Accademia Ligure di Scienze e Lettere

Architectural imagery:
a dialogue between designer and audience

Gaia Leandri

GENOVA
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Acknowledgements

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Contents

Foreword

This essay proposes an interesting and certainly unusual topic of study and reflection which succeeds in systematizing a humanistic branch of knowledge, by relating it to a decidedly technical-scientific one. Indeed, Architectural imagery: a dialogue between designer and audience by Gaia Leandri has the aim of reflecting on the value and importance of autograph drawing (albeit digitally realized) in the contemporary era, in which the value of technique seems to prevail over that of personal interpretation. This is the reason for its placement as a digital publication in the series Studi e ricerche delle opere edite dall'Accademia Ligure di Scienze e Lettere, an institution founded in 1798 ... *avente lo scopo di contribuire con studi, pubblicazioni, conferenze e col conferimento di premi e di borse di studio al progresso sia delle scienze fisiche, naturali, matematiche e mediche, sia di quelle morali, storiche, letterarie e giuridiche*[1], as mentioned at the opening of the website.
Leandri's work, precisely because of the particular viewpoint that characterizes the research, appears to be a definite contribution to academic purposes, specifically referring not only to the Department of Literature, to which our faculty of Architecture belongs, but also to that of Sciences, where medical sciences are situated, thus opening to new fruitful prospects for the expansion of knowledge.

Vincenzo Lorenzelli
President of the Accademia Ligure di Scienze e Lettere

[1] "...with the aim of contributing with studies, publications, conferences and with the awarding of prizes and scholarships to the progress of both physical, natural, mathematical and medical sciences, and has the moral, historical, literary and legal sciences."

Preface

The idea of endeavouring a combined enterprise where architecture and neuroscience were involved stemmed from an experience that I had had some time before, when I was working as an illustrator in architectural imagery very fond of freehand drawing, and an enthusiastic user of digital drawing tablets. In my working experience freehand drawn images of already built or future projects had far more communicative power than digital photographic quality renders, besides being somehow regarded as a human product rather than the outcome of a computer application. It was reassuring for me to see that this feeling of mine was shared by other scholars and professionals in architecture, but I also was a little stunned by the scarceness of testimonials in this sense. There is now a sort of renaissance of freehand drawing in illustrating architecture, and this inversion of tendency after several decades of increasing success of digital design must have some rationale at its roots. This essay is a summary of the research that I endeavoured so far in the quest of such rationale. The scientific approach to this issue started with the work for my PhD thesis, *Freehand digital drawing: a boost to creative design*. *The observer's eye and the draftsman brain*, carried out at the Departamento de Expresión Gráfica Arquitectónica, Universitat Politècnica de València, Spain, and at the Dipartimento di Neuroscienze, Riabilitazione, Oftalmologia, Genetica e Scienze Materno Infantili (DINOGMI), Università degli Studi di Genova, Italy. Following that, further research was carried out at the Dipartimento di Architettura e Design, Università degli Studi di Genova, Italy, within the framework for investigation on the visual language, with the involvement of the Centro Interdipartimentale per la Visualità, Università degli Studi di Genova, Italy. The main question to be answered is, why should an illustration made by a human hand be better than a mechanistic reproduction, or fiction, in transmitting the author's idea. Cultural, economic and social factors have a strong influence on communicative means, and no doubt the production of architectural imagery needs to be seen in such a perspective. But there are also neurobiological factors that we can tackle now but were still unknown only a few decades ago. It is important to be aware of cerebral functions that are behind feelings and decisions brought to our awareness by a picture. The neuroscience world has to be called in to explain our reactions. Hence, architecture and neuroscience find a common ground of application.

Introduction

Drawing is the exterior expression of the architect's mental process. It encompasses the insight monologue and the exterior dialogue, aiming at several objectives, one of the most relevant being the visualisation of a design. The subject of this essay is the relationship between the draftsman, the creativity of his brain, the represented design, and the mind of the observer. Each historical period has been marked by peculiar aspects in the path of visuality, as connotative elements forming the leitmotif of a narrative. It is worth recalling the work carried out by E. Gombrich in his *Secular creed of western civilization* (Gombrich, 1961) and reinterpreted in architectural key as the *Secular creed of western architecture* (Galli, 2019). The framework of this essay follows the steps of such a trend of thought delineating a map of the visual language over time. Since the 80s, architects, designers and scholars wondered whether the current habit of ever increasing digitalisation could be detrimental or advantageous to such relationship. After a critical analysis of architectural imaging, the current techniques will be reviewed and discussed. A first question to answer is whether the simulation of reality with renders of photographic quality would relate to the observer better or worse than a traditionally hand drawn image. A questionnaire was constructed to probe the communication and representation qualities of the images. The results suggest that these two qualities are best represented in the case of freehand drawing compared to photorealistic renders. The final conclusion is that the freehand drawn images make a better link between author and observer, and at the same time, the very movement and haptic perception of the hand elicit creativity. Indeed, the most recent advances in the technology of drawing tablets have provided a new medium for freehand drawing, which can merge the capacity of data handling by computers with the natural movement of using pencil and paper, ending up in a traditional hand made product. Wise usage of modern technology can therefore combine the human factor with the digital world.

Illustration is traditionally considered a part of the design process. From rough sketches to working drawings and renders, the designer gradually develops his or her ideas to enact them into the final object. But the very meaning of the visual product underwent transformations over the centuries according to the development of technical devices, changes in social background, and the impact of artistic movements. This graphic expression features elements from various

cultural fields: besides art and illustrative techniques, it encompasses architectural history, psychology, brain physiology, theory of communication and marketing.
Since the 80s of the last century, the attention of architects, designers and scholars has focused on the meaning and inner features of representations, seen as a visual expressive tool of the drawer's ideas, with strong cognitive implications on account of the observer. The world of architectural images was no longer considered an unbiased source of information.
The opinions of scholars and professionals about the new possibilities offered by computers in comparison to the old manual systems do not always agree. Recently, the almost abandoned freehand drawing has found new appreciation as a creative tool to convey the designer's personal touch, whether it portrays a real or visionary project. Whatever the nature of the image chosen to reproduce architecture, be it hand drawn, or computer made, the general attention has usually focused on the effect that it would yield on the observer. The quality of the onlooker's perception has been investigated in a number of works aimed at a scientific assessment. However, if the image is the chosen means of communication between the author and the public, then the author's viewpoint should also be considered.
This book will deal with only a part of this complex subject, first by providing a preliminary excursus on the features of architectural representations tackling the dichotomy between hand drawn images and modern photographic quality renders, then by discussing the results of a simple web test.
The test was meant to answer the question whether the communication of the architect's idea of a building and the representation of the architect's personal style are best conveyed by a hand drawn image or a photorealistic render. It was designed so that the answers were related to the responder's ability to match images and not to subjective opinions. In this way the test differed from most published material oriented on descriptive qualities of the images. The test showed that freehand drawing communicated the architect's ideas and style more significantly than photorealistic renders.
A further part of the research involved collecting experimental clues which could support the working hypothesis about the possible enhanced creativity linked to freehand drawing, compared to the plain activity in CAD design. Neurophysiological techniques were used to explore what happened to brain activity before and after freehand drawing or mouse clicking movements. Confirmation of the hypothesis came from the significant differences bound in cerebral activity linked to the two drawing modalities.

Drawing as a figurative language

The act of drawing has supported architects' work since ancient times although its recorded existence in western culture only dates back to the thirteenth century and, even so, in rare surviving documents.
Starting from the Renaissance, several crucial steps have characterised the historical development of this kind of graphic representation. The progress in optic science and further studies on perspective, new printing systems, the invention of photography, and finally the impressive advancement of computer technology brought a constant evolution in the process of creating images. In the last century, the concern on architectural illustration focused mainly on draftsmanship techniques to produce pictures that met the requirements of patrons. At the same time, architectural illustration has also been the object of psychological studies focused on cognitive mechanisms of interaction between the various subjects involved, from designers to clients and the lay public. Who makes architectural drawings and why? Which are the features of a graphical representation? Which is the audience meant to receive the message? Answers are closely linked to one another because the different subjects may have different needs and expectations (Smith Pierce, 1967). Due to its communicative function, visual representation can be considered as a form of figurative language that translates the initial mental speculations of the design process (Giachetta, 2022) into images and, in doing so, allows a variety of interpretations. «An architectural drawing is as much a prospective unfolding of future possibilities as it is a recovery of a particular history to whose intentions it testifies and whose limits it always challenges. In any case, a drawing is more than the shadow of an object, more than a pile of lines, more than a resignation to the inertia of convention » (Libeskind, 1991). The difficulty to read or watch an architectural drawing according to predetermined criteria raised a debate about its empathetic nature. The literature on the subject reveals the difficulty in labelling a graphic work that, owing to its very nature as a mental product, can hardly be codified. However, scholars have dwelt upon the indefinite relationship between image, drawing and visual perception (Luigini, 2020; Arnheim, 1997; Arnheim, 1974); in particular, some of them have studied architectural imagery focusing on its role in communication between designers and audience (de la Fuente Suárez, 2016; Hardenne, 1994; Meisenheimer, 1987; Oechslin, 1987; Seguí de la Riva, 1984).

Communicative function

In the 80s, when architectural drawing was still considered a traditional and conventional image on paper, its three *communicative functions* were emphasised: *representational, expressive* and *appellative* (Meisenheimer, 1987; Oechslin, 1987). If the drawing is part of the design process, it is considered a tool to represent an idea and to achieve communication between architect, client and builders (*representational function*). Working drawings convey precise information to constructors, but to the layman they may just provide a few clues about the appearance of a building (Bardola, 2021).

Throughout the history of architecture also other types of drawings have been developed and used. Whilst not strictly technical, they are aimed at different type of communication. In them, the represented element, be it a town, a building, a room or an item of furniture, is highlighted by the clever use of perspective, of colours and other pictorial conventions.

The object is rendered either alone or blended in an environment to make an appealing illustration. Such drawings may be addressed to clients, jury committees, and professional partners and can be used together with the working drawings for competitions. Sometimes they represent something already built to be shown at exhibitions or published in books or magazines. A summary of the communicative function is shown in Fig. 1.1.

These representations are most appreciated by the general public, because they are easier to understand and more captivating, hence deserving to be admired, even collected (*expressive function*). Finally, drawings may not be meant to provide any specific information but just to address the author self: they may be merely a means to fix on paper thoughts and uncertainties across the process of design. Also, images may be presented just to challenge the observer and stimulate his or her fantasy (*appellative function*).

These drawings, though in appearance quite far from any practical application, do have relevant importance.

There have been architects whose graphic work looks more significant and influential than their built architecture. Since the 60s some architects and designers have rediscovered drawing as a tool for reflection and polemics, artistic creation and social communication (Riahi, 2017; Carpo, 2013).

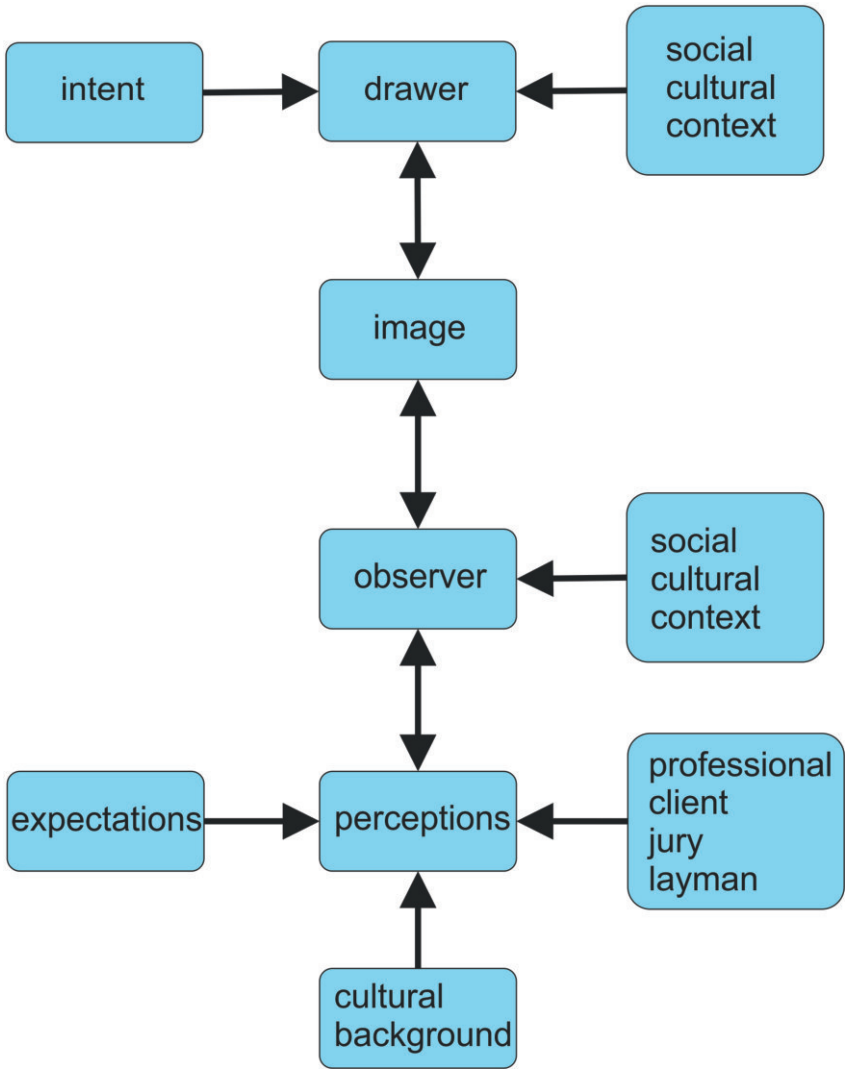

Figure 1.1. Flowchart about communication through the architectural image.
Outer and inner elements affecting the designer and observer.

Design function

Since their introduction, computer graphics have fostered new forms of virtual representation and created a novel relationship between the designer and his work. Envisaging a radical transformation of architectural representation, since the 80s some scholars have been focusing their attention on the graphic means traditionally used in architectural practice. Schematically, J.P. Hardenne (Hardenne, 1994) identified five different types of tools that mark the work of an architect. The first tool is the freehand explorative drawing made to record buildings and sites, which enhances visual culture and understanding (*learning tool*). The second tool is the sketch which helps thinking and translates initial ideas into images (*conceptual tool*). The third is represented by the preparatory drawing that allows going into further particulars (*representation tool*). As a fourth tool technical drawing, which shows every necessary detail, is proposed (communication tool). Finally, the fifth tool is the perspective drawing which displays a realistic appearance of the project (*simulation tool*).
The age of CAD opened unforeseen possibilities in the field of visual rendering and architects faced the challenge of a substantial change in their routine. Were computer graphics becoming an unavoidable tool in each working phase or could designers decide whether adopt the new technology or not? In those years the answer seemed to be a full acceptance or at least a strong inclination towards digital media for the three technical stages (3-4-5), leaving as optional the decision about the first two, which are the most creative in the design process (Hardenne, 1994).
The distinctive feature that distinguishes analog and digital drawing has been studied to underline their interrelation, complementary in content and purpose: «The characteristic of analogic drawing is the expressive and communicative synthesis, while the feature of digital drawing is the processing and representation of the complexity» (Valenti, 2021, p. 24) (translation by the author).
The dichotomy still persists at least in the attitude of architects whose education and creativity were developed, before the advent of CAD, through the medium of drawing and model-making. B. Edwards explored how freehand drawing is employed in the design process by interviewing ten leading architects in the UK. The questions addressed to the architects dealt with the relationship between drawing and thinking, the type of drawing used at the different stages in the design process, and the support provided by the drawing tool in problem solving and communication.

All of them acknowledged the symbiotic relationship between thinking, drawing and designing on one hand, and the power of sketching to test and develop the initial design concept on the other. Despite the wide use of digital cameras, most of them still keep either a personal sketchbook or notebook to collect precedents of interest and reinforce visual memory. They first make drawings and later on interact with CAD, usually considered a mechanical drawing and testing tool rather than a design aid.

The findings of the research undertaken by Edwards suggest that freehand drawing remains paramount at the early stages of the design evolution. In this process, hand drawing is the main tool employed.

Early drawings contain the essence of architectural creativity, they are «a kind of conversation acted out in line and often integrated with words, symbols and photographs to produce a kind of collage of design potential […] CAD remains essentially a drafting, documenting and presentation tool». In addition, «CAD glamorizes the image and provides at best a superficial impression of design quality». Its early use can undermine creative exploration and has a negative effect on architectural thought (Edwards, 2008).

B. Lawson, after carrying out a research in university contexts of three countries, maintains that he found «examples of students combining impressive and convincing computer presentations with poor design […] it is possible to put forward computer presentations that look attractive and even dazzling, that seem authoritative, while the architecture so represented is really quite awful» (Lawson, 2002).

J. Pallasmaa, without disclaiming the digital techniques, emphasises the importance of handmade drawing and asserts:

> All students of design and architecture should first be taught to work with their internalised mental imagery and their hands before they are allowed to use the computer. In my opinion, the computer probably cannot do much harm after the student has learned to use his/her imagination, and has internalised the crucial process of embodying a design task. Without this mental internalisation, however, the computerised design process tends to turn into a purely retinal journey in which the student him/herself remains an outsider and observer without having built a vivid mental model of the conceived reality (Pallasmaa, 2009, p. 99).

S. Calatrava underlines the essential role of drawing in his own experience and claims:

> The sketching and drawing I do for purely architectural purposes continues as intensely now as on the first day of my career. As far as my own experience is concerned, I sometimes begin a drawing with no preconceived problem to solve, with only the desire to use pencil on paper, and I make lines, tones and shapes with no conscious purpose. With drawing, you are always working with the same two instruments, your hand and your intuition; even if it seems you have no conscious aim, you're continually trying to solve a real construction problem. It is always the same process: sketch, repeat, change. I rely on continual drawing by hand because through very hard work, making hundreds of sketches, it is possible to arrive at a higher level […] at a point where an idea becomes conscious and crystallized, and then a control and order begins to appear (Carrillo de Albornoz and Calatrava, 2018, p. 160).

Experiential representation

Another theory concerning architectural drawing, formulated by L.A. de la Fuente Suárez focuses on the interactive relation between architect and beholder based on their different experiential attitudes. Both the architect's creative thinking and the viewer's physiological and cognitive mechanisms are taken into consideration. An image on paper (or on screen) is not reality but the experience of an object, existent or non-existent, that is the representation of a mental concept by a person (creative process), to be perceived by other persons (interpretative process). From the point of view of the designer, exploratory drawings allow creating while representing. This type of representation is useful for generating ideas (*ideational representation*).

The sketch is left open to interpretation, allowing new design alternatives to be explored. After the sketch, original ideas will be visualised by more specific and well-defined images to show the appearance of the architectural artifact clearly. «However, to consider a representation as a resulting object is an incomplete approach, for this representational object is not a static or finished product,

but something created to be experienced, i.e., an object capable of evoking the represented in the mind of the viewer».
In the experiential representation two components, the *what* and the *how*, are related to the designer and the viewer: in the first case (production by the designer), what is represented and how is it represented? In the second case (reception by the viewer), what is experienced and how is it experienced? In the production process, the *what* originates from a *referent* (architectural space and elements) that the architect tries to represent in an image (referential representation). The *how* is the medium through which the object is delineated. In the reception process, a representation is interpreted as an object (*what*). The *how* is the particular interaction produced by the observer's encounter with the representation itself, which is a different experience compared to looking at a real object. Some other aspects of experiential representation are brought to attention by de la Fuente Suarez. A representation is *selective*, i.e., it just encompasses some features of the object, not only because it is impossible to render all aspects of a personal experience, but also because the architect is interested in giving prominence to elements or qualities considered more relevant and wants to direct the beholder's attention to them (*directive representation*).
A representation is not limited to visualisation, other experiences can be part of it. «By the term architectural experiences we refer to the phenomena that buildings can cause in humans, i.e. those arising from the interaction between our senses, body and mind, and the building. Such phenomena include the sensory encounter with architectural works – e.g. tactile, auditory, visual etc.-, the perception of depth and lighting, our movements and activities in space, the meanings, thoughts and emotions that architecture produces in us» (de la Fuente Suárez, 2016).

The drawing and the audience

The drawing can just be an inner monologue by the architect, an expression of mental processing, yet architectural illustration also represents a visual dialogue with other people. Leaving aside the working drawings meant for the architect's staff and builders, in other kinds of imagery the drawer seeks to meet the audience's demands and expectations (Bistagnino, 2020; Malagugini, 2018). Perspective was the first tool to render an object in its spatial dimension and has been steadily used until today. In addition, the diffusion of innovative methods of reproduction has been an enormous boost to disseminating architectural illustrations, praised by artists, collectors and laymen.
The great success of drawing prints in modern history can only be compared to the widespread imagery through the web and other mass media in our digital age.

The need for three-dimensionality

Until the fourteenth century, building practices were mainly empirical, being based upon well-established traditions and knowledge of geometric rules handed on through generations by itinerant master craftsmen. Drawings were not used to project a building in its wholeness, in their stead wooden models were made to represent the general structure and fairly often details were designed on site. Medieval anonymous drawings were just templates, often annotated for direct use on the construction site. In erecting Gothic cathedrals, masons were building the house of God, the Architect of the Universe. Their earthly work was strictly linked with theological and cosmological implications; thus the written paper was considered a language intended only for the initiated.
The fifteenth century marked the beginning of a new conception of architecture as a liberal art separated from the builder's craft and related to innovative theories about vision and image.
Studies on the human eye and its *modus perspiciendi* were performed, which was both a way of watching an object and a way of understanding its inner essence.
A key role in these researches was played by the perspective, which became a topic in the debates, due to its importance as a technical device to obtain a tridimensional representation. Images of buildings had been previously depicted by painters.

Suffice it to mention urban landscapes by Giotto and Lorenzetti and, going back in time, by Roman artists (Fig.2.1); the approach to representation, however, was still empirical. Scientific studies to improve the perspectival representation were carried out both by architects and painters particularly versed in mathematics, such as Piero della Francesca and Albrecht Dürer.

Figure 2.1. Roman fresco in the villa of Publius Fannius Synistor. First century b.c. Metropolitan Museum of Art, New York.

Filippo Brunelleschi and Leon Battista Alberti were the first architects to address attention to the geometric system that was regulating the visual world and to the mechanisms of perspective. Their theories, first applied to the art of painting, «were associated with architecture primarily because the regular geometry of architectural subjects enables perspective depth to appear, and less obviously because of the quasi-magical generative power attributed to mathematics and proportionality in revealing the secret structure of the cosmos» (Pérez-Gómez and Pelletier, 2000, p. 23).
Alberti introduced the notion of architectural design as an intellectual product with the meaning of a rigorous scientific graphic representation. In his treatise *De re aedificatoria* Alberti wrote that architecture is made of drawing (*lineamenti*) and building (*structura*). The architectural drawing consists in finding a precise rational method to fit and link together lines and angles in order to render the intended building in its completeness (Alberti, 1966, p.18). Further on, Alberti comments on the difference between the geometrical bi-dimensional drawings of the architect with plans and elevation and representations by painters aimed at conveying the live illusion of three-dimensional objects coming out of the canvas:

> Between the graphic representation of the painter and that of the architect, there is this difference, that the painter by the exactness of his shades and the foreshortening of lines and angles endeavours to make the figures seem to rise from the canvas, whereas the architect, without shading, brings his projected building into relief by designing the plan and visualises the elevations by drawing exact lines and angles; thus he will have his work valued not by the apparent perspective (apparentibus visis) but by rational measurable dimensions (certis ratisque dimensionibus) (Alberti, 1966, p. 98) (translation by the author).

Though Alberti advised architects against the use of perspective, the path was now open to new illustration techniques, based not only upon geometry but on pictorial methods as well.
Raffaello was aware that combining technical lineamenti with perspective drawings was an effective means to make a building that was still in the design phase more visible and intelligible. In his letter to Pope Leone X in 1519 Raffaello claimed:

> And, in order to satisfy even more thoroughly the desire of those who love to see and fully understand the things that will be drawn, we have, in addition to the three methods of architecture proposed and mentioned above [plan, elevation, section], also drawn in perspective some buildings which they seem to seek so that the eyes can see and judge the gracefulness of that resemblance revealed to them by the beautiful proportion and symmetry of the buildings, which do not appear in the design of those that are architecturally measured [...]. And, although this way of drawing in perspective is typical of the painter, it is also suitable for the architect. For, just as the understanding of architecture deserves to be known to the painter to make well measured ornaments with their proportion, at the same time the architect has to know the perspective because with that technique he better imagines the whole building provided with its ornaments (De Vecchi, 1995, p. 195) (translation by the author).

The architect Jacopo Barozzi da Vignola also asserted the need for perspective drawing to better understand a drawing or a design in its spatial consistency: «An architect is someone who must possess at least these four Sciences, namely Grammar, Arithmetic, Geometry and Perspective [...] and who is also inclined to always study, and invent» (Barozzi da Vignola, 1682) (translation by the author) (Fig. 2.2).

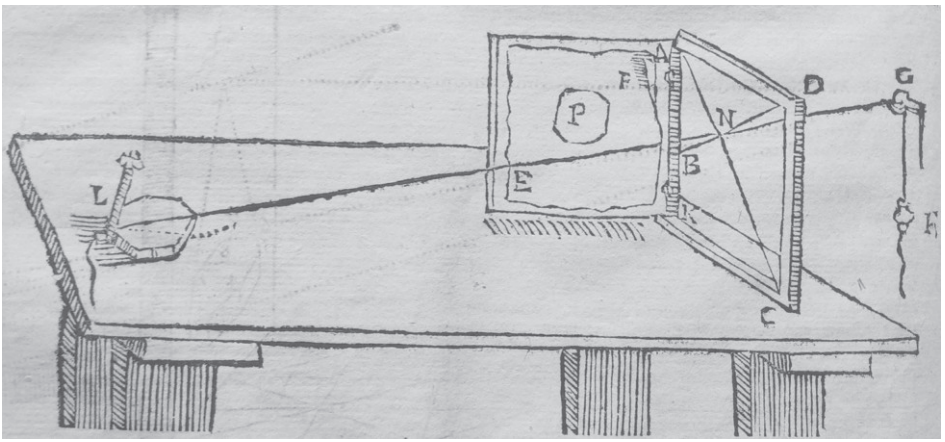

Figure 2.2. Jacopo Barozzi da Vignola, *Le Due Regole della Prospettiva Pratica.* A perspectival device. Bologna, G. Longhi Publisher, 1682.

The disclosure of imagery

In addition to the studies on perspective, in those years another phenomenon was having a huge impact on handmade drawings: the diffusion of printing techniques made it possible the dissemination of images that so far had only been visible to a small circle of people. If perspective allowed a greater understanding of a design, printing promoted this new understanding among a broad public. The architect and painter Francesco di Giorgio Martini pioneered the use of supplementing text with images. In his *Trattato di architettura, ingegneria e arte militare*, he supported his writing with an exceptional number of illustrations (Fig. 2.3). Martini considered this method a useful tool for *i diligenti e curiosi architettori* (the careful and inquisitive architects) to translate an idea into an accurate project and «recognized the potential power of drawing beyond mere illustration and used drawing both as a creative mode of inquiry and a vehicle for communication». He «promoted the primacy of draftsmanship explicitly and effectively and by doing so paved the way for an extensive engagement with drawing by the generation who followed» (Riahi, 2016, p. 1).

During the sixteenth century, engraving techniques, perfected by printmakers and publishers who had undertaken successfully large enterprises, especially in northern Europe, allowed the dissemination of high quality images at affordable costs. New types of drawing were created that met expectations and tastes of an unprecedentedly vast number of purchasers: architects, painters, collectors, bibliophiles and art dealers who showed interest in printed architecture for different professional reasons. This new availability of edited illustrations paved the way for innovative architectural imagery. The treatises of Sebastiano Serlio and Andrea Palladio became influential landmarks throughout Europe.

These works, meant for punlication, disseminated professional experience and creative design by means of rich kits of high quality drawings that became a collective heritage. Serlio was the first one to have his drawings printed to supplement the text. Alberti's unillustrated treatise was written in Latin and destined only for the humanistic cultural élite. Serlio wrote in Italian and some of his treatise books were published also in French. Whereas his general intent was to educate the taste for beauty, his practical task was meeting the needs of architects and craftsmen by means of technical information, historical data and project templates. Copies of Serlio's treatise were released in France, Germany, the Netherlands and Britain, and famous architects had a copy in their libraries. The second book is about the theory of perspective and the design of scenes in

Figure 2.3. Francesco di Giorgio Martini. *Trattato di architettura civile e militare.* Codex Ashburnham 361, c. 1490. Biblioteca Medicea Laurenziana, Firenze.

which perspective is essential. Serlio developed studies on the theatrical setting already outlined by Vitruvius, which became influential during the following centuries (Fig. 2.4). Palladio, besides information and instruction to the practising architects by illustrating his own methods and proven solutions, presents his drawings of ancient monuments that he had the opportunity to admire on previous

Figure 2.4. Sebastiano Serlio, *I sette libri dell'Architettura*, second book: On perspective, the tragic stage. First edition: Venezia, P. de Nicolini de Sabbio Publisher, 1551.

journeys to Rome. He maintains that *ridurre in disegno* (converting into drawings) was the most suitable method to *comprendere* (understand) in its completeness a monument or a building, after having measured it *minutissimamente con somma diligenza* (in the smallest details with great diligence). (Palladio, 1570, introduction to the first book). This drawing, though an imaginative rendering,

shows meticulous attention to representation and extreme precision over details. Palladio never drew in perspective, preferring the more accurate methods of plan, elevation and section, through his skilful use of chiaroscuro still gives a remarkable effect of three-dimensionality (Fig. 2.5). The graphic work by the Dutch architect, painter and print designer Hans Vredeman de Vries, an estimator of Serlio's work, became a reference chiefly for painters of cityscapes and for makers of ephemeral urban decorations.

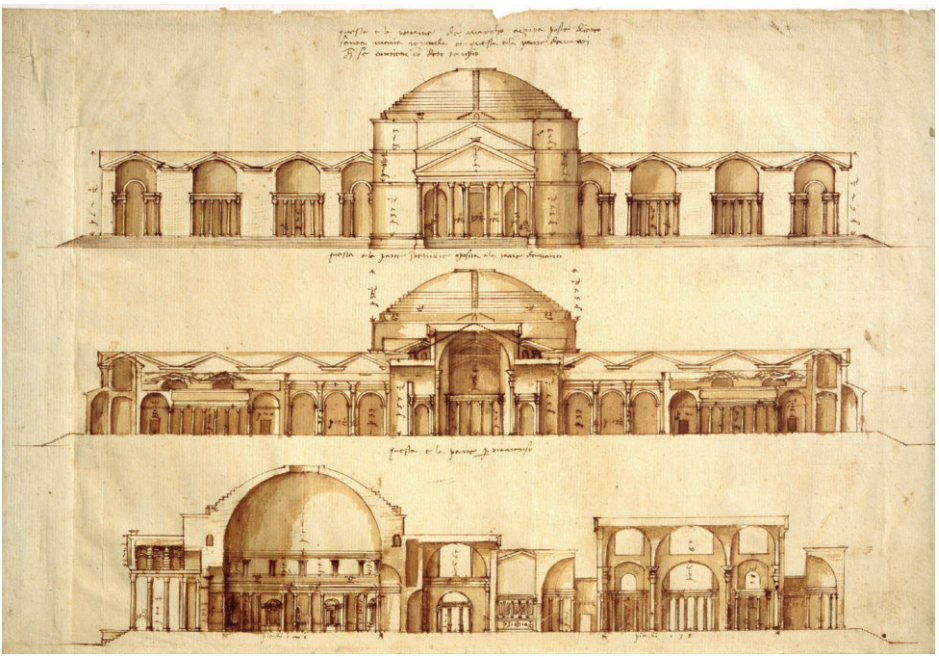

Figure 2.5. Andrea Palladio. Fancy restoration of the Agrippa's Terme in Rome, gone to ruin. Sections, c. 1550. Drawings Collection of the R.I.B.A., London.

His printed drawings, a sort of unprecedented guidebook for artists, displayed perspective sequences of ideal contemporary architecture as patterns to be admired by an educated audience and to be copied as starting points for further experimental representations. Vredeman's architectural images usually were devoid of characters, the addition of human figures was most often part of

collaboration with other artists, a common practice in that time as the depiction of people, not always necessary, was a secondary accessory that could increase the marketability of a painting (Heuer, 2009) (Fig. 2.6).

Figure 2.6. Hans Vredeman de Vries. Architectural perspective view, in *Variae architecturae formae / a Ioanne Vredemanni Vriesio magno artis huius studiosorum commodo, inventae,* first edition c. 1560. Etching. Print by Théodore Galle Publisher, Antwerp, 1601. Avery Architectural & Fine Arts Library, Columbia University, New York.

Despite their widespread appreciation, printed architectural images were not without criticism. The Italian theorist and painter Gian Paolo Lomazzo warned his readers about the risk of mental laziness due to the increased availability of reproducible templates. In his opinion this new habit improved the art of building by practice and plagiarism, not by invention. Serlio's prints, he claimed, turned

«more construction workers into architects than he had hairs on his beard». Creativity had to remain a prerogative of «expert designers who have their hand ready to outline and represent what they conceive and realise in their mind» (Lomazzo, 1585, p. 407) (translation by the author). These fears were fortunately disproved. Architects, at least most of them, continued to show their creativity by handmade drawings, using printed images only to disseminate defined personal outcomes which were intended to be admired rather than copied. What Lomazzo did not say, or could not envisage, was that the very notion of graphic work was about to undergo a radical change.

Regarding architectural drawings, the visualisation of an idea or the illustration of a building was no longer a single representation of a work of art. The uniqueness gave way to reproducibility: the charm of a handmade drawing could be appreciated by a few, whereas its copy could be looked at by a much larger audience. The published illustrations were an outstanding means to bring remains of the classical age and famous buildings to the attention of interested people. Some Flemish draftsmen specialized in depicting views of art cities intended for sale. Buildings, streets and squares were accurately portrayed using perspective to render them more realistic and easier to understand. Such renderings were appreciated by educated travellers as souvenirs of their trips, or else by the lay public curious of images from foreign countries. The architect and engraver Lievin Cruyl, during his long stay in Rome, masterly depicted scenes of daily life set in the most representative places of the city. Some of them were collected in a book dedicated to Pope Alexander VII, who had promoted a large-scale urban renewal.

The descriptive purpose is particularly evident in the use of captions helping the reader to identify the most remarkable monuments. The study of peculiar perspectives and attention to architectural features did not prevent Cruyl from adding human figures of different social conditions. In this kind of imagery the architectural representation, even though accurately performed, appears subdued to descriptive effects and anticipates the widespread success of the pictorial movement called *Vedutismo*. In figure 2.7 Cruyl renders the overview of Piazza Navona more appealing by drawings the buildings reflected on the wet ground, a successful trick that will be replicated by several architectural illustrators in the future years.

Voltaire wrote that the 18th century was not favourable to young gifted architects who wanted to practice. Unlike other artists, they had rare opportunities to display their skills and could raise important buildings only when asked by rich clients.

Figure 2.7. Lievin Cruyl, Perspective view of the *Forus Agonalis*, in *Prospectus locorum urbis Romae insignium.* Print from a drawing in pen, brown ink, brush and grey wash. M. G. De Rossi Publisher, Roma, 1666. Universiteitsbibliotheek, Gent.

Thus, their talent was often wasted. One of these missed architects was Giovanni Battista Piranesi who claimed: «Since an architect nowadays has no hope to exercise his profession, I have nothing left, like other modern architects, but to explain my ideas by means of drawings» (Piranesi, 1745) (translation by the author). He had a central role in devising new types of representation, asserting their autonomy from the design process. His views of ancient Rome, printed through the complex technique of etching, stood out for the extraordinary visual relief of the monuments they represented, conveyed thanks to the unconventional use of impressive perspectives. His figurative language had no precedents, merging pictorial effects with the spatial dynamics of stage design tradition. From the Roman printing workshop of Piranesi, attended by foreign guests of the French Academy and by the cosmopolitan society engaged in the Grand Tour, new

prolific ideas spread all over Europe. Architectural representation became a genre in its own right, which offered innovative suggestions rising from painting and scenography. Piranesi's series of prints of Rome and its surroundings combined archeological accuracy with a profound knowledge of Roman architecture and building materials. Ancient monuments were faithfully represented, and the atmosphere of decay was rendered in an exquisitely evocative way. Piranesi intended to preserve, at least in the graphical representation, a priceless heritage that he considered superior to Greek culture. His illustrations influenced other architects both promoting ancient architecture and inspiring more flexible representation techniques. Besides affecting architectural tastes towards a new classicism, his drawings representing monuments in ruins inspired contemporary artists and illustrators for years to come (Fig. 2.8).

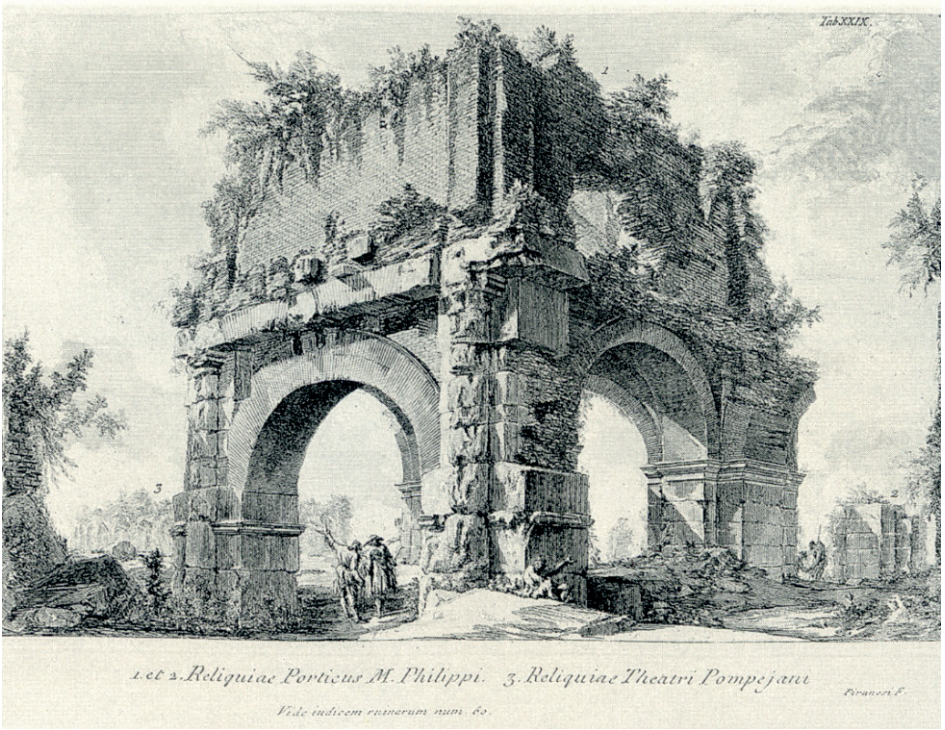

Figure 2.8. Giovanni Battista Piranesi. *The Campus Martius of Ancient Rome: remains of the Portico di Marco Filippo*. First edition, Roma, 1762.

The language of line and the language of perspective

From the sixteenth century onwards, the dichotomy already pointed out by Alberti between the representation of an idea through lines and its realistic image through perspective was still a topic of discussion among architecture theorists. In daily practice or in their essays intended for publication, architects found that these two kinds of visual language could offer new opportunities in the field of communication, either to represent real projects or fanciful proposals.
Side by side or merged together these drawings were tools for illustrating their thoughts. Sometimes they gained the status of true works of art and became cultural icons.

Classicism and provocation in the age of Enlightenment

L'Académie d'Architecture, then École des Beaux-Arts was a French institution that had a leading role in coding the features of architectural representation throughout Europe. The academicians developed and imposed, especially for utilitarian buildings, a style almost exclusively based upon the Roman and Greek classical orders. Future architects were trained on the traditional working drawings, i.e. plans, elevations and sections, and the use of perspective was unusual. The only concessions to pictorial effects were the shading of elevation drawings with monochrome washes and the colouring of some details. The so-called *presentation drawings* required a high level of precision in making. In 1832 the French art theorist A. C. Quatremère de Quincy in his *Dictionnaire historique d'architecture* remarked as extremely important that in representing buildings each drawing had to be *rendu*, i.e. perfected in its details, because «the drawing shows the artist's skill and his care in illustrating as faithfully as possible all the parts of his work» (Vernes, 1984, p. 28). Perspective was gradually introduced among the teaching courses of the Académie to help the architect «make prominent his design, arousing in his clients a joy and excitement before the actual construction».
Whilst the ground plan conveyed the accuracy of the design, the elevations represented the outer appearance of the building and could be rendered with

techniques matching the taste of the beholder and stimulating his imagination. Thus, it was taken for granted that the interest of the lay public for architecture focused on the outer appearance of the building and its relationship with the surrounding environment.

The aim of the drawing, neither technical nor pictorial, was to «charm with discretion and inform without being dull» (Vernes, 1984, p. 28).

Despite the academic instructions to only use *dry and severe* representations, some architects tried to render their drawings more appealing when they were meant for the lay public. Claude-Nicolas Ledoux, when designing the utopic city of Chaux, made a series of drawings out of the ordinary standards. In order to appeal to the audience, he used a visual strategy that strikingly anticipated the photomontage technique. He fit the image of his projected buildings into realistically painted landscapes or cityscapes that served as background settings. The familiar view of vegetation, acting people and animals made the design easier to understand and to accept as a possible reality by untrained onlookers (Fig. 3.1).

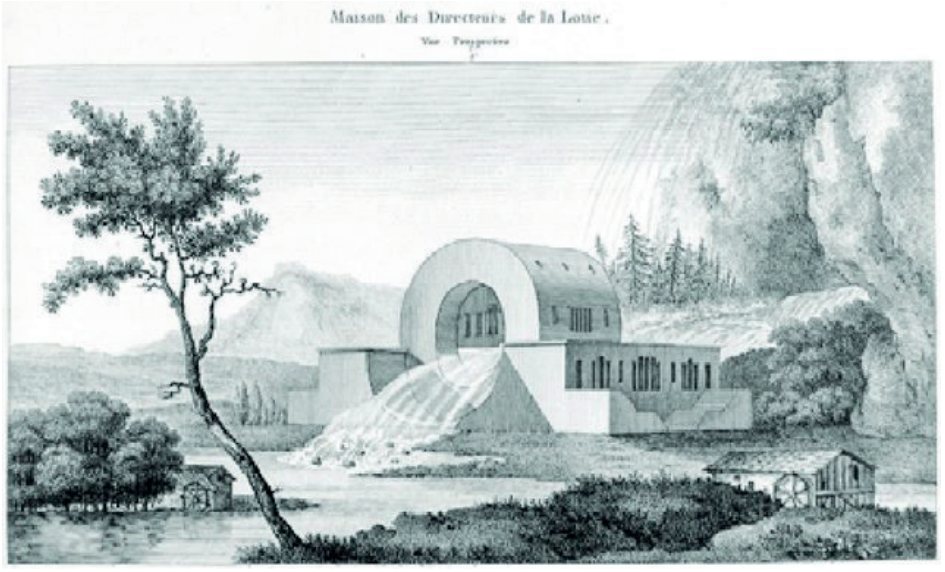

Figure 3.1. Claude-Nicolas Ledoux, *The ideal city of Chaux*. House of the surveyors of the Loue river. Engraving, 1804. Fisher Fine Arts Library, University of Pennsylvania, Philadelphia.

The drawings of this ideal city became part of the Ledoux's treatise *L'architecture considérée sous le rapport de l'art, des moeurs et de la legislation* and, after its publication, helped to make him known as a pioneering architect in visual representation.
New techniques for astonishing drawings were offered by the Bibienas' studies on the *scena or veduta per angolo*, which introduced innovative methods of perspective in stage design amplifying the boundaries of imaginary spaces.

> The *scena per angolo* displaced the focal point of the composition out of the audience's sight by replacing the primary vanishing point – traditionally on the central axis of the baroque stage – with a two-point perspective, so as to create a greater illusion of reality […]. The basic pattern of the *scena per angolo* was based either on a V-shaped plan, with its acute angle pointing toward the audience, or on an X-shaped distribution of intersecting arcades that spread simultaneously forward toward the proscenium arch and backward through receding rows of columns. Thus, the audience […] was drawn into the perspective illusion of scenery.
> (Pérez-Gómez and Pelletier, 2000, p. 207).

The dazing scenes created by the Bibienas had a great influence on graphic expression, mostly as a means to explore, in an unconventional way, the indefinite limits between reality and illusion, buildable and unbuildable. A renowned specimen of this kind of drawing was Piranesi's publication *Carceri di Invenzione.*
It was his most famous set of printings and perhaps the most extraordinary of his time. He investigates new possibilities of representation deconstructing the homogeneous space of traditional perspective. Images represent the same scenary in a compelling rhythm: wide vaults encompassed by massive gloomy walls, intersected and crossed by the most unlikely perspectival structures. The artist creates tangles of stairways, arches and bridges that emerge from disconcerting depths, in sharp contrast of light and dark, and are projected beyond the edge of the drawing toward the onlooker (Wilton-Ely, 1978) (Fig. 3.2).
The *Carceri* imagery has been influential throughout Europe and even today those images astonish the observer. They have given way to graphic experiments on optical deception and ambiguous perception by architects and painters, up to the unsettling perspectives by Surrealist and Metaphysic painters.

Figure 3.2. Giovanni Battista Piranesi, *Carceri di Invenzione: the Drawbridge.* First edition: Bouchard Publisher, Roma, c. 1750.

Graphic signs in Piranesi's drawings create a sort of new iconographic language that intentionally defies routine conventions. A similarity has been found between Piranesi and Libeskind. Like the Italian artist, Libeskind explores through a series of drawings the meanings of architecture by transgressing its limits. These images seem to challenge the visual perception of the observer who is simultaneously seized by different, contradictory hints (Meisenheimer, 1987; Oechslin, 1981). According to Libeskind's words, «My drawings and projects are a critique of the venerable and now exhausted virtuosity of the "Language of Architecture". For me […] it has become a false – albeit well informed – rhetorical device». «My own work is concerned with the specific meaning of a metaphorical, fictional and artificial construction – architecture – and its capacity to reveal the truth of reality» (Libeskind, 1991) (Fig. 3.3).

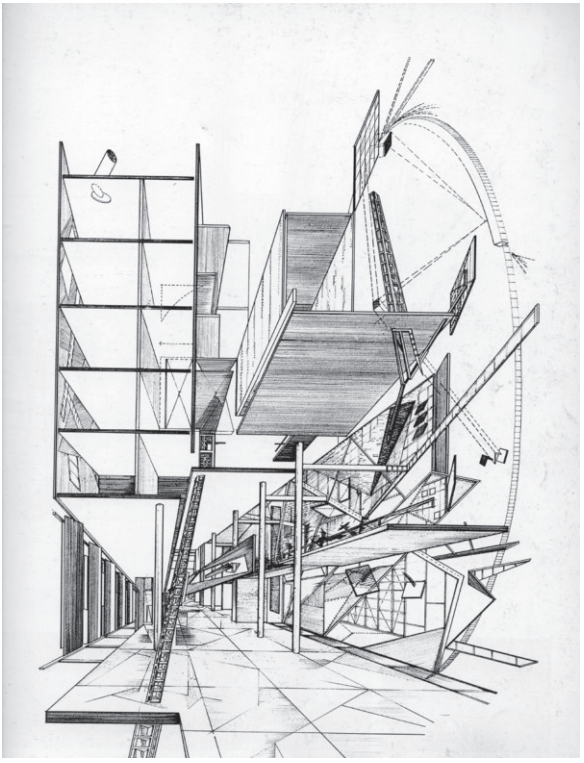

Figure 3.3. Daniel Libeskind, *Berlin City Edge*, Ink on paper. Studio Libeskind, New York, 1987.

The discreet charm of the picturesque for the nineteenth-century bourgeoisie

The French notion of *dessin rendu* was adopted in Britain, where realistic representation in the architectural project was illustrated by means of *renders*.
In these drawings, the artistic effects were emphasized, more than in other countries, by making use of perspective and pictorial devices. One possible reason for the sudden development of this kind of illustration may have been the foundation of the London Royal Academy of Arts in 1768. In the annual exhibition of works by contemporary artists, architects had the opportunity to show their designs to a larger cultivated audience. They may have realised the advantage of adopting an immediately comprehensible and appealing method of representation rather than relying upon the dry perfection of geometrical drawings. The landscape painting, particularly appreciated in those times, may have been another reason for the shifting towards the depiction of a building not as an object of its own, but rather as an artefact inserted in a natural context. The environment then became the necessary counterpart wherewith a building must dialogue and a basic element for the architect to consider.
In his first lecture given as Professor of Architecture at the Royal Academy in 1809, John Soane announced that «The Student in Architecture […] must be familiar with the use of the Pencil and must not be satisfied with Geometrical delineation, for the real effect of a Composition can only be correctly shown by Perspective representation» (Stamp, 1982, p. 28). Soane was the affectionate patron and employer of Joseph M. Gandy, whom he valued as the most brilliant illustrator of his time. A challenging and nontraditional work was the depiction of the Bank of England, an extensive and articulated complex of buildings designed by Soane and considered his masterpiece. It was erected in London between 1790 and 1827. In Soane's 1830 Academy exhibit, Gandy rendered the newly built Bank of England as a surreal vision of ruins of great visual impact, taking a cue from the Piranesian representation of the Terme di Antonino (Fig. 3.4). Whereas the image of the Italian artist illustrated a real view of the Roman monument, Gandy's amazing picture was the result of a powerful fantasy. His aerial vista (Fig. 3.5) as a display of future decay, included the plan, section, and perspective on a single sheet. «The structural innovations, spatial sequencing and interior distribution […] are made visible […]. The overall effect of the rendering is that of a storm-streaked ruinscape with architectural debris and vegetation encroaching from the corner» (Lukacher, 1987).

Figure 3.4. G. B. Piranesi, *Views of Rome: Ruins of the Antonine Baths* (*Terme di Antonino*). Posthumous edition, Roma, 1778.

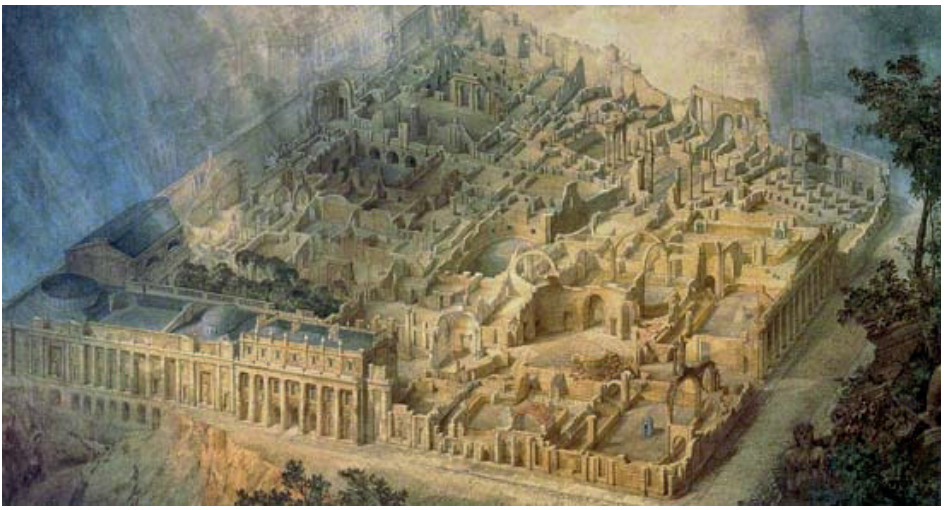

Figure 3.5. J.M. Gandy, *A Bird's Eye View of the Bank of England in ruins*, c. 1830. Soanes's design. Watercolour on paper.
Courtesy of the Trustees of Sir John Soane's Museum, London.

Soane's imagery, made by Gandy, did not always arise unconditional admiration, sometimes he had to bear distrust and criticism from the architectural press, which usually preferred technical accuracy to artistic visions. Nevertheless, the spell of these representations outlasts until today. Even A. Isozaki has rendered his Tsukuba Center, a multifunctional space built in the 80s near Tokio, as a square enclosed by ruins, «in order to imbue it with a fictional life beyond the building's conventional existence» (Lim, 2013) (Fig. 3.6).

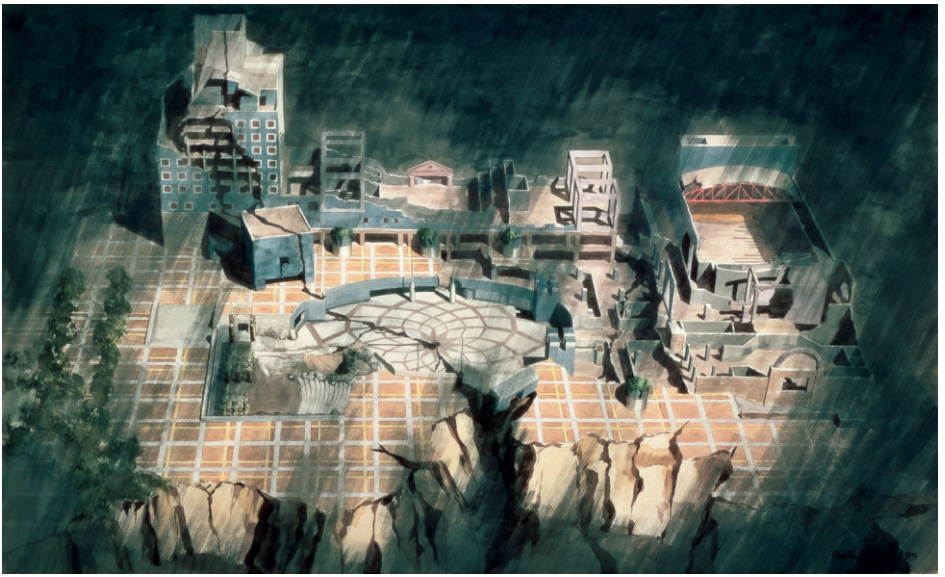

Figure 3.6. Arata Isozaki, *Tsukuba Center Buildings in ruins.* Tsukuba Science City, Ibaraki Prefecture, Japan, c. 1983. Mixed technique and watercolour.

Gandy and other British architects took a further step in the realm of fantasy, by creating imaginative drawings of fictitious architectures and urban landscapes. This was not a mere game, but a kind of imagery that could have different purposes: to illustrate a cultural atmosphere, clarify personal ideas, communicate utopic dreams, and even satirise the architecture of their own country where the eclecticism, with its lack of cultural and spiritual connotations, had caused a crisis of meaning and style in contemporary design.

Pictorial perspective drawings flourished in Britain to a much greater extent than

in any other country; this kind of representation achieved considerable virtuosity when performed by prominent architects and talented illustrators. These detailed renders, sometimes juxtaposed to working drawings, could be used to bring attention to the quality of materials. Nevertheless in too many cases pictorial effects, commonly accepted up to a certain degree, had overriden the technical language, becoming an impediment to the correct perception of the project by builders, jury committees and the general audience. The authoritative London journal *The Builder* had expressed reservations about the choices made by the judges during some competitions, due to the presentation of « showy drawings, or anything rather than design and constructive skill » (The Builder, 1857).
The shifting towards the *picturesque*, typical of Victorian times, frequently turned architectural illustrations into pictures to hang in the bourgeois parlour as objects of furniture.

Revaluation of the line in modern architecture

The early 20th century was a turning point for innovative and radical changes in all arts: in the span of a few decades, avant-garde movements marked a definite break against traditional styles and new modes flourished in Europe and America, often influenced by contemporary painting. Meanwhile, the graphic language of architecture underwent a deep metamorphosis, changing into different trends. The *Art Nouveau* Movement represented an answer to the negative consequences of industrialisation and proposed a revaluation of Nature, regarded as a dynamic and vital force. Inspired by botanical forms and japanese prints, graphic arts privileged the use of the line traced in flowing curves to perform stylized ornate decorations in bright colours. Architects often designed furniture in the new style to accompany their building projects. A transition towards more geometric forms was marked by the *Art Deco* Movement which preferred straight lines and simple shapes both in architecture and in all ornamental aspects related to artistic creation.
Instead of smooth changes, italian *Futurismo* made a sensational breakthrough away from the tradition in all arts. In 1914 the *Manifesto dell'Architettura Futurista* by Antonio Sant'Elia was a strong charge against architectural conventional styles, from classicism to gothic, from eclecticism to the other contemporary movements in Europe and America. Sant'Elia claimed: «The problem posed in Futurist architecture is […] in determining new forms, new

lines, a new harmony of profiles and volumes, an architecture whose reason for existence can be found exclusively in the conditions of modern life […].We must invent and rebuild the Futurist city like an immense and tumultuous construction site, vital and dynamic in each of its parts, and the Futurist house must be like a gigantic machine» (Sartoris, 1993, p. 88, translation by the author).
The illustrations made by Futurist architects had an enormous impact on modern representation. The very concept of *line*, essential for their creating architecture, underlies new graphic expressions. In their *manifesto*, they asserted: «Oblique and elliptic lines are dynamic, and by their very nature possess an emotional power stronger than perpendiculars and horizontals […], no integral, dynamic architecture can exist apart from them» (Sartoris, 1993, p. 90, translation by the author). Vertical lines are the true connotation of tall buildings and one of the features of Futurist imagery. Occasionally these drawings, where the line is the prevailing element, are vividly coloured since in Futurist aesthetics the «violent colour» of the building material has a decorative value.
Their visual impact produces an effect of reality on the illusory design, and one might say that they anticipate digital renders (Fig. 3.7).

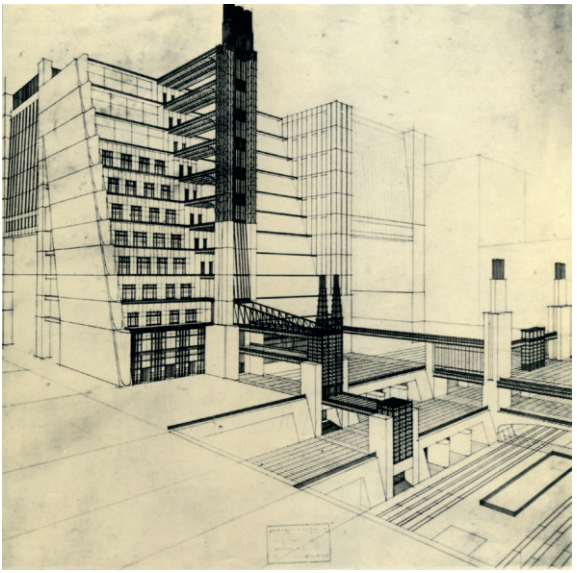

Figure 3.7. Antonio Sant'Elia, *The New City: study for a staircase house with lifts upon four road levels*, 1914. Black ink and pencil on paper. Wikimedia Commons.

Futurists' ideas on the representation of a building or a cityscape were developed after the first world war by architects and designers of various countries who shared the emphasis on pure lines and geometrical surfaces, without indulging in decorative forms. Unconventional representation techniques were explored by architects themselves not simply to present an explanatory illustration of a building but to try new visual tools for a better understanding of architectural design.

The Netherlands-based art Movement *De Stijl* promoted pure abstraction of form and colour instead of pictorial features, both in architecture and painting. The reality was not so much a visual perception of outward appearance as the deep insight into the essential design principles: straight horizontal and vertical lines bordering the space and primary colours underlining the surfaces. The Dutch architect Gerrit Rietveld chose this technique to explain the complex relationship between form and space drawing the observer's attention to the dynamic rhythms of the composition (Luscombe, 2013).

Avant-garde and Modernism shared the revaluation of the line as the primary element in architectural drawings since the line was acknowledged as the leading sign during the design process and also as a necessary means to convey the final idea to an external audience. They expressed a clear mistrust and a dismissive attitude towards realistic representation as a misleading means of communication. This criticism against pictorial drawings is evident in Le Corbusier's thoughts. In his manifesto, *Vers une architecture*, first edited in 1923, he claimed:

«The whole structure rises from its base and is developed in accordance with a rule which is written on the ground in the plan: noble forms, variety of form, unity of the geometric principle» (Le Corbusier, 1986, p. 48). «The regulating line is a satisfaction of a spiritual order which leads to the pursuit of ingenious and harmonious relations […]. The regulating line brings in this tangible form of mathematics which gives the reassuring perception of order. The choice of a regulating line fixes the fundamental geometry of the work […], it is one of the vital operations of architecture» (Le Corbusier, 1986, p. 75).

His statements recall Alberti's assertion on *lineamenti* as unique graphic tools. This well-known drawing by Le Corbusier shows a wall of Villa Stein «as a paper-thin plane, like a stage flat from which windows might have been cut with scissors, as Frank Lloyd Right observed. But the openings are rendered as opaque lavender patches – not the most obvious way of indicating glass – and the sky, essential to this drawing, is like a blue wall on which Le Corbusier has hung a painting» (Drexler, 1984, p. 24).

In this image, any reference to the environment is removed so that the observer can see the house as an object of thought and concentrate on its formal qualities. The drawing is reduced to essential forms, calling to mind Purist theories.
The colour on the flat surface does not conceal the harmony and proportion between each part and the whole.
The villa's structure exemplifies Le Corbusier's mathematical theory based on the Modulor system and the Golden section application.

The illusion of reality

Photography was an invention that has exerted a great influence on all artistic expressions. In the 19th century, this new technique was still in an experimental phase and the photographer's attention was focused on people rather than on buildings and landscapes.

During the last century, previously unthinkable performances became possible in the field of representation. Photography proved to be a useful tool to create new kinds of images that meet the public's tastes.

Despite its wide use, its architecture application remained quite marginal, a tool for photomontages to simulate the future building in its environment and for pictures in illustrated magazines. Some criticism about its reliability in representing reality involving the complex interaction between maker and viewer had already been raised by scholars and art critics and are debated even today (Kenney, 2005).

Thus, traditional drawing was far from being considered outdated. A metaphor was found by C. Recht between a painter (or a drawer) and a photographer:

> The violinist must first produce the note, must seek it out, find it in an instant; the pianist strikes the key and the note rings out. The painter and the photographer both have an instrument at their disposal. Drawing and colouring, for the painter, correspond to the violinist's production of sound; the photographer, like the pianist, has the advantage of a mechanical device that is subject to restrictive laws, while the violinist is under no such restraint. No Paderewski will ever reap the fame, ever cast the almost fabulous spell, that Paganini did (Benjamin, 1979, p. 249, quoted in Benjamin's essay of 1931).

Photography and drawing

Photography was not universally accepted by architects as a substitute for drawing neither in the stage of exploration of existing buildings nor in the final phase of presenting their own works already done. Le Corbusier repeatedly opposed freehand sketches to photography. In 1960 he wrote: «When someone travels and understands visual arts – architecture, painting, or sculpture – he uses his eyes and draws, so as to fix inwardly, in his own experience, what he has seen. Once the impressions have been recorded by the pencil, they stay inside forever, they are registered and inscribed. The camera is a tool for idling; we give a mechanical device the task of seeing for us» (Le Corbusier, 2008, p. 37) (translation by the author). Sometimes his drawings were taken directly from photographs. «This practice of drawing an image after it has already been fixed by the camera appears throughout Le Corbusier's work, recalling his no less enigmatic habit of sketching his own projects again and again, even long after they have been built. He redrew not only his own photographs but also those he encountered in newspapers, catalogues, postcards» (Colomina, 1994, p. 93).

Frank Lloyd Wright was keen on photography, but he saw limits in that technique. When he decided to submit his early works to the European public, he prepared a publication that was to become one of the most admired and influential of those years, the *Wasmuth Portfolio* edited in Berlin in 1911.

Wright chose to show his houses and utilitarian edifices already built mainly by means of drawings made by himself or by his skilful illustrators' team.

In his essays, Wright had already made known his scepticism about the camera. «To have imitated the natural modeling and position of the subject photographically in order to give a realistic topography of features and form would have been little and have required but manual dexterity and a mechanic's eye […]. A picture should be more than an imitation of a real object» (Brooks Pfeiffer, 1992, p. 43). «Photographs do not adequately present these subjects. A building has a presence, as has a person, that defies the photographer» (Brooks Pfeiffer, 1992, p. 92).

The architectural historian H.A. Brooks claims that at least ten eye-level perspectives in the *Wasmuth Portfolio* (1910) were copied from photographs. He takes as an example the Tomek House comparing the drawing with an earlier photograph: «The fidelity of the copy is extraordinary; it even embraces the setting. Each tree has been carefully traced, including the branches and the shaggy bark. The house is the same, line for line, even to the open bedroom

window. The only additions are urns of flowers at either side of the porch, and a change in the direction that the shadows fall» (Brooks, 1966).
The Larkin Building too, a newly built edifice intended for the offices of a company, was presented as a drawing in the refined Wright's style where the compact mass of the building - that had arisen some criticism- was lightened by the skilful use of lines and shadows.
If Le Corbusier and Wright had made a countercurrent choice since the 30s the traditional perspective hand drawing seemed overshadowed by the new photographic representations. Photography was considered a powerful means of communication that could influence public opinion and promote architecture.
It became evident to architects and illustrators that the camera was a true antagonist when it came to competing on the same ground, namely portraying an existing building.
Cyril A. Farey, a successful British illustrator, pointed out: «What remains then of architectural draughtsmanship if there is no longer any need for realistic drawings of existing buildings? This is a question easy to answer, for there is obviously one thing that a photograph cannot do, and that is to portray a building which has not yet been erected» (Farey and Edwards, 1949, first edition 1931, p. 12).
The render in Fig. 4.1, made by Farey in the traditional British style, combines evident realism and meticulous accuracy. Farey only used watercolour, with the occasional white highlighting. His distinctive style is recognisable by the soft shadows and variations in tone and light on the building surfaces, by the pale blue sky and the wet roads reflecting the building (Stamp, 1982, p. 134).
If Farey showed realism in a traditional way, other illustrators made images like photographs. The picture of London traffic on a rainy day is vivid and realistic in this drawing by D. Muirhead Bone, where figures and vehicles passing down the streets are rendered using the same tones of the building (Stamp, 1982, p. 133).
The intense mobility creates a visual counterpoint with the massive static building. It appears as if the beholder is looking at the street from an upper floor facing the building.
The overall effect, the viewpoint and the framing, can be compared to a black and white camera snapshot (Fig. 4.2). «Modern architecture becomes modern not simply by using glass, steel, or reinforced concrete, as it is usually understood, but precisely by engaging with the new mechanical equipment of the mass media» (Colomina, 1994, p. 73).

Figure 4.1. C.A. Farey, No. 68 Pall Mall, London. 1928. E.L. Lutyens's design. Perspective in pencil and watercolour. Drawings Collection of the R.I.B.A., London.

Figure 4.2. David Muirhead Bone, No. 55 Broadway, Westminster, London. c. 1927. Adams, Holden & Pearson's design. Perspective in pencil and watercolour.

Photographs were partially used by architects during the design process: photomontages could give an idea about future shapes and masses and help to perceive the impact of the proposed building in the surroundings with almost realistic effects. The image presented with the photomontage technique was not a representation made to deceive the onlooker by simulating a non-existing reality: it appeared instead to be just an attempt to help the client's imagination to envisage the future building in its context (Fig. 4.3).

Figure 4.3. Ludwig Mies van der Rohe, Project of a glass skyscraper. Berlin, Friedrichstrasse. 1921. Photomontage.

During the 60s an Italian team of architects presented the *Continuous Monument* as a utopic «architectural model for total urbanisation» that could be located across landscapes and cityscapes. Not a technological megastructure, but rather, an enigmatic orthogonal shape with a flat white surface whose faint transparency did not allow interior views. This unconventional and provocative architecture was illustrated both through photomontages and pencil drawings (Gargiani and Lampariello, 2010; Lang and Menking, 2003) (Fig. 4.4).

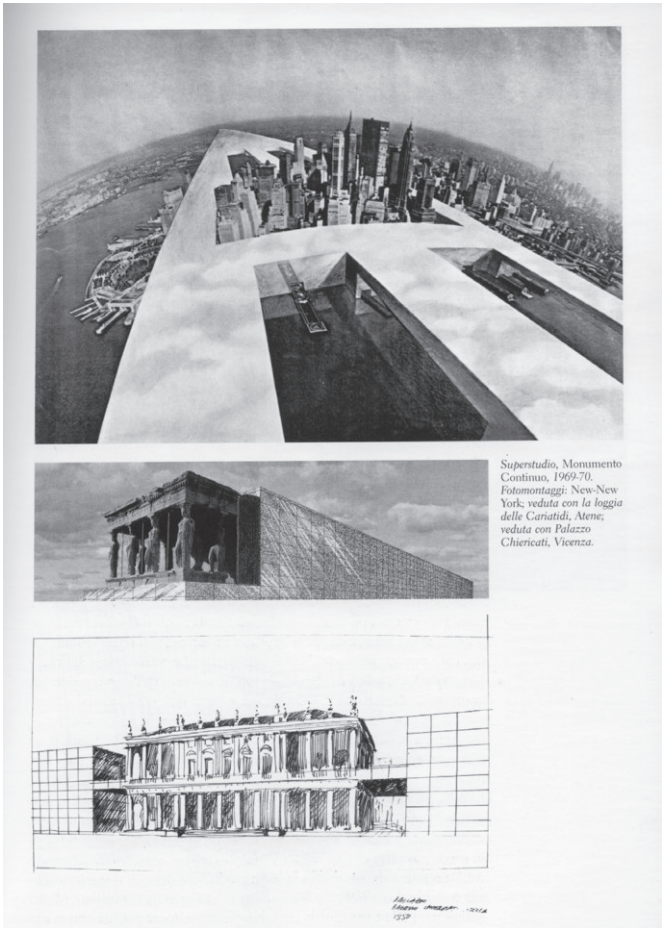

Figure 4.4. Superstudio. *The Continuous Monument* in New York, Athens and Vicenza. Photomontages and pencil on paper. c. 1969.

Daniel Libeskind, a most influential theorist on architectural imagery, in picturing his project for the Dresden Museum of Military History, chose some realistic drawings to render the impact of the proposed expansion on the old Museum façade (Fig. 4.5).

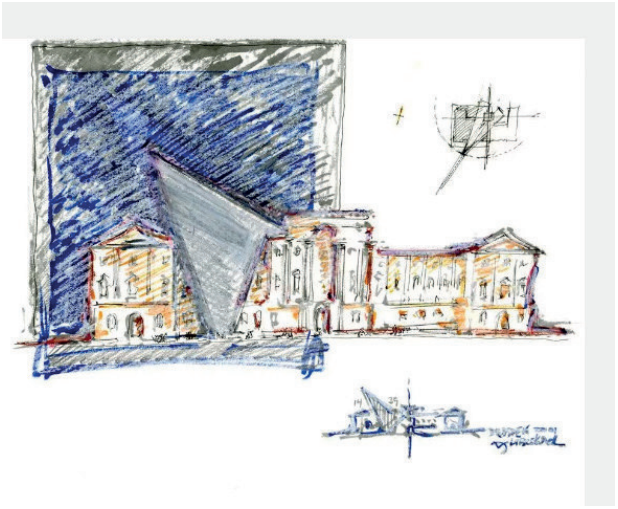

Figure 4.5. Daniel Libeskind, Museum of Military History. Dresden, c. 2001. Pencil on paper. Studio Libeskind, New York, c. 1969.

A view on Wonderland: the digital photorealistic render

Starting from the late 20th century, computer technology has taken over as a powerful means of communication and dissemination of images with ever-increasing efficiency and precision. Computer graphics and virtual images have radically transformed the traditional understanding of drawing, challenging the complex discourse on visual representation.

In such a context the new techniques have been widely and successfully used by architects since they are sophisticated tools to make realistic three-dimensional renders. Furthermore, the digital visualisation process can extrapolate photographic-like images with extreme accuracy of details, materials, colours and lighting effects. At the same time animation of inside and outside spaces anticipates the daily life of the future (Leandri, 2022c; Leandri, 2021).

Digital images are mostly appreciated by a wide audience who have no previous knowledge of technical drawings and are inclined to appreciate architectural works less than other visual arts. As W. Benjamin had already envisaged in his 1935 essay on the age of mechanical reproduction, «Distraction and concentration form polar opposites which may be stated as follows: a man who concentrates before a work of art is absorbed by it […] in contrast, the distracted mass absorbs the work of art. This is most obvious with regard to buildings. Architecture has always represented the prototype of a work of art the reception of which is consummated by a collectivity in a state of distraction […]. The public is an examiner, but an absent-minded one» (Benjamin, 1969, p. 18).

To catch the attention of this absent-minded public, photorealistic renders seem to be the best solution, mostly because they are perceived as similar to other visual images already assimilated through the mass media. In theories on visual communication formulated in the twentieth century, the concept of perception became more complex, and a large number of variables were included.

The relational character of perception and the role of the background are stressed. Perceptions are regarded both as a result of interaction between perceiver and perceived, and as a consequence of past experience. The adaptation-level theory proves that the perceptual response may be represented as a function of the difference between some present stimulus process and an internal standard derived from the effects of previous stimulations: «an individual's attitudes, values, ways of structuring his experiences, judgments of physical, aesthetic and symbolic objects, intellectual and emotional behaviour, learning and interpersonal relations all represent modes of adaptation to environmental and organismic forces […]. Stimuli impinge upon organisms already adapted to what has gone before, and internal states depend upon previously existing internal conditions as well as external inciters to action» (Helson and Murphy, 1964, p. 37).

The adaptation level is a dynamic concept: it is the level of previous experience to which the single subject has adapted his/her behaviour. Today, the modern media of communication, mainly visual channels, affect the perceptual process in such a pervasive way that even the act of watching an image can't elude the influence of the cultural background. Television programs, movies, magazines, websites, and commercial press create a world filled with images. The creation of realistic virtual spaces has shifted to the unfolding of *nonplaces* beyond reality in videogames simulation. In this age of digital mass communication, «whereas a representation finds its original referent in the real, a simulation generates a new "real" without an original» (Sturken and Cartwright, 2018, p. 209).

The likeness of a photorealistic render to an actual photograph, including detailed specific stereotypes of daily life, makes the simulation hidden and creates extremely positive expectations in the public, not matching with the future, more trivial reality. «The co-existence of both the realistic view and the fictional vision as a new simulated reality problematises the distinction between experiences of natural reality and experiences of artificial photo-reality. Rendering cuts through the naïve trust we have instilled in photographic images because our perceptual framework is confused by conflicting messages: 'This must be real!' and 'This cannot be real!'» (Bernath, 2007).

Jacob says that «drawing packages and super sophisticated renderware, have narrowed the scope of architectural drawing even as they have exponentially increased its precision». The illustrative role of a digital realistic representation has often produced images as «glossy visions of soon-to-be-built projects, usually blue-skied, lush-leafed, and populated by groups of groomed and grinning clip-art figures, where buildings appeared with a polished sheen» (Jacob, 2017). The 3D renders, according to de la Fuente Suárez are «the product of standardized methods and are not intended for experiencing buildings, as they are created by using the representational styles, techniques and aesthetics of the moment». This kind of representation «does not promote awareness of the building as a producer of experiences and, therefore, does not function as a tool or method of research on the design process» (de la Fuente Suárez, 2016).

D. Bernath points out a risk for western culture, already affecting some architectural companies in far-east countries: could this mechanism of rendering production escape the control of the design? «This is where the rendering process is accentuated to a point of crisis in the design, where the image reinserts itself back to influence the outcome of the design process. The hypothetical projection of the rendering is hijacked and fed back into the loop of design prematurely; instead of saying 'it could be like this', the rendering dictates over the design to say 'it must be like this'[…]. The effectiveness of rendering is potentially in competition with the effectiveness of the design at the moment of realisation» (Bernath, 2007).

Creativty and design

In the last two decades, some proposals arose to find new methods of drawing especially in the initial phase of creation and in the final representation of the architectural object. Two different paths have been suggested to reach a compromise between the traditional handmade image and the increasing use of digital media. Peter Cook seems to have chosen the *hybridization* of the drawing, made initially via computer, then retouched manually to render it more evocative and seductive (Cook, 2014). Marco Frascari instead looked forward to new digital tools that would allow more flexibility and manipulation during the design process (Frascari, 2001). An adequate answer to this last speculation could be the digital drawing tablet, a comparatively recent device that imitates almost to perfection pen and paper, brush and canvas or other traditional implements.

Creative drawing in today's culture

The ubiquitous spreading of photorealistic rendering has caused different attempts to shift the boundaries of architectural representation to more creative contexts, working out other kinds of images less realistic but more expressive and evocative. Criticism about computer-generated imagery had already arisen previously in the visual arts field and novel research was undertaken in computer graphics called *non-photorealistic rendering*.

These types of images were not judged by their likeness to photographs, instead, they were appraised according to their ability to focus the viewer's attention (Gooch and Gooch, 2001).

The meaning of architectural drawing, its link between an idea and its achievement has been widely debated since the 80s. «The functional and rational sides of representation were increasingly reinforced by poetic and irrational characteristics. No longer is mere information offered to the attentive observer; the drawing presents itself to the imagination as material for play. The drawing is now to be understood as a kind of object for meditation, which transfers perception postures, sensibilities and ideas instead of "things"» (Meisenheimer, 1987).

P. Cook defines drawing as the motive force of architecture. «Drawing – of every kind – is a motor that absorbs imagination and converts it into usable or transferable information or inspiration, thus self-consciousness is but another form of evaluation» (Cook, 2014, p. 211).
The antithesis between screen and paper has sometimes established a balance between a predetermined pseudo photorealism and alternative forms of drawings that allow flexibility, imagination, and even provocation. Architects and artists have tested and redefined mixed images that simultaneously inform and create pictorial effects. They are at once digital and manual drawings, part paintings and part assemblage, and offer the onlooker visual evidence of multilayered levels of interpretation. This does not exclude the choice of using exclusively the digital or analog medium in an original way that goes beyond a mere realistic representation. «To have the whole thing plotted out beforehand and entirely predictable and therefore just a graphic exercise – this is infinitely boring. A drawing should be an investigative device, a voyage of discovery, a series of glances into the future» (Cook, 2013). «There will always be the need for the speed, the wit, and those bursts of inconsistency in hand drawing that the procedures of the digital process tend to find indigestible» (Cook, 2014, p. 218). Some architects feel the need to free themselves from definite trends in illustration, experiencing various graphic representations to express their architectural thinking. The drawings selected are a small set of different forms of visualisation, which range significantly both illustrative intents and in graphic techniques (Figg. 5.1, 5.2, 5.3, 5.4, 5.5).
The intense debates brought about by the introduction of new digital tools between the 70s and the 80s leads to a rethinking of architectural imagery and to the creation of new paths of expression, sometimes unconventional, often more creative.
Until the 80s, Daniel Libeskind's graphic production focuses mainly on the concept of architectural space and on the critique of conventional representations; his drawings became a breaking point from the past and an opportunity for reflection. Chamber Works have been subjects of investigation and speculation by architects and scholars, who highlighted some of their extraordinary characteristics as objects of thought. Libeskind's drawings mark a milestone in architectural representation, a moment of no return to the rules of codified conventions. They are a mental stimulus for the observer, who can hardly forget them. Libeskind himself has kept traces of their memory in his later drawings made for competitions, as a connection between his past theoretical thought and his designer activity (Fig. 5.1).

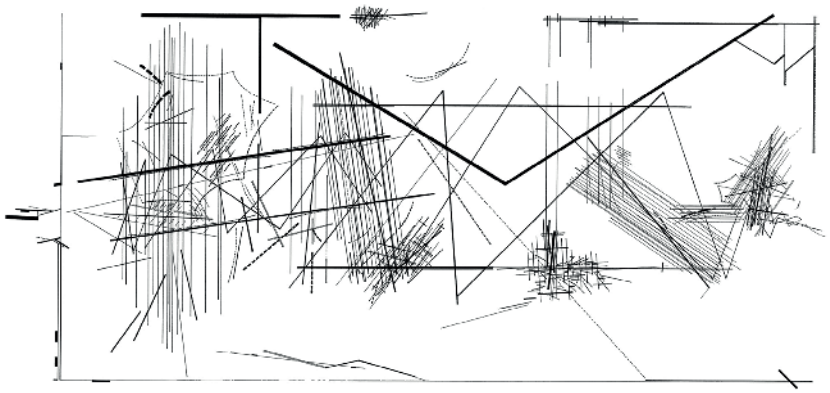

Figure 5.1. Daniel Libeskind, *Chamber works*, I Horizontal. 1983. Ink on paper. Studio Libeskind, New York.

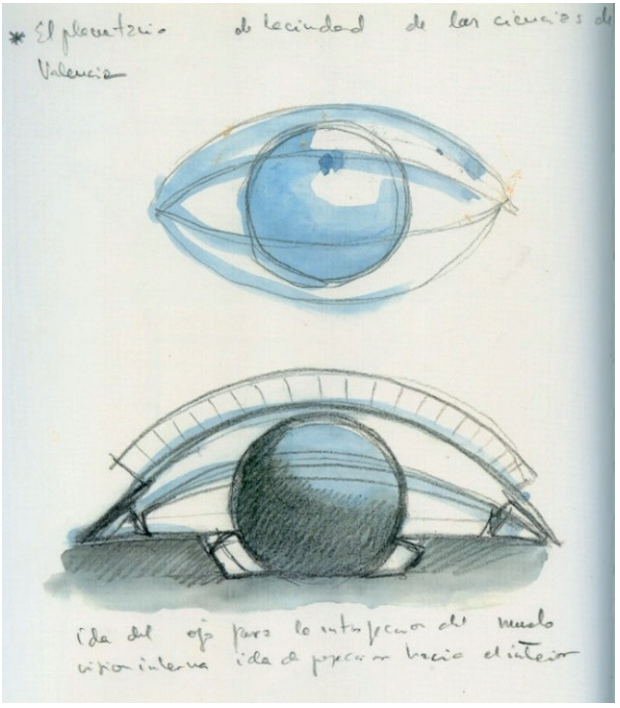

Figure 5.2. Santiago Calatrava, City of Arts and Sciences, Planetarium, Valencia. c.1990. Pencil and watercolour on paper. Courtesy of Santiago Calatrava LLC, Zurich.

According to Zaha Hadid, her drawings are not the building, but about the building. They are not illustrations of a final product, but rather, they are tools to explore ideas, a way to see whether something is right or wrong. Her use of colour was often misunderstood. The colours in the paintings were not the colours of the building, but a study of light on its surface depending on time, transparency, quality of materials, sense of movement and energy (Hadid and Futagawa, 1995). The themes of movement and natural forms are a persistent inspiration in Calatrava's works of art and architecture: the opening and closing of a flower, the flight of a bird, the movement of the sun, and the gestures of the human body. Calatrava, as a Renaissance artist, believes in anthropomorphism as a generator of forms. «I consider the body to be the most beautiful and functional of all natural objects; in its proportion and construction, there is something essential that relates to the souls of both architecture and engineering» (Carrillo de Albornoz and Calatrava, 2018, p.17). The expressive gesture of the hand and the movement of the perceptive eye are favoured artistic motifs. In Fig. 5.2 Calatrava imagines an eye with a moveable eyelid structure as the starting point for his design; to use his words: «the idea of the eye for the introspection of the world – internal vision idea of perception from within» (Tzonis and Lefaivre, 2001, p. 234). «The image of the eye is used as the generating element for the building while water, as a reflecting film, becomes an additional architectural device enabling duplication of the image. A complete element is thus created, based on two symmetrical halves: one real, and the other virtual or reflected» (Tzonis and Lefaivre, 2001, p. 190). Kulper's creative hand drawings are both informative and imaginative. Pencil lines used in differential weights, delicate tones, and a myriad of overlapping, but never invasive, detail in varied media attract and intrigue the observer (Fig. 5.3). As the author maintains:

> Rather than […] limiting the role of the drawing to a metrical description of a project, ideas are augmented through an emerging visual field of study that is discovered in the act of constructing a drawing. Design in this sense is fluid, weaving heterogeneous ideas, discussing one disciplinary set of questions in relation to another, and through the rehearsing of design skills in the drawings themselves, fusing visualization and thinking as a relational and synthetic practice […]. Doing this through lines and composited layers rather than through the logics of construction allows my work to incorporate both necessary and unexpected cultural and natural considerations (Kulper, 2013).

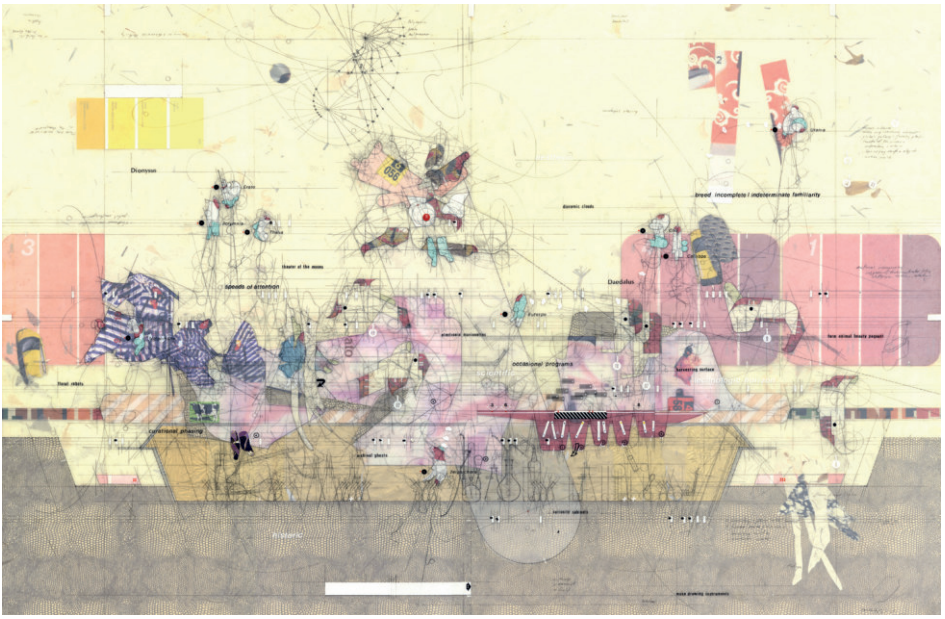

Figure 5.3. Perry Kulper, Competition design for Central California History Museum, c. 2010. Graphite, collage and varied media on plastic film.

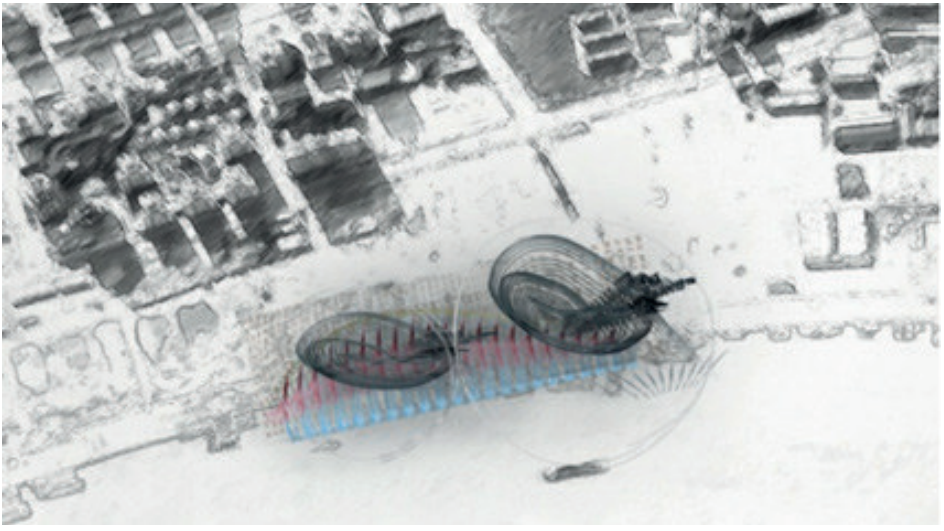

Figure 5.4. Kenny Kinugasa-Tsu. Cultural waterfront scheme in the Wang Pu Jian area, Shanghai. 2011. Colour pencil strokes on watercolour paper, Photoshop ®, 3D Studio Max ®

This sketch by Kinugasa-Tsui (Fig. 5.4) shows the volumetric composition of the waterfront structures interacting with the existing site. As the author explains, after a first colour pencil drawing, 3D Studio Max ® makes it easy to explore spatial composition. «The original analogue hand stroke qualities would intrinsically intertwine throughout with the digital 3-D modelling process, thus allowing the benefits of preserving a certain "looseness" and "softness" in the sketches, while simultaneously capable to explore complexities of multiplications, fragmentation, and other geometric manipulations offered by the computer software. The camera in the 3D software allows each stroke to be spatially explored from "mathematically correct" perspectives» (Cook, 2014, p. 208).

Labourel's images for a ballet school combine the digital technique and the manual drawing in a poetic synthesis. In each step of the project development, the beholder who looks at the drawings is not only involved with his/her eyes but can experiment other feelings, the harmony and the rhythm between the elements, and the sound hidden behind lines and colours (Fig. 5.5).

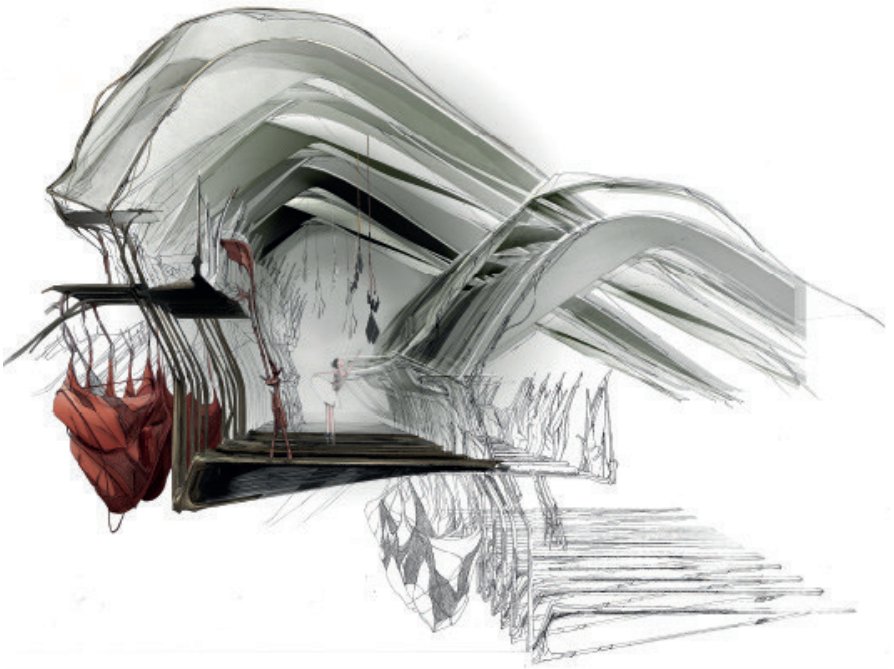

Figure 5.5. Alice Labourel, *The Hidden Orchestra*, project for a ballet school in Los Angeles, elevation. 2013. Digital rendering (Maya ®, Photoshop ®) and hand drawing (ink on paper).

Freehand digital drawing

The usual medium to sketch and draw has always been some kind of paper on which several types of drawing implements such as pen or pencil are used. Depending on the pigment, the trace may be more or less easily erasable, so corrections can be made, but always within limits and with some effort and time wasting. Besides, to draw in colours or to obtain some effects, an array of pencils must be available and anyway they have to be tended by appropriate sharpening and care. Using pen and ink is even more troublesome, mainly because afterthoughts or errors are not permitted, given the difficulty in erasing. All these implements have been employed for many decades, though with improvements that made their use easier. In design, be it architectural or industrial, the introduction of CAD solved most of the tedious operations of pencil and paper drawing. The input of cartesian coordinates either by keyboard or mouse would trace perfect lines that, if needed, could be deleted in a moment without leaving a clue of their previous presence. That solution, though useful for the technical side of a project, would not permit the freedom of hand drawing.

Hand drawing is analogic, pertaining to the real world of the infinitely divisible, whilst CAD, on the contrary, pertains to the digital world, the world of integer numbers. However, the computer offers attractive flexibility and facilities.

So how to combine the freedom of hand drawing on paper with the commodities provided by computers? The exponentially growing progress of solid state electronics has provided the answer.

The movements of the pencil can be traduced into very tiny bits, still integers, but so tiny that the resulting track memorized on storage medium cannot be distinguished by the human eye from the continuous flow of a real sign on paper. The paper was substituted by a surface (the tablet) that was sensitive to the position of a dedicated stylus, which had to be used as a pencil.

Next to the digital conversion of the movement, the most critical item was the stylus, which should provide the same grip and freedom as a pencil. This was not possible in the first implements, because they had to be connected with leads or be battery powered.

Things have changed, and the styluses are now wireless and with no batteries, taking power from an electromagnetic pulsating field generated by the tablet. Consequently, their dimension is the same as that of a pencil, they are sensitive to thousands of pressure levels, so the trace can be more or less marked; they are also

sensitive to tilt and rotation with the trace size and shape changing accordingly. Finally, one of the latest and most important improvements has been the combination of a screen with the sensitive surface of the tablet. So the tip of the stylus seems to actually interact with the surface, with a perfect alignment, just like tracing on paper.

Sophisticated raster software is also available as free open source applications, allowing imitation of all sorts of pencils, pens, brushes, and sprays of any dimension and colour. Multiple layers can be created or deleted to test superimposition effects. But the most important feature of all remains the strong similitude to drawing with a pencil or a pen, conferring the same haptic sensation to the hand, which moves freely and effectively while drawing on this new contrivance. Just as drawing implements evolved through the centuries, so digital tablets should be regarded as a novel drawing medium that can blend the perception and creativity of freehand drawing on paper with the commodities offered by the computer. We may well assert that freehand digital drawing is not an oxymoron, but a new method of still maintaining the creativity necessary for any design. As freehand drawing is now possible on digital tablets with a likeness unthinkable just a decade ago, some of the fears rightly asserted against computerized drawing are going to be dismissed. Just a few years ago Pallasmaa remarked on the different mental attitudes in using the pen or mouse:

> The computer creates a distance between the maker and the object, whereas drawing by hand […] puts the designer in skin-contact with the object [….]. In drawing by hand and pencil/pen, the hand follows the outlines, shapes and patterns of the object, whereas when drawing by mouse and computer, the hand usually selects the lines from a given set of symbols that have no analogical – or, consequently, haptic or emotional – relation to the object of drawing. Whereas the hand drawing is a mimetic moulding of lines, shades and tones, the computer drawing is a mediated construction (Pallasmaa, 2009, p. 97).

The need for new architectural tools was also highlighted:

> The physical grasping develops drawing tactics through both haptic interactions based on the manipulation of tools and the tacit learning due to the peripheral senses becoming aware of the rules

> embodied in the movements of the tools themselves […]. Architects live between two realms: a physical and a virtual environment […]. At present, we are torn between these parallel, but disjoined spaces. The invention of new architectural tools can lead to novel demonstrations of architecture. They have to be prosperous not prescriptive instruments, but manifestations of architectural thinking (Frascari, 2011, p. 136).

Quite surprisingly, these new implements merging freehand drawing with the world of computer facilities have not been taken on by designers as much as would be expected from the tremendous potentialities they offer. One of the reasons drawing tablets and raster applications are not in current use by designers may possibly be found in the still enduring belief that CAD drawing with the mouse is the quickest way to solve most of the problems relating to a project. There is little doubt that if the author is faced with a limited range of choices, all of them proposed by the available software, their selection will be much easier than finding a solution by insight. The former process is an easy one, driven by the outside, whilst the latter, i.e. the insight, would require an inner effort of fantasy, creativity, and even courage. A tendency to obtain results with the minimum effort and as fast as possible has no doubt much facilitated the use of CAD and has possibly fascinated and biased generations of students. However, the warnings issued towards the indiscriminate use of CAD are now starting to be considered in the professional and academic worlds, and there are signs that freehand drawing will return to be employed at least in some steps of the design process (Chiavoni and Porfiri, 2022).

The new drawing tablets can offer an ideal solution to foster creativity in design on one hand, and to meet time deadlines on the other, thus matching the needs of professional design studios. I have been using a tablet for many years in a very satisfactory way, each time exploring and choosing the available tools (sign, colour, framing, lay-out) to reach different aims (representative, playful, evocative).

The illustrator, a key figure behind the scenes

Conveying a visual message to an audience requires special skills. The process of image-making involves different variants considering the subjects (the maker and the viewer) and the object represented. If a painter usually makes a depiction only according to his/her own inspiration, even though the painting is valuable, for illustrating a product intended for the market or for a competition a presentation that meets the expectations of a potential customer or a committee is essential. In this case, the drawing maker can be the designer him/herself or another trustworthy person, i.e. the illustrator. This professional figure is quite recent in the history of architectural imagery.

Since the Renaissance technical drawings have been made, with few exceptions, only to convey information to insiders. These working drawings were the main communication tool between the architect and builder and in order to provide all possible details they needed extreme precision and were delineated conventionally in two dimensions with the aid of rulers and compass. As previously said, the 18th century marked a keystone in architectural imagery. The diffusion of new printing techniques and the appreciation shown by an educated audience towards the illustrations of ancient monuments and famous buildings made sure that the rendering should be successful. Moreover, it was a time in which job opportunities were low in the field of architecture, so many architects devoted themselves to drawing.

Some architects started to exploit painting skills (three dimensions, *chiaroscuro* and colours) in order to produce more realistic illustrations, the so-called *presentation drawings*, easier to be understood by the clients, the competition committees and the lay public. A few of them were the authors of these new perspective drawings, more often they entrusted the artistic visualisation of their projects to skilled draftsmen, who chose to illustrate buildings at the request of their colleagues engaged in the design process.

From unknown ghost to (sometimes) renowned artist

Initially, the illustrator's was not a professional job, but rather an occasional occupation often performed out of friendship. In this case, the consequence was that there was no identification of the illustrator who did not sign or initialise his drawings. To cite an instance, in 1757 the Scottish architect Robert Adam and the French architect and talented draftsman Charles-Louis Clérisseau visited together the Palace of the Roman emperor Diocletian in today's Croatia. Adam was determined to issue an imposing book of antiquities, in Piranesian style, which would increase his reputation in Britain.

The original set of drawings was made mainly by Clérisseau and his assistants, initially in ink, pen and watercolour. Later Clérisseau supervised the production of the engravings for publication. When the book was welcomed and widely appreciated by the public, Adam had already omitted all the names of the illustrators and just mentioned Clérisseau briefly in the preface just as a *companion on the voyage* (Lever and Richardson, 1984; Fleming, 1958).

The professional figure of the illustrator, who earned his living from his work by creating renders from the technical information provided by designers, appeared in the 19th century; most of these specialists, usually called *perspectivists, delineators* or *renderers* were hired for each project but their drawings were not recorded in any way, so they were often nicknamed *ghosts*. The editor of the journal *The Builder* was aware of the difficulties faced by young illustrators to find a job, so starting from the first issue of the paper in 1843 a space was dedicated to offers and inquiries for this kind of work.

By the 1870s in Britain, the name of the draftsmen began to appear on drawings published in the architectural press, but even at the end of the century many of their achievements exhibited at the Royal Academy or submitted in competitions were not signed (Stamp, 1982).

In those times the illustrators' life could be quite bohemian, at least during their early careers. C.H. Reilly, writing years later, recalled the world of draftsmanship quoting this anecdote about Robert Atkinson, a clever illustrator and watercolourist. When he was still scarcely known, Atkinson shared a room in London with three other talented young architects: Gascoyne, Horsnell and Nott.

> These four made not only a cheery set of companions, but between them a very powerful team. They lived like most young men did in those days "by taking in washing" – to use the architectural

> slang then prevalent. This meant they were willing to design anything from a palace to a pigsty for any architect not anxious to, or perhaps not capable of, designing it himself. They would design, and then make drawings of any and every kind, from Royal Academy perspectives to working-drawings and full-size details. When some provincial architect knocked at the door and asked for Mr. Atkinson, all the others would temporarily be his assistants, or really so if necessary. Sometimes the giver-out of the washing could not come to terms, and would then go away and consult his list of recommended ghosts, often turning up again to the same office and this time asking, say, for Mr Gascoyne, when all the others would in turn become his obsequious assistants. The man who eventually landed the job would charge perhaps five shillings an hour for his services and then sublet the work, or part of it, at four shillings and sixpence an hour to his friends (Reilly, 1931, p. 30).

Between the two world wars, illustrators became gradually more *visible* to the public, although the frequent collaboration between designer and draftsman was rarely perceived by outsiders. So most illustrators rarely acquired a reputation for themselves and the observer's identification of the architect with his drawings has been persisting until recent times. Outstanding artists such as J. F. Gandy and M. L. Mahony, who shared the characteristic of being mainly illustrators and seldom designers, were much less well-known than their employers, John Soane and Frank Lloyd Wright.

Also, the increasing industrial manufacturing needed illustrators to create posters advertising a brand or advanced commercial products, from clothing to transport. Since the 50s the mass production and the spread of new media had promoted the creation of captivating images in magazines, posters, and television. Some illustrators devoted themselves exclusively to the graphic language in the field of industrial design and their drawings had international success, coming right into the art world (Salsi C., ed., 2007).

Since the 80s, that is until the predominance of handmade drawings, the most celebrated illustrators were freelance professionals, some working on their own, others heading conspicuous firms. Nowadays computer graphics and virtual images have radically transformed the traditional understanding of visual representation. Several large companies are active in the field of architectural digital rendering, mostly in the United States and in Asian Countries with

hundreds of employees. Their renders, made according to coded standards, are often devoid of expressive and evocative quality because they lack a *personal touch*. In these cases, the illustrator can't express his/her personal skills and be acknowledged as an artist. The images have the trademark of the company and the draftsmen eventually go back to anonymity.

Professional awareness and artistic skill

Architectural images made by illustrators had been praised especially in Britain and the United States where a rich literature on rendering techniques had been flourishing since the beginning of the last century. Prominent British architects could not do without three-dimensional imagery or technical drawings. Edwin Lutyens, while asserting in a letter written to Lady Emily Lytton in 1897: «A working drawing is merely a letter to a builder telling him precisely what is required of him, and not a picture wherewith to charm an idiotic client», kept on producing fine pictorial and realistic illustrations for customers, competitions, and exhibitions (Lever and Richardson, 1984).

Several architects and illustrators found it useful to write handbooks to help people interested in making renders or drawings. Skill in presenting attractive images could become the beginning of professional activity. Guptill in 1921 claimed: «Many a draftsman has learned to his sorrow that it is much easier to open an office calling himself an architect and with his name on the door, than it is to induce clients to enter» (Guptill, 2007, p. 110).

In their successful books, the authors expounded the characteristic of draftsmanship as composition, points of view, lighting and shadows, colour treatment, staffage and so on. They explained the different techniques and outcomes of working from photographs and from nature, describing the features of the representation of buildings including exteriors, interiors and street scenes, and offering suggestions for managing windows, doors, furniture and other accessories.

What was always pointed out was the professional ethics of the illustrator whose task was to make a faithful presentation of a project. As Farey wrote in 1931, «truthfulness in presentation should be the principal object in an architectural perspective, and whatever agreeable qualities such a drawing may have by virtue of its composition, these should be regarded as a desirable addition to the former and not in any degree whatsoever a substitute for it » (Farey, 1949, p.13),

«the best architectural drawing is the one which best serves the advancement of architectural design» (Farey, 1949, p.14).
Some illustrators have marked the history of drawing and rendering and affected the ways of thinking, producing images beyond contemporary cultural schemes. I have selected four illustrators among others not only for their remarkable and long lasting influence on architectural representation but mostly for their distinctive drawing techniques. All these artists share the characteristic of having been mainly talented illustrators and seldom designers. Their images portray different historical moments and cultural contexts filtered through a unique personal vision.
Gandy privileged the colour which met his intent to represent buildings and landscapes between reality and dream: his images had the same features and the same visual impact of paintings on canvas, although he never used this medium. He chose to draw only with watercolours on paper to remind the onlookers that he was first of all an architect. Mahony and Ferriss depicted the two sides of American rich dwellings: the houses among nature and the skyscrapers of metropolitan areas. Mahony chose to outline in a decorative way the natural environment, sharpening with thin pen strokes trees, gardens, and every sort of vegetation which surrounded and shielded a home. Ferriss rendered the mass of the city towers with thick strokes of charcoal, emphasizing the building volumes as sculptures in black and white. Jacoby's almost monochromatic linear drawings reflected the increasing attention towards the relationship between the function of buildings and the user needs. Human figures depicted in everyday activities are perfectly integrated with the environment; Jacoby's interest in people paved the way to the contemporary renders in which figures crowd, and sometimes overcrowd, the surrounding.

Visions and dreams

John Soane considered Gandy «one of the most distinguished draughtsman of the present age». He was the most brilliant renderer of architectural representations in early 19th century England and his frustrated career as a practising architect was balanced by the reputation he reached as an outcast genius of pictorial architecture. His attractive watercolours had been shown annually at the Royal Academy for thirty years, although his authorship was not recorded in the catalogues and Soane's name was attached to his drawings.

«Gandy's renderings of Soane's designs were distinctly visionary in presentation and richly connotative in imagery […] Gandy strove to combine the pictorial drama of the Piranesian tradition with the sensitive landscape aesthetic of contemporary English watercolor painting […] The artistic connection between painting and architecture was a theoretical topic of contention, especially in the lectures on perspective delivered by J. M. W. Turner, and in Soane own lectures on architecture » (Lukacher, 1987).

Gandy shared Soane's discomfort about the ordinary standard of local architecture and his aspiration to raise it to a matchless level, worthy of the greatness of the British Empire. Consequently, there was an obvious parallel with Roman magnificence and a propensity towards the style and imagery of Piranesi whom he had met during his Italian stay. In Gandy's perspective, visual effects of indeterminate wideness and grandiosity were predominant, where the chiaroscuro played a spectacular role to create an uncanny aura.

Gandy's distinctive feature of converting architectural representations into images of future ruins was linked to Soane's speculations on the decline and destruction of human achievements.

The theme of ruin and death was a topic in art and romantic literature; in Britain, this subject, strictly joined to the ideas of Sublime and Beautiful expressed by E. Burke, was echoed widely in Soane's times. An extraordinary example of Gandy's skill and feelings is given by two pictures of the Rotunda, an imposing hall designed by Soane to house the Stock Exchange of the Bank of England (Figg. 6.1 and 6.2).

The first drawing shows the hall as a secular Pantheon. The light illuminates the walls of this interior utterly devoid of people, producing a mystical atmosphere. Gandy made this drawing in 1798, two years after its construction, but just a week later he had already envisaged the Rotunda as a superb ruin of the past.

The second representation, exhibited only in 1832, is an emblematic structure where time had effaced all reason for existence.

In showing this visionary representation, Soane quoted a passage from Shakespeare's *The Tempest*: «The cloud-cap't towers, the gorgeous palaces,/The solemn temples, the great globe itself,/ Yea, all which it inherit, shall dissolve». «In pristine condition […] the archway of the central passage contained a clock; in the future ruin, time itself has been torn from the building, the image dramatizing its own temporal disorder» (Lukacher, 1987).

In the first drawing, the Rotunda is represented as an empty and silent shell although it had been designed to contain one of the busiest wards of the Bank.

Figure 6.1. J.M. Gandy, *Bank of England, Rotunda*. 1798. J. Soane's design. Watercolour on paper. Courtesy of the Trustees of Sir John Soane's Museum, London.

Figure 6.2. J. Soane and J.M. Gandy. *Architectural Ruins-a vision*. 1832. Watercolour on paper. Courtesy of the Trustees of Sir John Soane's Museum, London.

The onlooker expects to see people (employees and clients) moving in and out, rather agitated, whispering confusedly and looking at the clock since time is a primary element in making money. Instead, the hall looks like an uninhabited temple where the presence of people is occasional and transient.

The second picture is an outstanding premonition on the vulnerability of a living structure destined for an ineluctable end. The ruins host some characters: they could be tramps, more likely treasure hunters who are searching unhurriedly for something of value. Their tiny silhouettes make the wrecked building appear even more imposing. The caryatids around the lantern dome look down at the tramps with indifferent eyes, as ever.

This illustration surprisingly anticipates the historical fate of the bank erected by Soane: less than a century later most of it, the Rotunda as well, was destined for demolition.

Other works by Gandy are not the presentation of Soane's projects, but dreams of an artist who had detached himself from reality and found refuge in an imaginary world: ideal reconstructions from classical antiquity, poetical illustrations from Romantic authors, unsolicited proposals for extravagant buildings.

A famous emblematic drawing joins Gandy and his employer in the same destiny of disillusion: it is an inventory of young Soane's unexecuted designs depicted in a magic landscape where triumphal bridges, arches, palaces, mausoleums and chapels are artistically displayed in a fancy scenery. «The melancholic strain to this image is self-evident, for while it exalts the creative wellspring of Soane's youthful imagination, it also recollects for the aging architect the dashed expectations and unfulfilled splendor associated with these monuments from the past» (Lukacher, 1987) (Fig. 6.3).

Figure 6.3. J. M. Gandy. *Architectural Visions of early Fancy, in the gay morning of youth; and dreams in the evening of life*. 1820. Watercolour on paper. Courtesy of the Trustees of Sir John Soane's Museum, London.

Architectural and natural forms

R. Banham, a renowned architectural critic, wrote about Marion L. Mahony: «Not only was she a highly competent domestic architect in her own right […] but she must surely have been the greatest architectural delineator of her generation, which included mere men like Lutyens and Loos and Wright, whose early reputation depended in part from some of her stunning renderings» (Banham, 1973). Until 1910, Mahony's fame was overshadowed by the outstanding figure of her employer, F. L. Wright; afterwards, when married to W.B. Griffin, it was she who chose to leave all credit to her husband during their partnership as designers.

After having earned a Bachelor of Architecture degree at MIT (the second woman at her time), she became a co-founding member of the so-called Prairie School and during the first decade of the last century, besides producing remarkable drawings, was the leading staff member of Wright office in Oak Park, thanks to her brilliant personality and clever mind. Mahony is now known mainly as an

illustrator, but she was also an innovative designer. To use her own words, «I was told to work out some economical plans for homes. Among the attempts was one which satisfied me as a solution. It was shown to my architect employer and filed for use when the occasion came […]. The scheme was the basis of a number of subsequent houses varying largely in such particulars as number of rooms, type of roof and motif of details» (Pregliasco, 1995). Although highly regarded by her colleagues of the Prairie School for her innovative style, «Wright jealously guarded credit for the designs; sharp reprimands followed any reference to "Miss Mahony's design"» (Van Zanten, 1966).

Her mastery in presentation drawing is now universally recognised, though her authorship remained in doubt for many years due to a number of reasons: firstly the frequent removal of her initials on the sheet margin and the manipulation of her drawings by other illustrators when a compelling publication made it necessary; secondly the words written on Mahony's illustrations by Wright himself, which might have hinted at his own authorship, and lastly the lost of many original images.

In the 60s a large Wright exhibition at the Museum of Modern Art and a simultaneous publication by A. Drexler brought attention also to the illustrators of Wright's designs and to the skills of Marion Mahony. Notably B. Byrne, a key member of the studio and illustrator himself, testified to her outstanding work, making a vital contribution to the vexing problem. According to Byrne's essay in which he amended some statements by Drexler:

> The style of these drawings of Miss Mahony's was determined only in a general way by Mr. Wright, he having in mind, of course, the artistic character evident in Japanese prints. The picture compositions were initiated by Miss Mahony, who had unusually fine compositional and linear ability, with a drawing 'touch' that met with Mr. Wright's highly critical approval. She was the most talented member of Frank Lloyd Wright's staff, and I doubt that the studio, then or later, produced anyone superior […]. Exception might here be taken to the word 'executed' as possibly implying close direction by Wright. There was stimulation, approval, and supplementing accord, but not what one could call close direction. Mr. Wright would occasionally sit at Marion's board and work on her drawings, and I recall one hilarious occasion when his work ruined the drawing. On that occasion Andrew Willatzen, an outspoken member of the staff,

> loudly proclaimed that Marion Mahony was Wright's superior as a draftsman. As a matter of fact, she was. Wright took the statement of her superiority equably. (Byrne, 1963)

Wright and Mahony surely had some beliefs in common, such as the fundamental role of nature in human life, and their admiration for Japanese illustrations. Wright was a competent connoisseur, a collector of Japanese prints and a fervent communicator of this oriental art. He admired Japanese artists for their skill in finding the beauty of nature through aesthetic abstraction.

They can perceive the inner harmony, the accord of form and function by a process of elimination of all that is insignificant; this simplification leads, through simple geometric principles, to the consciousness of the idea, which is ultimately the discovery of beauty (Brooks Pfeiffer B., 1992). The Japanese simplification was a hint and an opportunity also to change the traditional style of drawing. Whereas Wright's early production office consisted of watercolour images, with chiaroscuro and conventional staffage, since 1904 the presentation drawings began to show a refined search for linear graphic forms, thanks to Mahony's mastery.

The different techniques of Mahony and Wright, an illustrator himself when he had worked for Adler & Sullivan studio as a young apprentice, are effectively described by J. Pregliasco: «There are clear differences between Wright's and Mahony's drawing styles. Wright drew with rulers and triangles, Mahony drew freehand. Wright's foliage followed geometric shapes, but Mahony's was naturalistic. Wright favored color pencil on paper; Mahony, ink and color washes on fabric» (Pregliasco, 1995).

Some of her renders had the particular feature of being depicted on fabric, a female attitude in Friedman's opinion: «The inventiveness and exquisite care with which she approached the creation of presentation drawings, some of which were transferred from linen to silk and embellished with ink washes to form a tissue of softly colored layers […] reinforces an alternative sense of the architectural drawing as an object of luxury, like a satin coverlet or a precious ball gown: an object prized for its beauty and sensuous pleasure rather than for its strictly scientific or technical accuracy» (Friedman, 2011, p. 33).

Most elements of her rendering became Mahony's modus operandi throughout her career. The presentation of the building was never commonplace.

It was made to capture the observer's eye. Perspective, architectural elements and nature were melted together to create highly evocative images.

Mahony throughout her life recollected her childhood with her family in Winnetka, a small enclave founded by Unitarians near Chicago, amidst a natural world. Nature always had a central role in her imagery, architectural and natural forms were sympathetically integrated, the former being framed in the foreground and in the background by trees and bushes, often represented in their more detailed features.

> Marion often used trees as a vertical counterpoint to the horizontality of the Prairie homes […]. Plants establish the foreground plane, setting up a tension that pulls the eye to the building […]. Her buildings function as the negative, restful interlude in abundant, dynamic nature […]. One of the finest qualities of Marion's art is the contrast between the free, intricate movement of linework describing the natural world, and the crisp, angular, linework used for the buildings. The landscape is delicately and freely drawn; walls and roofs are indicated in broad, sharp lines.
> (Pregliasco, 1995)

Mahony always chose the best viewpoint for her renders. Many houses on flat sites were given a slight upward perspective to enhance their highness. Houses situated on hills were sometimes spectacularly shown on the top of a narrow and long sheet, rising above the observer and the landscape underneath, the view favorued by Japanese painters.
In some images she privileged a curvilinear graphic line that emphasised the untouched nature, water, leafy trees, and twisting vines, and blended them harmoniously with the portrayal of the building; it is the case, for instance, of the J.G. Melson House drawing (Fig. 6.4).
When Mahony joined her husband's office, the most significant change she brought to the rendering style she had created for Wright was the introduction of plans and sections into the whole composition, which showed in a standard shapely sequence the building perspective dominating the image, then the more technical drawings below.
This composition was not an original idea of Mahony's, for it was a combination usually present in beaux-arts graphic procedures in which she had been trained during her architectural studies (Kruty, 2011).
It was a kind of presentation drawing produced also by a few other illustrators, nevertheless she created masterworks never seen before (Fig. 6.5).

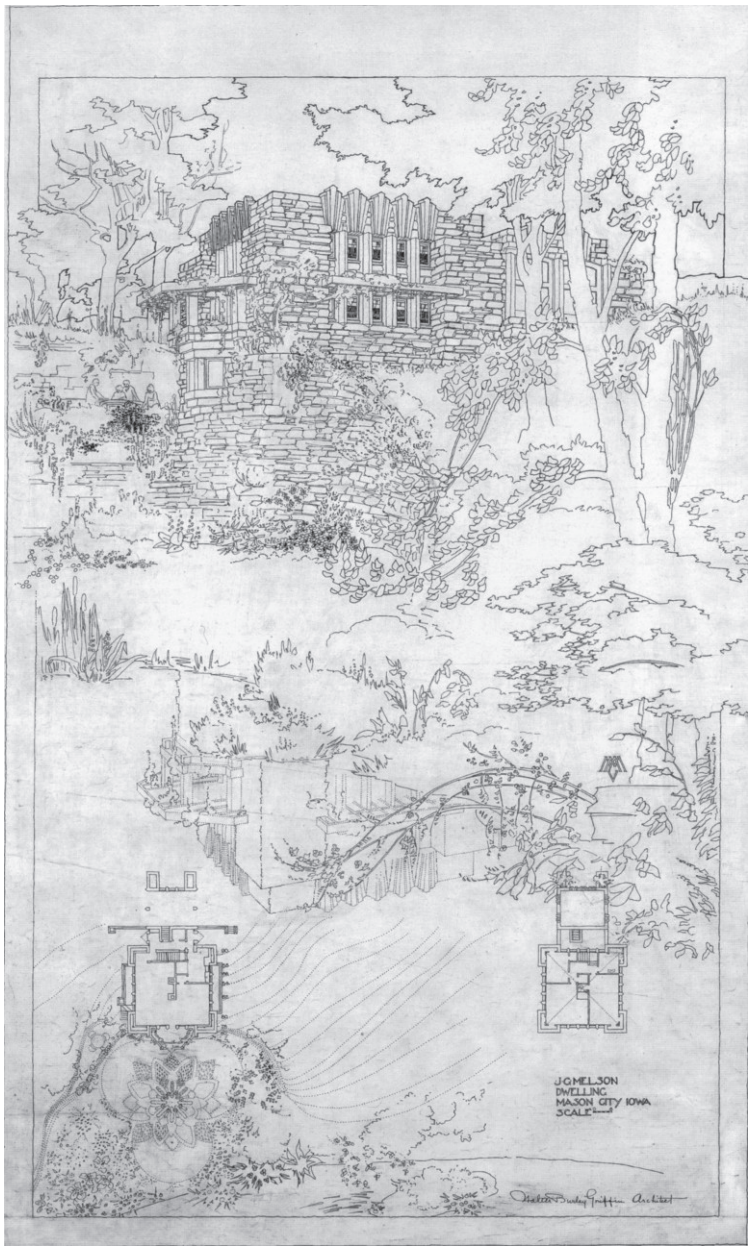

Figure 6.4. M.L. Mahony, Presentation drawing of J. C. Melson House. Mason City, IA. 1912. Griffin's design. Mary and Leigh Block Museum of Art, Northwestern University, Evanston IL. On the right, among the foliage, Mahony's monogram.

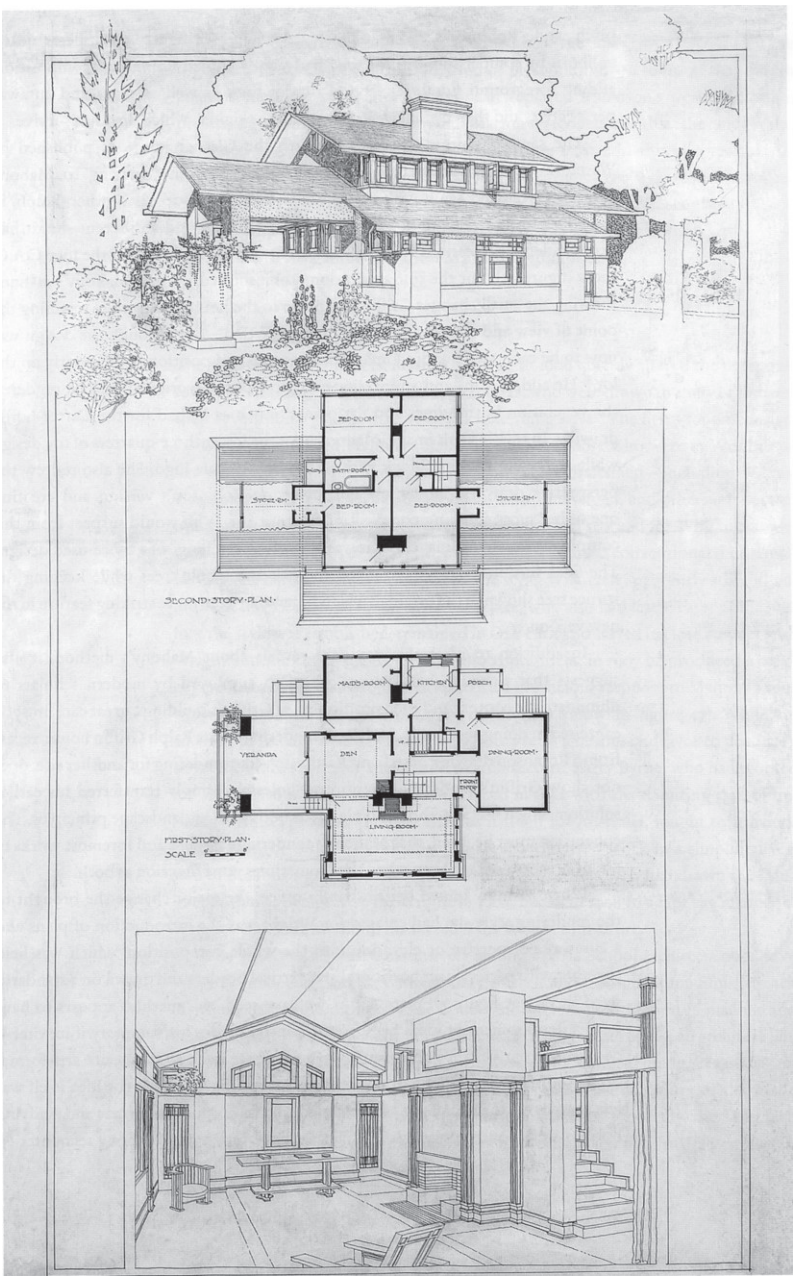

Figure 6.5. M.L. Mahony, Presentation drawing of R. Griffin House. Edwardsville, IL, 1911. Griffin's design. Mary and Leigh Block Museum of Art, Northwestern University, Evanston IL.

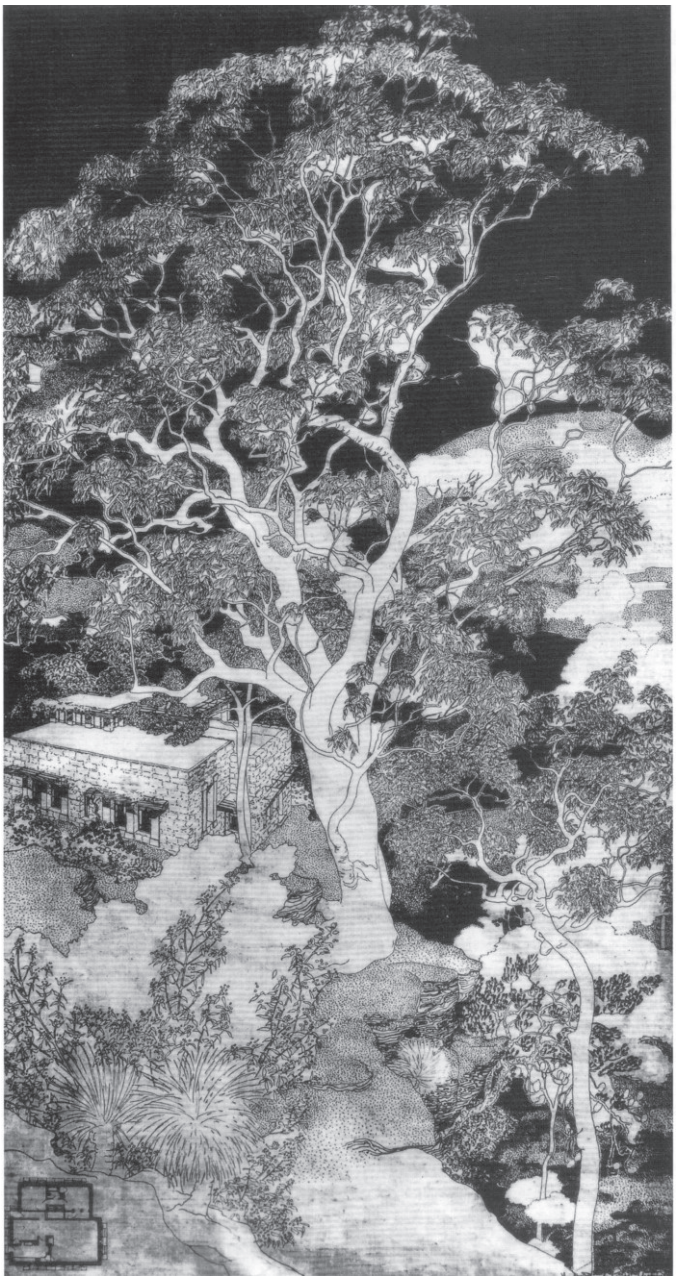

Figure 6.6. M.L. Mahony, *Angophora Lanceolata: A Castlecrag Home in a Castlecrag Gully*. c. 1925. Photographic print. Nicholls Collection, National Library of Australia, Canberra.

When Griffins participated in the competition for the new capital city of Australia, Canberra, Mahony's glamorous presentation drawings had a key role in their unexpected win, out of 137 entrants. «Marion's submission panels were dazzling and compelling. Eight feet wide and up to thirty feet long, the elevations continued across several hinged panels, unfolding like Japanese screens […]. It was so seductive that the judges had small reproductions made so as to not to be swayed by the originals» (Pregliasco, 1995).
The *Town Planning Review*, without mentioning the authorship of Mahony's drawings, wrote: «We have only reproductions of the originals before us, but are struck by the beautiful though somewhat eccentric method of presentment which Mr. Griffin has adopted in his drawings. It is quite possible that the Board of Assessors may have been carried away with the mere charm of this display. We certainly must offer Mr. Griffin our congratulations on his drawings, and his great success» (*Town Planning Review*, London, 1912).
In Australia the Griffins settled for ten years in a stone house previously built for a theatre producer in a place called Castlecrag, near Sidney, which reminded Mahony of the never forgotten American Winnetka. During her stay, she made some stunning images of Australian plants that had struck her imagination. In Fig. 6.6 she depicted her home sheltered by the exotic lush vegetation, with a spectacular outcome. The original, missing, was an ink-on-linen drawing and other versions were printed on silk with a wide range of bold colours to dramatize the view (Kruty, 2011).

American metropolis between utopia and reality

Whereas Mahony's drawings were the glorification of American landscapes, Ferriss had a deep belief in great cities that had become the predominant feature of the United States during the twenties.
Whilst Gandy's pictures conveyed a feeling of distrust towards an architecture that could not represent the greatness of mankind and was inexorably doomed to destruction, Ferriss was the optimistic promoter of a new concept of building which could improve the human dwelling.
Ferriss, who never built, chose to be a freelance delineator and had a successful career having famous architects and advertisers as his clients. He collected part of his thousands of drawings in *The Metropolis of Tomorrow*, which became a well-known book among architects and laymen.

He was persuaded that the rendering was a powerful means of communication. According to him «a truthful drawing was not a literal, visual description, but an interpretation of the architectural significance of a building». One of the chief concerns of the renderer, he asserted, was «to comprehend the nature of the architectural idea which his subject embodies, the trend of thought that the architect has expressed» (Willis, 1986, p. 150). In his book, the visual message of his drawings was developed by the text which encouraged architects to take responsibility for the future urban spaces.

The main occasion to intervene in current debates on modern architecture was offered to Ferriss by the new legislation that imposed restrictions on building's bulk, reacting to the undue development in lower Manhattan of large skyscrapers overwhelming the streets. Initially, there was a strong opposition by the architects to these restrictions, but Ferriss showed that the new legislation was actually a great opportunity: instead of the traditional *box*, setback pyramidal forms could be created around the central tower, surrounded by light and air.

«His dramatic interpretations of tall buildings as abstract sculptural masses impressed contemporaries with the beauty of pure formal expression at a time when historicism still reigned» (Willis, 1987). He was against the conventional triad of main stages usually adopted by architects for towers design: the base, composed of two or three stories in an order of columns or pilasters, then the windowed façade and on top again a row of columns and, to use his words, «a gigantic, expensive and absolutely useless cornice». (Fig. 6.7). In several of his sketches we can discern three main stages but they are detached from traditional standards: «There is the main body of the building which rises sheerly from the ground – the transitional stage in which the mass breaks, recedes and diversifies – and the lofty tower into which it finally resolves» (Ferriss, 1986, p. 32).

No historical decorations were added to those simple forms.

«Whereas another artist might first sketch lines and then shade individual areas, Ferriss usually darkened the general form, and then, working like a sculptor carving from a block, would create highlights and details with an eraser […]. Throughout his career, Ferriss worked almost exclusively in black and white […]. His favorite medium was charcoal or carbon pencil» (Willis, 1986, p. 156). Such a particular technique is indeed like a signature (Fig. 6.8).

Ferriss's evocative, compelling drawings were transforming an American city into a setting for the metropolis of the future. From his rooftop workroom in Manhattan, he could contemplate in admiration and somehow in awe the familiar spectacle of New York skyscrapers.

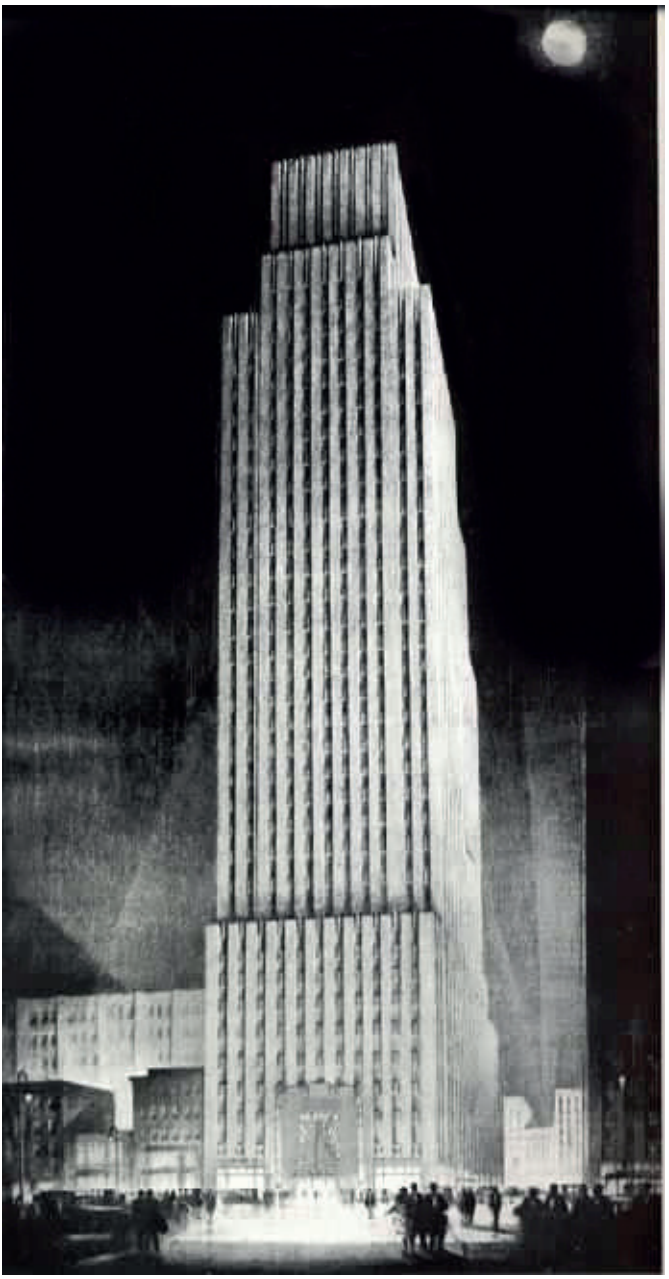

Figure 6.7. H. Ferriss. The Daily News Building. Raymond Hood's design. 1930. Charcoal on paper.

Figure 6.8. H. Ferriss. Woolworth Building. Cass Gilbert's design. c. 1910. Charcoal on paper.

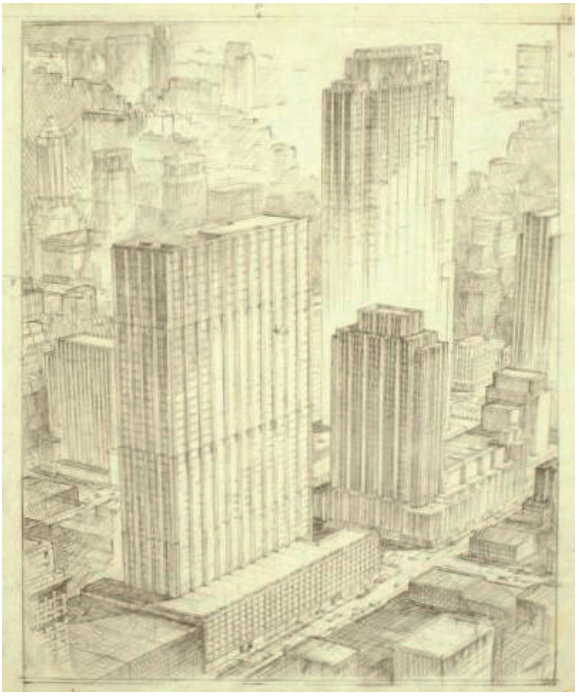

Figure 6.9. H. Ferriss, Rockefeller Center. Bird'eye view. 1906. Charcoal on paper.

The bird's-eye view on these powerful structures, a symbol of the technological age, was for him a source of inspiration as well as a motive for devising new architectural forms and spatial configurations (Fig. 6.9).
In his renders, massive towers are the dominant element in the urban scene.
In a few images little figures are depicted on top terraces leaning out to scan the abyss. It is difficult to guess their feelings, which could be the same described by Ferriss himself when he looked out from his studio early in the morning at *the modern metropolitan drama*. These people probably felt a sensation of littleness in front of a view comparable to a natural impressive landscape or experienced a feeling of loneliness, not so different from the sense of estrangement and isolation which emerges from contemporary Edward Hopper paintings.
Ferris's passionate words describe his concern for the unpredictable consequences of a troubled interaction between people and the built environment:

> there are occasional mornings when, with an early fog not yet dispersed, one finds oneself, on stepping onto the parapet, the spectator of an even more nebulous panorama [...] To an imaginative spectator, it might seem that he is perched in some elevated stage box to witness some gigantic spectacle, some cyclopean drama of forms; and that the curtain has not yet risen […] But a subtle differentiation is beginning to occur below in the monotone gray […] a Metropolis appears […] on a close scrutiny of the streets, certain minute, moving objects can be unmistakably distinguished. The city apparently contains, away down there, human beings! [...] Between the colossal inanimate forms and those mote-like creatures darting in and out among their foundations, there is such a contrast, such discrepancy in scale, that certain questions force their attention on the mind […] The drama which, from this balcony, we have been witnessing is, first and foremost, a human drama. Those vast architectural forms are only a stage set. It is those specks of figures down there below who are, in reality, the principals of the play. But what influences have these actors and this stage reciprocally upon one another? How perfectly or imperfectly have the actors expressed themselves in their constructions, how well have the architects designed the set? And how great is the influence which the architectural background exercises over the actors, and is it a beneficent one?
> (Ferriss, 1986, p.15)

Ferriss often showed interest and concern about the interplay between city buildings and inhabitants, an unusual topic at the time, that would be considered of paramount importance only in later times: «The character of the architectural forms and spaces which all people habitually encounter are powerful agencies in determining the nature of their thoughts, their emotions and their actions, however unconscious of this they may be» (Ferriss, 1986, p.16).
Ferriss «belongs to that group of architects who, although they chose to draw rather than to build, influenced the history of architecture through the force of their ideas as well as through their mastery of technique. Like Piranesi, Boullée, or Sant'Elia, Ferriss created a body of work as compelling as any built oeuvre. Great drawing must also have a historical dimension.
As with Piranesi's polemic of the superiority of Roman architecture, Boullée formal challenge to contemporary classicism or Sant'Elia's Futurist celebration

of speed and technology, Ferriss's drawings of the 1920s portray a historical moment filtered through one artist's vision» (Willis, 1987).

The atmosphere of urban spaces

The architect Helmut Jacoby, well-known mainly as an illustrator, produced his presentation drawings for famous American and British studios. His deceptively simple renders were a refined interpretation of the proposed building and its surroundings. Architecture and people were brought to life by his creative and poetic skills. More than colours he used line, a key element that became his distinctive feature. This line, while defining the buildings with technical accuracy, assumes a curvy shape in sketching figures and a sinuous rhythm in delineating trees and plants. Jacoby's characters, who populate interior and external spaces acting in everyday situations, are essential items to display, for instance, the living atmosphere of a supermarket at rush hour or a busy street in the city centre. Even in the most *crowded* drawings, as in Fig. 6.10, there is always perfect harmony in each and every detail, and the onlooker can at a glance detect the elements of special interest. D. Walker, the designer of Milton Keynes and one of his appraising employers, claims:

> He is at his happiest designing the drawing in close collaboration with the designer. His methods make for correct decisions; size is dependent on purpose, reproduction or exhibition, but always is aim is to show a projected building exactly as it will look when it is built. […] I wanted to use Jacobi's drawings for […] his professionalism, embracing time scale and quality. His skill as communicator, particularly to a lay audience […], his love of detail manifest in the delight he takes in placing a modern building in old surroundings, his technical proficiency […] in thinking and drawing through angles and viewpoints of widely individual schemes. Jacobi's drawings provide many of us with a measuring device which has often changed the detail design of a project, and working with him has invariably led to reappraisals of detailed arrangement and organization because his drawings are so correct. […] It seemed to me essential to have a fellow professional involved totally from the start of the design period who would assimilate the conceptual

> objectives and would give a visual consistency to the various design aspirations […]. The prime purpose was to indicate to an almost unknown client body, the new citizens of Milton Keynes, the reality of the concept. The drawings would provide a consistent and understandable base on which to measure their own thoughts of what housing, recreation, industry or landscape would be like (Jacoby, Walker, 1977).

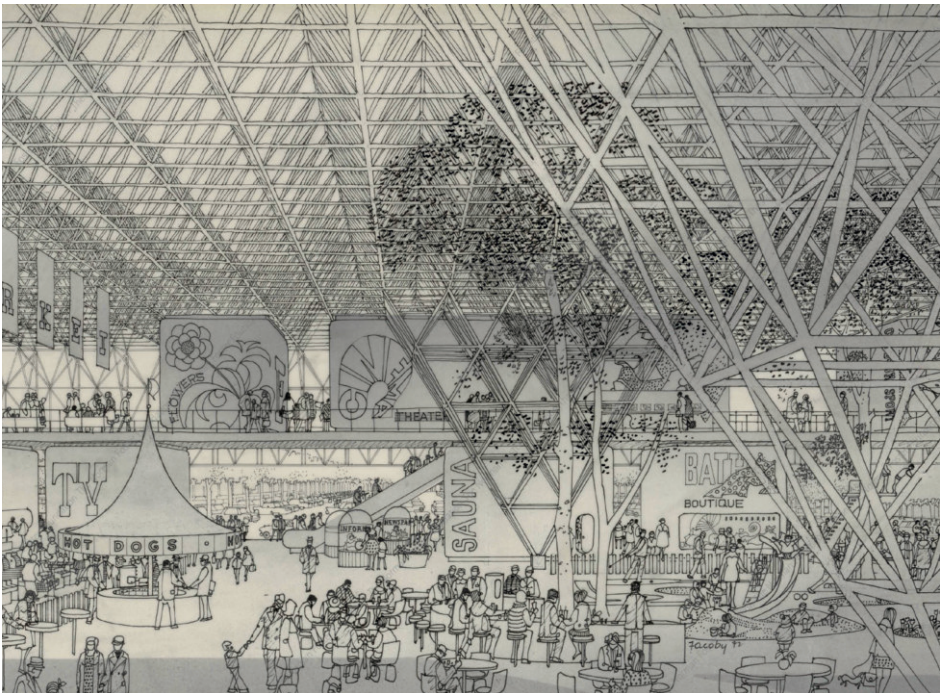

Figure 6.10. Helmut Jacoby, Knosley Park, hypermarket, Liverpool. Interior perspective (detail). N. Foster's design. 1972. Ink on paperboard. Norman Foster Foundation, Madrid.

Jacoby's images, so easy to understand for laymen, yet so sophisticated in their blend of technical detail and seductive atmosphere, have been investigated by architects, illustrators and scholars to capture their inner essence. As W. Durth asserts:

> At first Jacoby schooled himself in perspectives with a single vanishing point, developing out of a section a forceful sense of depth without distorting the drawing, at the same time managing to imbue the suggestion of space with a hard objectivity […] Jacoby's style, often copied and in the interim elevated to virtually "classical" status, soon began to evolve: exact geometric constructions overlaid by a layer of almost palpable material qualities, and penetrated by groups of people of which the onlooker almost naturally feels to be part thanks to the choice of eye level used in the perspectives, even when- or precisely because- the viewer remains a guest on the margin of the view into the world of blithe imagination (Durth, 1987).

Jacoby completely rejects those images which, owing to their seductive and indefinite appearance, charm his colleagues and intrigue even expert judges in competitions, however giving rise to the unease of builders and investors who want to see how the project they are in charge of and pay for actually looks. To use Jacoby's words, «a quick sketch is automatically dangerous to them, for it always looks good due to the fact that it doesn't show anything. Many architects have a preference for everything that's vague and yet manages to look pretty. That enables them to inject their thoughts and imagination into it. I do a precise drawing, though, you can't read anything else into it» (Durth, 1987).
Before beginning an illustration of a future building, he finds it necessary to identify the actual needs of the onlookers. «To a critical public, for example, he will present a proposal as detailed as possible, emphasizing the building's integration into its surroundings; the drawing for potential investors, on the other hand, will play up the volume of the project» (Durth, 1987). Without using any traditional trick, he delineates the architect's design, stressing the manifold aspects of the new building through the use of different points of view. To use Jacoby's words again, «I keep my distance. I don't create any distortions at the top, I just construct and show what I see. But if I were to stand next to a tall tree, the tree would seem much larger than the building: in reality, of course, that wouldn't take anything away from the size of the building» (Durth, 1987).
Jacoby's drawing for the headquarters of the Dresdner Bank in Frankfurt is a clear example of his refined (and somehow shrewd) technique. The competition had been preceded by residential protests and violent debates about speculation and urban destruction in the target area.

He pictures the projected skyscraper with its bright façade which stands out against the grey-black ground of the sky and seems to protect the old building on the right. The Schiller monument with its high pedestal reduces the high-rise structure behind it to less threatening proportions. Enormous leafy trees charmingly detailed mediate between the two parts of the drawing, creating a pleasant atmosphere where pedestrians feel comfortable (Fig. 6.11).

Fig. 6.11. H. Jacoby, Dresdner Bank Administration Headquarters, Frankfurt am Main. Becker & Becker's design. Crayon on tracing paper. 1975.

In delineating urban spaces or landscapes, Jacoby creates unique views where buildings, lavish vegetation and figures are merged together in perfect harmony. The mirror effects, so often masterfully used, concur to lead the observer's eye through secret spaces in and out of the buildings. To use his words once again: «That's always the wonderful thing about a mirror: a mirror is something very cold, but when something warm is reflected in it, then it's not a mirror anymore» (Durth, 1987).

When he depicts vegetation, a subject never absent from his external perspectives, Jacoby's attention to detail reminds us of the Japanese – and the Mahony's – drawings. His love for nature becomes a source of dreams, without however concealing any features of the project (Fig. 6.12).

«His deceptively simple style attracted copyists of all shapes and sizes but the quality an ease of his draughtsmanship was never captured by others and the genuine Jacoby remained unique» (Jacoby, Walker, 1977).

Fig. 6. 12. H. Jacoby, Country Offices Vestby, Norway. N. Foster's design, unbuilt. Crayon on tracing paper. 1974. Norman Foster Foundation Archive, Madrid.

Visual communication

Aims of the graphic messages

Since prehistoric times, information and ideas have been transmitted among humans by means of visual elements. Long before the use of graphic elements to symbolise spoken words, images were the only means to communicate without the presence of the speaker. And this sort of communication comprised not only news or facts of the day, but history, ideas, memories, desires.

The visual message is universal and innate. The biology of the visual system does not need education to interpret what is seen in an image. Until very recently in the history of humans, the only visual elements that could be produced were bidimensional crafts with signs or paint on a flat surface, tridimensional sculptures, or a mixture of the two, i.e. the bas-relief. Either way, the creation of the artificial image was by the hand of man. With the invention of engraving methods images started to be transferred on paper by machinery, but still the plate had to be prepared by hand.

With the invention of photography and later of television and digital imaging techniques, the visual reality could be captured, processed, memorised and shown in a fully automatic process, apparently with no human intervention. So, we went from a world of images which are exclusively the product of the brain, to a world that is borne by a machine. The former represents reality filtered by consciousness, or sometimes the author's consciousness itself. The latter is usually considered a representation of reality as it is, without processing.

Of course, photography and digital reproduction can be guided and bear the human factor, but their general purpose is to give the illusion of something that is real. So there is a choice between two opposites: the human or the machine generated image. The decisional process of a competent choice in favour of the former or the latter as a communication means depends on their intrinsic features and on the endpoint of the project.

Images can be analyzed through many viewpoints; P.M. Lester proposes six major perspectives: Personal, Historical, Technical, Ethical, Cultural, and Critical, which he applies to «all the media through which we see: Typography, Graphic Design, Informational graphics, Cartoons, Photography, Motion Pictures, Television and Video, Computers» (Lester, 1995).

The list could be much longer, but it is of paramount importance that the observer is capable of understanding the meaning of what he/she sees. What can be grasped at first sight, may hide further content, perhaps to be unveiled by only a few privileged persons. Although it is usually understood that visual analysis takes place at a conscious level, nevertheless, unconscious brain processes may be triggered and heavily contribute to the final decision.

The unconscious process underlies the personal perspective, the «gut reaction to the work based upon subjective opinions» (Lester, 1995), which eventually may be thought of as the determining factor for the behaviour of the observer. If possible, evidence from instrumental analysis of biological parameters should be used to assess the unconscious elicited reactions, as these could be strongly influenced by a critical process of the observer when responding, for example, to surveys (Leandri et al., 2022). This could lead to an erroneous evaluation of the consequent behaviour, which might, in the end, be more influenced by the unconscious messages, thus deviating from the survey result. In the field of marketing this would have important consequences.

An interesting analysis of this issue has been conducted by using an eye tracking instrument on subjects looking for a few seconds at Facebook pages. Results compatible with positive moods have been recorded in images containing human faces, whereas negative moods characterised the vision of written announcements or graphs (Šola et al., 2022). The elements of visual language have been analysed by considering their specific significance for communicative purposes. In particular typefaces, their position in space and their visibility when the visual language contains written words; the features of the drawing, from artistic to technical components; the form and meaning of a graphic sign to convey messages (Falcidieno, 2009).

A simplified visualisation for a general audience

Visual messages addressed to a general audience are purposely made as clear as possible to be understood by all without uncertainties. From road signs to descriptive posters the intent of the designer is to use simplified forms that can be perceived by the viewer very quickly, even when he/she is driving a car or is in a hurry. To clarify means to know the graphic methods which sustain a visual message and to use them in the most effective way (Falcidieno, 2009; Fatta, 2020a). An example is the currently used map of the London underground. In the first three decades of the last century, the maps of the London underground had been drawn geographically, like city maps, maintaining the real proportions. But the information they conveyed was difficult to read and confusing. In 1933 Henry Beck drew a new map, inspired by the way electric diagrams are drawn, using colours and geometrical settings, with 90° and 45° angles to provide a sense of order and clarity (Martin, 2013) (Fig. 7.1). The map has been in use since then, and it is one of the symbols of London. Although the author was not given the proper credit at the time, his creation was a huge success. It was not only a smart solution for reducing a very extensive transport facility in a pocket map but also, because its reading was so easy, it was and is a psychologically reassuring item for the million users that every day find their way thanks to it.

Figure 7.1. The original tube map of London by Henry Beck.

When it is necessary to convey quick messages to an audience attending events or visiting public places, communication through visuals is effective and quickly understood. One of the most currently used forms is represented by pictograms, i.e. graphic symbols representing real objects, people, or situations in extremely simplified forms, constituted by definite geometrical elements and disposition. One example of such a method of conveying messages is given by the tables of directions provided for the benefit of visitors to the National Park Service of the USA (Fig. 7.2).

Figure 7.2. Set of pictograms for the National Park Service, USA.

The corporate identity

Each company needs to be recognised at a glance as a definite entity. It is the corporate identity, the *self* of the company that is symbolized by the trademark. Trademark design is also a demanding task, because it has to be easily noticeable from any background and to be imprinted in the public memory as long as possible, so that everyone, with no need to read words, will know that a given product or craft comes from that given company. One of the most iconic marks is the one by Apple Inc. Technology Company. It started with a graphically pretentious and detailed logo, then was much simplified until it reached today's version. The path went from a detailed realistic image of Newton's discovery accompanied by a brief text to justify the company's name, to a much simplified and less informative image, but much more efficient in recognizability and memorisation. Looking at the evolution, it is clear how the simpler icons are much better and more immediate identifiers of the company than the first one, though the Newton reference is now lost (Fig. 7.3).

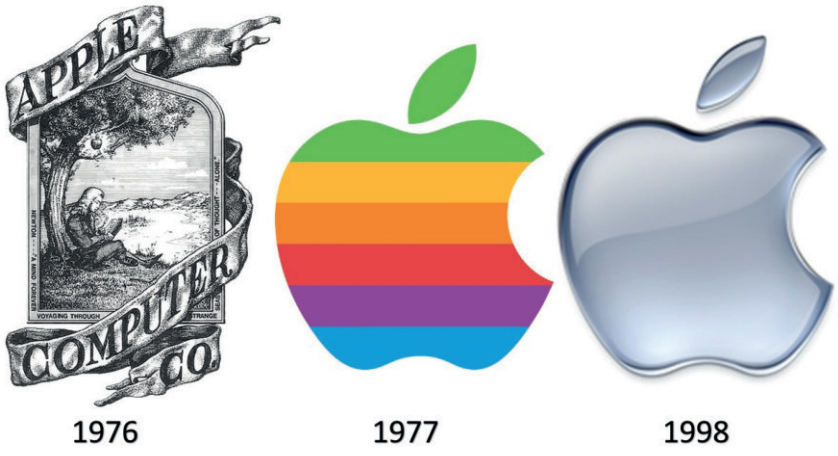

Figure 7.3. The evolution of the Apple logo (R. Wayne, R. Jamoff, Apple.com. Trademark).

The schools or companies of design and architecture, often identify themselves with an evocative graphic symbol. One renowned example is the icon of the Bauhaus school, which is simultaneously the product and the summary of a very peculiar and innovative approach. The Bauhaus movement fostered a strictly geometric, clean and abstract style of lines, and plain and striking colours, with no historical reference, and no emotional attitude. It was an industrial driven design, mainly tuned towards the creation of art products, from houses to everyday objects, which could contribute to the fulfilment of the individual.
The *logo* itself is a manifest of the Bauhaus theories. The face on a side view, reduced to essential straight lines and few geometrical spaces summarises some design principles of the school (Fig. 7.4).

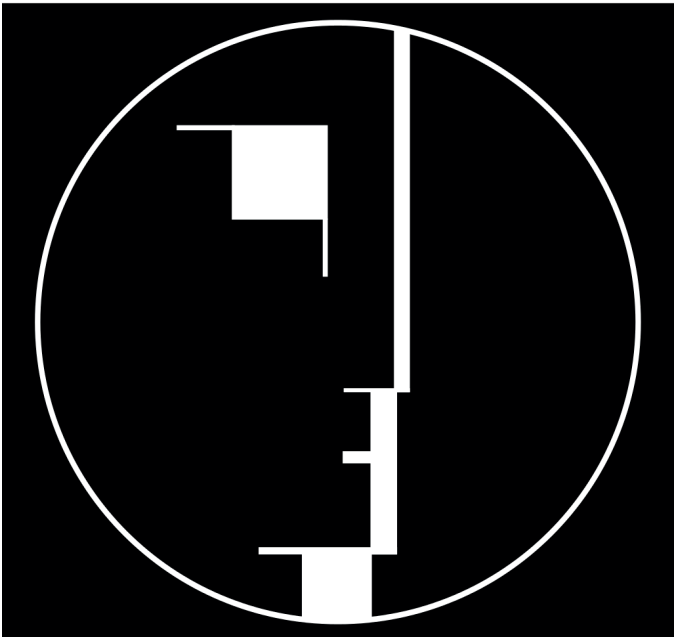

Figure 7.4. Oskar Schlemmer, Signet of the Staatliche Bauhaus, 1922.

The corporate identity is an extremely important matter in the architectural world, but here the objective company's signature should be sought in the recognisable style of the produced drawings.

This objective is much more subtle and difficult to attain that the printing of a trademark on an industrial product. Also, the notion of recognizability is in some antagonism with the current trend of photorealistic renders and CAD drawings. Later in this book (chapter 8), the recognizability of a style will be the object of a simple test, and it will be demonstrated that it is lacking in computer generated works while, instead, it is well represented in handmade drawings.

Advertising

The creative imagery of advertising started at the beginning of the last century as a special branch of the Art Déco and acquired increasing significance after the first world war, due to widespread industrialization, becoming of paramount importance starting from the 50s. This kind of graphic communication conveyed messages to people, initially through printed paper and afterwards through the new mass media. Now it is a pervasive form of information, which sometimes can take the unsettling appearance of mental conditioning.

Its principal aim is to lead people to accept an object, an attitude, or even a method of life as essential to their welfare. The main purpose is to direct the audience to purchase the so-called consumer goods.

Another category of goals is encouragement or, on the contrary, deprecation of behaviours: campaigns for vaccination or against pollution, and for political preferences are just some emblematic cases.

Whatever the particular aim, the general purpose is to convince people to do or not to do something. In a highly competitive context designers have been asked to produce visual messages which strike the observer's eye and direct the choices of a potential customer. For instance, they can help promote a commercial product, or an upcoming movie, a place for a holiday and a means of transport for a journey.

Designers involved in advertising production used different methods and techniques to catch the attention of the beholder and to make people remember a brand, as shown in the sample illustrations reported here. Marcello Dudovich's initially created his posters in Déco style, but over time underwent a simplification of ornaments to highlight the advertised product.

The representation of a woman was a feature of his imagery: always refined and elegant she was depicted with fashionable clothes, in attitudes that denoted her emancipation and interest in a freer kind of life (Fig. 7.5).

Figure 7.5. M. Dudovich, Poster advertising a new model of FIAT *La nuova Balilla per tutti*. Colour lithographic print on paper. 1934. Courtesy of Fondazione Massimo e Sonia Cirulli. San Lazzaro di Savena, Bologna.

A.M. Cassandre's advertising illustrations, influenced by Cubism and industrial design, were characterised by geometric volumes which transmitted a feeling of power. He maintained that the poster is a tool of communication between seller and purchaser and the designer has the task of transmitting a message without expressing his/her opinion. Cassandre tutored Raymond Savignac who chose a completely different style. His posters were witty, and optimistic, with light-hearted images full of poetry.

Scientific communication

Scientific imagery relies on the enormous array of facilities offered by modern technology. From graphics summarizing data to visualisation of infinitesimally small particles, scientists converse with one other through highly automated and technical imagery. Such images are not meant for the general public, who would not understand them. But scientific knowledge should be grasped by everyone in its essentials; it needs not to be complicated, and most of it can actually be reduced to very simple statements and drawings. The process of extracting a few elementary statements from a riddle of data is not an easy one, but it should be done for the benefit not only of the less educated but also of scientists themselves. A saying attributed to Einstein goes: «You do not really understand something unless you can explain it to your grandmother». There are several sayings of such a trend allegedly proffered by famous scientists, all of them reputing the process of simplification as being indispensable for a full comprehension of the laws of nature or of rational thinking. One may add: «if you can't draw it you didn't understand it and you don't know it». So, the task of the scientific illustrator is a difficult one. The words describing a phenomenon may be vague, but the lines composing a delineative drawing are not allowed to be so. A clear example of the simplification of complex theories and experiments is given in illustrations about the models of the atom (Fig. 7.6).

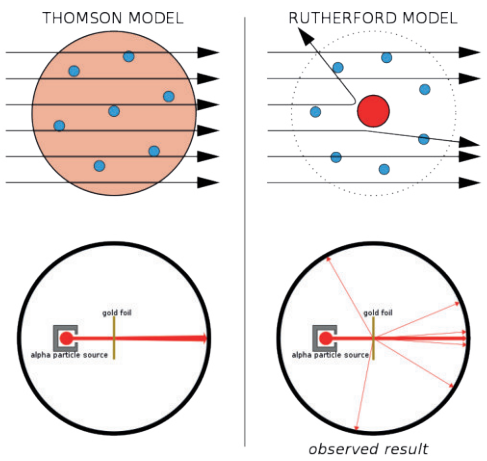

Figure 7.6. Geiger-Marsden experiment on models of the atom.

Scientific magazines, such as Science and Nature, publish illustrations for a wide range of subjects. Here is a cartoon authored by Nigel Sussman, describing in a witty and humoristic style the activity that maintains cell homeostasis, to which various organelles contribute, like workers in a multifunctional factory (Fig. 7.7), published as an illustration for a special issue of Science.

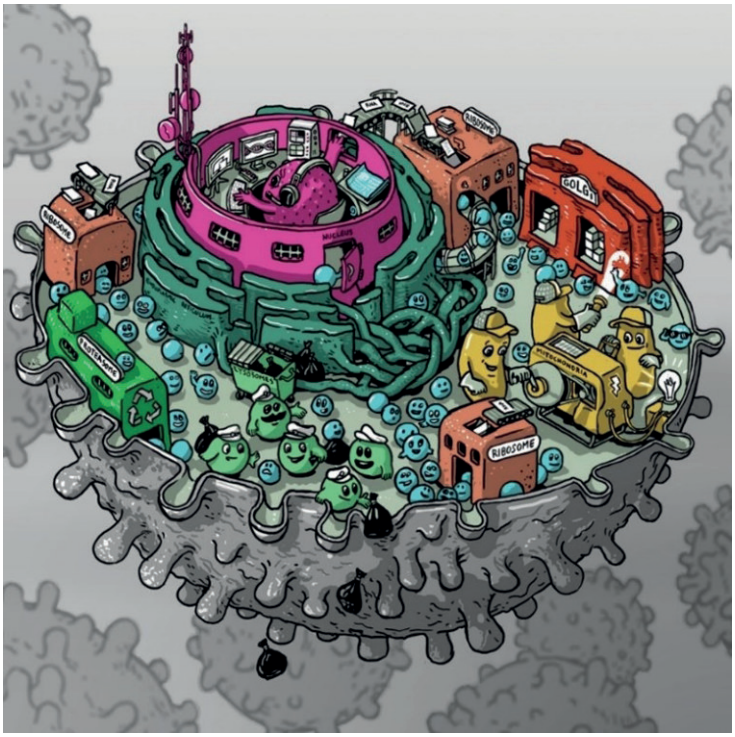

Figure 7.7. Quality control in the cell, by N. Sussman. Science, 15, 366, 6467, Nov. 2019.

Educational illustrations in the field of health sciences are important for prevention, health and hygiene campaigns. With the Covid-19 SARS pandemic, there has been a multitude of such visual messages. The Johns Hopkins School of Medicine has a special Department of Art applied to Medicine which promotes courses for professional illustrators in various fields of health sciences. Here is a poster, about what to do when returning home from possibly contaminated areas (Fig. 7.8).

Figure 7.8. Poster for decontamination procedures. Johns Hopkins School of Medicine. Department of Art applied to Medicine. Baltimore, MD.

The universal effectiveness of visual communication in science is attested by the choice of NASA to create their well-known interstellar message. (Fig. 7.9). They chose to send a vignette describing humans and the known (to us) fundamental laws of nature to some possible alien intelligence in the space probes Pioneer 10 and Pioneer 11. The probes were launched in 1972 and 1973 as the first human made objects intended to ride an interstellar journey outside the Solar system. The plaque design was etched into a gold anodized aluminium plate. It carries information about humans, their aspects, on which planet of the solar system they live, and the situation of the solar system (Falcidieno, 2009). As universal units for time and space, there is a schematic figure of the hyperfine transition of the neutral atomic hydrogen, the most commonly found element in the Universe. The silhouette of the probe is reported as a further spatial unit for the human figures. The message is for the future, and interstellar coordinates are provided in case the solar system might no longer be existent.

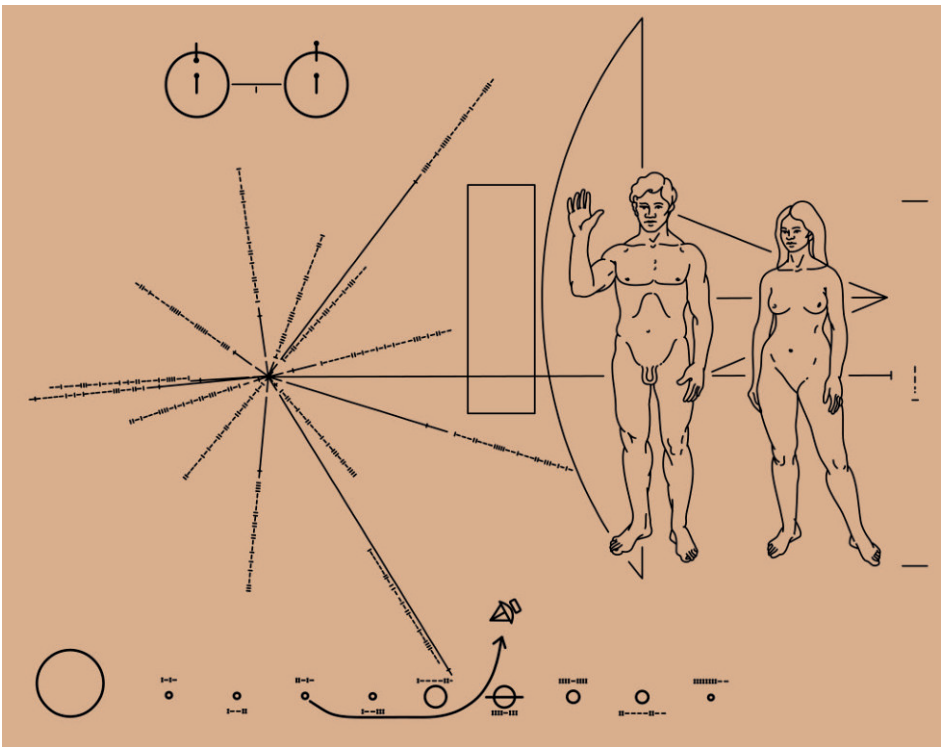

Figure 7.9. NASA. The interstellar message.

Sense and perception of vision

The processing of visual information

Of the classic Aristotelian five senses, vision is perhaps the most comprehensive, as it allows our brain to perceive an extremely large amount of information in a fraction of a second. A verbal description of a scene would take a long stream of words, a long time and would anyhow still be incomplete. To fully understand the importance and complexity of a visual message, it is paramount to be aware of its biological bases. This starts from the retina, where the light is converted into electrical impulses by no less than 100 million photoreceptors (Masland R.H., 2012); then through the visual pathway, the information is conveyed to the brain's visual cortex, situated at the back of the brain, in the occipital lobe.

Approximately at the centre of this lobe is the *primary* visual area, where the nervous afferents from the retina, after one intermediate relay, connect for the first time with cortical neurons, taking approximately 50 ms for this part of the journey. The latter are spatially arranged in a faithful map of the retina, called *retinotopy*. This part of the visual system is devoted to analysing some physical constituents of the image, called *visual primitives* (contrast, line orientation, brightness, colour, movement and depth) (Gilbert, 2013), which are essential to recognise objects. It is at this stage that most of the image characteristics aimed at social communication play their role. For example, definite angles of line orientation are better identified by cortical neurons. Drawing lines at such angles may catch the eye of the drawer, even unconsciously, who will use them more often than other lines.

The observer's eye will also be caught by the same lines, and the object will stand up from the background, with little apparent reason.

There are several such hidden hallmarks that a handmade drawing might include unknowingly to the drawer and beholder, but that will make the end product more communicative. Other cortical areas receive visual information for further analysis and comprehension, for example, recognition of faces and complex objects. It is hypothesized that such more subtle analysis is based on details of the image that are interpreted at a further level of cortical processing (Ullman et al., 2002). This could be another feature that easily escapes the conscious acts of drawing and observation, but that nevertheless plays an important role in visual communication. It is easy to imagine that the introduction by the author of visual elements fitting the observer's visual perception may best be performed by a human hand, which could behave as an instinctive independent crafter, i.e. the *thinking hand* mentioned by Pallasmaa (Pallasmaa, 2009), rather than by a computer which automatically creates a simulation. A summary of this first set of brain mechanisms is illustrated in Fig. 8.1.

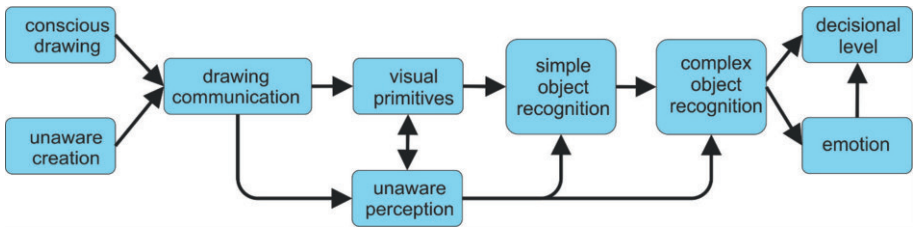

Figure 8.1. Processing of the visual information taking to decisional level.

Another reason for the better performances by *professionals* and *others* when visualising manual drawings may reside in the amount of visual *noise* (Fig. 8.2). In communication theory, the object of communication, or the *signal* should stand out as much as possible from the background. If there are elements other than the signal present in the visual message, they are called *noise*: something unwanted, that disturbs the perception of the signal because it creates an interference, changing the meaning of the message (McLean, 2005). It is easy to imagine that in the handmade image the author has to choose which features to draw from his/her design, thus filtering out the unnecessary details (the *noise*) and conveying to the visual message just the essentials, or the *signal*.

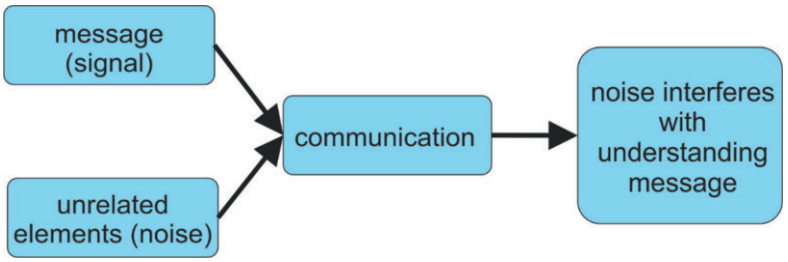

Figure 8.2. In communication, unrelated elements (noise) are transmitted alongside the correct message (signal). When communication is received noise interferes with the message and impairs its understanding.

The holistic brain

Finally, the human hand may insert into its visual creation some properties peculiar to the whole image, unknown to the mechanistic process performed by the computer (Fig. 8.3). Properties of the whole have been theorised and studied by the *Gestalt* psychology most of all in the analysis of the images (Arnheim, 1974). The single components of an image do not possess properties that can only be found in the perceived whole. Our brain, according to Gestaltists, processes visual perceptions by grouping constituents following preset principles, such as, for example, reification, proximity, similarity, continuation, closure, closeness and insularity (Wagemans et al., 2012). Some graphical specimens are shown in Figg. 8.4 and 8.5. Such properties of the whole, or holistic properties, are thought to have a perceptual dominance attracting the observer's attention even without conscious perception (Wagemans et al., 2012). Although the basics of such theories were borne in an era by the dawn of experimental neurophysiology and could not be substantiated by scientific evidence, it is now recognised that the brain structure is provided with functional features underlying those principles. So called *Gestalt* neurons have been found, for example, in the temporal lobe, responding to holistic characteristics of images while being insensitive to details (Spillmann and Ehrenstein, 1996). It is obvious that such holistic properties can be present in hand drawn images as the author is subject to the same *Gestalt* laws as the observer, but a machine made image will much more likely to be devoid of them.

To sum up, there are several functional factors based on identified brain mechanisms underlying visual perception that may explain why the hand drawn images have transmitted, at least in the presented tests, the author's message better than the digital photographic renders.

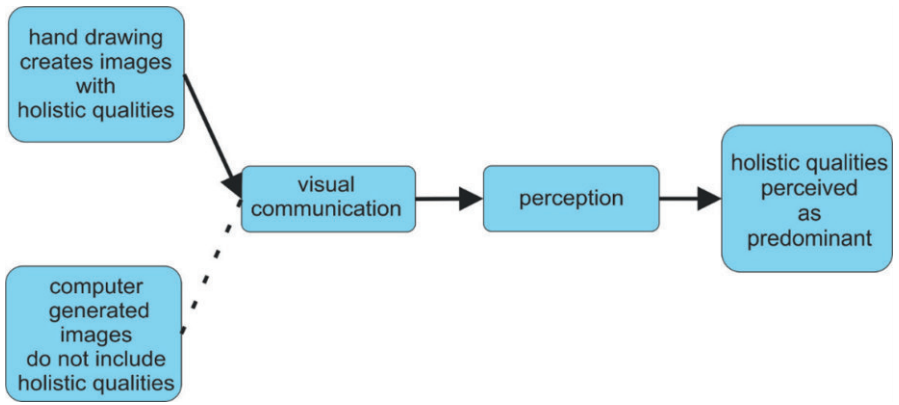

Figure 8.3. Holistic qualities are dominant in visual perception. Characteristics of single components may be disattended. Hand drawings are more likely to be permeated with holistic qualities.

Handcrafted representation is thought to be aesthetically more pleasant and meaningful than photographic render (Richards, 2013), and the results of our web survey support its superiority in communication too. Neuroscience provides some definite clues as to the involved mechanisms. Broadly speaking, these could be of three types. Firstly, the brain functions leading to a handmade drawing are the same that are used by onlookers to gaze at the drawing and evaluate it. Secondly, such mechanisms may not reach the conscious level either on the part of the drawer or on the part of the observer. Thirdly, the communicative property of the image is probably stronger if it happens at a subconscious rather than at conscious level.

Summing up, the properties of handcrafted images should be taken into due account both at educational and professional levels, so that they can be used with proficiency alongside the photographic renders.

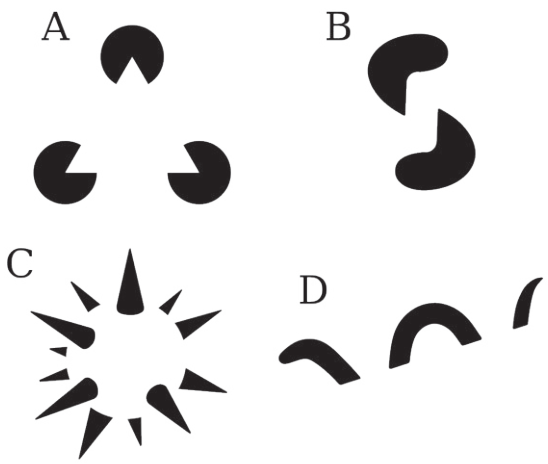

Figure 8.4. Examples of the reification holistic quality. The eye constructs an object that is actually not represented in the figure. A triangle is perceived in picture A, though no triangle is there. In pictures B and D the eye recognizes disparate shapes as belonging to a single shape, in C a complete three-dimensional shape is seen, where in actual fact no such thing is drawn.

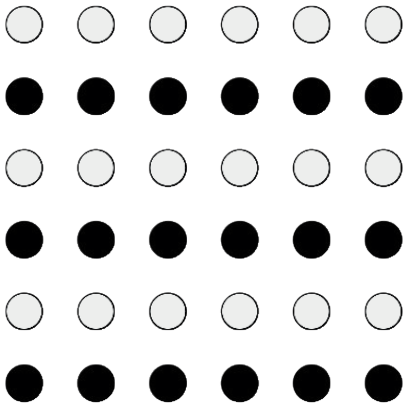

Figure 8.5. An example of the similarity principle. In this depiction, 18 of the circles are shaded dark, and 18 of the circles are shaded light. We perceive the dark and the light circles as grouped, forming six horizontal lines within the square of circles. This perception of lines is due to the law of similarity.

Test on architectural imagery

Visualisation - The eye of the observer

The relationship between the observer and the object of observation is quite straightforward: the observer's eye catches the visual stimuli which are processed by the brain as visual perception so that the meaning of the image can be extracted and lead to a proper reaction, either physical or mental. No other sense can convey the amount of information transmitted by sight, so it is obvious that since very ancient times drawn images have been used to communicate messages that could be understood at a glance, whatever their complexity.

Of course, drawn images could also be used to transmit untruthful messages. Because of their very nature, such deceitful images were more likely to be trusted than any other form of misinformation. So, images have sometimes been considered a misleading means of communication. Such mistrust, which often led to an open refusal of imagery meant to transmit relevant information, has ancient roots.

In western and middle eastern religions only the word had a sacred significance. Also in Greek culture antagonism towards images appeared among the philosophers' teachings. In the *Republic* Plato disregarded painters as magicians and imitators. Images, easy sources of leisure, could draw people away from sacred writings or cultural discourses. Furthermore, there was steadfast wariness about images as fake representations of nature: they pretended to be something different from reality and were regarded as imitations of appearance instead of truth (Stephens, 1998, p. 60). But there have been also those who thought that images had some positive role. An unexpected supporter of this favourable trend was the Catholic Church.

In 599 Pope Gregory First wrote: «We do no harm in wishing to show the invisible by means of the visible». In the thirteenth century, Thomas Aquinas defended the usefulness of images: they are easily accessible to illiterate people who might learn from depictions as if from a book. Besides, images can arise emotions that are more effectively elicited by things seen than by things heard (Stephens, 1998, p. 61).

From the Renaissance onwards *explaining by drawings* was considered a reliable tool of communication by scientists who found images the necessary complement to their writings, for instance, in botany, anatomy, geography, and astronomy. Also, architects used two-dimensional technical drawings in the design process. From an operational point of view, this kind of image was never questioned as it conveyed information more quickly, effectively and comprehensively than many words. Perspectival or three dimensional drawings instead were often criticized as constructed for the purpose to show as existent something that was not. In the best of cases, they were considered ambiguous. If we can learn to read words, usually we are not trained to read images and extrapolate their meaning. In this case, we must refer to mental models dwelling in our mind as the fruit of our experience and «we make sense by comparing the reality before us with the mental abstractions we store in memory […]. The human brain's ability to quickly process new information is based on prior knowledge stored in mental categories» (Reaves, 2005).

In general, architectural imagery based on perspective representation has been used to direct the onlooker's attention towards the aesthetical and emotive characteristics of the building (Fatta, 2020b). Of course, the temptation to enhance the beauty and agreeability of the architect's product is not irrelevant and may sometimes have led to overexploit the many possibilities offered by pen, brush and colours. With the invention and development of means apt to create and distribute images, the printing process first, then, centuries later, photography and eventually digitalization, representations imitating reality have been widely accepted. More than that, they are currently required by many boards in architectural competitions. In a world where fiction has pervaded so many sides of everyday's life, the realistic images generated by digital technology have been considered the ideal solution to create effectual representations and facilitate the observer's understanding.

In university courses, students are taught to use CADs and virtual reality applications. They learn to appreciate the speed, ease of use, precision and stunning special effects, but they are walking a path which may lead to addiction and

impair fantasy (Guney, 2015). The representation of a project, a building or a townscape, needs realism but still has to convey the spirit of the designer and to this end, too detailed visualisations may not be agreeable (Farey and Edwards, 1949). This point of view has prompted some authors to avoid the excessive, cold realism of photographic renders in favour of handmade artwork (Richards, 2013).

As much as perception is one's notion of reality formed through the biological channels of the body (Arnheim, 1998), so the drawing is a representation materialised through the work of the hands, the final product of an embodied experience (Pallasmaa, 2009). In modern design, digitally made 3D renderings of photographic quality are extremely popular and easy to make.

Most authors praise such products also on grounds of creativity because various solutions can be simulated and tested in just a few moments (Khan, 2018; Ivarsson, 2010; Lawson, 1997). But the asserted creativity only lies inside the application world created by developers; it is a limited creativity, an oxymoron in itself, against which several warnings have been issued (Bernath, 2007; Lawson, 1997). We are now in an age where handcrafted representation is often considered outdated and uselessly time-consuming, whilst the virtual reality is easy to produce and perceived as authentic as a postcard (Jacob, 2017).

Little thought is given to the fact that postcards and creativity do not have much in coomon. But postcards also have other drawbacks. Can they be considered reliable language, can they convey the author's ideas? Perhaps not as well as manual drawings.

Simulation - The misled eye

Photography, after an initial enthusiasm for its being considered a mirror of reality, was mistrusted as soon as it provided the possibility of the *montage*, which happened a hundred years ago: pieces of pictures allowed to be pasted together to create new untrue, yet intriguing, images. The traditional notion of reality could thus be disassembled. Visual manipulation was then possible but still required time consuming craftsmanship, technical skills and an artist's eye. Things changed after the introduction of computer graphics in the 80s of the last century. Since then, artificial pictures that can be perceived even more real than actual objects are within the reach of anyone who can handle a computer. Digital tools can create a seducing reality that is taken for granted by onlookers.

Simulation, nowadays very popular, is a novel creation where everything is known and completely under control. It is «an artificial environment that creates an artificial experience that is felt to be reality» (Scheer 2014, p 31). Anything can be done but on condition that it stays within the constraints of the provided frame, be it software or hardware. There is no ambiguity, there is no incompleteness, there are no divergent ideas. The rules are set by the authors of the simulation application, so no user can develop ideas outside it.
The outstanding quality of today's photographic renders raises the issue of professional ethical behaviour on account of the author, who should not provide ground for biased judgment by the observer, inducing false positive expectations. Most studies on the public's perception of computer simulations investigated the perceived sense of reality, wellbeing and other qualities of the illustrated design, but the ethical issue of simulations seems to have been left rather unattended in the architectural field. Conversely, newspapers and magazines deal extensively with this matter.
A survey made by Reaves (Reaves, 2005) assessed that newspaper editors were very critical of any kind of digital manipulations of photographs, whilst magazine editors were more tolerant of glamorous illustrations. A picture in a newspaper should be perceived as natural and accordingly informative and educational.
The magazine photo illustration must catch the imagination, it should be creative and pictorial, and some positive bias could be tolerated or even encouraged. The ethical dilemma arises when readers or onlookers may not understand that a given photograph is just meant to create illusions (Wheeler and Gleason, 1995). «New technology often outpaces our understanding of its effects […]. The digital scalpel has changed the ethical query "What's wrong with this picture" to a more cynical question: "What's wrong with this perfect picture?"» (Reaves 2005, p. 455). Photorealistic renders fall in the category of magazine glamour pictures, so it is up to the author's ethical principles to keep the simulation within the limits of something agreeable to the eye without trespassing into distorted reality.

Communication - The mind of the observer

In the implementation of a project, representation is an integral part of it, to the benefit of the designer and the public. If the graphic expression can be an anticipation of a building that does not yet exist, it plays an even more essential role in the design of a city project, where the visual image alone has to deal

with manifold features on different perceptual levels. The purely abstract act of creation becomes a project in the mind and hands of the designer and should be conveyed in the right way to make an abstract thought real to the beholders.
The image of the project becomes a project of the image, where invention and analysis of the existing must establish a dialogue between the designer and the final user. Therefore it is essential to define what is the best means of communication.
The word communication comes from the Latin *comunicare*, which stands for sharing, making common. Hence the term has been defined as the process of understanding and sharing meanings (Pearson and Nelson, 2000). Meanings can be conveyed by gestures, words and images. Due to the complex nature of language, occasionally the best and almost only method to experience it is through an image. So, the most important step in communication between the designer and the public is to convert the ideas, either still unmaterial or already reified, into drawings.
The choice of communicating meanings through a visual channel provides several potential advantages. The most important of them is perhaps the capacity of the onlooker to perceive at a single glance features belonging to the whole picture and that could not be conveyed by written or spoken words.
In this visual communication, the creativity of the image-maker is entrusted to the message with the aim of being perceived by the beholder, who interprets it with a new and independent act of creativity (Dake, 2005). According to the channel, or modality, chosen to convey the architectural message, such advantages can be fully or just partially exploited.

Assessments on photorealistic rendering

There have been several reports on the reception by the observers of photorealistic renders or architectural hand drawn images. It appears that the main focus of investigations has been whether such images could be perceived as realistic (Bates-Brkljac, 2012). These have been fostered by the trend of exasperated photorealism that now pervades computer generated images, so it may be hard to differentiate them from a photograph of something real (Nastasi, 2016).
Since the first introduction of CAD, its undeniable advantages have led to the current situation, where no architect can present a project which has not been CAD processed. Realism through digital images seems to be the ultimate goal

of the presentation process. The old traditional hand drawn images, though still in some use, seem to have been forgotten, particularly in the educational field. Working preferences for students are strongly biased towards an entirely computerised world (Şenyapili and Basa, 2006).

Dichotomy between digital and hand drawn images has been the object of some studies inquiring whether digital images are perceived as a more comprehensible and effective tool of communication than handmade representations (Bates-Brkljac, 2011, Bates-Brkljac 2009; Iñarra Abad et al., 2013).

The results were partially dependent on the background of the audience, divided in two groups, with architects on one side and other professionals on the other. Computer generated images were generally perceived as more accurate and realistic than traditional illustrations, a characteristic mainly appraised by the non-architects (Bates-Brkljac, 2009).

All in all, architects preferred artistic images and paid attention to attributes such as innovation and functionality, whereas non-architects preferred photorealistic images and paid attention to the wellbeing feeling conveyed by the digital image (Bates-Brkljac, 2011).

One more important issue is represented by meeting the consumer's preferences and needs, as already occurs in the field of industrial design (Iñarra Abad et al., 2013; Llinares Millan and Iñarra Abad, 2014).

It is worth observing that most of the tests on architectural imagery so far submitted either to the lay public or architectural professionals are based upon preferences that are more or less quantified, often according to a Likert scale (Likert, 1932). The latter is an ordinal psychometric evaluation scale very easy to design and administer. Though apparently very straightforward, it hides some pitfalls, especially if it is used to calculate statistical significance. Besides, it may be difficult for the test takers to quantify, for example, how much wellbeing an image could transmit.

These are very subjective assessments, and their transformation into numbers will only apparently transform a feeling into a scientific parameter. Taking a hint from such a warning, we set up to design a test that could provide results based on the correct or incorrect performance by the test taker.

If the task requires linking an image to the style of just one among three or four authors, the result can only be right or wrong, with no questionable quantification (Leandri, 2022).

A one-stem multiple-choice multimedia test

The *communication* and *recognisability* tests used in this survey that has been run on the web are based on the performance of the observers. This performance strategy guarantees against subjective biases, but it has been much less assessed than the traditional paradigms. Further research would be needed to defend its robustness, and, to that purpose, this first attempt should be considered as a proof of concept to assess some observer's reactions so far little explored but of fundamental importance. Of course, the results of the tests can be influenced by the images chosen, so there might be a bias on the side of the test maker. In our case, extra care has been used in choosing images with similar contrast, brightness and, whenever possible, style. No instrumental assessment of image qualities has been performed in our investigation; in future research, this could better ensure equivalence between image sets. The questionnaire was named Architectural Drawing 3.0. It was an online web questionnaire created on Typeform, an interactive platform which allows combining images and text. It was run on Instagram and LinkedIn for a duration of two months, during which random people were targeted, with no limitation in number. It was conceived for a wide range of different users who could represent the heterogeneous public usually reached by architectural imagery. The questionnaire had been designed according to recent overviews (Mittal and Mittal, 2011); the questions were of the following typologies:

1 - Text questions which assessed the user's background, interests or attitudes towards drawing tools and renders;
2 - Multimedia test which provided textual and multimedia contents (images) with a true or false type of answer;
3 - Multimedia test with a single preference type of answer, for which the general impression of the user was the parameter we were seeking.

The two multimedia tests were of the conventional one-stem multiple-choice type with the correct answer scoring 1 and the wrong answer scoring 0 (Ng and Chan, 2009).
The position of the correct answer in each question was randomised by the Typeform platform. The whole questionnaire was divided into six sections.

First section on status information

The first section just asked questions #1) age, #2) gender and #3) occupation. All questions were of the close ended type, so the answers could be precisely categorised. Age groups were a) 19 and under, b) 20-29 c) 30-39, d) 40-49, e) 50-59, f) 60 and over; gender a) male, b) female; occupation a) architect, b) student, c) civil/construction engineer, d) architectural assistant, e) architectural illustrator, f) 3D artist, g) academic (in the architectural field), h) interior/product designer, i) developer, j) real estate agent, k) other.

There were 154 full responders who completed the questionnaire. Among these, 77% were in the age range of 20-39 and 9% were 19 or under (Fig. 9.1). So 86% could be defined young adults; 58% were males and 42% females (Fig. 9.2). Occupations are summarized in Fig. 9.3: architects represented 28%, students in the architectural field were 21%, civil or construction engineer 6%, architectural assistant 4%, architectural illustrator 3%, 3D artist 2%, academic 2%, interior designer 2%, developer 1%. The other category scored 26%. So we decided to group all *professionals* altogether, scoring a total of 74% of test takers, to be compared to the *others* group (Fig. 9.4).

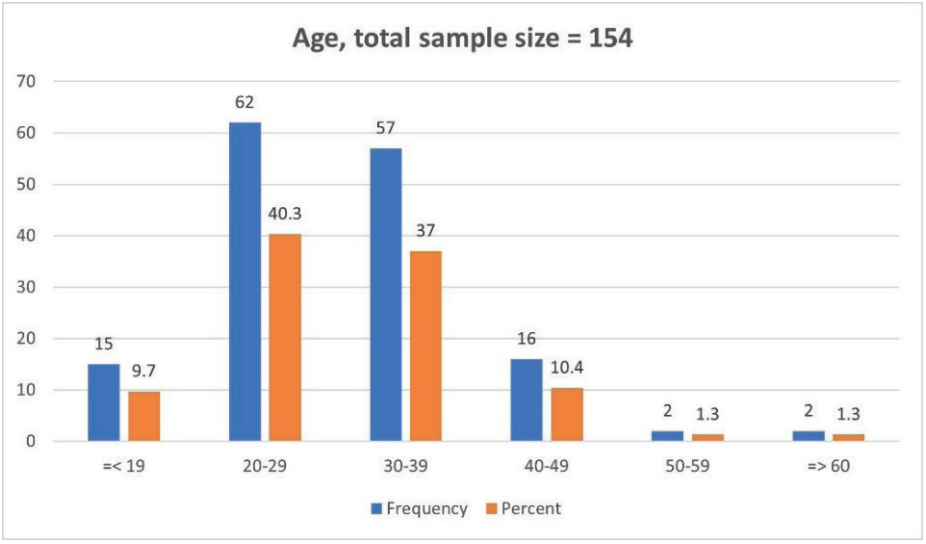

Figure 9.1. Question #1: age. Distribution of age of participants. The 20-39 range was the most represented.

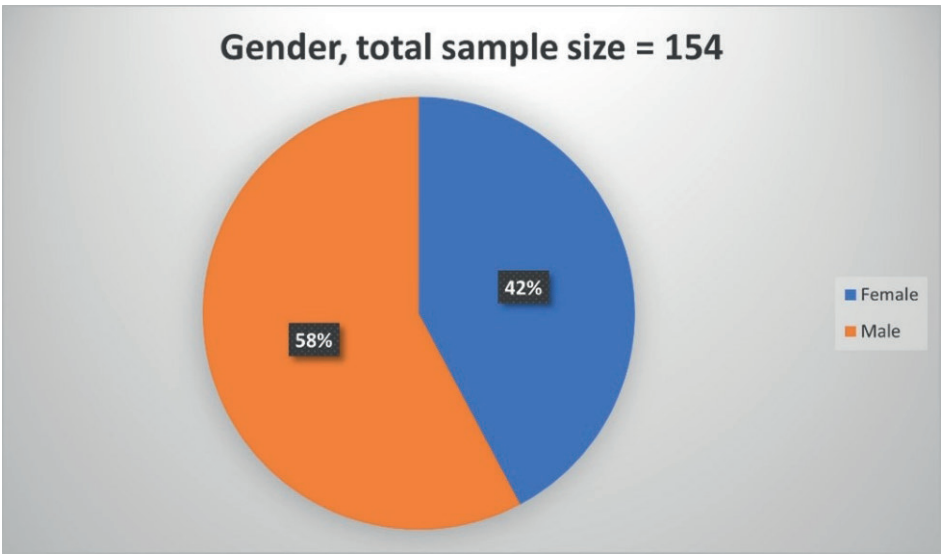

Figure 9.2. Question #2: gender of participants.

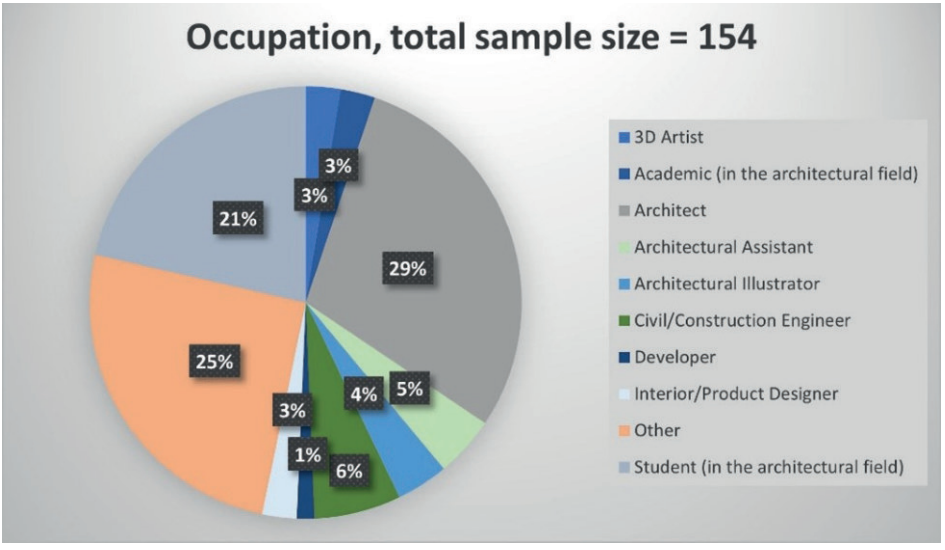

Figure 9.3. Question #3: occupation. All groups.

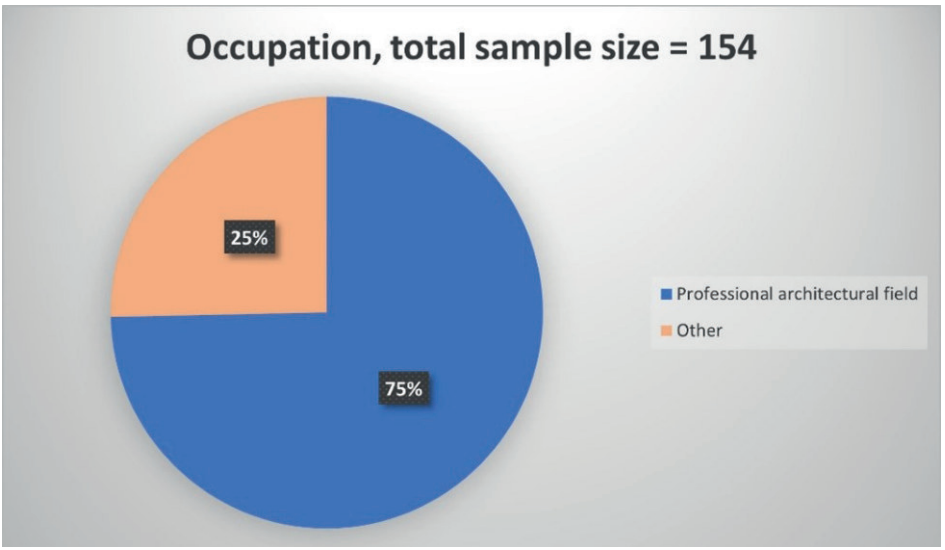

Figure 9.4. Question #3: occupation. Clustered in two groups.

Second section on Communication

The second section, containing questions #4 (Fig. 9.5), #5 (Fig. 9.7), #6 (Fig. 9.9), #7 (Fig. 9.11) was named *Communication*, meaning that it was aimed at assessing how much the visual message (vignette) would communicate to the observer its meaning as novelty and originality of a newly designed project, to be recognized among others already existent. The comparison was between hand drawn illustrations versus photorealistic renders: which of the two would best communicate to the onlooker. Question #4 showed a vignette with a hand drawn image which illustrated a new project among other already existing city buildings. Four vignettes with already marked different buildings were offered as possible solutions. Only one showed the correct new project. Question #5 showed a similar hand drawn project, but with only two vignettes as a choice. Question #6 was analogous to #4 but the illustrations were photorealistic renders. Question #7 was analogous to #5 but now photorealistic renders showed the project. Responses to question #4 (locate a hand drawn project image in an urban environment, 4 choices) (Fig. 9.5) yielded 89.6% of correct answers by

professionals and 87.2% by *others* (graph on Fig. 9.6). There was no significant difference between the two groups. A similar result turned out for question #5, with another hand drawn vignette (Fig. 9.7), where correct answers were 93% in the case of *professionals* and 82% for *others* (graph on Fig. 9.8). No significant difference between groups was detected.

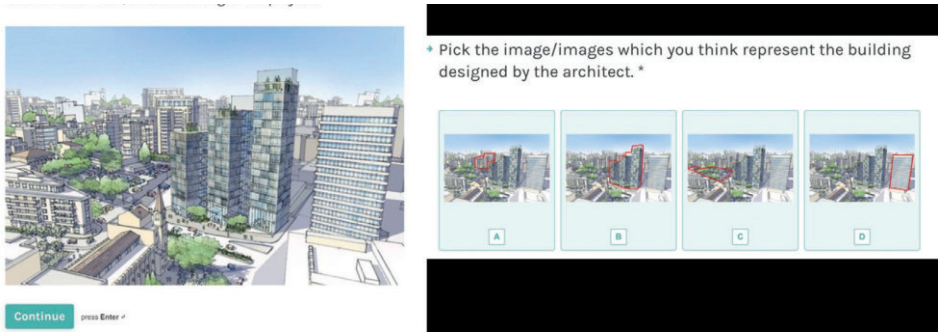

Figure 9.5. Question #4. *In this illustration, which building is the project*? Example of hand drawn image.

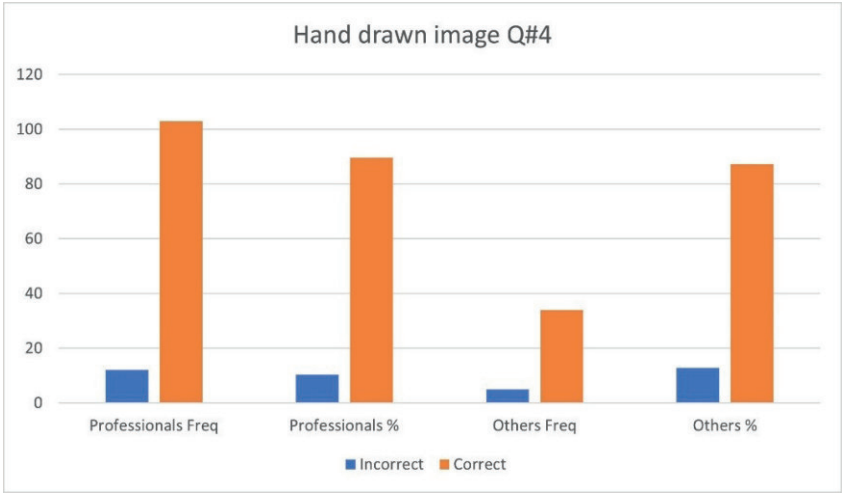

Figure 9.6. Question #4. Graph of correct and wrong answers to hand drawn image A. In both groups there is a very significant difference between correct and incorrect answers, and there is no difference between groups.

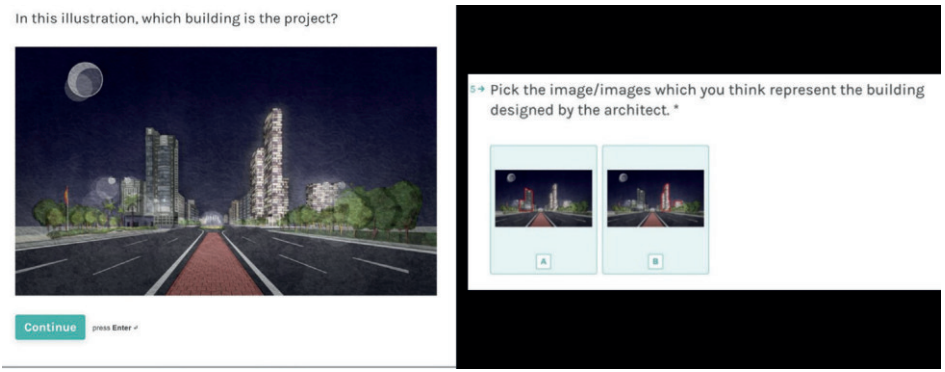

Figure 9.7. Question #5. *In this illustration, which building is the project?* Example of hand drawn image.

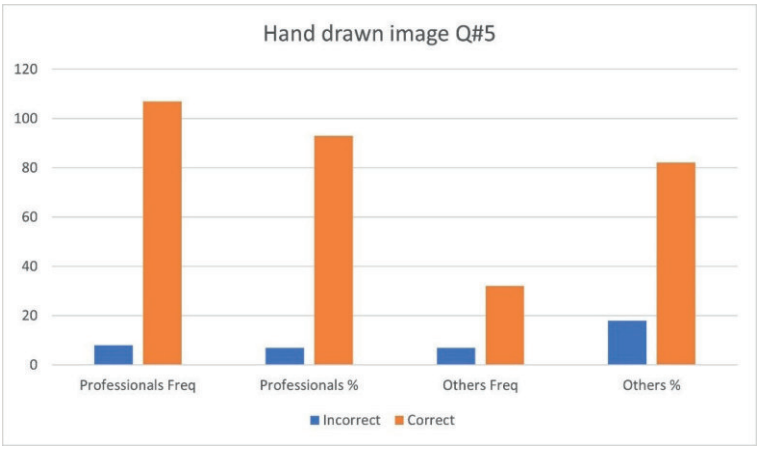

Figure 9.8. Question #5. Graph of correct and wrong answers to hand drawn image B. In both groups there is a very significant difference between correct and incorrect answers, and there is no difference between groups.

Questions #6 and #7 (Fig. 9.9 and Fig. 9.12) concerned photorealistic renders, again there was no significant difference between professionals and others in each of the two questions: professionals were 23.5% correct in question #6 and 32% in question #7, while the others proportions for correct answers were 12.8% (question #6) and 47% (question #7) (graphs on Fig. 9.10 and Fig. 9. 3).

When the scores of the same group in recognising the project were compared between hand drawn images (questions #4 and #6) (graph on Fig 9.11). and photorealistic renders (questions #5 and #7) (graph on Fig. 9.4), a difference emerged of 66.10% for professionals and 74.40% for others, with a very high significance level ($p<0.0001$) in both cases.

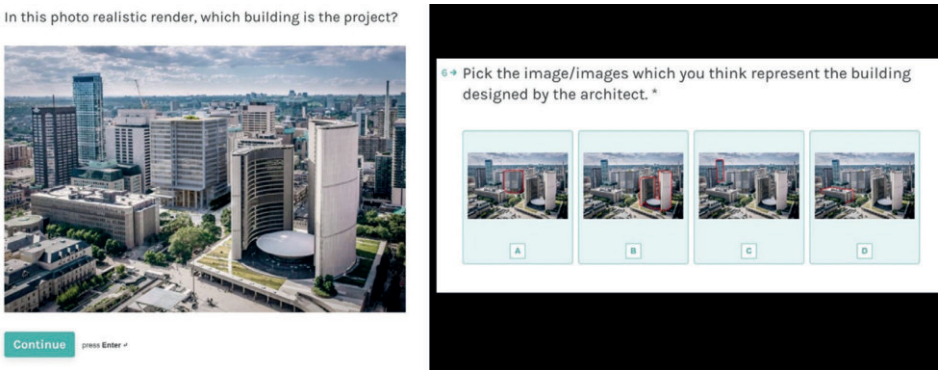

Figure. 9.9. Question #6. *In this render, which building is the project?* Example of photorealistic rendering.

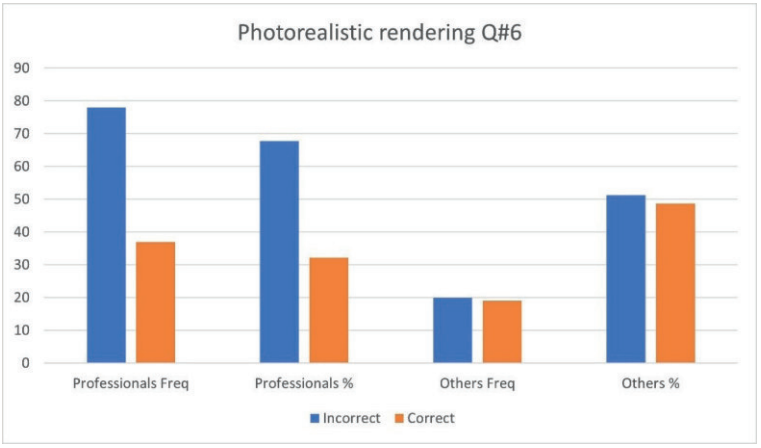

Figure 9.10. Question #6. Graph of correct and wrong answers to the photorealistic rendered image. In both groups there is a very significant difference between correct and incorrect answers, and there is no difference between groups.

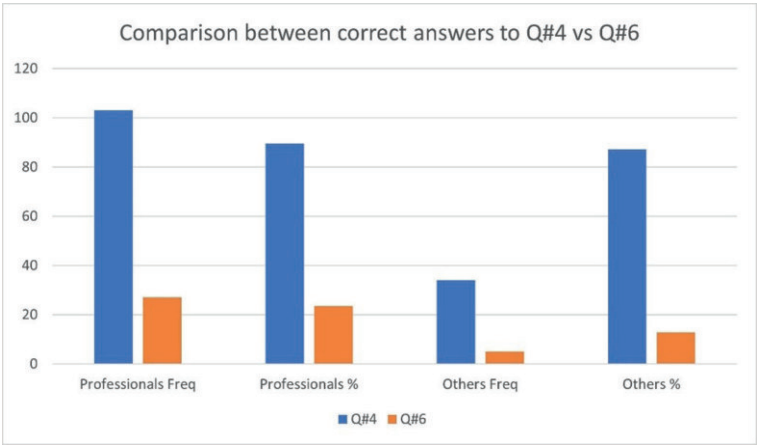

Figure 9.11. The score of correct answers to Q#4 (hand drawn image) was significantly higher than to Q#6 (render) for both groups.

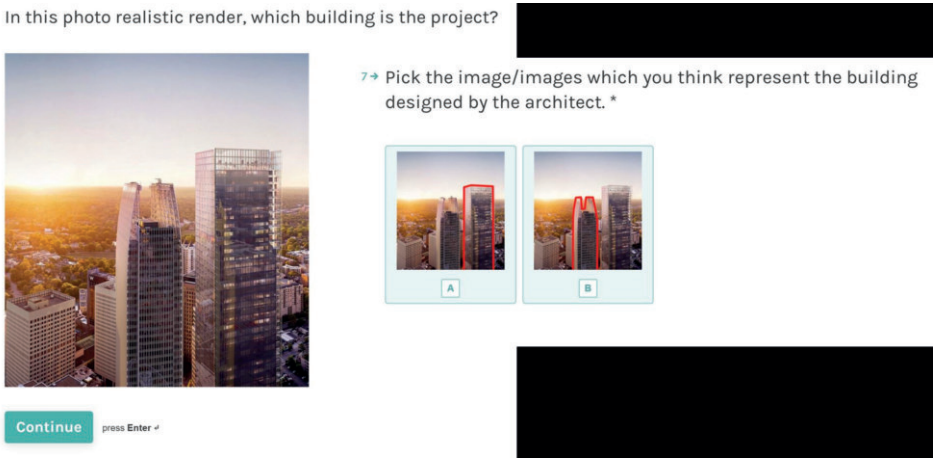

Figure. 9.12. Question #7. *In this render, which building is the project?* Example of photorealistic rendering.

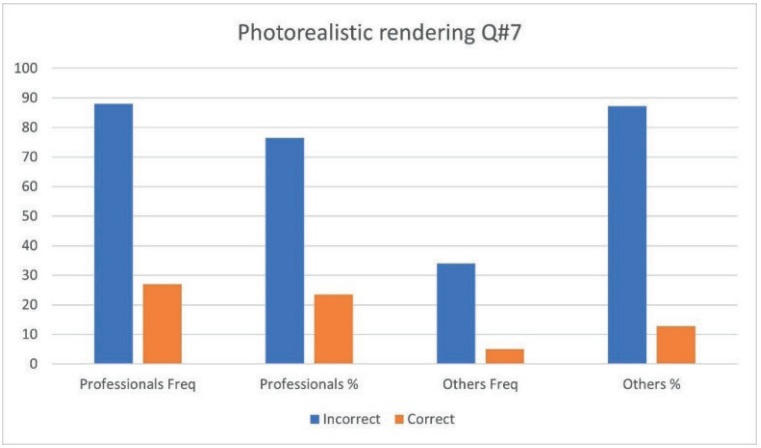

Figure 9.13. Question #7. Graph of correct and wrong answers to a photorealistic render. In both groups there is a very significant difference between correct and incorrect answers, and there is no difference between groups.

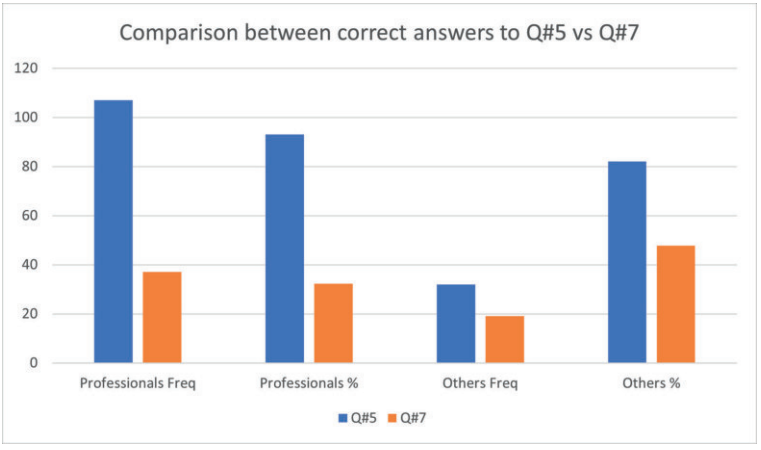

Figure 9.14. The score of correct answers to Q#5 (hand drawn image) was significantly higher than to Q#7 (render) for both groups.

Third section on Recognisability

The goal was to assess how much the sign of the author of a project could be recognised in hand drawn illustrations compared to photorealistic renders. The test takers were first shown 3 hand drawn images authored by as many famous architectural companies (Fig. 9.15, right column), and 3 photorealistic renders from the same (Fig. 9.15, left column), in order to become familiar with each company style. In question #8 a set of 3 new hand drawn images by the same companies was shown (Fig. 9.16), unlabelled: the test takers had to pick up the correct combination of authorship just by recognizing the style of the illustrations among 6 possibilities. Question #9 was analogous to #8, but this time the images were photorealistic renders (Fig. 9.19).

The images were hand drawn and the test takers, after having familiarised with each company's style (Fig. 9.15), had to spot the answer with the correct labelling combination among 6 possible choices.

The 3 hand drawn styles (Fig. 9.16) were correctly recognised by 70.4% of professionals and 56.4% of others (graph in Fig. 9.17).

The difference between the two groups was not significant. For question #9, the same procedure as question #8 was applied, but the images were photorealistic renders (Fig. 9.18). The professionals scored 20.9% of correct answers, whilst the others scored 23.1% (graph in Fig. 9.19).

No significant difference between groups was demonstrated.

Comparing the same group responding to the two questions (graph in Fig. 9.20), it came out that the *professionals* showed a 49.50% score difference between the correct answers to question #8 and question #9, which was highly significant ($p<0.0001$).

The *others* also showed a significant difference of 23.1% ($p=0.0028$) between the two questions. So, both *professionals* and *others* scored more correctly in the case of hand drawn images than photorealistic renders.

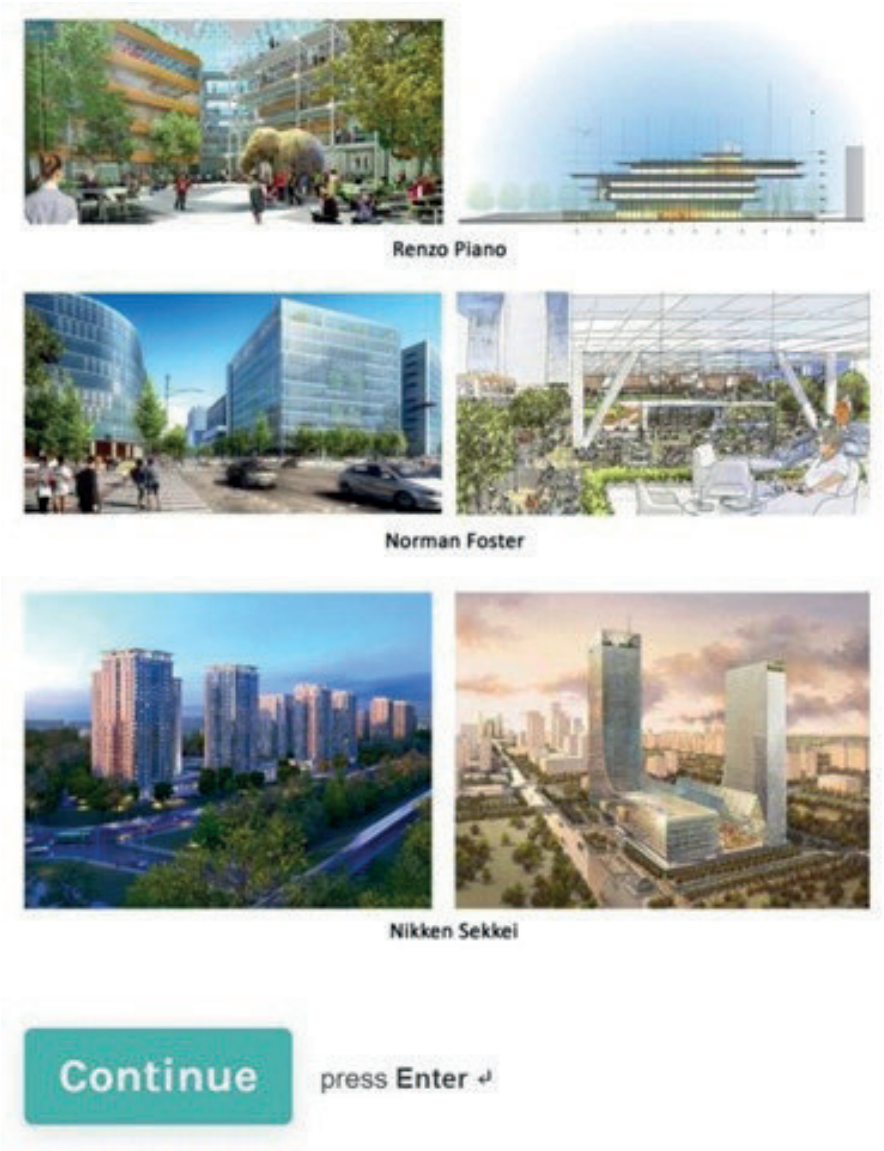

Figure 9.15. Examples of images from three renowned international studios in hand drawn and computer generated photorealistic styles. These were shown for the test takers to familiarise themselves with each studio's signature in both styles.

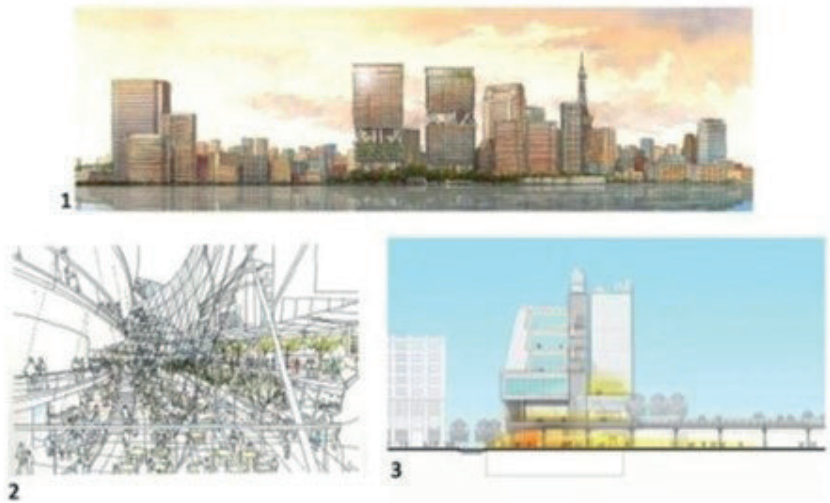

Figure 9.16. Question #8, hand drawn images: *Using the previous set of images as a reference, assign each illustration to the correct architect.* Only one correct combination should be chosen on the left hand table.

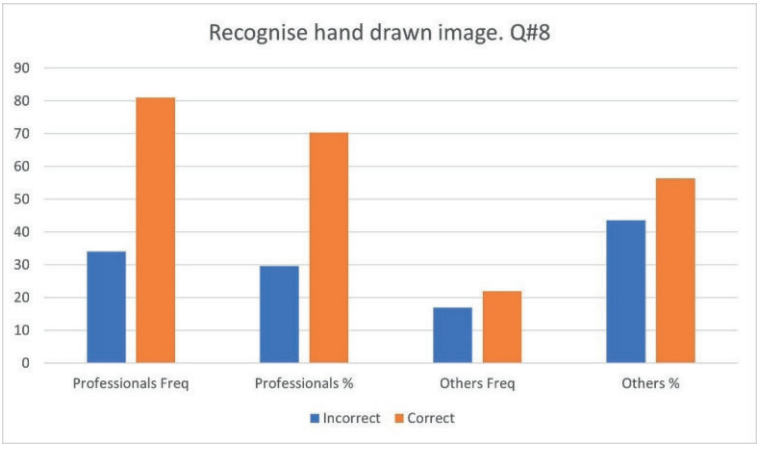

Figure 9.17. Graph of correct and wrong answers to question #8. In both groups the correct answers were significantly more than the incorrect ones.

Fig. 9.18. Question #9, photographic renders: *Using the previous set of images as a reference, assign each illustration to the correct architect.* Only one correct combination should be chosen on the left hand table.

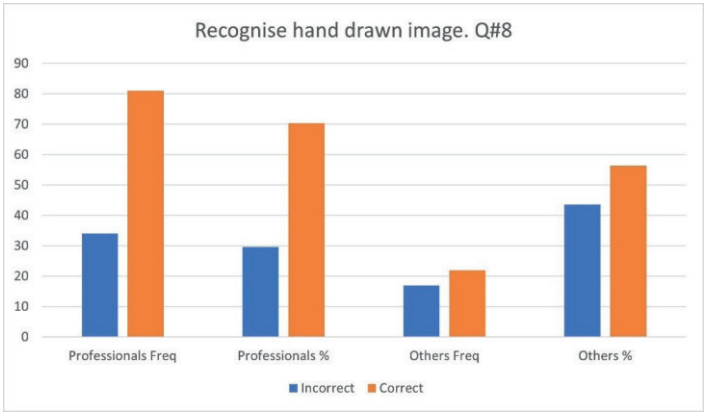

Figure 9.19. Graph of correct and wrong answers to question #9. Both groups scored significantly more incorrect than correct answers. There were no significant scoring differences between groups.

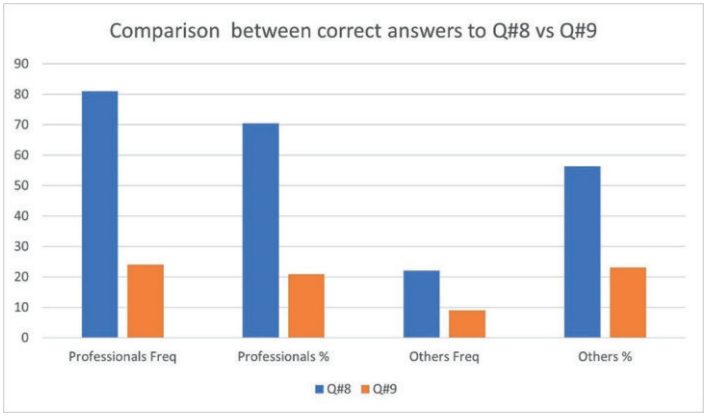

Figure 9.20. Comparison of performances from the same group to answer Q#8 and Q#9. The score of correct answers to Q#8 (hand drawn image) was significantly higher than to Q#9 (render) for both groups.

Fourth section on Engagement

Questions in this section simply asked the observer for a personal preference between hand drawn illustrations (Fig. 9.21) and photorealistic renders (Fig. 9.22). The two options were presented in a different order for each participant, randomly organised by the Typeform platform. The perceptive engagement was sought, with an answer presumably based upon the general impression and instinctive reaction of the onlooker. No statistics were performed to compare these results, since the choice was strictly based not on performance but on personal taste, and could depend on the quality of the image. Two images, one hand drawn and one a photorealistic render of two very similar living rooms and two bedrooms were presented.

The *professionals* group expressed a slight preference for the hand drawn living room (56%) against the photorealistic render (44%), but showed a reversed preference for the photorealistic bedroom (56%) against the hand drawn version (44%). The *others* group expressed an almost perfectly even opinion, with 51% preference on the hand drawn living room against the photorealistic render (49%), with identical proportion as to the bedroom.

These results could be approximated to a 50/50 preference for both groups and for both representations.

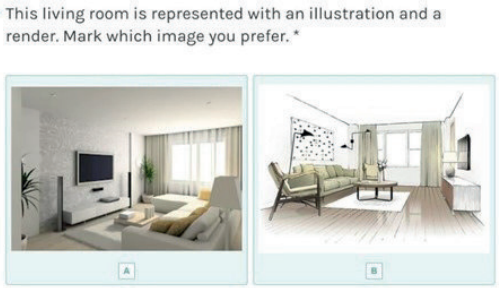

Figure 9.21 Question #10. In this test on interior visualisation preference, the subjects were asked whether they preferred a manual drawing or a CAD of a living room. Most of *professionals* and *others* preferred CAD.

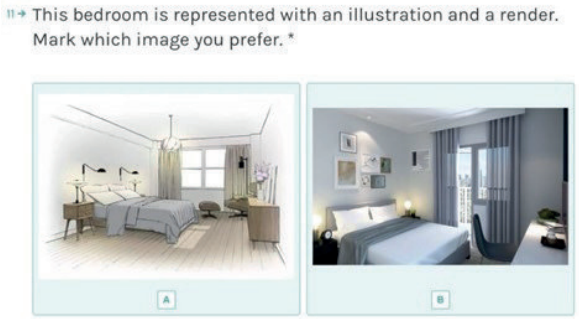

Figure 9.22. Question #11. In this test on interior visualisation preference, the subjects were asked whether they preferred a manual drawing or a CAD of a bedroom. Most of *professionals* and *others* preferred the manual drawing.

The web platform provided detailed data on a spreadsheet and some preliminary descriptive statistics. Differences in the ratios of right and wrong answers were tested by using the chi-squared ($\chi 2$) test. Fishers' exact test was used if any of the cells had expected counts less than 5. All tests were conducted with $\alpha=0.05$ (5% level) and a null hypothesis of no difference between the two groups (reject null hypothesis/accept evidence of a difference if $p<0.05$ i.e. chance of wrongly saying there is no difference (false negative) was less than 5%).

Conclusions

The participants to the questionnaire responded to publication on some of the web channels; their recruitment may of course have been biased by the chosen channels, but it is deemed that they represented an audience generally interested in architecture and images. The *others* group can be assimilated to the general public, with no specific education on architecture or image crafting and processing; they were expected to respond more instinctively to the tests, without looking for technical assessments. The *professionals*, many of them architects, would look at the images from a more educated point of view, and, in theory, spot better than the others the correct answers to the proposed questions. We shall see that, eventually, the educated professionals and the more naïve others behaved very similarly. The two main tests on communication and recognisability were meant to assess the ability of images to convey the correct message. All professionals and students in the architectural field do not only design buildings, but they also need to sell their projects to clients, juries and public commissioners.

The importance of images is paramount to such an end. When the observer looks at an image portraying more than one building, for example a bird's eye view or simply a view of the environment contextualising the proposed design, he/she may have trouble in spotting the project in a photorealistic render. In some cases, the aim of the image may be to show the still non-existent building will perfectly blend with the surroundings, but at the same time, such type of imagery limits the very purpose of the architectural representation, which is to tackle the reaction of the observer to the project, to introduce critical concepts, to communicate the architect's emotions to the customer). Recognisability is obviously linked with the style of the design and presentation of the project. It is the marker's signature. As in every other industry, architecture is nothing less than a product of the architect's mind behind which there is the designer's name. Whether the object comes to life or remains unbuilt, whether it gets published on a website or presented at a competition, it is important for the architect, the creator of the idea, to leave a personal trademark. The expressive language of the author, therefore, is essential to make the design memorable. However, it is possible to use different visual languages also for sketches, final renders, etc. which do not necessarily represent the author, but are the result of a research for the most effective way of communicating the design based on the purpose for which the drawing was created (Figg. 9.23 - 9.28).

It may be surprising to find that architects and the general public had very

similar reactions to the images presented. In both cases, the hand drawn images conveyed more correctly the information meant to be transmitted to the onlooker; a sure token of the greater efficacy of the hand drawn images to express the author's ideas and personality. The photorealistic render, though needed in some circumstances in order to provide detailed information about the future results, may not have such important qualities. It is remarkable that whereas the objective qualities of communication and recognisability were assessed as belonging more to hand drawn images than to photorealistic renders, the subjective opinion on aesthetics about the living room and bedroom was a perfectly balanced response by professionals and others. The dichotomy between the objective and the subjective sets suggests that the perception mechanisms of a pleasurable image are disjointed from the meaning that the image should convey. Both factors, on one side the personal feeling elicited by the image and arising inside the observer, and on the other, the architect's sign and communication (a more objective quality of the image) should be carefully considered. To summing up, in the handcrafted figure the new building was definitely identified better than in the photographic render. The message that the building had something special that characterised it from the others was clear in the hand drawn figure but far less clear in the render. Why was that? The hand drawn figure did not have peculiar features that could suggest which building was the new one; nevertheless, it could be spotted in most of cases. Of course, the experiment will have to be repeated several times with different styles of drawing and rendering, but this first attempt is a strong suggestion that there are differences that the conscious eye may not catch, but the unconscious might.

Figure 9.23. Casa industrializada rNrH, Juan Marcos arquitectos, Valencia, 2018. Author's drawing.

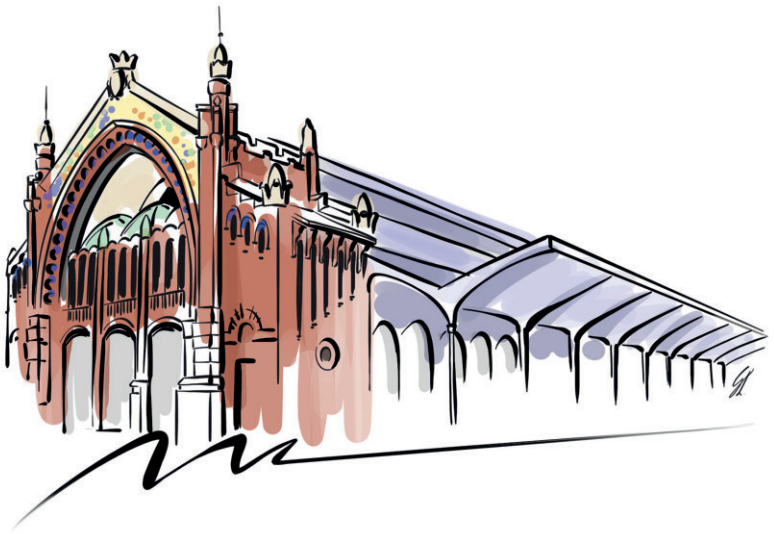

Figure 9.24. Mercado central, Valencia, 2022. Author's drawing.

Figure 9.25. San Paolino, Genius Loci Architettura e Milan Ingegneria, Firenze, 2017. Author's drawing.

Figure 9.26. Casa Cal-Cària, Puchol arquitectos, Alacant, 2019. Author's drawing.

Figure 9.27. Torre Laminar, Gallardo Llopis arquitectos, Valencia, 2020. Author's drawing.

Figure 9.28. Hyde Park, Oxford and Cambridge mansions, Londra, 2012. Author's drawing.

The brain, the hand, and the visual message

In the above chapters, the architectural illustration has been analysed through the eyes of the observer. How it is perceived and what cognitive and emotional mechanisms may be triggered are all key features for the making of efficient visual messages. But of course, at the origin of the whole process there is the designer and his creative ability (Leandri, 2022b). Higher mental functions are a characteristic of humans which, since ancient times, have been thought to be linked with the use of the hands. Aristotle reports «*Ἀναξάγορας μέν οὖν φησί δἰά τό χεῖρας ἔχειν φρονεμώτατον εἶναι των ζωών ἄνθροπον*» (Fragment ds54, Diels, 1974), that is: «Anaxagoras indeed said that among the living creatures, the man is the most intelligent because he has the hands». Human creativity is obviously linked with hands, but Anaxagoras' claim signifies that hands are not just an instrument to implement what the brain plans, but that they may be responsible for the development of intelligence and creativity, by somehow affecting the very functions of the brain. Knowledge of such functions was extremely limited until recent times, so the notion of reciprocal influence between brain and hand could only be an empirical observation. Fortunately, current progress in neuroscience has permitted us to find experimental evidence to justify what Anaxagoras had said twenty five centuries before.

Cortical representation of the hand

Broadly speaking, the functions of the brain cortex can be summarized as split into two parts: the front part is devoted to the motor functions and the posterior to the sensory. The border between the two is given by the Rolandic fissure and the Sylvian fissure, with the frontal lobe anterior, and the parietal, occipital and temporal lobes posterior (Fig. 10.1).

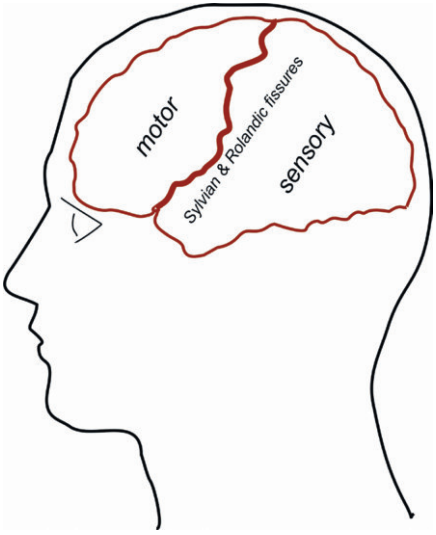

Figure 10.1. The anterior and posterior parts of the brain cortex are separated by a quasi-vertical groove formed by the Sylvian and Rolandic Scissures. Author's schematic drawings.

The motor part of the brain cortex communicates through the spinal cord and the peripheral nerves with the motor effectors, the muscles, which translate the electric impulses of the nervous system into mechanical movement. These are efferent connections, from the brain to the periphery. In a mirror-like manner, the posterior part communicates with the somatosensory receptors of the skin, limb joints and some inner parts of the body, but this time receiving information rather than sending orders.

Everybody has experienced that the hands are capable of extremely fine and precise movements, and they can recognise the smallest indent in surfaces and explore the shape and texture of objects. The Braille writing system for visually impaired people is but an example of how the somatosensory hand features can be exploited. Such performances by the hand are possible thanks to the very large number of neurons that are in direct connections with its muscles and sensory receptors. A very precise and detailed map of the movements and somatosensory cutaneous fields of the human body had been drawn by the half of the last century as a result of neurophysiological experiments during neurosurgical procedures (Penfield and Rasmussen, 1950)

The map was called *the homunculus*, as it resembled a small human body which had disproportionately large hands both for motor and sensory functions. This meant that the number of neurons for motor command and for the reception of sensory information from the hand was far greater than from other parts of the body. This great displacement of neural resources explained the astonishing related performances.

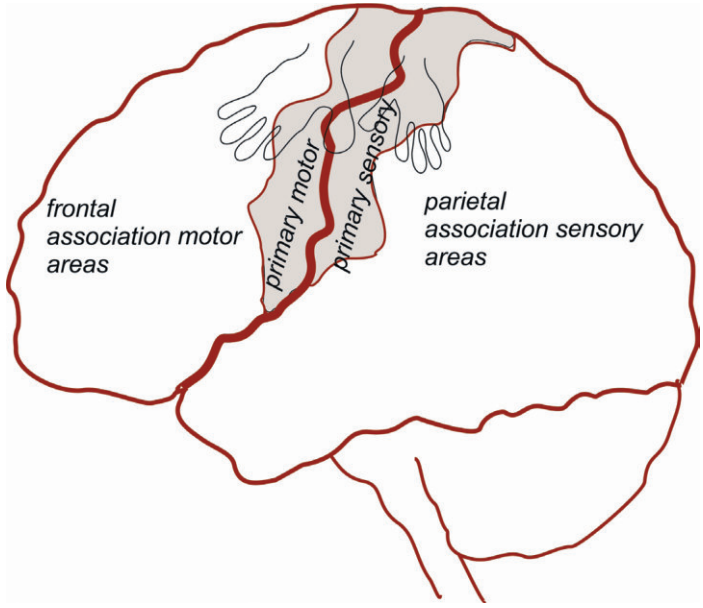

Figure 10.2. Primary and association areas of the brain cortex with the hands of the *homunculus.*

The two areas of the cortex devoted to these direct motor and sensory connections are called the *primary* areas. They are just one part, comparatively small, of the brain cortex. The remnant part of the cortex constitutes the *association* areas, where the *thinking*, conscious and unconscious, takes place (Fig. 10.2). These areas are in close connection with all the *primary* ones (there is also a *primary visual area*, as we have seen in chapter 7, hence their name. It is in such areas that we should look to unveil the mechanisms that underlie creativity linked to hand movements.

Creativity and association areas

Although it is recognised that creativity is a psychological process stemming from the ubiquitarian activity of the brain cortex, some cortical association areas have been hypothesised to be more important than others. These are the *supplementary* and *presupplementary* motor areas (Fig. 10.3), in front of the *primary motor area* (Nachev et al., 2008).

It is worth noting that nearby, in an area called the *premotor cortex*, *mirror neurons* (Kohler et al., 2002) have been found (Fig 10.3). These are intrinsically ambivalent, as they behave like motor neurons but are also activated by sensory impulses. Because of this property they are thought to play a key role in creativity (Matheson and Kenett, 2020). What is most important, this area receives strong connections from the parietal cortex (Rizzolati and Kalaska, 2013) (Fig. 10.3). The parietal areas, receiving somatosensory information from the hand are thought to be an essential link in the chain of creative thinking, as they may be the site where a range of novel ideas can be borne, stimulated by hand movements. Experiments with electroencephalographic recordings time locked to hand motion have provided some evidence of such a relationship (Bozzacchi et al., 2015; Wheaton et al., 2005).

But it is not only the brain cortical areas that are relevant to creativity. The cerebellum has also been claimed to play a definite role (Vandervert et al., 2007). It is of some relevance that both the frontal lobes and cerebellum are neural centres for origin and control of movements. On one hand, the frontal lobes develop the intention, plan and speed of the movement, on the other hand, the cerebellum ensures that the orders from the frontal lobes are correctly and smoothly executed, coordinating all muscles contributing to the movement, as some of them have to contract, others to give way. In addition to that, both neuroanatomical studies in

animals and neuroimaging in humans, performed around the turn of the century, demonstrated that the cerebellum is not exclusively dedicated to motor control, but also is an important structure for cognitive function, with connections to all the associative areas (Buckner, 2013).

In conclusion, it is possible to imagine a creativity circuit involving the somatosensory parietal areas and the motor frontal areas, together with the cerebellum (Fig. 10.3).

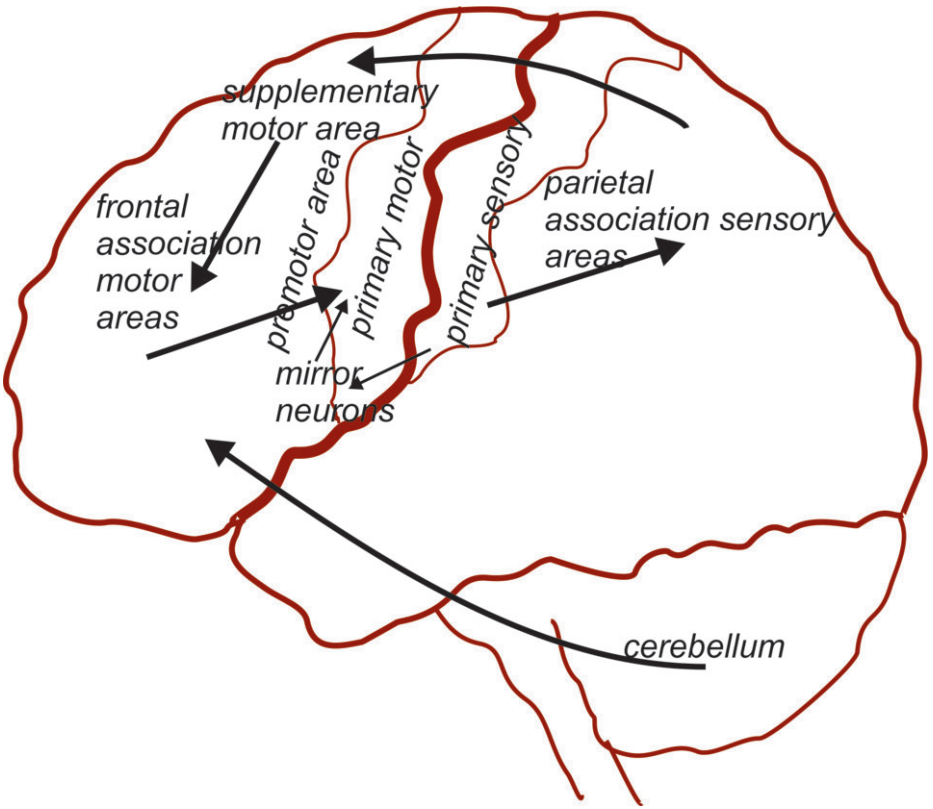

Figure 10.3. Primary and association areas involved in the cognitive activity that supposedly constitute a loop related to creativity enhanced by hand movement. Sensory afferents from the hand are processed by the parietal association areas, sending output to the supplementary motor area and then to the frontal association areas, where the subsequent motor activity is planned. The final output to muscles for mechanical movement is from the primary motor area.

However, it is worth recalling that complex cognitive functions like creativity are the result of many mental constructs, in turn influenced by a large number of variables, most of them still unknown (Sawyer, 2011). There is also the complexity due to the multifunctionality of cortical areas. Correlation between cerebral areas and cognition, therefore, is not straightforward and cannot be restrained to linear deterministic processes. This is particularly true for creativity, one of the most complex cognitive functions. So, the quest for experimental evidence about creativity is far from straightforward. It should be endeavoured by posing simple questions, with an as little number of variables as possible and with answers based upon the most direct parameter linked to neuronal activity: the generated electrical field.

The live drawing experiments

In the last three years, at the Department of Neurology of the University of Genova, we tried to answer one elementary question which had never been posed before: is it possible to record electroencephalographic (EEG) activity time locked to pen/freehand or mouse/CAD drawing movements and detect differences between the two? The choice to use electroencephalography instead of the much in vogue fNMRi (functional nuclear magnetic resonance imaging) stemmed from several considerations. One was the cost of the test, quite high in the case of the fNMRi and negligible in the case of EEG. Secondly, neurons communicate each other with electric signals which generate fields that can be recorded by the EEG, not by the fNMRi. Thirdly, in order to understand the time sequence of cortical events taking place during drawing, a technique with a high temporal definition was needed. Unfortunately, fMNRi has a low time definition whilst a dedicated EEG equipment, properly configured, can easily detect time intervals of 1/10 of the millisecond. Lastly, in order to fulfill our objective, the subjects had to draw naturally, seated at a desk, without encumbrances. It would have been impossible to do that while lying down in a fNMRi machine. The setup of the experiment implicated a device to synchronise each freehand drawing stroke or each mouse click with the EEG recorded from the scalp, and use the technique of averaging to enhance the signal to noise ratio. Where signal is meant to be the activity temporally linked to the movement, whilst noise signifies all the other spontaneous electrical activity generated by neurons and not time linked with the movements (hence with no cause-effect relation with the

movements). We analysed both the EEG events preceding the movements (pre-motion) and also those following them (post-motion). (Leandri et al., 2022d; Leandri et al., 2022f; Leandri et al., 2021b) (Fig 10.4). The pre-motion events were considered to be originated from the frontal lobe (the motor part), whilst the post-motion from the parietal lobe of the brain (the sensory part).

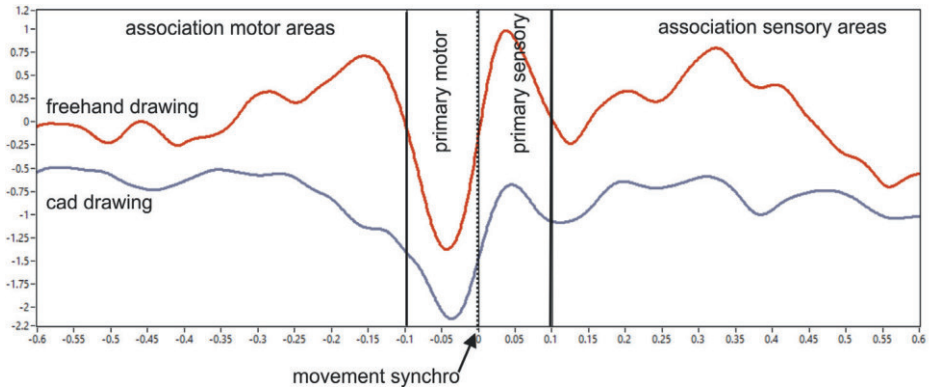

Figure 10.4. Grand average of recordings from derivation C3-Au1. Negativity at C3 I upwards. Amplitude (y axis) is in μV, time (x axis) is in seconds. The timing of deflection indicates their probable origin even if they are recorded from one single derivation. In freehand drawing the association areas generate much larger activity than in CAD drawing, on the contrary, the activity of the primary cortex is not dissimilar. This signifies that the commands to muscles and perceived movements are approximately the same number, but the cognitive activity both before and after movement is very different.

We asked our volunteer subjects first to draw freehand with a pen on a digital tablet and raster graphic application, then to draw with a mouse and CAD application. In both cases, the length of each movement ought to be approximately 2-3 cm. When time locked to each movement, the EEG can discriminate between the direct motor and sensory neural traffic to muscles and from joint sensors (involving just the primary motor and sensory areas) on one side, and the much more elaborated activity of the association areas, on the other. The time window immediately before and after movement is related to the primary areas, whilst the temporally more distant events are from the association areas.

This way, it was possible to detect that the physical motion impressed on the hand was quite similar in the two cases of freehand and mouse drawing.
Conversely, the EEGs reflecting the association activity were very different, indicating that in the case of freehand drawing a much larger amount of neuronal activity took place. Such evidence strongly supports the hypothesis that freehand drawing, devoid of the constraints of the mouse/CAD, may better promote the breeding of new creative ideas.

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Fig. 9.17. Correct and wrong answers to question #8 (author's graph).

Afterword

Mind, hand, instrument: drawing variants and invariants

Architectural imagery: a dialogue between designer and audience is, above all, a book on Drawings and on how Drawing is done.
A book that tackles, but also investigates, two major issues: firstly, the impact of different drawing technologies on the enhancement of neuronal activity and, consequently, on creativity; secondly, the strength in communication, which falls into the two macro-categories of photorealistic rendering and traditional drawing (whether created with analogue and/or digital technology).
A book which contributes to establishing the idea of drawing as thought shaping – that is as a primary action aimed at clarifying and fuelling speculation on the project, and also at rousing its communicative power – but which, above all, intends to endorse this established theoretical-disciplinary view through an innovative scientific approach relating to neuroscience. There is no doubt that the originality of the research carried out by Gaia Leandri is accountable, to a large extent, to the experimental methodology on the action of drawing based on instrumental techniques suitable to detect the duration and intensity of brain activity underlying the execution of the graphic layout and to study its cause/effect role in the creative stage. It is a difficult goal, which brings out an enthralling question on the very methods of investigation. An interesting core issue, currently under analysis in the research progression, is the reliability of those means usually employed in neurophysiology to explore and make accessible an abstract and complex cognitive process like creativity.
In short: what the devices to be used in this endeavour may actually assess? To which extent are they suited to support the comprehension of qualitative phenomena like the visualisation-formation of creative-design thinking? What other tools and knowledge can be involved to further refine the results observed to date? In addition to the thematic nucleus mentioned above, the articulation of this book encompasses a wide range of topics related to representation: from the periodization of theoretical events that brought important progress to the subject, to the understanding of drawing relative to different areas of application; from

the different purposes of visual artefacts to the variety of technical-operational tools for graphic implementation.
Within this articulation, a compelling dual view takes shape which connects the history of representation to its latest achievements. Besides, it establishes a dialogue between art and science, subjectivity and objectivity, author and observer, mind and hand, analogue and digital, freehand tracing (created with traditional or digital interfaces) and drawing with numerical coordinates.
And dual it is also the thematic macro-articulation of the book which, overall, has the important quality of supporting and substantiating the historical-humanistic themes on drawing – which is valued as a heuristic practice and communicative medium – through the outcomes of the experimental investigation in the field of neuroscience. Also, viewing this book with a reversed perspective, that is through the historical framework conducted with narrative vivacity, the reader may find that it has the quality of facilitating to focus those issues addressed by the scientific experimentation.
Therefore, a book that deals with consolidated and historicized theoretical-disciplinary visions, but, at the same time, opens towards important and fascinating research.

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