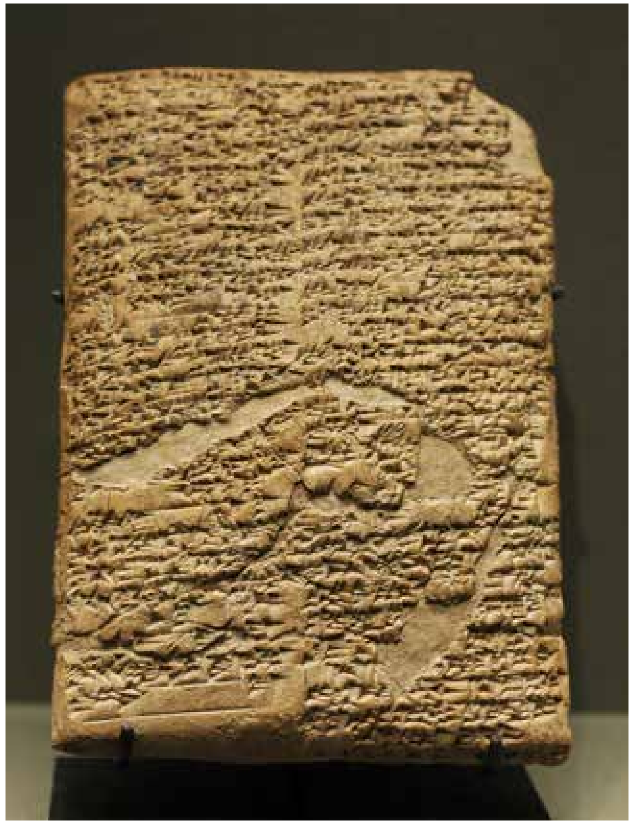
CONTENTS

Note: italics indicate case studies



↑ The earliest regulations relating to safety in construction are found in the Code of Hammurabi, dating from about 1754 BC. These laws are an early example of how design can assist in the management of risk. **Prologue of the Code of Hammurabi**, Louvre, Paris, France, about 1754 BC.

→ The coordination of the manufacturing, construction and installation of the hundreds of different elements of this interior required the careful preparation of design information and its translation into construction information. **Hotel Hotel** lobby, Canberra, Australia, March Studio, 2014.

The scale, expense and time required to construct buildings make it impractical to prototype a structure in full. Thus, design provides a way of defining the scope, parameters and specifics of a project. We use drawings, models and other representations to allow us to envisage how the building will look, and how it can be constructed, before any material and construction labour are expended.

The design process also helps with safety considerations. Every locality will have some form of planning and building regulations, which form a set of requirements and minimum standards that ensure that buildings are safe and meet the needs of the public. The design process allows the architect to ensure that these requirements are met, as far as possible, before construction begins. Requirements and restrictions can be very complex for large projects, and require the input of many different groups of people, so design allows both local authorities and the public to understand the nature of a project early on.

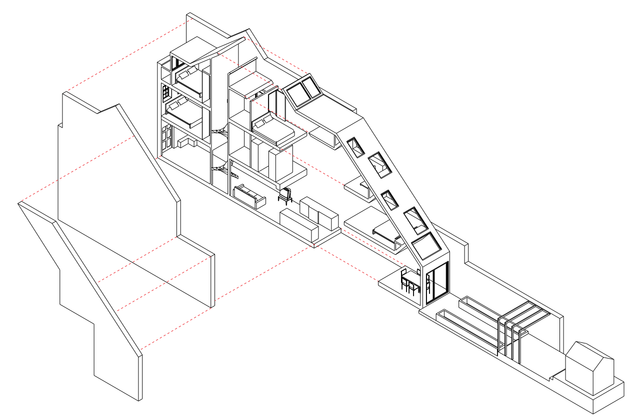
Who designs?

In professional practice, we often speak of the ‘design team’. In any project there will be more than just an architect involved, and this means that design is undertaken by different people, working in different disciplines. While the architect (or a team of architects within a practice) may be responsible for the building design, engineers will work on the design of the structural solution, and others on the design of the services (electrical systems, heating/cooling systems and plumbing systems). Very large projects may involve specialist consultants working on the design of specific aspects such as traffic systems and parking layouts, and some may involve many other architects for the design of the interiors.

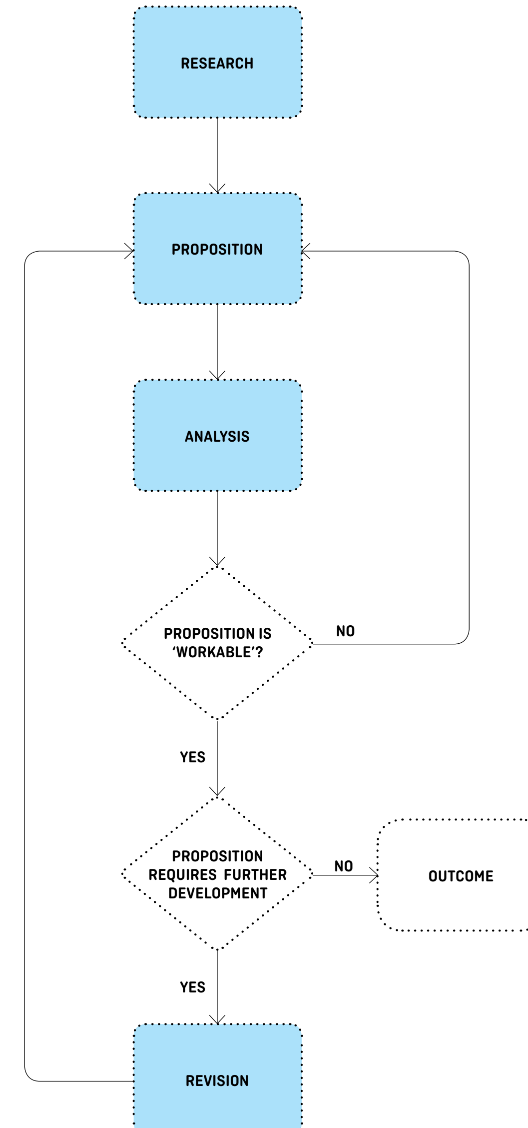
CHAPTER 1

THE STAGES OF THE DESIGN PROCESS

Every architect or designer will have a different way of generating ideas, but the stages of the design process generally follow a similar pattern. As we have seen, the design process is iterative. A design is very seldom considered complete after the first ideas are established. Instead, the designer will continuously review and redesign, improving the solution by returning to previous stages of the process and then moving forward with modified ideas or outcomes.



←+↑ The way a designer addresses challenges and constraints can drive a project in ways that make it unique. This was the case with a remarkably narrow site for a house in London, which resulted in an award-winning project. **Slim House**, London, UK, alma-nac, 2013.



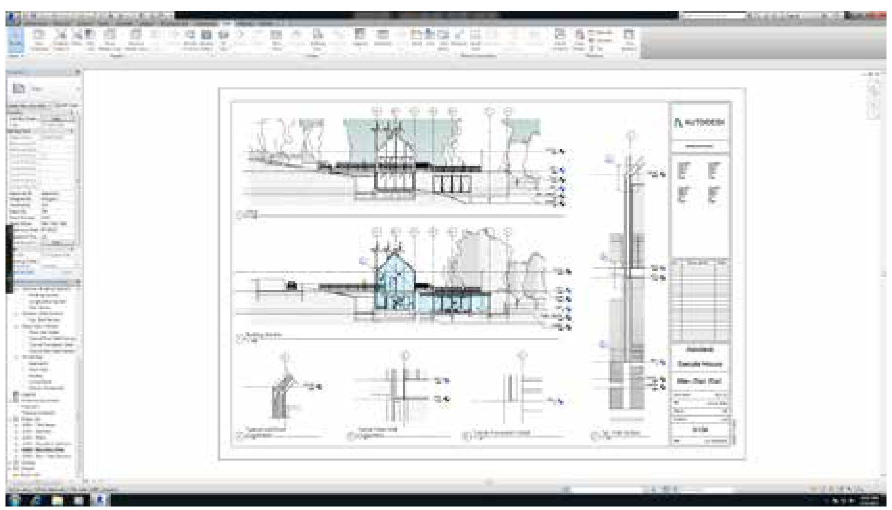
Building Information Modelling (BIM)

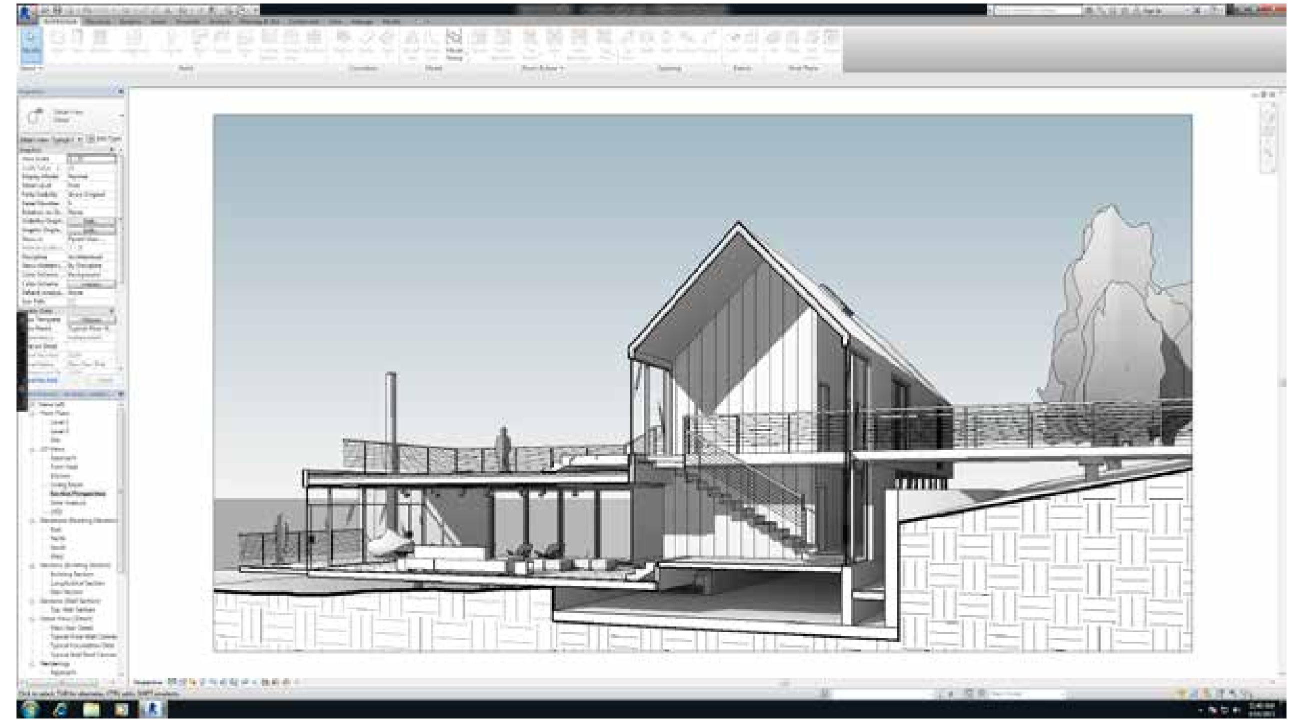
While 3D modelling has become a very common feature in the design process, and CAD an (almost) ubiquitous tool for the development of detailed construction drawings, Building Information Modelling (BIM) is increasingly being used throughout the process of design and construction. BIM is based on the notion of an 'intelligent model': one in which each element of the model (each wall, door, floor and so on) has a set of pre-defined properties that can be 'interrogated' by the software. For instance, when modelling a wall we define the type of wall (masonry, concrete, etc.), as well as the thickness, height and other properties that are important.

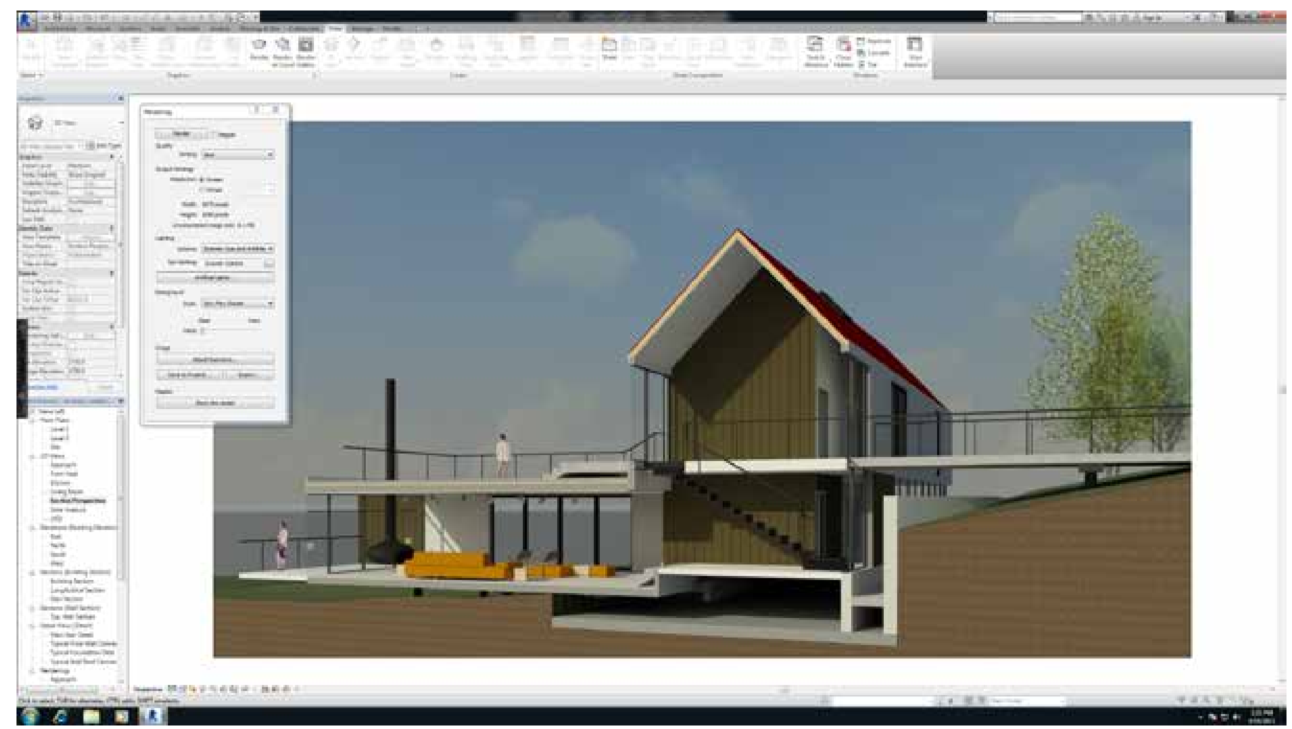
Working with a BIM model is very different from working in CAD. In CAD (whether 2D or 3D), the architect creates geometric representations of physical things. BIM is more like actually building in the computer, as the representation produced by the architect reflects the physical properties of the elements themselves. The importance of this cannot be underestimated. It allows the accurate representation of the design (since most BIM software also allows full 3D rendering and visualization) as well as extremely accurate construction information.

BIM software was at first used primarily as a way of developing construction drawings with greater accuracy and efficiency. However, as the software has matured (along with the increase in low-cost, powerful computers), BIM has become a tool that is used throughout the project process. Within BIM applications, it is now possible to work through initial design studies that are then developed throughout the project. Further, the concept of 'one model' has become common in the industry, allowing architects, engineers, contractors and other members of the project team to work on a single model. The entire project team is therefore aware of changes, and problems of coordination can be avoided by referring to a common data source.

Since, in architecture, the design process is not confined to a single stage of a project, an architect will probably use many different tools to achieve the necessary work for each phase. There are some architects who, based on their approach to design, spend a great deal of the design process using computer software, but their actual process (the steps or stages) may seem very similar to that of an architect who sketches and draws using traditional tools. What we must recognize is that the design process is not specific to the tools that are used, but to the architect's approach.







→+→→ Building Information Modelling (BIM) is becoming standard, in many practices, for the development of both design information and construction information. Its integrated nature allows architects to manage projects from initial studies through development, and then to produce visualizations and construction documents. This paradigm shift in the use of software is having an effect throughout the construction industry. **Revit** (BIM software), Autodesk, 2015–16.

ECONOMICS AND BUSINESS FACULTY, DIEGO PORTALES UNIVERSITY, SANTA CLARA, HUECHURABA, CHILE, DUQUE MOTTA & ARQUITECTOS ASOCIADOS, 2010

A material approach is rarely driven only by the material. Rather, the selection of materials is a means by which the designer can achieve a range of aims, be they functional, environmental, conceptual or otherwise. A material approach is based on the designer's ability to use materials, primarily, to express the important aspects of the project. The Economics and Business Faculty at Diego Portales University in Santa Clara, Huechuraba, Chile, by Duque Motta & Arquitectos Asociados, presents a very different material approach, one in which the mass and weight of reinforced concrete become a specific feature.

Concrete was chosen for its ability to convey an impression of weight and permanence. The aim was 'to build a contrast, a structure with weight that speaks of permanence and stability, to accompany the university in its long-range commitment'. This contrast was in relation to the surrounding architecture, which is dominated by glass-walled office buildings.

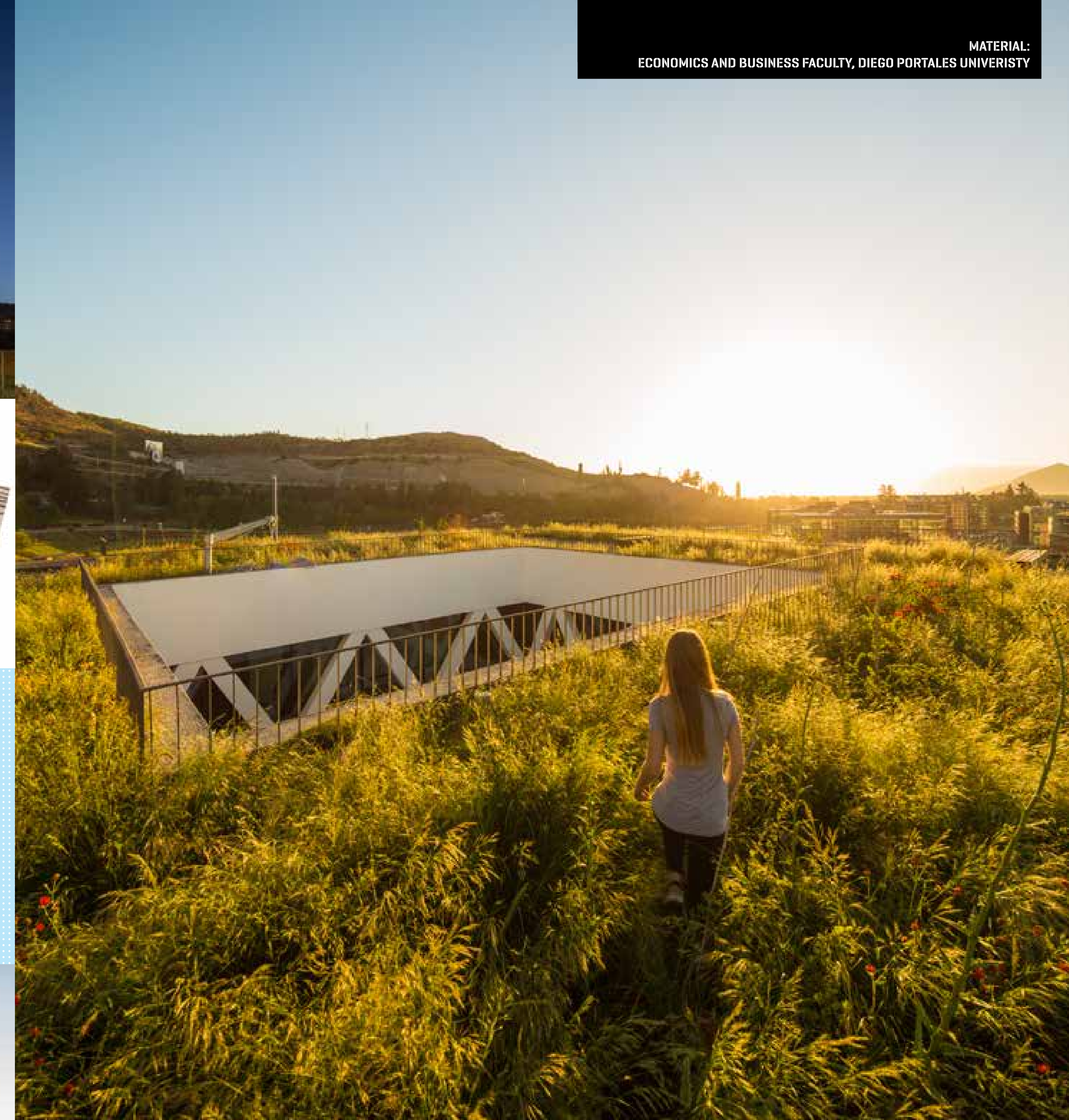
As the model of the masterplan shows, the architects developed a strategy that used the long, slab-like Business Faculty building (behind) to create a definitive edge – a border – to the San Cristóbal Hills. Although the structure is primarily of concrete, the facade (facing the hills) is of glass, reflecting the buildings nearby. However, as soon as we move around the side of the building we see that this glass facade is, literally, just a thin plane applied to a concrete volume.

The architects' material approach serves an additional purpose. From the outset, the university wanted the faculty to be environmentally efficient, and so the choice of material allows the project to meet other requirements. The massive concrete walls, with their minimal openings, allow the building to be heated and cooled with greater efficiency. Planters on the north and west facades will promote the growth of deciduous vines on these walls, providing shade and increasing humidity in the hotter months. The inclusion of courtyards and large openings promotes natural ventilation, making use of the breeze from the hills.

↑↑ The masterplan of the Economics and Business Faculty at Diego Portales University shows the play between the solid, block-like Economics buildings and the sinuous curve of the Business building.

↑ Creating a sense of permanence through weight and mass, these university buildings use our perception of concrete to reinforce the concept of the project.

↓ The thin glass facade, accentuated by the corner reveals, emphasizes the mass and solidity of the concrete. Using such contrasting materials allows the designers both to enhance the material properties and to provide specific internal environments.



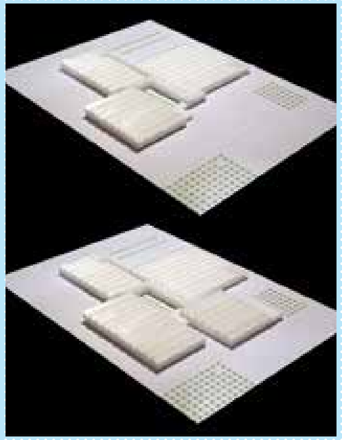
↑ The proposed roof gardens of the Economics buildings create a playful relationship between the natural and the built environment. The solidity of the concrete becomes the foundation for supporting a return to nature.

↙ Overall view ↓↓ Model → Entrance

↓ Staff lounge ↓↘ Factory floor

HAWE HYDRAULIK, KAUFBEUREN, GERMANY, BARKOW LEIBINGER, 2014

The HAWE factory in Kaufbeuren, Germany, by Barkow Leibinger differentiates much more between production and non-production areas than the McLaren factory we have just examined. HAWE, a manufacturer of mobile hydraulic systems and components, required a new production centre in an agricultural area at the edge of the Bavarian Alps. Barkow Leibinger developed a factory and office complex that fits into the natural landscape while providing efficient production floors and offices.



The manufacturing processes undertaken at HAWE are much closer to what we might expect from an industrial process. A great many different types of machinery require specific services (exhaust, cooling, material supply and so on), and so the factory spaces are very 'process-driven', creating a crowded environment. However, when we understand the nature of the production process, we find that there is an equally well-developed sense of the way in which the building supports the industrial processes required.

The overall design of the factory follows a simple ordering principle. The 'pinwheel' layout of the large production areas relates specifically to the flow and logic of the production process. Raw materials are delivered into the easternmost shed, and then progress from prefabrication, production, surface treatment and assembly to shipping. This arrangement creates additional external wall surfaces, allowing more natural light into the production areas; it also affords space for future flexibility and expansion.

The support areas (among them offices, conference rooms, canteen and training rooms) are clustered in the centre of the plan, and specific offices are related to the various production areas. The heart of the scheme is an internal green space, where staff can relax. The offices, conference rooms and other 'habitable' spaces are just as efficient as the factory areas, but the impetus for their design is functional in terms of the activities that are carried out within them. The crucial feature of functional design is understanding the nature of the activities that are to be undertaken in each area, and optimizing the efficiency and effectiveness of that area.

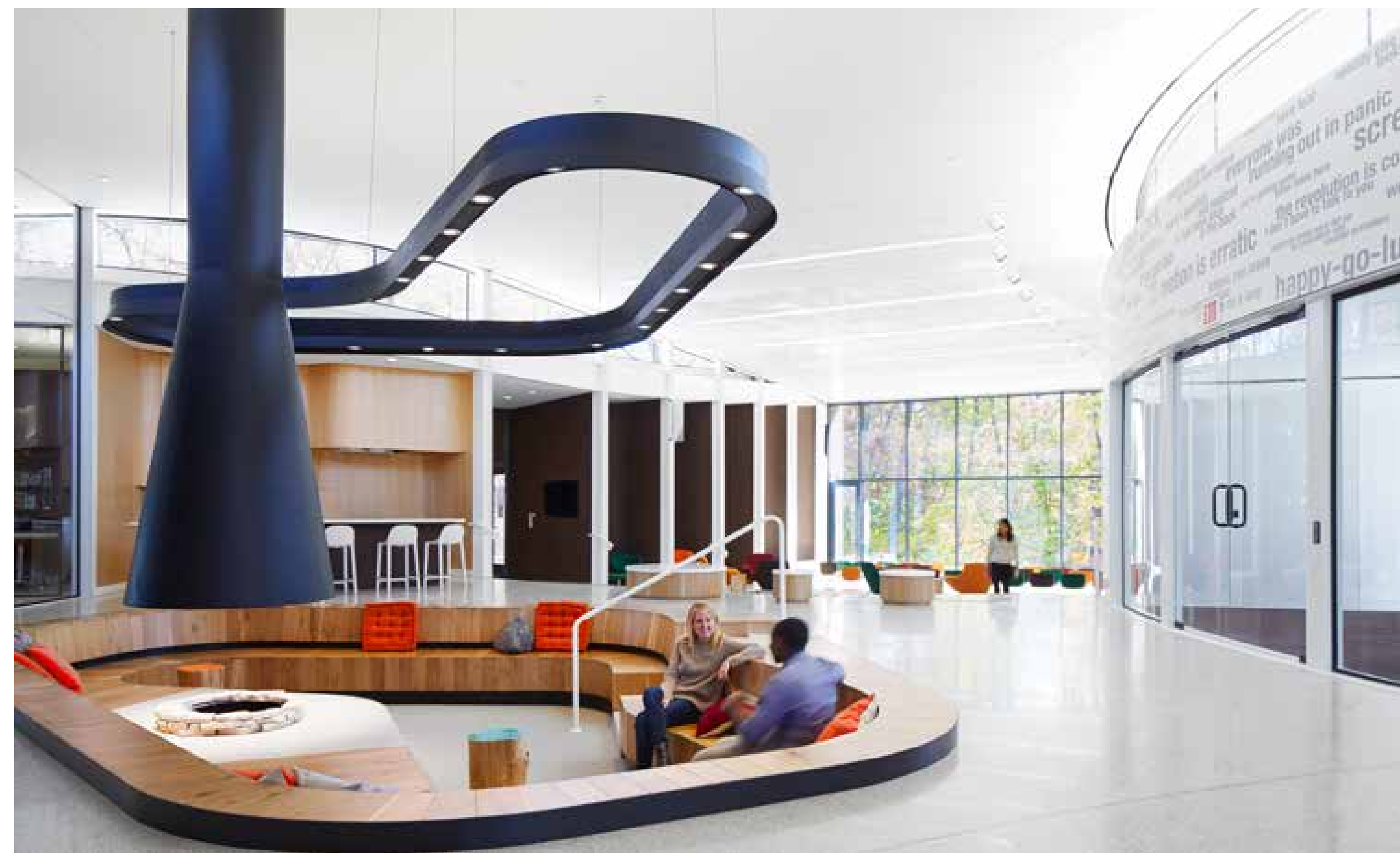
Collaborative

For many people, the image of someone engaged in a design process is similar to that of a writer. We imagine a single person having a 'Eureka!' moment, in which inspiration comes to them and they write (or, in our case, draw or model) their idea. There is some truth to this view (although there is seldom a single moment of that kind), in that, for many practices, a primary designer will be responsible for generating the overall idea or concept of a project. In large practices there are many designers, all working on different projects, but this early stage of the process will still be similar.

The process described above, and the notion of the designer, follows a very traditional approach to design. In recent years many people have started to question whether this way of designing is truly effective in meeting the needs of users. They argue that the notion of the sole designer – predicated on the idea that the architect is the expert and, therefore, able to provide the user with the 'right' solution – is flawed. Instead, we might take the approach that says the user is the expert, and that, if the design is developed through a more collaborative process between architect, user(s) and other stakeholders, a better solution can be achieved.

Such a collaborative approach requires both a change in the role of the architect and a different set of skills. It requires that the architect be willing for others to have an input in the design process, even, at times, to the point of relinquishing the leading role in that process. For some architects, this can be very challenging: for centuries, architects have been taught that they are specialists and have unique knowledge that makes them experts. A collaborative approach means that others may be experts in certain aspects of the situation, and that the design must respond to their input as well. In such a situation, the resulting design is not simply what comes from the mind of the architect, but what comes from the interaction of a group, each member of which brings something unique to the process.

The use of participatory, or collaborative, design is growing in popularity among architects as well as the public, particularly where projects have an important social or community role. In addition, if the project is in a location where the government or local community may not have a great deal of money to spend (and will therefore rely on local labour for help with construction), a participatory approach can more readily draw on the skills and knowledge that are present within the community.



Collaboration is essential to any design process. While engineers and consultants will almost always be part of the design team, there may also be a need to draw on more specialized knowledge. To achieve their aims, the architects of the Arcus Centre for Social Justice Leadership had to understand the nature of developing awareness of social justice and translate that into a building. Working with staff from the centre, the architects have created a place that is a physical manifestation of the aims of inclusion and diversity. **Arcus Centre for Social Justice Leadership**, Kalamazoo, Michigan, USA, Studio Gang Architects, 2014.

Commercial

Commercial projects – for buildings that are designed to support business activity – are probably the second most common project type for architects. The range of such commissions is formidable: offices, shops, small-business premises, factories, restaurants and so on. This category can include everything from an office renovation for a small company to a skyscraper housing many businesses.

For shops or restaurants, there may be specific aspects of the brief that relate to the identity of the company or the type of food served. The design of such premises often has to fit in with the business's overall 'look and feel'.

The brief for an office building or office interior should be clear about how spaces will be used. While many office activities take place at a desk, the way desks are used can vary. For example, someone involved in the buying and selling of financial stocks requires multiple computer screens, but uses relatively little of their desk's surface, since most of their activity takes place digitally. On the other hand, someone who spends a good deal of their time dealing with documents, such as a lawyer, will need more desk surface. Similarly, people who work at computers may require less light, whereas those who spend a lot of time reading documents will need more. Where office space is to be designed without a specific user in mind, the architect must consider how the scheme can be made flexible for different uses.

↖+← The challenge with a commercial project is often to create an environment that communicates the company's brand or identity. For the Fish Market restaurant in the Old Bengal Warehouse, London, Conran and Partners had to balance the design of a new interior with the historic British East India Company building. By seeking to minimize change, the new restaurant complements the old by using natural materials and simple furniture and fittings. **Fish Market**, Old Bengal Warehouse, London, UK, Conran and Partners, 2012.

↑+↗ An office interior must support specific types of work. The locations of desks, lighting and other services all play a part in making the work environment both comfortable and efficient. In designing a new headquarters to house four different government departments, Arkitema recognized that each had its own working practice. The building has an integrated visual appearance but is divided into four sections, related to the four departments, and each interior accommodates a different ways of working. **NEXUS CPH,** Copenhagen, Denmark, Arkitema Architects, 2014.

What is the context?

Every project, whatever the design approach that is taken, exists in a context: a physical location and/or a broader set of issues. For many designers, the context is the starting point for developing a proposal. While for some the project will relate to the context at all stages, for others the context will set out only the basic conditions to drive the project in a particular direction.

The context of a site is both physical – size, location, orientation, etc. – and non-physical – history, use, and so on. In both cases, we must understand the place in order to formulate a response. Even in a theoretical project that does not have a specific site, there is still a context. It may be the social, political or historical situation in which we design, or it may be derived from the theoretical position we take in relation to the project.

The physical context

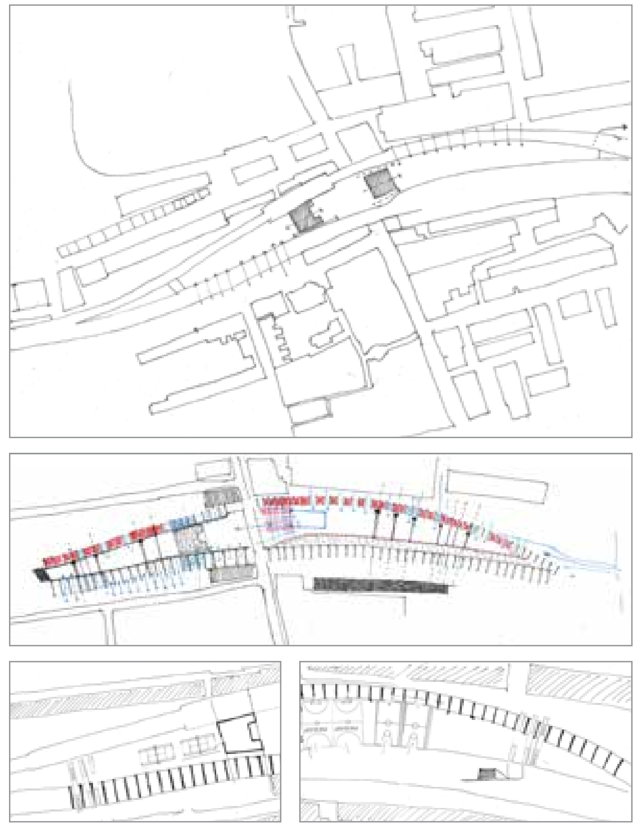
In most cases the physical context is one of the primary influences on the way in which the design is developed. An architect may actively seek to integrate a design closely with the physical context, or challenge it.

The most obvious context for a project is the physical characteristics of the site. For a small site, this may be obtained by simply observing and taking measurements with a tape. However, this will provide only the most basic information that may not be accurate enough. Many localities (particularly major cities) can now supply detailed topographical information, including digitized mapping data.

Other sources, such as property deeds and other land registry information, can be useful. For sites with many changes in level (or elevation), or that are particularly steep, a topographical survey will give the architect a clear understanding. In addition, a survey can provide accurate mapping of features such as mature trees, so that they can either be retained or clearly indicated for removal.

The physical context also includes the environmental factors of the site. Characteristics such as the amount of sunlight that will reach the site (based on the position of surrounding buildings, trees and so on), the prevailing wind direction and the amount of rainfall are all important, depending on the type of project. For example, the location of the site will determine the amount and

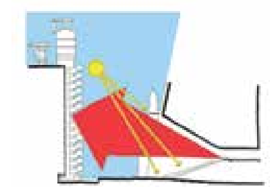
↓ The physical context of a place is the most immediate information that can be analyzed. Through photography, mapping, surveys or sketches, the designer will seek to understand the physical properties of the site. In the early stages of a project for a series of recreation facilities in the wasteland between two raised railway lines, Previn Naidoo explored the context through drawings and mappings that highlight the different uses and spatial rhythms found in the area. **Context studies, Peckham, London**, Previn Naidoo, 2012.



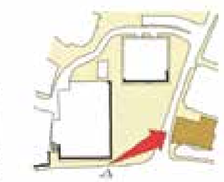
angle of sunlight that is available at any given time of year. This may lead to decisions about the placing of windows, the height of the building and its orientation. Similarly, the prevailing wind may determine factors such as the location of the entrance, or even influence the form of the building overall.

Sound is an important physical factor. On an urban site, we may need to consider the amount of traffic noise. For a project such as a recording studio or theatre, that requires a controlled aural environment, the frequencies of sound in the surrounding environment must be understood, sometimes in great detail, so that the resulting design can minimize or block them. Similarly, if a building might host noisy activities, the design will probably need to limit the amount of sound that escapes from the building.

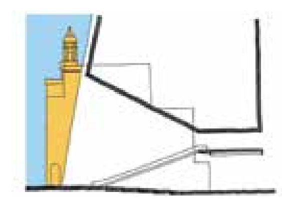
↓→↘ Early in the development of a new building on Leadenhall Street, London, the architects considered sunlight, wind and sound around the site, all of which played an important role in defining the form and precise location of the building. Site studies, **Leadenhall Building**, London, UK, Rogers Stirk Harbour + Partners, 2012.



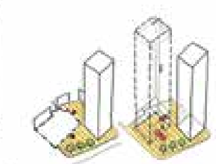
The creation of a public space



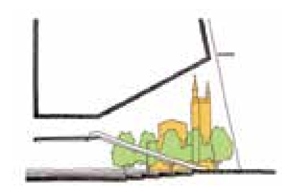
Existing plan: St. Andrew Undershaft becomes visible on emergence into St. Helen's Square



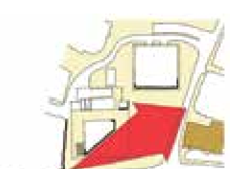
Proposed building profile respects the listed facade of 144 Leadenhall Street by Lutyens



Create public space within building footprint at low level



Eroded lower levels reveal the presence of St. Andrew Undershaft



Proposed plan enhances the visibility and presence of the listed church

Re-tender

A further twelve months would pass before the university had developed a strategy for tuition fees and new senior staff had taken up their posts, and throughout this period the team at Stride Treglown had been working at revisions to the design. Many of those changes made the building's use of space more efficient while not altering its overall volume.

The university had expected that the changes to the design would increase the cost of the building somewhat, but one of the most important alterations had considerable implications: the infilling of the galleried double-height space between levels 5 and 6, which radically changed the strategy for ventilation on those levels. With their large, open-plan areas, they had been designed to be passively ventilated, thereby requiring less mechanical equipment. However, with the double-height space gone, there was much less opportunity for air to flow between levels. This meant that more mechanical equipment, ventilation shafts and ductwork would be required, and that meant the cost of the whole project would increase significantly.

After twelve months of redesign and review, the project was re-tendered. Initial tenders had been below the expected cost, but the re-tender exceeded the estimated budget. Since the contractor was appointed, however, the project was at least moving forward once more, but because it was over budget, one of the first things to be undertaken was value-engineering.

Value-engineering

Although many equate value-engineering with cost-cutting, it is in fact a closely managed way of achieving greater efficiency and lower costs. Value-engineering was pioneered by General Electric (GE) during World War II, when engineering production was hampered by a limited supply of materials and labour. Through systematically reviewing functional requirements, GE found that it could often achieve the same or better results at lower cost by using different materials or production methods. Value-engineering has become a common feature of large projects in a great many sectors, and every large architectural project will go through a phase of value-engineering. Many design teams find the process difficult, since it often requires changes

↑↑+↑ Two views of the Entrance Lobby, showing the design before value-engineering (top) and after it. While there are still further design changes that will take place, we can see the design team beginning to revise the use of different coloured brickwork within the interior.

→ Despite being higher cost, the red glazed brickwork was retained on the Workshop Block through the value-engineering process. The position of this strong element, visible when approaching the building from either of the two main axes, means that the splash of colour offered by the glazed bricks represents a high aesthetic value.