixed parts are the outer shells of the building, the dynamic parts follow the instructions given by scientists around the world.

Gallery 2.11 Architecture built for gathering information

Schmitt, G. 2007. *One of the 1.8m diameter auxiliary telescopes, mobile on tracks, working in synchronization with the large telescopes.* [Photograph]. Paranal, Chile.

Example libraries

Libraries have the purpose to store, protect, display, and provide access to data and information, mostly in printed form.They have developed over the centuries in all cultures, and form, if successful, communal and social centres in urban systems. Their status and media content is constantly changing in the society, especially in the digital society, yet the inexplicable connection between architecture and information remains.

Gallery 2.12 INFORMATION ARCHITECTURE

Schmitt, G. 2008. *A place to store and access information.* [Photograph]. Library in the Collegium Maius, Krakow.

Example stores

It appears unusual that digital companies need physical stores. Yet it has become a successful business model to build attractive stores selling digital and information technology equipment directly to consumers in prominent locations in the city. The desire of clients to explore the product together with well-trained personnel makes those stories commercially successful.

Gallery 2.13 INFORMATION ARCHITECTURE

Schmitt, G. 2012. *Store that sells digital instruments for accessing digital information.* [Photograph]. Apple Store in Sydney.

Example churches

Churches are good examples of information architecture. The structure is optimised for light and sound impact, in order to support both contemplation and festive celebrations. Strong symmetries and spatial hierarchies in plan and spatial realisation suggest analogies to the organisation of the church. Walls and windows are additional places to display data and information – or leave free space for projections.

Gallery 2.14 INFORMATION ARCHITECTURE

Schmitt, E. 2012. *The Catholic Cathedral in Ho Chi Minh City.* [Photograph]. Vietnam.