Draw the Line

An Alternative Form of Architectural Drawings

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Abstract

For centuries, architectural drawing has been considered one of the most effective representational tools, representing buildings and communicating architectural designs between architects and non-architects. It conveys information by using a set of graphic codes, which then becomes a message that allows architectural drawing not only to be read at a basic level, but also to be decoded. However, the codes have over time become internalised and play out as a private language that excludes non-architects. The use of particular codes within an architectural drawing leads to difficulties in reading and understanding by anyone outside the profession; this becomes a problematic issue in communication between architects and non-architects.

Therefore, the main aim of this research is to examine whether conventional drawings, in particular plan drawings, are still considered an effective tool for communicating with non-architects. The dilemma of how best to communicate between architects and non-architects is explored through three related approaches. First, tracing the history of previous periods makes it possible to perceive and to understand the direction of the potential communication breakdown in the role of today's architectural drawings. Secondly, the process of using drawings as a means of communication is examined through a basic communication process. Finally, a study of research in environmental psychology focuses on the way in which architects and non-architects perceive and interpret such drawings. This consequently acknowledges the limits of architectural drawings found in the role of teaching, learning, and drawing, which are very much established in the structure of architectural education.

The communicative potential of conventional drawings is then investigated through a series of empirical tests, with the aim of developing a new set of communicative drawings. This hopefully will mean that non-architects in the future will be better informed in the process of designing buildings. The tests indicate that lay people read architectural drawings differently from architects. They also show ways in which the communicative potential of architectural drawing may be improved.

In conclusion, the research suggests a possibility in bridging the communication gap between architectural context and the public realm. It provides implications and recommendations for improving the communicative potential of architectural drawings.

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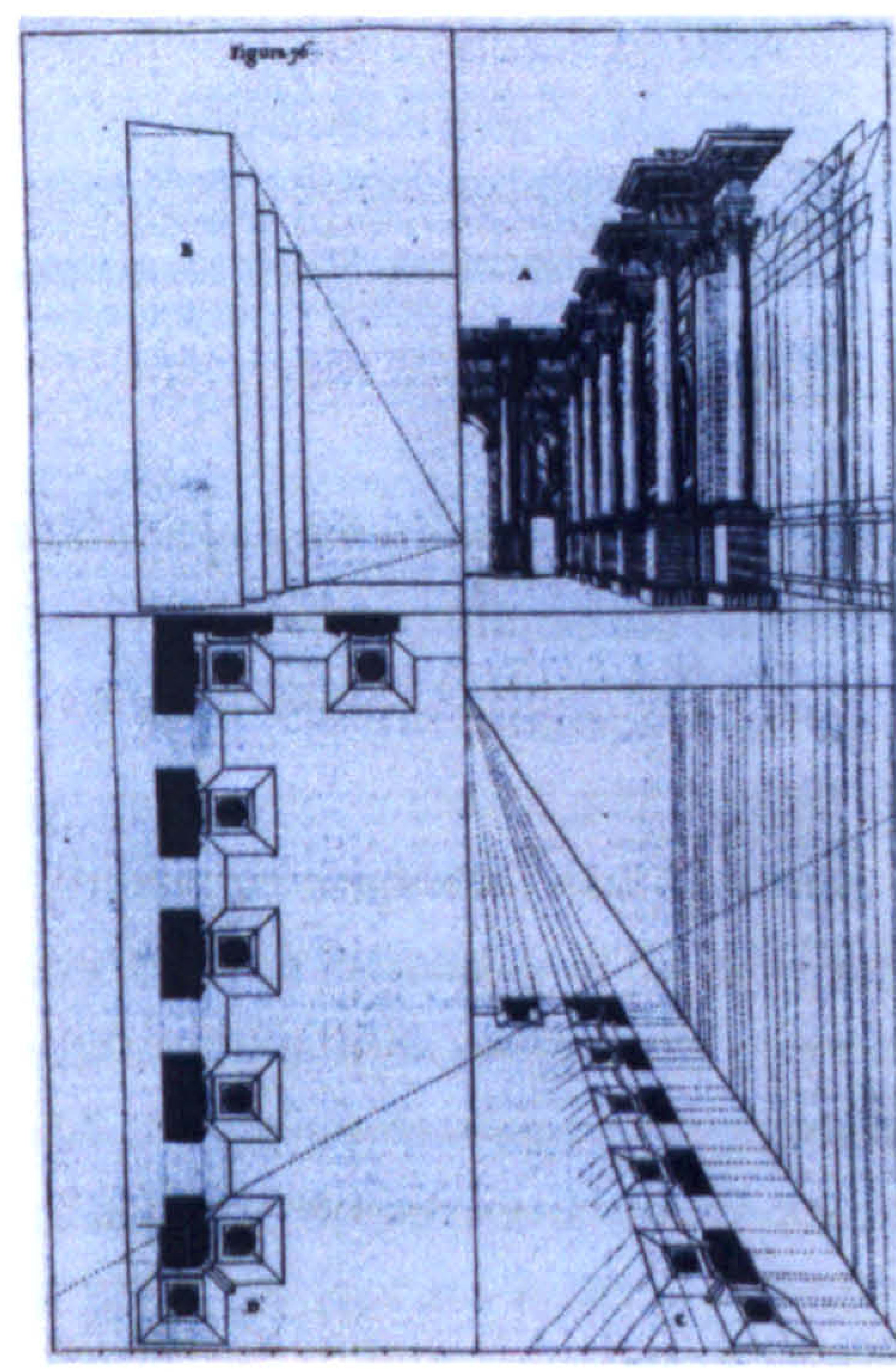

Pozzo's drawing method, demonstrated in his treatise, was based on a correspondence among plan, elevation, and perspective (Gomez and Pelletier, 1997: 201).

Architectural drawings are represented as three-dimensions via a two-dimensional plane. It carries a mimetic shadow that is translated across space and scale as traced by the architect. This trace makes its appearance a fundamental operation of projection.

Chapter One | INTRODUCTION

1.1 Architects and their Drawings

Throughout the centuries, an architectural drawing has been a threshold to, or an emblem of, architecture; as a means of communicating a building to an audience.[1] For the architect, the drawing is considered a working tool: the way of learning, understanding, communicating, transforming, and in particular the way of designing. Vitruvius listed drawing as one of the branches of knowledge with which architects needed to be familiar. Borden and Dunster (1995) note,

> *Vitruvius drew from a great variety of sources, and that he wished to present architecture as a liberal art. He lists the branches of knowledge with which architects need to be familiar – literature, drawing, geometry, optics, arithmetic, history, philosophy, music, and medicine – 'for a liberal education forms as it were, a single body made up of these members'. Borden and Dunster (1995: 25)*

Vitruvius included drawings, which are composed of plan, elevation, and perspective, as one of the key factors in designing architecture.[2] Regarding the fundamental principles of architecture, he noted,

> *Architecture depends on Order, Arrangement, Eurythmy, Symmetry, Propriety, and Economy... Order gives due measure to the members of a work considered separately, and symmetrical agreement to the proportions of the whole... Arrangement includes the putting of things in their proper places and the elegance of effect which is due to adjustments appropriate to the character of the work. Its forms of expression are these: ground plan, elevation, and perspective. A ground plan is made by the proper successive use of compasses and rule, through which we get outlines of the plane surface of the buildings. An elevation is a picture of the front of a building, set upright and properly drawn in the proportions of the contemplated work. Perspective is the method of sketching a front with the sides withdrawing into the background, the lines all meeting in the centre of a circle. Vitruvius (1914: 13-4)*

The centrality of drawing to architects and architecture is a common theme in much architectural writing. As Forty (2000) notes the relationship between the architect, drawing, and architecture is extremely close in that they are inextricably bound to each other. Tschumi (1980) notes, "Architecture does not exist without drawing, in the same way that architecture does not exist without texts" Tschumi (1980: 24-5). Robbins (1994), who has written one of the most definitive main texts on drawing, notes that architectural drawing is the root of architecture and the uses to which drawing has been put over time have been associated with the transformation

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[1] The term 'audience' is here used to indicate the viewers of the architectural drawing which includes both architects and non-architects.

[2] There is a slight irony here in that Vitruvius himself favoured writing over drawing as a means of explication. See McEwen (2003: 16-8).

of cultural and social organisation of architectural practice. He explains, "It is the instrument through which architecture is most often brought into virtual and actual existence. Architecture has created its cultural subject and, to a great extent, has produced its social object through drawing for the last five hundred years or so" Robbins (1994: 29).

Whilst architecture uses a wide range of sources and means of production, many argue that it is drawing that forms the basis of practice and the core of communication in architecture. Carlo Scarpa claims, "My architecture is done with the architect's medium which is drawing and drawings only" cited in Teut (1981:12). Drawing is a mode of working and of thinking about architecture, which allows architects to develop ideas towards tangible built objects. As Robbins (1994) notes,

> *The drawing is used to communicate or record ideas as they are brought up in the conversation. Drawings are used also to illustrate points the architects are trying to make; to suggest various points of view or approaches to the problem; to educate us and the client, about how the architects intend to respond to a request we have made, or to cement an agreement about what is expected from the architects or what the design agreed upon will look like. Robbins (1994: 3)*

An architectural drawing is conventionally composed of codes and texts that represent, explain, and translate into architectural buildings (see Forty (2000), Bloomer (1993)). The codes are controlled by the architect and are mostly prescribed by the prevailing culture of architecture. Hence, there is always the potential that the codes may be ambiguous and may exclude anyone outside the profession. This suggests that the communicative potential of drawing may be limited and restrained by the autonomy of its codes (see Forty (2000)). Some commentators suggest that an architectural drawing has been limited to a single role by architectural culture[3], defined as one step towards the process of constructing a building and used as a tool to describe the building (see Ockman (1993)).

In actual fact, an architectural drawing has more than one role and in its abstract properties has the potential for multiple interpretations and uses. For example, it can provide architects and their audience with a conceptual rather than simply a perceptual view of buildings. By its nature, as Tschumi (1980: 106) notes, the architectural drawing usually refer to something outside itself[4]. This is reinforced by Kahn (1992: 7) when she writes that there are two contrary roles: on one hand, drawing is predicated upon building, while on the other, it proposes drawing as altogether 'other' than built. An architectural drawing thus plays more than a single role, it can be created and interpreted in various ways depending on its creator and the audience. There is no standard for interpretation in architectural drawing. Any architectural

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[3] Cuff (1991) explains the term culture: "Some anthropologists argue that culture is the knowledge needed to act appropriately, while some say it is the complexes of behaviour patterns (such as customs and traditions) in a society; still others suggest that culture is the manifestation of basic and essential human characteristics" Cuff (1991: 112-3).

[4] Tschumi (1980) notes that the difference between architectural and art drawings is that art drawings refer only to themselves, to their own materiality and devices. See also Grosz (2001): 'Architecture from the Outside'.

drawing is credited with the capacity to simultaneously construe diverse aspects of knowledge; it can be read any number of ways, each reading offering a different understanding.

Rather than looking at all these multiple aspects of an architectural drawing in a comprehensive manner, this research aims to investigate the way in which an architectural drawing communicates in order to reveal the communicative relationship between the drawing and its audience. The study of this relationship allows us to understand issues faced by architects and their audience in communicating and in the process reveal a possible step in the right direction to improve the way architects and their audience respectively encode and decode architectural drawings.

1.2 Types of Architectural Drawing

1.2.1 Orthographic Projection

This section presents types of architectural drawing in order to provide a basic understanding as to the configuration of a drawing. The main type of drawing used in architectural practice and production are orthographic projections.[5] Even though perspective and other three-dimensional drawings are increasingly used with the rise of CAD (Computer-Aided Design), these three-dimensional drawings still relate back to orthographic projection. Blau and Kaufman (1989) note, "Perspective, like axonometry, has a complex relationship to orthography. Despite the illusion of three-dimensional space achieved by perspective projection, treatises published from the sixteenth to the twentieth century emphasize that architectural perspective is not a highly deliberate artificial construction but one based upon an equally abstract construction-the orthographic set" Blau and Kaufman (1989: 159)[6]. Orthography is the projection at right angles of all points on a building's surface onto a plane parallel to that surface. It is comprised of the plan (a horizontal plane of projection), elevation (a vertical plane of projection), and section (a slice through the fabric of the building) (see Blau and Kaufman (1989), Fraser and Henmi (1994)).

First, the plan is based on an aerial viewpoint, which is a very difficult depiction to visualise as this is a way of seeing that one is unaccustomed to. Secondly, the section is a cut slice vertically from top to bottom through the building and into the ground profiling the structure and its enclosure. It reveals the interior array of space both vertically and horizontally. Finally,

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[5] Evans (1989) noted, "In orthographic projection the projectors do not all converge to a point, but remain parallel. ... the advantage of orthographic projection is that it preserves more of the shape and size of what is drawn than perspective does" Evans (1989: 21). They are also called architectural projections, engineering drawings, geometrical drawings, parallel projections, cylindrical projections, or descriptive drawings. Furthermore, Fraser and Henmi (1994) notes, "Orthographic = ortho + graphic or straight writing. Orthographic use two axes of measurement, fixed at right angles to each other. In plan, the axes measure length and width, while in section and elevation the axes measure width and height. ... In orthographic drawings, projection lines are parallel and orthogonal to the picture plane" Fraser and Henmi (1994: 42-3).

[6] See more about perspective in Fraser and Henmi (1994: 78-9).

the elevation is conceptually an exterior section, where the vertical cut is made in front of the building and extends into the ground (see Fraser and Henmi (1994)).

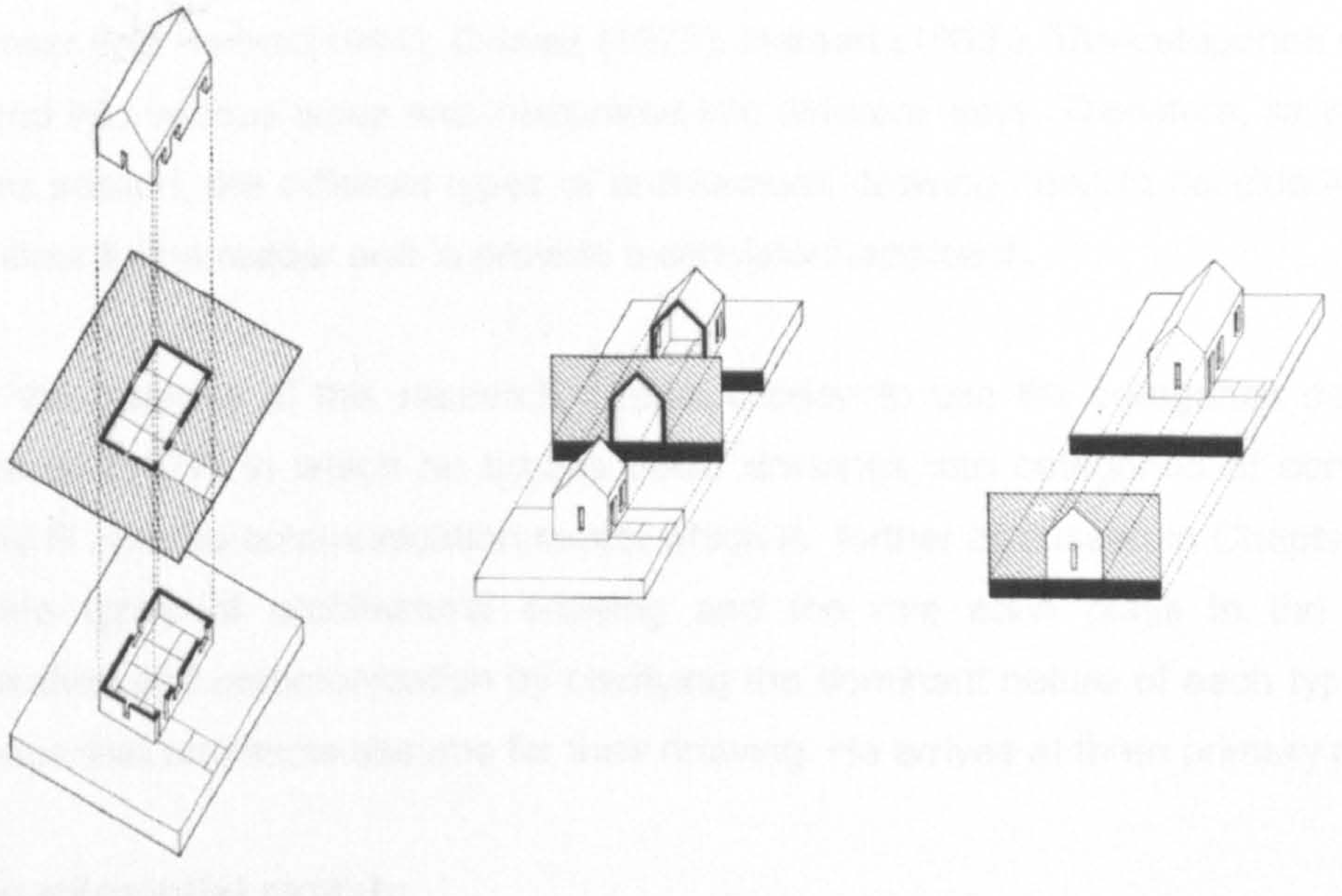

Figure 1.1: Plan, section, and elevation (from left to right). Fraser and Henmi (1994: 42-3)

As will be seen, this research will concentrate on the plan drawing. Borden (1995) emphasises the properties and the complexities of the plan; noting that in standard triad of architectural drawings, the plan yields the most information, the section depicts volumes and construction[7], and the elevation suggests external appearance. However, it is the plan that tells us most about how the building is arranged and used. This is particularly true as the plan identifies and locates human activities by assigning certain social functions to certain areas of the building. It tells us where, and in what size and shape of space, we do what. He continues,

> *A plan is an abstraction, a two dimensional horizontal slice through the building demonstrating the relative sizes and positions of rooms, circulation, doors and windows. A series of plans, typically one per floor, add up to a complete functional and spatial inventory of a building, performing a key role in how architects perceive and understand them. Indeed, in the work of architects like Hannes Meyer (1889-1954) and Leslie Martin (1908-), a building's design is often generated principally from the plan, with materials, structure and aesthetics relegated to secondary consideration. Yet a plan is quite different from the normal experience of a building – few people visualize a building as a plan unless trained to do so. Borden (1995: 214)*

It is this combination of abstraction with perceived completeness that makes the plan such an interesting object for study. On the one hand architects are given to believe that the plan can communicate a lot about the building, and on the other hand, its very abstraction may make communication of this wholeness problematic to a lay audience.

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[7] It should be noted that Borden does not refer here to the way that section relates to the human scale by being in the vertical plane and thus is easier to relate.

1.2.2 Categories of Drawings

There are clearly multiple ways in which one can categorise architectural drawings, depending on their role and the stage that they are used in the design and production process[8] (see e.g. Fraser and Henmi (1994), Graves (1977), Herbert (1988)). The categories of drawings can be divided into various types and interpreted into different ways. Therefore, as we shall see further in this section, the different types of architectural drawing need to be clearly defined in order to be clear to the reader and to provide a consistent approach.

For the purpose of this research, I have chosen to use the categories developed by Michael Graves (1977) in which he breaks down drawings into categories of communication which clearly fit into the communication model which is further discussed in Chapter Three. He describes the types of architectural drawing and the role each plays in the process of conceptualisation and communication by clarifying the dominant nature of each type according to the intention that architects assume for their drawing. He arrives at three primary categories:

1.2.2.1 The referential sketch:

Graves (1977) notes, "This kind of drawing maybe thought of as the architect's diary or record of discovery. It is a shorthand reference which is generally fragmentary in nature, and yet has the power to develop into a more fully elaborated composition when remembered and combined with other themes" Graves (1977: 384).

The sketch may appear very abstract and subjective as it is represented by a personal language of its creator (see Herbert (1988), Herbert (1993)). It can be used in various ways from the very beginning to the final stage of the design project. One may consider it as a useful tool at the conceptualisation stage, particularly when architects begin to articulate their ideas on paper, whilst one may also use it to additionally explain and support the final working drawing (see Robbins (1994)).

However, the sketch drawing is often more useful to the person drawing it than it is to someone else, based as it is on personal and often intuitive gestures (see Fraser and Henmi (1994), Lawson (1994)). Thus, it is sometimes very difficult for the public to interpret and understand a sketch as the realisation of the design object. As Cuff (1991) notes, the sketch drawing that represents an approximate building to the architect, may easily be misread by the client, setting a misleading direction for subsequent work. It is the drawing, Lawson (1994: 66) argues, which reflects how the designer "talks to himself" through the pencil.

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[8] Fraser and Henmi (1994), for example, describe categories of drawing as 'Applications of drawing' which is divided into six categories: Referential drawings, Diagrams, Design drawings, Presentation drawings, Visionary drawings, and Representation. Furthermore, they categorise drawing types into three groups: Orthographic, Axonometric, and Perspective drawing.

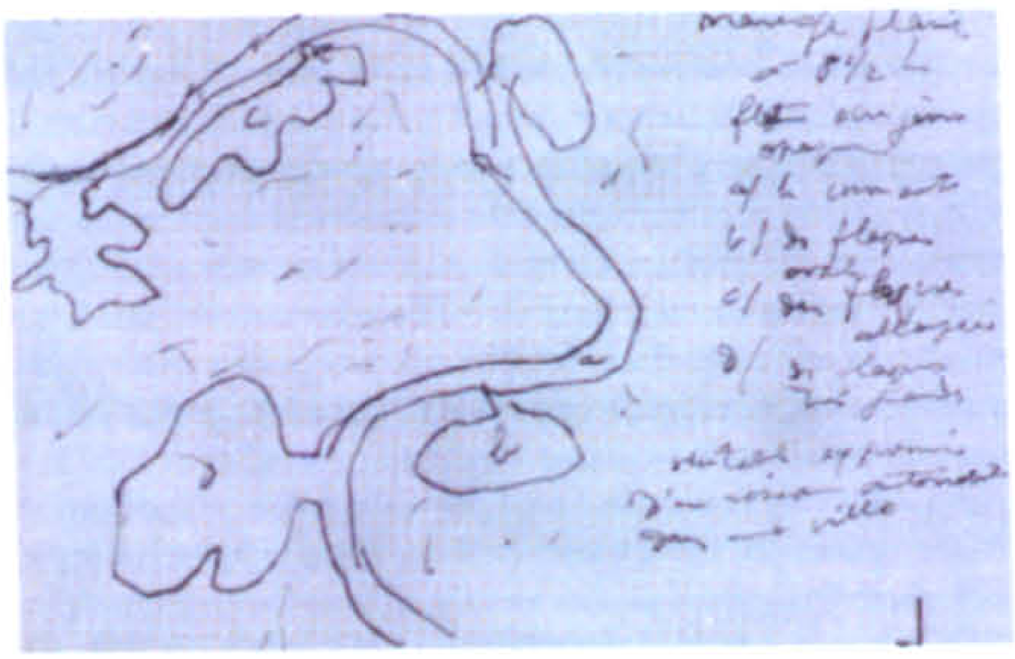

Figure 1.2: View from an airplane: Le Corbusier. Fraser and Henmi (1994: 3)

The sketch expresses the way he sees the world. It may be difficult for others to read and understand without a title or explanation from the architect who draws it.

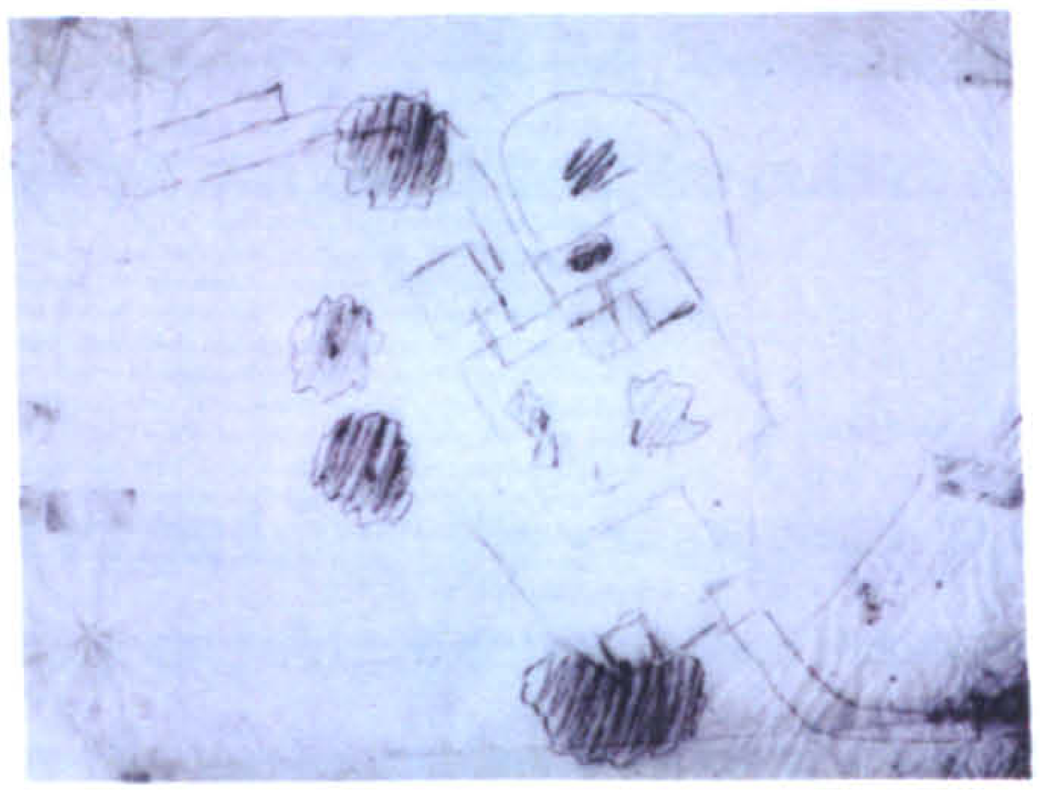

Figure 1.3: The sketch of Carpenter Visual Arts Centre, Harvard University, Boston, Massachusetts, (1960): Le Corbusier. Fraser and Henmi (1994:11-13)

1.2.2.2 The preparatory study:

This type of drawing is used during the design process and provides the basis for later or more defined work. Graves (1977) notes, "These drawings are by nature deliberately experimental. They produce variations on themes and are clearly exercised toward a more concrete architectural ends" Graves (1977: 384).

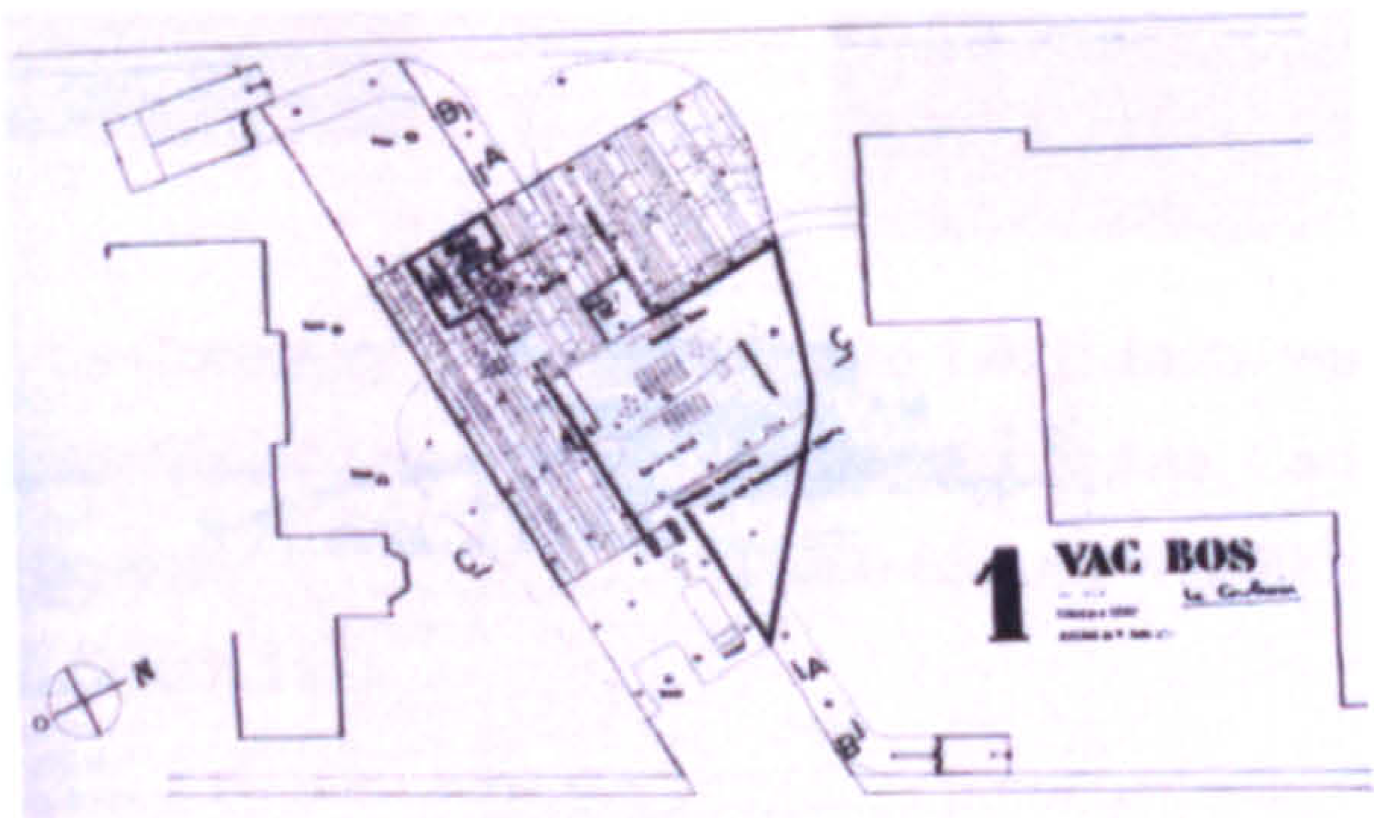

Figure 1.4: The preparatory study drawings of Carpenter Visual Arts Centre, Harvard University, Boston, Massachusetts, (1960); by Le Corbusier. Fraser and Henmi (1994: 15)

This type of drawing can be a design drawing (see Herbert (1988)), representational drawing or diagram, and is drawn in a more analytical way by using various techniques in order to show the architect's ideas, processes, and how the architect proposes to end with a tangible product. In addition, in some cases, this drawing may be used as a presentation drawing[9] that is drawn and shows the end product in a descriptive way (see Fraser and Henmi (1994)).

[9] Fraser and Henmi (1994) notes that presentation drawings require a maker to be more conscious of the drawing as a finished product, since they are intended to engage and persuade as outside audience. It is generally the most public of architectural drawings, as they are often well publicized by the mass media, playing an important role in public understanding before the realization of a project. See more in Fraser and Henmi (1994). Furthermore, Evans (1989) claimed that presentation drawings are drawn up ready for production when a scheme has been finished. It is frequently shown in as flattering and as realistic a light as possible. He noted that presentation drawings are not supposed to have any effect on the design. Their job is to propagate a completely defined idea, not to test it or to modify it.

Therefore, to a certain extent, the preparatory study drawing may be considered as a communicative drawing which aims to communicate between architects and the public.

1.2.2.3 The definitive drawing:

In this final classification, the use of drawing is shifted from the conceptual to a more tangible approach. Graves (1977) notes that the definitive drawing becomes an instrument for answering questions rather than posing them. They can be regarded as the final step taken in the drawing process which allows for the possibility or blueprint of the built reality. The definitive drawing is also referred to as a working or technical drawing, which is fully represented by a set of codes. Robbins (1994) notes,

> *Less personal and more conventionalised representations are called the "working," "contract," "production," or "realization" drawings. These drawings are produced at the end of the design process and are drawn to represent as precisely as possible how the design should be realized in the actual construction of the building. Robbins (1994: 27)*

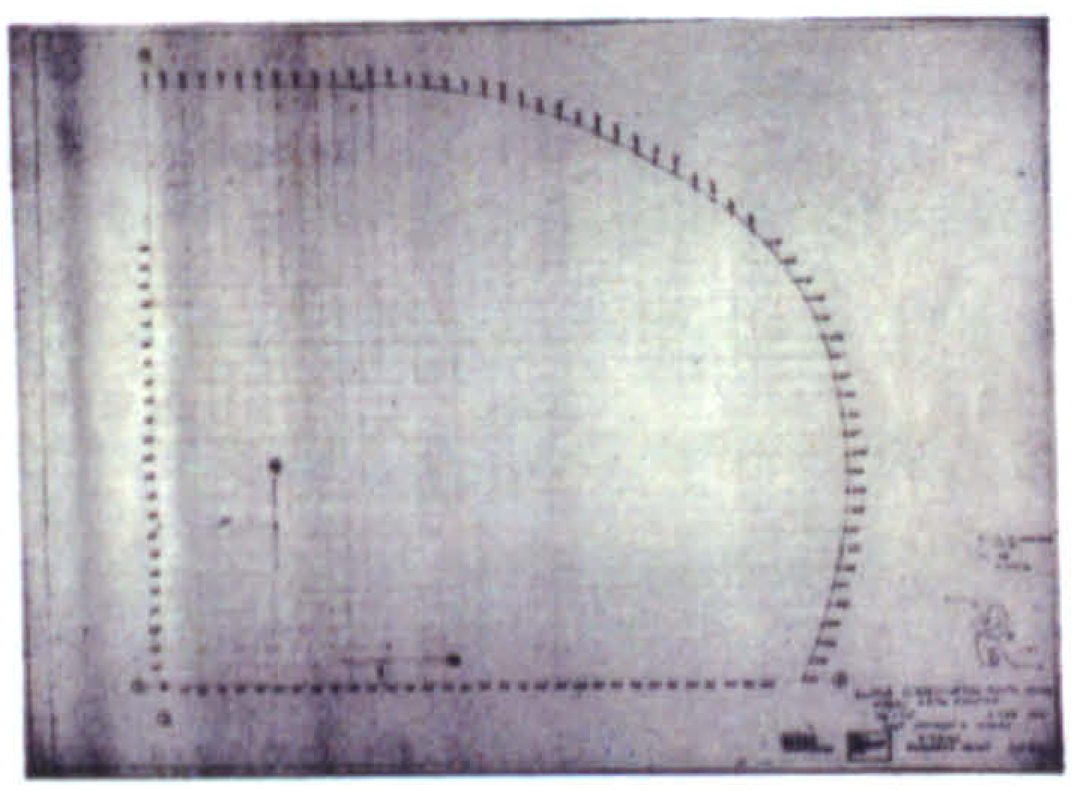

Figure 1.5: "Curve Layouts", Le Corbusier' s definitive drawings of "Carpenter Visual Arts Centre", Harvard University, Boston, Massachusetts, (1961). Allen (2000: 117)

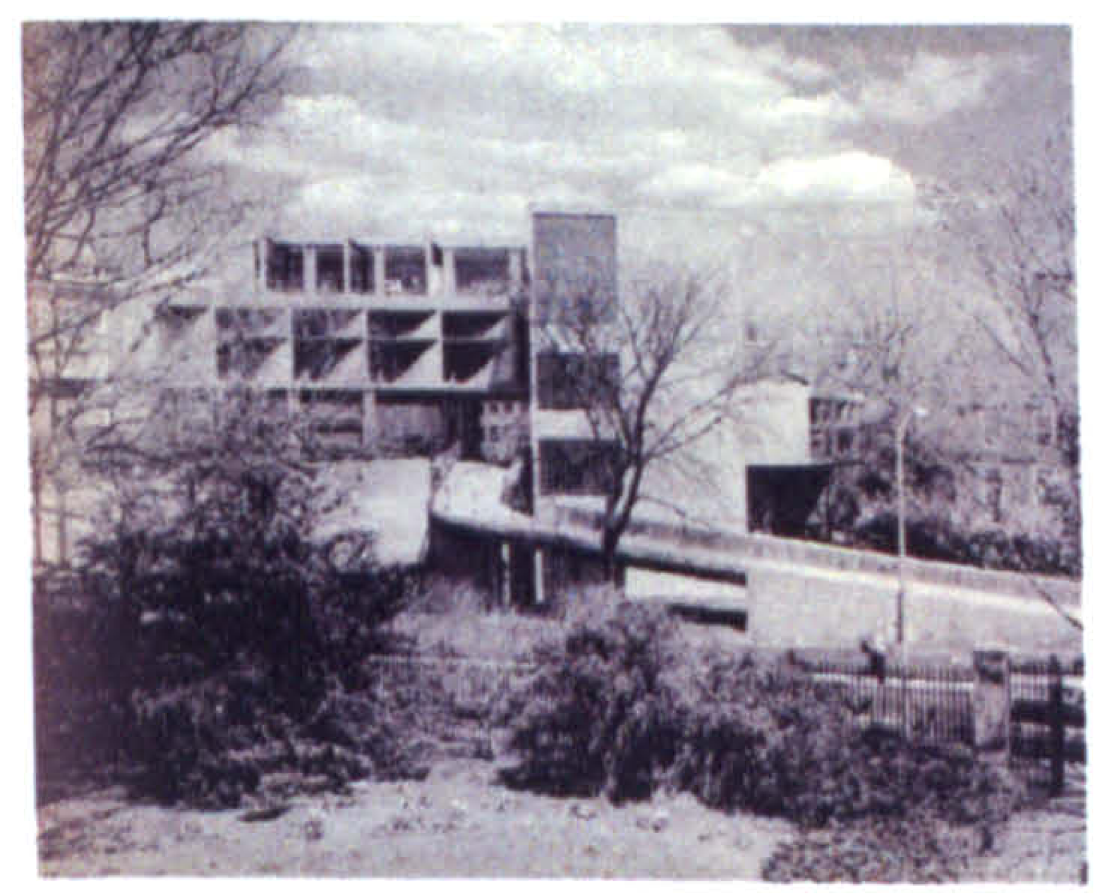

Figure 1.6: Exterior view of The Carpenter Centre for the Visual Arts, Cambridge, Massachusetts, (1960-63). Allen (2000: 115)

No single drawing could explain all the disparate aspects of a building's intentions which why architects employ the full range and scales of definitive drawings, including plans, sections, elevations, and three-dimensional drawings, in order to provide a more thorough understanding of the building. Graves' brief explanation of the three categories of drawing suggests a sequence of drawings that is more concerned with answering questions of architectural problems that architects face rather than being developed for the benefit of the general public.

For the non-architect, the architectural drawing and its coding system become part of an autonomous world from which they are excluded. As Cuff (1991: 12) notes, plans, sections, and elevations- the conventional means to represent a building - are difficult images for most clients to interpret. This suggests that there is no conventional drawing that is created to illustrate architecture in a comprehensible way for non-architects who have no architectural knowledge. This raises the question as to whether an architectural drawing is created solely for the architectural context or is also meant for the public realm. The status of drawing thus needs to be clarified.

1.3 Other modes of representation

> *Great architecture, I believe, is born in the tension between several different modes of representation, each of which illuminates a corner of this complex art. Modelling, drawing, computing as well as writing, talking and decoding; each is a different mode of thought that contributes to the creativity. Jencks (2001: 4)*

Architectural drawing is not the only tool of representation and communication in architecture; it is one mode among others which supports and constructs architecture. Architecture has been described as a three-part system constituting the building, drawing (its image), and writing (its accompanying critical discourse)[10] (see Agrest (2000), Forty (2000)). These have been used in the context of architectural representation throughout the centuries. However, each part has a different agenda so that when they are combined or viewed as a whole, they may create a conflict between one another. As Evans (1995) noted, "Drawing is not writing and architecture does not speak" Evans (1995: XXXVI). Thus, the use of each has to be carefully applied to architecture. The role of writing is thus discussed in the following section in order to clarify their respective roles as a means of representation and communication, as well as in particular to emphasise and distinguish the apparent role of the drawing.

Writing and language have clearly influenced architectural production. As Allen (2000) notes, "The purpose of writing is not so much to explain, or to justify a particular work or working methods (situating writing prior to, or above drawing or building, as activities proper to architecture) as it is a continual process of clarification. The activity of writing for me is part of the practice of architecture: something that happens alongside drawing, building and teaching" Allen (2000: XXIV).

Ellis and Cuff (1989) note, "Architects' words are not their buildings, but they are windows to the architects' thinking about their designing..." Ellis and Cuff (1989: 13). Forty (2000) notes, writing is not only used as an explanation inscribed directly onto the drawing, but is also indirectly communicated with the audience of the drawing and building through publications. This means writing and language become directly connected to the architects and indirectly to the public. He notes a further difference, "It is in the nature of language that words have to be spoken or written in a linear sequence. A drawing, on the other hand, presents its image all at once." He continues, "In this respect, buildings are more like language than they are like drawings, for they cannot be experienced all at once" Forty (2000: 39).

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[10] Diana Agrest (2000) notes, "Architecture is produced in three different registers, through three different texts: drawing, writing, and building. The production of each implies different problems concerning the question of representation" Agrest (2000: 164). She also said it would have been four if models are included. See more in Allen (2000: 163-177).

This argument is reinforced by Catherine Ingraham (1998); she refers to Stendhal's text[11] which opposes the two systems of representation, "One unfolding visually as a straight line over time (writing) and one using lines in non-linear symbolic configurations to be read "all at once," visually in space (drawing)" Ingraham (1998: 99).

However, in comparison with drawing, writing or language cannot explain the architectural object as a whole. Forty claims that language always searches for new ways of saying and writing things, whereas drawing seems to retain its own autonomy (he made this statement in his lecture: '*Architecture under the Empire of Language*' during the 9th International Bauhaus Colloquiums, Bauhaus University, Germany; in 2003). The culture of architecture presumes that drawing as its own application is able to convey information seamlessly to every audience. This research questions this assumption by explicitly investigating the relationship of drawings with their lay audience.

There are some architects who have tried to improve the connection between drawings and the public; one example can be found in the drawing of the Chinnor Surgery proposed by Aldington and Craig (see Figure 1.7), which attempted to convey an idea of the effects of building on patients and relationship between a doctor and his/her patients to the clients (see Mikellides (1980: 30)), but the main thrust in recent times has been to improve the surface quality of drawings by exploiting computer technology.

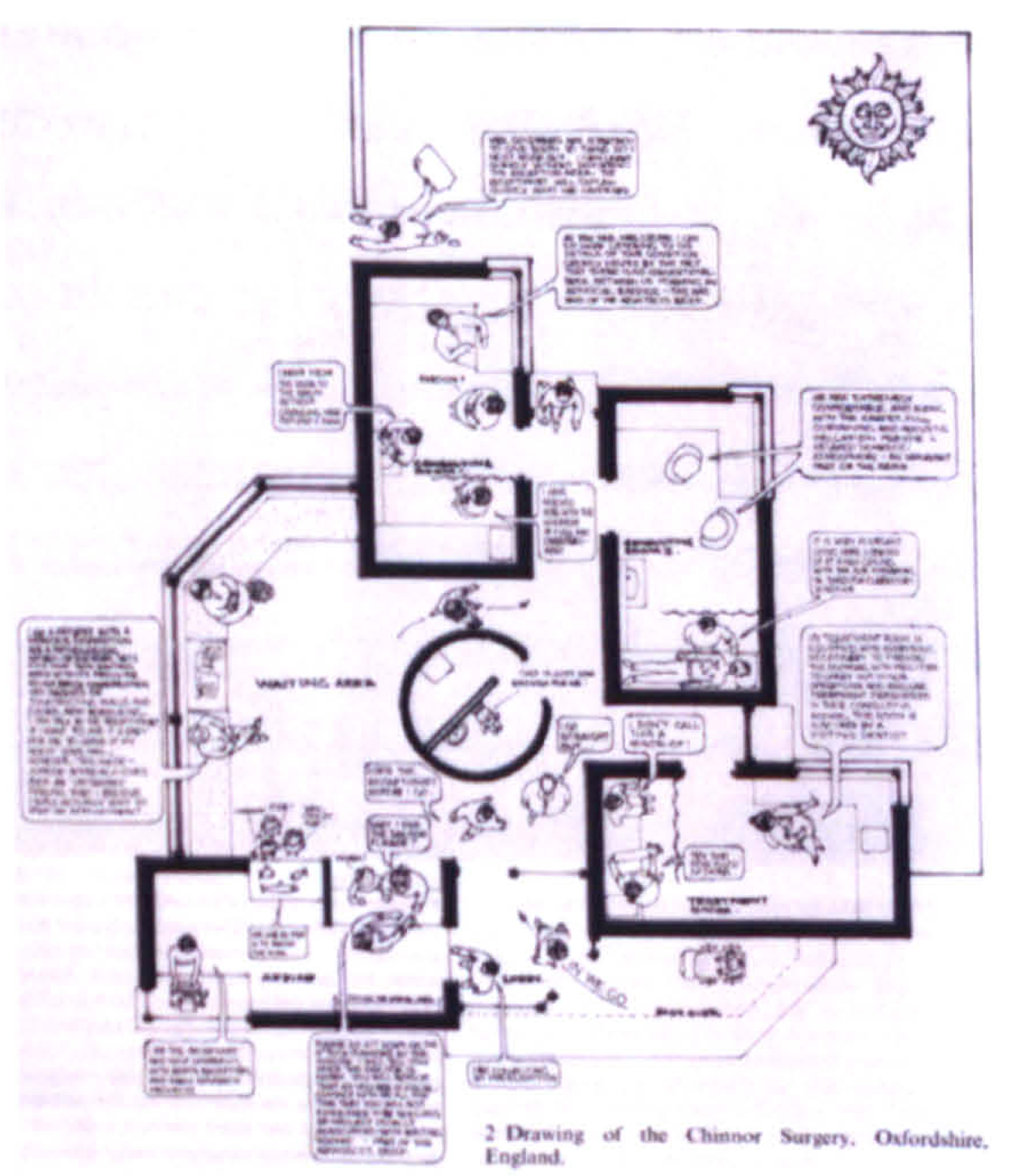

Figure 1.7: Drawing of the Chinnor Surgery, Oxfordshire, England. Mikellides (1980: 30)

However, it is argued that this 'improvement' does not address the issue of communication with a wider audience, but is more to do with manifesting progress in the

[11] See Ingraham (1998).

internalised culture of architecture. This shows that architects do not consider the lay audience sufficiently. As it is a privileged vehicle for expressing architectural intentions, architects put a variety of ideas and concepts into drawing which can thus become too subjective and excessive, and with this, too abstract for its audience. Gomez (1982) claims that the architect seems condemned to make either poetic drawings or critical ones. He notes,

> *The risk is the production of either screaming, an excessive dependence on context, and an unwarranted faith in the possibility of meaning in the world, or babbling, an excessive independence from context and an unwarranted faith in the impossibility of meaningless abstraction. Gomez (1982: 6)*

The excessive drawing reveals a self-portrait of its maker and therefore unable to communicate by itself, and without explanation from its maker, it is impossible for the audience to understand it. It becomes private to the individual speaker, not meant to promote communication, and therefore self-contradictory, "impossible like all private language" (see Bloomer (1993)). This problem is exaggerated with the use of orthographic drawings as Evans (1989) notes,

> *Because this is not the way we see things, orthographic drawing seems less easy to place. It does not correspond to any aspect of our perception of the real world. It is more abstract and more axiomatic system. This is why so many people find such drawings difficult to read at first sight. Evans (1989: 21)*

Thus the architectural drawing seems to have the problem with communication and its audience. The problem of communication breakdown becomes crucial as the drawing is considered as the crucial medium linking architects to buildings; buildings to users (non-architects); and users to architectural space. Therefore, this research is conducted to investigate this perceived problem and in doing so attempts to find a solution that is hoped to be useful within the context of architectural education and practice. Particularly, it emphasises the fact that architects do not consider the lay audience sufficiently; and this issue needs to be examined. In order to focus the purpose of the research, this research looks at the architectural drawing itself and the way it communicates. It does not deal with other modes of communication. Moreover, the plan drawing is selected as the main focus, in order to allow for consistency.

It is important to note that this research cannot be value-free. The author acknowledges the potential influence of his values, biases, and assumptions, on the process of research and subsequently findings. Such values are brought by the author's position with regard to the self-referential culture of architecture. These value and belief in the culture of architecture, I believe, potentially lead to a breakdown of communication between architects and the public; through any means of communication. This is in some way negative as it reveals architect's ignorance, arrogance, and unawareness towards their audience and, in some cases, even architects themselves. Since these values are set in their education and a fundamental culture of architecture, architects do not consider their audience sufficiently and usually make their position different from the others.

Hence, this could also affect the author's research position and his process in analysing and writing up subsequently findings. However, in order to make this research explicit and to reduce a potential effect from such values, lay audience is considered and included in the process of research; particularly at the stage of empirical studies. It is hoped that the value of the inclusion lay audience would help architects to re-consider their own self-referential value, reveal the difference between their values, and suggest directions for inclusive research outcomes and faithful communication.

1.4 Research Aims and Objectives

The main aim of this research is to examine whether a conventional architectural drawing, in particular the plan drawing, is an effective tool for communicating with non-architects. The role of architectural drawing will be explored and clarified. The dilemma of how best to communicate between the two parties is revealed through historical evidence and relevant theories in order to investigate how to formulate appropriate approaches for more communicative architectural drawings. Consequently, the research objective is to investigate the communicative potential of a conventional drawing through empirical tests in order to achieve alternative methods of developing architectural drawing with the hope to provide a more efficient and accessible medium for communication. This research thus attempts to re-bridge the gap between architectural context and the public realm through making specific recommendations for architectural education and practice to improve or develop their architectural drawing.

1.5 Research Questions

1. Are conventional architectural drawings an effective tool for communicating with non-architects?
2. Do non-architects understand architectural drawings as architects do? If so, what kind of interpretative system does each party use?

1.6 Research Hypotheses

1. Conventional architectural drawings have become internalised and play out as a private language that excludes non-architects.
2. The set of codes used within a drawing lead to difficulties in reading and understanding by anyone outside the profession.
3. Architects and non-architects have different interpretative systems in understanding architectural drawings.

1.7 Research Organisation

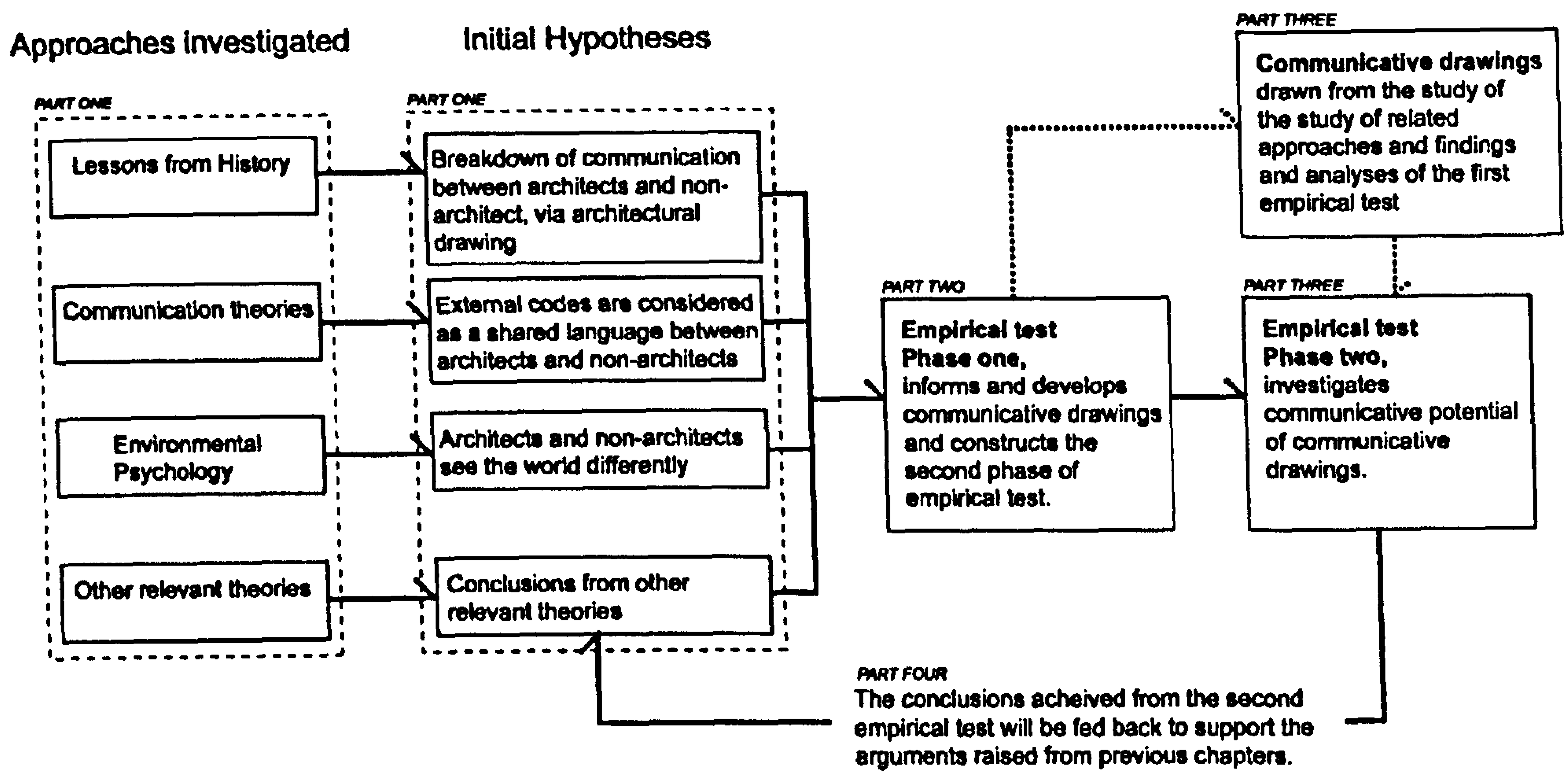

Figure 1.8: Proposed research organisation

The research is conducted in four major parts. Each part is related to a specific aim and encompasses a variable number of chapters. At the end of these chapters, there is a conclusion that lists the main points and discusses the implications for subsequent stages of work.

1.7.1 Part one: Reviews of Literature and Relevant Theories

The first part examines three related approaches: Historical overview, Communication theories, and Environmental psychology (Chapters Two, Three, and Four). This part will not attempt a comprehensive investigation of each theme, but will use them solely as a vehicle towards an explanation of the perceived communication breakdown. It is hoped to indicate and help us understand where the breakdown of communication in architectural drawings occurs.

This part aims to re-support inclusive approaches to architectural design and practice and to inform practical recommendations as final outcomes. Therefore, each theme is taken with a practical rather than a philosophical approach. The critique of the sources maybe quite broad, in order to provide a wide-range of relevant examples which could identify the perceived communication breakdown.

Chapter Two: Lessons from History

This chapter attempts to propose a theoretical foundation for extending the understanding of architectural drawing by bringing forward historical evidence, examples, and ideas. It reviews the history of architectural drawing during critical periods of time. It illustrates the trends in representing and communicating through architectural drawing within each period, through which it may be able to indicate when the perceived breakdown between architects and non-architects began.

Chapter Three: Drawings as a Mean of Communication

Basic communication theories are reviewed and linked to a basic structure of communication in architectural drawing. However, the main idea of this chapter is to examine a communication model between architects and non-architects, in particular when they employ architectural drawing as a communicative medium. The basic communicative model of architectural drawing is investigated, involving the relationship between architects, architectural code, conveyed messages, and the audience. This chapter shows how architects and non-architects encode and decode architectural drawings respectively.

Chapter Four: Seeing Drawings with Different Eyes

Initially, this chapter begins with a brief study of environmental psychology in architecture, particularly suggesting the way concepts and constructs by which architects and non-architects relate to buildings that may also relate to architectural drawings. It suggests that the differences in interpretative systems between architects and non-architects influence the way they engage with and understand architectural drawings. Moreover, the role of architectural drawing as a communicative tool is considered to test if architectural codes can be effectively communicated with non-architects. It is hypothesised that both parties see the world differently and the use of external codes should be considered in developing the communication (through architectural drawings) between them. In conclusion, this chapter informs and develop questions for the Empirical test that is conducted in the next stage.

1.7.2 Part Two: The First Empirical Test

In the second part, the empirical test is conducted in an attempt to verify the main research hypotheses. The first phase of the empirical test (based on the use of a questionnaire) is aimed to identify the communication breakdown between architects and non-architects.

Chapter Five: Methodology and the Empirical Test

This chapter introduces the basic research framework and methodology used within the test. The main objectives of the empirical test are raised and the preliminary hypotheses are then developed. The chapter describes the process for designing and constructing the first empirical test, 'Draw the line questionnaire 1', and includes an explanation of the methods for data analysis.

Chapter Six: The First Empirical Test

The results obtained from the first empirical test – 'Draw the line questionnaire 1' are presented in this chapter. There are two main research hypotheses raised here, in which one focuses on a significant difference in the way conventional architectural drawing is **seen and read** by lay people and architects, while another focuses on a significant difference in the way conventional architectural drawing is **interpreted and understood** by lay people and architects. The statistical analysis allows the raised hypotheses to be tested and the significant results to be analysed and interpreted. The first empirical test is hoped to inform the next stage of the empirical test and present key ideas in developing an alternative form of architectural drawing, which will be presented in Chapter Seven.

1.7.3 Part Three: The Second Empirical Test

Deriving from the two previous parts, where the breakdown of communication (through architectural drawings) is identified, part three attempts to develop an alternative method for architectural drawings.

Chapter Seven: Communicative Drawing

This chapter describes the development of an alternative form of architectural drawing, the so-called 'communicative drawing'; the term 'communicative' is used here to identify the act of conveying and providing information to both architects and non-architects. Three other means of representation (the map, the diagram and the architectural graphics) are initially reviewed in order to find clues in developing the communicative drawing. These lessons are then combined with the conclusions from the three chapters in Part One (on history, communication and psychology), together with the findings from the first empirical test, in order to design the communicative drawings. The designing and construction of the second empirical test are then described. In contrast to the previous test, the second empirical test contains more specific questions and uses communicative drawings as the experimental tool in the process of data collection. The aim of the test is to find out whether the communicative drawings can indeed begin to address the problem of communication between architect and non-architect.

Chapter Eight: The Second Empirical Test

This chapter presents the results obtained from 'Draw the line questionnaire 2'. Similar to the previous empirical test, the latter empirical analysis is based on both quantitative and qualitative methodology. The analysis compares the results between two phases of the empirical test and also between the two forms of drawing (Conventional and Communicative drawing). The main research hypotheses considered within the second empirical test focuses on a significant difference in the way **conventional drawing** and **communicative drawing convey information and communicate with the audience.** The comparative study between the two forms of drawings allows the hypotheses to be tested in order to verify the communicative potential of communicative drawings.

1.7.4 Part Four: Conclusion and Further research

Chapter Nine: Conclusion

The whole research is summarised in the conclusion. Main findings are discussed and outcomes are fed back into the initial hypotheses raised in the first part. Furthermore, recommendations and directions for future research are outlined. Details of both phases of empirical test and other supporting documentation can be found in the Appendices.

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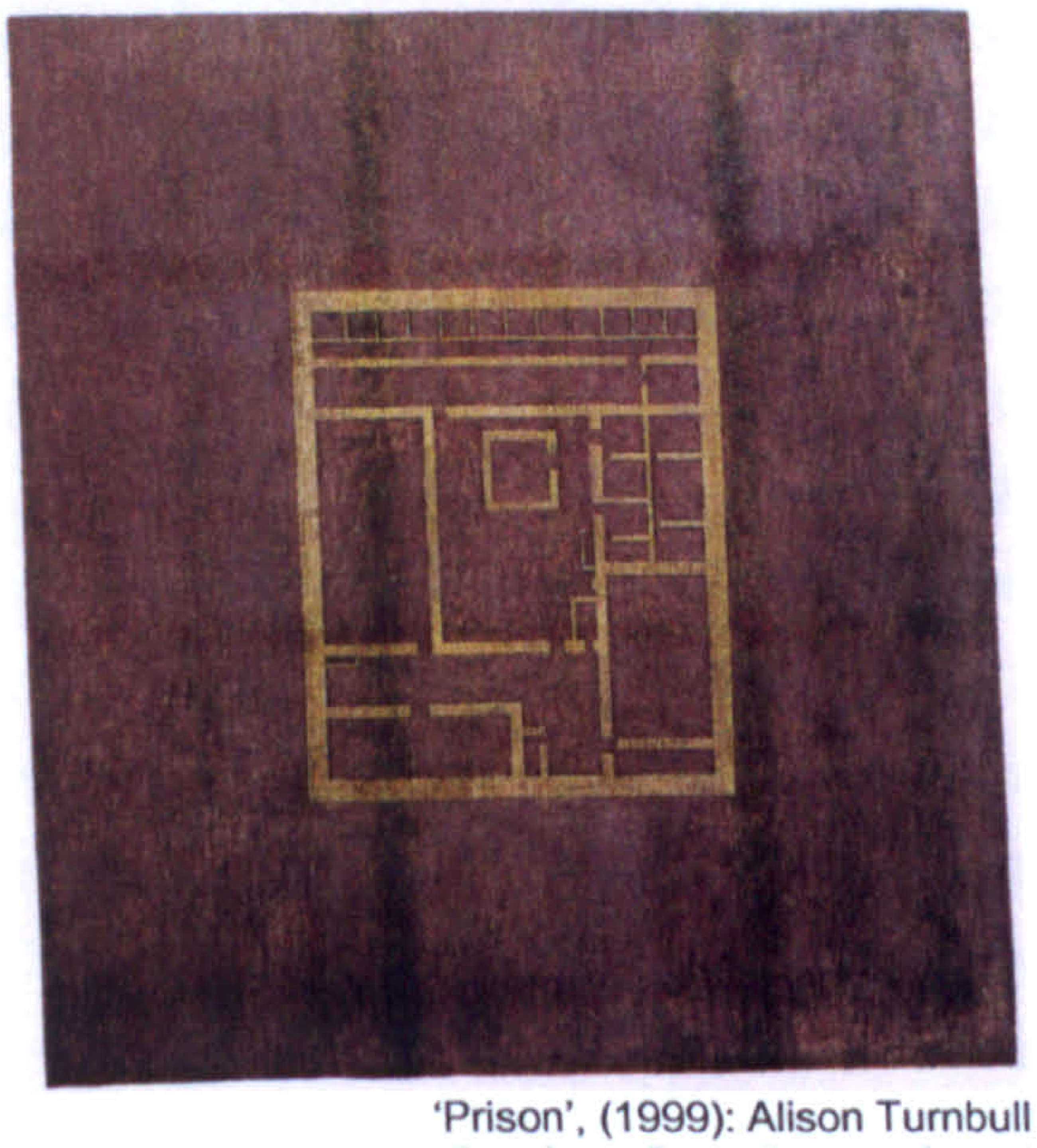
Chapter 2
The Lessons from History



'Prison', (1999): Alison Turnbull
oil and acrylic on linen on board

'Plans and elevations are a form of architectural drawing. It is a particular and specialised kind of drawing as well as one which follows conventions quite different from those of other forms of representation. It is a kind of drawing that resists depiction or illusion – but which nonetheless carries with it a host of cultural connotations. More or less legible, depending on one's knowledge, plans are a specialised from of codifying space – the world of spaces we inhabit' (Fer, 2000: 8).

Chapter Two | THE LESSONS FROM HISTORY

2.1 Introduction

Throughout the history of architecture, architectural drawings have been used as a tool in the making, communicating, and understanding of architectural production. Drawings convey architectural ideas and provide instructions that can be understood by both architects and non-architects. Its function is a medium of communication, not only between architects and clients, but also between architects themselves.

In the development of architecture, drawings have historically appeared in many different forms through varying methods and techniques in representation. In the first instance, (see e.g. Kostof (1977), Robbins (1994)), flakes of stone or wooden boards were used as drawing pads and ideas were conveyed through the pictorial language indigenous to a specific cultural medium, such as Hieroglyphics (see Badawy (1966), Badawy (1968), Kostof (1977), Peck and Ross (1978), James (1985)). Drawings became a general tool of architectural production during the Medieval and Renaissance period (see Ackerman (1970), Gomez (1982), Gomez and Pelletier (1997), Eck (2002)). These two critical periods have significantly established the role of the architect. The role shifted from the traditional designer or builder to the architect who produced drawings and provided information to other people to construct his designs (see Ackerman (1970), Kostof (1977)). At the same time, the relationship between architects and non-architects began to develop during those times. Today, architectural drawings have undergone many changes and refinement as a result of various social, economic, and technological developments. Drawings have apparently been improved and reshaped though advanced technology, particularly with computers. For example, computer aided-design (CAD), which can be incorporated in both design and drafting tools, theoretically helps to enhance a drawings' communicative capability (see Gero (1977), Mitchell (1977), Bruegmann (1989), Szalapaj (2001), Giddings and Horne (2002)). Thus, the architectural representation has presently shifted from paper to computer screen, from one with a two-dimensional surface to another with three-dimensional attributes, from conventional methods to an alternative approach, and from corporeal to abstract properties (see Schmitt et al. (1994)).

The development of architectural drawings through the historical periods creates their own trend for architectural representation. This chapter briefly traces the development of architectural representation, with a view to identifying trends in the relationship between architects and non-architects. Most architects use drawings as a medium of communication and in this (either explicitly or implicitly) expose the link between the drawing and its social production. As Robbins (1994) notes, the drawing, to a great extent, serves to frame and structure the social interaction we have with the architect. He is interested in drawings as a bridge between different aspects of architectural practice. He looks at the way drawing provides the framework that connects the cultural creation of architecture to its social production. He notes,

> *Architectural drawing has many effects, serving as it does to join concept to its materialisation and the architect as cultural creator to the architect as social practitioner. Drawing both produces architectural knowledge and is a production of that knowledge; it both guides social practice and is guided by social practice. As a result architectural drawing must be understood from a variety of perspectives. ... the analysis of the social uses of architectural drawing should run parallel to discussions of drawing as a mode and language of representation, we cannot claim to adequately understand how an architectural drawing means outside of its effects.* Robbins (1994: 5)

This means drawings play more than a single role. It is not merely an architectural image[1], but it also socially and spatially has an effect on its audience. Therefore the triangular relationship between social production, the drawing, and also the period when the drawing is created should be considered.

This chapter will investigate the aims which architects[2] have had in each historical period and whether they have developed a communicative model of representation; the term "communicative" is here used to denote the act of conveying and providing information to non-architects, both clients and the public. Over the centuries, architects have attempted to develop their own language by employing different techniques (see Fraser and Henmi (1994), Allen (2000)). Some of the techniques, such as perspective, enhance the production of drawings and their communication, but some techniques create limitations to their configurations and to the audience. This has led the language of drawings to become autonomous and self-contained, thus suggesting that the shift of historical periods has created both comprehensible and incomprehensible communication. This chapter investigates whether the perceived breakdown and limitation of communication within drawing as a means of representation emerged historically. As Tschumi (1994) mentioned, "The limits of architecture are variable: each decade has its own ideal themes, its own confused fashions" Tschumi (1994:107). Therefore, the historical overview of architectural drawing is required to carefully examine the lessons that can be learnt from each period through its historical evidence. The study will trace both architectural and social production and identify the evidence as to why the perceived breakdown of communication transpired. The aim also is to identify exemplars in communicative aspects of

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[1] Adrian Forty (2000) considers drawing as an architectural image. He notes, "Architecture is a three parts system constituted out of the building, its image (photograph or drawing), and its accompanying critical discourse (whether presented by the architect, client or critic)" Forty (2000: 13).

[2] This term is used to cover people involved in the design of buildings. Kostof (1977) notes that the term and role of architects was developed through the centuries. Its summons has come from clients who had need of special buildings, buildings with a disposition and refinement of form that was out of the ordinary, and who could afford to pay them. He notes, "What they (architects) do is to design, that is, supply concrete images for a new structure so that it can be put up. The primary task of the architect, then as now, is to communicate what proposed building should be and look like. The architect does not initiate buildings, nor necessarily take part in the physical act of construction. The architect's role is that of mediator between the client or patron, that is, the person who decides to build, and the work force with its overseers, which we might collectively refer to as the builder" Kostof (1977: V).

drawing which may then inform the refinement in today's architectural drawings and the process of communication.

2.2 The Lessons from History

This section will not look at a comprehensive history of drawing, but it is aimed to examine the way in which drawings have been communicated in selective historical periods. The evidence and lessons from these specific periods will inform the argument of the research. Five historical periods have been selected for this study: the Ancient times, the Middle Ages, the Renaissance, the École des Beaux-Arts, and the Twentieth Century. These particular periods have each developed highly distinct styles of drawing, techniques, and communicative methods, which have potentially affected contemporary architectural drawings and their communication process. The study focuses on examples of comprehensible communication through the architectural drawings, as well as examples of the perceived breakdown of communication in drawings.

2.2.1 The Ancient times: Egypt and Greece

Ancient Egypt exemplifies the efficiency of communication between architects and non-architects, by using drawings as a medium of communication[3] (see Kostof (1977), Peck and Ross (1978)). The configuration of Egyptian drawing was mainly dominated by the Hieroglyphic culture, which offers a shared code between architects and non-architects. Peck and Ross note that a hieratic text gives information concerning the orientation of the drawing. Moreover, the two-dimensional pictorial representation, based on the shared Egyptian culture and figurative code, has effectively provided a reading system catering to readers accustomed to Hieroglyphic culture (see Plommer (1956), Badawy (1966), Badawy (1968), Peck and Ross (1978)). The Egyptian drawing does not directly show an architectural drawing in the contemporary sense of a coded and scaled representation, but instead, the picture-like icons of the building has its spatial configuration and architectural viewpoints expressed through human figures, gestures, activities, and figurative codes. As Kostof (1977) notes that what the building would look like in its totality was probably conveyed through images like the representations of architecture in pictorial art.

As such the hieroglyphic drawing may be considered as a drawing which was created from a non-architect's language. As Forty (2000) refers to in Quatremère de Quincy's essay "De Architecture Egyptienne" (1803), the hieroglyphic inscription, which was written on both the

[3] There are some surviving evidence of architectural ground plans, which were mostly drawn on limestone flakes. One example is a papyrus plan of the tomb of Ramesses IV (Dynasty XX, time of Ramesses IV, c. 1162-1156 BC), which was not drawn accurately to scale and precise measurement. (see Figure 2.1) The plan's measurements were given in hieratic writing. However, the measurements were so accurate as it can be shown that it have been a projected treatment of the tomb of Remesses IV (see Plommer (1956), Badawy (1968)). Peck and Ross (1978) note that it is difficult to determine what stage in the cutting of the tomb this plan was made for. It could have been an initial conception, but also possibly a working drawing for the use of those who superintended the labourers on the tomb. See more in Peck and Ross (1978).

drawing and the building, is referred to by Quatremère de Quincy's as a "public library" Forty (2000). It is information which provides clear communication to the public. This idea of the architectural drawing as a resource to be shared by designer and non-designer alike accords with Robins (1994) notion of the drawing as a powerful means of social communication,

> *Drawing can also provide a code or template that guides the social production of the object it represents. It embodies within itself the relationship between society and culture, the relationship between realization and imagination, and the relation between object and subject. Robbins (1994: 7)*

The following examples of Egyptian drawings indicate the way that the shared language is developed:

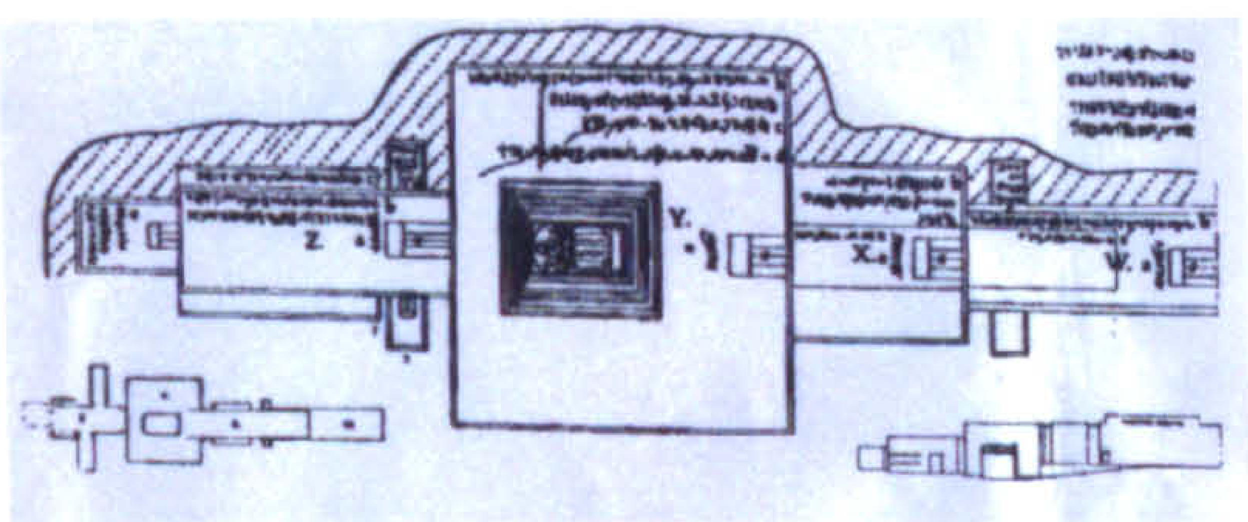

Figure 2.1: Papyrus plan of the tomb of Ramesses IV (Dynasty XX, time of Ramesses IV, c. 1162-1156 BC). Badawy (1968, Plommer (1956: 46)

The plan's measurements were given in hieratic writing. This shows a communicative relation between hieroglyphic culture and architectural drawing.

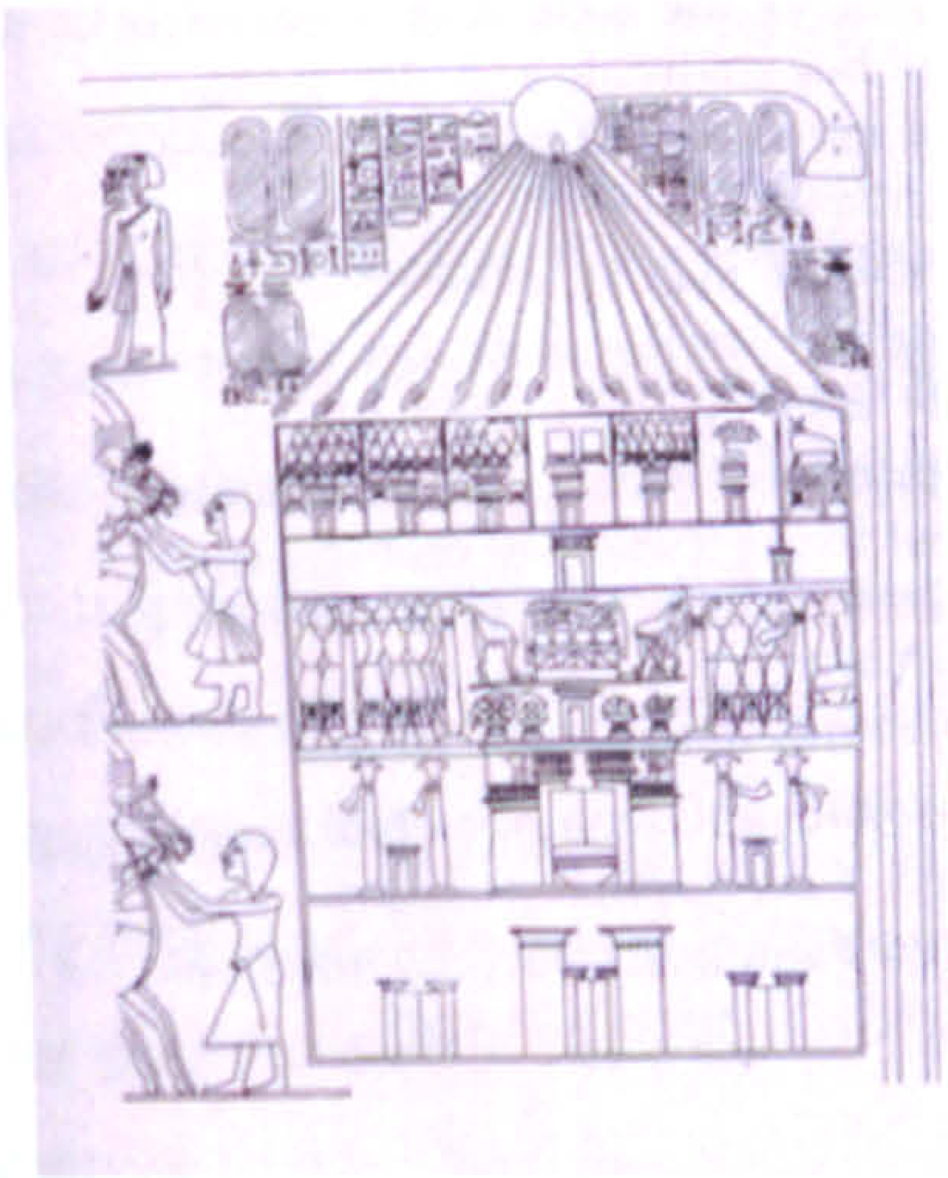

Figure 2.2: Bird's eye view of an Amarna Palace in a painting from the tomb of Mery-Re, high priest of Aten; XVIII dynasty. Kostof (1977: 9)

The drawing does not show any specific architectural feature, but metaphorically explains architecture and spatial configuration by relying on drawn objects, human figures, gestures, and activities. The main sections of the palace are shown in depth as registers placed one on top of the other, with the bottom most register representing the three gates of the outer court and the topmost, in the farthest distance, some interior rooms.

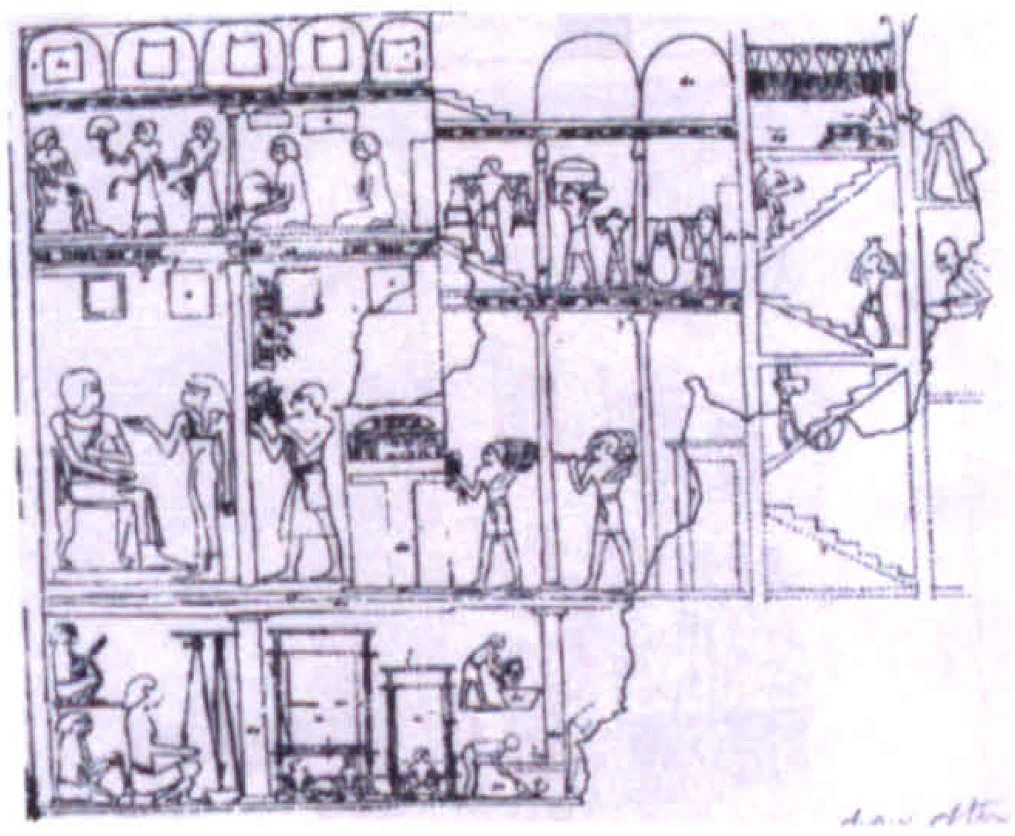

Figure 2.3: Section in the town house of Thutnefer at Thebes. Badawy (1968: 16)

Pictorial language is used as code or reading key in communicating with the (in particular Egyptian) reader. The information and experience of place are conveyed through the presence of drawn objects and human figures, as well their activities. Architectural features become less important and are shown as additional elements.

What can be identified most clearly in the Egyptian period is that the codes used on the drawings are part of a wider system of signification, and thus the drawings have a communicative value that we shall see is lost in later periods. Of particular importance is the incorporation of human elements, giving a sense of both scale and occupation in an easily understood manner.

This sense of shared communication is not found in the Greek period, in which the distance between architectural drawing and building starts to become opaque and ambiguous. In the Greek period drawings played a minor role in the process of producing architecture in the social sense, for example, as a method of communication with non-architects. Instead, the Greek architect used a technical description called "Syngraphai" to explain the construction process and communicate his intention to the workmen. As Coulton (1977) notes,

The most important element seems to have been a technical description called the syngraphai – specifications – which set out the general lines of the building with a good deal of detail on the way it was to be built. The information given there might be supplemented by further details in the individual contract – also called syngraphai – specifying the work undertaken by each contractor. Coulton (1977: 54)

One such example of the use of Syngraphai inscription can be found in a reconstruction drawing of the naval arsenal at Piraeus, the port of Athens (see Figure 2.4), built between 340 and 330 BC (see Kostof (1977: 14), Martin (1967: 41). The architects were Philon and Euthydemos. The building, which has not survived, can be recreated with some surety on the basis of specifications inscribed on a stone tablet. The Syngraphai explained information about the site, the overall measurements, the thickness of the foundations, and the material and standard size of the stone blocks, but not their exact number, or details about their quarrying, transport, and final dressing; it ended by including the contract paper for the contractor. Some of the inscriptions extracted from the document are shown as follows,

The Gods: Specifications (Syngraphai) of Euthydemos, son of Demetrios of Melite, and Philon, son of Exekestides of Eleusis, for the stone arsenal to be used for the storage of naval tackle. An arsenal shell be built in Zeia for naval tackle... beginning at the Propylaea of the market place and running behind the ship sheds which have a common roof. The length shall be four Plethra (About 405 feet), the width 50 feet or 55 feet including the walls. The ground of the site shall be cut down 3 feet where it is highest and levelled off in the other parts. On this area the course masonry of the foundations shall be laid to an even height, the whole being dressed by the level. The foundations shall be extended so as to support the piers, to a distance of 15 feet from the walls, including the thickness of the pier. ... All these things that shall be carried out by the contractors in accordance with the specifications and the measurements and the model which the architect shall provide, and they will make delivery at the time agreed to in the contract for each of the jobs. Kostof (1977: 14)

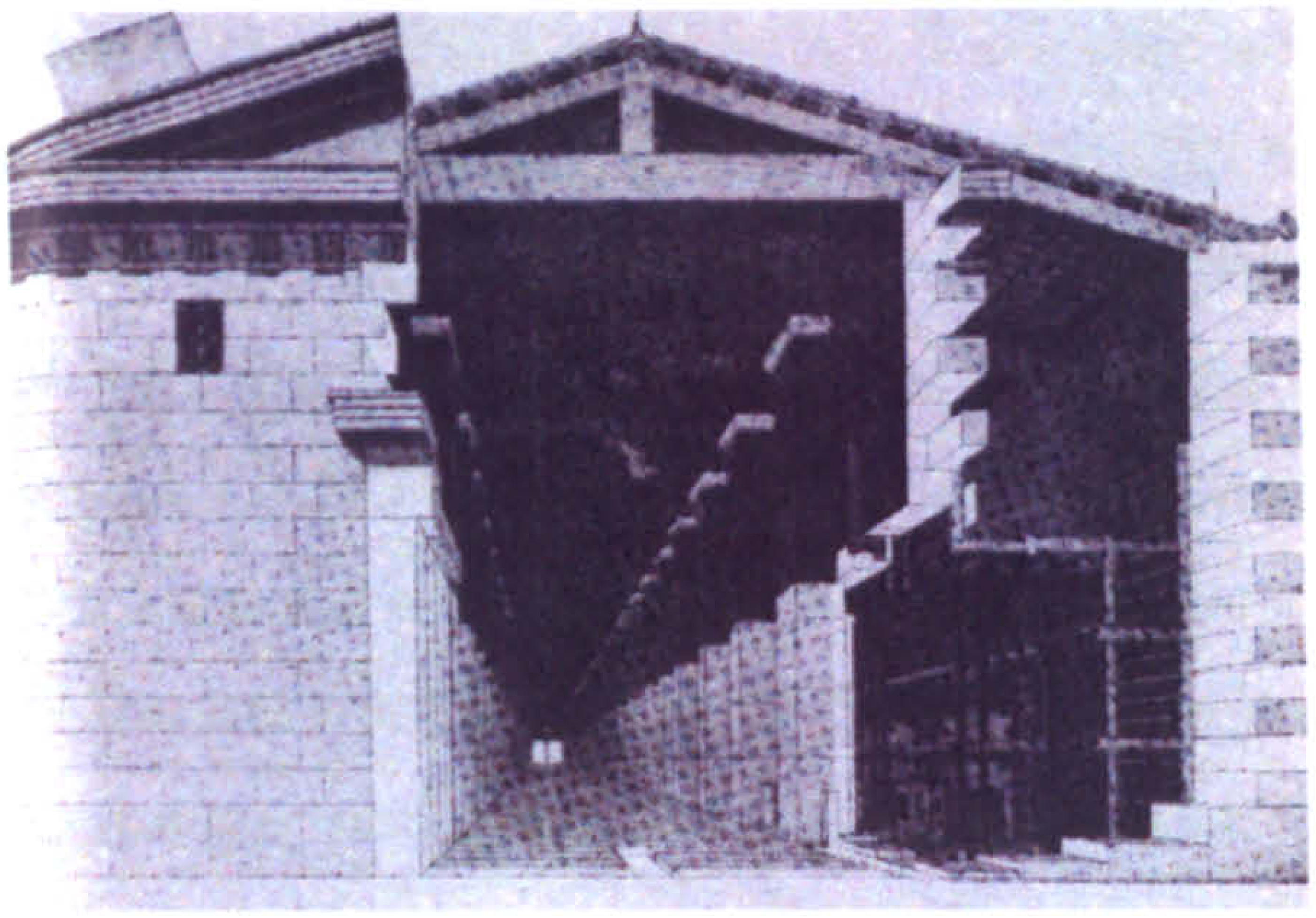

Figure 2.4: A *reconstruction drawing* of the naval arsenal at Piraeus, the port of Athens, built between 340 and 330 BC. Kostof (1977: 13)

What this indicates is that drawings were not used as the primary means of communication, either technically (for the contractor) or socially (for the public). As Bundgaard[4] (cited in Kostof (1977)) notes, "The Greek architect never made plans or elevations for the buildings he undertook to design. He did not design building the way Senmut or Rabirius or Michelangelo did. He was rather a master craftsman..." Kostof (1977: 11). This evidently suggests that in some periods architecture did not necessarily rely on drawing as its main method of communication.

2.2.2 The Middle Ages

In the Middle Ages, architectural drawings had became more architecturally defined. Working drawings and full-scale drawing[5] were widely employed in the building project. The Medieval architects and master masons were considered to be of equal status as they both received the same training, mainly in creating working drawings (see Shelby (1971), Kostof (1977)). In fact, the master masons played a more significant role than the architects of the Middle Ages. A master mason was in charge of almost everything within the building project by himself, for example making a set of working drawings for the entire project, which included details and shop drawings on the construction site, dealing with building contracts with patrons in order to secure an authorization, supervising the construction process on the site, communicating working drawings with the laymen, and so on.

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[4] J.A. Bundgaard's research can be found in his book *Mnesicle: A Greek Architect at work* (Copenhagen, 1957), where you will also find the texts and translations of the inscriptions for the porch at Eleusis and the arsenal of Piraeus (see Kostof (1977)).

[5] Full-size templates techniques, may consider as another kind of drawing technique in Gothic period and it was an especially sophisticated practice in the Middle Ages. Medieval Architects used the full-size templates techniques within the process of building design. A medieval architect mapped out full-size figures directly on the site itself, or on the building as it was being constructed. The full-size drawings are not a picture or representation but demonstrations of how drawing becomes building (seeShelby (1971), Pett (1996)). As Pett (1996) notes, "Medieval templates were encoded with instructions that went beyond their obvious two-dimensional shape or outline; they were devices which, when properly deployed, generated three-dimensional details and components" Pett (1996: 100).

Robbins (1994) notes that in medieval building, there was not the ordered progression of modern building practice, from the architectural drawing through to the shop drawing to the design and construction of mason's templates. The Medieval master mason combined in himself the equivalents of the modern architect, stone contractor, building contractor, and construction supervisor. Shelby (1971) argues that the drawing constituted a significant part of the mason's skill but was not crucial either to his self-definition or to his work. Moreover, she notes that in spite of the masons' contribution in the development and increased skills in working drawing; they had not yet perfected their skill to the point where the drawings alone were adequate instrument for directing the construction.[6] This is why the master mason was tied to the site throughout the construction period and had to communicate the design to other people working on the building. The drawings had to be supplemented by verbal explanation. This suggests the communicative potential of Medieval working drawing had not yet achieved a standard to provide full communication to its intended audience which in this case was not the general public but an internal audience of the construction world.

One such example is the drawing of Sansedoni elevation (Figure 2.5) which was produced in the fourteenth century. It is an orthographic drawing, drawn to scale, supplied with dimensional measurements, and accompanied by written notations to guide its realisation. A master mason drew it as a working drawing or definitive drawing in order to proceed with its construction process and to request an authorization from a patron. However, this drawing is not detailed enough to be used to actually guide and control the production of the building as working drawings are meant to do today. The lack of detail in the elevation reminds us of how considerably little relation there is between the drawing and its construction during the fourteenth century. This is why the mason had to be on site to guide and supervise the construction process himself. In addition, this elevation drawing was not able to communicate with the external audience or even with other masons, without explanation from its creator.

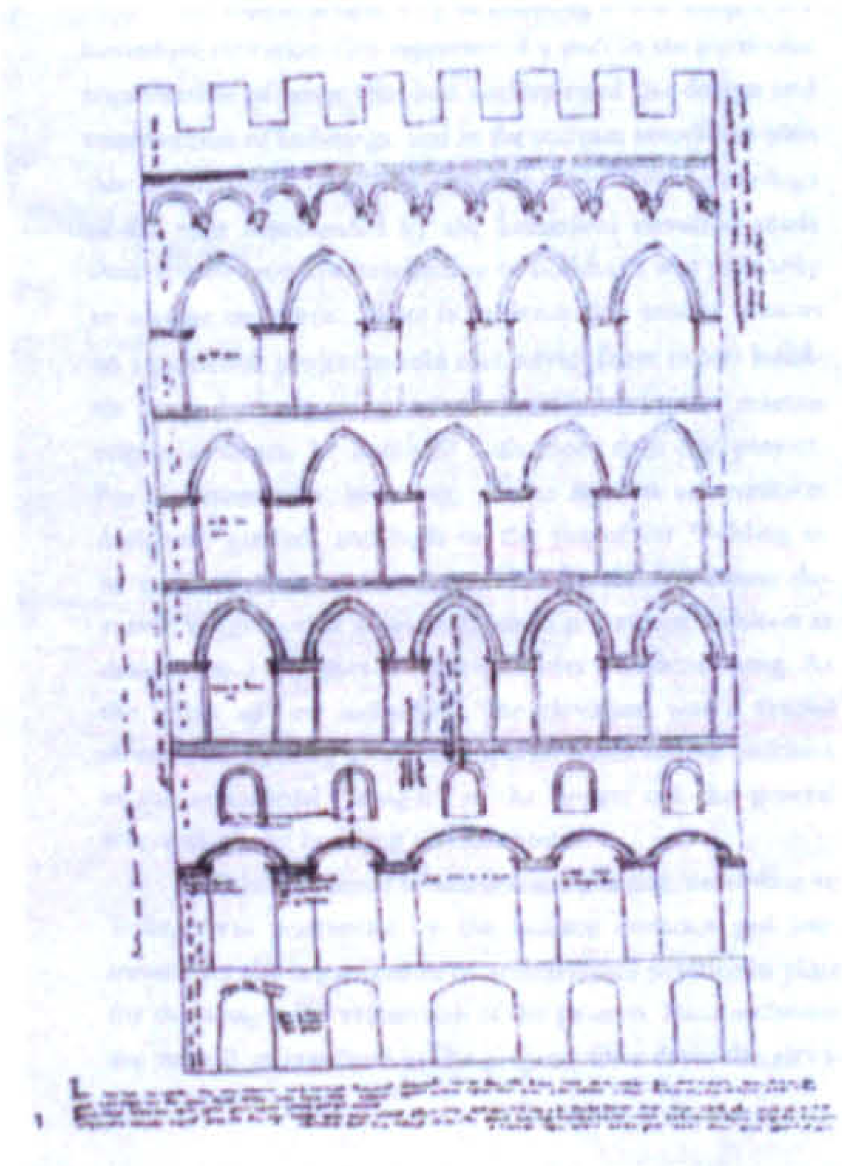

Figure 2.5: The drawing of Sansedoni elevation. Robbins (1994: 14)

[6] See more in Robbins (1994).

The evidence provided by the Sansedoni elevation suggests the communicative potential of Middle Ages' working drawings, as well as the level of communication between architectural context and the public realm. What can be seen is a problem of communication in architectural drawings, particularly in working or technical drawing[7]. The status of the architectural profession is given by the fact that they, the architects, know how to produce a drawing. The profession is defined through the act of drawing. However, in this very definition, a gap begins to open up between the profession and the public, between the drawing and its audience. Drawing was beginning to take on a new importance as an apparently autonomous instrument in the process of architectural design and conception. This meant that in order to understand a drawing, the audience were required to know how to use and receive the internal codes of this profession. We can thus identify that during the Middle Ages, the drawing was beginning to be used within a closed context, defined through the technical and procedural demands of construction. The wider aspects of representation in terms of social communication begin to take a secondary role.

2.2.3 The Renaissance

During the Renaissance, the role of the architect and the use of drawings changed. As Agrest (2000) notes,

> *The moment of separation between the field of construction and that of drawing (as a tool) that occurs during the Renaissance is crucial. This separation allowed abstract thought to guide the process of design as separate from the process of construction. It is at this juncture that the mode of representation, while developing its own discourse, becomes a part of the process of production of architecture and that the development of the techniques of drawing and design have an impact as important, if not more, as building techniques themselves. Agrest (2000: 168)*

Architects were trained in the arts such as painting, sculpture, goldsmithery, and so on (see Ackerman (1970), Kostof (1977)). The artistic training was reflected in the choice of communicative mediums. As Gomez (1982) notes, "During the Renaissance, architecture became a liberal art because it was perceived to be an activity of the intellect, akin to geometry and mathematics" Gomez (1982: 2). Furthermore, Serlio (cited in Eck (2002)) pointed out that painter and architect could not exist without each other in the Renaissance. He proposed, "The painter takes his ornaments from architecture; the architect learns from painting how to reveal his concept in a visible design, and how to give a good account of whatever he builds in a scientific way, guided by theory, which in this case is geometry" Eck (2002: 165).

Thus, the Renaissance period allowed architects to begin experimenting with the expressive quality of a building and also allowed them to be more artistic in the medium of representation to which both architects and their audience could respond.[8] What can be seen is

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[7] In this context, 'technical drawing' is referred to architectural measured drawing. See Graves' (1977) term of technical drawing in Chapter One.

[8] Ackerman (1970) notes, "The Roman Renaissance architect was less trained in the technique and less organised in the practice of his calling than any of his contemporaries in the arts. But paradoxically this was a step towards

the development of the presentation drawing, in which the architect used a range of artistic techniques to produce drawings specifically for clients. These drawings typically show the building that was to have been built rather than the one that was built[9] (see Ackerman (1970)). Consequently, different techniques were invented and employed in Renaissance architectural drawing, such as a combination of orthographic projections (Blau and Kaufman (1989: 158))), perspectival projection[10], and analytical drawing[11] (such as the convergence of the plan and section or of the section and elevation) (see Blau and Kaufman (1989), Kahn (1992)), in order to produce the presentation drawing.

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establishing architecture as a respected profession, because it represented, far more than the procedures of painters or scluptors, a liberation from the bonds of the medieval shop system. At this stage the development of the architect's freedom and social stature was more important than the establishment of standards of workmanship" Ackerman (1970: 171).

[9] Ackerman (1970) notes that of the surviving drawings from the early sixteenth century, very few were intended to be used in constructing a building or to be seen by anyone other than the architect. These drawings are nearly all rapid sketch studies of tentative ideas. The few that are finished were carefully drawn and attractively rendered; these were specifically made for the client. These are the presentation drawings and cannot have been much use for construction because they almost never include measurements or scale.

[10] The real concepts of perspective emerged precisely in the early Renaissance, which retained implicit connections to classical optics. During the Renaissance period, the subject of perspective was highly developed and played the central role in art and architectural context. Perspective creates (infinitively) architectural space. As a technique, it would not only be useful for architecture, but also for painting, astronomy, surveying, cartography, ballistics, stereotomy, carpentry, and gardening. See more in Panofsky (1991), Sarkis and Papazian (1993), Gomez and Pelletier (1997)).

[11] Kahn (1992) notes on the multiple views, "In orthographic drawing two plus two equals three. The multiple view, delineating plan, section, and/or elevation, makes this architectural mathematics explicit. The two dimensions of horizontal plane added to the two dimensions of the vertical plane fabricate and contain the three dimensions of architecture's space. ... The convergence of the plan and section, as well as the impossibility of occupying one without the other, is recognised in these drawings. However, they go beyond simple orthographic invention; they represent a composite mode of conception. The cut, an explicit incision, implies opening up and occupying. Drawn together along the joint, horizontal, vertical, interior, and exterior overcome the dimensional disengagement imposed by distinct drawing types. The spatial abstraction of plan is mitigated by the experiencing body implicated in section and elevation. The abstraction of one orthogonal plane, once conjoined with others, forms architectural space as a resonant composition of diverse dimensions. The fragmentation given by many cuts exactly delineates the aspects of architectural work, suggesting a process of discovery where knowledge is accrued from many directions" Kahn (1992: 10).

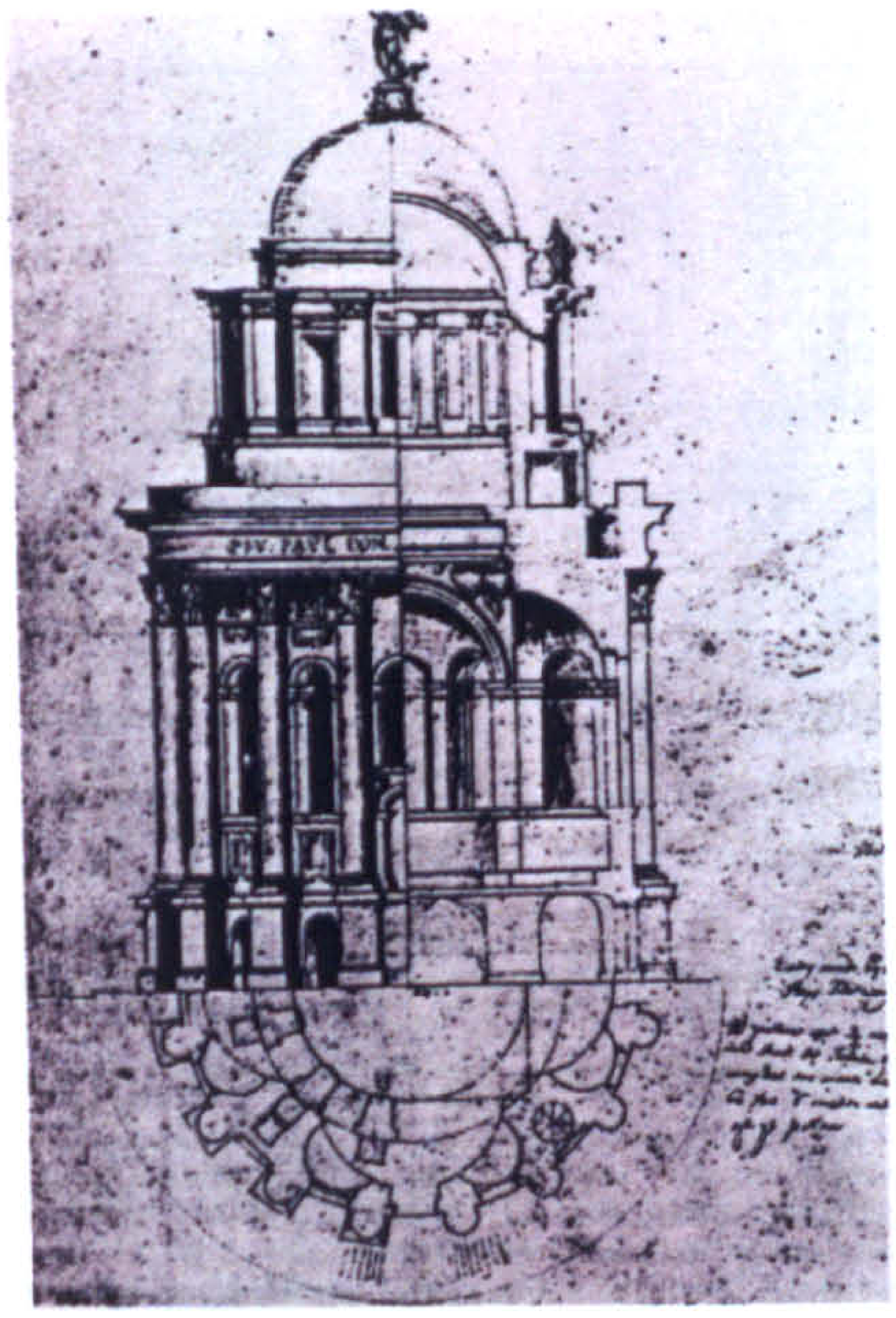

Figure 2.6: An example of analytical drawing of Chapter House or Baptistry for St. Pauls, (1675): by Sir Christopher Wren. Kahn (1992: 11)

The convergence of drawings was made in order to depict and present an architectural object to the audience. The drawing manifests the processes and completion of architectural work. Such multiple views allows the drawing to be approached in a non-linear way, putting forth architecture as a speculative pursuit which cannot be reduced to situating a single answer, but which calls for a chorus of questions (see Kahn (1992)).

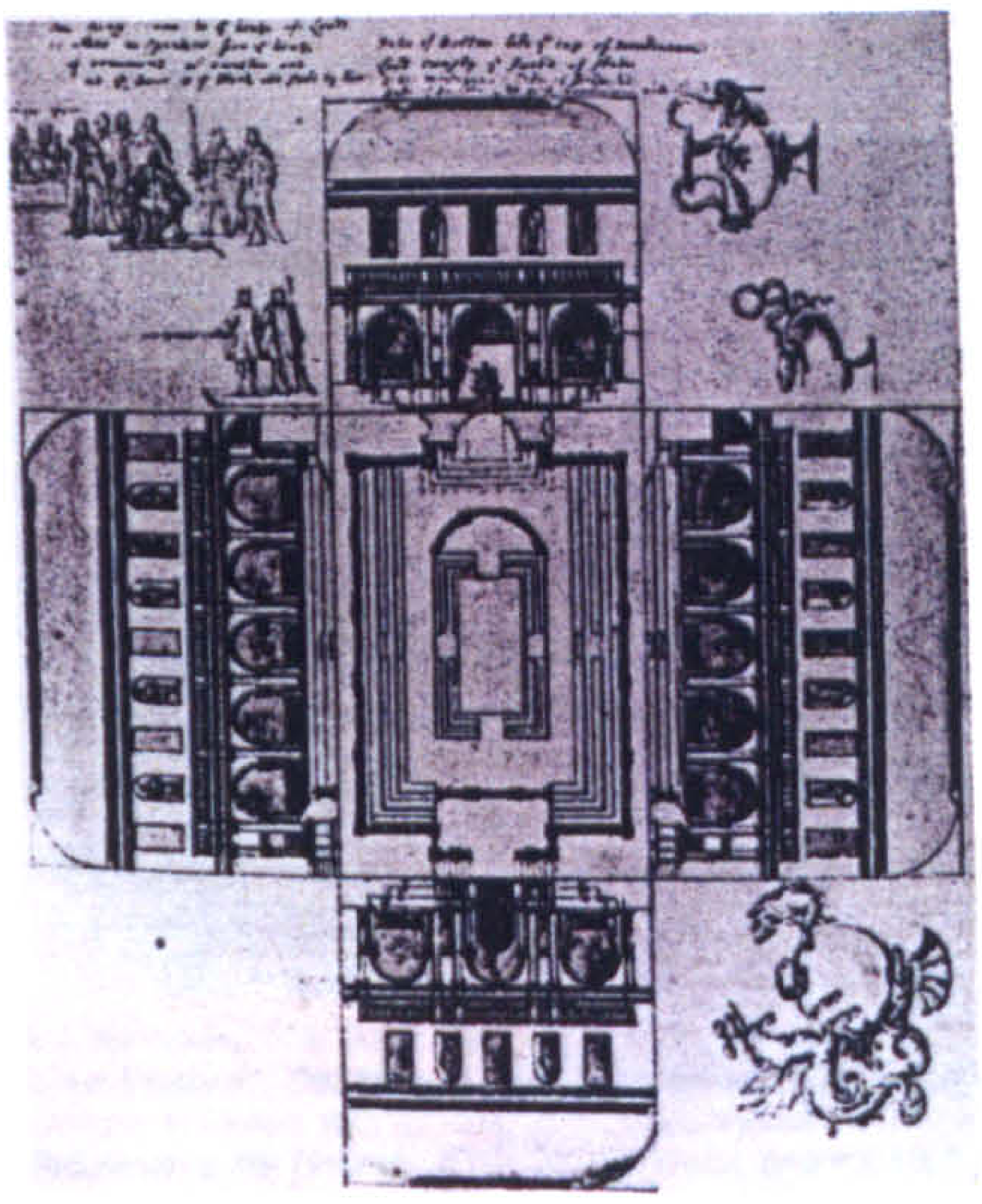

Figure 2.7: Design for a new House of Lords, Westminster, London, (1735): by William Kent. Kahn (1992: 11)

Kahn (1992) notes, "In Willaim Kents' plan/interior, elevation, unwrapping vertical surfaces about the perimeter of the plan suggests a spatial volume, but the composition is predicated in the formal order of the drawing as object; three of the four elevations suspend a gravitationally determined approach to vertical surfaces" Kahn (1992: 11).

The use of different techniques, most of which were taken from other art practices, helped the audience to interpret the drawing. As Robins (1994) notes,

> *Advances in drawing provided the Renaissance architect with capacity to express and experiment with a greater range of ideas than did Medieval drawing. Medieval architects drew, but their drawing effectively expressed, for the most part, only measure. It was measure that the architect could vary; the rest was borrowed from the other buildings. Robins (1994: 18)*

One example is the engraving of the Pantheon by an unknown engraver (Figure 2.8), which exemplifies the sixteenth century pictorial approach. The analytical drawing, which attempted to show technical aspects by carving a huge chunk out of the wall so that the viewer could look through the shell of the building as if it were a ruin, combined plan, section, interior, and exterior perspective into a single view.[12] It thus clearly shows the combination of both an artistic and analytical mode of expression in the depiction of an architectural object.

[12] See more in Blau and Kaufman (1989).

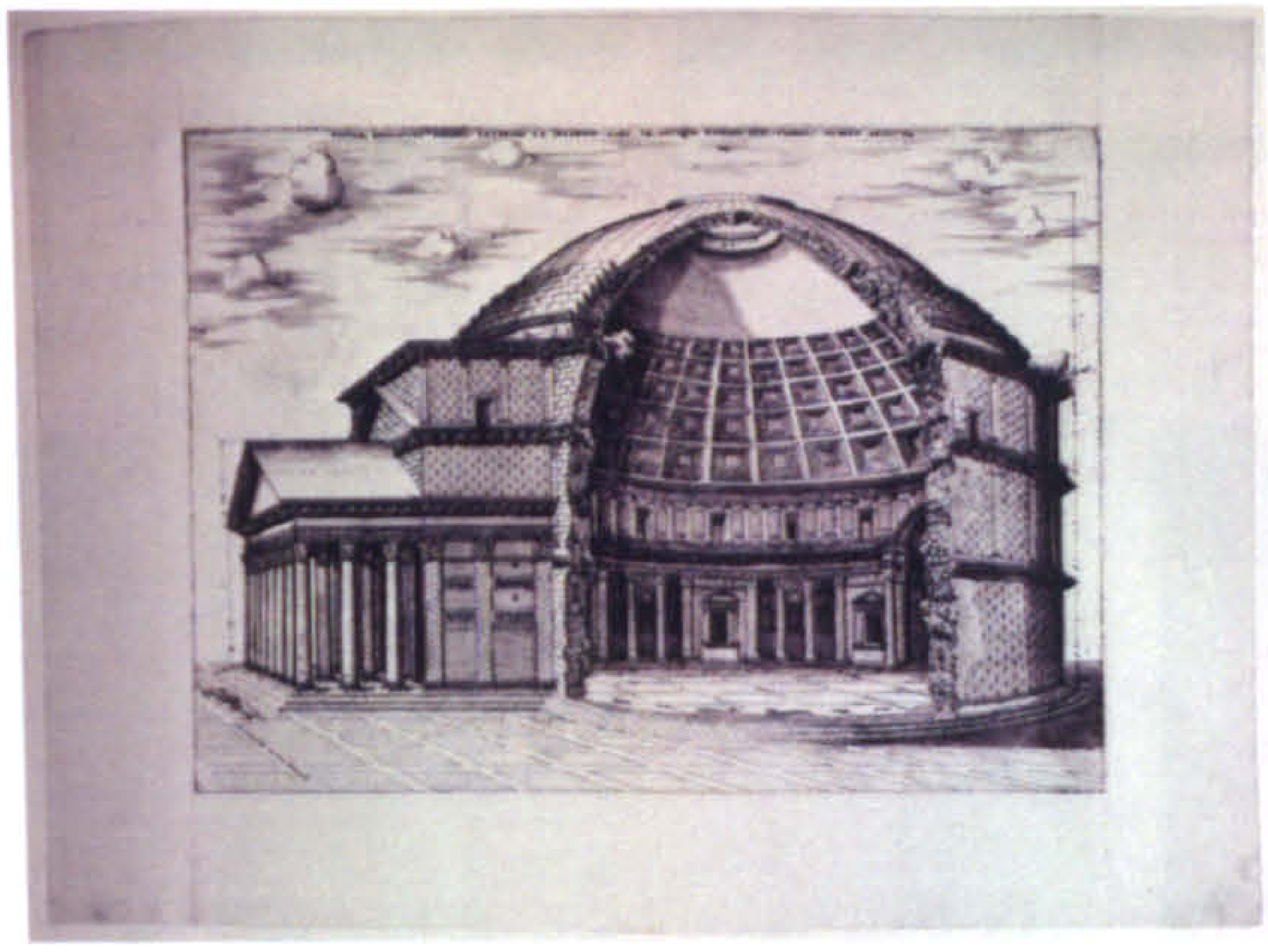

Figure 2.8: The pantheon: Elevation and Cut-Away Section, (Italy; Rome, Mid-sixteenth century): by unknown engraver. Blau and Kaufman (1989: 181)

This analytical drawing shows the combination of techniques and an influence of art on the Renaissance architectural drawing.

Furthermore, the juxtaposition in Renaissance presentation drawings of the work of architects and the production of art brings another aspect of communicative potential to the architectural drawing. Gomez (1982) explains the Renaissance architectural drawing as being perceived as a symbolic intention to be fulfilled in the building. Within the drawing, the architectural objects were used as a backdrop of the picture frame, whilst the human figures and events, conversely, told the story or meaning of the drawing (see Figure 2.10 and 2.11). Gomez and Pelletier (1992) note,

> *The Painter's interest in mathematical depth, in a measurable order of experience through layers of events, had as a corollary the use of architectural backdrops as the ideal means to express this concern. It would be naïve to deny the often-stated connection between Renaissance paintings and the work of architects. Gomez and Pelletier (1992: 24)*

Therefore, this indicated that the presentation drawing in Renaissance period had changed with a shift in the relationship between the intentions of architectural drawings and the built objects. Non-architectural objects, such as human figures, landscape, and symbolic forms became increasingly important in the use of architectural drawings. The drawing was not treated solely as the visualisation of the architect's invention but aimed to display the essence, and meaning, of a building.

This shift actually offered an alternative way for the audience to interpret the drawing: the drawing did not require a code to be understood, but is related to social production and public through the events and figures that told a story within the drawing. The audience can perceive and experience the drawing within the context of their respective cultural world, and within the conception of space and time on which they are grounded. Thus, these Renaissance presentation drawings communicated in a way that the working drawings from the Middle Ages, and even today's conventional drawings, could not. As Gomez and Pelletier (1992) explains,

> *Renaissance drawings are not simply the same as modern drawing in their relationship to the built place. Plans and elevations were not yet systematically coordinated within the framework of*

descriptive geometry. These drawings were not instrumental and remained much more autonomous from the building than those that result from typical contemporary practice. Gomez and Pelletier (1992: 26)

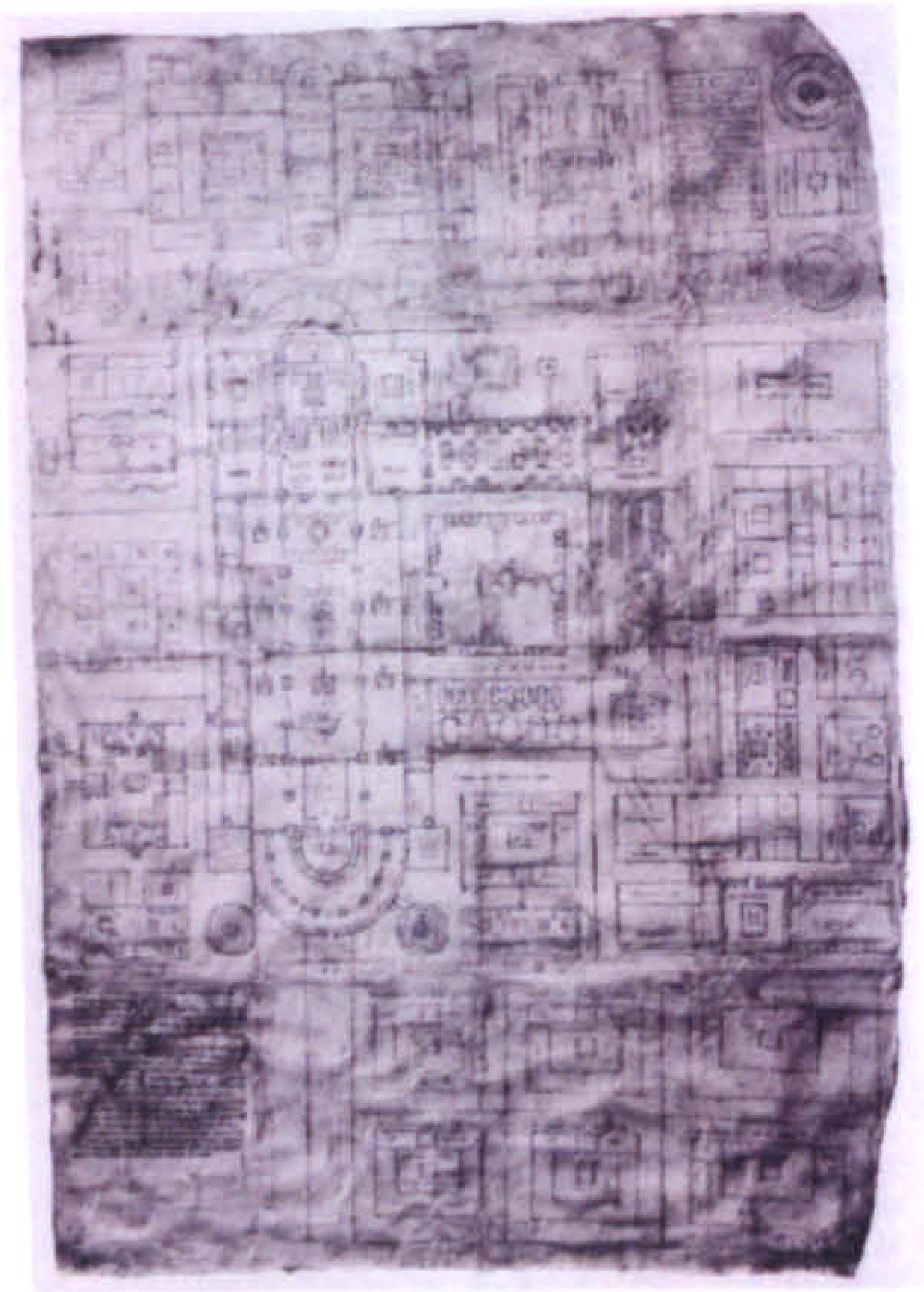

Figure 2.9: Monastery plan of St. Gall, (ca.820). Kostof (1977: 72)

This drawing is a rare survivor from the earlier Middle Ages. It shows the influence of technical and construction in architectural drawing. This is very similar to today's working drawing which only considers on one purpose in explaining the construction process and executing the architectural building.

Figure 2.10:, Allegory of the arts of architectural representation (detail). From G.G. Ciampini, Vetera Monimenta, Rome, (1690): by G.B. Lenardi. Forty (2000: 10)

Figure 2.11: Marriage of the Virgin, (1504): by Raphael Sanzio. Evans (1995: 134)

However, there is one very important development from the Renaissance period that should be included and studied: perspectival projection, the technique which combined architectural projections, art and mathematics all together. Blau and Kaufman (1989) note,

Perspective, like axonometry, has a complex relationship to orthography. Despite the illusion of three-dimensional space achieved by perspective projection, treatises published from the sixteenth to the twentieth century emphasize that architectural perspective is not a highly deliberate artificial construction but one based upon an equally abstract construction-the orthographic set. Blau and Kaufman (1989: 159) [13]

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[13] This in fact can be traced back to Chapter One, in which Vitruvius writes about drawing. See more in Vitruvius (1914), Vitruvius (1999), Gomez and Pelletier (1997).

Linear perspective[14] was first systematically constructed around 1420 A.D. by Filippo di Ser Brunelleschi (1377-1446), who discovered the vanishing point, which was critical to the development of perspective (see Edgerton (1975), Frommel (1994), Sarkis and Papazian (1993)). He demonstrated a method for constructing a perspective space and object (the Cathedral of Florence) within that space. As Gomez and Pelletier (1997) notes,

> *On a small, rectangular wooden panel, Brunelleschi painted a systematical representation of the octagonal baptistery in Florence's Piazza San Giovanni, as seen from the threshold of the Duomo. He then perforated the panel at the vanishing point and asked observers to verify the "correctness" of the representation by looking through the orifice from the back of the panel toward a mirror that the observer held in the other hand. Gomez and Pelletier (1997: 25)* [15]

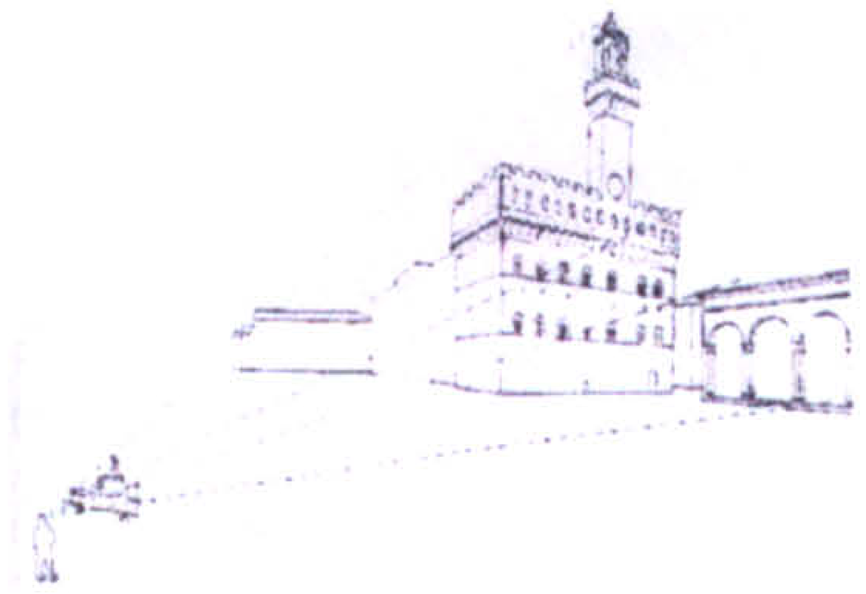

Figure 2.12: Brunelleschi's first (left) and second (right) experiments. Sarkis and Papazian (1993: 30-1)

Whilst some Renaissance treatises consider linear perspective as a technique of visual representation, they all consider it as an instrument for communicating knowledge. Eck (2002) notes that for some authors, linear perspective is a science, an essential technique for the architect, which enables him to communicate his designs, and conveys true knowledge. For others it is simply a painterly technique that deals with illusions and distortions. As has been pointed out, both in the Renaissance and the present day, perspectival images do not allow the

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[14] See Damisch (1994), Edgerton (1975), Gomez and Pelletier (1992).

Linear perspective system was described in depth by Alberti in 1435. Leon Battista Alberti (1404-1472) wrote his treatise on painting, the first written recording of how to draw a linear perspective construction, and dedicated it to Brunelleschi, Masaccio, Donatello, Ghiberti and Luca della Robbia. He also emphasized the difference between the drawings of the painter and those of the architect. He pointed out that the architect and the painter both reveal depth, but in very different ways. Alberti notes, "While the painter "takes pains to emphasize the relief of objects in paintings with shading and diminishing lines and angles" through the methods of linear perspective, the architect represents depth by drawing the footprint or ichnographia and in other drawing represents the shape and dimensions of each face or orthographia "without altering the lines and maintaining the true angles" cited in Gomez and Pelletier (1997). These complexities have obscured the role of linear perspective techniques in fifteenth century architecture. During this period, perspective shared its geometric nature with the newly defined lineamenti, the drawing that effectively turned Renaissance architecture from a medieval construction into a liberal art. The perspective turned into a kind of symbolic form which defined and controlled the visible and invisible universe. The hidden three-dimensional space which was created from perspective provided the relationship between real and unreal. See also Panofsky (1991).

[15] According to Brunelleschi's experiments, in his first attempt to verify the operations of perspective, he had to silver over the sky in his painting of the Florence Baptistry. As Sarkis and Papazian (1993) note, "When seen reflected in a mirror that Brunelleschi held facing the painting, the image of the Baptistry included an already-once-reflected patch of real sky from above. (Figure 2.12 - left) Within the construct of perspective that he mastered so well, Brunelleschi seemed unable to accommodate for the sky. In the second experiment, he held a cut-out drawing of the Castelvecchio up against the sky without using mirror. (Figure 2.12 - right) The skyline marked the border at which his perspective stopped being operative Sarkis and Papazian (1993: 30).

viewer to make all the calculations needed to obtain reasonably complete data, because perspectival foreshortening prevents this. Cataneo (cited in Eck (2002)) notes,

> *Through the use of linear perspective, the architect or draughtsman acknowledges that buildings are always seen from a particular point of view, at a particular moment, and in particular lighting conditions, rather than presenting them as pure geometrical constructions based on abstract system of proportions, whose beauty is eternal and unchangeable. Eck (2002: 171)*

Moreover, Borden (1995) notes, "Linear perspective was intended not for architectural composition but for observation and representation" Borden (1995). He consequently claims that linear perspective orders space in a manner quite distinct from the reality of space or actual human perception. In seeking to record, represent and control urban space, perspective requires the artist and spectator to replace direct subjective experience with a systematic objective procedure of powerful operational characteristics. In short, it requires a conceptual abstraction; perspective is subtly different from the reality it is trying to address. He continues,

> *Linear perspective became the dominant mode of spatial representation. Conceptually, the kind of space presented by linear perspective is infinite (it has no boundaries), unchanging (it is static) and homogenous (it has universally constant characteristics). This is clearly quite different from real urban space... Borden (1995: 102)*

Thus, what Borden points to is that whilst the perspective becomes a powerful tool of communication, what it is communicating becomes removed from the lived world. The drawing, through the power of its technique, presents to the viewer a 'reality', but that reality is in fact an illusion.

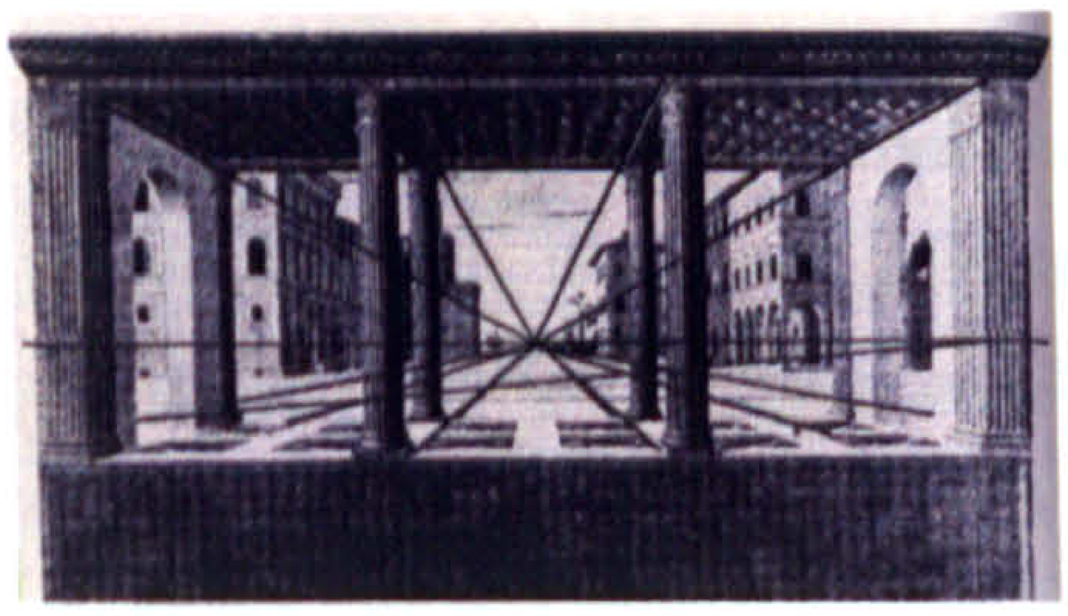

Figure 2.13: Linear perspective reconstruction: by unknown Italian artist. Edgerton (1975: 54)

Figure 2.14: The Flagellation of Christ: by Piero della Francesca. Evans (1995: 145)

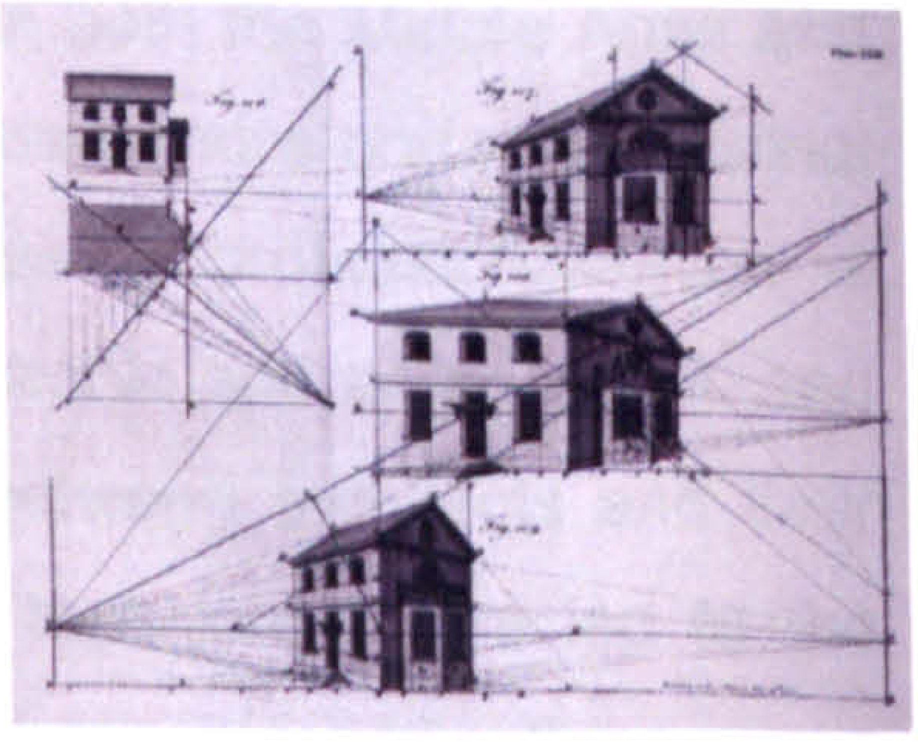

Figure 2.15: Plan, Elevation, and three Perspective views of a house engraving, (1776). Blau and Kaufman (1989: 191)

This drawing shows how an orthographic ground plan can be projected into a perspectival space. It shows that perspective has a complex relationship to orthographic drawing.

Later in the Renaissance period, the drawing became the means by which architects could transform their design ideas into built form. They used drawing to aid in directing the architectural construction (see Frommel (1994), Robbins (1994)). The new forms of Renaissance drawing, such as perspective, analytical section and elevation, became the primary means of communication between designer, builder, and audience. It became an essential link between the conception and realisation of design, and indeed remains as such today. As Robbins (1994) notes,

Differences in how each architect used drawing in his design work notwithstanding, it is clear that drawing, as an instrument of memory, self-education, experiment, and communication and as a means to direct the construction of buildings, had become crucial to the architect of the Renaissance. Robbins (1994: 19)

Furthermore, Wiebenson (1982) notes,

The main concern of the Renaissance architect was with the defining, ordering and controlling of his visible universe. This he would achieve by means of graphic representations. The most rudimentary graphic system, geometry, was an essential tool for the accurate recording of architectural information, the knowledge of which was considered by Serlio to be essential to all workmen so that they would be able to communicate information systematically and accurately. Wiebenson (1982: 44)

What can be traced, therefore, is a further reinforcement of notion that the profession is defined through drawing that was first noted in the Middle Ages. Robins (1994: 19) notes that with the changes in architectural practice in the Renaissance, drawing took hold as the dominant instrument of design and as the symbol of what makes the architect unique. The transformation of the architect's role and status within the society in both the Middle Ages and the Renaissance suggests that architecture in turn has evolved to be a more and more distinct profession with its own particular status and tasks. This increasing professionalisation is reflected in the increasing specialisation of drawings, both orthographic and perspectival, and with this specialisation came the potential opening up of a gap between architects and their audience. In the case of orthographic drawings, the coded and technical nature led to the development of an internalised language. In the case of perspectival drawing, whilst there was a shared symbolic language, this was only available to a cultured elite; in addition to the fact that perspective edits the world of its lived aspects.

In conclusion, what can be seen is that from the Middle Ages to the Renaissance, the development of architectural drawing began to witness a split into two distinct approaches: that of technical drawing and representational drawing. This separation was the beginning of the split between drawing as an internal architectural language and drawing as an external communicative language. The difference between these two types of drawings becomes a crucial factor for us to understand the problem in the communication process. The perceived breakdown in communication between architects and their audience can be argued to have emerged when the architectural drawing began to be technically defined, self-contained, and especially when the audience was particularly defined. The separation created two distinctly different sets of communicative tools.

The distance between the orthographic and perspective drawing, for example, shows the clear break between drawing which is self-referential (which is to do with architectural code and culture) and a pictographic drawing (which may not be 'accurate'[16]), but in fact is more communicative in a particular manner). The difference between two types of drawing raises the argument of which drawing as a communicative tool is the better of the two. This will be investigated later in the research.

2.2.4 The École des Beaux Arts

The teaching of architects at the École des Beaux Arts[17] from 1819 onwards established a set of drawing conventions which have been used ever since. The École influenced the development of architectural education and the Beaux-Arts approach has become highly influential in the development of nineteenth century French architecture, especially as a means of representation. This in particular is true of the competition: the Grand Prix (known after 1819 as the Prix de Rome) developed the principle that these drawings were not simply beautiful artistic objects, but often contain the seeds of important architectural ideas (see Leatherbarrow and Powell (1982)). The design competition provided more than just an opportunity to encourage the best possible design solution for a specific problem. It also provided the primary vehicle for education.[18]

As mentioned, Beaux-Arts drawings were largely defined by architectural programmes and competitions. The drawings were not created for public but for a specific audience, in particular the judges of the competition: the Grand Prix. Thus this led to the Beaux-Arts

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[16] The term 'accurate' in this context is related to scale, which is not to do with the degree of refinement in standard or specification of the conventional architectural drawing.

[17] The architectural program in the École des Beaux Arts (1819-1968) focused around architectural competitions particularly the Grand Prix or Prix de Rome. The Grand Prix was the most important competition which was the final hurdle in the education of a nineteenth century French architect. Drawing was a tool which represented the idea of the student to the eyes of both judges and the public. The school project was assigned in the form of sketch designs, rendered projects, and other special competitions. The activity within the school was reflected more faithfully by the monthly competitions judged by a jury made up of teachers within the École.

Another interesting aspect is the student's studio (atelier) where all the Beaux-Arts drawings were created. The atelier was the heart of the students' education. As Kostof (1977) notes "the centre of the student's world was the atelier (studio) where the competition projects were maintained independently by patrons (design professors) who were practicing architects. The patron usually came around in the evening to give critiques, but otherwise the atelier was student-run according to time-honored traditions. Students could come to the atelier whenever they wanted, since only a minimum number of projects were required each year" Kostof (1977: 211-2). See more about the École des Beaux Arts in Carlhian (1979), Drexler (1977), Leatherbarrow and Powell (1982), Middleton (1982).

[18] Jacques (cited in Middleton (1982: 59)) notes "One aspect of the teaching of architecture at the École des Beaux Arts that has been little studied is the monthly architectural competition, both in the form of sketch designs (*esqisses)* and rendered projects (*projets rendus)*, together with other related competitions...".

drawings becoming increasingly internalised and hence created a barrier between them and the public audience. Even though the Beaux-Arts drawings were generally drawn and presented as a form of presentation drawing, which was less technical, they actually served as a piece of graphic design, as well as a piece of art; not as a means of communication.

On the other hand, some architects have claimed that the Beaux-Arts drawing is a good example of conventional architectural drawing as a communicative language. The picture-like drawing is not only capable of representing the building to the clients or judges but it can also communicate with non-architects. Leatherbarrow and Powell (1982) note,

> *Le Corbusier's phrase 'the plan is the generator' is only a repetition of the traditional method of the École, although he translated into different visual terms. Beaux Arts drawings were suited less for the construction of buildings than for exhibition. All the drawings are done to orthographic projections, but in order to give a greater feeling of depth and texture, all the shadows were carefully cast, even on the plan, and a landscape background was frequently included in the elevations. Leatherbarrow and Powell (1982: 43-4)*

Nevertheless, the question is raised whether a good drawing - as defined by an architect - means that the drawing also provides comprehensible communication and a clear message to the public? The attempt to create beautiful drawings and renderings, as the Beaux-Arts did, may create an illusion which will distort the whole message. This therefore suggests that such a presentation drawing cannot be guaranteed to deliver the whole message to its audience, as the architect created the drawing in order to convince a judge of the competition and not to communicate with the public.

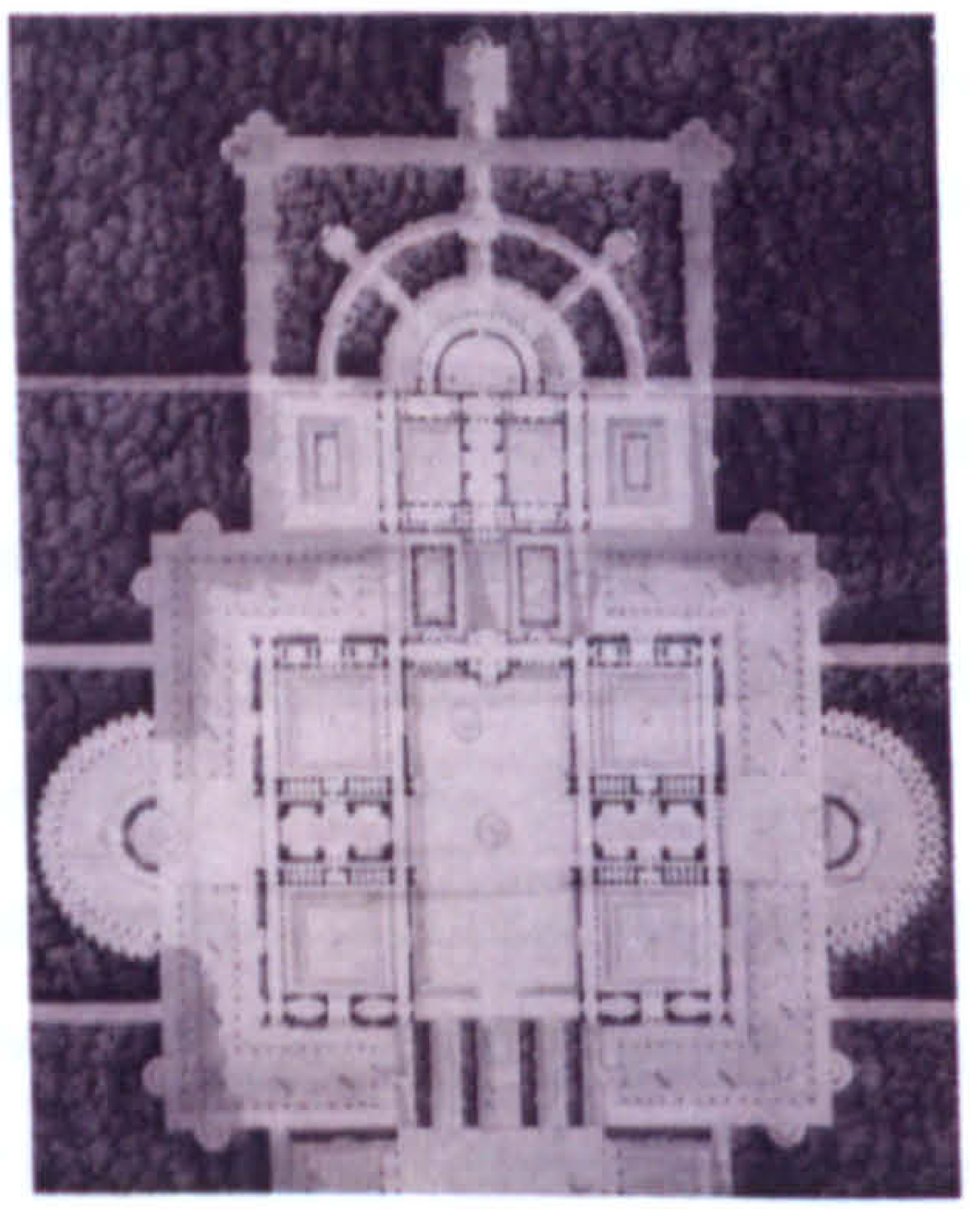

Figure 2.16: L. Vaudoyer. Bains d' Eau Minérale (Spa), (1824): rendered plan. (Beaux-Arts). Middleton (1982: 76)

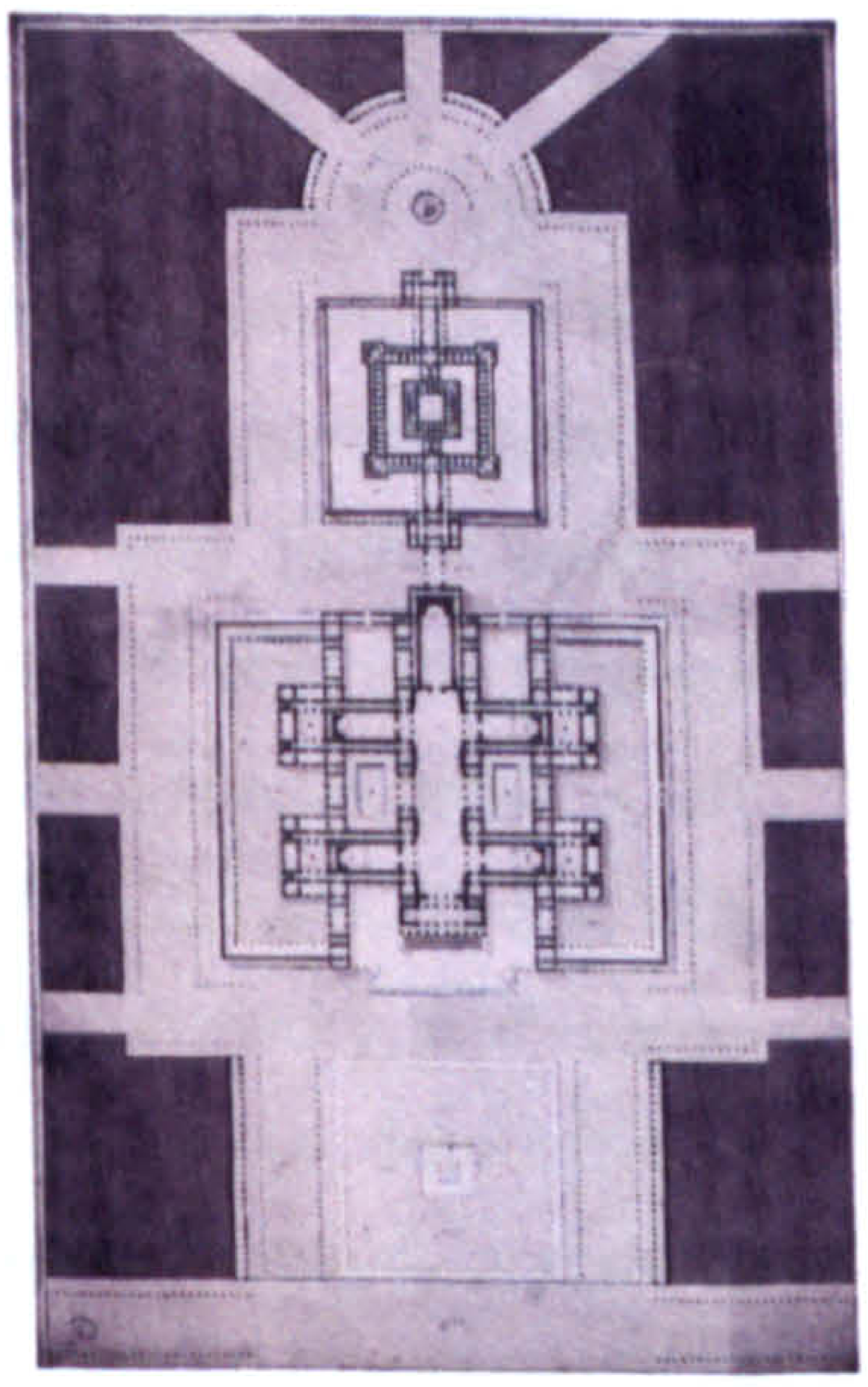

Figure 2.17: A. Blouet. Palais de Justice, (1821): rendered plan. Middleton (1982 114)

Both are Beaux-Arts drawing submitted for the Grand Prix de Rome Competition. Such beautiful drawings were only meant to woo and convince the judges of the competition.

This potential breakdown in communication is established in the processes by which these final drawings are reached. In the École, after reading the programme, the students prepared sketches which were then marked. The students were then required to stick with the initial design contained in the sketch, which they then developed further for a limited time with a very prescribed idea of what sort of drawing they could do (for example they are not allowed to do a perspective[19]). Furthermore, Carlhian (1979) notes that the design process proceeds in steps determined by the type of drawing. First the programme is read: an adequately trained student was expected to be able to grasp the main elements of any programme at first glance. Second, the programme is resolved through arriving at a 'Solution in Plan'. Third, the section is designed, always taken perpendicularly to the anticipated main façade. Next came the elevation, which to a certain extent had been committed to in the section. Finally, depending whether the presentation format was horizontal or vertical format, the final presentation sheets were placed on the exhibition wall and judged by the jury member. The students were only concerned about the final presentation sheets and how to arrange them to fit into the exhibition room, rather than how the drawings might communicate to the public. He notes,

The final presentation sheet being always rectangular in shape, the student was, in each instance, given the freedom to choose in which direction it was to be presented. Everyone knew that a horizontal presentation, taking more room on the exhibition wall, was the more favourable, since a greater number of jury members could crowd in front of it. Carlhian (1979: 11)

By referring to Graves (1977)' category of drawings, the Beaux-Arts drawings may be classed as preparatory study drawings or presentation drawings; the latter classification has nothing to do with the construction process, but is designed only for exhibition. One might think that these presentation drawings would be more approachable for an outside audience than the working drawing or (termed by Graves) the definitive drawing, as the normal role of a presentation drawing is to communicate with its audience. However, the previously normal role of the presentation drawing was to sell the scheme to particular patrons or to be exhibited to the public, and the Beaux-Arts drawing was created to satisfy the specialist eyes of the jury in the Prix de Rome competition. Its communicative potential was further limited by the very prescribed process by which the final drawings were reached, in which the emphasis was not on the communicative role of the drawing but on the drawing as a specific vehicle within the design and assessment process. As Leatherbarrow and Powell (1982) note, "It was truly the drawing which won or lost a competition and everything else was subsidiary to it" Leatherbarrow and Powell (1982: 42). This means that the drawing had a life of its own, determined by the internal expectations and system of the School. The process generated a highly standardised approach

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[19] Leatherbarrow and Powell (1982) note that the first thing which strikes one about the drawings is that while they were produced as artistic objects in their own right, they acknowledged conventional means of representation: plans, sections and elevations, but not perspectives Leatherbarrow and Powell (1982: 41-2). Also Carlhian (1979) notes on the submission that it was excluded perspective, he noted, "The very fact that all submissions, due to the drastic nature of the requirements, the strictly enforced presentation limitations, the paring down of the issue to a one-page programme and only three drawings (plan, section and elevation) presented on a prescribed single sheet of paper, ..." Carlhian (1979: 14).

to drawing in which "individuality was valued less than conformity to an accepted set of standards" Leatherbarrow and Powell (1982: 42).The Beaux Arts thus generated a set of drawing codes; the issue is that these codes were developed for a specialist audience; the public did not have the same access to the code, so it seemed they could not engage with drawings.

This is where drawing in the Beaux-Arts becomes interesting; the architectural students think that they are communicating because they spend all their time making drawings. They invest all their design and intellectual skills into making these drawings and so they believe that firstly, drawings are the building; and secondly, that drawings are legible. However, because of the internalised nature of the process it can be seen that these aims are not met; the drawings present only images of buildings, not the reality of their construction or occupation, and their legibility is limited to a specific audience. The breakdown of communication between the architectural world and the public realm, identified in the Renaissance, is thus reinforced. More importantly, the Beaux-Arts established the codes and values of the architectural world through its pedagogical processes; the profession and education come together through the act of drawing to create a distinct culture concerned more with its internal values than its external relevance.

2.2.5 The Twentieth Century (until the present)

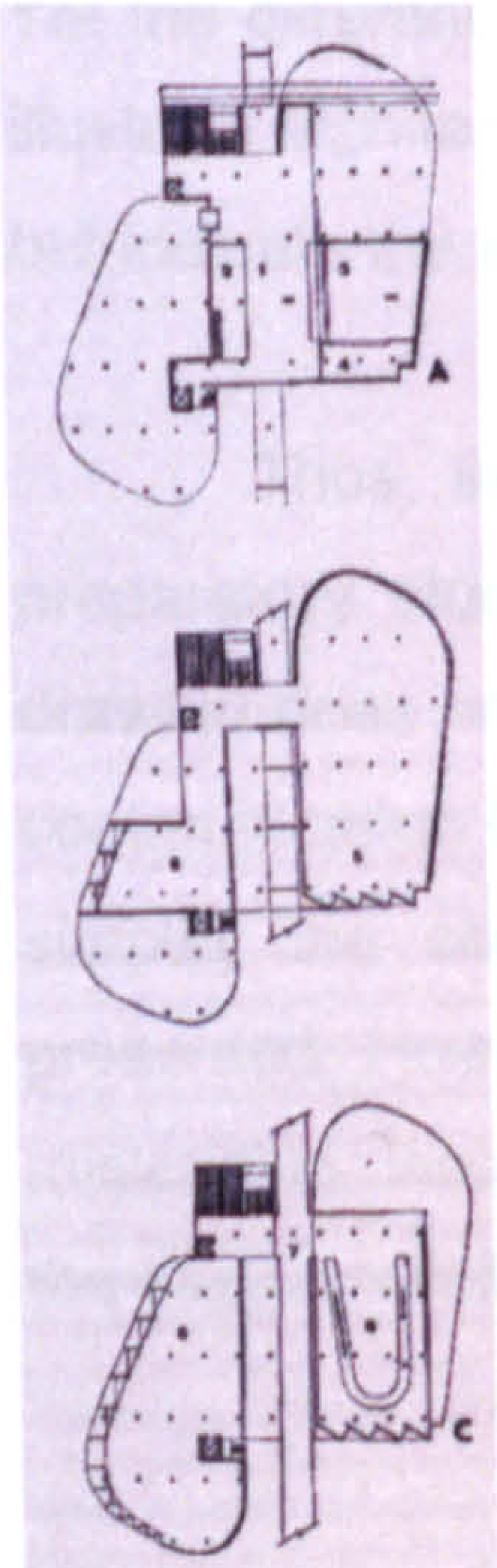
Since late nineteenth century architectural drawings have undergone many changes brought about by various techniques. However, two main types of architectural drawings that may be identified in the twentieth century are the technical drawing and representational drawing. Within this context, technical drawing is defined as definitive drawing (see Graves (1977)), which is mainly used for the communication between architects and builders; or, in some cases, with clients, with the prime function being to initiate the construction process of the building. Such a drawing is systematically created by architectural codes within a specific culture, and this determines how it should be drawn and read. Robin Evans (1995) argues that technical drawing should be seen as an analogy and not an explanation. He notes,

> *It* (technical drawing) *helped re-assert the importance of the object within a practice that was on the verge of annihilating it; it provided a precedent showing that overlaid multiplicity adds up to a unified picture; a precedent also for the collapse of pictorial depth into a shallow stratum; and, in its more complex demonstrations, it rendered the object transparent and gave suggestive instances of rotation and discontinuity. But although originating from engineering and construction, technical drawing did not provide a handy route back to architecture. Its influence was not reversible because the analogy was to pictures, and the visual properties of pictures of building are not those of buildings. Evans (1995: 63)*

According to Evans (1995), this suggests that today's technical drawing is not a direct explanation, but a construction of others. It relies on its code and symbolic inscription not only in relation to the building that it represents, but also to other referents. It thus operates as a notation system, which presents the process of coding that is partly analogical and partly instrumental. Hence, technical drawing should not be considered as a wider communicative medium, but as an architectural language. It does not offer comprehensible knowledge to the reader, except to its audience of internal readers. This may suggest reasons as to why communication has broken down in the context of technical drawing, as it was supposedly meant to communicate to others but it has finally come to communicate only to certain groups of people.

On the other hand, architectural drawing such as the representational drawing can be as unconventional, as poetic or idiosyncratic, as the individual who draws it wants it to be. In this context, representational drawing or preparatory study (see Graves (1977)) drawing could be defined as the drawing that architects use to represent his or her idea, especially when they attempt to communicate a specific interpretation through it. This drawing engages self-consciousness in its process, subjectivity and abstraction. It can be found from the first stage of design process to the final stage (before it evolves into a technical drawing). As Hill (1998) notes, representational drawing, which he calls 'the abstraction of the drawing', "is very different from the building, may be useful while, for a different purpose, it may be productive to exploit the similarities of the drawing and the building" Hill (1998: 34).

The stature of representational drawing can be related to the architectural diagram (widely used in the late Twentieth century). Based on individualism of the architect, both forms of drawing are drawn as a reduction of an architectural object. The representational drawing represents a presence of the architecture, whilst the diagram reveals a presence of ideas and processes towards the built object. Both drawings are interpreted by the use of codes– the codes that are invented by the architect and have a specific way of interpretation.



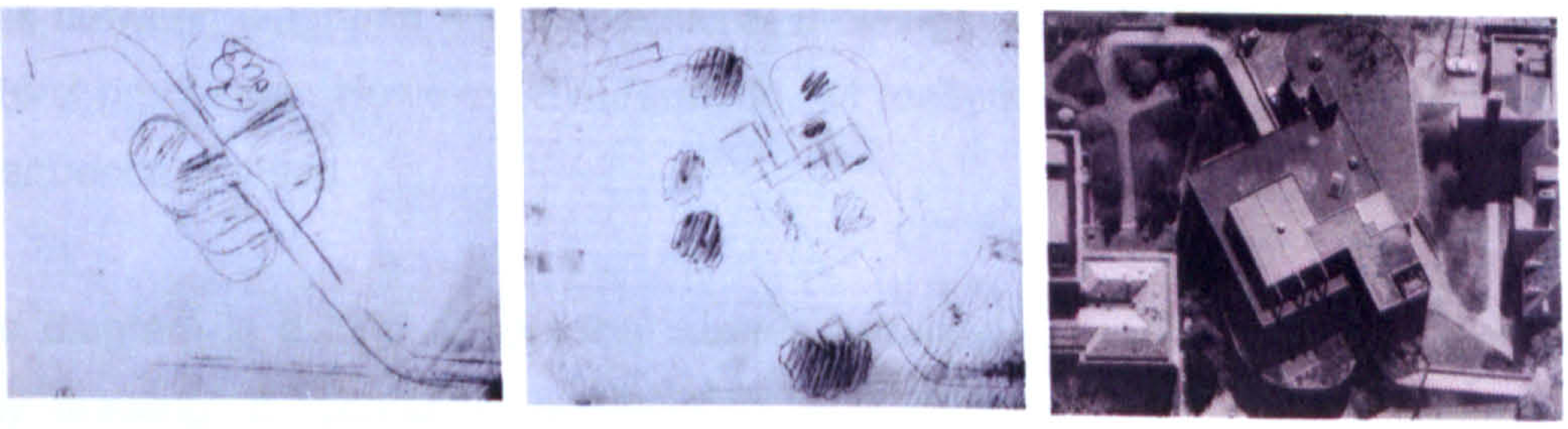


Figure 2.18: Sketches Fraser and Henmi (1994: 11-3), Plans, and Aerial view of Carpenter Centre for Visual Arts designed by Le Corbusier. Allen (2000: 106-7)

Le Corbusier claims to have designed the shape of this building from the idea of a woman's thigh. This shows that relationship between architect's subjective idea and his final production. The drawing cannot be traced to the concept of a thigh unless this has been explained to the audience.

The difference between technical and representational drawing can be seen in the radical difference between Le Corbusier's concept diagrams- their untutored, spontaneous quality; and his more conventional construction drawings. This split exaggerated the division between the poetic and technical aspects of design (see Leatherbarrow and Powell (1982)).

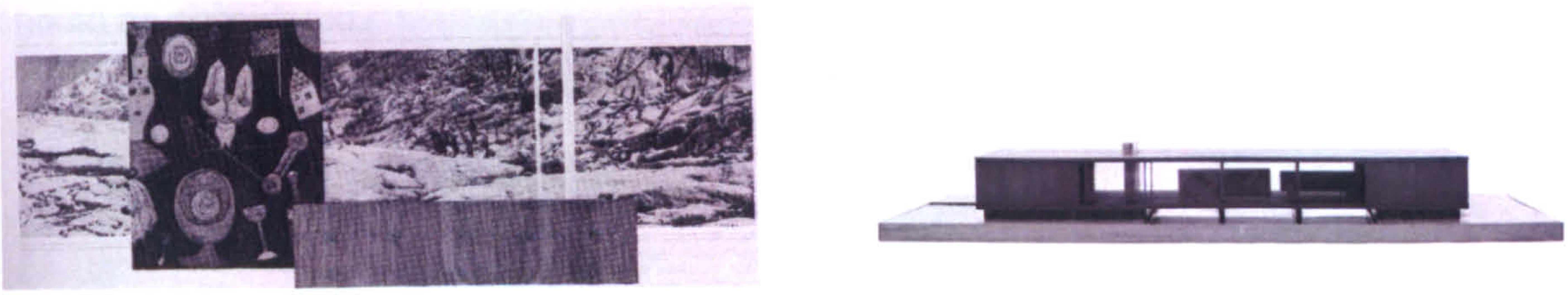


Figure 2.19: Interior perspective of living room, looking south. Resor house, Jackson Hole, Wyoming Project, (1938) : by Mies van der Rohe. Fraser and Henmi (1994: 141)

Mies uses photomontage as a graphic rhetorical device to represent his inspiration to relate nature, house, and inhabitation. The image is considered as a kind of representational drawing, which is very subjective. The specific interpretation is communicated through the abstraction of codes he uses.

In the late Twentieth century, the architectural diagram[20] was introduced into architectural representation, especially during the design process. As Eisenman (1999) notes, "...the architects of the neo-avant-garde are drawn to the diagram because unlike drawing or text, or bubble notation, it appears in the first instance to operate precisely between form and word" Eisenman (1999: 8). The information of an architectural project was reduced and showed as a diagram, instead of drawings. Thus, the diagrammatic drawing becomes the reduction that contains ideas and sequence of the project, which is suppose to communicate clearly to its audience.

As Fraser and Henmi (1994) note, "Diagrams are those drawings which engage in a self-conscious reductive process, attempting to make clear a specific interpretation through the exclusion of that information which the author deems irrelevant" Fraser and Henmi (1994: 99). Yet the differences between diagrams and conventional drawings are subtle and relative. Both illustrate architectural production. However, diagrams do not really focus on the final production but indicate the sequence of ideas.

Thus, the diagram is a kind of tool that stands between a definitive drawing and a preparatory study drawing. It represents architecture in a systematic way like a technical drawing does and it also shows and sequences an architect's ideas in an abstracted mode of communication like the representational drawing. The advantage of diagrams is their ability to simplify the consideration of formal or conceptual qualities by minimizing the elements presented. However, there is almost always too much elimination; the diagram may become misleading, incorrect, or even incomplete. It also becomes too risky to rely on the diagram, as the diagrammatic production alone would never lead to the production of architectural drawings

[20] In this context, the diagram can be related to what Vidler (2001) claimed in his essay called "Diagrams of Utopia". He notes, "I want, that is, to speak about the architectural diagram: not the sketch, the parti, the geometrical projection, or the various kind of drawing toward, about, and of architecture, but the diagram" Vidler (2001: 84).

and buildings. But the combination of diagrammatic representation and architectural production should be considered.

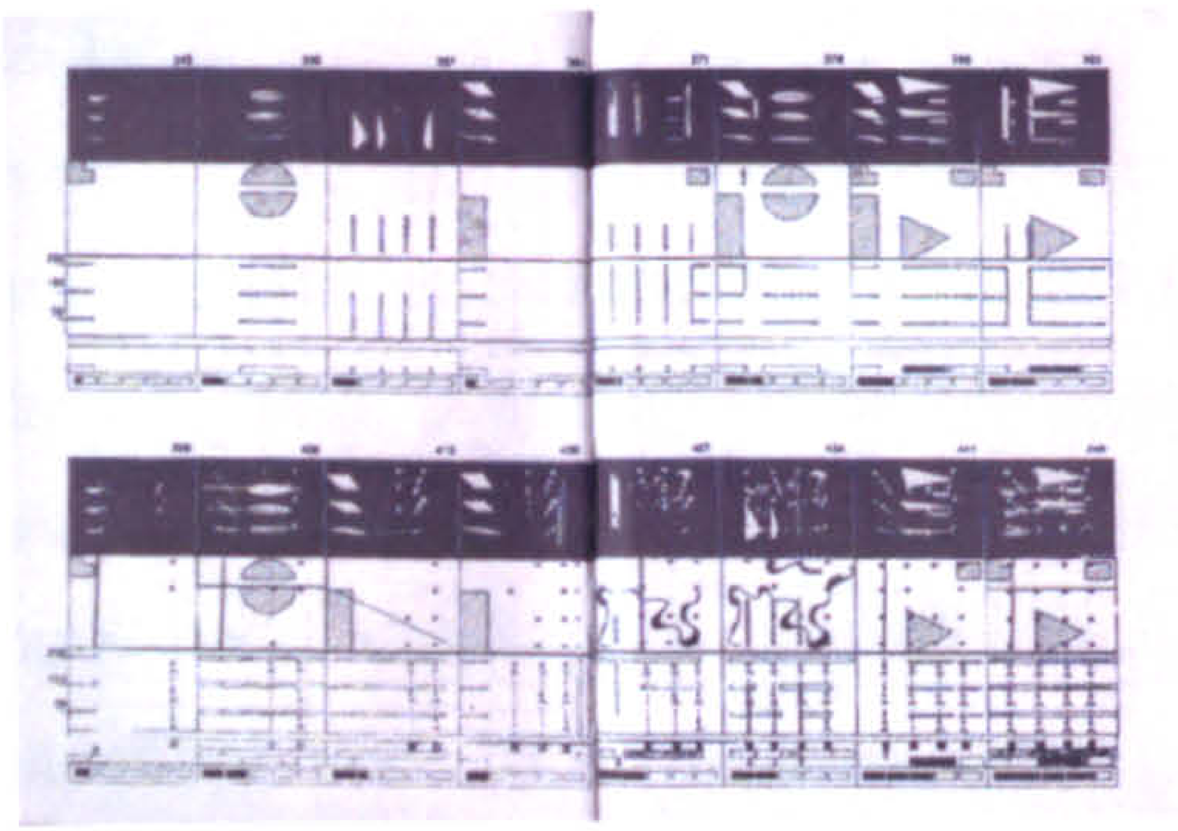


Figure 2.20: The diagram of the fireworks at Parc de la Villette in Paris, (1992): by Bernard Tschumi. Tschumi (1999: 19-35)

The diagram expanded on the theme of fireworks as a manifesto for architecture.

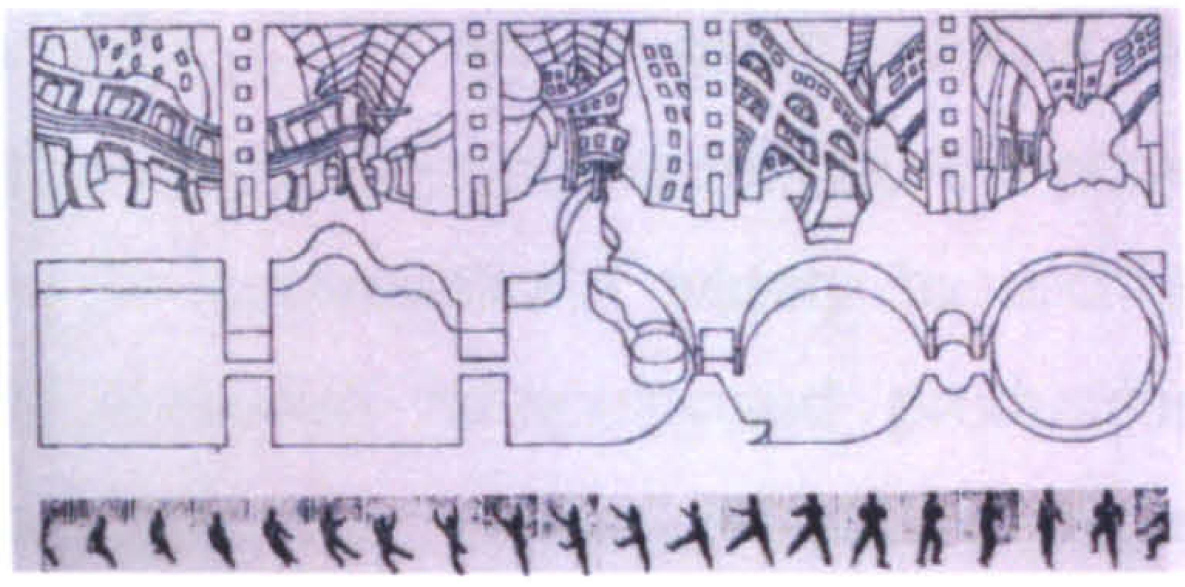


Figure 2.21: The Manhattan Transcripts drawing, (1978): by Bernard Tschumi. In 'The Manhattan Transcripts;' there was an attempt to explore the relation of bodily and social movement to built space, without resorting to a notion of 'function'. Forty (2000: 193)

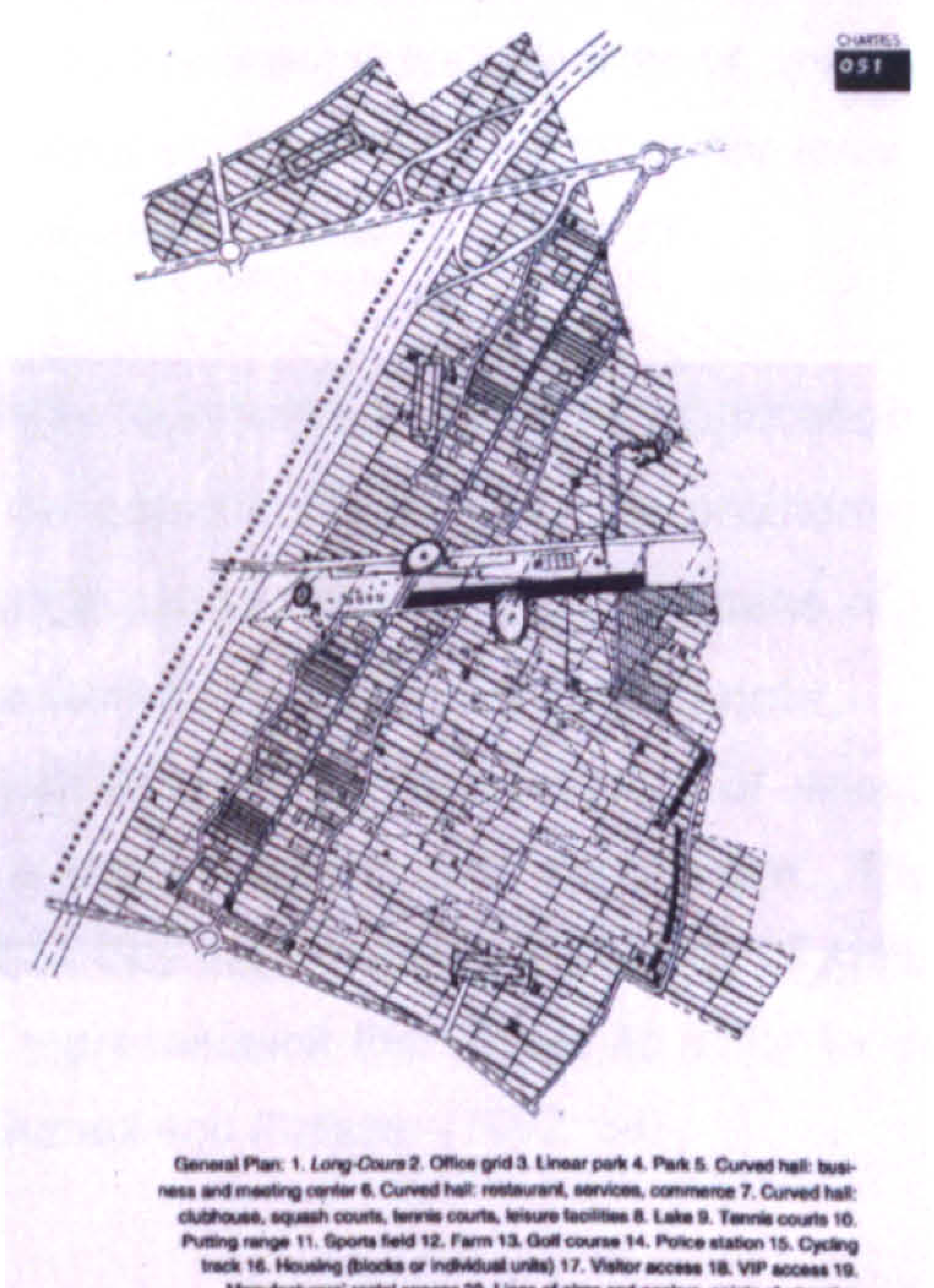


Figure 2.22: Proposed plan of Chartres, Business park, (1991): by Bernard Tschumi. Tschumi (1999: 51)

The diagram presents layers of the general plan of the Chartres Business park in France. It is used as a reduction of an architectural object that tries to convey ideas and process from the architect to the audience (within a single image). Information is reduced and represented as codes, which can be interpreted by the use of reading keys or explanations. However, the abstraction of codes may lead to inaccessibility and misinterpretation by the audience that may later cause the breakdown of communication.

At the same time as when architectural diagram was introduced[21], computer-aided design (CAD), which in this context means a computerised system that integrates both design and drafting, was already beginning to dominate the framework of architectural drawing. In particular it became very useful for such technical drawings and construction process, being seen as a more 'efficient' form of drawing. The computerised system had extended the potential of architectural representation and acted as a tool to communicate widely to architects, draftsmen, and builders. However, the relationship between computerised production of architectural drawings and their audience, in particular the public, is still ambiguous. Computerised drafting as a technical drawing is still dominated by the configuration of architectural code and culture; indeed it may be argued that CAD has deepened the dependence of the technical drawing on a set of internal codes and procedures. On the other hand, computer rendering as a representational drawing presents idealised and edited versions of reality. Whilst these versions are deemed to be approaching 'photo-reality', that reality is highly controlled and so manipulated through computer techniques that it may be too complex, hyper-real, and eventually misleading for the public. Lonsway (2002) notes,

> *Yet the spaces of computation extend beyond this electronic surface into a complex domain of spatial behaviours and operations. Space in this context performs like any space: providing a framework for measure, sociality, and organisation within the lived and cognitive realm of our existence. Although its materiality is essential to our livelihood, space is by no means exclusively physical. It exists where (or when) we describe it – on whether terms and in whatever context – while still maintaining its omnipresence. Lonsway (2002: 23)*

Furthermore, if primarily concerned with the application of computers to the early conceptual design process, the computer seems to be problematic from the point of view of aiding the creativity at the design stage, including the process of making a representational or preparatory study drawing. As Gomez and Pelletier (1992) note,

> *Today computer graphics, with its seductive manipulations of viewpoints and delusion of three-dimensionality, is simply a more sophisticated mechanism. The growing obsession with productivity and rationalization has transformed the process of maturation from the idea to the built work into a systematic representation that leaves no place for the 'invisible' to emerge from the process of translation. Gomez and Pelletier (1992: 34)*

Therefore, the question is asked whether the computerised system offers an advantage to the architectural context? On the one hand, Gomez and Pelletier (1992) claim that the computer-aided design and technical drawing have become part of the everyday life of the

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[21] Vidler (2001) quotes from Oxford English Dictionary, "Borden (1995) (Geom.) A figure composed of lines, serving to illustrate a definition or statement, or to aid in the proof of a proposition. An illustrative figure, which, without representing the exact appearance of an object, gives an outline or general scheme of it, so as to exhibit the shape and relations to its various parts. A set of lines, marks, or tracings which represent symbolically the course of results of any action or process, or the variations which characterised it. A delineation used to symbolise related abstract propositions or mental processes" Vidler (2001: 84). Furthermore, he notes further that the 'Bubble diagram' developed in the 1950s as a corrective to modemist universalism, and expanded in its role by Christopher Alexander in his early attempts to develop a design method authorised and driven by cybernetic logic (see more in Vidler (2001)).

architect. Their undisputed precision has made the architect's task into something akin to applied science, and whilst their efficiency is now deemed to be a proof of quality, the problem of what the means and the content of their representation remain problematic. They note, "The fact is, however, that the results of computer graphics applications are always disappointing. The objectification of another reality appears more intense, and the tool seems clumsy at best to show an animated picture of a fallacious building" Gomez and Pelletier (1992: 34). In this light, the danger of the computer is in its very power to convince that what is being represented is 'truthful'.

In conclusion, the communicative role of drawings in the contemporary period still remains ambiguous. The representational drawing or the diagram initially acts as a primary medium for generating, testing, and recording an individual architect's own creative and conceptual musing about design (see Robbins (1994)). By this, the audience - in particular non-architects - may face a difficulty in accessing and interpreting the drawings. Secondly, an architectural drawing - in particular the technical drawing - is bounded by the use of codes. The abstraction of codes leads the audience to a difficulty in reading and understanding the drawing. Thus the drawing cannot be shared and served as "a product of social and cultural agreement among architects and others" Robbins (1994: 7-9). Thirdly, even though the computer has enhanced the communication process in the context of architectural representation, the computerised drawing cannot really provide an architectural experience in the physical world for the audience. Therefore, the breakdown of communication between the architect and non-architect, identified in the Renaissance, is reinforced by the role of today's architectural drawing. In order to resolve this communicative problem and to retain architectural drawing as a shared medium of architectural discourse, the existing role of architect and architectural drawing thus requires it to be re-examined.

2.3 Conclusion

This very brief look at the development of architectural drawings in relation to their communicative potential may have made it possible to understand, and even to perceive the direction of, the potential communication breakdown in today's architectural drawings. The historical evidence suggests that the separation of drawing types beginning from the Medieval period, the difference between various type of drawings, and the difference between the role of architects and audience, has led to the confusion in understanding and reading architectural drawing by its audience. This may be one of the reasons for the communication breakdown between architects and the public realm. The two different types of drawings, technical and representational, may not be compatible and should not be combined. As Kahn (1992) notes, "While opposed, the abstract and corporeal properties of drawing need not be incompatible. The combination of these two aspects may be more readily acknowledged in painting and drawing which, on one hand, are not assumed to bear the burden of representation to the same extent as architectural drawings, and on the other, are expected to transcend a purely descriptive function in the creation of representational imagery" Kahn (1992: 19). It is difficult to choose one effective drawing to explain and communicate all the information to the audience. Drawings have multiplied in number and in the quantity of information they contain because of the continuous developments of new methods and techniques. So one single drawing is not enough to explain all the stages of architectural production. This has created limitations in a specific drawing's use and in certain drawing techniques.

Therefore, the communication (through architectural drawings) between architects and non-architects is currently a problematic issue, even though the quality of architectural drawings has progressively advanced through new methods such as computer-aided design. It may be argued that current architectural drawing has become internalised and is played out in a private language that excludes non-architects. This exclusion is studied through an examination of social means of communication (Chapter Three) and the differences between architects and lay people in their perceptions of buildings and representations (Chapter Four). In Chapter Seven we return to how lessons from history may inform the development of a more communicative type of drawing.

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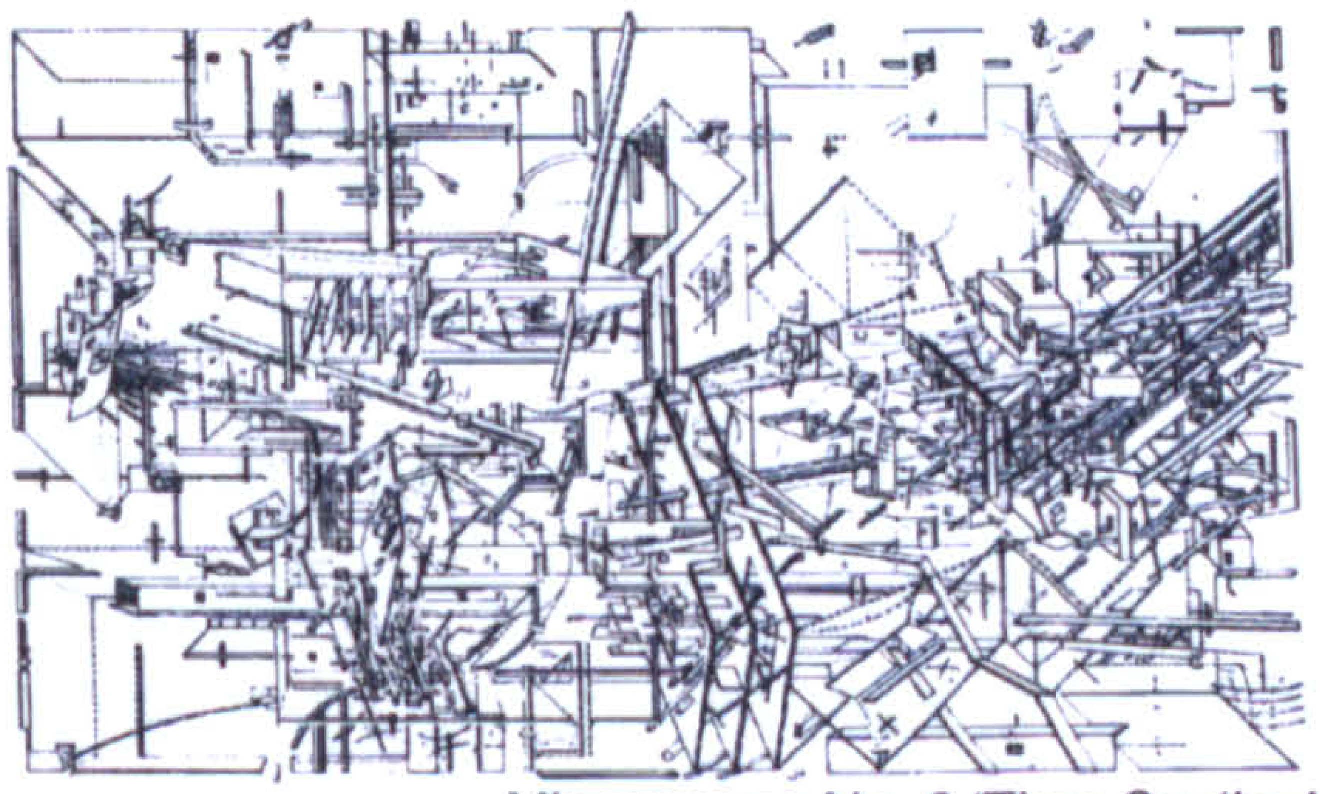
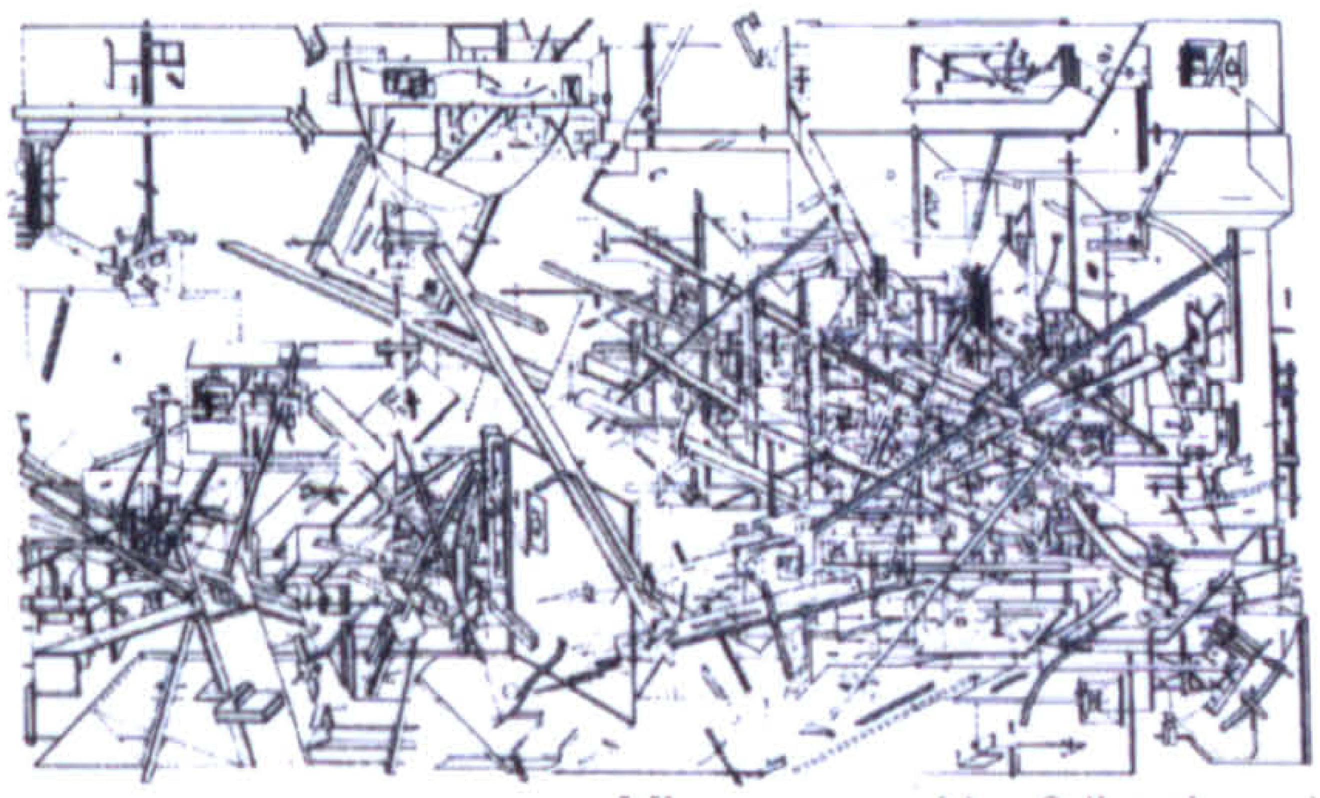
Chapter 3

Drawings as a Mean of Communication



Micromegas No. 2 'Time Section'



Micromegas No. 3 'Leakage'

'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, 2001).

Chapter Three | DRAWINGS AS A MEAN OF COMMUNICATION

3.1 Introduction

This chapter examines the way in which architects communicate through their drawings. It focuses in particular the factors involved in the communication process between architects and their audience, and the characteristics of each party. The chapter will first explore the basic concepts of a standard communication process and then relate it to the context of the architectural drawing. This is in an attempt to show how architectural drawings can fit into a more general understanding of communication. By investigating the factors involved in the standard communication process, it is hoped to find clues as to how to develop better modes of communication between architects and their audience. The aim is to increase the fidelity of the communication process in architectural drawings.

This chapter is divided into three parts. The first part attempts to define a basic communication model in architectural drawing by relating it to a standard communication model (see Berlo (1960), Robert (1946), Jakobson (1958), McQuail (1975), Cherry (1978)). The second part examines a set of architectural codes within a drawing, which convey a message from the architect to the audience (see Eco (1976), Eco (1980), Broadbent et al. (1980)). This latter section raises the question as to whether or not non-architects are able to read and translate these codes in the same way as architects.[1] The final part focuses on the social characteristics of the audience, in terms of their capacity to understand, and the way that particular backgrounds affect this capacity (see Berlo (1960), McQuail (1975), Mead (1934), Schramm (1960a)). It is hoped that a study of these characteristics will suggest alternative ways of communicating through drawing.

3.2 Communication Model

3.2.1 General Communication Process

"Communication means a sharing of elements of behaviour, or modes of life, by the existence of sets of rules of sign usage" Cherry (1978: 6).

Communication, in general, is an interaction through message. It covers and encompasses anything that conveys ideas, thoughts, and information. It includes anything from messages transmitted orally, to written messages (texts), to drawings. Essentially, the process of communication is where information is exchanged between individuals; it may be divided into verbal and non-verbal communication. A person speaking, reading, listening or writing is considered as communicating verbally, whereas a person gesturing, using facial expression or

[1] The results from the first empirical test in chapter Six will present a clear picture of the way architects and non-architects see and intepret architectural drawings.

body movement is considered as communicating non-verbally (see Dittmann (1972), Cherry (1978)).

There are clearly many different approaches to interpreting the topic of communication[2]. One of the first is set out in Aristotle's 'Rhetorica', in which he identified three ingredients for communication: the speaker, the speech, and the audience. Most models of communication that followed use this basic schema (see Robert (1946: 14)). Fawzy (1991) notes, contemporary models generally emerge from relevant theory and research in experimental and social psychology, sociology, anthropology and philosophy, in addition to studies in mass communication, behavioural sciences, mathematics and electronics. In the context of mass communication, for example, Schramm (1960a: 299) notes that the essential elements of the communication process are a sender, a message, and a receiver. The sender here is a communication organisation working with a 'communicating machine' to send similar messages at about the same time to a large number of people. Thus, everything is somewhat more complicated than face-to-face or standard communication. Whilst the communication model is relatively diverse, depending on its context, the process is basically the same, and can be reduced to four basic factors: a sender, a message, a medium or a channel, and a receiver (see Figure 3.1).

Figure 3.1 is a diagram based on Berlo's (1960) model of the ingredients in communication; this shows that a sender encodes a message and transmits it through a channel of communication to a receiver. More importantly, the message should be correctly decoded by the receiver in order to accurately match it to the one the sender has sent. This may be considered as an essential structure in any basic communication process.

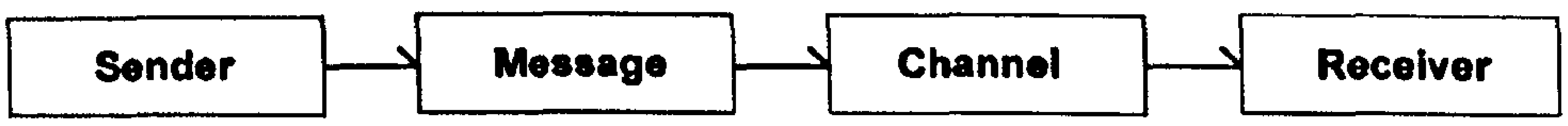


Figure 3.1: Basic Communication Model.

McQuail (1975) notes that a simple way of regarding human communication is to consider it as the act of sending from one person to another a meaningful message. It presupposes a communicator and a receiver, and a relationship between them. It implies an intention, especially on the part of the communicator; an external referent – what the message is about; a common language and some sharing of experience.

Eisenberg and Smith (1971) developed another model which is based on the basic communication model, but is more complex. They emphasise that the message received may

[2] See Berlo (1960), McQuail (1975), Cherry (1978) for the issue of communication process in general, see Schramm (1960a), Schramm (1960b) for communication process in the context of mass communication, see Jakobson (1958) for the act of verbal communication and the term of poetic function in lingiustics and poetics, and see Robert (1946) for the work of Aristotle in relation to communication matter.

not fully coincide with that which had been sent. As can be seen in Figure 3.2, the term message appears twice to indicate that what the receiver decodes (message (2)) may not be what the sender had encoded (message (1)). This suggests that the sender and receiver need an appropriate encoder and decoder to enable a clear and faithful communication.

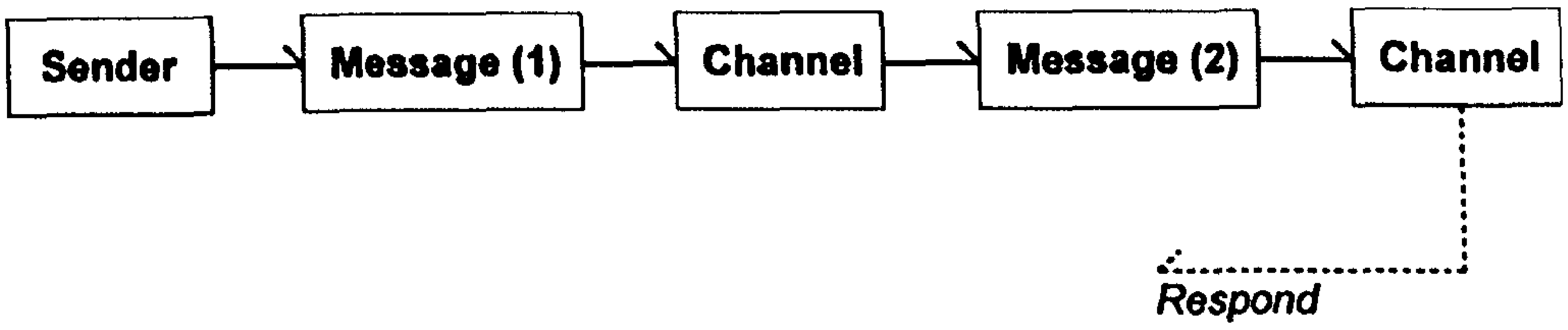


Figure 3.2: Eisenberg and Smith's (1971: 13) basic communication model

Berlo's concept of the communication process is initially used as the basis for this research (see Berlo (1960: 30)). Starting with the basic elements of the encoder and decoder then develops a more complex structure for the communication process. The stages described in his model are:

1. Communication source: a person, or a group of persons, who gives and transmits ideas, thoughts, and information with the purpose of communicating.
2. Encoder: takes information from the source, puts it into a code, and expresses it in the form of messages.
3. Message: a translation of ideas, thoughts, and information. It is expressed by purpose of a communication source.
4. Channel: a medium or a carrier of the message. The choice of channels (chosen by communication source) is often an important factor in the effectiveness of communication.
5. Decoder: the means by which receiver retranslates and decodes the message and puts it into a form that can be used and to respond.
6. Communication receiver: considered as the target of the communication process who should be, theoretically, in a similar context as the source.

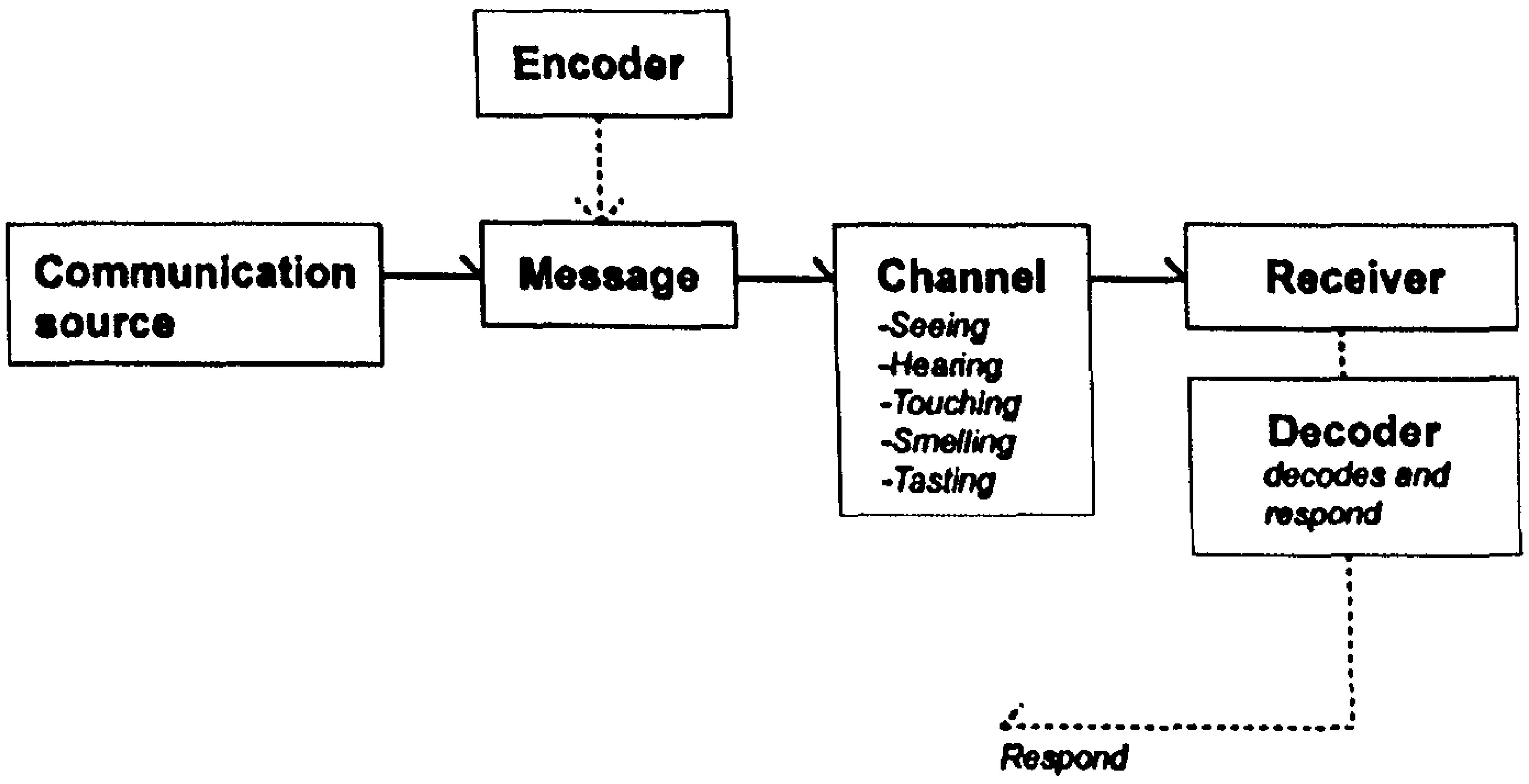


Figure 3.3: Berlo's (1960) communication model (Drawn by the author).

For comprehensible communication, Berlo (1960) notes that the communication source and the receiver must be within similar contexts because the message is encoded through the use of a restricted code which is common to the users and refers to an appropriate context that emphasises its meaning. If the context to which it refers is unrelated to the content of the message, the meaning in the message could be misunderstood and the communication would not occur. In the context of architecture, for example, the drawing is one of obvious implications for communication. In order to make a comprehensible communication and be part of the context or the society, both the architect and potential audience must acquire knowledge in reading codes of the drawing.

McQuail (1975) notes,

Communication processes refer to all acts of transmitting message, to the channels which link people, to the language and symbolic codes which are used to transmit message, the means by which messages are received and stored and the rules, customs and conventions which define and regulate communication relationships and events. Each of these elements are interdependent which the structure and culture of any given society and the analysis of communication as a social process require us to look at the ways in which social structure affects and interacts with each of them. McQuail (1975: 5)

He claims that the main elements of communication process are the presence of a communicator or sender, a message, a language or code, a means of transmission or sending, a receiver who is able to 'read' or 'decode' the message. Any communication act involves a sequence of events which take the basic form of a decision to transmit meaning, the formulation of the intended message into a language or code, and an act of transmission and of reception by someone else (see McQuail (1975)).

Jakobson (1958) introduces a six point schema of the functions of the communicative process in linguistics and poetry. It is similar to the standard communication model introduced by Berlo (1960), but includes three more factors which provide a clearer communication model and shows a more complete picture of the communicative process (see Figure 3.4). The three factors included now are Code, Context, and Contact. Jakobson (1958) claimed that "the model not only represents verbal communication but can also be generalized to represent non-verbal communication". He thus explains his concept of his communication model:

The addresser sends a message to addressee. To be operative the message requires a context referred to ("referent" in another, somewhat ambiguous, nomenclature), seizable by the addressee, and either verbal or capable of being verbalized; a code fully, or at least partially, common to the addresser and addressee (or in other words, to the encoder and decoder of the message); and, finally, a contact, a physical channel and psychological connection between the addresser and the addressee, enabling both of them to enter and stay in communication. All these factors inalienably involved in verbal communication may be schematised as follows. Jakobson (1958: 353)

The six fundamental factors[3] he identifies are as follows:

1. Addresser: a person or a group of persons who convey and encode a message.
2. Addressee: a target of communication. The addressee and the addresser should be in similar contexts in order to simplify communication.
3. Message: translated by a set of codes. The addresser chooses the choice of codes.
4. Code: may be considered as encoder and decoder of the message for the addresser and the addressee respectively.
5. Context: is required when the message is sent. The familiar context of both addresser and addressee leads to effectiveness of communication.
6. Contact: is a physical channel and psychological connection between the addresser and the addressee, enabling both of them to enter and stay in communication.

Context

Message

Addresser ______________________ **Addressee**

Contact

Code

Figure 3.4: Communication model developed by Jakobson (1958: 353)

The addresser expresses himself or herself in the form of a message. In order for a message to be comprehensible, it has to be generated by using a meaningful code. A code is a systematic set of symbols of some shared significance within a group. The wrong use of a code would mean that the message would be ambiguous and lead to incomplete communication. On the other hand, the appropriate use of code simplifies communication. Next, the message has to be put in an appropriate context related to its meaning; without this, the communication would be impossible. Finally, a channel or contact is the vehicle by means of which the addresser's ideas and intentions are conveyed.

Although Jakobson's six-point schema of the functions of the communicative process was applied to linguistics and poetry, it can also be seen as complementary to Berlo's standard communication model, which makes it appropriate for constructing the communication model for architectural drawing. As can be noticed, the model of communication developed by Jakobson not only suggests an idea of the way in which architects communicate with the audience via their drawings, but also emphasises the context where such communication takes place. Moreover, it also considers the way in which the audience interprets and responds to the message as a contact to the architect.

[3] See Jakobson (1958: 353) and Fawzy (1991).

Thus, Jakobson's communication model may be considered as kind of a further development to Berlo's standard communication model. In the following section, Jakobson's six-point schema of the functions of the communicative process is used as a core idea and relates more directly to the communication process of the architectural drawing. It is hoped to provide a clearer picture of how architectural drawings communicate between architects and their audience.

3.2.2 Communication Process of Architectural Drawing

Architectural drawing, as a communicative medium, holds the relationship between architects, architectural objects, and the audience together. As mentioned above, architectural drawing can be seen as part of a broader system of communication, and in this shares the same basic characteristics as the linguistic communication process, which in return, is consistent with that of architectural drawing. If we translate writers into architects, written pieces into drawings, and readers into non-architects, we can see that they both have the same structure of codification and process of transmission and communication. A system of written language has a group of elements or symbols (a vocabulary) and a method for meaningfully combining those symbols (a syntax), in the same way, architectural drawing has a vocabulary (a set of graphic codes), which is then put together in a meaningful combination (projection or view). However, the clear difference between them is that the message in the architectural context is in the form of graphic representation, while the message of language is information and data.

This suggests that the communication process of the architectural drawing can be analysed in the same way as the standard communication process (see Figure 3.5). The basic model of communication for the architectural drawings may then be developed further into Figure 3.6.

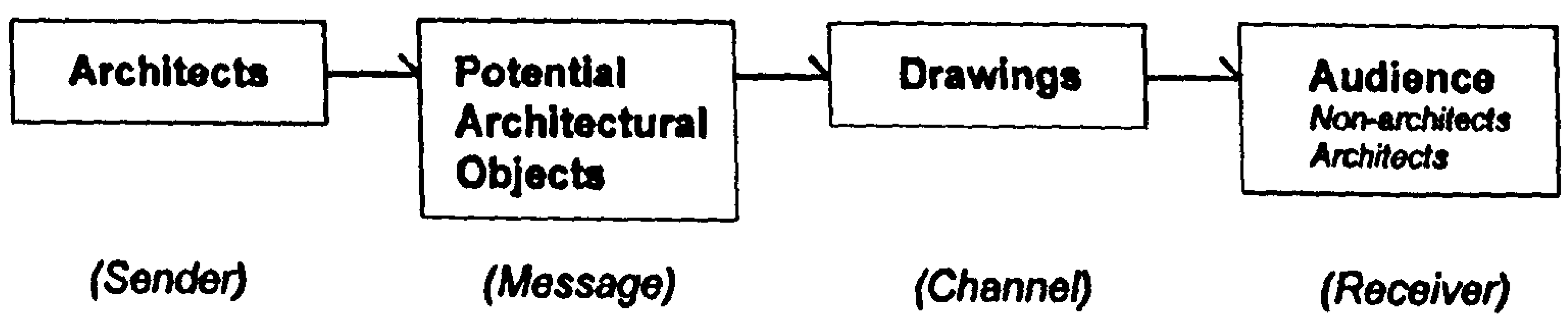


Figure 3.5: Basic communication model of architectural drawing. (Drawn by the author)

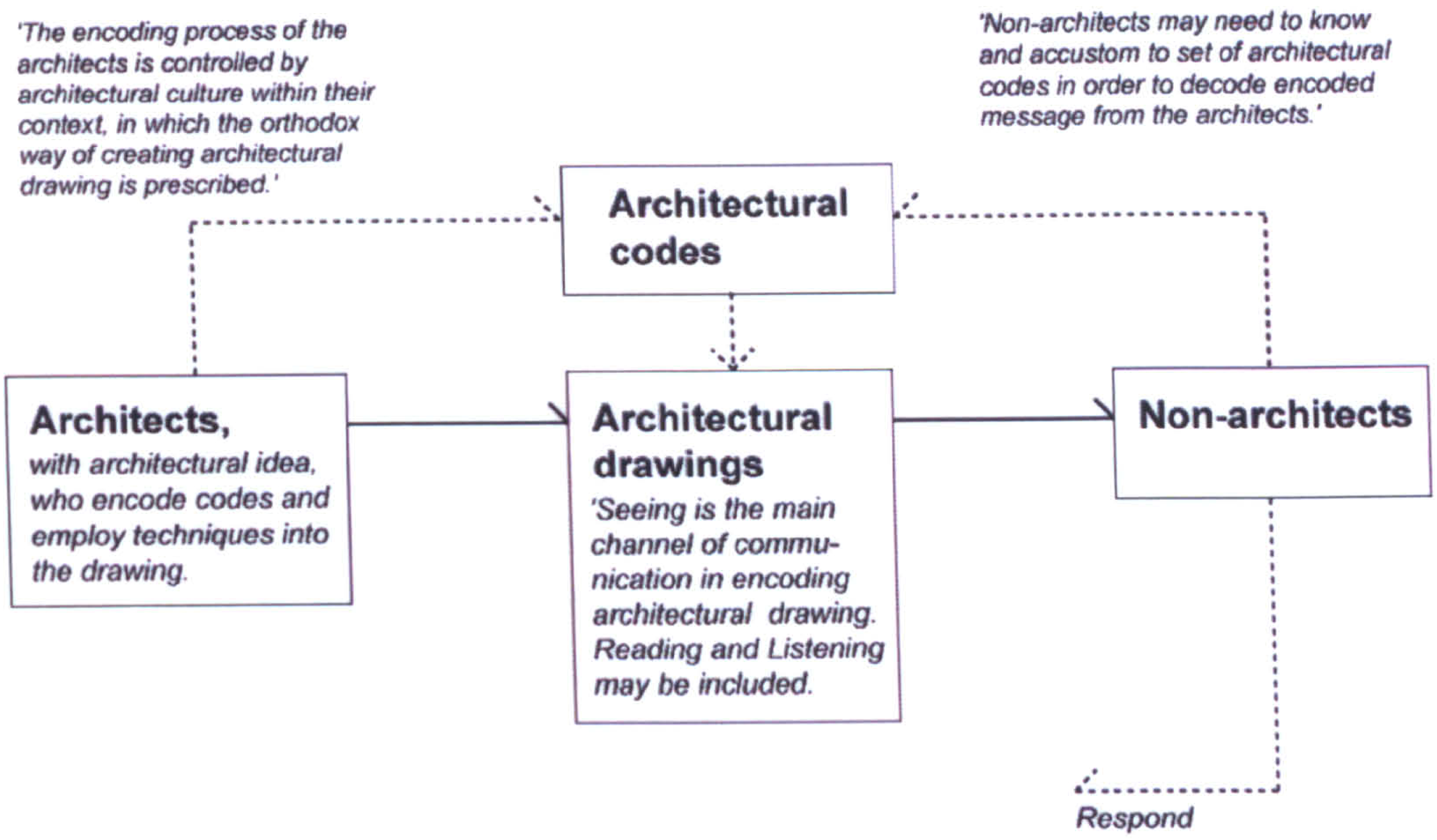


Figure 3.6: Communication model of architectural drawing (Drawn by the author).

The architects, as the addresser, encode an architectural drawing and in this transforms a conceived notion (architectural idea) into a tangible one (graphic representation of it) by using a set of graphic codes. The message contains both drawing (graphical representation) and writing (information and related data), which are put together into a coherent context. Consequently, the encoded message (architectural drawing) is transmitted to non-architects, as the addressee, by visual means of communication as the contact. Non-architects receive the message, decode it and then respond accordingly. However, an architectural drawing as a message, which is encoded by architects, has to be decoded by non-architects who are often not accustomed to this particular set of codes. This means that the decoded message may not fully coincide with the one that had been encoded by the architect.

Consequently, it is not only architects, their message, and their audience that are the important factor to examine, but one should also focus on the codes (this will be discussed in the following section.) In addition, as we have seen above, the context is also important for communication[4]. The architect generally communicates the drawing within their context, which is based on their profession and culture, to other architects. By this, it is meant that they are often unaware of the context by which they convey the drawing to non-architects, meaning that the context may be inappropriate for non-architects. Therefore, a familiar and appropriate context needs to be considered, in particular on the non-architects' side. What can be seen is that every element of the communication should be considered as part of a whole. The

[4] In order for the drawing to be more readily understandable, the drawing has to be placed in its proper context. Context may be defined as the message's environment (see Fawzy (1991)). In this research, however, it is suggested that architects and non-architects each occupy a different context. Thus their message and communication are conveyed in a different environment. As can be noticed, the communication occurring within the context of the architect is controlled and prescribed by architectural culture. They have rules and an orthodox way of encoding and decoding the drawing. On the other hand, non-architects aim to create a comprehensible communication without depending on rules or specific culture.

inappropriate use of any of the various elements may cause a communication breakdown between architects and non-architects.

3.3 Architectural Code

In relation to the architectural drawing, the method of codification is a key part of the communication process and therefore needs to be studied. In standard communication, a code is generally invented for a specific purpose and follows explicit rules that have been created (see Cherry (1978), Eco (1976), Eco (1984), Eco (1986), McQuail (1975)). As Eco (1984: 165) notes that a code is something which tells something else; it has had to do so with communication or signification since its most remote origins. Cherry (1978) notes, "Messages can be coded after they are already expressed by means of signs; then a code is an agreed transformation, usually one to one and reversible, by which messages may be converted from one set of signs to another" Cherry (1978: 8). The communication source employs signs to signify a set of codes in order to provide a communicative language for the receiver to understand the sent message. As Leach (1976) notes, "The modes and channels through which we communicate with one another are very diverse and very complex"... "Human communication is achieved by means of expressive actions which operate as signals, signs and symbols" Leach (1976: 9).

The way of using codes in standard communication is comparable to the way in which architectural codes are employed within the architectural context. As we have seen from the communication model of architectural drawing, architects initially encode a message by means of architectural signs. The code is represented and explains the meaning within the drawing. It therefore becomes a kind of communicative language used in the architects' drawings for their audience. After the drawing is conveyed to the audience, they have to decode the drawing in order to understand the message. However, the code which appeared in an architectural context is more complex and autonomous than in standard communication and normally requires an architectural background for the message to be fully read and understood.

The following section thus attempts to explain properties and appropriate ways of using a set of codes in architecture, which will help to provide understanding and accessibility to the audience and to achieve a more faithful communication process in architectural drawing.

In order to understand the methods of coding, it may be worth looking at Umberto Eco's analysis of architectural objects[5] in which he examines the way architectural objects are codified (see Eco (1980)). Whilst it is important to note that the term 'code' as used in his analysis does not refer to the code in architectural drawing, it actually refers to the code in architectural objects, lessons may be learnt from his analysis. Eco argues that architectural objects could be

[5] See Theory of codes and Codes in the philosophy of language in Eco (1976:48-139) and Eco (1984: 164-85), respectively.

codified into three categories[6]: Technical codes, Syntactic codes, and Semantic codes. He notes:

1) Technical codes: To this category would belong, to take a ready example, articulations of the kind dealt with in the science of architectural engineering. The architectural form resolves into beams, flooring systems, columns, plates, reinforced concrete elements, insulation, wiring, etc. There is at this level of codification no communicative 'content', except of course in cases where a structural (or technical) function or technique itself becomes such; there is only a structural logic, or structural conditions behind architecture and architectural signification,

2) Syntactic codes: These are exemplified by typological codes concerning articulation into spatial types (circular plan, Greek-cross plan, 'open' plan, labyrinth, high-rise, etc.),

3) Semantic codes: These concern the significant units of architecture or the relations established between individual architectural 'sign-vehicles' and their denotative and connotative meanings. They might be subdivided as to whether, through them, the units (a) denote primary functions (roof, stairway, window), (b) have connotative secondary functions (typanum, triumphal arch, neo-Gothic arch), (c) connote ideologies of inhabitation (common room, dining room, parlour), or (d) at a larger scale have typological meaning under certain functional and sociological types (hospital, villa, school, palace, railway station.) Eco (1980: 38-9)

Eco (1980) here draws on a standard linguistic differentiation, that of the syntactic and the semantic. The former refers to how languages convey meaning; the latter to what the meaning is that is conveyed. He notes that not only semantic codes, but also the syntactic ones, clearly confine us to a certain quite specialised 'grammar' of building.

As we shall see, what Eco talks about is a particular manner of reading buildings as visual field. Buildings can be read like a language and have all the aspects of language. Hence, within this context, the system of linguistic analysis can be applied to buildings. At the same time, drawings are also seen and read as another set of language. It is therefore suggested that it is appropriated to relevantly apply Eco's analysis technique of architectural objects to drawings. Eco's analysis of architectural objects, dealing as it does with codification systems, may be applied to the structure and codification of architectural drawing. If architectural objects communicate then the whole process of the drawing and the way drawing communicates should take into account the final means by which the architectural object communicates[7]. Eco's analysis is diagrammatically represented in Figure 3.7.

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[6] On the logic of human communication, Morris (cited in Cherry (1978: 9)) distinguishes three types of rules operating upon signs: (a) Syntactic rules (rules of syntax; relations between signs); (b) semantic rules (relations between sign and the things, actions, relationships, qualities-designata); (c) pragmatic rules (relations between sign and their users). See more in Morris (1946). Also see three different levels of semiotics (Syntactic, Semantics, Pragmatics) studied by Cherry in Cherry (1978: 223).

[7] Considering the relationship between audience and architectural objects, they generally experience architecture as a communication in the way of recognising its functionality. For the audience, architectural objects are characterised by architects as a possibility of function rather than a communicative medium. The objects are provided their function by architects and occupied by users. On the other hand, non-architects also recognise architectural objects by their functionality and spatiality, in particular after the completion of the project. The objects are not designed as a tool of

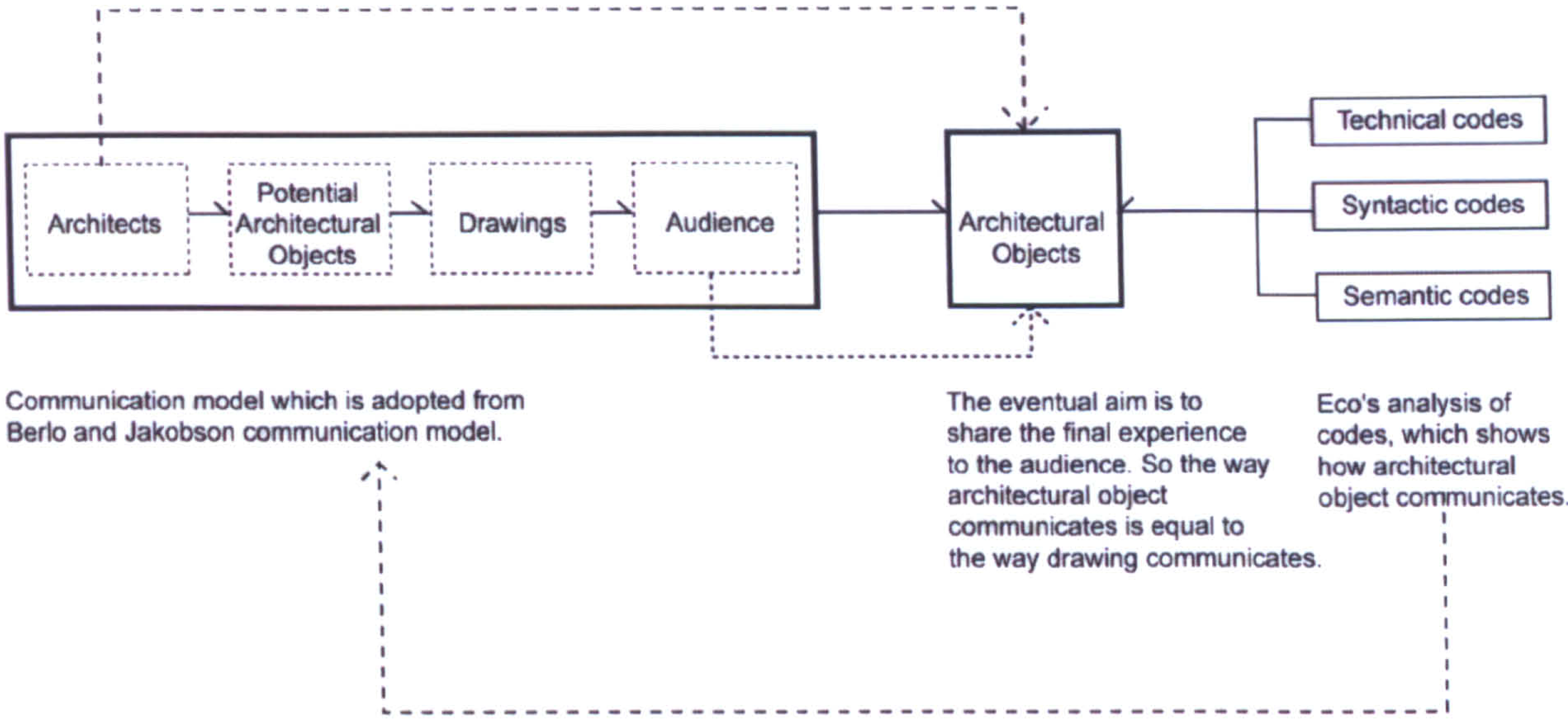

Figure 3.7: A correlation between Eco's analysis of the codification of architectural objects and a process of architectural drawings (Drawn by the author).

By referring back to Eco's analysis, codes within architectural drawings may be broken down roughly as follow:

1) **Technical codes**: These are codes employed to convey technical or construction information. This kind of code is used within a specialised context, and has been developed according to a set of internalised norms. Whilst technical codes are considered a communicative tool in the architectural context they are limited to the internal audience and generally not accessible by a wider audience. (see Figure 3.8)

2) **Syntactic code**: The term *Syntax* generally means how things convey meaning, such as through code, grammar, and structure. Thus, syntactic code may be considered as the rules of codes, the structure of sign and symbol which describes architectural drawings, or the internalised discourse (see Cherry (1978), Eco (1976), Morris (1946)). It is less complex than the technical code but knowing a method of coding is still necessary. Thus, the accessibility of this code may depend on the audience's experience or knowledge. The sign and symbol may remind the audience of their past experience. (see Figure 3.9) However, this syntactic codification also relies on architectural culture in that it has to follow a certain rule that that culture has prescribed. A staircase sign, for example, consists of the articulation of morphological elements which express the function for ascending. The sign signifies function and can be signified by knowing the method of coding. Eco (1976: 308) notes that on the notion of signs one should now read them by substituting for the notion of 'architectural sign' that of 'architectural text' in which many modes of sign production are simultaneously at work.

communication but, in fact, they work as a medium that represents functionality of the building. As Eco (1980) claims, "Most architectural objects do not communicate (and are not designed to communicate), but function" Eco (1980:12).

3) **Semantic code**: The term *Semantic* in this context refers to what things mean. It is more open, involves discourse, and shows how the drawing communicates meaning. As Eco (1980) notes that semantic codes within the architectural object rely on relations established between individual architects and their sign-vehicles. In this much, the architectural object may have inherent and fixed meaning for its creator, but because the codes are not necessarily universal or shared across all cultures or context, the object may convey another meaning to its audience of users or observers. This could also refer to semantic codes in architectural drawing which rely on codification by the individual and therefore become a subjective way of coding, especially in such contemporary times where cultures are so plural (see Allen (2000)). If, as many observers argue, there are no shared value systems, then there will be multiple interpretations of a given drawing constructed through semantic codes. As Eco (cited in Leach (1976: 181)) notes codes must be viewed within their cultural context. Within standard communication, Leach (1976) claims that the communication between two parties can only be understood if they are situated within the same context. He notes, "A private symbol generated in a dream or in a poem, or a newly invented 'symbolic statement' of non-verbal kind, will fail to convey information to others until it has been explained by other means" Leach (1976: 11). This suggests that semantic codes, at the level of both drawing and object, need to move beyond a personal or subjective sphere if they are to have a wider communicative role. (See Figure 3.10 and 11)

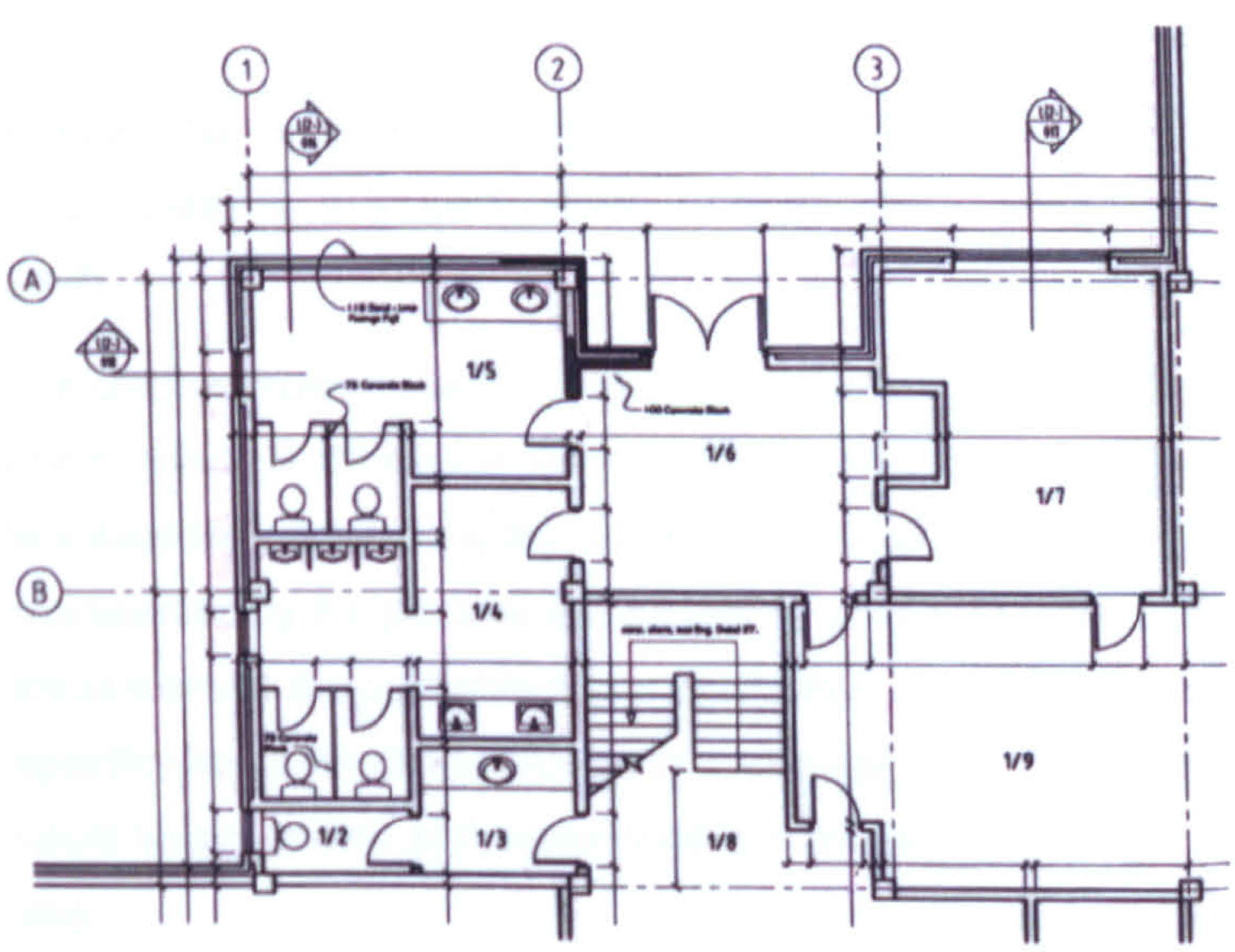

Figure 3.8: The basic construction plan. Styles (1995: 96)

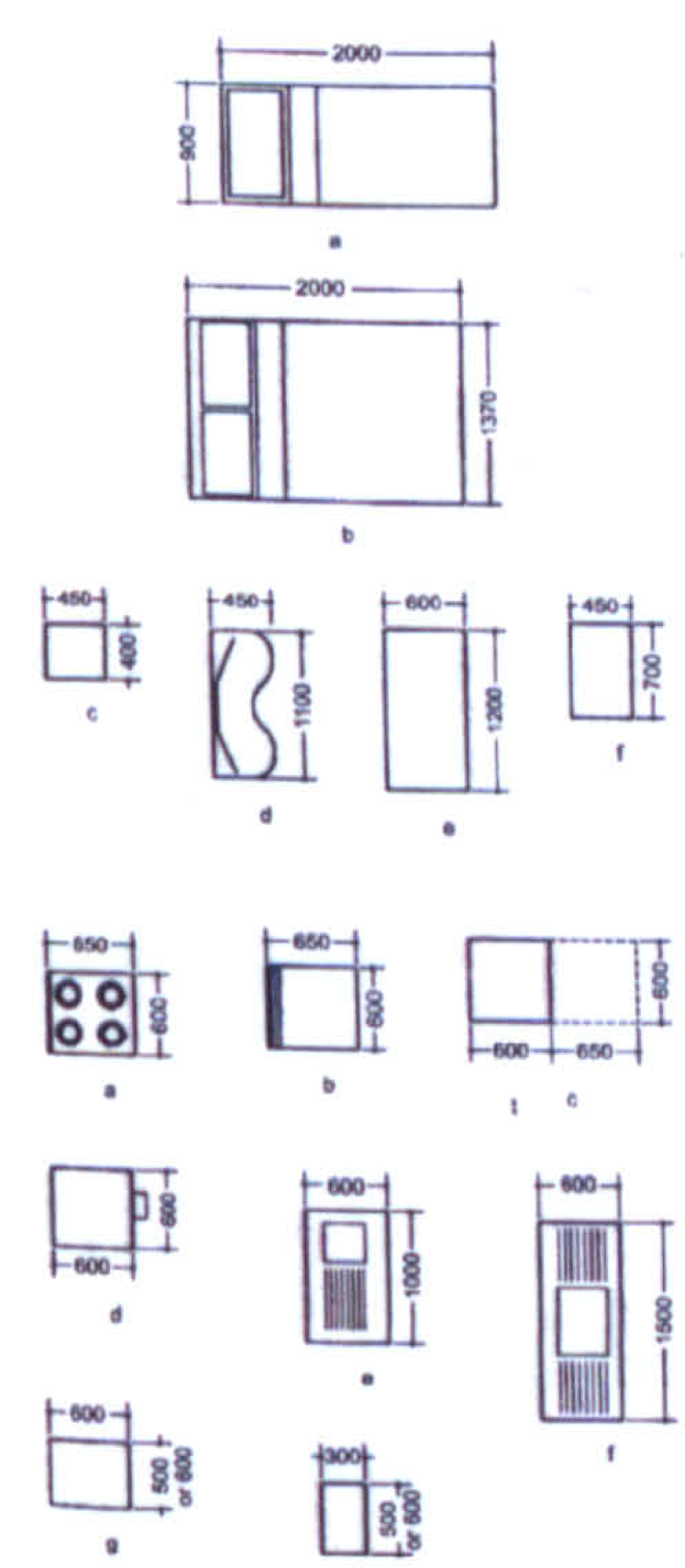

Figure 3.9: Architectural signs represent bedroom and kitchen furniture. Tutt and Adler (1979: 2.21)

This drawing (Figure 3.8) shows the way technical codes are used in plan and how the architect uses these codes to explain technical aspects of the proposed building. In order to read and understand this kind of drawing, architectural background or knowledge of architectural codes are generally required.

These architectural symbols show the system of coding in an architectural drawing (see Figure 3.9). They may consider as syntactic code since they convey meaning and describe the drawing. Conventionally, the architect uses them by following what architectural culture has prescribed. The codes are created and fixed by rules in making a proper architectural drawing.

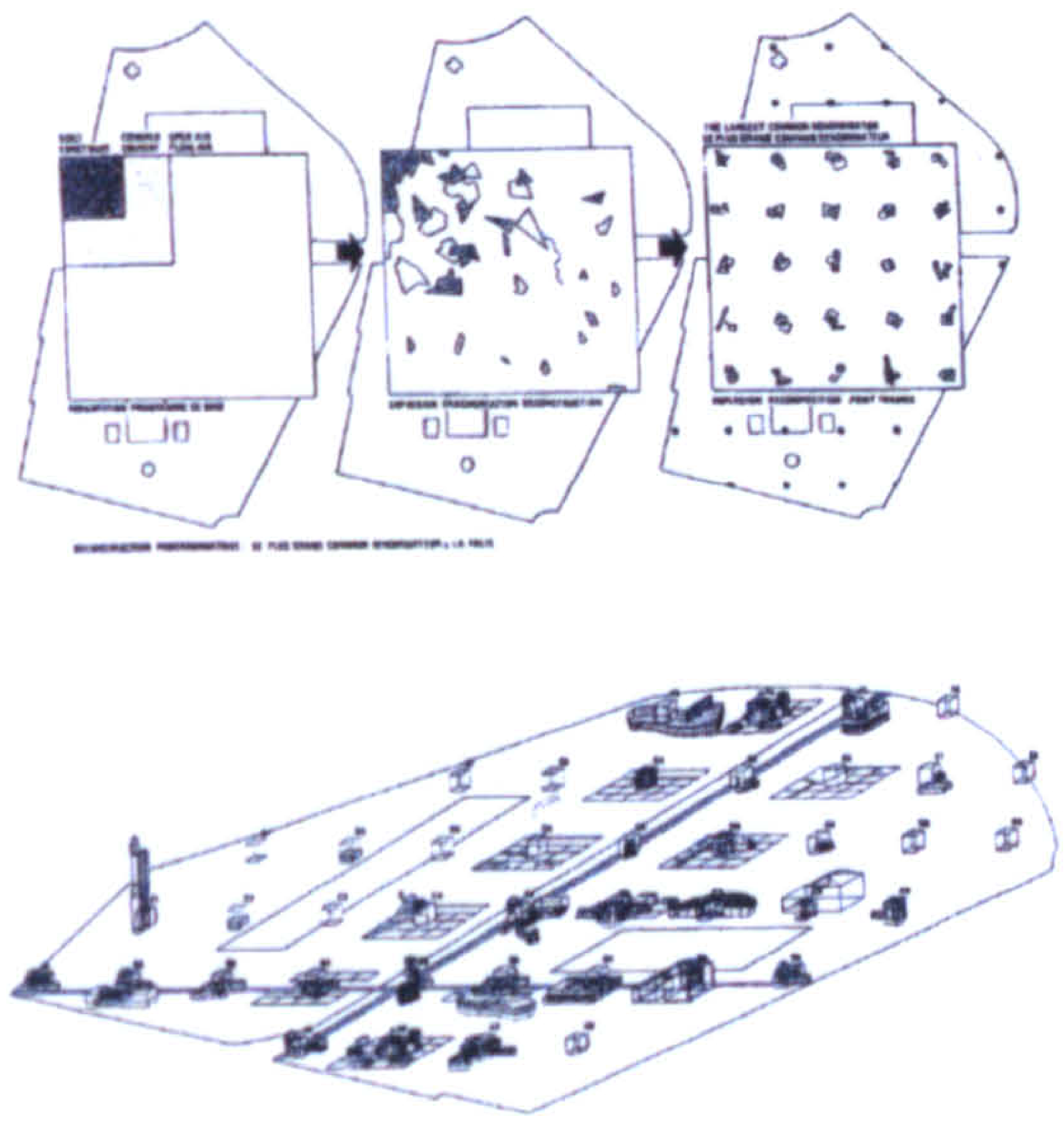

Figure 3.10: Deconstruction programme for Parc de la Villette, by Bernard Tschumi. Tschumi (2002: 58-9)

The diagrammatic drawing contains semantic codes, which is referred to what the thing means. It is subjectively codified by the architect, which is represented by the process and sequence of his ideas towards the built object. It is interpreted in a specific way. Without the architect's explanation, it could be interpreted and understood in a different way.

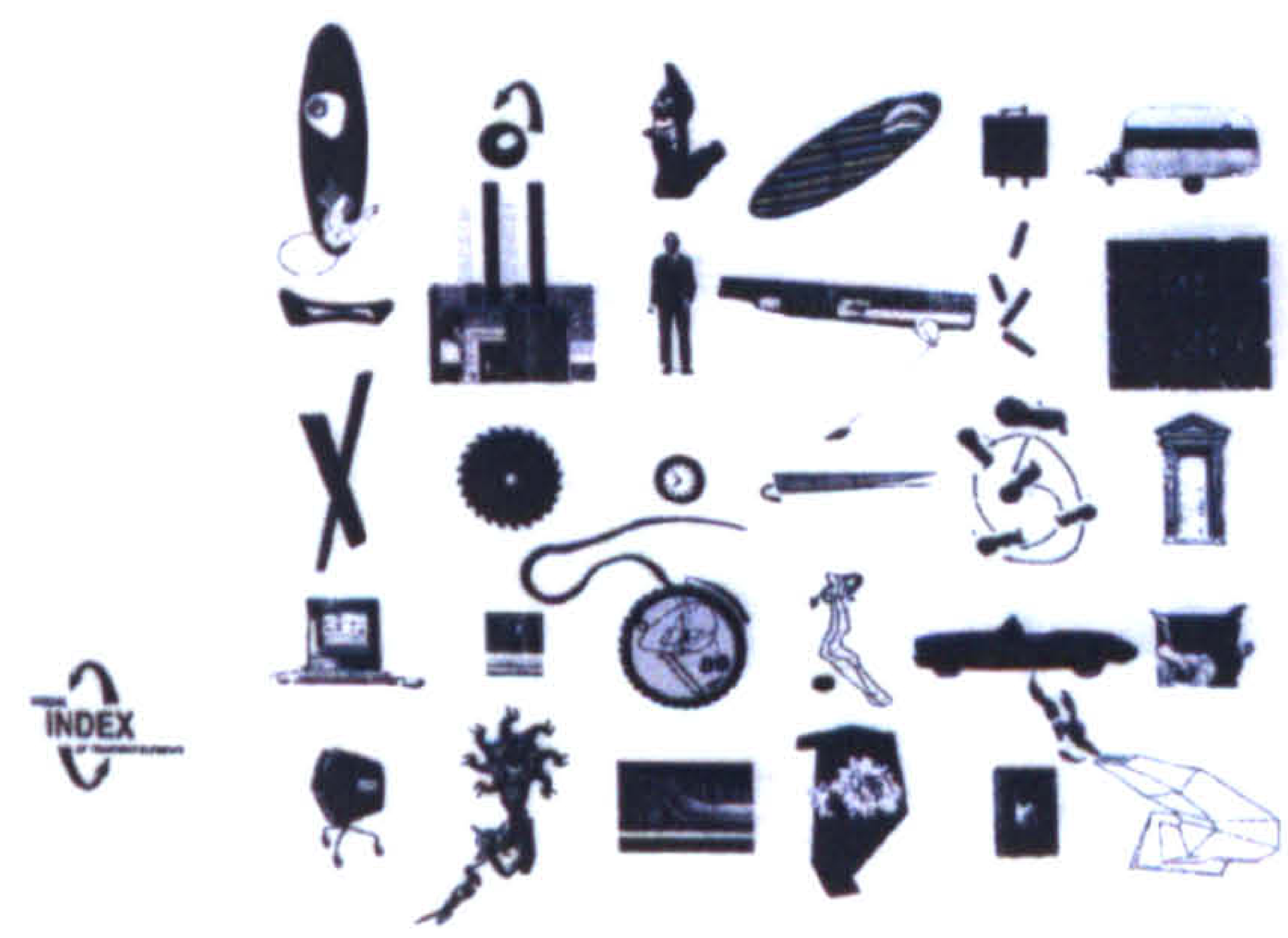

Figure 3.11: Visual Index of the transient elements for the Institute of Illegal Architects, (1996). Hill (1998: 45)

Hill creates these codes (considered as semantic code) in order to explain and communicate his project (called the Institute of Illegal Architects) with the audience. Even though the project has never been built, the codes act as a reference and subjectively relate the drawing to the whole project.

What can be seen, if we follow Eco's classification, is that in all three cases the codes employed by architects to 'encode' drawings are based on internalised systems of communication, and thus the audience is often unable to faithfully decode them.

Codes are necessary to communicate the message of architectural drawing and there will be no architectural message without the use of codes. However, since the code has become internalised, it becomes difficult for the audience to access. The code becomes, as Eco claimed, a message inscription instead of a communicative language (see Eco (1980), Eco

(1976)). Eco (1980) notes that with the use of the wrong code, a plan might be read as a section or *vice versa*. He said that in the case of architecture, codes of reading (and construction) of the object would have to be distinguished from codes of reading (and of construction) of the *design* for the object. Thus, the questions are asked how and as to what code should architects use in architectural drawings in order to provide a language comprehensible to both architects and non-architects?

The analysis above suggests that architectural codifications in architectural drawing should be more open and less limited to instrumental ends or technical demands. Therefore, considering alternative codes, these questions arise: What rules for the combination of codes are there for the architects to follow? If an architect rejects the traditional codes and rules, what then does he base his combination of codes upon?

The possible answer, Eco suggests for the architectural object, is that architecture must in fact be based not only upon existing architectural codes, from which the architect may then depart from, but also upon other external codes: it is with reference to these that the users would identify the meaning of the new architectural message. Referring to the architectural object, Eco (1980) notes,

> *While looking outside architecture, then, for the code of architecture, the architect must also fashion his significative forms in such a way that they will remain relevant under different codes of reading. This is because the historical situation in which is his attempts to identify a code would be grounded will be outlived by the significative forms he feeds into this situation. The architect may have to get his bearing to some extent from the sociologist, the economist, the psychologist, the anthropologist, and so on, but he must at the same time acknowledge, in the way he fashions forms to answer to the exigencies they have shown him, the possible failure of their hypotheses and the degree of error and obsolescence to which their work is subject. And he must realize throughout that his work will at best cooperate with, not prescribe, the movement of history. Eco (1980: 61)*

Eco (1980) notes:

> *If there is a growing interest in interdisciplinary work as the proper basis for architectural design, then, it could be explained by the fact that the architect has to elaborate his sign vehicles and messages in relation to systems of meanings that lie outside his province. And for that reason the architect might find himself in the position of having to reject the existing architectural codes. Eco (1980: 46)*

The observation of external codes offer architects a possibility of a new viewpoint, both at the level of the drawing and the eventual object[8]. This not only opens up a different approach

[8] The architectural drawing is an architect's idealised image of how the building should look. It is also an interpretation of the constructed building. This internalised symbiotic relationship thus makes it difficult for non-architects to infiltrate. By this, the research suggests external codes that is hoped to offer a more accessible and comprehensible way in understanding the relation between the eventual architectural object and the architectural drawing. See more on architectural object in Eco (1980).

and means of speculation to architects, it also provides a potential for non-architects to engage the drawing in a manner which allows for a more faithful communication.

The lessons learnt from Eco's analysis and from previous ideas of communication inform the following sections and arguments of the research. What is apparent is that the capacity of the audience to understand the encoded messages is determined to a large extent by their background and cultural context. Thus, the next section will examine the characteristics of architects and non-architects (as the audience) in order to see how they experience the drawing.

3.4 The Audience: Architect and Non-architects

According to the previous standard communication models of Berlo (1960), fidelity of communication is dependent on the personal characteristics of the architect and their audience. He defined four factors that effect the transmission of the message: Communication skill (codification and decodification), attitude (towards self, others, and subject matter), knowledge level, and one's position within a social-cultural system in which one's communication behaviour occurs. These four characteristics, in relation to both the architect and their audience, may be presumed to affect the success or failure of the communication process in architectural drawing, and therefore will be analysed in the following sections. The aim is to see how a study of these personal characteristics may inform the development of alternative ways of architectural drawing that are easier for a lay audience to understand and achieve a higher degree of fidelity in communication.

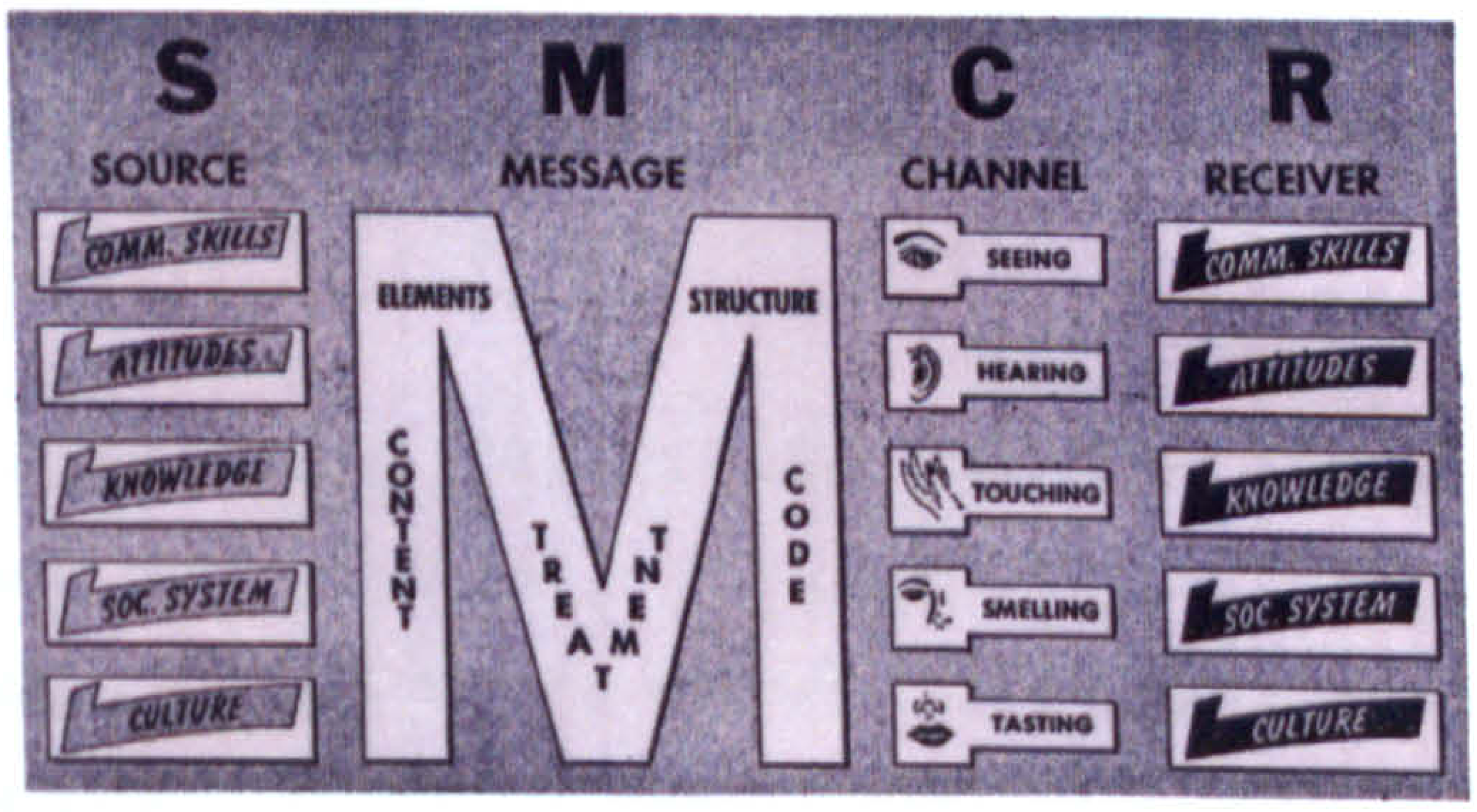

Figure 3.12: A model of the ingredients required to produce communication. Berlo (1960: 72)

3.4.1 Communication skill

In any communication situation, a clear and effective message depends on the encoding skills of the addresser; at the same time, in order to understand a message properly, the addressee must also possess the decoding skills (see Berlo (1960), Cherry (1978), McQuail (1975)). Architects are limited in their ability to express their ideas if they do not possess the communication skills to encode messages in an appropriate manner, whereas non-architects are likewise limited in their ability to understand these messages if they do not possess the requisite communication skill to decode them.

Clearly, the main aim must be to encode the drawings in a manner that takes into account the final audience. For a lay audience, this means avoiding abstract or technical codes – and yet, as we have seen, these codes form the basis of most architectural drawings.

The process of codification may be traced historically. For example, as we have seen, in the medieval period architects were trained as master masons. They verbally communicated to the patron and created drawings for the workmen on site (see Robbins (1994)). Thus their methods of communication in the two different contexts were appropriate since they involved a mutually understandable code. On the other hand, Renaissance architects were not trained as craftsmen but as artists (see Ackerman (1970), Kostof (1977), Gomez (1982)). This artistic training was reflected in their mode of communication, with ideas expressed via particular types of drawings which did not always serve the purpose of the target audience. In later periods, we saw how the codes became more and more directed by the professional and educational context, and in this how they became further remote from a target audience of lay people. This is especially true in the case of the late twentieth and early twentieth first centuries, where a large number of techniques have been applied to drawings; architectural codes have become more complicated and thus more problematic in providing comprehensible information. In order to address this communication breakdown, it is suggested that new methods of coding drawings must be employed, and it is suggested that these may be developed from systems external to architecture.

3.4.2 Attitude

Berlo (1960) identifies three types of attitude that affect the addresser's behaviour in a given communication situation: attitude towards oneself, attitude towards the subject matter (which could be related to knowledge level in the following section), and attitude towards the addressee.

In an architectural context, the architect's attitude towards him or herself is clearly reflected on a drawing and its means of representation. For example, overconfidence, or arrogance, might cause confusion for non-architects (in as much as the codes employed will probably be self-referential), whereas a more modest disposition might lead to a desirable cautiousness and openness in representation (see Nicol and Pilling (2000)). However, architecturally the most crucial of Berlo's three attitudes is the third - the addresser's attitude toward the addressee.[9]

Ideally, if an architect's 'attitude' is orientated towards a target audience of non-architects, the communication situation will succeed. An architect will encode a message in an appropriate manner, which will provide a track for non-architects to simply decode it. However,

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[9] As Mead (1934) notes, "The development of communication is not simply a matter of abstract ideas. But is a process of putting one's self in the place of the other person's attitude, communicating through significant symbols" Mead (1934: 327).

in many cases, particularly in contemporary practice, an architect's attitude towards non-architects is an inappropriate one (see Brown and Yates (2000), Nicol and Pilling (2000)). As systems of representation developed in the twentieth century, drawings have been aligned more with the values of architectural culture and techniques of production than with a determination to communicate with a wider audience. What the idea of 'attitude' suggests is that the production of comprehensible drawings is more than just a matter of technique, it is also a social and cultural matter, in which architects need to re-examine their value system (see Cuff (1991), Egan (1998), Nicol and Pilling (2000), Robbins (1994)).

3.4.3 Knowledge Level

McQuail (1975) notes:

The general view of society as a set of shared understandings has obvious implications for communication, since the 'knowledge' which people have of their society must be acquired, maintained and altered by communication. To belong to a social group, a society, a culture is to share a common denominator of frames of reference, significant objects, systems for describing the world and facilitating interaction with each other. McQuail (1975: 4)

Considering the standard communication process, there is an amount of information which could enter into a message and still maintain its comprehensibility to the audience decoding it. The lesser the audience's knowledge level on the subject matter, the more likely the message would appear trivial and lacking in substance.

However Berlo (1960) has shown, more knowledge does not necessarily ensure better communication. The amount of knowledge an architect has about architecture and architectural drawing in general undoubtedly affects the process of communication. Even though he might be an expert and has a high level of comprehensive knowledge in his field, he may fail to incorporate comprehensible information in his drawings on the basis that such information is elementary and should be understood by everyone. The depth of an architect's knowledge may over–burden the relevant information and leads to the drawing being too dense or too abstract and excluding non-architects in the process. Berlo (1960) notes, "Knowledge of communication affects communication behaviour" Berlo (1960: 49).

This suggests that architects should balance meaningfulness and triviality in architectural drawing, providing neither too much nor too little information. It is also clear that the drawing must be appropriate to the knowledge level of the target audience. This can best be seen in drawings in Ancient Egypt which were based on a language and knowledge system that was shared; in the context of the architectural drawing, the knowledge of architects and non-architects were equal and this led to a widely used and successful model of communication (see Figure 3.13).

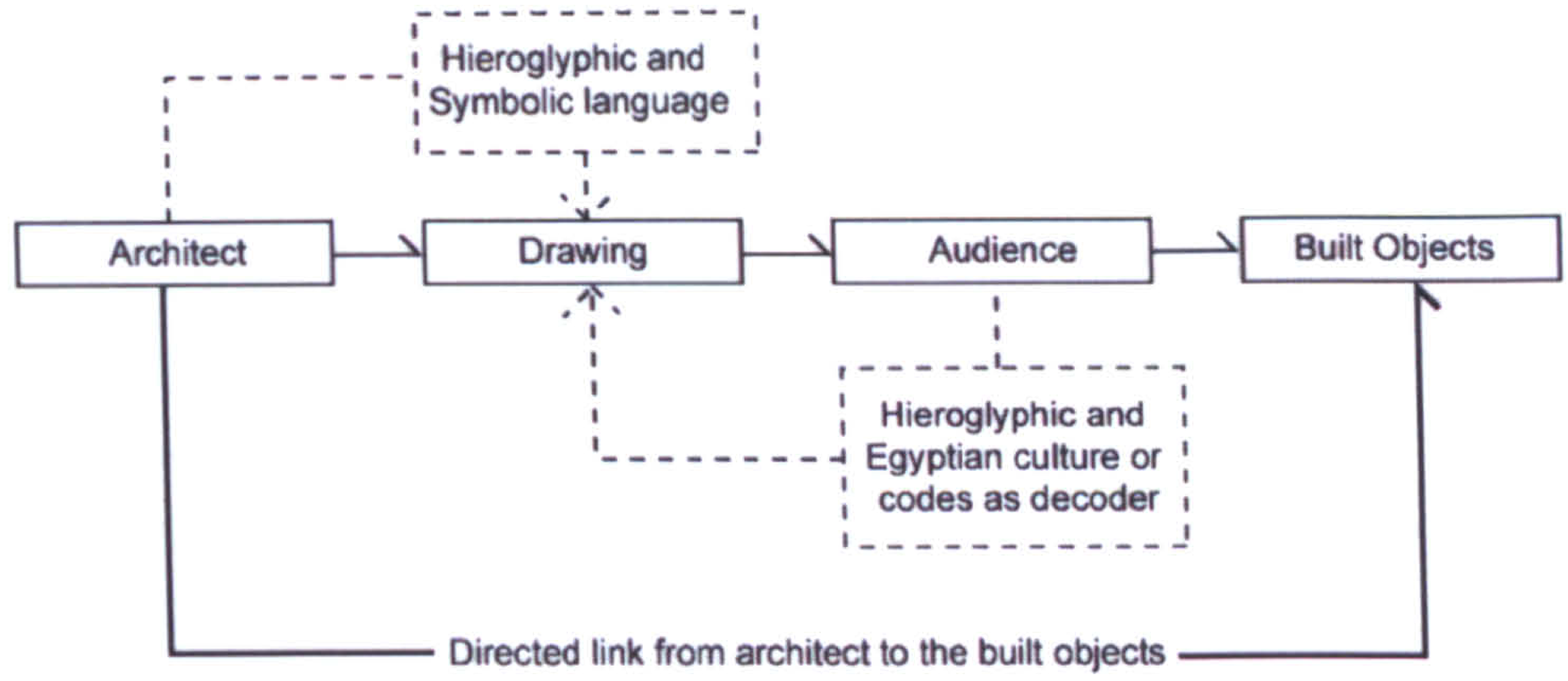

Figure 3.13: A diagram showing how architects convey their drawings towards designed objects and to communicate with their audience (Drawn by the author).

3.4.4 Social- Cultural system

According to the standard communication process, the social, cultural, and professional status of addresser and addressee affect the ways in which they encode and decode a message respectively (see Mead (1934), Schramm (1960a)).[10] Berlo (1960) notes that people in differing social classes communicate differently. People from different cultural backgrounds communicate differently. Social and cultural systems partly determine the choices of words that people use, the purpose they have for communicating, the meanings they attach to certain words, their choice of receivers, the channels they use for this or that kind of message, etc.

In an architectural context this most obviously leads to architects and non-architects interpreting drawings differently.[11] I also suggest that in the process of coding a drawing one should take into account differences in education, class and professional background of the target audience. For example, we have seen how in the Renaissance that the architect was raised to a new social status as a consequence of his professional position, and this affected the way in which he encoded his drawing. As Shelby (1977) notes, the Renaissance architect often came from a different social class than that of the builder. Thus, the way he conveyed a drawing to the builder and patron was different.

Considering the effectiveness of communication, Berlo (1960) argues, one must accept the receiver as the most important link in the communication process. The context where the architectural drawing is conveyed to and where communication occurs becomes important. This is because the context relates directly to the audience's position within a social-cultural system and this needs to be of particular concern when the architect conveys the drawing to non-architects who occupy a different context.

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[10] See communication and society in Mead (1934) , see social thoery and its structure in Merton (1949), and see communication process in relation to social structure and interpretation of message in Mass Communication in Schramm (1960b).

[11] Chapter Four will address the difference between architects and non-architects when they see and intrepret architectural buildings.

According to the personal characteristics of both architects and non-architects, in summary, it can be concluded that:

a) The personal characteristic of the two parties should be considered when architectural drawings are employed and the context of drawings should be considered.

b) An appropriate drawing as message-vehicle should be carefully addressed to the relevant group of audience.

c) It is a very significant task for architects to allocate drawings to the right channel (as mentioned in Figure 3.6, seeing is the main channel; reading and listening may also be included) and to an appropriate context and contact.

d) In order to achieve comprehensive communication, architects (encoder) and non-architects (decoder) should ideally share the same set of codes or languages.

These issues are summarised in diagram 3.14.

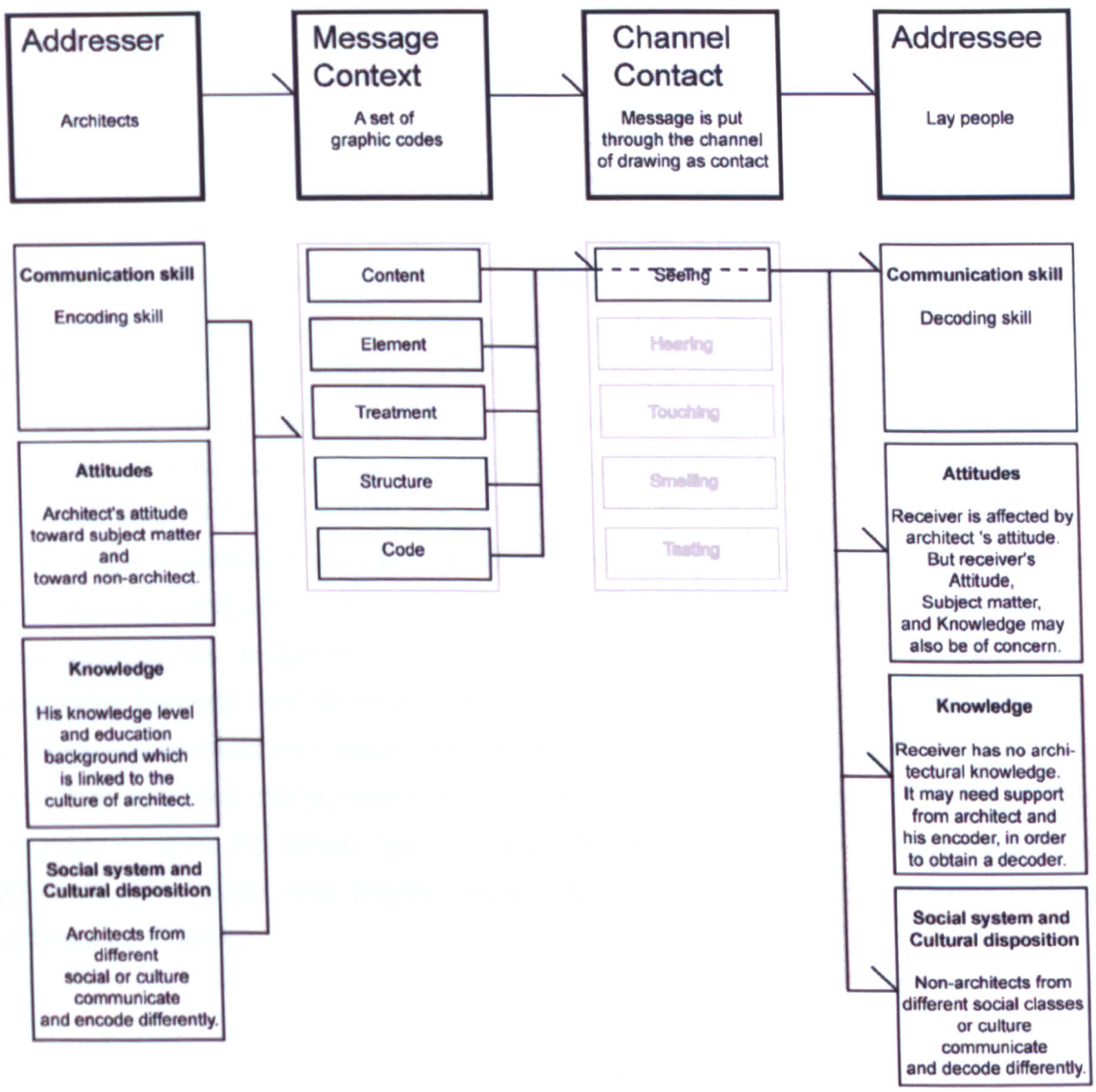

Figure 3.14: A diagram showing fidelity of the communication process in architectural drawing (Based on Berlo (1960)).

What can be seen from this diagram is that the overlooking of one factor may cause the failure of the whole communication process and widen the communicative gap between architects and their audience.

Moreover, what is important are the lessons that can be drawn from the concept of personal characteristics in terms of suggesting alternative approaches to architectural drawing. Architects' unawareness towards their audience becomes a crucial problem, which affects the success of their communication. The next chapter addresses this problem by looking at the different ways in which architects and lay people interpret and analyse architecture.

3.5 Conclusion

What this chapter has investigated is a series of questions about the kind of language that architects should use in order to communicate with a lay audience. It has suggested the use of a shared language based on an external code that comes from outside the architectural context.

Furthermore, not only is it suggested that it is important to uncover a shared language, external code, or alternative ways of drawing (which is the aim of this research), but architects' and non-architects' personal characteristics need to be understood in order for this to be achieved. It is unlikely that non-architects could, or indeed should, achieve the same level of decoding skill or the background knowledge of an architect. This means that architects should be much more aware of their drawings and their encoding methods; they can no longer assume what they have taken for granted, namely that non-architects will see and understand drawings in the same way as they do. Communication breakdown arises when architects forget that their drawing is drawn in the form of an abstraction and assumes that the experience of all users, of all their target audience, is the same. Architects and non-architects see drawings and the world differently; their personal background and experience lead them to different interpretations. This goes back to the suggestion that architects should concern themselves more with the relationship between their drawings and the relevant audience rather than the relationship of drawings and architectural culture. This chapter informs the empirical test carried out in chapter Six, which examines how architects and non-architects see and understand drawings. The test will begin to show the factors that lead them to see and understand architectural drawings differently. The results may provide clues to the development of an alternative method for architectural drawing.

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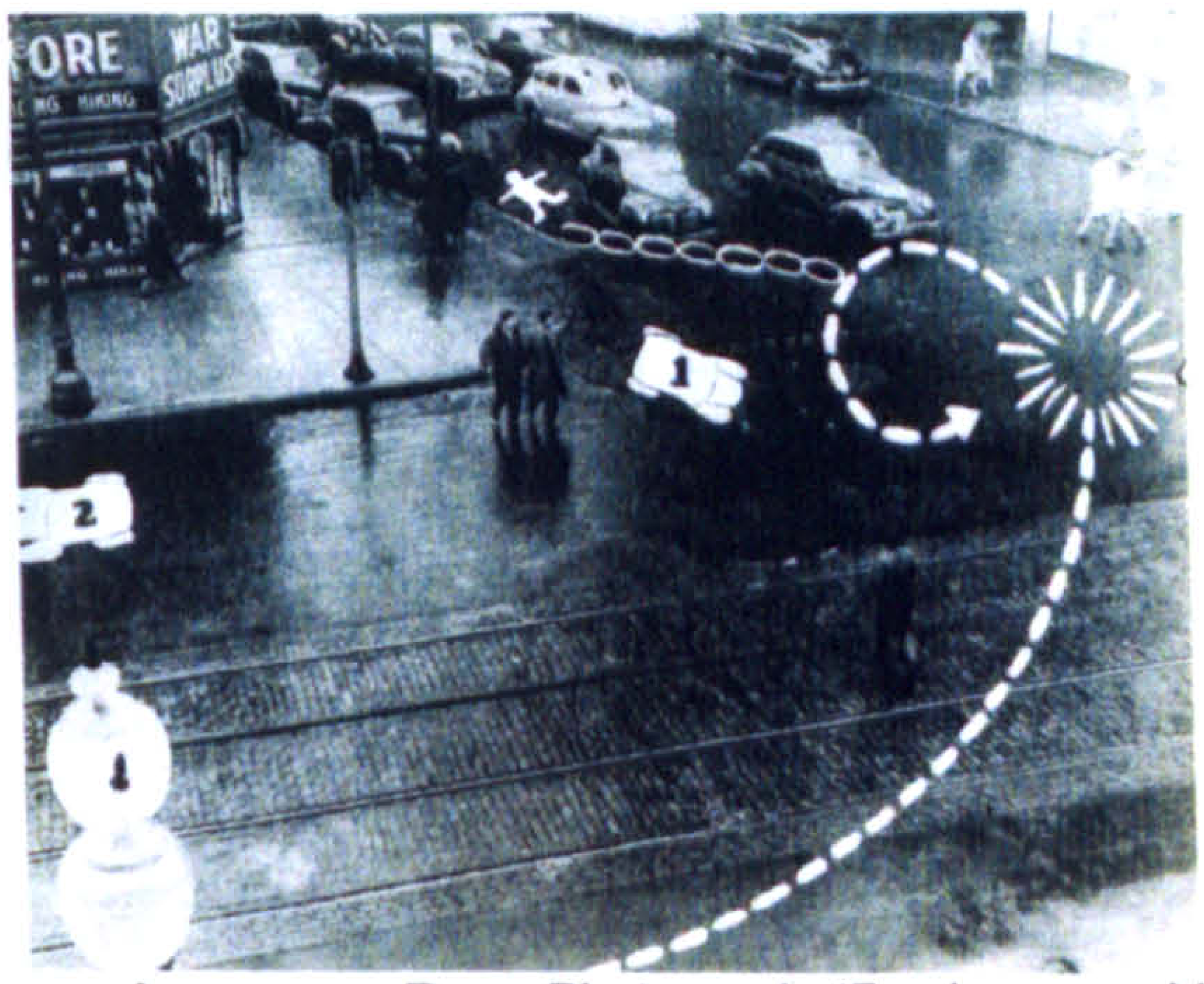
Chapter 4
See Drawings with Different Eyes



Anonymous Press Photograph: 'Freak car crash'
2 April, 1948, Minneapolis, MN.

'Architecture has often borrowed concepts from the visual arts, and in architecture too, the index has been linked to a narrative of process. But it may be important to point out that what Vitruvius's Philosopher saw on the beach were not footprints but geometrical figures; not indexs, strictly speaking, but abstracted tracing of idealized forms and coded sign' (Allen, 2000: 51).

Chapter Four | SEE DRAWINGS WITH DIFFERENT EYES

4.1 Introduction

This chapter examines the way in which architects and non-architects see and interpret an architectural drawing. The study is primarily based on research in environmental psychology, particularly on the set of values that architects and non-architects use to interpret the built environment. The differences in their systems of interpretation of architectural buildings are investigated.

It is hypothesised that the concepts and constructs by which architects and non-architects relate to buildings may also adapt and relate to architectural drawings. There are some issues that buildings and drawings may be related, particularly in term of perceptions and experience of its audience. Thus, with a study of the way in which buildings communicate to the public, and *vice versa,* it is hoped to provide an understanding of how an architectural drawing is perceived, interpreted, and finally understood by an audience. The interpretative system used by both architects and non-architects for the drawing is also examined. It is hypothesised that each group would use different systems of categorisation for interpreting an architectural drawing. Finally, this chapter will address the relevant factors that influence their ways of seeing and interpreting drawing differently.

4.2 Interpretation of Architecture

This section will look at the way that architects and non-architects interpret buildings differently (see Kaplan (1973), Groat and Canter (1979), Groat (1982), Hershberger (1988), Devlin (1990)). Beginning with Hershberger's (1988) research, he notes that there is a focus on the differences in environmental meaning between architectural and non-architectural students, particularly the difference in interpretation using representational meaning and those using responsive meaning. He explains that representational meaning is defined as taking the form of percepts, concepts, and ideas, whereas responsive meaning is affective, evaluative, and prescriptive. His research suggests that architects respond more to representational meaning, while non-architects respond more to responsive meaning; he attributes this to their different education and experience.

As Devlin (1990) notes that, when interpreting architecture, architects comment more on the idea and concept used to arrive at the physical forms. Categories of historical significance, design quality, anthropomorphism, and form and function are used exclusively by architects. On the other hand, non-architects give more affective and descriptive responses to the physical feature of the building. The comments made by non-architects often fit into the affective category preference. This is also similar to what Groat (1982) found in her research, which examined the difference in interpretative systems between architects and the lay public; she found that architects and non-architects have different constructs for evaluating or interpreting buildings.

A number of researchers suggest that architects and non-architects have different constructs for interpretation because they have different environmental preferences (see e.g. Groat (1982), Groat and Canter (1979), Hershberger (1988), Kaplan (1973)). The term preference in this context means an aesthetic judgment which is based on taste, personal choice, or individual subjective responses to the object. Kaplan (1973) explains, "One view of preference is as an indicator of aesthetic judgment. ...An alternative view of preference involves decision-making and choice. Perhaps a preference judgment reflects the complex calculations assumed to be involved in any process of choosing among alternatives" Kaplan (1988: 56). Architects and non-architects rely on preferences to construct an aesthetic judgement, particularly the first time they approach and see the building. It is an affective response, which is basically conditioned by their judgmental view of liking or disliking.

Furthermore, Bartlett (1967) suggests that not only is preference considered, but also the memory, which influences the way of seeing, and affects the way in which architects and non-architects interpret and respond to buildings. He notes:

Clearly we see the whole of a scene, but may only perceive parts of it; we then use other methods, all relying on memory in some way, to recreate the rest of the scene in 'our mind's eye' if later we need to recall it. So just how do we decide which elements of what we see we shall go on to perceive? Cited in Lawson (2001: 61)

Similarly Ward et al. (1988) suggested that people use their own past experiences to value architecture.[1] Each past experience differentiates people's interpretative system and affects their preference in terms of like-dislike, familiar-unfamiliar, or comfortable-uncomfortable. For example, people who have had experience of a place would have constructed a different set of preferences and interpretations from people who have not experienced that same place before. In addition, they suggest that personal past experience can be related to person-environment interactions, in particular as defined by the architectural plan. They note:

The way in which a plan is cognitively and affectively represented would presumably then influence how behaviour proceeds. Stored cognitive and affective representations of the place would also influence subsequent planning and (through expectations) subsequent behaviour in and responses to the place. Ward et al. (1988: 6)

As previously mentioned, Hershberger (1988) claims that the difference between architects and non-architects' system of evaluation and interpretation is due to their differences in education. According to this difference, non-architects generally see and interpret

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[1] Their research examines the role of plan in cognitive and affective responses to places. They note, "Plans influence the interactive between a person and a place by guiding what a person does, thinks, and feels in that place...plans can influence the way in which a place is experienced" Ward et al. (1988: 1).

architectural buildings not relying on architectural knowledge, but based on their judgmental view of whether they like or dislike. On the other hand, architects who have comprehensive knowledge of architecture evaluate and interpret architecture in terms of conceptual issues (see Devlin (1990)). They tend to see and interpret a building depending on their architectural knowledge and trained experience. When they approach a building, instead of seeing a building and then responding to it as to whether they like or dislike it, they instantly refer to their architectural knowledge and rules, and then criticise whether or not the building is properly designed or well-organised. They usually follow what architectural culture has prescribed in order to make this criticism or critical judgement. This can be related to Groat's (1982) finding that architects respond to what she terms 'aesthetic quality'. Architects discuss issues of form, style, historic significance, and design quality, while non-architects use preference as a dominant category.

Wilson (1996) suggests in her research, '*The Socialization of Architectural Reference*', that there were very significant differences between the set of values that architects and non-architects use when they look at buildings, and that there are significant clusters of sets of value that are established through architectural education. She claims that (cited in Lawson (2001: 5)) architects do indeed seem to use quite different evaluative systems to others. This tendency is mainly acquired during higher education with a strong correlation between the architectural preferences expressed by students within a school of architecture. She notes, "If architects truly have different standards of appreciation from non-architects, it is then most likely that these standards of judgement are acquired within the schools of architecture during the period of architectural education" Wilson (1996: 33). It can be surmised that architectural education manipulates and trains architectural students to develop their thoughts and construct a system of interpretation in a very particular way, and that this is determined by the value systems of the prevailing architectural culture. This is why architectural peers have a different construct for interpretation from the rest of the public. This particular way of interpretation leads them to associate with subjective and detached values, which are deemed as difficult to associate with from the public's point of view. As, Lawson (2001) notes:

> *Recent studies have shown empirically what many have thought intuitively. Architects as a group think about architecture in a distinctly different way to the rest of humanity. This is not surprising, since all professional groups begin to develop highly sensitised and specialised ways of both conceptualising and evaluating the work in their field. They develop jargon as shorthand for some of these concepts, and communicate in ways that make it difficult for outsiders to penetrate. Lawson (2001: 4-5)*

This can be related to, in Kaplan's (1973) terms, the 'function of the area of professional interest', which potentially affects the system of interpretation. She suggests that the differences in profession could differentiate the architectural preferences of the individual. For example, she uses a sample group of architectural students, landscape students, and non-design students, and then examines the differences between these three groups on their evaluations of environmental scenes (photographic slice). As a result, she concludes that architects have a preference for the person-built environment, whereas the non-design students have a preference for natural setting; the landscape architects fall somewhere between these two categories.

The difference in the system of interpretation between architects and non-architects can be related to the problem of communication between them. The study of previous researchers, therefore, suggests that the disparity and confusion between the two groups and their communication have emerged from the differences in their interpretative system, which occurs from the differences in primary aspects: preference, past experience, educational background, and knowledge. As Groat (1982) suggests in her research, which focused on the differences in interpretative schemes between architects and non-architects, that this difference of interpretation has usually been cited as a non-architects' misinterpretation of the architects' intended interpretation. But this may not be the case. The difference in architect and non-architect interpretations may be a result of different classification categories used by architects and non-architects for the interpretation of architecture.

By this, it may also be possible to apply this argument to the interpretation of drawings. If architects and non-architects have different values in interpretation of buildings, does this also affect how they perceive an architectural drawing, and in particular the role architectural drawing plays as a tool of communication? In addition are there any other factors, apart from the difference in interpretative systems, that cause a communication problem between architects and non-architects, such as the way architectural drawing is introduced or the way architects and non-architects approach the drawing?

4.3 Interpretation of Architectural Drawing

As previously mentioned, it is considered that the concepts and constructs of preference and interpretative systems by which architects and non-architects relate to architectural buildings may also relate to architectural drawings. As we shall see, clients generally see the drawing as an anticipation of the building. In an anticipation of the building, therefore, it is expected the clients will bring the same value system, preference to interpretation of the drawing, as they would in interpretation of building. This suggests that preference, past experience, educational background, or knowledge become important aspects that affect the way in which architects and non-architects value and interpret architectural drawings, as well as influencing their encoding and decoding skills.

If non-architects see and interpret architectural drawings by depending on their preference, which simultaneously relates to their past experience and background, their response and interpretation will be constructed by a judgemental view of like-dislike, feeling comfortable-uncomfortable, or familiar-unfamiliar with the drawings. This is particularly the case at their first sight. If non-architects have a spatial experience of place, then the first time that they see a drawing, they would relate the drawing to their memory or experience of place. A person would, Ward et al. (1988) note, remember more plan-relevant details of a place than plan-irrelevant details[2]. Moreover, non-architects would consider the drawn objects within the drawing, such as furniture, as recognisable objects that can be linked to their spatial experience of place or plan-relevant details of a place. Ward et al. (1988) note, "Aspects of a place relevant to the plan are psychologically salient, attention-getting, and memorable. A person's affective appraisal of the place will then vary depending on which aspects are noticed, as well as on the way in which that place will facilitate or hinder the plan" Ward et al. (1988).

For architects, architectural drawings generally record the permanent and measurable aspects of a building. Cuff (1979) notes that it helps to tell the story, which forms a structure for architects' experience of the place. A drawing should communicate the experience of that place because it is a means of understanding the place; standard drawings are not used pro forma, but to say something about the place. By this, it means architects may use their experience of the place to encode the drawing. But because of the difference in architects and non-architects' background and level of knowledge, they may see and respond to the drawing differently.

As we have seen that architects tend to respond more to representational meaning, while non-architects respond more to responsive meaning, in buildings. We would expect the same divide in architectural drawing, only here the divide leads to a breakdown in communication. Where architects will build up their representational system through drawing codes, the non-architect is left searching for clues to stimulate a responsive reaction. Where architects assume clarity in their codes because they belong to a shared representational system, non-architects, in their responsive reaction, will tend towards individual interpretations. For a discipline in which the drawing is the prime means of communication, this breakdown becomes crucial.

To a large extent the value system, and the associated methods of drawing, are established through architectural education, which introduces 'proper' ways of being an architect and 'proper' ways of creating conventional drawings. Robbins (1994) notes, "To assure that drawing remains the crucial and shared medium of architectural discourse; its use is kept at the centre of architectural education. This form of education makes the architect somewhat unique in our society" Robbins (1994: 29). This is why most architects see and interpret architectural drawings in a typical and distinctive way. They are, as Wilson (1996: 40) notes, 'taught what to like'. Her research shows how architectural students become assimilated into the social and technical customs and codes of the profession during the course of their education. They develop increasingly abstract and different concepts to organise knowledge, which affects the way in which they both interpret and produce drawings.

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[2] They note that their prediction is consistent with available evidence that people remember more about a place after intentional interaction with it than after incidental interaction (see Mainardi Peron et al. (1985), Salmaso et al. (1983)), or people remember more schema-related aspects of the place then non-schema-related aspects (see Brewer and Treyens (1981)). They also expect that people's affective appraisals of a place will vary when their plans direct attention toward different aspects of the place (see Left et al. (1974)).

Lawson (2001: 198-9) notes that architects' knowledge is formal and explicit. Architectural students, for example, read books, attend lectures, study existing designs, which all involve architectural theories. Their knowledge is consciously, some might almost say artificially, implanted into their minds. On the other hand, the architectural knowledge of non-architects is acquired through the experience of living their lives. It is unstructured and largely un-theorised. It is implicit, practical and predictive. The disparity in the construction of knowledge between the two groups suggests their difference in systems of perception and interpretation, which in turn affects the communication process within architectural drawings.

Cuff (1979) examines and reveals the way architects see and interpret architectural drawings. Her research is focused on how architectural instructors and students approach the drawing, particularly on how they characterise a good architectural drawing and their perceived interpretation of it. Through a comparison of instructors and students, she suggests that there are three key domains for evaluating a drawing: (1) aspects of the drawing, (2) aspects of the drawer, and (3) aspects of viewing. The comparisons across the diagram (Figure 4.1) reveal that the students' concept of a good drawing is more concrete, specific, and technique-oriented than the instructors' which embodies principles and generalisations from a wider knowledge of drawing and is specific on a different level of analysis. The student's comments focus on the drawing itself, in particular the physical entity, while the instructor evaluates the ideas underlying the drawing, the way they are expressed, the ordering principles, the sense of movement, and the engaging qualities.

Furthermore, the comments obtained from both instructors and architectural students show that both groups are dominated and controlled by their architectural culture. The visual appeal or appearance of the drawing becomes the major concern rather than its communicative potential. The focus of the discussion is on whether or not the drawing follows the rules or fits into the culture, but forgets and ignores its actual role of communication with an audience. In her research, Cuff only finds one comment from the students that mentioned the role of non-architects and how the drawing might appear to them. Cuff notes that the goal of the instructors is generally to teach a student how to make a drawing, while the goal of the student is to create a good drawing. But the term 'good' drawing for them does not mean a drawing that is able to communicate to non-architects or the public at large, but a drawing that fits and follows the codes of architectural culture. (See Figure 4.1)

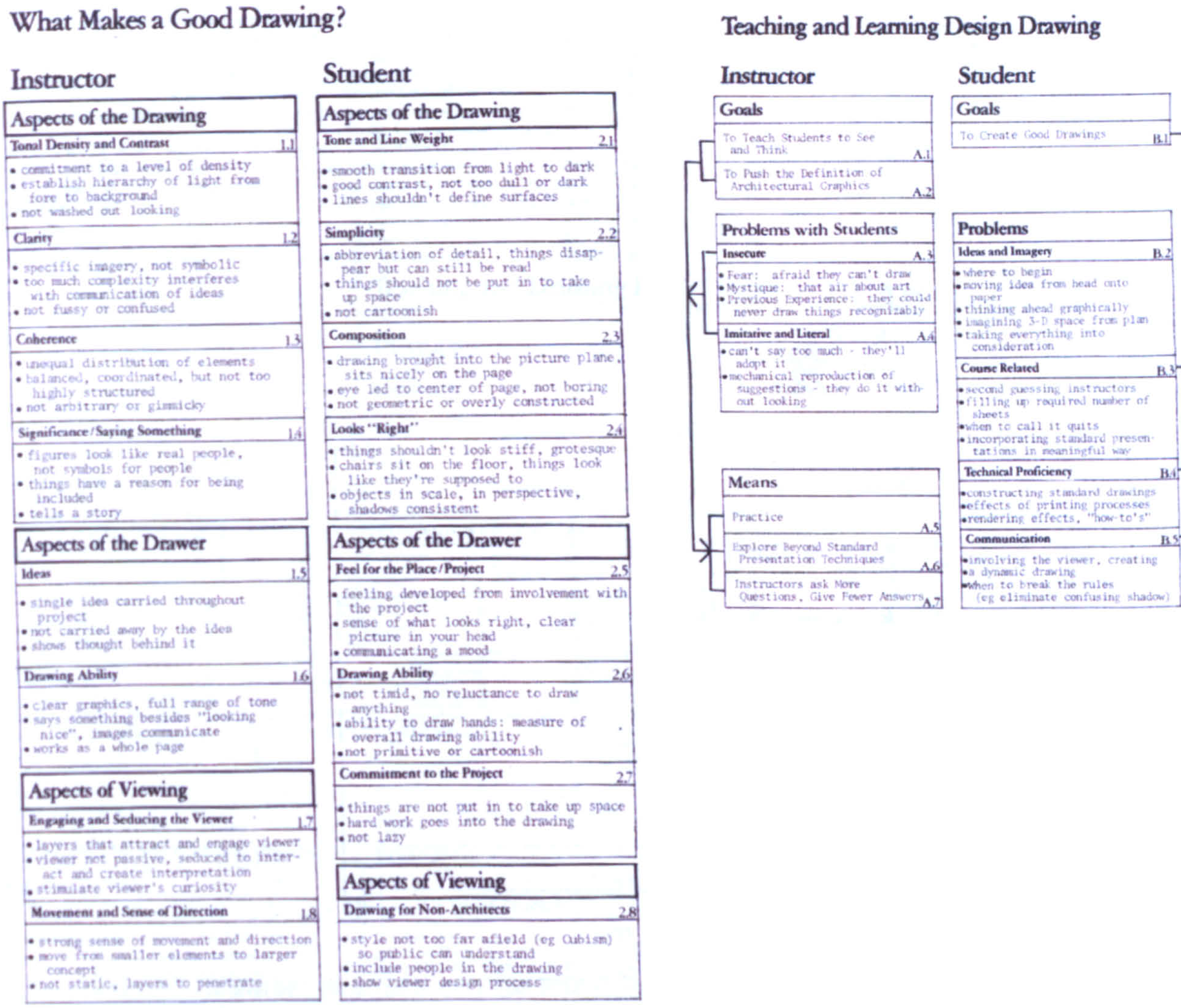

Figure 4.1: Instructors and students' responses. Cuff (1979: 6)

Cuff's diagram reveals a basic idea of the way in which architects have been taught and trained during their period of education. Moreover, it shows the differences in knowledge level amongst the architectural peers themselves.

The way architectural students are educated and taught to assimilate into the orthodoxies of architectural culture can also be found from the following diagram (Figure 4.2). This diagram, which is copied from a standard textbook for first year architectural students (Ching (1976)), shows how to draw a plan step by step. The sequence of drawings shows the students how to draw a 'proper' plan by following the rules that have been developed and prescribed in architectural culture. The emphasis in Ching's drawings is on learning standard systems and codes; and not on their communicative potential for a wider audience.

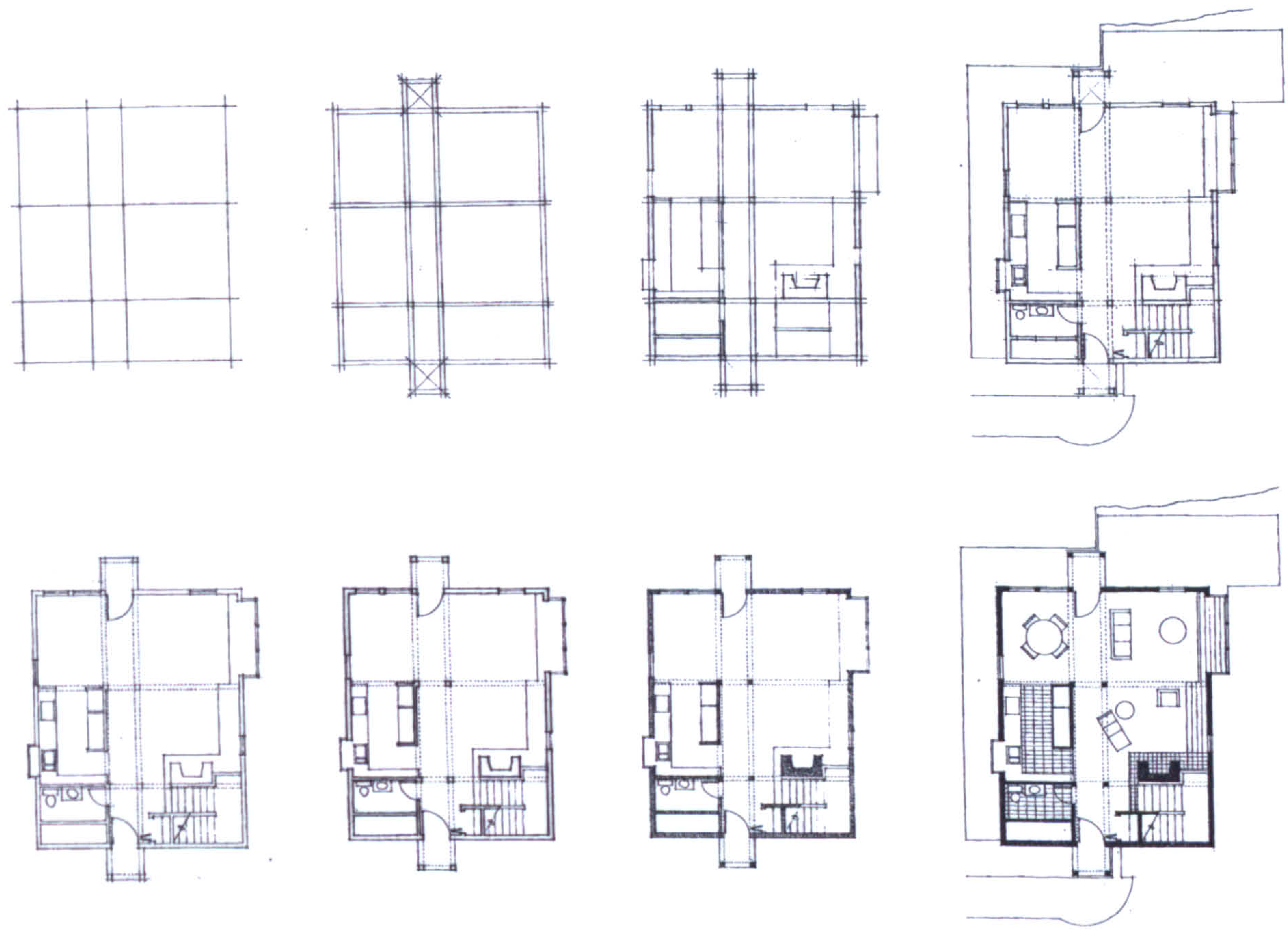

Figure 4.2: This series of drawings illustrates the sequence in which a plan drawing is executed. Ching (1976: 20-23)

Another apparent example can be found in '*RIBA Architect's Handbook of Practice Management*' (see Cox and Hamilton (1998)), which explains what architects should know and be aware of, as well as the implications and crucial elements for them to consider. The book includes chapters such as professionalism in architecture, self and statutory regulation, legal consideration, and business management. It even teaches architects how to apply effective communication in architecture. By this, it shows how the architectural profession and culture dominate and manipulate one to become a 'professional architect'.

Architects are more aware of their profession than their audiences. Instead of producing accessible drawing for their audience or the public at large, they prefer to draw for the critical acclaim of their peers. As Hill (2001) notes, "To acquire social status and financial security architects need a defined area of knowledge, with precise contexts and limits, in which they can prove expertise" Hill (2001: 2). Hence, this simultaneously influences the students to believe that making an architectural drawing depends on skill and knowing the rules. They believe that, as Cuff (1979) notes, if they can make a drawing 'like architects are supposed to' they can begin to see themselves as part of the culture. Moreover, Cuff's research clearly shows the differences between the drawer's priorities with the drawing and the expectation of the viewer; the drawer wants a drawing to fit into their culture and follow all the rules, but the viewer expects a drawing to provide them a comprehensible message. This is therefore where the communication breakdown in architectural drawing begins.

Consequently, the way in which architects and non-architects respond to an architectural drawing should also be examined. It is hoped that by uncovering the characteristics of the two systems of interpretation, one can begin to see a development in communicative potential of architectural drawing in a manner more suited to the demands and values of the lay audience.

Lawson (2001) explains how three-dimensional objects and spaces such as buildings can carry external reference or meaning. He notes that our perceptual system allows for both what we might call 'iconic' and 'symbolic' representations and that we seem to handle these rather differently. Iconic representations record some visual features or characteristics of a building, which are coded based on other well-known geometrical or visual elements. Such representations carry some of the characteristics of the real object, but not all. On the other hand, symbolic representations convey meaning quite precisely, but have themselves no qualities of the object at all. It is a pure symbol.[3]

By this, an architectural drawing may carry meaning in a similar manner. Previous research suggests that architects communicate primarily through symbolic representations, in contrast to non-architects who often give more iconic responses (see Lawson (2001), Bartlett (1967)). In the context of architectural drawing, architects' symbolic responses may represent or typify the building. It can denote, exemplify, and offer mediated reference (see Goodman and Elgin (1988)), that is not intrinsic to the building. While non-architects' iconic responses are formalised, while recalling the basic geometrical properties of the major features of the building. It may carry some characteristics of the building. That is why when architects and non-architects first approach architectural drawings, architects usually give symbolic descriptions, while non-architects prefer to give iconic descriptions. Moreover, architects solve and respond to both experimental and applied problems differently from non-architects (see Lawson (1980), Edward (1974), Hershberger (1988), Groat and Canter (1979), Rapoport (1982)). Architects see a drawing as a complete piece of information and try to capture everything together; they do not actually analyse a drawing, but in fact they are recognising it as a set of known symbols. Architects see and interpret a drawing by relying on their knowledge and experience, and respond accordingly by giving a symbolic description. They know the rules of the drawing and realise which rule they should or should not follow. Thus, when they see a plan, they would not question or analyse it, but accept it as the rules that have already been prescribed[4].

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[3] Lawson (2001: 84) also explains the term iconic and symbolic representations by giving an example of when we see a cat. He explains that there are three significantly different ways of representing a very familiar object: first, the photographic image of the cat seems to replicate the retinal experience of seeing the real thing. Second, the drawing gives a formalised, almost cartoon-like representation, which reminds us of the basic geometrical properties of the major features, and we can think of this as 'iconic'. Finally, the word has no intrinsic relationship to the real thing at all save that the English-speaking people have agreed that it stands for it (a cat) that we might call it 'symbolic'.

[4] See Wilson (1996). Her research explains how architects' standards of judgement are acquired within the schools of architecture during the period of their architectural education. It suggests a process of socialisation within the schools of architecture whereby students develop standards of judgement that are both characteristic of the profession as a whole and shaped by the specific school training.

On the other hand, non-architects do not have the same level of knowledge of architectural rules or the equivalent architectural experience. These disadvantages make an architectural drawing more complex, problematic, and difficult for them to understand. Their response is hence typically iconic, based on their personal experiences and preferences, which usually draw on physical aspects and depictions of real objects. This is supported by Groat's (1982) observations that non-architects' interpretation of buildings typically refer to previous experience and other building types.

This suggests that in order for architectural drawings to be clearer in their communication to non-architects, the architect as encoder must take into account the decoding preferences and mechanisms of the lay audience. This is very different from Hershberger's (1988) argument in which he notes:

> *If architects hope to utilize their medium (architectural drawings) to communicate intentions to laymen, they must (1) reorient the architectural education such that it does not change architects' way of experiencing architecture from that which they had as pre-architects, (2) reorient the architectural education such that architects are taught how forms, spaces, and the like are interpreted by laymen, as well as by architects, so that they can consciously manipulate them in such a way as to successfully communicate with both groups, (3) make greater effort to educate the general public to see and appreciate architecture in the same way as architects. It is felt that the first alternative is neither desirable nor possible without abandoning the architectural education almost in its entirety. A combination of the second and third alternatives would seem appropriate, along with greater efforts to teach architects to empathize with what is important to themselves, their instructors, their peers, or those who select their buildings for publication. Hershberger (1988: 192)*

Hershberger's idealised suggestion that non-architects should be educated in the ways of architectural drawing, and by association taught the established principles of the profession is hardly practical. As we shall see, this research argues that Hershberger's suggestion that lay people should be assimilated to the values of architectural education and the profession, rather than vice-versa is unacceptable. Not only does Hershberger argues that architectural education in some way contains values and procedures that are too precious to meddle with, but as the later chapters indicate, educating lay people in the internalised methods of the profession is not the best way to achieve fidelity in communication.

4.4 Conclusion

This chapter contends that the disparity between architects and non-architects arises from differences in experience and, most significantly - education - and that it is in education that there in lies a possible way forward. It has been argued that if non-architects understand drawings differently from architects it may not be because of the misinterpretation but because they differ in the system and values of interpretation.

In fact the best way to acquire the fidelity of communication is to make architects understand the particular way in which non-architects can simply understand drawings and in so to tweak the way that architects encode and convey information through the drawing. It is thus of considerable importance for architects to target their drawing to the right channel and relevant audience. This has the added advantage that in addressing the particular concerns of the audience through their drawings, architects will necessarily adjust to a broader range of potential users and behaviours in the drawn building and not make the common assumption that most people are similar to them. It may therefore be suggested that a drawing that communicates better to the lay audience will also help in the production of architecture that is more accessible and inclusive for the lay audience[5] – addressing their concerns and perceptions as opposed to those of the profession. The opposite is equally true; the drawing designed for an internal audience of architects, using codes that can only communicate to those in the know, will at the same time suggest an architecture that is concerned more with the internalised values of the profession.

The examination of the differences in the constructs of interpretation between architects and non-architects lead to the construction of the empirical test in the next two chapters, which examine the way architects and non-architects see and read architectural drawings. It is hoped to show in a measured way the differences that appear when architects and non-architects see an architectural drawing. It will also aim to show that these differences in interpretation cannot be dismissed when considering people's interaction to both building and drawing. The main aim of the empirical test is to provide clues for developing an approach to architectural drawing with better communicative potential than that of the orthodox approach.

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[5] One problem in architecture is that there is no common or shared language. This research therefore suggests the way of shared language in communication which potentially leads to inclusive architecture and through that it could also achieve more shared and inclusive debate about architecture.

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Chapter 5
Methodology and The Empirical Test

'Badegory'
'Allegories of the Good and the Bad Architect' from Phillibert De l' Orme's Premier Tome de l' Architecture (1567)

'The bad architect in all his splendour hurrying through a wasteland: no eyes, no eyes, no hands, across dead skulls lying around arbitrarily. Empty, senseless interiors – projection screnes. Architecture, buildings signalling violence and oppression. Laissez-faire! The elements are in rebellion, apocalypse in the air. Yet the bad architect is always in a hurry to sell his inability to the next sponsor' (cited in Teut, 1981: 12).

Chapter Five | METHODOLOGY AND THE EMPIRICAL TEST

Draw the Line Questionnaire 1

5.1 Introduction

This chapter presents the methodology of the first empirical test of this research. The test was devised in order to develop the hypothesis that architects and non-architects interpret drawings in different ways; it consists of showing the two groups the same set of drawings and asking them to evaluate and interpret them. This chapter outlines how the test was designed and the rationale for the methodology employed. The chapter is divided into five sections:

5.2 Research methodology overview
5.3 Objective and hypothesis
5.4 Methodology and the empirical test
5.5 The final questionnaire
5.6 Limitations

In order to provide a broader sense of the methodology used within this research, the definition of research methodology in general is initially explained. Secondly, the framework of research, its main objectives, and hypotheses are indicated. The fourth section discusses the methodology used to develop the empirical test and the process of data collection. Finally, the techniques adopted in data processing and the processes of analysis are highlighted, and the limitations whilst conducting the empirical test are revealed.

5.2 Research Methodology Overview

In general, research can be defined in different ways. Linn and Erickson (1986) define research as a systematic and careful inquiry or examination to discover new information or relationships, and to expand or verify existing knowledge for some specific purpose. Thompson (1995) describes research in *the Concise Oxford Dictionary* as:

a) The systematic investigation into and study of materials, sources, etc., in order to establish facts and reach new conclusions,

b) An endeavour to discover new or collate old facts etc. by the scientific study of a subject or by course of critical investigation. Thompson (1995: 1169-70)

Researchers normally distinguish research by identifying two broad methodologies that are used for collecting data: the quantitative and the qualitative method (see e.g. Bryman (2001), Bryman (1996), Linn and Erickson (1986), Moser and Kalton (1971), Diamantopoulos and Schlegelmilch (1997)). The quantitative method is based around measurement. It can be construed as a research strategy that emphasises quantification in the collection and analysis of data (see Bryman (2001)). This method becomes useful when the goal of the study is to represent some phenomenon numerically. In addition, its results are usually expressed in statistical form.

On the other hand, Mayhew (1997) notes, the qualitative method is concerned with meaning. It is involved with an individual's point of view on various subjects and with his or her attitudes, opinions, motivations and behaviours; the collection and subsequent analysis of a number of individual's views is basis for this kind of research. Bryman (2001) defines the qualitative method as an array of interpretative techniques which seek to describe, decode, translate and otherwise come to terms with the meaning, not the frequency, of certain phenomena in the social world. Furthermore, Cuba and Cocking (1997) note that, "qualitative method is best suited to answering questions about social organisation and processes. The researcher may, however, report numerical findings to support the argument, but they are chiefly concerned with illustrating the richness and expressiveness of social interaction as it occurs within specific context" Cuba and Cocking (1997: 93).

Linn and Erickson (1986) note, "Quantitative methods are generally associated with systematic measurement, experimental and quasi-experimental methods, statistical analysis, and mathematical models. Qualitative methods, on the other hand, are associated with naturalistic observation, case studies, ethnography, and narrative reports" Linn and Erickson (1986: 1). Bryman (2001) draws some common contrasts between them (See Table 5.1). He claims that quantitative research can be constructed as a research strategy that emphasises quantification in the collection and analysis of data, while qualitative research can be constructed as a research strategy that usually emphasise words rather then quantification in the collection and analysis of data[1].

Table 5.1: Some common contrasts between quantitative and qualitative research. Bryman (2001: 285)

Quantitative	***Qualitative***
Numbers	Words
Point of view of researcher	Point of view of participants
Researcher distant	Researcher close
Theory testing	Theory emergent
Static	Process
Structured	Unstructured
Generalization	Contextual understanding
Hard, reliable data	Rich, deep data
Macro	Micro
Behaviour	Meaning
Artificial settings	Natural settings

[1] Read more about contrast between quantitative and qualitative research in Bryman (2001: 284-5).

Moreover, he notes:

Quantitative researchers demand that data should be objective, non-reactive, representative, and should be collected using standard measures. They reject qualitative research as subjective, unrepresentative, unsystematic, and inconclusive. Qualitative researchers might counter that an individual's behaviour can only be understood if that individual's perspective is known and understood in context, and that quantitative research is artificially shallow and misleading scientifically Bryman (1996).

Moser and Kalton (1971) also summarise the differences between qualitative and quantitative methods, which is presented in Table 5.2.

Table 5.2: Differences between qualitative and quantitative method.

	Qualitative	**Quantitative**
Sample size	Small, typically less 100	Large, hundred or thousand
Questioning	Follows the respondent's reactions to set stimuli within a general framework	Follows a set format and is the same for each respondent
Objective	An expansion of existing data	A refinement of existing data
Analysis	Contents	Statistical
Report	Written for the purpose of understanding the attitude and behaviour of respondents	Based on statistical summaries and correlation

It is important to note that, in some cases, qualitative research can be referred to quantitative research and *vice versa* (see Bryman (2001), Bryman (1996), Linn and Erickson (1986)). However, this depends on appropriate circumstances and such a combination needs to be cautiously made. The qualitative findings are generally used to give further credibility and context to the quantitative findings; qualitative data also helps to pose questions that can be addressed quantitatively. As Bryman (2001) notes, the nature of quantitative research can be illuminated by being approached from the vantage point of qualitative research. Equally, the data in quantitative research can also be used to assure the findings in qualitative research and to be able to be examined in much greater depth in the research Bryman (2001: 440). According to Bryman (2001), quantitative research can be employed in the analysis of qualitative studies, while a qualitative research approach can be used to examine the rhetoric of quantitative researchers. As Denzin (1970) notes, "The rationale for this strategy is that the flaws of one method are often the strengths of another, and by combining methods, observers can achieve the best of each, while overcoming their unique deficiencies"[2] Denzin (1970: 308). The combination of these two methods may complement and overcome the weakness of using one method only. Moreover, since both methods have often different biases and disadvantages, each can be used to support each other.

[2] See more in 'Methodological Triangulation' section in Denzin (1970: 307-8).

Because this research addresses both issues of interpretation that are, arguably, socially-based, a qualitative approach is seen as appropriate. At the same time, in order to give statistical rigour to the results, a quantitative approach is also seen as appropriate. Thus, the mutual analysis of quantitative and qualitative research is seen best to address the initial approach of this research and the formation of the empirical test. This combination allows the research and the empirical test not only to be quantified but also to be analysed qualitatively in order to best examine the data obtained from the respondents and their interpretative system. From the empirical test, it is hoped to reveal through qualitative analysis the respondents' experience and how they respond to the drawing they see, whereas the quantitative findings provide statistical analysis that can support the qualitative data.

5.3 Objective and Hypothesis: The Empirical Test

The problem of communication between architects and non-architects has been explained in the preceding chapters through the study of historical transitions and communication theories. These primarily suggested that the type and style of drawing influence the way architects communicate with non-architects. Moreover, the question arises whether two parties share similar or different perception and interpretative systems when they experience the drawing. The empirical test is devised to test these arguments in order to clarify the communicative system in an architectural drawing.

It was decided that the most straightforward and effective way to explore and test these issues was through a questionnaire which included a number of different approaches to the same drawing, namely a plan. The test aimed to concentrate on the communicative potential of an architectural drawing, and to examine whether non-architects are able to read and understand a conventional architectural drawing. Moreover, it was hoped to clarify the potential factors that create difficulties or perceived problems in the way in which architects and non-architects see and interpret drawings. Finally, it was anticipated that the results of the first empirical test would suggest methods of developing an alternative method of drawing with better communicative potential.

The primary objectives of the empirical test are:

1. to examine whether there is a communicative gap between architects and lay people, in terms of reading and understanding an architectural drawing.
2. to identify key issues that lead architects and lay people to interpret architectural drawings differently, and problems that create difficulties in understanding the drawing.
3. to inform the development of an alternative method which could improve the way that lay people, or even architects, read and understand architectural drawings.

These objectives are translated into three experimental hypotheses:

1. There is a communication problem between architects and lay people when using architectural drawings as a means of communication.

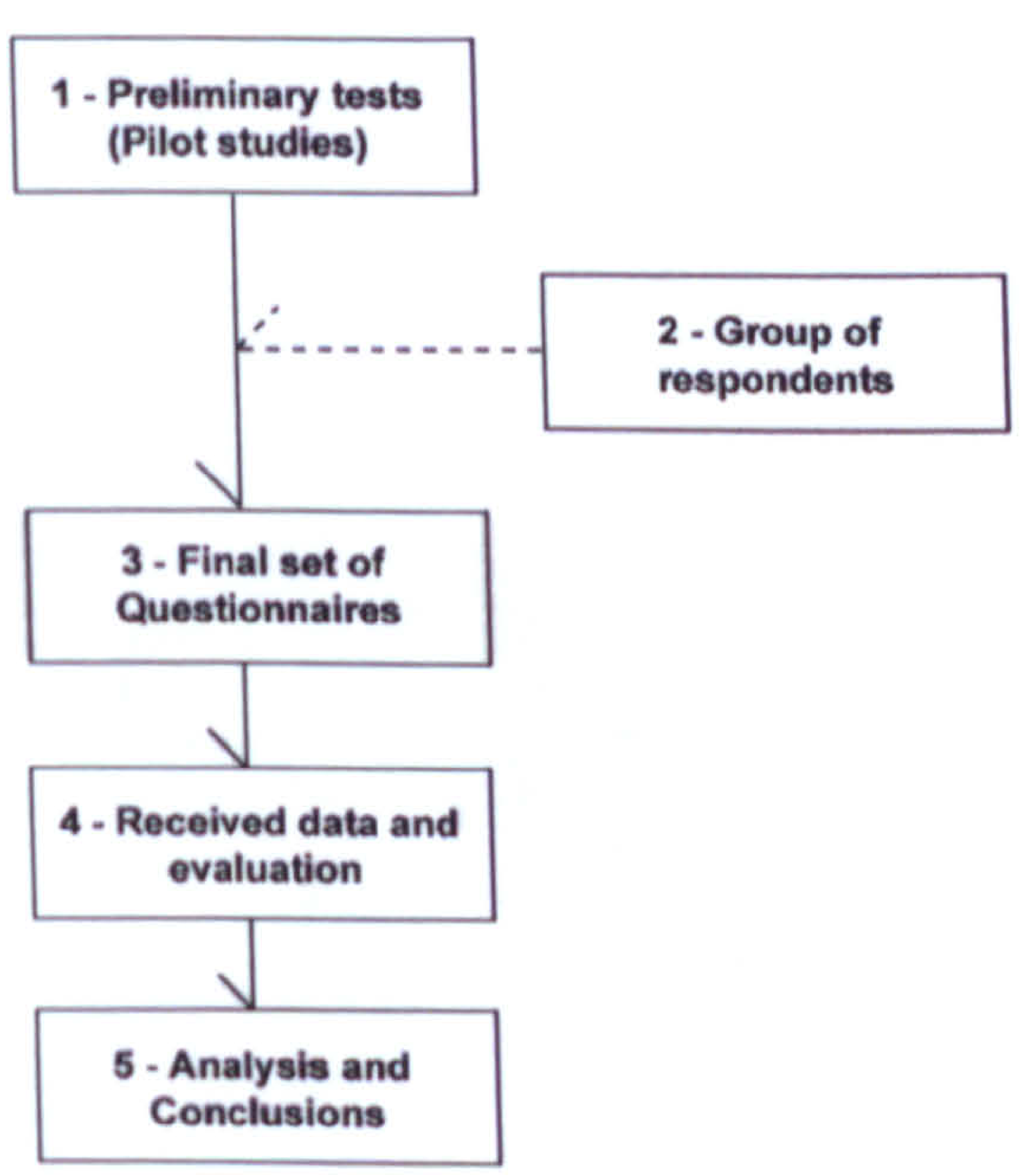
2. Architects and lay people see and interpret architectural drawings differently. The difference could be attributed to the professional education of an architect and the difference in background of each individual, which influences their interpretative system.
3. The less technical drawing could provide more communicative potential than a conventional architectural drawing.

5.4 Methodology: The First Empirical Test

The framework of methodology for the first empirical test is organised into three major stages. The first stage derives from the perceived problem of communication raised in the previous chapters of literature reviews, as well as from previously stated objectives and hypotheses. Therefore, the definition of respondents and the fundamental structure of the first empirical test are considered important and explained at this stage.

The second stage reviews two pilot studies, which were conducted as a preliminary test regarding the perceived problem of communication. The aim of both pilot studies is to explore basic responses and to obtain first–hand data concerning the issue of difficulty in seeing and reading an architectural drawing. The results and findings are analysed and consequently used in developing the final questionnaire. Finally, the third stage is aimed at refining the research instrument that is used in the process of data collection. The instrument, which is eventually decided to be in the form of a questionnaire, is used as an experiment to obtain data about the perceived problems of communication. Both quantitative and qualitative methods are simultaneously employed by using statistical analysis and evaluative system respectively.

According to research questions stated in Chapter One and the chosen research methodologies, the structure of the empirical test can be summarised as follows:



1) Pilot studies were carried out in order to achieve first-hand data. Lay people were selected as respondents. The responses obtained from the pilot studies were used to develop questions and drawings towards the final set of questionnaires.

2) The groups of respondent are identified as described below.

3) The use of questionnaire was selected as research instrument. The final set of questionnaires, which based on quantitative and qualitative methods, was used and delivered to respondents by using an on-line questionnaire.

4) The data were received and evaluated. The quantitative data were statistically compared between architects and lay people, while the qualitative data was evaluated and clarified.

5) The analysis and conclusions drawn from the first empirical test, consequently informed the second empirical test.

Figure 5.1: Structure of the first empirical test

The following sections explain pilot studies conducted to help design the research instrument, the selection of the respondent groups, research structure, and details of the research instrument. The results obtained and their analyses are discussed in Chapter Six.

5.4.1 The Pilot Studies

It was decided to conduct two pilot studies in order to quickly test the basic hypotheses before proceeding to the main empirical study. Whilst the sample size was small, the method of selection of respondents was not systematic, and it was hoped that the pilot studies would improve later tests by addressing some broad points. The pilot studies do not presume to give substantive results that may inform the final thesis, but are used as tools to refine the research instrument.

5.4.1.1 The First Pilot Study

As previously mentioned, the first pilot study was primarily conducted in order to gather first-hand data and to examine instant responses from lay people towards architectural drawings; the study was not designed to give substantive quantifiable results. It was hoped to basically observe whether lay people can read and understand conventional architectural drawings and how they react to the drawing at first glance. The results obtained are used to inform and develop the second pilot study, which are then fed into the final form of questionnaire.

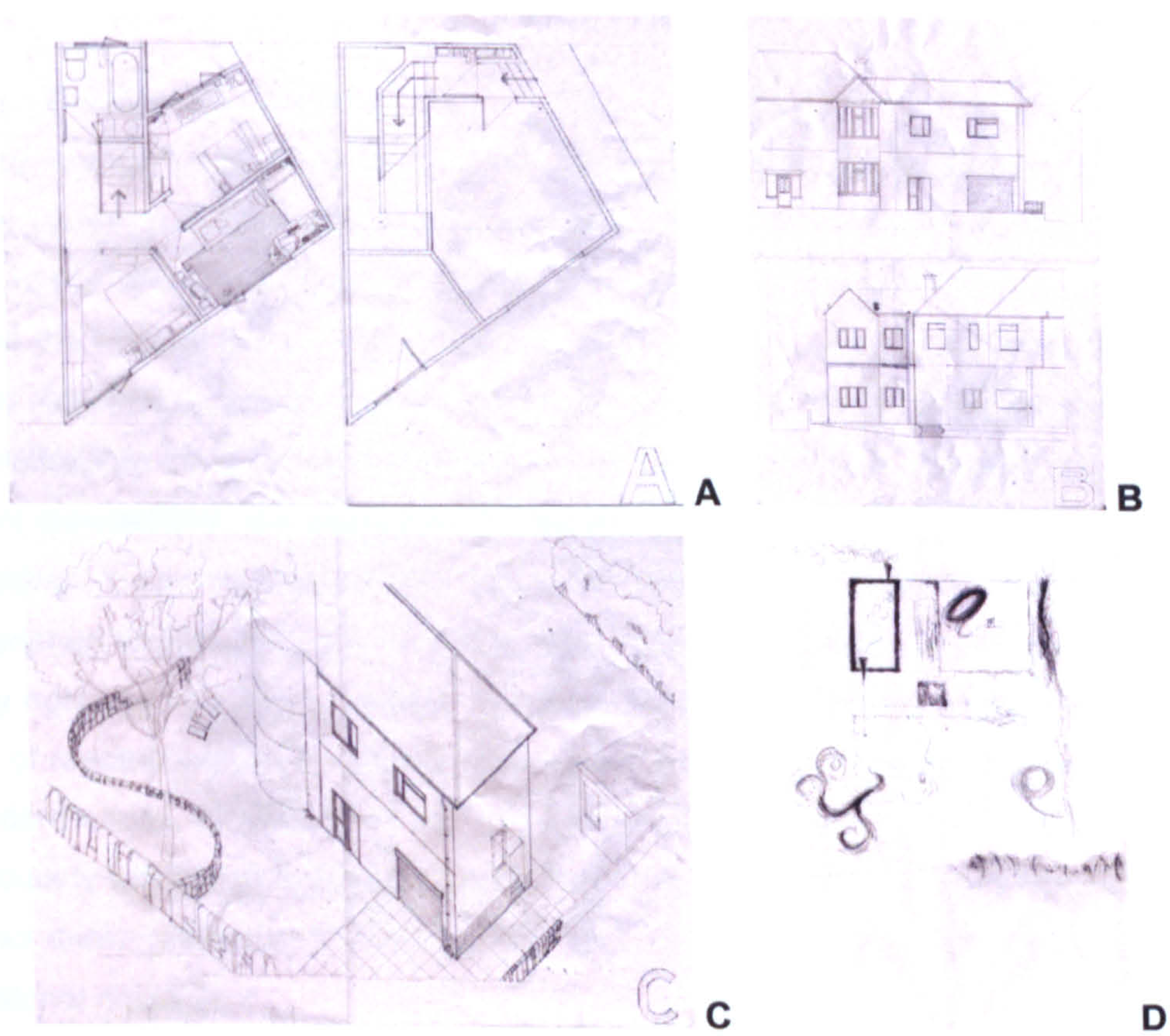


Figure 5.2: Four drawings which were used within the first pilot study – A: Ground and first floor plans, B: East and West elevations, C: Isometric drawing, and D: Abstract drawing which represented the floor plan.

The drawings used in the first pilot study represent the author's flat in Sheffield, and are drawn by the author. They comprise three conventional architectural drawings: Plan, Elevation, and Isometric drawing, and one additional drawing that represents a conceptual idea: a so-called 'Abstract' drawing. These four drawings are drawn to scale and presented on A2-size paper. The drawings were shown to respondents with four questions asked against each drawing (see Appendix A):

Question 1: Which is the main entrance of the flat?
Question 2: If you enter the main entrance door, which area are you in?
Question 3: Which is the living room's window?
Question 4: If you look out from the living room's window, what do you see?

The questions generally aim to examine whether lay people are able to relate to, and locate themselves within, the drawings. Moreover, they are asked to give a reason for their answer. At the end of the study, lay people were also asked to rank the drawings according to their preference, which is identified in terms of ease of understanding:

Question 5: Which drawings are the easiest and the hardest to understand?
Question 6: Which drawing has the most information for you?
Question 7: If I told you that all drawings are of the same space, what is your reaction?

a) Results: The first pilot study

The first pilot study showed that Plan and Isometric drawing (A and C) seemed to be the easiest drawings for lay people to understand, whilst Abstract drawing (D), as expected, turned out to be the hardest. However, there were some respondents who seemed to be able to understand the relation between plan and elevation. This suggests that some of them had the potential to read and understand the basic role and configuration of the drawings, as well as the spatial relationship of architectural objects. On the other hand, interestingly enough, one respondent claimed that '*It is quite hard to believe that these four drawings are drawn from the same building*'. It can be noticed from the verbal responses that lay people tend to use their past experience to recognise the drawings and identify their spatial organisation. At the same time, they note the difficulty in reading these drawings. The problem was found particularly in the issue of reading architectural codes. The test revealed that most lay people are not familiar with standard codes, for example they cannot recognise or identify where doors and windows are, particularly within a plan drawing. Moreover, they found difficulty in reading and interpreting an abstract drawing because it is drawn and coded in a completely different format from that of a conventional drawing.

Thus, the responses from the first pilot study are fed into the next stage; the received feedback can be learnt and is used to develop the questions and drawings in the second pilot study. It can be summarised as follows:

- Since non-architects showed difficulty in reading and understanding codes, the questions in the next pilot study should focus more on how codes are read, decoded, and understood by non-architects.
- The drawings used in the questionnaire should be arranged more systematically and less abstract. Modes of drawing and its mediums of representation should be clearly categorised. This is hoped to provide consistency for drawings and questions used in the second pilot study.
- The test should not only aim to focus on how non-architects react to the drawing at first glance, but also to examine non-architects' feedback regarding the relationship between drawing and building, such as its appearance and spatial organisation.

5.4.1.2 The Second Pilot Study

The second pilot study also aimed to examine whether lay people can read and understand conventional architectural drawings, but develops the questions and drawings used in the first pilot study. In particular the study aimed to explore the uses of architectural codes or symbols, and the difficulties that lay people may have in interpreting them.

Drawings are shown to 30 students from a non-architectural department at the University of Sheffield. Three different modes of conventional drawings are used: Plan, Section, and Perspective. Moreover, each mode of representation is sub-divided into four different mediums of representation (See Figure 5.3):

1. Coded (coded language, hard-line drawing, use of key),
2. Pictorial drawing (pictorial language, applied text),
3. Sketch (hand-drawing, 'friendly' way of representation),
4. Three-dimensional (in the case of the perspective drawing this was taken as photo-realistic).

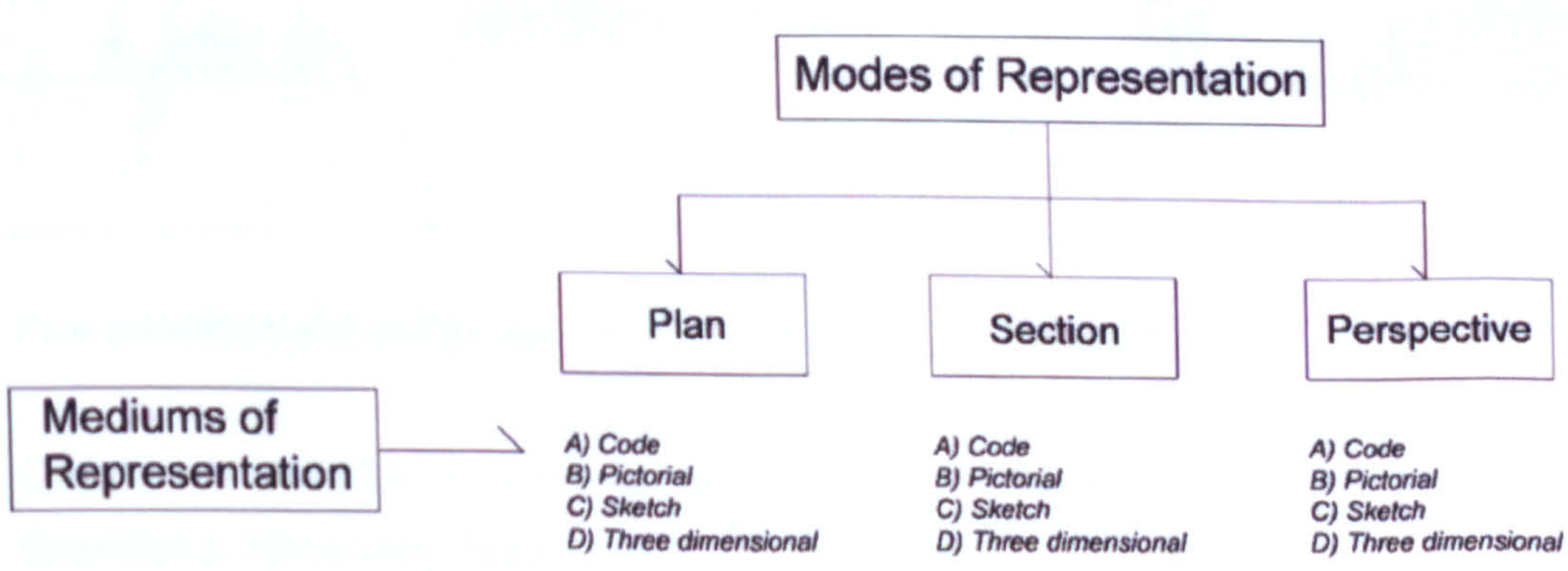
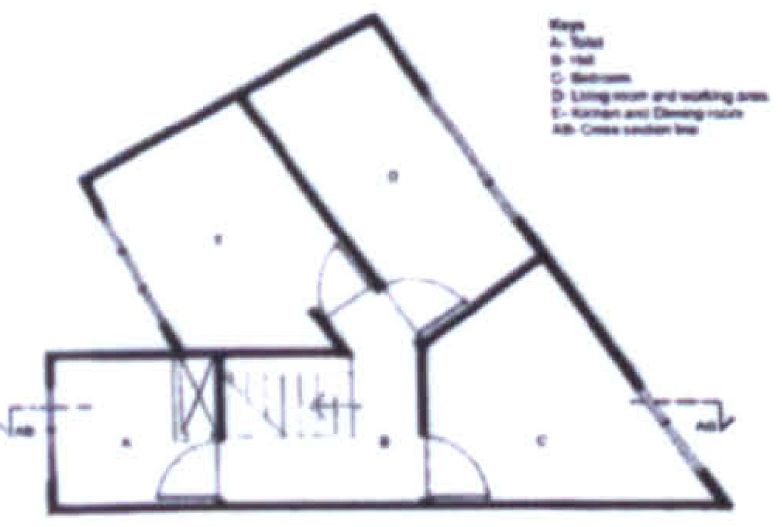
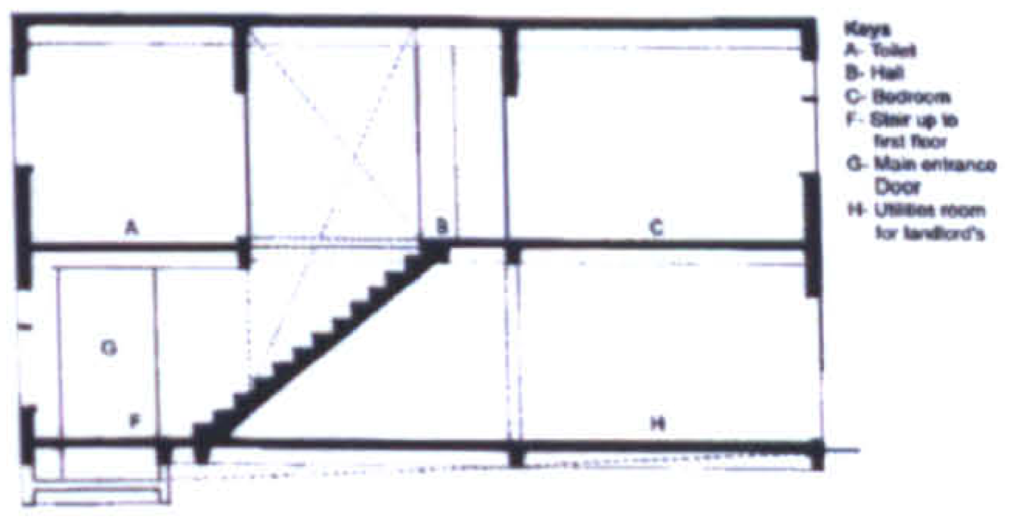
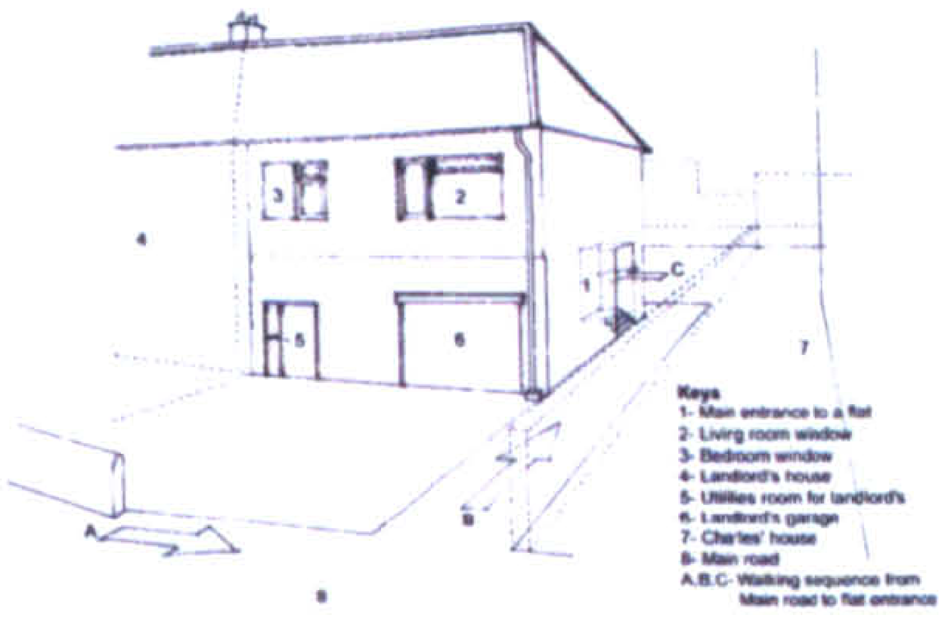
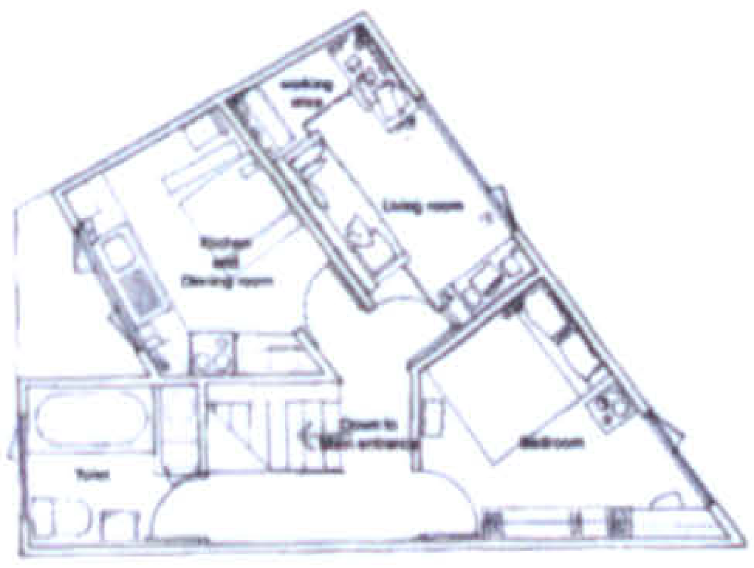
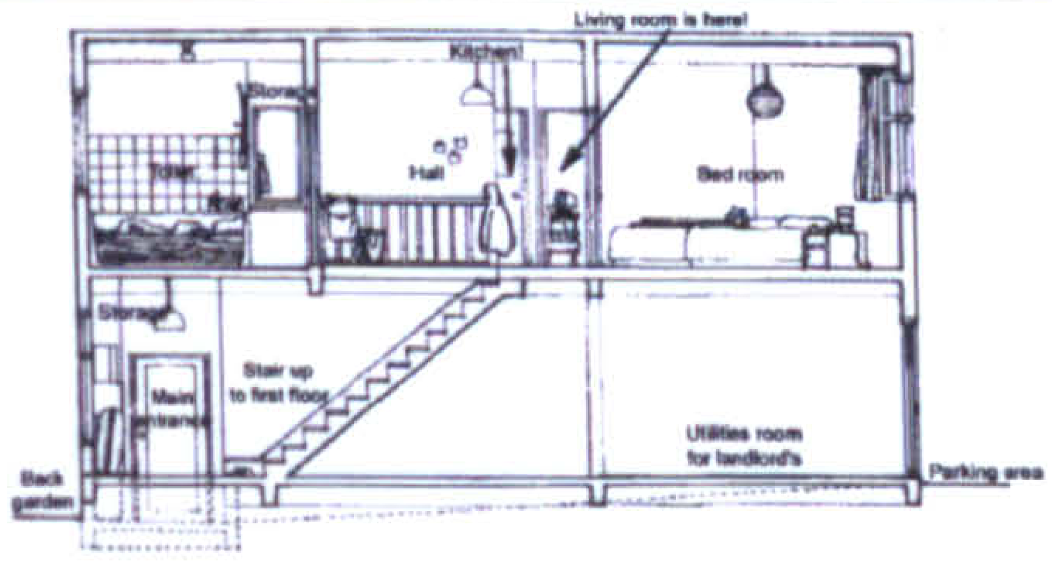
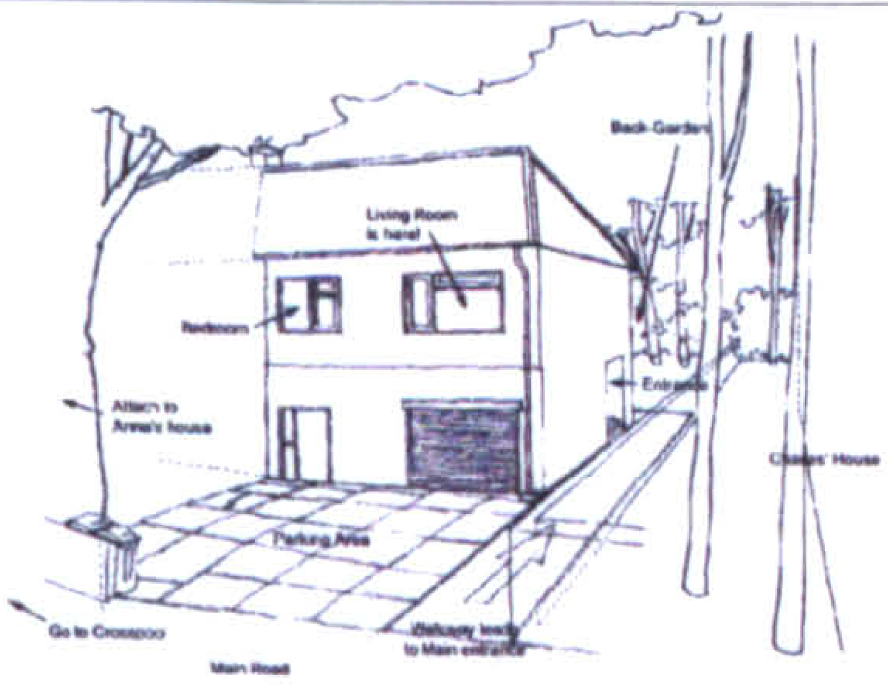
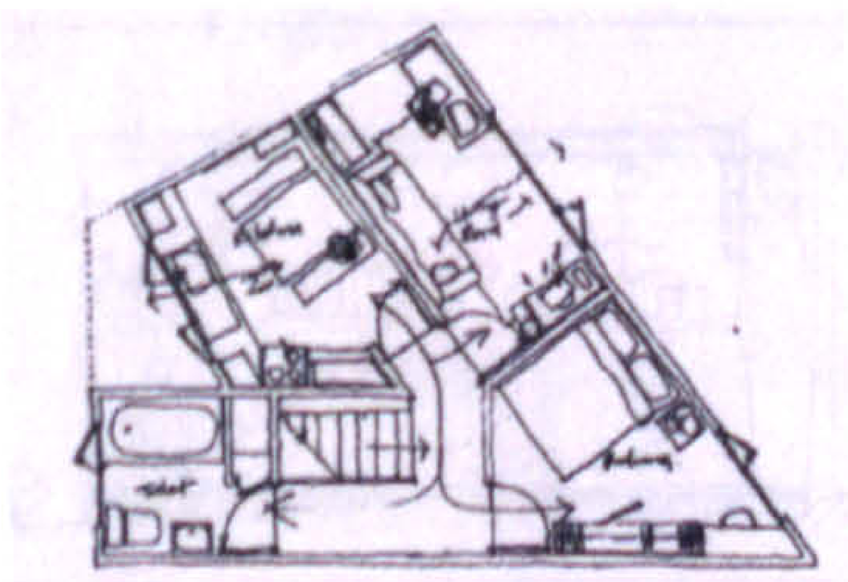
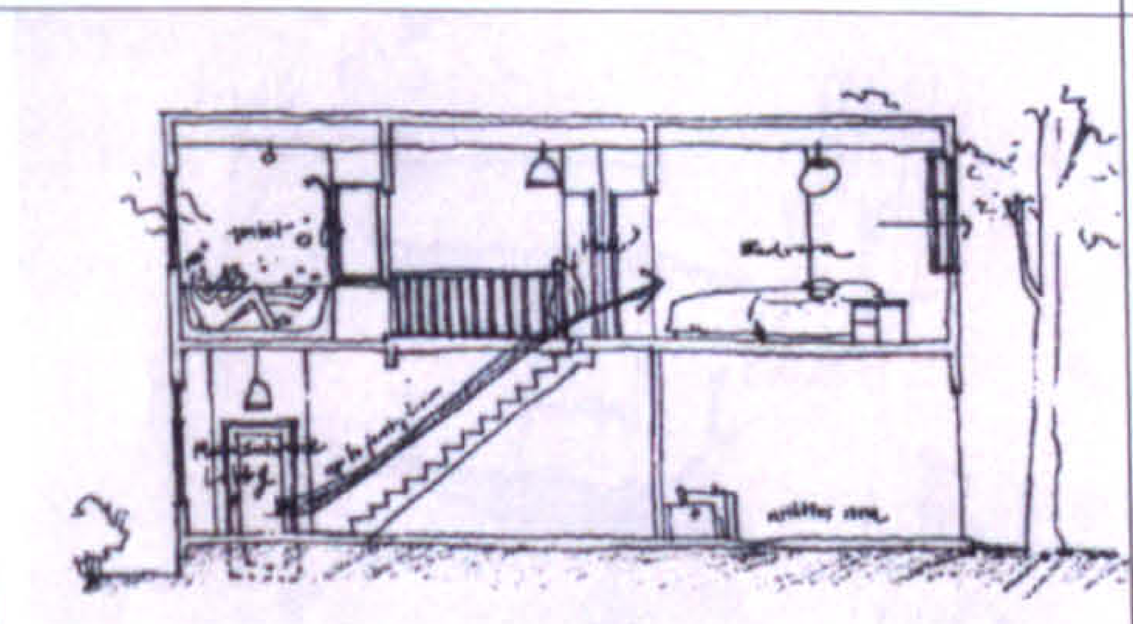
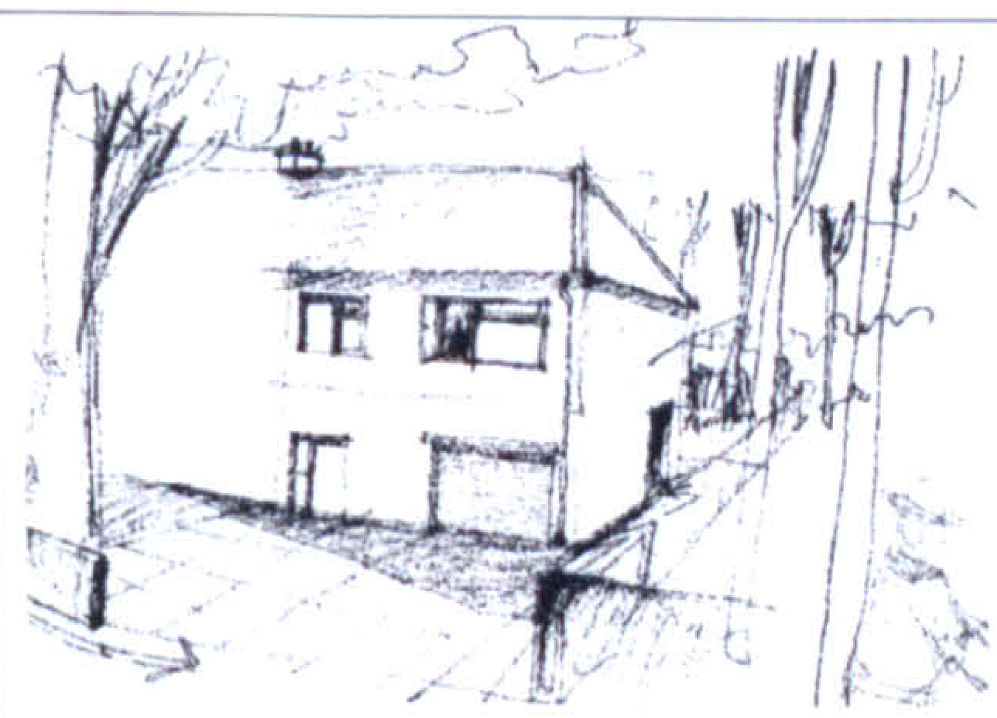
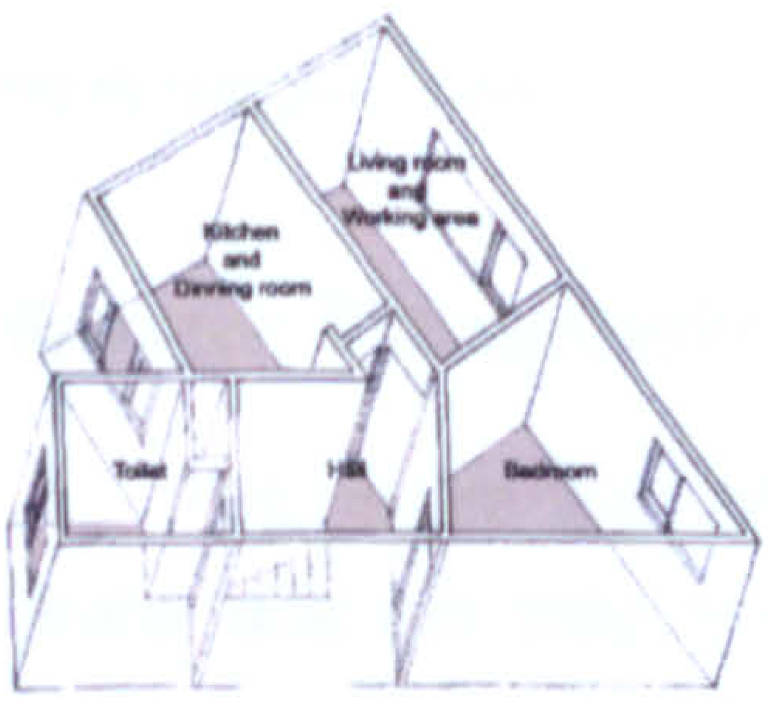
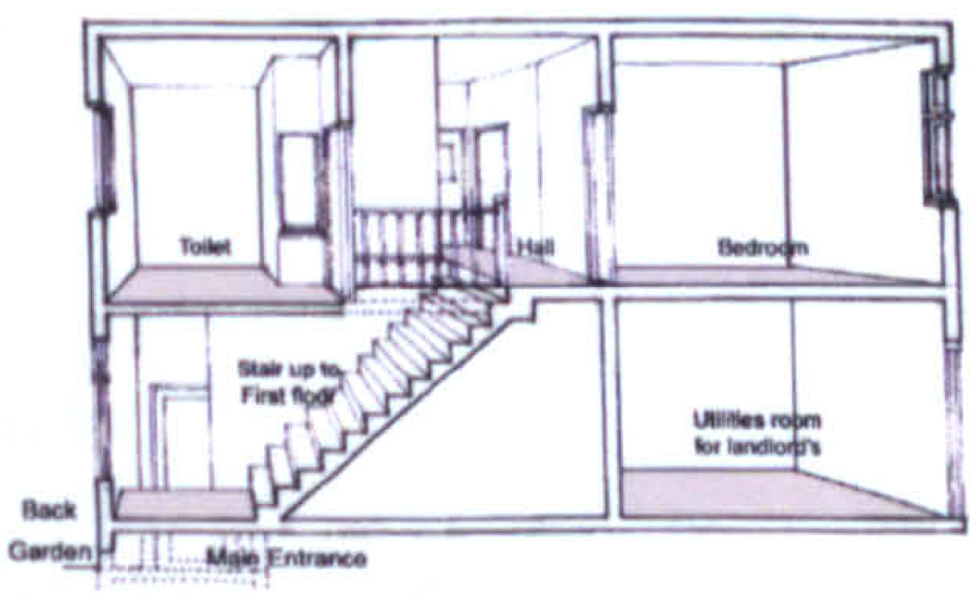


Figure 5.3: Structure of drawings used in the second pilot study.

The drawings categorised into three different modes of drawing are shown in Table 5.3. They are arranged vertically from (A-D) from most coded to least.

Table 5.3: Three modes of conventional architectural drawings: Plan, Section, and Perspective. They are arranged (from top to below) from most coded to least: A: Coded language, B: Pictorial Language, C: Sketch, and D: Three-dimensional representation.

	Plan Drawings	Section Drawings	Perspective Drawings
A			
B			
C			
D			

Five questions are asked against each mode (see Appendix B):

Plan:

Question 1: How can you walk from the kitchen to the toilet?

Question 2: How many doors and windows are there on this floor?

Question 3: Which is the smallest room in this flat?

Question 4: Does the plan drawing provide clear information for you to understand what the building looks like?

Question 5: Does the plan drawing have enough information for you to understand how the building is organised?

Section:

Question 1: Which pair of rooms are one above and the other?

Question 2: Which room does not have an external window?

Question 3: If you walk up the stairs from the ground floor, what are you going to see in front of you?

Question 4: Does the section drawing provides clear information for you to understand what the building looks like?

Question 5: Does the section drawing have enough information for you to understand how the building is organised?

Perspective:

Question 1: Which is the location of the main road?

Question 2: Which is the location of the main entrance?

Question 3: Which is the location of the living room window?

Question 4: Does the perspective drawing provide clear information for you to understand what the building looks like?

Question 5: Does the perspective drawing have enough information for you to understand how the building is organised?

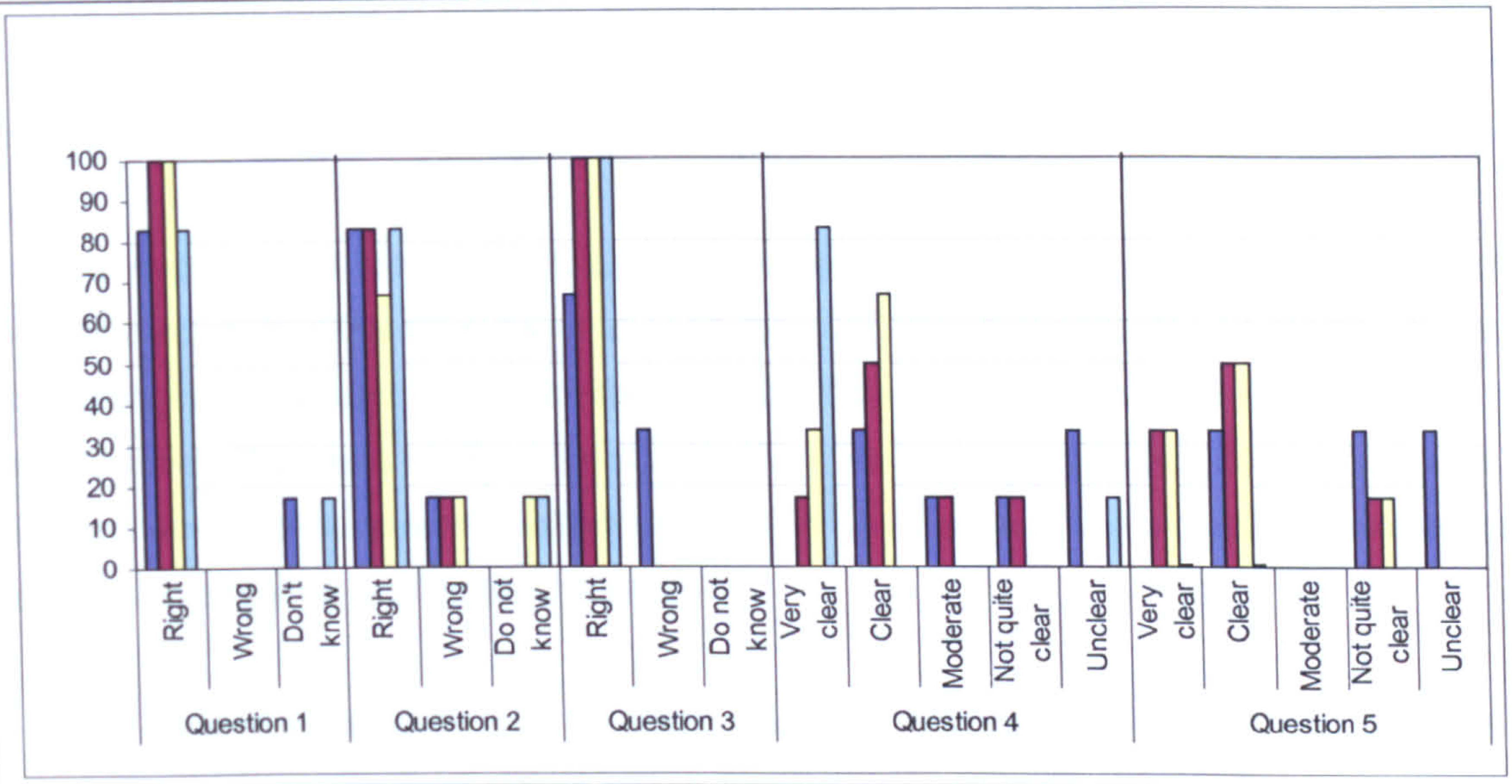
The general aim of the questions is to investigate whether or not respondents can read or understand codes and relate themselves to the drawing (Question 1-3). Moreover, respondents are required to evaluate each drawing regarding the way in which it provides information of what the building looks like and its organisation (Question 4-5). The evaluating scale is ranged from: Very clear / Clear / Moderate/ Not quite clear / Unclear.

b) Results: The second pilot study

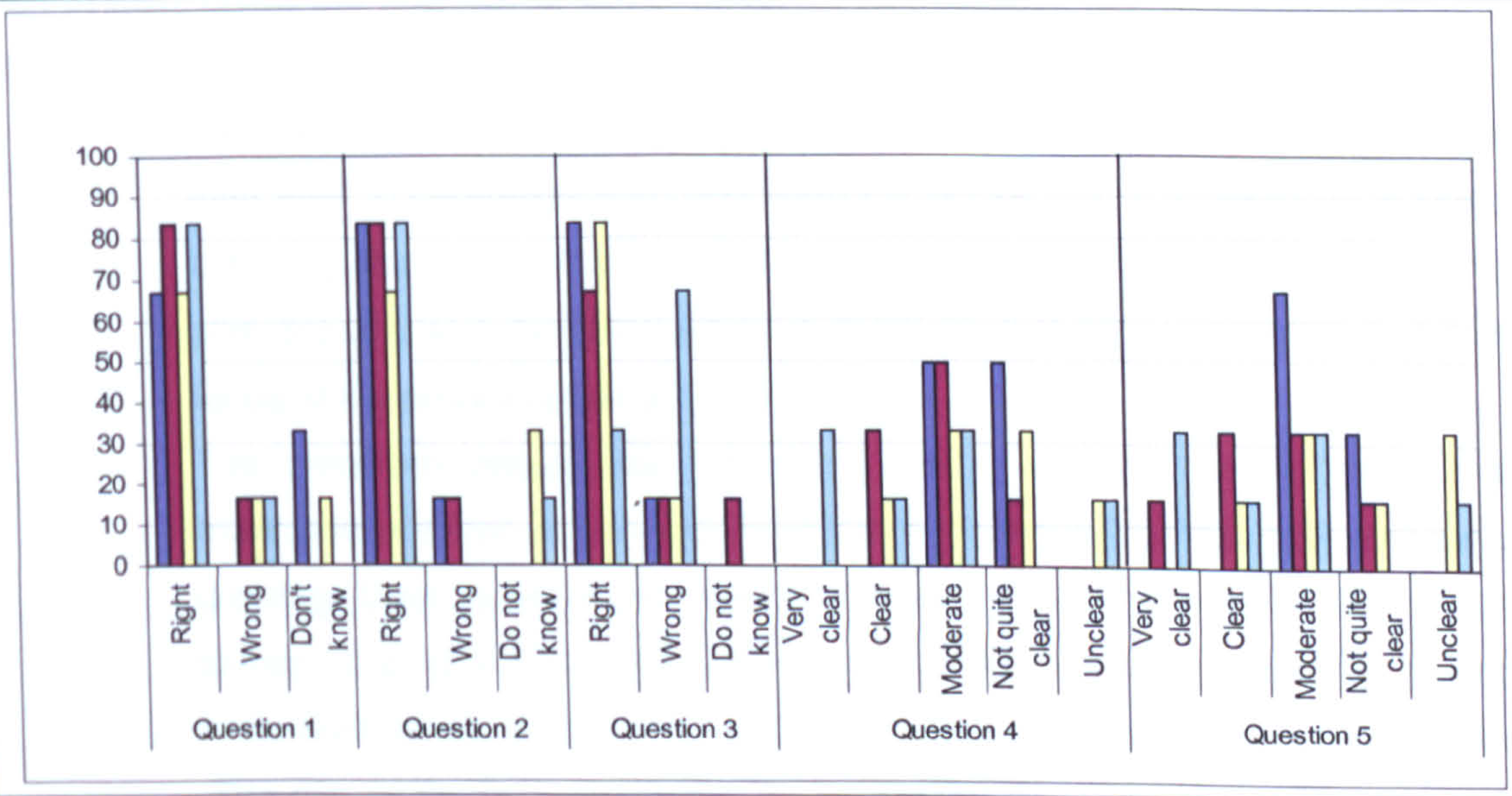
The results obtained from the second pilot study showed that most respondents seem to prefer and are able to read a perspectival mode of drawing quite well (see Figure 5.4). However, they seemed to have difficulty in reading and interpreting coded drawing. The problem was found in question 1 and 3 - particularly in a plan and a section drawing - in the issue of understanding circulation and reading architectural codes and symbols. It revealed that most respondents cannot figure out how to move around the building and identify door and window symbols. Moreover, most of them agreed that coded drawing does not provide enough information to understand how the building looks, the way a three dimensional drawing can. They claimed that coded drawing, in particular the plan drawing, also does not have enough information to explain a building's organisation.

Table 5.4: Graphs showing percentile scores received from the second pilot study.

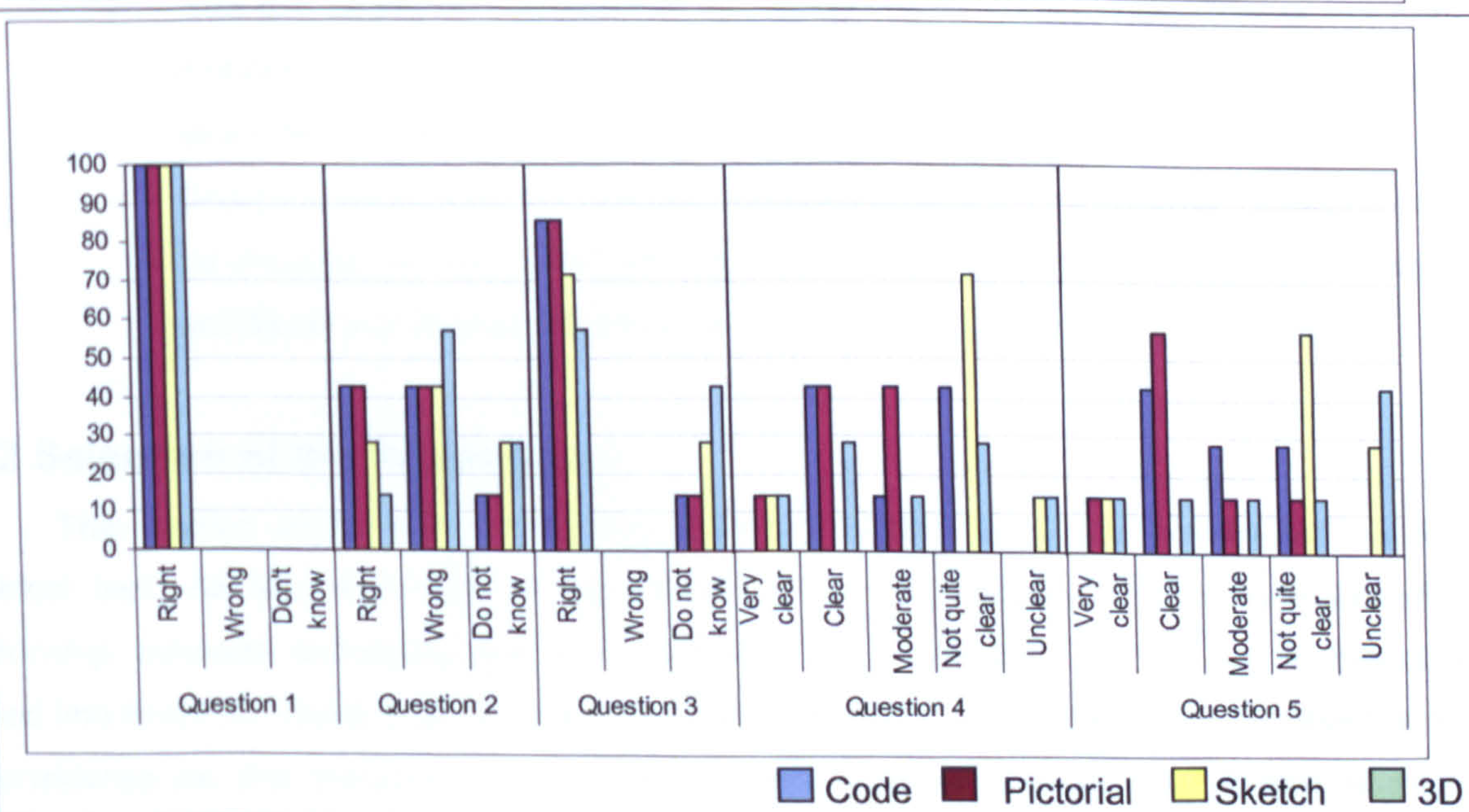
Plan



Section



Perspective



The second pilot study suggests a perceived problem of lay people in interpreting different modes and mediums of conventional drawing. They seemed to have difficulty in reading code and its arrangements. Particularly, as can be noticed, plan drawing seems to be the most problematic mode of drawing, especially ones using the medium of coded language. They found that the codification of plan drawing is unfamiliar and too difficult for them to comprehend.

The second pilot study also found differences in the abilities of the different groups of students who study in different subject to read the plan. For example, the students who study science or engineering read and understand a plan drawing better than the students who read politics. However, the main study did not take this into account because the sample was not stratified and does not necessarily reflect the population at large. This is therefore a limitation of the study which might have affected the results.

The second pilot study can be used as the fundamental idea that can suggest the direction in developing the final set of questionnaire - its structure and its drawings. It can be summarised as follows:

- The drawing should be more precise. Too many modes or mediums of drawing may lead to confusion and inconsistency of the test. It is however suggested that only one mode of representation is used in the final questionnaire; since a plan drawing was the most problematic mode, it is later suggested as the main focus of the empirical test and the research.
- The questions should also be more precise and consistent, which mainly examined whether or not non-architects can read and interpret a conventional drawing. Open question is needed in order to acquire respondents' feedback toward the drawing. The issues of reading and understanding codes, circulation, and a building's organisation should particularly be of more concern.
- The aim of the test should not only superficially focus on whether or not non-architects can superficially read a conventional drawing, but also profoundly examine whether they can interpret information within a drawing.
- Group of respondents should be precisely defined. Architectural audience may be included as one group of respondents; this allows a comparison between architects and non-architects to be subsequently made at a further stage.

5.4.2 Selection of the Respondent

This section explains the sampling process[3] for the final questionnaire of the first empirical test. As the main aim of this research is concentrated on the communicative relationship between architects and non-architects, the population for the test is therefore divided into these two main groups. They are drawn from within the University of Sheffield which is considered as the sampling frame. The samples are self-selected and therefore might possibly have a greater interest in architecture and drawing.[4]

[3] See more in Diamantopoulos and Schlegelmilch (1997: 18-9).

[4] See Limitations which may occur by using self-selected samples in section 5.6

The respondents in the group of non-architects, the so-called lay people, are self-selected through university departments at the University of Sheffield through sending an on-line questionnaire through the general University distribution list (volunteers@sheffield.ac.uk). This covers University academic and administrative staff, together with postgraduate students. Responses from the Faculty of Architectural Studies were not included in order to keep the notion of this population being lay. The architects' group were drawn from first year and diploma architectural students with the School of Architecture. The reason for this separation is to allow the results from the two different years of study to be subsequently compared.

Selecting these three groups (lay people, experienced architectural students, novice architectural students) over all other groups that might have been selected allows consistency within the test. The selection of the respondent groups from the same institute tends to ensure a reasonable similarity in academic background and educational level. This allows the first hypothesis (concerning the difference between lay and architectural audiences) to be tested within a structure that controls a number of other factors that might have confused the results, such as substantive differences in educational achievement.

5.4.3 Structure and Research Instruments

In order to gather data from the respondents, the use of a questionnaire is chosen as the main research instrument, more particularly the use of a self-completion questionnaire. In comparison with other techniques, particularly with that of the structured interview, the self-completion questionnaire is not only cheaper and quicker to manage, but also can be sent out through either mail or internet in one batch, so allowing a wide population to be reached at the same time. Moreover, respondents are not subjected to the interviewer's bias because it was self-administrated. It is more convenient for respondents because they can complete it when they want and at the speed that they want to go.[5]

By considering effectiveness in delivering and performing the questionnaire, online questionnaire is considered and selected as a promising method. The questionnaire was created in the form of an electronic version and sent out to the respondents via the Internet. As we shall see, the use of an online questionnaire has several advantages over a mail questionnaire or other methods of questionnaire. It is, for example, more accessible than the mail questionnaires, which frequently produce a low response rate. Moreover, the data obtained from computer based questionnaires can be collected and stored with a minimum of intervention by the experimenter, thus reducing the risk of 'transposition errors'.[6] On the other hand, disadvantages include less flexibility as there is not much interaction with respondents and it is biased to people that have computer access and email accounts. The designing and process of achieving the final form of the questionnaire are explained in the following sections.

[5] See Bryman (2001: 129-30)

[6] See Kenyon (2000).

5.5 The Final Questionnaire: Draw the Line Questionnaire 1

This final questionnaire used within the first empirical test is informed by the mutual analysis of the previous two pilot studies. The former study suggested the problem faced by lay people in seeing a conventional drawing, whilst the latter suggested the medium or mode of representation that lay people are able to understand the most or the least. The findings obtained from both studies have suggested the criteria that would influence lay people to perceive and understand drawings better. These, therefore, have led and informed the formation of the final set of questionnaire, which is called 'Draw the Line Questionnaire 1'.

The main aims of 'Draw the Line Questionnaire 1' is to quantify the issues raised (the difficulties faced by lay people in reading and understanding a conventional architectural drawing) and to investigate the essential factors that would enhance and develop the communicative potential of architectural drawing.

In order to contain the scope of the empirical test and to allow consistency in the questionnaire, as mentioned, only one mode of representation is used, that is 'plan drawing'. The pilot studies showed divergences in the interpretation of mode of the representation, as well as the medium of representation. In order to allow the study to investigate the medium of representation in a consistent manner, it was decided to limit the first empirical test to the plan. The second pilot study indicated that this may be the most difficult of the various modes for lay people to understand; by choosing the plan, it therefore allows the research to identify the problems more clearly. It was also thought, that by using a problematic mode of representation, more room of improvement could be found when developing alternative methods of drawing. Finally, the plan is the most used mode of representation in architecture and therefore was felt important to address potential improvements in this area, particularly if it appears to be at the same time to be the most confusing for a lay audience to understand.

Corbusier (1946) notes, "The plan is the generator"[7]. It is considered the core of communication in architectural drawing. To make a plan is to determine and fix ideas. It is to have had ideas and to order these ideas to become intelligible, capable of execution and communicable (see Jenger (1996)). It is often accepted as the starting point in architectural design, and therefore is seen as one of the most basic forms of architectural communication. It is hardly presented to the public as a communicative language, but as an abstract application. However, as we have seen in the above examples such as those by Ching (1976), it is also one

[7] Le Corbusier (1946) notes "The plan is at its basis. Without plan there can be neither grandeur of aim and expression, nor rhythm, nor mass, nor coherence. Without plan we have the sensation, so insupportable to man, of shapelessness, of poverty, of disorder, of wilfulness. A plan calls for the most active imagination, It calls for the most severe discipline also. The plan is what determines everything; it is the decisive moment. A plan is not a pretty thing to be drawn, like a Madonna face; it is an austere abstraction; it is nothing more than an algebrization and a dry-looking thing. The work of the mathematician remains none the less one of the highest activities of the human spirit" Corbusier (1946: 46-7).

of the most severely coded forms of representation leading to a split between architects who assume clarity in its usage and non-architects who have problems in decoding its abstract rules.

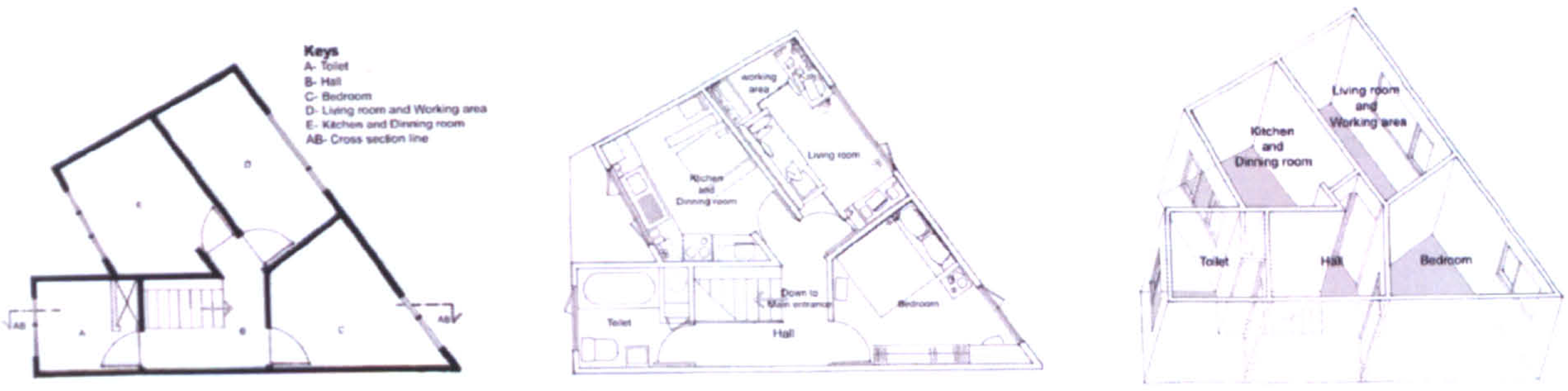
Moreover, the medium of representation is also reduced into three techniques only: coded language, pictorial language, and three-dimensions; excluding sketch (See Figure 5.6). By referring to Goodman (1968: 218-21) brief analysis of the architect's papers, he notes that a sketch is quite different from a plan[8]. The sketch does not define a work, he says, even though it is often made to convey the appearance of the finished building, whilst the plan are measurement on words and figures, which is more complex than a sketch. Moreover, a sketch is generally considered as the drawing drawn in the early stages of design which focuses rather on the thinking process of the architect than that communication process with the public. By this, the sketch is therefore not included as one of the media of representation used in this empirical test. This is hoped to allow the questionnaire and the empirical test to be more focused and consistent, in order to provide effective and significant results.

Three drawings were therefore developed for use in the final questionnaire. All show the same building, namely the first floor of the author's house. It was decided to keep to a simple building, and of a type familiar to a lay audience, so that results would not be overly affected by confusion caused by complexity or uncertainty as to building type. There was some concern that the building and its representation may be too simple for substantive conclusions to be arrived at, but these fears proved unfounded; the very basic level of what was being represented allowed the study to focus more clearly on issues of how and why the representations communicated, rather than on what was being represented.[9] All three drawings were drawn on the same scale and in the same orientation; again, to ensure consistency in interpretation.

[8] In Goodman (1968) analysis of architectural papers, he considers three sorts of documents: specifications, renderings, and plans (by 'plans' he apparently means construction drawings). Specification, Goodman (1968: 193) says, present few problems in that they are written with ordinary language. Architectural renderings are more complex, however: he defines a rendering as a sketch, and notes that "(a) sketch does not define a work...but rather is one". Construction drawings are even more complex than rendering, he says, because of their mixture of pictorial representation, words, and numerals.

[9] The author did not use famous or complex plan drawings for the questionnaire because, first the famous drawing has its own value attached to it. Such value would affect the way in which architectural audience respond to the test; second the more complex plan has too many variables which mean it becomes more difficult to analyse.

Hence, the three plan drawings used within the first empirical test were neutralised by using such an 'everyday plan', which is simple, domestic scaled, and has no specific value on it. Such an everyday plan closes down or reduces variables and allows consistency for the test. However, findings found from a small domestic scale plans can be subsequently used and adapted for the analysis of the bigger and the more complex plan.



Coded Language | Pictorial Language | Three dimensions

Figure 5.4: Three plan drawings, drawn by using different mediums of representation, used in 'Draw the Line Questionnaire 1', the first empirical test.

The first drawing is a plan drawn with conventional architectural codes, of a type commonly used when buildings are published or designs explained in reviews in Schools of Architecture. It uses a key to explain the room functions. The second drawing uses more pictorial codes, with furniture represented diagrammatically[10]. It draws on methods of representation developed by architects such as Ted Cullinan in the 1970s with a will to address the user (see Mikellides (1980)). The third drawing takes the standard plan and projects it axonometrically into three dimensions[11]. (See larger version in Appendix D)

As mentioned earlier, the author's biases and assumptions were considered as they may potentially affect the implication of the results. In an attempt to reduce these self-referential value, however, the questions and drawings, as well as the fact that the lay audience was included, were made as generic as possible. This supports the view of making minimal bias in this respect.

Furthermore, the 'Draw the Line Questionnaire 1' is divided into two parts: part one: ranking section and part two: true-false section. (See the questionnaire in Appendix C)

5.5.1 Part One

The first part asked respondents to rank the drawings according to the basic purposes and qualities of plan drawing: overall information, circulation, use, appearance, and scale. A three-point scale, which is measured on a nominal scale[12], is chosen as an evaluating means;

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[10] One good example is the drawing of the Chinnor Surgery, Oxfordshire, England, drawn by Aldington and Craig (see Figure 1.7 in Chapter One).

[11] The axonometrics retain consistent scalar measurements parallel to the three axes. Measurement remains absolute rather then the relative dimensions of the perspective. Also lines parallel in the object remain parallel in the drawing in axonometric constructions, making the drawing clearer and easier to construct than a perspective drawing (see Fraser and Henmi (1994)).

[12] Diamantopoulos and Schlegelmilch (1997) note, a norminal scale, as the name implies, is a scale 'in name only' and represents the simplest type of scaling. In norminal scaling, the numbers used have no mathematical properties in themselves and serve only as labels for identifucation and/or classification.

this is categorised as 'the best', 'medium', and 'the worst'. There are a total of six questions in this part, which aim to examine the views and values of lay people and architects. Consequently, the six questions are categorised into three basic approaches: general, specific, and technical.

General question:

1) Which drawing is generally the easiest to understand?

This question focuses on:

- The quality of drawing in general: instant reaction from respondents before they have time to analyse the drawings in depth.
- The overall graphic representation: How much do the respondents engage with a drawing?
- Is the drawing comprehensible and easy to look at?
- Information contained: How much information is conveyed?

Specific questions:

2) Which drawing clearly provides information on the relationship between rooms?

This question considers:

- Location: Does the drawing provide information which help respondents to locate themselves within the plan?
- Spatial arrangement: Do respondents understand how space is arranged in a plan drawing?

3) Which drawing clearly describes how to move from one room to another?

This question focuses on:

- Circulation: Does a drawing provide a sense of direction and movement in plan drawing?

4) Which drawing clearly describes the use of building?

This question focuses on:

- Functions and usages: How much do respondents understand the functions of each room?

5) Which drawing clearly shows what the building may look like?

This question is focused on:

- Appearance of a building: Does the drawing show a relationship between inside and outside of the building?

Technical question:

6) Which drawing clearly provides information on scale and size?

This question considers:

- Size and scale: Can respondents understand and estimate the size and scale of the building and its components?
- Dimensioning: Can respondents relate themselves to the building's and human's dimensions in a plan drawing?

Examples of questions in part one as they appeared in the 'Draw the Line Questionnaire 1' are presented in Figure 5.5.

1) Which drawing is generally the easiest to understand?

A	A	A
Best		Worse

2) Which drawing clearly provides information on the relationship between rooms?

A	A	A
Best		Worse

Figure 5.5: Question one and two asked in part one (See full set of questions in Appendix C).

5.5.2 Part Two

The questions in the second part attempted to examine differences in the way that lay people and architects interpret and understanding the drawing. The aim is to identify their decoding skills, particularly the interpretative system of lay people, in reading and understanding a conventional plan drawing.

The questions are based on the true or false format. Initially, the questions ask respondents to identify whether the statement given is true, false, or undecided, against the three plan drawings (Questions 7-12, 15-20, and 23-28). Then there are additional open questions which aim to assemble respondents' feedback regarding the issue of developing a more communicative drawing. The open questions ask respondents whether or not the plan drawings have provided comprehensible information and ask them for their opinion as to what factors should be included in the communicative architectural drawing (Questions 13-14, 21-22, 29-30, and 31).

The questions asked in part two are presented as follows and examples of questions in part two as they appear in the 'Draw the Line Questionnaire 1' are shown in Figure 5.7 and 5.8.

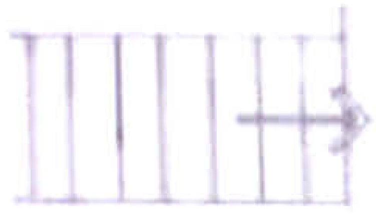
Table 5.6: Questions asked in part two; according to plan A, B, and C

Plan A
7) This drawing shows a horizontal slice through a building.

8) Information about the height of rooms is provided by this drawing.

9) If you walk out from the bedroom, you can walk straight to the bathroom, or turn to the living room and the kitchen.

10) This symbol represents a window. 

11) This symbol represents tiled floor. 

12) This symbol represents a sliding door. 

13) Does the drawing provide information for you to understand what the building may look like?

14) Does the drawing provide information for you to understand how the building is used?

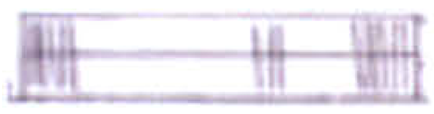
Plan B

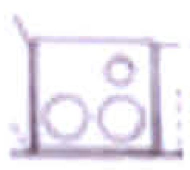
15) This drawing is drawn to scale.

16) All the rooms lead off the hallway.

17) The stair is enclosed with walls on both sides.

18) You can look outside the house when you are washing dishes.

19) This symbol represents a book shelf. 

20) This symbol represents a cooker. 

21) Does the drawing provide information for you to understand what the building may look like?

22) Does the drawing provide information for you to understand how the building is used?

Plan C

23) This is the ground floor level of the building.

24) This is a one-storey building.

25) The toilet is the smallest room.

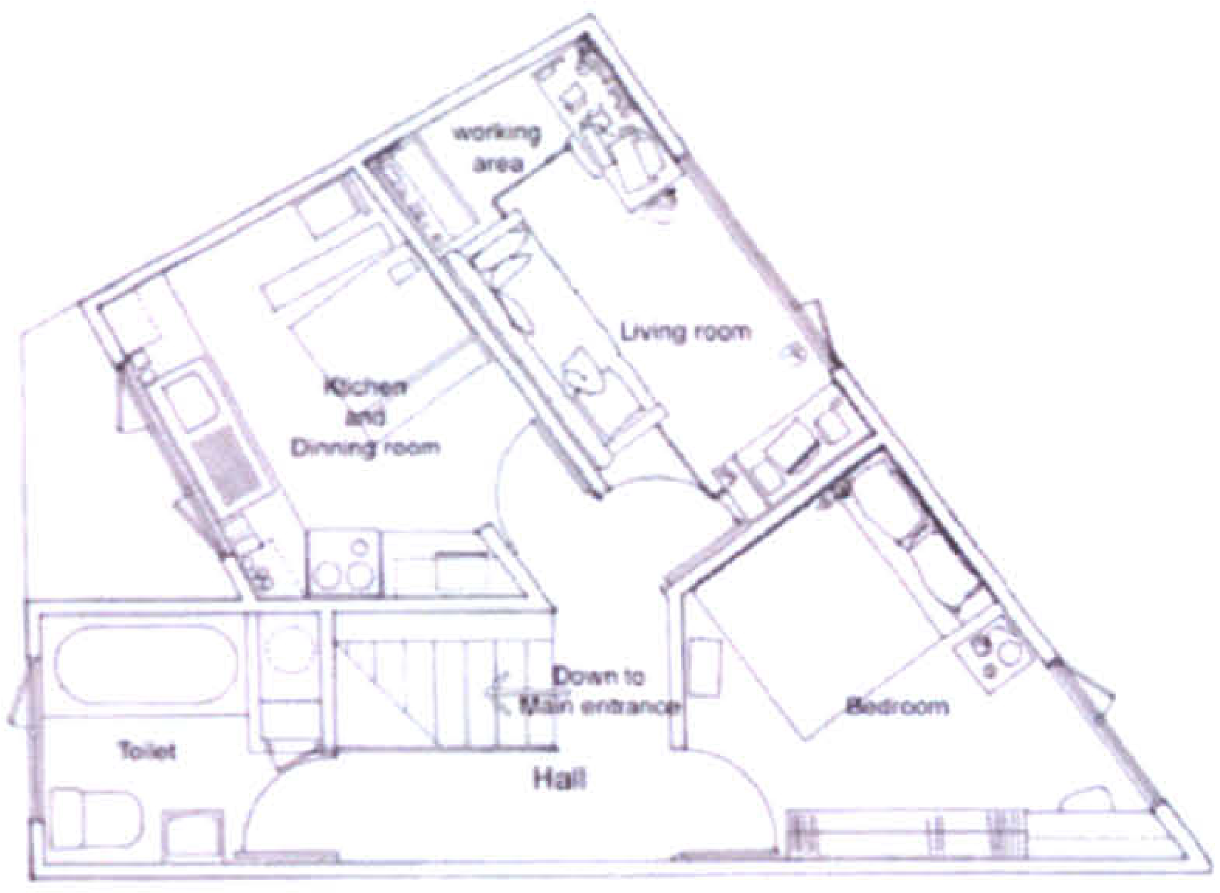
26) There are 5 doors in this drawing.

27) The hallway is the only room that has no external window.

28) This drawing provides information about how to move around the building.

29) Does the drawing provide information for you to understand what the building may look like?

30) Does the drawing provide information for you to understand how the building is used?



	True	False	Don't know
15. This drawing is drawn to scale.	T	F	DK
16. All the rooms lead off the hallway.	T	F	DK
17. The stair is enclosed with walls on both sides.	T	F	DK

Figure 5.7: An example of a drawing and questions asked in part two (See full set of questions in Appendix C).

29. Does this drawing provide information for you to understand how the building may look?

Yes - WHY No - WHY? (Please give your opinion in the box below)

30. Does this drawing provide information for you to understand how the building is used?

Yes - WHY No - WHY? (Please give your opinion in the box below)

31. What will make you understand architectural drawing better?

Figure 5.8: An example of open questions asked in part two (See full set of questions in Appendix C).

As a result, the data and findings obtained from Draw the Line Questionnaire 1 are hoped to respond to the main objectives of this research, that is, to justify the stated hypotheses, and to derive conclusions to inform the next stage of the empirical test. (See full set of questionnaire of the first empirical test in Appendix C)

5.5.3 Data Analysis Technique

In order to analyse the quantitative results obtained from the questionnaire, an appropriate technique for data analysis needs to be carefully chosen. It was decided to use

Descriptive Analysis[13] as the initial method for examining the obtained quantitative data. This determines basic distributions of characteristics of the variables and of the obtained data; principally through frequencies and percentages (Categorical data). Following this, a comparative study is carried out to examine if there are statistically significant differences between the groups of respondents. The two independent samples Chi-square test is used as a basic statistical method; this is because the two groups of respondents are asked to compare on a variable which is measured on a nominal scale, as well as analysing the association between categorical variables (see Siegel (1956), Diamantopoulos and Schlegelmilch (1997), Dancey and Reidy (2002)). In this context, the two independent samples are lay people and architectural students.

The null hypothesis[14] (H0) tested by the two independent samples Chi-square test is that no difference exists between the two groups of independent samples with respect to the relative frequency with which groups members fall into the various categories of the variable of interest (see Diamantopoulos and Schlegelmilch (1997)). A two tailed test[15] at 95% confident interval[16] is used to detect the differences between two groups. Thus, if the p-value[17] is less

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[13] Diamantopoulos and Schlegelmilch (1997) note, "Data description is a typical first step in any idea analysis project. In addition to being an important, self standing acitvity when a descriptive focus characterises the analysis objectives, descriptive analysis provides a useful initial examination of the data even when the ultimate concern of the investigator is inferential in nature(i.e. involving estimation and/or hypothesis-testing). The purpose of descriptive anaysis is to

1) Provide preliminary insights as to the nature of the responses obtained, as reflected in the distribution of values for each variable of interest.
2) Help detect errors in the coding process.
3) Provide a means for presenting the data in a digestible manner, through the use of tables and graphs.
4) Provide summary measures of 'typical' or 'average' responses as well as the extent of variationin responses for a given variable.
5) Provides as early opportunity for checking whether the distributional assumptions of subsequentstatistical tests are likely to be satisfied" Diamantopoulos and Schlegelmilch (1997: 73-4).

[14] Dancey and Reidy (2002) notes that the null hypothesis is very important to the process of hypothesis testing. It is based on the assumption that there is no relationship between the two variables in the population. If the research hypothesis (often called alternative hypothesis) states that there will be a relationship between two variables, then the null hypothesis states that here is absolutely no relationship between the two variables.

[15] According to the rejection region, since the alternative hypothesis (H1) will show only the difference between lay people and first year architectural students and will not predict any significant direction, the region of rejection is two-tailed (see Siegel (1956), Sprinthall (1982), Mendenhall and Beaver (1994), Cabrera and McDougall (2002)). While if the direction of the relationship between the two variables is specified (Directional hypothesis), the region of rejection is one-tailed (see Howell (1992), Dancey and Reidy (2002)).

[16] Confidence intervals of the mean are interval estimates of where the population mean may lie. That is, they provide us with a range of scores (an interval) within which we can be confident that the population mean lies. (see Dancey and Reidy (2002)).

[17] We can also compute the probability of obtaining a test statistic as extreme as or more extreme than the one actually obtained by looking at the table of the standard normal distribution. This probability is known as the *p-value* and, the lower it is, the stronger is the evidence against the null hypothesis (H0). The null hypothesis is true or significant, if the probability of a given effect is less than 5% then we have reasonable support for the research hypothesis, while ff it is grater than 5% then the findings are said to be non-significant (see Dancey and Reidy (2002), Diamantopoulos and Schlegelmilch (1997)).

than the significant level (α)[18] ($p \geq 0.05$), the null hypothesis (H0) indicating that the two groups are equal, is rejected in favour of the alternative hypothesis (H1)[19] (see Siegel (1956), Sprinthall (1982), Mendenhall and Beaver (1994), Cabrera and McDougall (2002)).

Details and explanations of the use of Chi square test in relation to the obtained results is further discussed in Chapter Six.

5.6 Limitations: The First Empirical Test

As with any research, it is felt important to note the limitations of the methodology used and research instrument chosen.

1. The first limitation of the first empirical test is the drawings themselves. As previously mentioned, the drawings used within the questionnaire are drawn by the author. Thus, they may be considered to be subjectively drawn and presented. There is a potential built-in interpretative bias in comparison to drawings that are drawn in different styles by other architects. This was addressed by making the drawings as generic as possible, using known conventions. In addition, the potential ambiguities of the questions are also considered. Since the questions are raised by the author and very much aimed to test lay audience's abilities in reading and understanding the plan, some of the questions may be confusing and mislead the readers. This problem was addressed by making the questions as clear and comprehensible as possible in relation to the drawings, however, ambiguities may have remained.
2. Second, in order to allow consistency and to narrow the scope of the experiment, only one mode of drawing, the plan, was selected. The use of a plan drawing may limit the results and findings that could be obtained from a wider range of drawings had been used, and in particular the potential to make cross-comparisons between different modes of drawing. However, as discussed above the benefits of using the plan alone appeared strong. It was also thought that more drawings and more questions would have led to an unwieldy questionnaire, with the danger of a lower number of, and less consistent, returns.
3. The third limitation is with regard to self-selected sample groups who might have above average interest or who may be familiar with the topic. In addition, by using the University of Sheffield as sampling frame, the potential respondents have similar qualifications and educational backgrounds. The majority of the chosen population are at or have achieved degree level; this is

[18] It is used to indicate the maximum risk we are willing to take in rejecting a true null hypothesis; the less risk we are willing to assume, the lower the significant level (see Diamantopoulos and Schlegelmilch (1997)).

[19] An alternative hypothesis (a research hypothesis) is the complement of the null hypothesis, that is it postulates some difference or inequality; as such, it can never include a statement of equality (see Dancey and Reidy (2002), Diamantopoulos and Schlegelmilch (1997)).

not representative of the population at large. However, since the focus of the study is on the generic differences between architects and non-architects, this limitation is accepted. One might expect more divergence between interpretations in a less-educated sample of non-architects, so the results from the more educated lay sample should be indicative of the wider lay population if they show differences from the architectural audience. Consequently, the fact that Diploma students are represented as practising architects within the test may have an effect on the findings. This is because the students are regularly tested on their relevant skills and knowledge and answer these kinds of questions in their context of an educational institution. Therefore, findings found from Diploma students may be applied back to the architects in certain or some relevant aspects.

4. Finally, the fact that all the architectural group is drawn from a single School of Architecture may mean that the results are skewed by the particular culture and education at Sheffield. It is hoped that the generic nature of the drawings to some extent overcomes this limitation.

In all cases, these limitations also suggest avenues for further research. These are addressed in the final chapter of this research.

5.7 Conclusion

The major issues involving methodology, the structure of research and questionnaire, and the procedures of data collection within the first empirical test have been discussed in this chapter. In the following chapter, the results obtained from the 'Draw the Line Questionnaire 1' are reviewed, and the analysis and discussions are carried out. The quantitative findings are statistically analysed and explained through tables and graphs, while the qualitative finding are evaluated and summarised. The analyses carried out from both approaches then inform the second empirical test, which explores the success or otherwise of a proposed alternative way of representing the plan – an alternative that attempts to communicate better to a lay audience.

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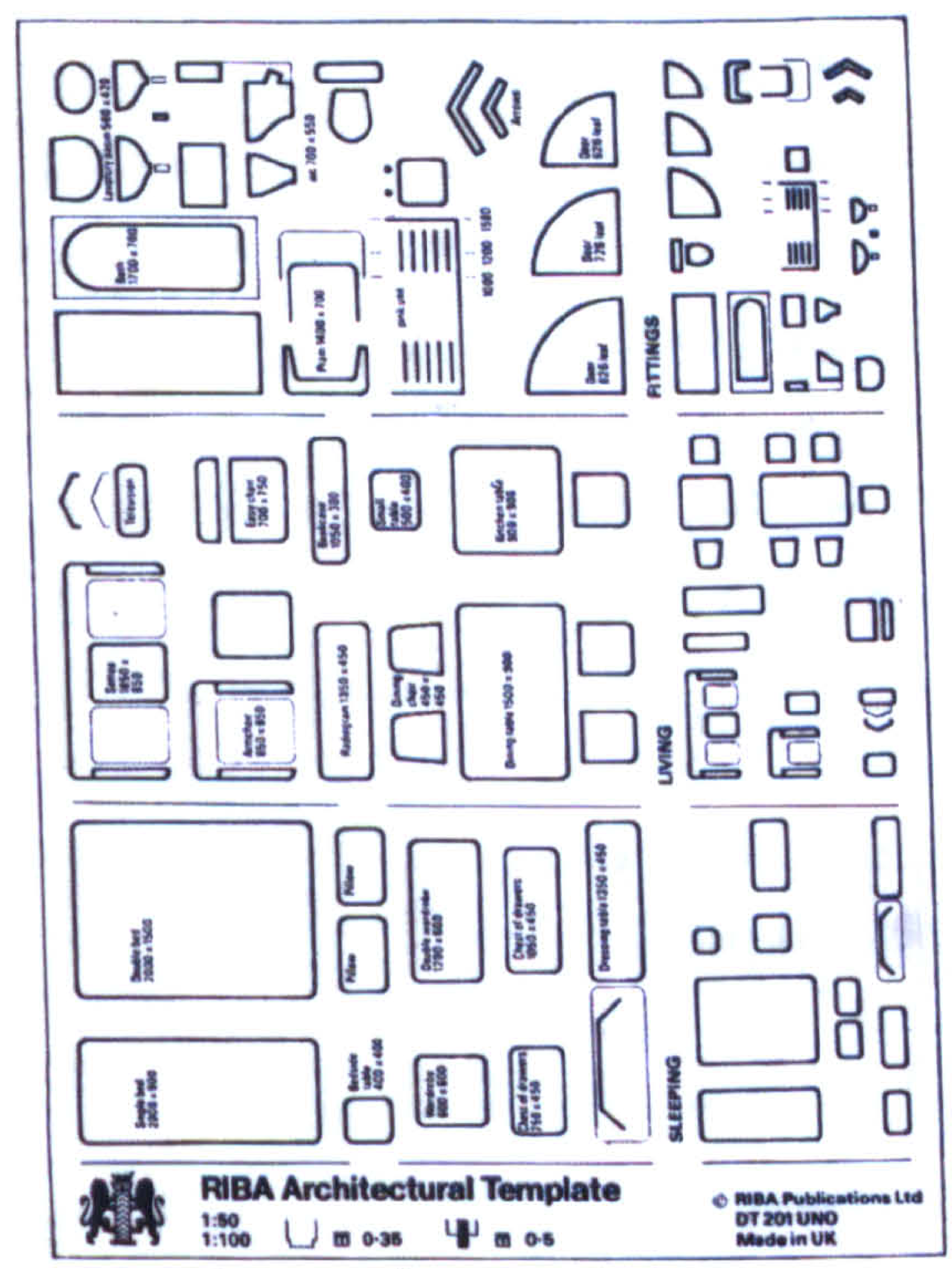
Chapter 6
The First Empirical test



'Drawing template' (Styles, 1995: 77)

Template: 1 a shaped piece of rigid material used as a pattern for processes such as cutting out, shaping, or drilling, **2** Something that serves as a model or example (Pearsall, 2002: 1474-5).

Chapter Six | THE FIRST EMPIRICAL TEST

Results, Analysis, and Discussions

6.1 Introduction

This chapter introduces and discusses results obtained from the first empirical test, which was conducted through an online questionnaire: 'Draw the Line Questionnaire 1'. The fundamental aim of the questionnaire was to examine whether or not non-architects are able to read and understand conventional architectural drawing, as well as to test the key issue raised, namely the perceived communication breakdown between non-architects and architects.

The questionnaire was performed on three groups of respondents: (1) non-architects who study or work at the University of Sheffield and (2) first year and (3) diploma architectural students at the School of Architecture. For the purposes of the test, non-architects were considered as a group that have no architectural knowledge and named as 'lay people', while the first year architectural students were generally students who had just entered the school. However, as shall be seen, the test assumes that the group of first year students may be considered as being similar to non-architects in regard to their level of architectural knowledge, but may have differences in terms of expectation and socialisation. By including first year students, who presumably have an aptitude for spatial interpretation compared to the general lay population, the subsequent findings could actually support the previous hypothesis with regard to the socialisation of architects through education. The test was conducted at the end of the academic year, which means the first year students are already affected by the architectural culture inculcated within an architecture school. These issues will be raised and discussed later in the section of comparative study. On the other hand, the diploma students were mainly final year architectural students. As far as their level of knowledge goes, they may be considered as close to professional architects who are fully educated in architecture and have comprehensive architectural knowledge and experience. This chapter is divided into four main sections:

6.2 Description of the respondents
6.3 Quantitative findings
6.4 Qualitative findings
6.5 Conclusion

The responses are firstly examined through a table of frequencies and percentile scores. Secondly, all data collected from the questionnaire is presented. Quantitative data is initially shown and analysed according to the three different groups of respondents. According to the aim of the questionnaire, results obtained from lay people form the main focus, and are subsequently compared with those obtained from the groups of architectural students. Then qualitative data obtained from respondents' feedback is reviewed and evaluated; this informs the development of the second empirical test. At the end of the chapter, summaries and ideas developed from the first empirical test are discussed with a view to informing the structure of the second empirical test.

6.2 Description of the Respondents

This section provides brief descriptions of the respondents who participated in the first empirical test. There were 379 responses received from the group of lay people, 41 responses from first year architectural students, and 38 responses from diploma architectural students.

Table 6.1 shows the frequencies and percentages of lay people in accordance with different classifications, for example gender, age, and department of study, whilst table 6.2 shows the frequencies and percentage of architectural students categorised according to their year of study.

Table 6.1: Summary of descriptions of Lay people

Gender	Frequencies	Percentages (%)
Male	198	53.80
Female	170	46.20
Total	368	100.00
Missing	11	-
Total	379	
Age		
16-18	0	0.00
19-21	4	1.10
22-24	28	7.70
25+	332	91.20
Total	364	100.00
Missing	15	-
Total	379	
Department		
Arts	18	5.70
Law	5	1.60
Medicine	94	29.90
Pure science	93	29.60
Social science	42	13.40
Other	35	11.10
Engineering	27	8.60
Total	314	100.00
Missing	65	-
Total	379	

Table 6. 2: Summary of descriptions of Architectural students

Gender	Frequencies	Percentages (%)
Male	46	58.20[1]
Female	33	41.80
Total	79	100.00
Missing	0	-
Total	79	
Age		
16-18	25	31.60
19-21	12	15.20
22-24	27	34.20
25+	15	19.00
Total	79	100.00
Missing	0	-
Total	79	
Year of study		
First year	41	51.90
Diploma	38	48.10
Total	79	100.00
Missing	0	-
Total	79	

6.3 Quantitative Findings: the First Empirical Test

This section presents the quantitative findings, which are shown according to two main parts of the questionnaire: 6.3.1) Part one and 6.3.2) Part two. Within each part, the data is analysed and explained in accordance with the three different groups of respondents: lay people, first year architectural students, and diploma architectural students.

6.3.1 Part one

As previously mentioned, the first part of the test aims to examine the way lay people and architectural students see and evaluate a range of drawings, as well as to investigate the way they react to the drawings at first glance (See drawings in Appendix D). The questions asked respondents to rank each drawing from three categories, 'the best' to 'the worst', concerning certain qualities of plan drawing. The results obtained are shown in the form of tables of percentages and as graphs.

[1] These percentages for gender are in line with the percentage for the School of Architecture as a whole.

6.3.1.1 Lay people (part one)

Question 1: Which drawing is generally the easiest to understand?

Table 6.3: Percentile scores obtained from Lay people: Question1-part 1

	Plan A (N)	Plan B (N)	Plan C (N)
Best	18.10% (61)	**43.32% (146)**	40.36% (136)
Medium	26.41% (89)	**37.98% (128)**	35.01% (118)
Worst	**55.49% (187)**	18.69% (63)	24.63% (83)
Total	100% (337)	100% (337)	100% (337)

Plan A - Code language
Plan B - Pictorial language
Plan C - Thee dimensions
Question was based on three categories: Easiest, Middle, and Hardest.
N = Number of respondents
Note: Highest percentages are in bold

According to percentile scores from the lay persons' responses, the majority agreed that plan B (pictorial language) is the easiest mode of drawing to understand (43.32%), and is thus considered as 'the best' drawing in providing overall information. However, the closeness of 'best' responses for plan B and plan C (three dimensions) may suggest that both of these two mediums of drawing, or a combination of them, could provide a better way for understanding an architectural plan. Plan A (code language) was seen as the most difficult drawing to understand (55.49% in worst and only 18.10% in best).

This question was designed to examine judgemental views and preferences of lay people, in terms of which drawing they like or dislike, or feel comfortable with, 'at first glance'. It revealed that, superficially, most lay people prefer plan B and C. These two mediums of drawings might have recalled their experience of place, such as memory of their rooms, so that they found them easy and comfortable to engage. On the other hand, they seemed to face difficulty in seeing and reading plan A, which is based on a technical format. Even this initial response may surprise most architects, for whom plan A, or the basic approach and techniques within it, would be the normative method for drawing plans.

Question 2: Which drawing clearly provides information on the relationship between rooms?

Table 6.4: Percentile scores obtained from Lay people: Question 2-part 1

	Plan A (N)	Plan B (N)	Plan C (N)
Best	26.51% (88)	29.52% (98)	**44.28% (147)**
Medium	29.82% (99)	**44.28% (147)**	25.90% (86)
Worst	**43.67% (145)**	26.20% (87)	29.82% (99)
Total	100% (332)	100% (332)	100% (332)

Plan A - Code language
Plan B - Pictorial language
Plan C - Thee dimensions
Question was based on three categories: Easiest, Middle, and Hardest.
N = Number of respondents
Note: Highest percentages are in bold

It clearly shows that almost half of the lay people (44.28%) found plan C (three dimensions) best in providing information on relationship between rooms, while plan A (code language) and plan B (pictorial language) obtained very similar percentage for the best drawing. Since both drawings were drawn in two-dimensional format, it may difficult for lay people to mentally convert the two-dimensional drawing on the paper into three-dimensional space, and thus find it difficult to imagine and understand the location and arrangement of rooms.

Again the drawing with the code language (plan A) was noted as 'the worst' drawing (43.67%). It also appears from some of the written comments that, *'Plan A tells you the names of the rooms but does not give you how the rooms will be used and related'* (see Appendix E). In plan B, lay people claimed that the furniture and objects drawn overload the audience with information which affect their perceptions and interpretations (see Appendix E for comments made on the questionnaires). As a result, they agreed that the three-dimensional drawing was best in showing spatial organisation of the building. One commented that he can imagine how the rooms would be arranged and occupied from plan C, because it offers the opportunity to see a drawing as close to real space and to imagine how the rooms would be used. Most lay people noted that plan C gives a clearer view of rooms by adding height and depth. One says *'Three-dimensional drawing gives an idea of dark corners in a room that may exist'* (see Appendix E).

Question 3: Which drawing clearly describes how to move from one room to another?

Table 6.5: Percentile scores obtained from Lay people: Question 3-part 1

	Plan A (N)	Plan B (N)	Plan C (N)
Best	**44.77% (154)**	26.74% (92)	29.94% (103)
Medium	28.20% (97)	**46.22% (159)**	24.13% (83)
Worst	27.03% (93)	27.03% (93)	**45.93% (158)**
Total	100% (332)	100% (332)	100% (332)

Plan A - Code language
Plan B - Pictorial language
Plan C - Thee dimensions
Question was based on three categories: Easiest, Middle, and Hardest.
N = Number of respondents
Note: Highest percentages are in bold

According to percentile scores of plan A (code language) and feedback commented by lay people, the coded language, used simple lines and a basic reading-key, found best in indicating information on circulation (44.77%). At the same time, lay people claimed that the pictorial information on plan B was 'cluttered' and contained too much information, and this could lead to confusion. Plan C, drawn as axonometric projection, was noted as 'the worst' in providing the same information (45.93%). Lay people claimed that it could not provide clear views of room because overlapping walls may create a hidden corner within the building (see Appendix E).

It is also interesting to compare the responses to Question 2 and 3; both questions were based on the same premise and basic understanding, namely the relationship between rooms and how to move from one room to another. Thus the results from them might be expected to be similar. But, in fact, the results were diametrically opposite, with plan A being best in one and worse in the other, and plan C *vice-versa*.

This suggests that these two questions actually have a different basis for the lay audience. Question 2, which asked about the relationship between rooms, relies on **an overview approach.** This means 'the best' drawing should be able to provide overall information on location of rooms and spatial arrangements, and this requirement was best met by the three-dimensional drawing. As we shall see, the three-dimensional drawing acts as **an object**, within which the audience can see from a distance and get a basic idea of spatial relationships. It creates the expression of a built object that easily catches the audience's eye. On the other hand, Question 3 is related to how one moves from one room to another or, in other words, circulation. This means 'the best' drawing should be able to link the audience to their **detailed experience**, and should be able to allow the audience to engage with the drawing. Here a coded drawing was chosen as 'the best' drawing. As we shall see, it contains reading keys, which work as **descriptive information** that allows the audience to relate spatial experience and trace a flow of circulation; it allows the audience to place themselves into a drawing and obtain a basic idea of circulation flow. This means these two questions require a different information set, in which Question 2 relates to the general and Question 3 relates to the particular.

Question 4: Which drawing clearly describes the use of the building?

Table 6.6: Percentile scores obtained from Lay people: Question 4-part 1

	Plan A (N)	Plan B (N)	Plan C (N)
Best	5.65% (20)	**78.81% (279)**	16.10% (57)
Medium	21.47% (76)	17.51% (62)	**60.73% (215)**
Worst	**72.88% (258)**	3.67% (13)	23.16% (82)
Total	100% (354)	100% (354)	100% (354)

Plan A - Code language
Plan B - Pictorial language
Plan C - Thee dimensions
Question was based on three categories: Easiest, Middle, and Hardest.
N = Number of respondents
Note: Highest percentages are in bold

A very high percentage (78.81%) of lay people agreed that plan B (pictorial language) is 'the best' drawing for indicating how the building is used, while plan A (code language) was noted as 'the worst' drawing with a score of 72.88% This is one of the highest percentage differentials in Part one.

In plan B, the furniture becomes **instantly recognisable icons** for the lay people. Where architects may see the furniture as just another set of codes, for the lay person, furniture appears to provide a rough scale and clues that refer to their experience of place or spatial organisation, and helps them to imagine how to occupy and arrange the space. Importantly, lay people were able to recognise these icons without the need for detailed architectural knowledge. One says, *'The furniture and appliances provide a sense of scale'* (see Appendix E).

This contrasts with plan A (with its high 'disapproval' rating in this question) in which the coded language was difficult for someone who has no architectural background or knowledge to interpret and understand. One respondent says that it is 'technically drawn' and too 'architecturally expressed' (see Appendix E).

Question 5: Which drawing clearly shows what the building may look like?

Table 6.7: Percentile scores obtained from Lay people: Question 5-part 1

	Plan A (N)	Plan B (N)	Plan C (N)
Best	4.17% (15)	21.39%(77)	**75.00% (270)**
Medium	13.61% (49)	**67.22% (242)**	18.61% (67)
Worst	**82.22% (296)**	11.39% (41)	6.39% (23)
Total	100% (360)	100% (360)	100% (360)

Plan A - Code language
Plan B - Pictorial language
Plan C - Thee dimensions
Question was based on three categories: Easiest, Middle, and Hardest.
N = Number of respondents
Note: Highest percentages are in bold

More than half of lay people (75.0%) found plan C (three dimensions) 'the best' in showing what the building may look like, while plan A (code language) was noted as 'the worst' (82.22%).

Generally, a two-dimensional plan drawing is not designed to show what the building may look like, so it is not surprising that the three dimensional drawing (plan C) was voted by lay people as 'the best' drawing in depicting the appearance of the building. It provided a potential for lay people to read and relate the proposal of architectural design to the final built object. With the two-dimensional drawing, it was difficult for lay people to convert from two to three dimensional projections. They understood the three-dimensional representation, which appears closer to the real object than the two-dimensional representation, which is flat and graphically represented.

This, therefore, suggests the limitation of knowledge level and decoding skill of the audience. Architects may be able to simply imagine and convert the drawing from two to three dimensions because they are educated and trained to do so.

Question 6: Which drawing clearly provides information on scale and size?

Table 6.8: Percentile scores obtained from Lay people: Question 6-part 1

	Plan A (N)	Plan B (N)	Plan C (N)
Best	11.83% (42)	**49.86% (177)**	**38.59% (137)**
Medium	22.25% (79)	**40.85% (145)**	36.62% (130)
Worst	**65.92% (234)**	9.30% (33)	24.79% (88)
Total	100% (355)	100% (355)	100% (355)

Plan A - Code language
Plan B - Pictorial language
Plan C - Thee dimensions
Question was based on three categories: Easiest, Middle, and Hardest.
N = Number of respondents
Note: Highest percentages are in bold

The majority of lay people (49.86%) agreed that plan B (pictorial language) is 'the best' drawing that shows scale and size of the building. It appears from some of the written comments, lay people note, '*Furniture inside each room or even symbols of door and window gives a clue of the scale of rooms and of the whole building*' (see Appendix E). Interestingly, plan A (code language) was noted by 65.92% of lay people as 'the worst' in providing scale information. This result may come as a surprise. According to what is prescribed by architectural culture, plan A as a straightforward coded drawing is generally considered as the basic communication tool in providing and explaining information on the dimensioning of the building (see Ching (1976), Fraser and Henmi (1994)). It is taken for granted that such technical or coded drawing is considered as the effective medium in communicating within the architectural context, and as such is widely employed within professional practice.

According to lay people's viewpoints, on the other hand, plan A turned out to be 'the worst' drawing in this question. This showed the difference between lay people's attitude and the culture, and associated assumptions, of architects. This suggested that architects can no longer assume what they (architects) have always taken for granted, that lay people will understand in the same way as they (architects) do.

In conclusion, part one of the test showed how pictorial representation was seen by lay people as 'the best' medium in providing a whole picture of the drawing and 'the easiest' for lay people to understand. As we shall see, the pictorial language, which uses an approachable, even 'friendly', way of representation, provides the means for lay people to recall their memory and experience of place. They can simply engage and understand the drawing, for example one says that furniture as an 'everyday life object' or 'familiar object' within plan B helps him to understand drawing better because it looks similar to his home (see Appendix E). In contrast, plan A, which is conventionally drawn as a plan drawing, was seen as 'the worst'. One of lay people commented that he has to look between reading keys and the drawing, and this is confusing for him. He feels uncomfortable with this and suggests that the drawing should have all its information in one place (see Appendix E).

What is also interesting in the results is that for three successive questions (2, 3, and 4), each of the three drawings was chosen as the 'best' (C, A, and B respectively). This suggests that, even within the limitations of the plan, one mode of drawing is more appropriate than another depending on the purpose of the drawing. Again this questions normative practice in which one mode of plan has to cover all purposes. Even at this quite basic level, the research suggests lessons for practice, namely in the need to be flexible and sensitive in choosing how to represent plans.

More importantly, we have now seen how the results obtained from some of the questions counter what may have been expected. This suggests that the lay audience has a different set of priorities and skills than are catered for by normative architectural drawings. The background and personal experience of the audience become crucial factors that influence or cause the 'inconsistency' of the responses. Since lay people have no or little architectural background, they seem to prefer certain types of drawing that they feel comfortable with from their first glance. For some purposes, this is the drawing that most clearly relates to their experience of space, for others it is the drawing that most clearly provides keys for decoding. As shall be discussed later, these first findings will inform the development of what we shall call the 'communicative drawing'.

In the following sections the quantitative findings obtained from first year and diploma architectural students are presented. The comparative studies between lay people and two groups of architectural student are subsequently shown. The studies relates to the previous hypothesis raised; noted that (1) the group of first year students may be considered as being similar to non-architects, in regard to their level of architectural knowledge; and (2) the diploma students who may considered as close to professional architects and as they are fully educated in architecture, see the plan drawing differently.

6.3.1.2 First Year Architectural Students (part one)

Table 6.9: Percentile scores obtained from First year architectural students: Question 1 to 6 -part 1

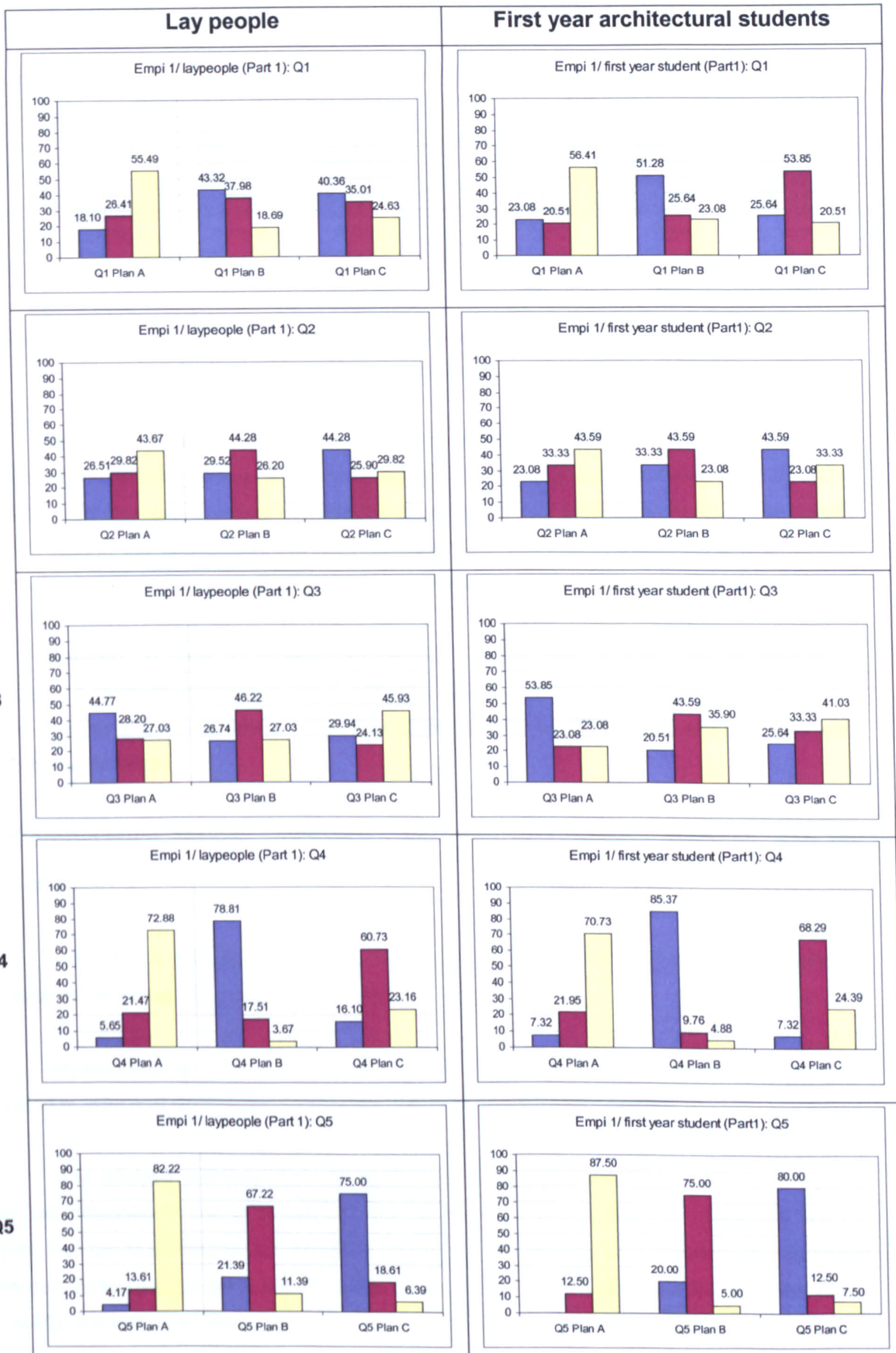
Questions		Plan A (N)	Plan B (N)	Plan C (N)
Question 1: Which drawing is generally the easiest to understand?	**Best**	23.08% (9)	**51.28% (20)**	25.64% (10)
	Medium	20.51% (8)	25.64% (10)	**53.85% (21)**
	Worst	**56.41% (22)**	23.08% (9)	20.51% (8)
	Total	100% (39)	100% (39)	100% (39)
Question 2: Which drawing clearly provides information on the relationship between rooms?	**Best**	23.08% (9)	33.33%(13)	**43.59% (17)**
	Medium	33.33% (13)	**43.59% (17)**	23.08% (9)
	Worst	**43.59% (17)**	23.08% (9)	33.33% (13)
	Total	100% (39)	100% (39)	100% (39)

Question 3: Which drawing clearly describes how to move from one room to another?	**Best**	**53.85% (21)**	20.51% (8)	25.64% (10)
	Medium	23.08% (9)	**43.59% (17)**	33.33% (13)
	Worst	23.08% (9)	35.90% (14)	**41.03% (16)**
	Total	100% (39)	100% (39)	100% (39)
Question 4: Which drawing clearly describes the use of the building?	**Best**	7.32% (3)	**85.37% (35)**	7.32% (3)
	Medium	21.95% (9)	9.76% (4)	**68.29% (28)**
	Worst	**70.73% (29)**	4.88% (2)	24.39% (10)
	Total	100% (41)	100% (41)	100% (41)
Question 5: Which drawing clearly shows what the building may look like?	**Best**	0.00%	20.00% (8)	**80.00% (32)**
	Medium	12.50% (5)	**75.00% (30)**	12.50% (5)
	Worst	**87.50% (35)**	5.00% (2)	7.50% (3)
	Total	100% (40)	100% (40)	100% (40)
Question 6: Which drawing clearly provides information on scale and size?	**Best**	17.50% (7)	**45.00% (18)**	37.50% (15)
	Medium	15.00% (6)	42.50% (17)	**42.50% (17)**
	Worst	**67.50% (27)**	12.50% (5)	20.00% (8)
	Total	100% (40)	100% (40)	100% (40)

Plan A - Code language / Plan B - Pictorial language / Plan C - Thee dimensions
Question was based on three categories: Easiest, Middle, and Hardest.
N = Number of respondents
Note: Highest percentages are in bold

From table 6.9, quantitative findings obtained from first year architectural students seemed consistent with those of the lay people. In Question 1, for example, which asked in a general manner which drawing is the easiest to understand; half of the first year students (51.28%) agreed that plan B (pictorial language) is the easiest drawing to understand, while plan A (code language) was noted as the most difficult (56.41%). One might have expected that the socialisation of the architectural students into architectural culture would already have been in progress, and their context in an architecture school would have introduced them to the rudimentary skill of being able to understand the technical codes of plan A; but these codes appear to be as much a mystery to first year students as they are to lay people.

Moreover, in Question 2, which asked which drawing provides the clearest information about relationship between rooms; the findings again appear to be consistent with those of lay people, and again we can see that first year students, without a developed architectural knowledge, preferred the drawing that relates better to the reality of space (plan C - three dimensional drawing) rather than the conventional drawing (plan A - technical representation). One first year student comments that, without confidence in architectural knowledge, they would rather '*have someone explain the drawing*' than try to read and decode it themselves (see Appendix E).


Lay people
First year architectural students
Q1
Empi 1/ laypeople (Part 1): Q1
18.10 26.41 55.49
43.32 37.98 18.69
40.36 35.01 24.63
Q1 Plan A
Q1 Plan B
Q1 Plan C
Empi 1/ first year student (Part1): Q1
23.08 20.51 56.41
51.28 25.64 23.08
25.64 53.85 20.51
Q2
Empi 1/ laypeople (Part 1): Q2
26.51 29.82 43.67
29.52 44.28 26.20
44.28 25.90 29.82
Q2 Plan A
Q2 Plan B
Q2 Plan C
Empi 1/ first year student (Part1): Q2
23.08 33.33 43.59
33.33 43.59 23.08
43.59 23.08 33.33
Q3
Empi 1/ laypeople (Part 1): Q3
44.77 28.20 27.03
26.74 46.22 27.03
29.94 24.13 45.93
Q3 Plan A
Q3 Plan B
Q3 Plan C
Empi 1/ first year student (Part1): Q3
53.85 23.08 23.08
20.51 43.59 35.90
25.64 33.33 41.03
Q4
Empi 1/ laypeople (Part 1): Q4
5.65 21.47 72.88
78.81 17.51 3.67
16.10 60.73 23.16
Q4 Plan A
Q4 Plan B
Q4 Plan C
Empi 1/ first year student (Part1): Q4
7.32 21.95 70.73
85.37 9.76 4.88
7.32 68.29 24.39
Q5
Empi 1/ laypeople (Part 1): Q5
4.17 13.61 82.22
21.39 67.22 11.39
75.00 18.61 6.39
Q5 Plan A
Q5 Plan B
Q5 Plan C
Empi 1/ first year student (Part1): Q5
12.50 87.50
20.00 75.00 5.00
80.00 12.50 7.50

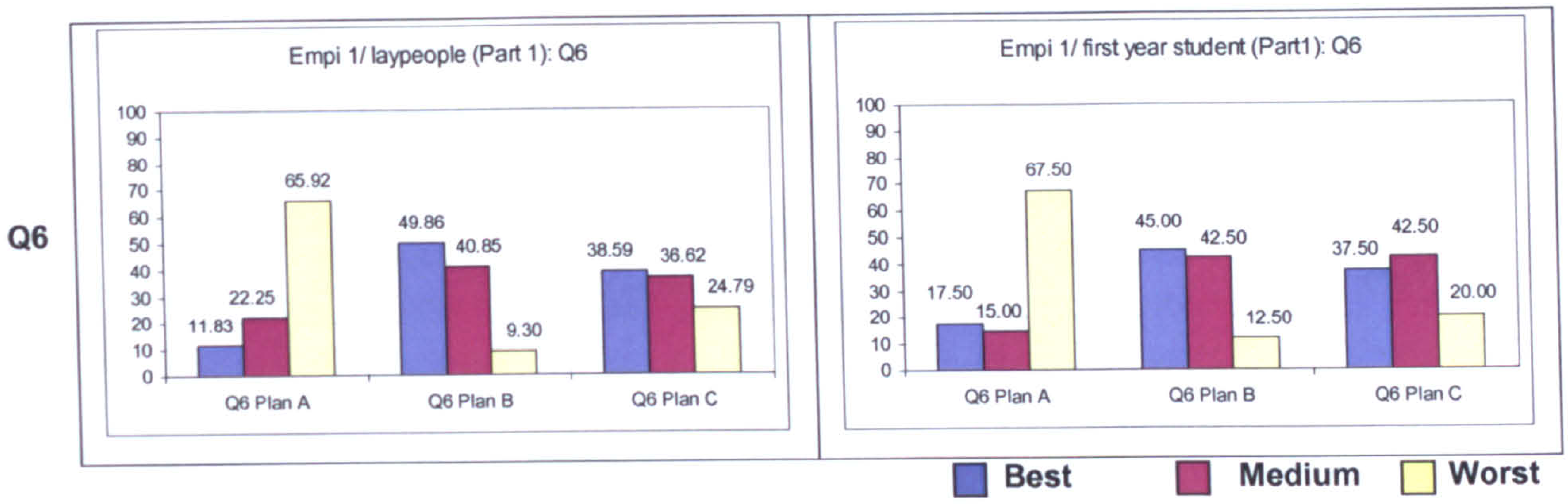


Figure 6.1: Graphs comparing percentile scores received from Lay people and First year students: Question 1 to 6 -part 1

Taking all six questions together, most of first year students' results corresponded with those obtained from lay people; with a preference for the pictorial representation (plan B) and a relatively high disapproval rating for technical drawing (plan A) (see Figure 6.1). These results tend to confirm the expectation that both groups have a similar way of seeing and reading architectural plan drawings, particularly at a basic level.

However, in order to compare lay people and first year architectural students more rigorously, a statistical analysis is introduced. As mentioned in the earlier chapter, a Chi-square test is used as a basic statistical method to significantly verify the way in which both groups relate to the drawings.

a) **Comparative Study:** Comparing first year architectural students with lay people - part 1

This section compares the way in which lay people and first year architectural students relate to the drawings. The following hypothesis is tested:

Hypothesis (a): '*There is a significant difference in the way in which conventional plan drawing is seen and read by lay people and first year architectural students*'.

The analysis is explored by the results of a Chi-square test. The test is used to prove that two independent samples (Lay people versus First year architectural students) are not equal. The two tailed test at 95% confident interval (α = 0.05) was used to detect any difference between these two groups of respondents. Thus, if the p-value is less than the significant level ($p \geq 0.05$), the null hypothesis (H0), which means there is no difference between the two groups of respondents, is rejected.

However, because of the large difference between numbers of the respondents (41 first year students and 379 lay persons), Chi-square test is calculated by relying on the value of percentile scores, and computed by using the following formula (6.1) (see Siegel (1956: 104)), through 'CHITEST' in the Excel programme.

$$x^2 = \sum_{i=1}^{r} \sum_{j=1}^{k} \frac{(O_{ij} - E_{ij})^2}{E_{ij}} \tag{6.1}$$

where O_{ij} = observed number of cases categorised in *i*th row of *j*th column

E_{ij} = number of cases expected under H_0 to be categorised in *i*th row of *j*th column

$\sum_{i=1}^{r} \sum_{j=1}^{k}$ directs one to sum over all (*r*) rows and all (*k*) columns, i.e., to sum over all cells

Percentile scores compared between lay people and first year architectural students, and results computed by Chi-square test are shown in the following table.

Table 6.10: Percentile scores and results of the Chi-square test, comparing first year architectural students with lay people: Question 1 to 6 -part 1

Q	Status	Percentile scores (%)			Chi square test	
		best	medium	worst	X^2 value	P-value
Q1 Plan A	Lay people	18.10	26.41	55.49	1.352	0.509
	First year	23.08	20.51	56.41		
Q1 Plan B	Lay people	43.32	37.98	18.69	3.525	0.172
	First year	51.28	25.64	23.08		
Q1 Plan C	Lay people	40.36	35.01	24.63	7.653	**0.022***
	First year	25.64	53.85	20.51		
Q2 Plan A	Lay people	26.51	29.82	43.67	0.4324	0.806
	First year	23.08	33.33	43.59		
Q2 Plan B	Lay people	29.52	44.28	26.20	0.4339	0.805
	First year	33.33	43.59	23.08		
Q2 Plan C	Lay people	44.28	25.90	29.82	0.3629	0.834
	First year	43.59	23.08	33.33		
Q3 Plan A	Lay people	44.77	28.20	27.03	1.659	0.436
	First year	53.85	23.08	23.08		
Q3 Plan B	Lay people	26.74	46.22	27.03	2.149	0.342
	First year	20.51	43.59	35.9		
Q3 Plan C	Lay people	29.94	24.13	45.93	12.481	**0.002***
	First year	25.64	33.33	41.03		
Q4 Plan A	Lay people	5.65	21.47	72.88	0.2525	0.881
	First year	7.32	21.95	70.73		
Q4 Plan B	Lay people	78.81	17.51	3.67	2.6359	0.268
	First year	85.37	9.76	4.88		
Q4 Plan C	Lay people	16.10	60.73	23.16	3.7664	0.152
	First year	7.32	68.29	24.39		
Q5 Plan A	Lay people	4.17	13.61	82.22	4.381	0.112

	First year	0	12.50	87.50		
Q5 Plan B	Lay people	21.39	67.22	11.39	2.964	0.227
	First year	20.00	75.00	5.00		
Q5 Plan C	Lay people	75.00	18.61	6.39	1.450	0.484
	First year	80.00	12.50	7.50		
Q6 Plan A	Lay people	11.83	22.25	65.92	2.5259	0.283
	First year	17.50	15.00	67.50		
Q6 Plan B	Lay people	49.86	40.85	9.30	0.7514	0.687
	First year	45.00	42.50	12.50		
Q6 Plan C	Lay people	38.59	36.62	24.79	0.9649	0.617
	First year	37.50	42.50	20.00		

Questions were based on three-point (nominal) scale: Best / Easiest, Medium / Middle, and Worst / Hardest.
X^2 value = Chi square value ($p \leq 0.05$) df = 2
P value = Significant level (two-tailed)
* The test proves the significant difference at $p \leq 0.05$ level

At ($p \leq 0.05$), there is no significant difference found in most of the questions. The Chi-square test significantly indicated that there is no significant difference in the way in which the conventional plan drawing is seen and read by lay people and first year architectural students. The results showed significant differences in the way in which lay people and first year students see and read the conventional plan drawing in two questions: Q1 plan C (p=0.022) and Q3 plan C (p=0.002). This can be interpreted that the conventional plan C, concerning aspects in explaining general information and circulation of a plan drawing, is seen and read differently by lay audience and first year students.

However, the test significantly confirms the raised hypothesis; namely the similarity in the way in which lay people and first year architectural students see and read a conventional plan drawing at a basic level.

6.3.1.3 Diploma Architectural Students (part one)

Table 6.11: Percentile scores obtained from Diploma architectural students: Question 1 to 6 -part 1

Questions		Plan A (N)	Plan B (N)	Plan C (N)
Question 1: Which drawing is generally the easiest to understand?	**Best**	27.00% (10)	**54.10% (20)**	18.90% (7)
	Medium	**37.80% (14)**	**40.50% (15)**	21.60% (8)
	Worst	35.10% (13)	5.40% (2)	**59.50% (22)**
	Total	100% (37)	100% (37)	100% (37)
Question 2: Which drawing clearly provides information on the relationship between rooms?	**Best**	25.00% (9)	**44.40% (16)**	30.60% (11)
	Medium	38.90% (14)	8.30% (3)	**52.80% (19)**
	Worst	36.10% (13)	**47.20% (17)**	16.70% (6)
	Total	100% (36)	100% (36)	100% (36)

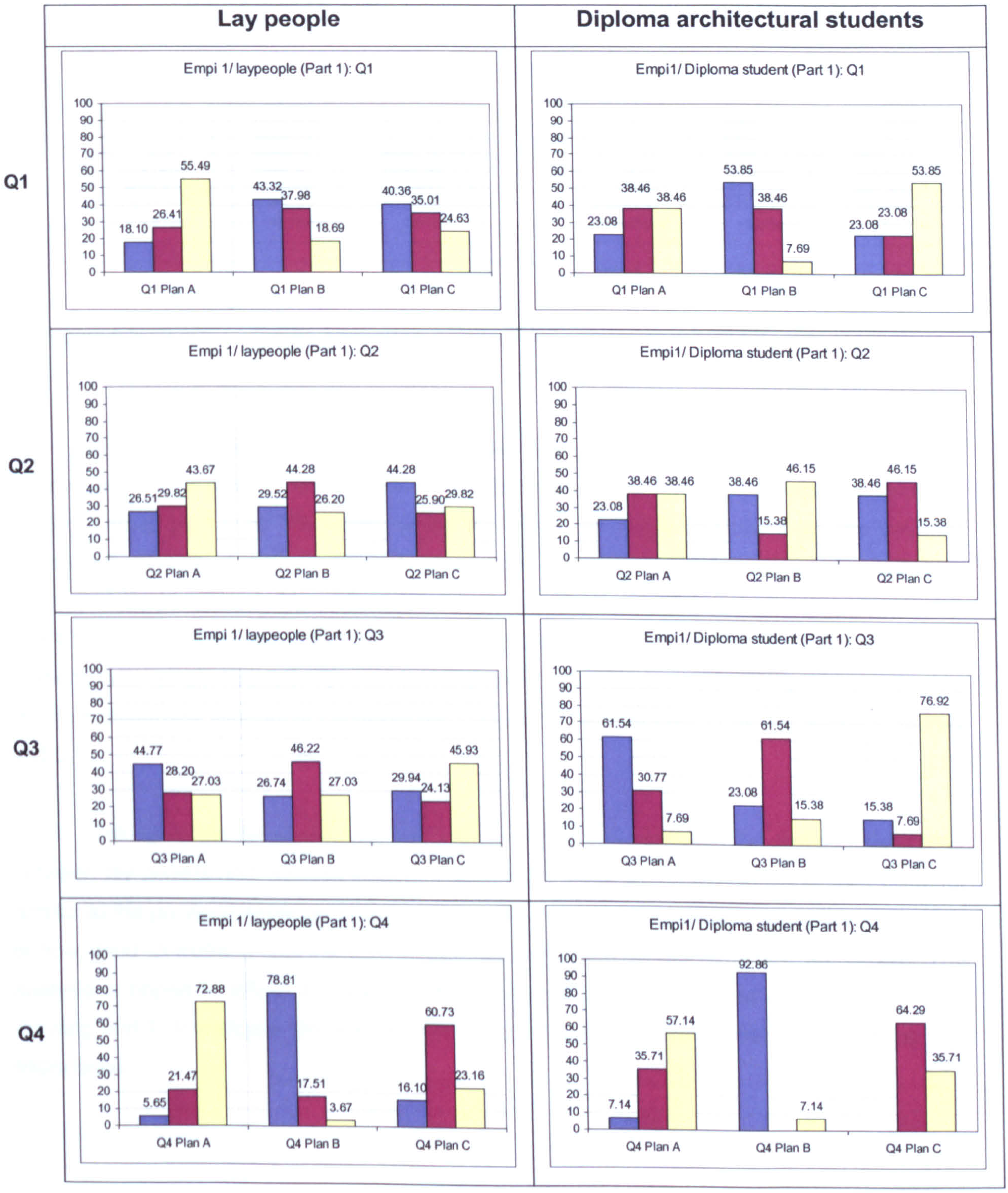
Question 3: Which drawing clearly describes how to move from one room to another?	**Best**	**63.90% (23)**	22.20% (8)	13.90% (5)
	Medium	27.80% (10)	**63.90% (23)**	8.30% (3)
	Worst	8.30% (3)	13.90% (5)	**77.80% (28)**
	Total	100% (36)	100% (36)	100% (36)
Question 4: Which drawing clearly describes the use of the building?	**Best**	7.90% (3)	**92.10% (35)**	0.00%
	Medium	36.80% (14)	0.00%	**63.20% (24)**
	Worst	**55.30% (21)**	7.90% (3)	36.80% (14)
	Total	100% (38)	100% (38)	100% (38)
Question 5: Which drawing clearly shows what the building may look like?	**Best**	0.00%	7.90% (3)	**92.10% (35)**
	Medium	21.10% (8)	**71.10% (27)**	7.90% (3)
	Worst	**78.90% (30)**	21.10% (8)	0.00%
	Total	100% (38)	100% (38)	100% (38)
Question 6: Which drawing clearly provides information on scale and size?	**Best**	7.90% (3)	**57.90% (22)**	34.20% (13)
	Medium	13.30% (5)	21.10% (8)	**65.80% (25)**
	Worst	**78.90% (30)**	21.10% (8)	0.00%
	Total	100% (38)	100% (38)	100% (38)

Plan A - Code language / Plan B - Pictorial language / Plan C - Thee dimensions
Question was based on three categories: Easiest, Middle, and Hardest.
N = Number of respondents
Note: Highest percentages are in bold

According to table 6.11, the findings obtained from diploma architectural students appeared to be quite different from those of lay people. In Question 1, half of diploma students (54.10%) found the pictorial representation (plan B) easy to understand and has 'the best' potential in conveying overall information. Interestingly, 59.50% noted plan C (three-dimensional drawing) as 'the worst' drawing. One diploma student comments, '*Three-dimensional drawing or perspective is an illusion, which distorts information and visual within the drawing. So it may not be able to convey a clear message to the audience*' (see Appendix E). In Question 2, almost half of diploma students (44.40%) not only noted plan B (pictorial language) as 'the best', but 47.20% also claimed it as 'the worst' in providing information on spatial arrangements.

It can be noticed that most results obtained from diploma students seemed more significant than those obtained from lay people or even from first year students. In Question 3, for example, 77.8% of diploma students noted plan C (three dimensional) as 'the worst' in explaining circulation, which is higher than the lay person did (45.93%). Interestingly, there was no response for 'the best' in plan C in Question 4 and plan A in Question 5, and for 'the worst' in plan C in both Question 5 and 6 (see Table 6.11). This suggests that diploma students were much clearer in the preferences (and prejudices) than either lay people or first year students.

There is an unexpected result in Question 6, where the majority of diploma students found plan B (pictorial language) best in explaining scale and size of the building (57.90%), whilst plan A (code language) was noted as 'the worst' drawing with a very high percentage of 78.90%. It may come as a surprise that plan A, as the most technical drawing, was noted by diploma student as 'the worst' in providing information on scale and size of the building. This seems to be in contrast to what the architectural culture prescribes; that technical drawing is basically used to explain a building's dimensions (see Ching (1976), Fraser and Henmi (1994)).



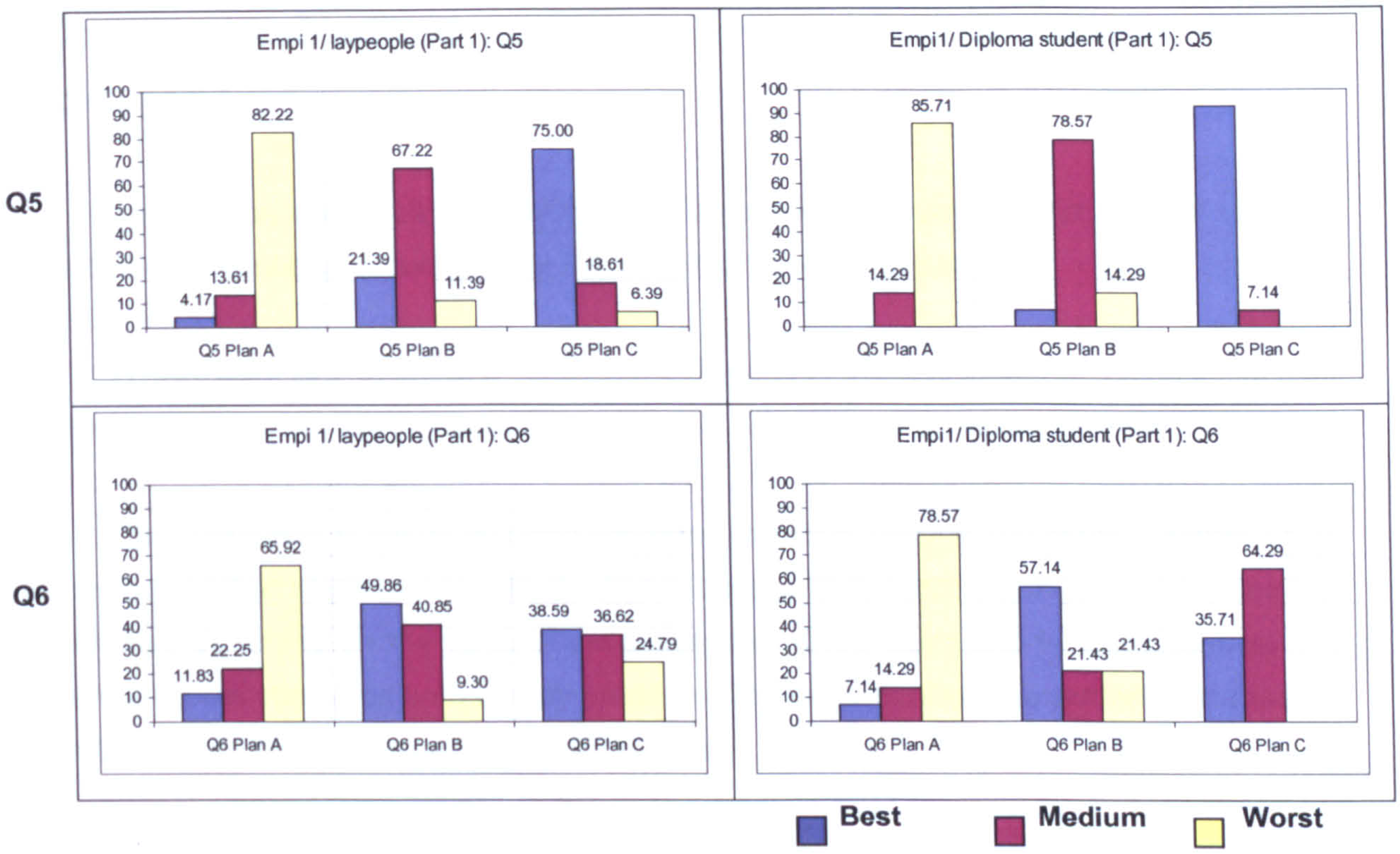


Figure 6.2: Graphs comparing percentile scores received from Lay people and Diploma students: Question 1 to 6 -part 1

Graphs in figure 6.2 comparing between lay people and diploma students reveal differences in their results. In Question 1, for example, more than half of diploma students (53.85%) noted plan C as 'the worst', whilst 40.36% of lay people claimed it as 'the best'. In Question 2, 44.40% of diploma students found plan B best in explaining relationship between rooms, but lay people noted plan C as 'the best' instead with 44.28% and plan A as 'the worst' with 43.67%. Furthermore, in Question 6, diploma students clearly see plan B, C, and A as best, medium, and worst, respectively, in explaining scale and size of the building. Meanwhile, lay people's responses seemed to be varied and indecisive, particularly the results shown in plan B and C.

Taking all the questions together, the results strongly suggest the potential difference between lay people and diploma student's perception towards the conventional plan drawing. Similar to the previous analysis between lay people and first year students, a statistical analysis is now used to make a rigorous comparison between diploma students and lay people. The analysis is hoped to inform the way in which both groups see and read a conventional plan drawing and to investigate the means used by people from different levels of knowledge and experience.

b) Comparative Study: Comparing diploma architectural students with lay people - part 1

This section compares the way in which lay people with diploma architectural students relate to the conventional drawings. The following hypothesis is tested.

Hypothesis (b): '*There is a significant difference in the way in which conventional plan drawing is seen and read by lay people and diploma architectural students*'.

The hypothesis is tested by using the same statistical method and analytical process as the previous section of comparative study. Again, because of the difference in numbers, the test is calculated by relying on the value of percentile scores and computed by using formula 6.1. Percentile scores compared between lay people and diploma architectural students, and results of the Chi-square test are shown in the following table.

Table 6.12: Percentile scores and results of the Chi-square test, comparing diploma architectural students with lay people: Question 1 to 6 -part 1

Q	Status	Percentile scores (%)			Chi square test	
		best	medium	worst	X^2 value	*P*-value
Q1 Plan A	Lay people	18.10	26.41	55.49	8.366	**0.015***
	Diploma	27.00	37.80	35.10		
Q1 Plan B	Lay people	43.32	37.98	18.69	1.483	0.476
	Diploma	54.10	40.50	21.60		
Q1 Plan C	Lay people	40.36	35.01	24.63	25.398	**0.000***
	Diploma	18.90	21.60	59.50		
Q2 Plan A	Lay people	26.51	29.82	43.67	1.964	0.375
	Diploma	25.00	38.90	36.10		
Q2 Plan B	Lay people	29.52	44.28	26.20	33.624	**0.000***
	Diploma	44.40	8.30	47.20		
Q2 Plan C	Lay people	44.28	25.90	29.82	15.394	**0.000***
	Diploma	30.60	52.80	16.70		
Q3 Plan A	Lay people	44.77	28.20	27.03	13.302	**0.001***
	Diploma	63.90	27.80	8.30		
Q3 Plan B	Lay people	26.74	46.22	27.03	7.747	**0.024***
	Diploma	22.20	63.90	13.90		
Q3 Plan C	Lay people	29.94	24.13	45.93	21.874	**0.000***
	Diploma	13.90	8.30	77.80		
Q4 Plan A	Lay people	5.65	21.47	72.88	6.813	**0.033***
	Diploma	7.90	36.80	55.30		
Q4 Plan B	Lay people	78.81	17.51	3.67	20.085	**0.003***
	Diploma	92.10	0.00	7.90		
Q4 Plan C	Lay people	16.10	60.73	23.16	19.252	**0.004***
	Diploma	0.00	63.20	36.80		

Q5 Plan A	Lay people	4.17	13.61	82.22	5.852	**0.054***
	Diploma	0.00	21.10	78.90		
Q5 Plan B	Lay people	21.39	67.22	11.39	9.224	**0.010***
	Diploma	7.90	71.10	21.10		
Q5 Plan C	Lay people	75.00	18.61	6.39	12.470	**0.002***
	Diploma	92.10	7.90	0.00		
Q6 Plan A	Lay people	11.83	22.25	65.92	4.261	0.119
	Diploma	7.90	13.20	78.90		
Q6 Plan B	Lay people	49.86	40.85	9.30	11.479	**0.003***
	Diploma	57.90	21.10	21.10		
Q6 Plan C	Lay people	38.59	36.62	24.79	33.369	**0.000***
	Diploma	34.20	65.80	0.00		

Questions were based on three-point (nominal) scale: Best / Easiest, Medium / Middle, and Worst / Hardest.
X^2 value = Chi square value ($p \leq 0.05$) df = 2
P value = Significant level (two-tailed)
* The test proves the significant difference at $p \leq 0.05$ level

In most questions, the Chi-square test revealed significant differences in the way in which conventional plan drawing is seen and read by lay people and diploma architectural students (at $p \leq 0.05$). The test significantly indicated that both groups see and read the conventional drawings differently concerning aspects included in the above questions.

The results also showed no significant differences between the way in which both groups see and read the conventional plan A and B in questions: Q1 plan B (p=0.476), Q2 plan A (p=0.325), and Q6 plan A (p=0.110). This can be interpreted that the conventional plan B (concerning aspects in explaining general information) and plan A (concerning aspect in showing relationship between rooms and scale of the building) are seen and read differently by lay audience and diploma students.

Thus, the test showed significant differences between diploma students and lay people at a basic level of seeing and reading architectural drawing. Moreover, findings obtained from diploma students seem to be more bunched than those of lay people. Experience helps the diploma respondents to respond to the plan at first glance, to realise what information to search for, and finally to make a definite decision. The group of diploma architectural students, who have been educated in, and involved with, architectural drawing, make their decisions in a clearer and more definite manner than lay people, who have less experience or never engaged with architectural drawing before.

To conclude, part one only suggested how three different groups of respondents see and read the plan drawing at a basic level of understanding; this being achieved by asking general questions. In part two, respondents require deeper thought or knowledge to interpret the drawings; the study here thus examines responses at a more detailed level. Quantitative findings obtained from part two are examined and discussed in the next section, and a comparative study between lay people and the two groups of architectural students is then carried out.

It is important to note that the analysis of the difference between first year and diploma architectural students is not carried out because the research and the test aim to examine and compare non-architects with architects.

6.3.2 Part Two

The fundamental aim of the second part of 'Draw the Line Questionnaire 1' is to examine the way in which lay people and architects interpret and understand a conventional plan drawing. The questions not only considered respondents' ability of seeing and reading the plan drawing at a basic level, but also focused on their system of interpretation at a more detailed level of understanding. There were two sets of questions asked against three different mediums of plan drawing (plan A, B and C);

a) True-false questions: Q7-12, 15-20, and 23-28; respondents were requested to indicate whether the given statement is 'true', 'false', or 'don't know' (undecided).
b) Open questions: Q13-14, 21-22, and 29-30; respondents were asked to supply feedback on each drawing.

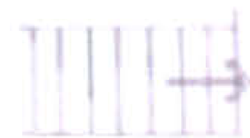
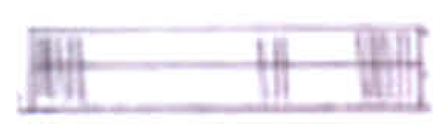
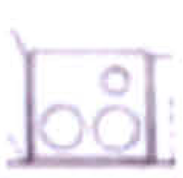
At the end of the questionnaire, one additional question (Q31) asked respondents 'what would make them understand an architectural drawing better?' With the 'true/false' questions, it is hoped to find out how much respondents are able to read and understand the details of an architectural drawing, while the received feedback is expected to indicate their system of interpretation and the criteria they use in understanding the conventional plan drawing.

The results are reviewed in the form of tables of percentages and frequency, according to the three different groups of respondents.

6.3.2.1 Lay people (part two)

Table 6.13: Percentile scores of true/false questions obtained from Lay people: part 2

	Questions	Percentages and (No. of respondents)		
		Right Answer	Wrong Answer	Don't know
Plan A	Q 7: The drawing shows a horizontal slice through the building.	85.7 (324)	8.5 (32)	5.8 (22)
	Q 8: Information about the height of rooms is provided by this drawing.	95.5 (358)	1.1 (4)	3.5 (13)
	Q 9: If you walk out from the bedroom, you can walk straight to the bathroom, or turn to the living room and the kitchen.	88.0 (324)	6.3 (23)	5.7 (21)

	Q 10: This symbol represents a window. 	**88.3** (332)	**1.3** (5)	**10.4** (9)
	Q 11: This symbol represents tiled floor. 	**94.9** (357)	**1.1** (4)	**4.0** (15)
	Q 12: This symbol represents a sliding door. 	**88.9** (335)	**5.0** (19)	**6.1** (23)
Plan B	Q 15: This drawing is drawn to scale.	**41.5** (152)	**10.7** (39)	**47.8** (175)
	Q 16: All the rooms lead off the hallway.	**94.5** (344)	**3.3** (12)	**2.2** (8)
	Q 17: The stair is enclosed with walls on both sides.	**33.4** (123)	**29.9** (110)	**36.7** (135)
	Q 18: You can look outside the house when you are washing dishes.	**86.8** (317)	**4.9** (18)	**8.2** (30)
	Q 19: This symbol represents a book shelf. 	**19.3** (72)	**16.1** (60)	**64.6** (241)
	Q 20: This symbol represents a cooker. 	**92.0** (344)	**0.8** (3)	**7.2** (27)
Plan C	Q 23: This is the ground floor level of the building.	**58.8** (217)	**7.3** (27)	**33.9** (125)
	Q 24: This is a one-storey building.	**64.4** (241)	**5.3** (20)	**30.2** (113)
	Q 25: The toilet is the smallest room.	**85.8** (313)	**3.0** (11)	**11.2** (41)
	Q 26: There are 5 doors in this drawing.	**81.5** (303)	**10.2** (38)	**8.3** (31)
	Q 27: There is no window in the hallway.	**94.2** (338)	**2.2** (8)	**3.6** (13)
	Q 28: This drawing provides information about how to move around the building.	**81.9** (304)	**12.9** (48)	**5.1** (19)

Q13-14, 21-22, and 29-30 (Open questions) is shown in Table 6.14

Notes: Results showing that lay people have a difficulty in understanding the plan drawing is underlined

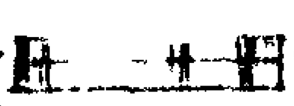
Table 6.14: Percentile scores of open questions obtained from Lay people: part 2

	Questions	Percentages and (Frequency) Yes (N)	No (N)
Plan A	Q 13: Does the drawing provide information for you to understand what the building may look like?	**37.7** (136)	**62.3** (225)
	Q 14: Does the drawing provide information for you to understand how the building is used?	**76.2** (276)	**23.8** (86)
Plan B	Q 21: Does the drawing provide information for you to understand how the building may look like?	**66.2** (233)	**33.8** (119)
	Q 22: Does the drawing provide information for you to understand how the building is used?	**98.1** (353)	**1.9** (7)

Plan C	Q 29: Does the drawing provide information for you to understand what the building may look like?	**69.9** (248)	**30.1** (107)
	Q 30: Does the drawing provide information for you to understand how the building is used?	**78.4** (279)	**21.6** (77)

In general, lay people answered the true/false questions quite accurately, but there were some significant moments when they seemed to have a difficulty in interpreting and understanding the plan drawings, namely Questions 15, 17, 19, 23, and 24.

Question 15 asked whether or not plan B (pictorial language) is drawn to scale. At first glance, lay people instantly search for relevant information on building's scale in order to read and understand the drawing. However, plan B as a pictorial drawing does not definitively provide such information, but instead contains furniture as a key of explanation. This is why almost half of lay people (47.8%) answered 'do not know' and 10.7% of them answered the question wrong. However, 41.5% of them managed to score correct answers. **Question 17** asked against plan B (pictorial language), whether or not the stairs are enclosed with walls on both sides. 36.7% of lay people indicated that they 'do not know', while 29.9% scored wrong answers. In part one, however, plan B was previously considered as 'the best' drawing in providing information and basic understanding for lay people, but more than half of the lay people (29.9% wrong and 36.7% do not know) apparently could not read and understand plan B in this question.

Question 19 asked against plan B (pictorial language); whether or not this symbol () represents a bookshelf. Generally, an architectural symbol is considered as a communicative tool for the architects. Some architects consider it as their own private language and sometimes create their own symbols or codes. The code used here is not a generally accepted one, but for the author was absolutely clear in its intent. However, these private codes can cause confusion for the external audience. As can be noticed from this question; more than half of lay people (64.6%) indicated that they cannot recognise the symbol, while 16.1% of them scored wrong answers. Only 19.3% managed to score 'correct' answers.

This suggests a crucial problem in the way that architects utilise architectural symbols. Without knowledge in reading and understanding architectural symbols, lay people are not able to appropriately interpret and understand architectural drawings. This suggests that architectural symbols need to be carefully chosen to be part of a more generally understood language of signs and should avoid private or technical codification.

Question 23 asked whether it is true or false that plan C (Three dimensions) shows a ground floor level of a building, the correct answer being that it was false. Interestingly, almost fifty percent of lay people (33.9% in do not know and 7.3% in wrong) were not able to indicate a floor level from the three-dimensional drawing. This is probably because plan C (Three dimensions) is not generally designed for providing information on a building's floor levels.

Moreover, without explanatory notes, the drawing can be read in differing ways depending on the individual. Written comments by lay people include: *'This drawing might have more than ten floors below or above'* and *'Who knows what is at the bottom of the stairs? A cellar? 35 other floors? A door to the outside?'* (see Appendix E). Thus, lay people would rather choose 'do not know' than give a definite answer of right or wrong.

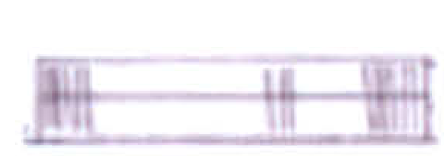
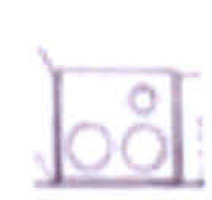
Question 24 asked whether it is true or false that plan C (Three dimensions) is a one-storey building. In plan C, stairs act as a code indicating that the building must have more than one storey. This is considered as a basic knowledge that every architect would know, however one third of lay people are unable to read and understand the drawing in this respect; 30.2% of them noted that they do not know, while 5.3% scored wrong answers This may be considered as a relatively minor aspect in understanding an architectural drawing, but the confusion in communication is enough to suggest, again, that architects should not take the knowledge level or interpretative skills of a lay audience for granted.

The questions in table 6.14 concerning what the building looks like and how it may be used support the findings from 'true/false' questions and also questions from part one, 66.2% and 69.9% of lay people respectively agreed that plans B and C are able to provide information on what the building may look like. On the other hand 62.3% of them thought that plan A cannot provide such information. Furthermore, they agreed that whilst all three of plans A, B, and C were able to provide information of how building is used, plan B (pictorial drawing) received by far the highest score.

In conclusion, the results obtained from lay people support the previous argument mentioned in part one: that what an architect has taken for granted, such as basic knowledge in architectural conventions, is actually difficult for others to comprehend. Trained architects assume that others would know and understand everything as they do. In fact, the external audience such as lay people, who have no architectural knowledge, are unable to understand some basic architectural codes. They have completely different levels of knowledge, and different backgrounds, which limit and differentiate their way of reading and interpreting an architectural drawing. Therefore, a more comprehensible method of coding needs to be considered if a more faithful system of communication is to be achieved. This will be addressed in the next chapter.

6.3.2.2 First year Architectural students (part two)

Table 6.15: Percentile scores of true/false questions obtained from First year architectural students: part 2

	Questions	Percentages and (No. of respondents)		
		Right Answer	Wrong Answer	Don't know
Plan A	Q 7: The drawing shows a horizontal slice through the building.	**87.5** (35)	**12.5** (5)	**0.0** (0)
Plan A	Q 8: Information about the height of rooms is provided by this drawing.	**92.7** (38)	**2.4** (1)	**4.9** (2)
Plan A	Q 9: If you walk out from the bedroom, you can walk straight to the bathroom, or turn to the living room and the kitchen.	**95.1** (39)	**2.4** (1)	**2.4** (1)
Plan A	Q 10: This symbol represents a window. 	**95.1** (39)	**0.0** (0)	**4.9** (2)
Plan A	Q 11: This symbol represents tiled floor. 	**97.6** (40)	**0.0** (0)	**2.4** (1)
Plan A	Q 12: This symbol represents a sliding door. 	**100.0** (41)	**0.0** (0)	**0.0** (0)
Plan B	Q 15: This drawing is drawn to scale.	**50.0** (20)	**7.5** (3)	**42.5** (17)
Plan B	Q 16: All the rooms lead off the hallway.	**95.0** (38)	**2.5** (1)	**2.5** (1)
Plan B	Q 17: The stair is enclosed with walls on both sides.	**70.0** (28)	**12.5** (5)	**17.5** (7)
Plan B	Q 18: You can look outside the house when you are washing dishes.	**95.0** (38)	**0.0** (0)	**5.0** (2)
Plan B	Q 19: This symbol represents a book shelf. 	**15.0** (6)	**35.0** (14)	**50.0** (20)
Plan B	Q 20: This symbol represents a cooker. 	**92.5** (37)	**0.0** (0)	**7.5** (3)
Plan C	Q 23: This is the ground floor level of the building.	**69.2** (27)	**0.0** (0)	**30.8** (2)
Plan C	Q 24: This is a one-storey building.	**85.0** (34)	**2.5** (1)	**12.5** (5)
Plan C	Q 25: The toilet is the smallest room.	**85.0** (34)	**0.0** (0)	**15.0** (6)
Plan C	Q 26: There are 5 doors in this drawing.	**87.5** (35)	**10.0** (4)	**2.5** (1)
Plan C	Q 27: There is no window in the hallway.	**95.0** (38)	**0.0** (0)	**5.0** (2)
Plan C	Q 28: This drawing provides information about how to move around the building.	**89.7** (35)	**7.7** (3)	**2.6** (1)

Q13-14, 21-22, and 29-30 (Open questions) is shown in Table 6.16

Notes: Results showing that first year students have a difficulty in understanding the plan drawing is underlined

Table 6.16: Percentile scores of open questions obtained from First year architectural students: part 2

	Questions	Percentages and (Frequency)	
		Yes (N)	No (N)
Plan A	Q 13: Does the drawing provide information for you to understand what the building may look like?	35.0 (14)	65.0 (26)
	Q 14: Does the drawing provide information for you to understand how the building is used?	85.0 (34)	15.0 (6)
Plan B	Q 21: Does the drawing provide information for you to understand what the building may look like?	57.5 (23)	42.5 (17)
	Q 22: Does the drawing provide information for you to understand how the building is used?	97.5 (39)	2.5 (1)
Plan C	Q 29: Does the drawing provide information for you to understand what the building may look like?	84.6 (33)	15.4 (6)
	Q 30: Does a drawing provide information for you to understand how the building is used?	82.1 (32)	17.9 (7)

Table 6.15 clearly shows that first year students managed to score correct answers in most of the questions. The scores of correct answers in some questions appear to be higher than those obtained from the group of lay people, for example Question12 (all first year students (100%) managed to score correct answers) and Question17 (70% of them could score correct answers). However, there were results obtained from some questions appeared to be consistent with those of lay people; Questions15, 19, and 23.

Question 15 whether or not plan B (pictorial language) is drawn to scale. Whilst half of first year students answered correctly, it is surprising that 42.5 % of them indicated that they do not know and 7.5% scored wrong answers. Similar to those of Lay people, 50% of first year students indicated that they do not know this symbol () in **question 19**. There were 35.0% of them scoring wrong answers, which is actually higher than the scores of lay people (16.1%), while only 15.0% managed to answer correctly, which is lower than lay people's obtain score (19.3%). This may come as surprise that first year architectural students are worse than lay people in reading particular symbol in architectural drawing, though it may also point to the private, and thus ambiguous, nature of that particular code. In **Question 23**, even though 69.2% of first year students managed to answer correctly, there were still 30.8% of them who indicated that they do not know or were not able to ascertain basic information about floor levels.

Table 6.16 shows broad consensus with the results from Part one and also those obtained from lay people.

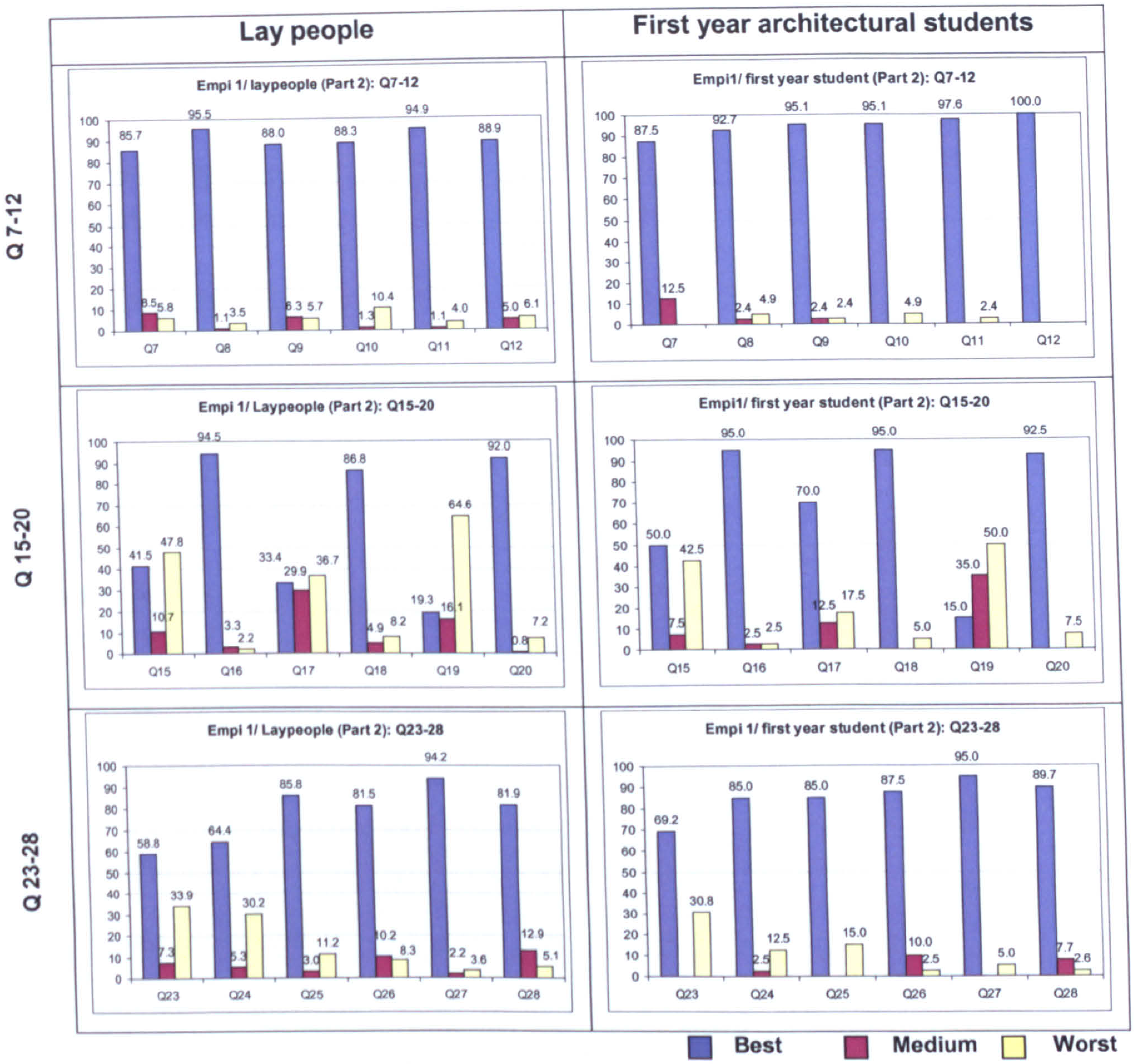


Figure 6.3: Graphs comparing percentile scores received from Lay people and First year students: part 2

By taking all the questions together, the knowledge level of the first year students and their experience in reading an architectural drawing and symbol does not seem to be that much different from lay people. This can be related to part one which revealed that lay people and first year architectural students superficially see conventional drawings in the same way. A statistical test is now introduced to see if they also see drawings at a more detailed level in the same way. Again a statistical method (Chi square) is used as an analytical tool in making a rigorous comparison between first year students and lay people. Results obtained from the statistical computation is hoped to significantly verify the way two groups relate to the conventional drawing.

c) Comparative Study: Comparing first year architectural students with lay people - part 2

This section compares the way in which lay people and first year students relate to the conventional drawing at a more detailed level. The following hypothesis is tested.

Hypothesis (c): *'There is a significant difference in the way in which conventional plan drawing is interpreted and understood by lay people and first year architectural students'.*

Based on the same statistical method and analytical process as part one, percentile scores are compared between lay people and first year architectural students and results computed by Chi-square test are shown in the following table.

Table 6.17: Percentile scores and results of the Chi-square test, comparing first year architectural students with lay people: part 2

Q	Status	Percentile scores (%)			Chi square test	
		Right answer	Wrong answer	Don't know	X^2 value	P-value
Q7 Plan A	Lay people	85.71	8.47	5.82	6.518	**0.038***
	First year	87.80	12.20	0.00		
Q8 Plan A	Lay people	95.47	1.07	3.47	0.736	0.692
	First year	92.86	2.38	4.76		
Q9 Plan A	Lay people	88.04	6.25	5.71	3.389	0.184
	First year	95.24	2.38	2.38		
Q10 Plan A	Lay people	88.30	1.33	10.37	3.673	0.159
	First year	95.24	0.00	4.76		
Q11 Plan A	Lay people	94.95	1.06	3.99	1.504	0.471
	First year	97.62	0.00	2.38		
Q12 Plan A	Lay people	88.86	5.04	6.10	11.797	**0.003***
	First year	100.00	0.00	0.00		
Q15 Plan B	Lay people	41.53	10.66	47.81	1.646	0.439
	First year	50.00	7.5.00	42.50		
Q16 Plan B	Lay people	94.51	3.30	2.20	0.131	0.937
	First year	95.00	2.50	2.50		
Q17 Plan B	Lay people	33.42	29.89	36.68	26.862	**0.000***
	First year	70.00	12.50	17.50		
Q18 Plan B	Lay people	86.85	4.93	8.22	6.080	**0.048***
	First year	95.00	0.00	5.00		
Q19 Plan B	Lay people	19.30	16.09	64.61	9.401	**0.009***
	First year	15.00	35.00	50.00		
Q20 Plan B	Lay people	91.98	0.80	7.22	0.807	0.668
	First year	92.50	0.00	7.50		
Q23 Plan C	Lay people	58.81	7.32	33.88	8.318	**0.016***
	First year	69.23	0.00	30.77		

Q24 Plan C	Lay people	64.44	5.35	30.21	11.207	**0.004***
	First year	85.00	2.50	12.50		
Q25 Plan C	Lay people	85.75	3.01	11.23	3.555	0.169
	First year	85.00	0.00	15.00		
Q26 Plan C	Lay people	81.45	10.22	8.33	3.357	0.187
	First year	87.50	10.00	2.50		
Q27 Plan C	Lay people	94.15	2.23	3.62	2.455	0.293
	First year	95.00	0.00	5.00		
Q28 Plan C	Lay people	81.94	12.94	5.12	2.544	0.280
	First year	89.74	7.69	2.56		

Questions were based on three choices: Right, Wrong, and Don't know (or Undecided)
X^2 value = Chi square value ($p \leq 0.05$) df = 2
P value = Significant level (two-tailed)
* The test proves the significant difference at $p \leq 0.05$ level, by using Chi square test
Question13, 14, 21, 22, 29, and 30 are open (yes-no) question, which are not shown in this section.

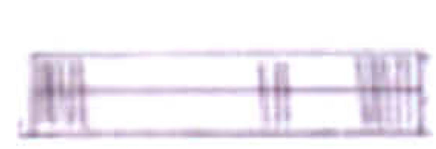
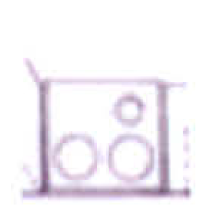
Significant differences were found at ($p \leq 0.05$) in Questions 7, 12, 17, 18, 19, 23, and 24. The Chi-square significantly showed that there is a significant difference in the way in which a conventional plan drawing is interpreted and understood by lay people and first year architectural students. As can be also noticed from the percentile scores of these questions, first year students not only interpret differently, but also understand better than lay people. For example, the students scored more correct answers in Questions 12, 17, and 18, which respectively asked about architectural symbols and basic knowledge of architectural drawing, as well as in Question 23 and 24, in which some codes were needed to indicate floor and building levels. It is also interesting in Question 19 that more than 50% of both lay people and first year students indicated that they do not know the symbol for a bookshelf.

The results also showed no significant differences between both groups in the remaining questions. The test significantly suggested that there is no difference between them in interpreting and understanding the conventional drawing, in particular aspects in showing some architectural symbols, circulation and scale of the building, as well as in explaining the basic term of a plan drawing.

This therefore suggests that, on one hand, the group of first year students may be considered as being similar to lay people regarding their level of architectural knowledge, but on the other hand, they may be considered different because of their differences in terms of socialisation and expectation. Since the first year students have already been in the architectural education and influenced by the architectural culture, they may, to a certain extent, superficially see the drawing in a similar way to lay people, but at a more detailed level interpret and understand them differently. Knowing even basic elements of an architectural drawing has already given more advantages and potential in the ability to understand.

6.3.2.3 Diploma Architectural students (part two)

Table 6.18: Percentile scores of true/false questions obtained from Diploma students: part 2

	Questions	Percentages and (Frequency)		
		Right	Wrong	Don't know
Plan A	Q 7: The drawing shows a horizontal slice through the building.	**100.0** (38)	**0.0** (0)	**0.0** (0)
	Q 8: Information about the height of rooms is provided by this drawing.	**100.0** (38)	**0.0** (0)	**0.0** (0)
	Q 9: If you walk out from the bedroom, you can walk straight to the bathroom, or turn to the living room and the kitchen.	**94.7** (36)	**0.0** (0)	**5.3** (2)
	Q 10: This symbol represents a window. 	**100.0** (38)	**0.0** (0)	**0.0** (0)
	Q 11: This symbol represents tiled floor. 	**100.0** (38)	**0.0** (0)	**0.0** (0)
	Q 12: This symbol represents a sliding door. 	**100.0** (38)	**0.0** (0)	**0.0** (0)
Plan B	Q 15: This drawing is drawn to scale.	**47.4** (18)	**15.8** (6)	**36.8** (14)
	Q 16: All the rooms lead off the hallway.	**100.0** (38)	**0.0** (0)	**0.0** (0)
	Q 17: The stair is enclosed with walls on both sides.	**100.0** (38)	**0.0** (0)	**0.0** (0)
	Q 18: You can look outside the house when you are washing dishes.	**100.0** (38)	**0.0** (0)	**0.0** (0)
	Q 19: This symbol represents a book shelf. 	**63.2** (24)	**13.2** (5)	**23.7** (9)
	Q 20: This symbol represents a cooker. 	**100.0** (38)	**0.0** (0)	**0.0** (0)
Plan C	Q 23: This is the ground floor level of the building.	**86.8** (33)	**0.0** (0)	**13.2** (5)
	Q 24: This is a one-storey building.	**92.1** (35)	**0.0** (0)	**7.9** (3)
	Q 25: The toilet is the smallest room.	**100.0** (38)	**0.0** (0)	**0.0** (0)
	Q 26: There are 5 doors in total in this drawing.	**100.0** (38)	**0.0** (0)	**0.0** (0)
	Q 27: There is no window in the hallway.	**100.0** (38)	**0.0** (0)	**0.0** (0)
	Q 28: This drawing provides information about how to move around the building.	**73.7** (28)	**26.3** (10)	**0.0** (0)

Q13-14, 21-22, and 29-30 (Open questions) is shown in Table 6.19

Notes: Results showing that diploma students have a difficulty in understanding the plan drawing is underlined

Table 6.19: Percentile scores of open questions obtained from Diploma students: part 2

	Questions	**Percentages and (Frequency)** Yes (N)	No (N)
Plan A	Q 13: Does the drawing provide information for you to understand what the building may look like?	**44.7** (17)	**55.3** (21)
	Q 14: Does the drawing provide information for you to understand how the building is used?	**76.3** (29)	23.7 (9)
Plan B	Q 21: Does the drawing provide information for you to understand what the building may look like?	**71.1** (27)	**28.9** (11)
	Q 22: Does the drawing provide information for you to understand how the building is used?	**92.1** (35)	**7.9** (3)
Plan C	Q 29: Does the drawing provide information for you to understand what the building may look like?	**76.3** (29)	**23.7** (9)
	Q 30: Does the drawing provide information for you to understand how the building is used?	**92.1** (35)	**7.9** (3)

Because of their more comprehensive architectural knowledge and the longer period in education, it is expected that diploma students should be able to score more correct answers than the two previous groups (lay people and first year students). As can be noticed from table 6.18, most of the questions were answered correctly by diploma students. However, there were only two questions that they seemed to have difficulty in interpreting and understanding the drawings: Questions15 and 19.

In **Question 15**, less than half of diploma students answered correctly (42.9%), while 35.7 % of them indicated that they did not know that plan B (pictorial language) is drawn to scale, with 21.4% of them giving wrong answers; this latter has a higher percentage of wrong answers than those obtained from lay people and first year students. Plan B did not have a normal indication of scale but used furniture as a code. Without the conventional indication of scale, diploma students became indecisive and did not feel confident with their answer. Thus, they rather choose 'do not know' than make a definite decision of 'right' or 'wrong', or even ended up choosing the wrong answer. This suggests that for all groups of people, some definitive indication of scale is necessary to avoid confusion.

64.3% of diploma students could read this symbol () in **question 19**, while there were 35.7% of them could not read and gave undecided answers; 21.4% indicated that they do not know and 14.3% scored wrong answers. Whilst the results here are better than for the other two groups, they still suggest that ambiguous codes should not be used.

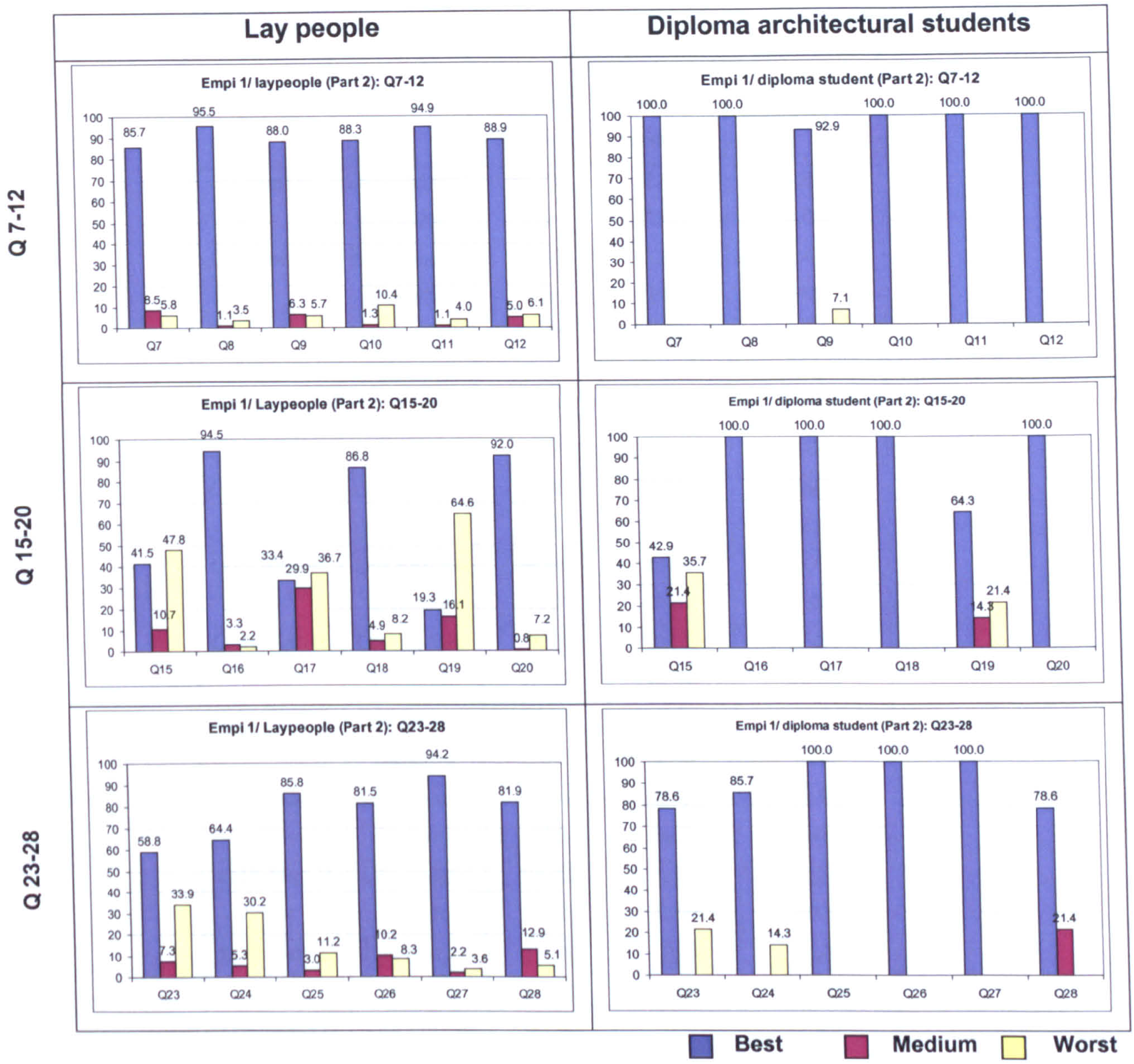


Figure 6.4: Graphs comparing percentile scores received from Lay people and Diploma students: part 2

Similar to the previous sections of comparative study, the comparison between lay people and diploma students is now made.

d) **Comparative Study:** Comparing diploma architectural students with lay people - part 2

In this part, most of the questions were answered correctly by diploma students, thus a statistical analysis was therefore not seen to be useful here. This section therefore broadly compares diploma students and lay people based on their percentile scores.

The percentile scores received from lay people and diploma architectural students are compared in table 6.20.

Table 6.20: Percentile scores comparing diploma architectural students with lay people: part 2

Q	Status	Percentile scores (%)		
		Right answer	Wrong answer	Don't know
Q7 Plan A	Lay people	85.71	8.47	5.82
	Diploma	100	0.00	0.00
Q8 Plan A	Lay people	95.47	1.07	3.47
	Diploma	100	0.00	0.00
Q9 Plan A	Lay people	88.04	6.25	5.71
	Diploma	94.7	0.00	5.3
Q10 Plan A	Lay people	88.3	1.33	10.37
	Diploma	100	0.00	0.00
Q11 Plan A	Lay people	94.95	1.06	3.99
	Diploma	100	0.00	0.00
Q12 Plan A	Lay people	88.86	5.04	6.1
	Diploma	100	0.00	0.00
Q15 Plan B	Lay people	41.53	10.66	47.81
	Diploma	47.40	15.80	36.80
Q16 Plan B	Lay people	94.51	3.3	2.2
	Diploma	100	0.00	0.00
Q17 Plan B	Lay people	33.42	29.89	36.68
	Diploma	100	0.00	0.00
Q18 Plan B	Lay people	86.85	4.93	8.22
	Diploma	100	0.00	0.00
Q19 Plan B	Lay people	19.30	16.09	64.61
	Diploma	63.20	13.20	23.70
Q20 Plan B	Lay people	91.98	0.8	7.22
	Diploma	100	0.00	0.00
Q23 Plan C	Lay people	58.81	7.32	33.88
	Diploma	86.8	0.00	13.2
Q24 Plan C	Lay people	64.44	5.35	30.21
	Diploma	92.10	0.00	7.90
Q25 Plan C	Lay people	85.75	3.01	11.23
	Diploma	100	0.00	0.00
Q26 Plan C	Lay people	81.45	10.22	8.33
	Diploma	100	0.00	0.00
Q27 Plan C	Lay people	94.15	2.23	3.62
	Diploma	100	0.00	0.00
Q28 Plan C	Lay people	81.94	12.94	5.12
	Diploma	73.70	26.30	0.00

Questions were based on three choices: Right, Wrong, and Don't know (or Undecided)
Q13, 14, 21, 22, 29, and 30 are open (yes-no) question, which are not shown in this section.
Notes: Results showing that both groups have a difficulty in understanding the plan drawing is underlined

In regards to percentile scores received from lay people and diploma students, the test showed a difference in the way in which conventional plan drawing is interpreted and understood by them. This can be noticed from the questions where 100% of diploma student answered the questions correctly. Moreover, percentile scores also indicated that diploma students seemed to interpret and understand the drawings better than lay people. Even in the questions that were not answered correctly by all the diploma students, they still managed to score more correct answers than lay people: Questions 15 and 19 plan B, and Questions 23 and 24 plan C,

However interesting findings were found in table 6.20. Firstly, in Question 15, which as we have seen has a degree of ambiguity in it which is apparently confusing to all groups, less than half of both lay people and diploma students could indicate the scale of the conventional plan B. This suggests that scale becomes one of the most problematic issues faced by three groups of respondents. Subsequently in Question 28, where 81.94% of lay people found plan C useful in providing information for how to move around the building, there were 26.30% of diploma students who disagreed with this respect. As can be assumed, diploma students may consider plan C as the drawing for showing building's appearance, while plan A for explaining circulation.

6.3.3 Summary of Quantitative Findings

To conclude, the quantitative results suggest two main findings. First, the similarity between lay people and first year architectural students in terms of seeing and interpreting a conventional plan drawing. They see and read a plan drawing similarly, particularly at first glance. Both groups apparently have some difficulty in reading and understanding a conventional plan drawing; in particular the results showed that what some architects take for granted is actually difficult for lay people or first year students to understand. At a more detailed level of understanding, however, differences in ability to interpret begin to open up between lay people and first year students. It is concluded that because of their socialisation and early training, first year architects have begun to assimilate and understand architectural codes.

Secondly, the findings and statistical tests suggest a significant difference between architects (as represented by diploma students) and non-architects. The results showed that the diploma students are not only able to understand drawings better, but also they tend to prefer different types of drawings to lay people. This suggests that over the course of their education, certain methods of drawing become normative and unquestioned. This is not only a matter of knowledge or experience giving them the skills to both encode and decode drawings, but also a matter of architectural culture in prescribing what the 'correct' and 'proper' codes should be to create 'correct' and 'proper' architectural drawings, as well as to eventually become a 'proper' architect. The rules fixed by the culture lead drawing to become an internalised system of codes and this turns out to be ambiguous or incomprehensible for the public at large. Architects know how and where to search for relevant or necessary information in reading and understanding a conventional drawing, but are not aware that this same skill is not shared with an external audience. They do not aware of lay audience sufficiently.

This breakdown is particularly apparent in part two of the questionnaire in which lay people had more difficulty in answering questions involving code, technical approaches or using architectural symbols. These questions require architectural experience, thus they become more difficult for laypeople to read and comprehend. Instead of using architectural knowledge, some lay people managed to answer them by drawing on personal experience, common sense, or even instinct; as one of the comments states: *'the stair helps me to see that they go down somewhere'* (see Appendix E). He or she did not look at the stair as a communicative code but as a recognisable object from his or her experience of space.

These results suggest the need for architects to be more aware of their communicative tools and the methods of creating drawings. Architects may need to be more receptive to the ability of their audience and more flexible in the way that they produce drawings to take into account the differing role that each drawing may have, and the context within which it is to be interpreted.

6.4 Qualitative Findings: the First Empirical Test

This section reviews the qualitative feedback received from open Questions: 13-14 (Plan A), 21-22 (Plan B), 29-30 (Plan C), and 31 in 'Draw the Line Questionnaire 1' (see selected qualitative feedbacks in Appendix E). However, the most important feedback is obtained from Question 31, which asked respondents to suggest potential factors in helping them understand an architectural plan drawing better. This will also be useful in the development of the 'communicative drawing' in later stages.

The feedback is summarised in table 6.21; in accordance with the three different groups of respondents. The feedback was selected by concentrating on critical views of the respondents; for example the comments that indicate how a respondent thinks of the conventional drawings and what makes them understand the drawings better. This includes advantages and disadvantages they found in the interpreting of conventional drawings.

6.4.1 Summary of Qualitative Findings

Table 6.21: Qualitative feedbacks obtained from 'Draw the Line Questionnaire 1'

Qualitative feedbacks			
Questions	**Diploma architectural students**	**First year architectural students**	**Lay people**
Q1: What do you think of drawings?	1) Rooms labelled helps them to understand the drawing; including annotations and titling.	1) Labels, annotations, titling, and texts.	1) Labelling.

Q2: What make you read and understand drawings better?	2) Furniture layout indicates how the spaces are used.	2) Furniture and layout of rooms.	2) Furniture arrangement and incorporation of familiar things to appropriate scale.
	3) Everyday objects such as bed or sink indicate spatial experience that helps to understand how space might work. (i.e. 'I know what a kitchen or toilet looks like and where they are.')	3) Everyday objects: doors and windows (Many of first year students mentioned it and were concerned about it.), i.e. width of doors may use as a reference of scale.	3) Day to day objects such as a bed or sink.
	6) Human figure.	6) Human figures and car.	6) People (could make drawing become alive).
	7) Scale.	7) Scale.	7) Statement indicates that a drawing is drawn to scale.
	8) Keys indicate a room's location.	8) Keys.	8) Keys indicate a room's location.
	9) Indication of surfaces, materials and textures.	9) Indication of surface and material.	9) Walls indicate depth.
	10) Height of building.	10) Size and height of rooms.	10) Simple and basic drawing.
	11) Colour and shading.	11) Colour and style of the building.	11) A drawing that has all needed information in one place.
	12) Walls indicate depth.	12) Cartoon furniture.	12) A drawing that gives an idea of any dark corner that may exist.
	13) Contextual perspective and atmospheric information.	13) Roof layout.	13) More contexts given.
	14) Other primary orthogonal drawing such as section, elevation, axonometric and perspective.	14) Different types of drawing.	14) Other architectural drawings.
	15) The use of three-dimensional representations.	15) The use of three-dimensional representations.	15) The use of three-dimensional representations.
	16) Architectural symbols that are recognisable.	16) Point out any architectural symbols used.	16) Definition of symbols.
	17) Additional drawings.	17) Drawing shows exterior of the building, such as elevation.	**17) More details and information for disabled people.**
	18) Indication of habitation and users.	18) A drawing that have been seen before.	18) The drawing should be drawn with artistic impression.
	19) Sketch or photograph.	19) **Having someone to explain the drawing**, (this strongly shows how similar first year students	19) **Ask an architect.**

	are to non-architects).	
20) Building's proportion and mass of building.	**20) Indication showing how occupants move around the space.**	**20) An explanation by the person who has drawn the drawing.**
21) A drawing showing other parts of the building.	21) Surrounding.	**21) Education, do an architectural degree.**
22) Drawings that demonstrate intention for inhabitation of designer, because it strongly shows the designer's point of views.	22) Show doors, windows, ceiling and masonry.	22) Experience and training, to have more knowledge about drawing and symbols used.
23) The use of architectural symbols and simple sign language, such as an arrow on the stair, doors, and windows.	23) Orientation and site information.	**23) User friendly drawing.**
24) The use of diagram as shorthand for expressing information to people, in particular professionals who are used to reading plans. (They claim they think diagrammatically.)	24) A key or instruction on how to read the drawing.	24) Depends on what one wants to know.
25) Lighting, Window areas and wall space give an idea how dark and light of the rooms.	25) Clear line drawn, not too dark or heavy and large scale.	25) Lager print.
26) Information on how the space might be used.	26) Eye level view.	26) Cartoon.
27) Information on how users live in the space.	27) Simple drawing (Without too many lines).	**27) I don't need to understand architectural drawing.**
28) Configuration of space, such as basic relationship between rooms and spatial arrangement, help to understand the drawing.	28) Functionality indicates what the place actually is.	28) Information satisfactorily conveyed.
	29) Complete architectural course.	29) A combination of drawings and photographs.
	30) Artistic perspective.	**30) Orientation indicates where the sun is coming.**
		31) Short introduction blurb.
		32) Less technical drawing and no more artistic impressions.

			33) Eye level view.
			34) A scaled model.
			35) Superimpose a drawing into real picture.
			36) Electronic versions enabling switching between views or use of colour.
			37) Virtual reality and fly though animation.
			38) The ability to rotate the drawing in real time.
			39) Universal keys.

The qualitative feedbacks show both similarities and dissimilarities among three different groups of respondents. Some of their feedback appears to be comparable across the three groups. For example, all agreed that human figures, texts, scale indications, and everyday objects would help them to read and understand the drawing better, while some of them required more contexts to be given: other types of drawings, the use of three dimensional drawing, and a definition of symbols.

The feedback suggests the way in which lay people and architectural students initially respond to the drawing. Lay people, in particular, respond to the drawing at first glance by using either their personal preference or a judgemental view. The feedback tends to descriptively describe the basic drawn elements, generally focussing on what is lacking in the drawing, and suggesting additional factors that would help them understand the drawing better. Some feedback were not really related to the specifics of the exercise, but commented on the exercise as a whole (See Appendix E);

- *'I don't consider that I need to understand them better'.*
- *'I understand it quite well thank you'.*
- *'I don't need to understand architectural drawing'.*
- *'Ask an architect'.*

Interestingly, these descriptive feedbacks are also found in the groups of architectural student, particularly in diploma students who often provided a critical view.

Diploma students tended to give more critical and abstract feedback, as well as comments related to technical approaches. Instead of comments on basic elements in the drawing, diploma students rather suggested the way the drawing should be drawn or how to draw it better. Most of their suggestions are focused on architectural aspects, based on their architectural knowledge and culture. For example, when they see the drawing, they do not relate it to their personal preference or (human) experience, but instantly thought about architectural and representational issues (see Appendix E):

- *'Building's proportion and mass of building would help them to understand the drawing better'*
- *'Drawings that demonstrate intention for inhabitation of designer, because it strongly shows the designer's point of views'.*
- *'The use of diagram as shorthand for expressing information to people, in particular professionals who are used to reading plans'* (They claim they think diagrammatically).
- *'Configuration of space, such as basic relationship between rooms and spatial arrangement, help to understand the drawing'.*

The qualitative feedback is consistent with Hershberger's (1980) concept of difference in environment meaning; Hershberger notes that architects interpret architecture by using 'representational meaning', while lay people use 'responsive meaning'.[2] As previously mentioned, representational meaning is defined as taking the form of precepts, concepts, and ideas (for example, a building symbolising its design idea or concept) form, style, design approach, design quality, drawing quality, while responsive meaning is affective, evaluative and prescriptive (for example, a judgemental view of liking or disliking a building) preference, building type (see Devlin (1990: 236)).

Within this context, most 'representational meaning' is mostly found in the architectural students' comments, which are based on an 'architectural approach' or are 'architecturally informed', meaning that the comments are informed by architectural knowledge or rely on professional experience or critical judgment. Comments such as these can be shared between architectural peers and often involve more abstract ideas and concepts, for example, certain qualities of a plan drawing, its spatial arrangement, a relationship between drawing and building, and so on. On the other hand, 'responsive meaning' is mostly found in the lay people's written comments. These include descriptive feedback and references to immediate responses from the audience. The feedback is basically informed by their experience of space and related to personal preference, which is unrelated to architectural knowledge but relies on their broad knowledge and individual judgement; for example explanations of the building's features or existing objects within a drawing.

The feedback can be interpreted further by looking at Downing's (1992) research. He defines architects' past experience as an 'image bank', which is explained as the accumulation of an architect's mental imagery of memorable past place-experience. Such memorable past place-experience is mostly gathered during years of education and practice. During years of education, architectural students tend to shift their memorable imagery from the informal (the past experience that is commonly encountered by the individual as a youth through significant places) to a more formal one. They typically gain their experience through books, journals, lectures, and course work. When they enter the practice, formal imagery further reinforces and

[2] See Chapter Four

influences their memorable experiences, gaining their formal experiences by working through a number of projects and with colleagues. Downing argues that "architects keep formal and informal place images separate in their image banks" Downing (1992: 441). This influences the way in which they interpret and understand a plan drawing.

In contrast, lay people have not gained experience of place through years of study, but through informal place imagery; they see and interpret the drawing by relying on their individual background and experience; without relation to any specific knowledge or culture. This leads to the difference in system of interpretation and the way of understanding between architects and non-architects. As Verderber and Moore (1977) suggest that meanings are influenced by 'socio-cultural context' and the 'background of the individual'.

Purcell (1986) notes that people from different backgrounds may differ in their environmental perceptions, which also leads to different interpretations. Purcell claims that experience with environmental situations is a result of 'incoming information' from the environment and the stored representation of prior experience with similar environmental situations. This may suggest the way an architectural drawing is encoded and decoded. The incoming information, socio-cultural context, and the background of individual become important key for architects and non-architects to encode and decode, respectively. Hill (2003) notes that architects' awareness towards the users needs to be better considered. An architect normally considers a user as a passive user: He explains, "The passive user is predictable and unable to transform use, space and meaning. ...The creative user either creates a new space or gives an existing one new meaning and uses. The creative user can either be a reaction to habit, result from the knowledge learned through habit, or be based on habit, as a conscious, evolving deviation from established behaviour" Hill (2003: 28). This notion of the creative user can also be applied to the creative reader of drawings. Both architects and audience have a role in the creation of meaning within architectural drawings, as well as in the experiencing of architecture. Thus, an architect should be aware of the audience's creativity; particularly that they may see and interpret meaning of the drawing in a different way.

6.5 Conclusion: the First Empirical Test

The first empirical test significantly verified that both architects and non-architects not only see and read architectural drawings differently, but they also interpret and understand in a different way, confirming the theoretical argument set out in Chapter Four. Secondly, the test suggested that the different interpretative systems between them would be attributable to the professional education and experience of the two groups. Thirdly, the test revealed that lay people have a difficulty in interpreting and understanding architectural drawings, particularly in terms of the technical and internalised coding systems used by architects.

The next chapter examines the way to improve the communication process between architects and non-architects. Findings analysed and discussed in the first empirical test inform the next stage of this research and are used as criteria in developing an alternative method of architectural drawing; the so called 'communicative drawing'. The drawings will be used and tested in the second empirical test, which is carried out in Chapter Eight.

*

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Chapter 7
Communicative Drawing

Initial sketch for 'Communicative drawing'
(drawn by the author)

Chapter Seven | COMMUNICATIVE DRAWING

Towards the second empirical test

7.1 Introduction

The first empirical test has suggested what architects take for granted is often a mystery to non-architects. Architects do not consider the lay audience sufficiently. The analyses carried out in the first empirical test have revealed a critical problem in communication between lay people and architects; in some cases, the apparent problem in reading and understanding an architectural drawing is also found amongst architects.

The findings revealed that comprehensible communication cannot be guaranteed between lay people who are non-architects. Even though some lay people showed a potential in reading drawings with standard architectural codes, the majority generally found it difficult to understand and to be able to clarify the whole method of conventional codification. Thus, the communicative potential of a conventional plan drawing has become limited and generally communicates best with the internal readers. Whilst conventional methods of coding are presently being developed or improved, and its quality is progressively advanced, through new methods such as computer-aided design, these processes are still carried out mainly for architects rather than an external audience. Moreover, however good or realistic the computer is, architects still need to have a basic set of drawings, such as plans, in order to show basic organisation or principles such as scale or how to get into rooms and so on. Thus the plan drawing will always be essential as a form of communication and it is still needed to show information that a computer cannot. As Lonsway (2002) notes, computer drawings actually exaggerate the problem by making drawings into a further still internalised and technically determined process. Gomez and Pelletier (1992) note further,

> *The question concerning the application of computers to architecture is, of course, hotly debated and as yet unresolved... Computer graphics tends to be just a much quicker and more facile tool that nonetheless still relies on the projection as its base, a radical tool of industrial production... The fact is, however, that the results of computer graphics applications are always disappointing. The objectification of another reality appears more intense, and the tool seems clumsy at best to show animated pictures of a fallacious building. Gomez and Pelletier (1992: 34)*

By responding to this perceived problem, this chapter attempts to develop an alternative method for architectural drawings, which will be designated 'a communicative drawing'; this approach aims to increase the communicative potential of a plan drawing. This 'communicative drawing' will then be used and analysed in the second empirical test; this test aims to examine whether lay people, or even architects, are able to read and understand the 'communicative' drawing better than a conventional one by comparing the communicative potential of each type.

7.2 Forming a Communicative Drawing

This section traces the background theories that may inform the development of the 'communicative drawing'. In the first instance, 'external codes' previously discussed in chapter Three are selected as key influential ideas.

According to Umberto Eco's argument on the codes of architecture (cited in Broadbent et al. (1980)), he notes,

> *While looking outside architecture, then, for the code of architecture, the architect must also fashion his significative forms in such a way that they will remain relevant under different codes of reading. This is because the historical situation in which his attempts to identify a code would be grounded will be outlived by the significative forms he feeds into this situation.* ***The architect may have to get his bearing to some extent from the sociologist, the economist, the psychologist, the anthropologist, and so on, but he must at the same time acknowledge, in the way he fashions forms to answer to the exigencies they have shown him, the possible failure of their hypotheses and the degree of error and obsolescence to which their work is subject. And he must realize throughout that his work will at best cooperate with, not prescribe, the movement of history.*** *Broadbent et al. (1980: 61, my emphasis)*

By following Eco's idea, exploring outside an architectural context may suggest an approach to improving or developing the quality and style of a conventional plan drawing. This might enable architects to open up their speculation and to expose themselves to the world outside the existing professional boundaries and assumptions. The investigation of different forms of external code might not only provide alternative prospects for the architects' encoding process, but also offers more potential for the sent message (drawing) to be better decoded by their audience. As Allen (2000) notes,

> *Today there is an accelerated, spiralling motion whereby materials from outside architecture have been cycled back through the discipline to enlarge architecture's catalogue of available techniques... So the architectural drawing has been replaced by available techniques from outside architecture's culture. So this image culture belongs to the new ways of thinking and seeing that have emerged with modernity..., and force us to see how the practice of architecture has been constantly revised by the complex currents of twentieth century thought. Allen (2000: XXII)*

Thus, a study which crosses boundaries between the inside and outside of the architectural context becomes a key to suggest how to inform the development of the communicative drawing. This is hoped to propose a type of drawing that can be recognised in both contexts, as well as one that can be shared and interpreted by everyone.

Three 'external' approaches are therefore introduced: Map, Diagram, and Graphic representation. These are considered codes, which are generally based on non-architects' language and to which most people are accustomed. The lessons learnt from these three approaches are supplemented with an analysis based on Chapters Two, Three, and Four. Finally, the findings obtained from the first empirical test, in particular the qualitative findings, are also taken into account, as they may inform some criteria of how a communicative drawing may be developed, as well as further recommend a structure for the second empirical test.

7.3 Map: Viewing from Above

Figure7.1: Geographical map Bertin (1983: 329) is presented with variations of textures, lines, and shapes. The keys and symbols are used and worked against legibility and efficiency.

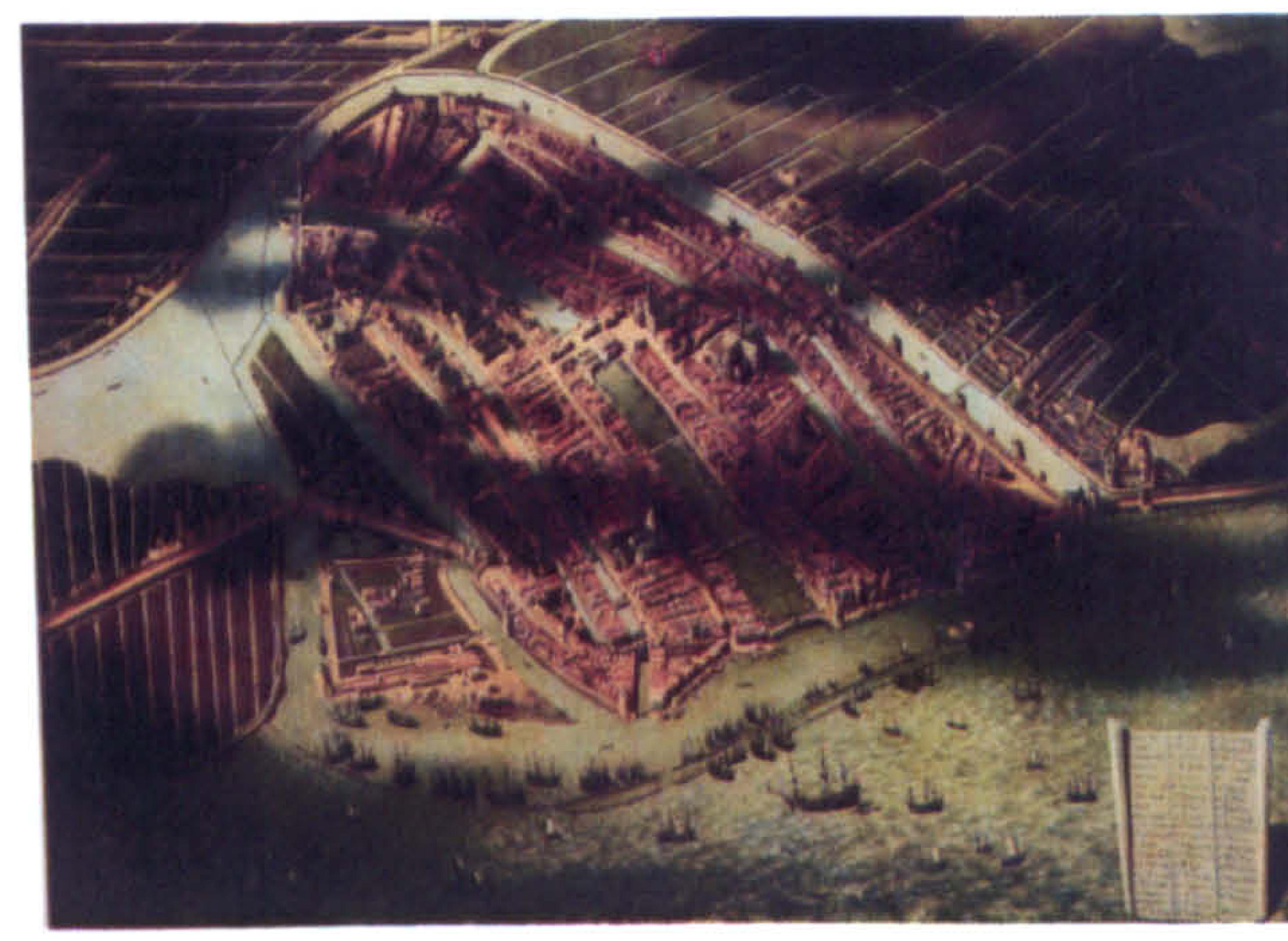


Figure7.2: View of Amsterdam; Micker Jan Christaensz's. Alpers (1983: 87)

The application of the map is first introduced as an approach to developing a communicative drawing. This section attempts to investigate the issues of using maps as a shared language, as well as to analyse any of its advantages which then could possibly be applied to the existing techniques of an architectural plan drawing.

Mapping is guided by a set of codes, techniques, and instruments. Cosgrove (1999) describes the act of mapping; that is to explore some of the contexts and contingencies which have helped shape acts of visualising, conceptualising, recording, representing and creating spaces graphically. She notes,

> *To map is one way or another to take a measure of the world, and more than merely take it, to figure the measure so taken in such a way that it may be communicated between people, places or times. The measure of mapping is not restricted to the mathematical; it may equally be spiritual, political or moral. By the same token, the mapping's record is not confined to the archival; it includes the remembered, the imagined, and the contemplated. The world figured through mapping may thus be material or immaterial, actual or desired, whole or part, in various ways experienced, remembered or projected. Cosgrove (1999: 1-2)*

James Corner (1999) notes that all maps have double-sided characteristics; this creates the agency of mapping. First, their surfaces are directly analogous to actual ground condition;

as horizontal planes, they record the surface of the earth as direct impressions. He notes, "One can put one's finger on a map and trace out a particular route or itinerary, the map projecting a mental image into a spatial imagination" Corner (1999: 215). The other side of their characteristic, by contrast, is the inevitable abstractness of maps. Map devices such as frames, scale, and orientation, projection, indexing and naming reveal artificial geographies that remain unavailable to human eyes. These devices are explained further by Cosgrove (1999); she considers them as 'the consistent features of mapping' which includes:

a) **Scale:** Scale is the fundamental key in mapping process. Scale selection and manipulation is thus central to the communicative potential of the map.
b) **Framing**: Framing is the overall act of surrounding and containing the territory being mapped. This means not only separating inside from outside, but also producing and organising the totality of the aspects within the space so contained.
c) **Selection:** The construction of any map is inevitably an act of editing – one clearly cannot depict everything on the given site. Selection in mapping thus 'generates its own anxieties, many of them circulating around questions of the status of the knowledge presented on the map'. What one selects and what one leaves out of a map is thus a key concern, and one that controls the reception of the information.
d) **Coding:** Information is translated through the complex semiotic systems of cartographic representation, which uniquely combine geometry (in projection, measure, scale, gridding and plotting) and graphic images (conventional signs, colour coding, and calligraphy) with numerical and alphabetic inscriptions and texts.

Taking these basic characteristics of mapping, the similarity between mapping and the process of architectural drawing can be identified. Both applications can be seen to share some basic principles; first, they are based on a concept of viewing from above; and second, they use a set of established codes in order to perform as a means of communication between the maker (a map maker or an architect if referring to a drawing) and the viewer. Cosgrove (1999) introduces the possible connection between maps and an architectural drawing, "Mapping is a process which involves both a 'complex architecture of signs' (graphic elements with internal forms and logics capable of theoretical disconnection from any geographical reference) and a 'visual architecture' through which the worlds they construct are selected, translated, organized and shaped" Cosgrove (1999: 3). By referring to the abstracted features of mapping, moreover, the plan is also controlled by scale and the frame, and just as the map, the plan selects what information to include and exclude. The plan is determined by sets of graphic codes, symbols, techniques, and fixed instructions. It is subjected to the architect's creativity and subjectivity, but overall is prescribed by architectural culture.

However, whilst the map shares many of the principles embedded into the architectural plan, it deploys them in a much more accessible manner, so that its information can be shared and simply interpreted by its audience. As James Corner (1999) points out, unlike a traditional plan drawing, the map can be open ended. The map is not necessarily prescriptive but 'infinitely promising'. Mapping allows information to be articulated, and certain sets of possibility to become actual. He notes,

Thus mapping differs from planning in that it entails searching, finding and unfolding complex and latent forces in the existing milieu rather than imposing a more-or-less idealized project from on high. Moreover, the synoptic imposition of the plan implies a consumption of contextual potential, wherein all that is available is subsumed into the making of the project. Mapping, by contrast, discloses, stages, and even adds potentials for later acts and events to unfold. Whereas the plan leads to an end, the map provides a generative means, a suggestive vehicle that points but does not overly determine. Corner (1999: 228)

In particular, the map becomes the site for expressing the possibility for future occupation and movement; it is common for people to pick up an atlas first to gain direct information ('how far is it from A to B'), but then to get lost in the map as they project themselves into these places ('what is 'A' like?'). As Corner (1999) claims, "There are some phenomena that can only achieve visibility through representation rather than through direct experience" Corner (1999: 229); and this is perceived and constructed through the act of mapping.

The map can be represented in a single image, its content is reduced into the smallest possible number of meaningful shapes or codes in such a way that they can be retained and compared. The map simplifies an actual space and converts into legible codes that represent and explain its spatial organisation. As Bertin (1983) notes, "Cartography, the planner translation of geography order, is the sole means of simplifying the geographic component as a function of spatial relation. There is no other system which can be accomplishing this 'regionalisation' of space" Bertin (1983: 285).

Therefore, this suggests that the map has a greater communicative potential than a normative plan. The study of maps suggests ways in which the act of mapping may enrich experiences and diversify potentials in architectural drawing. The advantages of the map thus inform the development of architectural plan drawing into the communicative drawing, through the following techniques:

1. Maps tend to convey quality rather than quantity. The information is conveyed within one single drawing and with the least possible elements.
2. A map is coded in a comprehensible manner and its codes can be read, interpreted, and understood by everyone. This suggests the codes of architectural drawing should be able to be shared and the relationship between abstractness and the concreteness of information should be balanced.

3. As Nuti (1999) notes, "Mapping places by means of drawing faithful portraits of the world as seen provides a record of visual choices, cultures, and partialities" Nuti (1999: 108). She notes that the visual evidence is presented in maps as a starting-point, as a source of information to be recorded from life and as a point of arrival, a mode of rendering information lifelike. This therefore could be applied into the architectural drawings, in terms of its visual appeal.
4. A map's information is considered limited. This controls the scope of communication and allows information to be properly interpreted by the audience. Again this could be applied in architectural drawing.

7.4 **Diagram:** a Possibility of Fact

As previously mentioned in Chapter Two, there is a theoretical difference between the role of a diagram and the conventional architectural drawing. The diagram, particularly during the twentieth century, does not really focus on the built object, but becomes a reduction of architecture. On the other hand, a conventional architectural drawing focuses on the appearance of a completed architectural project (either speculative or real) and normally aims to describe a project as a tangible built object.

The diagram is often used in architectural practice as a means of summarising a project for other colleagues, a shorthand for the design within the design process – as Peter Eisenman (1999) notes, "it is a graphic shorthand" Eisenman (1999: 27). It has thus developed as a means of internal communication, not intended for a wider audience. Eisenman is one example of an architect who uses the diagram within his own design process, and uses it in a manner that reinforces the internalised and autonomous nature of the design process. He sees architecture to be traditionally concerned with external phenomena such as politics, social conditions, and cultural values. However, he also notes that another tendency 'interiority' is for architecture to examine its own discourse. He sees his work on the diagram as one such examination, "that concerns the possibility that architecture can manifest itself, its own interiority in a realized building" Eisenman (1999: 48). He notes that the analytical and generative device of the diagram is a representation that is not the thing itself. For him, within the interiority of architecture there is also a prior history, the accumulated knowledge of all previous architectures, that he defines as the anteriority of architecture. In between these conditions the diagram is one potential means to articulate architecture's interiority, its sign and its being as a singular characteristic. In '*Diagrams of Anteriority*' Eisenman (1999: 36) refers to different approaches of former architectural works such as Palladio and Gropius (Bauhaus, bubble diagram). Thus, what Eisenman identifies is the internalised nature of the diagram in architectural culture – it becomes an instrument through which the profession detaches itself from external issues, and this is clearly not a good model for the communicative drawing.

However, another trajectory of the diagram is the way that it is used in other disciplines as a means of immediate and explanatory communication for others – in effect as an external instrument. In this light, the diagram becomes another key idea which should be taken into account in the development of the 'communicative drawing'. The advantages and lessons provided by the diagram are hoped to refine the quality and style of conventional architectural drawings. However, before we relate the configuration of the diagram to an architectural drawing, a broader understanding of the diagram is required. There are many researches based on the study of the diagram and the way it communicates (see e.g. Bertin (1983), Eisenman (1999), Lobsinger (2000), Somol (1999), Vidler (2001)). One of the writers who has explained the terminology of the diagram is Deleuze.

In the broader sense of the diagram as a means of representation, Deleuze (1999) claimed that the diagram is the display of the relations between forces which constitute power.

He wrote in the reading of 'Foucault',

The diagram is no longer an auditory or visual archive but a map, a cartography that is coextensive with the whole social field. It is an abstract machine. It is defined by its informal functions and matter and in terms of form makes no distinction between content and expression, a discursive formation and a nondiscursive formation. It is a machine that is almost blind and mute, even though it makes others see and speak. Deleuze (1999: 34)

The diagram is defined by Deleuze (1999) as a map[1] or a display of the relations of power between forces or intensities. He noted, "The diagram or abstract machine is the map of relations between forces, a map of destiny, or intensity, which proceeds by primary non-localizable relations and at every point passes through every point" Deleuze (1999: 36) The diagrams **"make others see and speak"**, meaning that it interacts with the persona of its audience (see Deleuze (1999, my emphasis)).

He explains further,

It never functions in order to represent a persisting world, but produces a new kind of reality, a new model of truth. It is neither the subject of history, nor does it survey history. It makes history by unmaking preceding realities and significations, constituting hundreds of points of emergence or creativity... It doubles history with a sense of continual evolution. Deleuze (1999: 35)

If we now relate this broad philosophical discourse to architectural drawing, it is hoped that the power of representation of the diagram could enhance the communicative potential of the method of coding in architectural drawings. In particular we might follow Deleuze (cited in Boundas (1993)) in suggesting that an architectural drawing considered as a diagram represents **"a possibility of fact – it is not fact itself"** Boundas (1993: 199-200, my emphasis). This refers to Peter Eisenman's reading of the diagram, following Derrida, in terms of the idea of the trace. Eisenman (1999) notes, "**The diagram acts like a surface that retrieves inscriptions from the memory of that which does not yet exists - that is, of the**

[1] In 'A Thousand Plateaus', Deleuze (1988) wrote, "The map is open and connectable in all of its dimensions; it is detachable, reversible, susceptible to constant modification. It can be torn, reversed, adapted to any kind of mounting, reworked by an individual, group, or social formation" Deleuze (1988: 12-3).

potential architectural object. This provides traces of function, enclosure, meaning, and site from the specific conditions" Eisenman (1999: 32, my emphasis). This suggests that the diagram can allow the audience to engage in the drawing in a more open manner.

Vidler (2001) claims that the diagram, at first sight, has little place in architectural practice. Quoting a definition of diagram from the Oxford English Dictionary, he notes that the diagram is,

> *A figure composed of lines, serving to illustrate a definition or statement, or to aid in the proof of a proposition. An illustrative figure which, without representing the exact appearance of an object, gives an outline or general scheme of it, so as to exhibit the shape and relations of its various parts. A set of lines, marks, or tracing which represent symbolically the course or results of any action or process, or the variations which characterize it. A delineation used to symbolize related abstract proposition or mental processes. Vidler (2001: 84)*

Most architects only draw diagrams for internalised use, not for an externalised purpose that can be shown and shared with a client. Most of them would not include these internalised diagrams when participating with a client, in particular when a client wants to be reassured that the project is being taken care of and represented in a tangible manner. However, the diagram can have other purposes other than just internal communication. Vidler refers to Charles Sanders Peirce, who defined the diagram as representing a kind of reasoning and placed it among the kinds of signs he called icons. Peirce (cited in Vidler (2001)) notes, "A Diagram is mainly an icon; and an icon of intelligible relations in the constitution of its object" Vidler (2001: 85). In this light, the diagram can assume a certain communicative authority which goes beyond architectural shorthand.

Vidler (2001: 85) claims that the most powerful use of the diagram in early modernism is that deployed by non-architects (such as lawyers, philosophers, and social theorists) to describe different forms of organisation. Therefore, since the diagram is originally organised by non-architects' language and emerged from the operation between form and word, or space and language, this perceived advantage could be used as one of the important key ideas to inform an alternative method for architectural drawing or to develop the communicative drawing.

Somol (1999) points out further advantages of the diagram. He notes that the diagram is seen as an operation between form and word; "an alternative of a repetition that produces difference rather than identity" Somol (1999: 8). It is constitutive, projective, and has a "more performative, rather than a representational device" Somol (1999:8). This is something that is addressed more clearly by architects such as Bernard Tschumi and Rem Koolhass.

Tschumi's projects use the diagram in a manner that draws on influences outside architecture to present a world full of hinted-at possibilities. In 'The Manhattan Transcripts' in 1981, for example, he makes these diagrams the main focus of his project outlining three relations: transformational, spatial, and programmatic sequence (see Figure 7.3). By supplementing traditional architectural drawing with methods borrowed from other disciplines, he uses photographs of events, diagrams (called transcripts), and an almost cartoon like system of notation to get his 'story' across (see Tschumi (1983)). Similarly in the Parc de la Villette in Paris, in 1983, Tschumi creates the relationship between space and content relationship by disassociating programme from their respective traditional forms and again by employing diagrammatic methods from the "Manhattan Transcripts" project (see figure 7.4). With his concepts of dislocation, disassociation, and rupture, he creates the diagrammatical framework for multiple combinations and substitutions that exist simultaneously (see Tschumi (1999)).

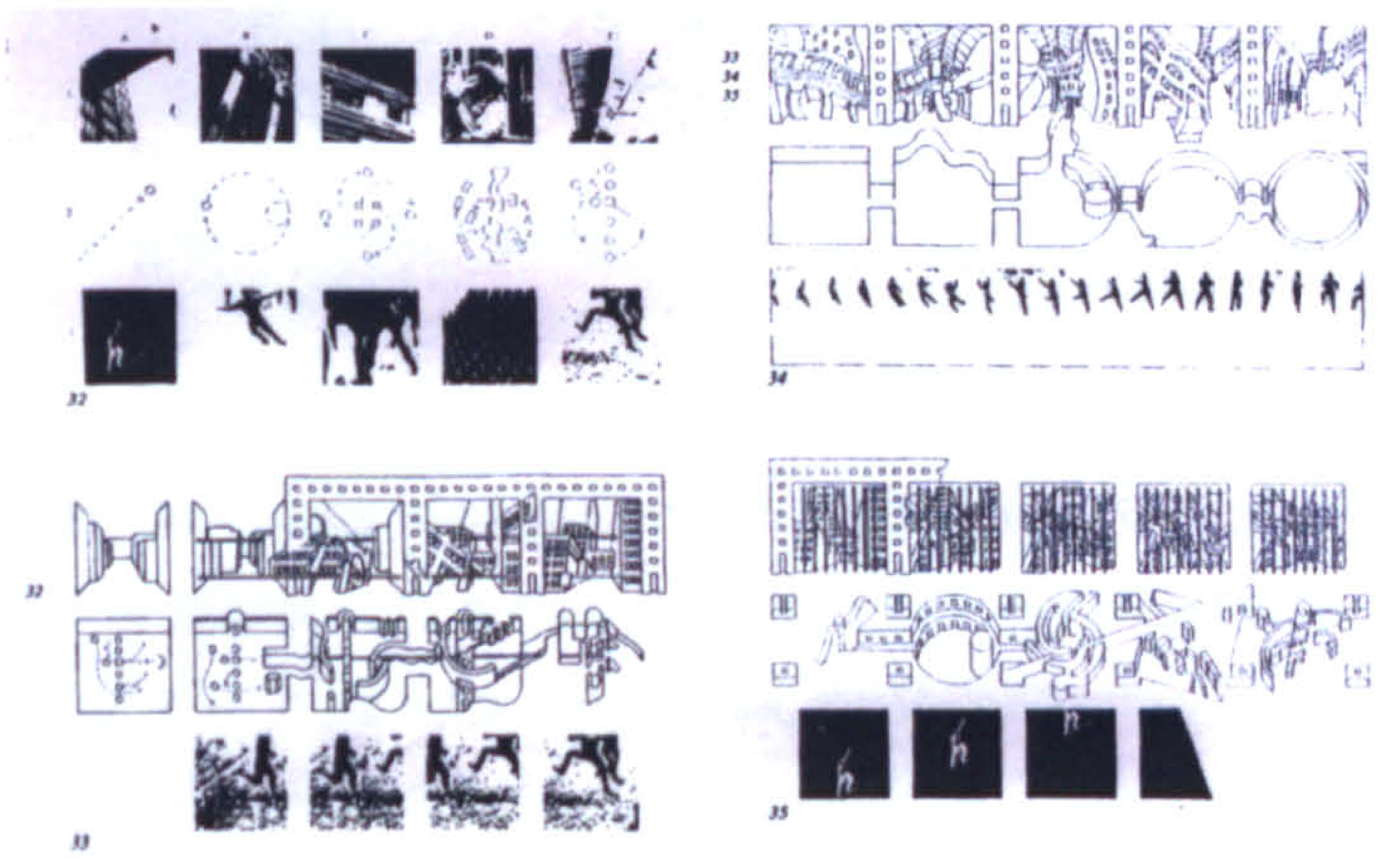


Figure 7.3: The Manhattan Transcripts, 1981. Tschumi (1983: 73)

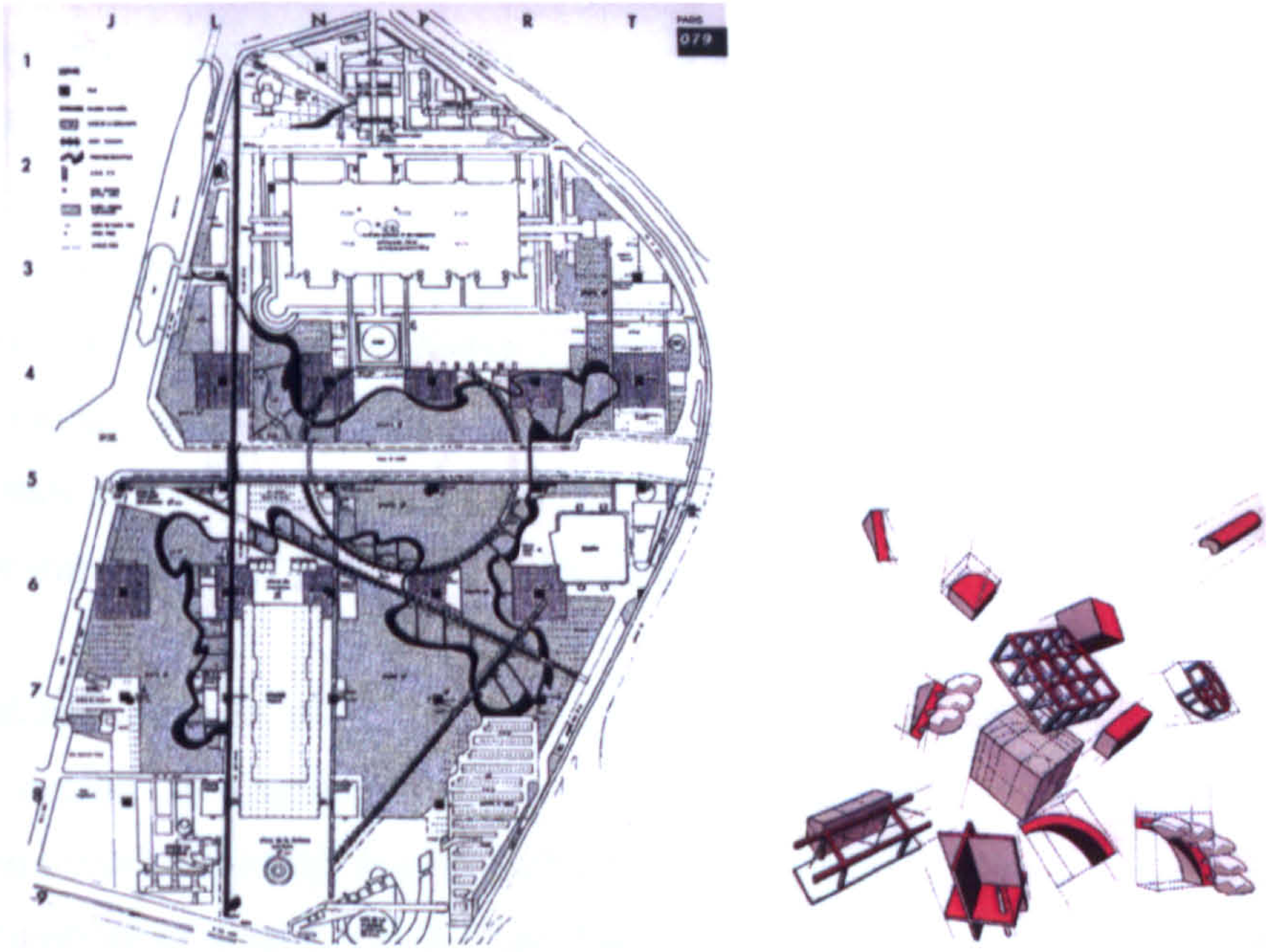


Figure 7.4: 'General Urbanism document': Diagrammatic plan of Parc de la Villette and 'Exploded Folie': the drawing of structural systems of the Folies, 1984. Tschumi (1987: 9 and 18)

Similarly, Koolhass develops the layering strategies in designing and planning proposal for the Parc de la Villette. His diagrammatic layers were not the mapping of an existing site or context, but of the complexity of the intended programme for the site (see Figure 7.5). Unlike a traditional plan drawing, his diagrams remain an open number of interpretations, uses, and transformations in time; 'open-ended characteristic' (see Corner (1999)).

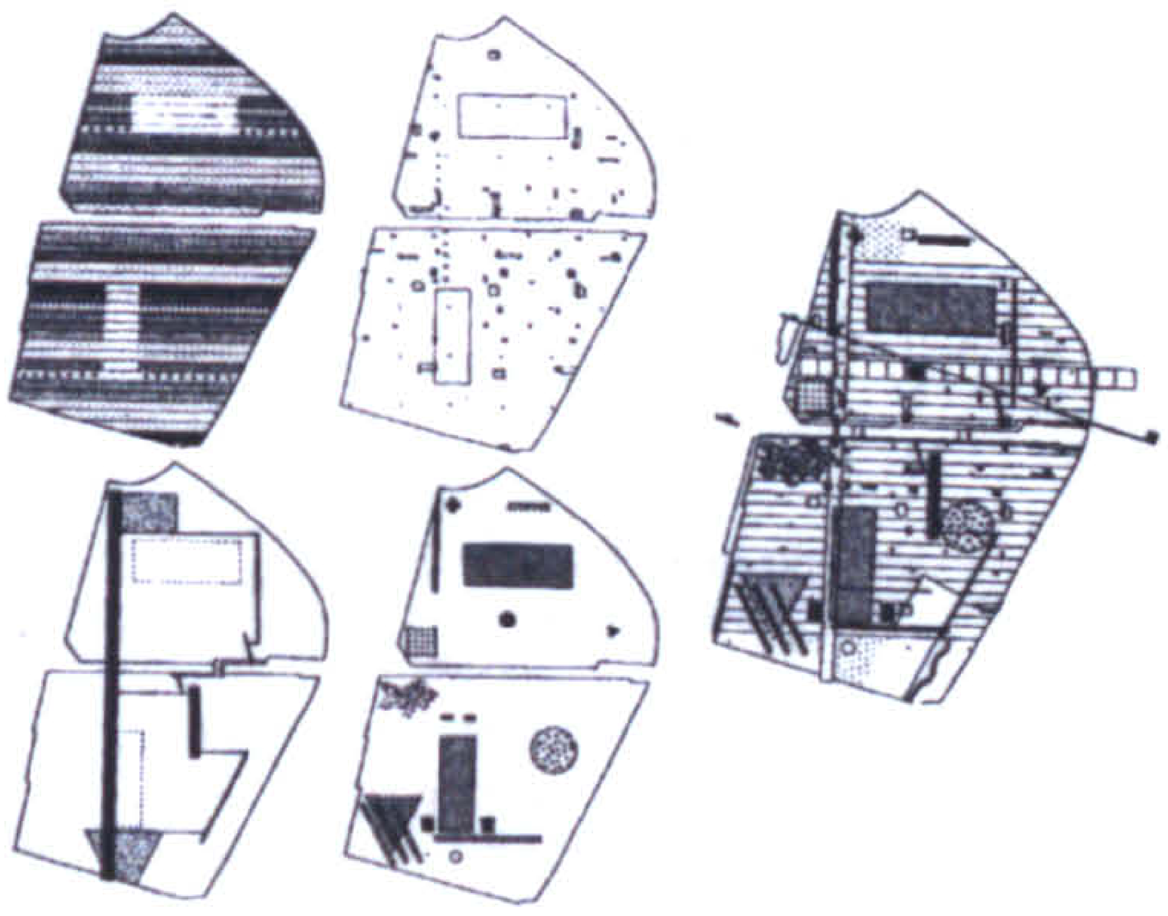


Figure 7.5: Layering diagrams for the Parc de la Villette, 1983; Rem Koolhass/Office for Metropolitan Architecture. Corner (1999: 236)

Deriving from Deleuze's descriptions, Lobsinger (2000) notes the potential of the diagram as an analytical device and as an indicator of the emergence of a new epistemological condition for architecture. In particular, one of its most productive attributes is **its capacity to organize and suspend diverse kinds of information within a single graphic or set of graphic configurations** Lobsinger (2000: 22, my emphasis). The diagram here offers a logical and abstract means for representing things, thinking about and explaining the complex, dynamic and information-dense conditions that we confront. From this point of view, therefore, diagrams can act not only as a means of organisation, but also as conceptual tools that approximate our experience of the real.

In this, the difference between the descriptions of the diagram in Eisenman's and Deleuze's sense is noticed. The diagram in architecture, as typified by Eisenman's usage, becomes a reduction, whilst the definition of diagram in the Deleuzian sense suggests fullness or something that is full of potential to suggest its possibilities. This latter approach suggests the potential of the communicative role of the diagram.

Therefore, lessons and advantages learnt from the Deleuzian description of the diagram are hoped to develop and to inform the architectural plan drawing into the communicative drawing through the following techniques:

1. The potential of diagram to suggest the forward possibility is the main key in developing a communicative drawing. Unlike a conventional drawing which tends to fix things down, the open diagram allows a drawing to remain flexible, adaptable, and versatile.
2. The diagram is based on the idea of the least possible elements providing the maximum possible communication – an economy of means leading to a richness of ends. The economy of means provides straightforward information that the audience can instantly interpret.

3. The capacity of the diagram to organise diverse kinds of information within a single set of graphic configuration.
4. The diagram allows various numbers of uses (open-ended characteristic), which can be interpreted by everyone.

However, when using the diagram, one should continually be aware of the dangers noted above – namely that it can become a reductive and internalised means of communication. The important thing therefore in the use of the diagram is always to externalise it in order to address a wider audience. This means the use of codes and organising systems should have a shared basis. The diagrammatic drawing may then be allowed to have the possibility of the built object to be interpreted in a more different and richer way, and one that is more comprehensible.

7.5 Graphic Representation: Architectural Graphic

The translation between drawing and building occurs not only within the Euclidean geometry[2], which is concerned with the ratios and equalities of lines, areas, and angles, but also the complex relationship between graphic systems of representation. Evans (1989) notes, "We are now witnessing a critical pincer movement that is at once more aware of, more wary of, and more interested in the active part played by the images on either side of architecture" Evans (1989: 20-1).

Architects make images from ideas (see Evans (1989)). They communicate their ideas and conceptions by moving from a verbal or written mode of communication to a predominantly graphic language. The graphic representation which appears within architectural drawing acts as a linkage to convey the message from the architects to the audience and to represent the experience of the built object. Thus, the appropriate system of architectural graphic representation, particularly the juxtaposition between texts and images, affects the communicative potential in an architectural drawing, as well as influencing the interpretative system of the audience. The role architectural graphic should therefore be taken into account and re-examined for the development of the 'communicative drawing', with the aim of providing an appropriate and simpler code for the audience.

To arrive at a basic understanding, the principle characteristics of texts and images within the construction of architectural graphics are first explained. Architects and non-architects often consider these text and image as two separate aspects (see Lupton and Miller (1996)). They are generally taught to make distinctions between texts and images and to not think of them in the same way. Generally, people have been taught to read stories, but never taught

[2] Robin Evans (1995) noted, "From the point of view of the architect seeking firmness and stability, the best geometry is surely dead geometry, and perhaps that, by and large, is what architecture is made with. What I mean by a dead geometry is an aspect of geometry no longer under development from within. Triangles, rectangles, and circles as defined by Euclid have been pretty well exhausted as subjects of geometry enquiry" Evans (1995: XXVII).

how to read images. Moreover, there is an assumption that images are presentational and not discursive, that they have no formal grammar. Hofmann (cited in Lupton (1993)) notes this disparity, "The picture contains an inherent message. Although it costs us an effort... to 'read' its outward forms... it nevertheless speaks to us directly. Unlike lettering, the picture radiates movements, tones values and forms as forces which evokes an immediate response" Lupton (1993: 23). According to Hofmann, Lupton (1993) notes that pictures have a universal significance, because their underlying abstract 'force' appeals to the 'immediate' and natural faculty of perception, rather than to cultural convention; the response is that they are sensual and emotional rather than intellectual.

In fact, without a grammar, images cannot be considered as a language, and without a language, images cannot be read and interpreted (see Lupton (1993)). The juxtaposition between texts and images therefore becomes part of a wider language system necessary for the completion of any communication. The syntax and grammar of the juxtaposition are used to merge these texts and images in order to communicate information as a whole.[3]

The same applies within architectural drawing where the appropriate combination of image and text must be judged in order for the message to be conveyed as a coherent whole. This also includes the judgement of the amount of information in the drawing so that it is neither too much to be overwhelming nor too little to be meaningless.

Bertin (1983) describes strategies for how information can be effectively and appropriately represented. He proposes rules for a graphic system that is primarily concerned with diagrams, networks, and maps, that may inform the development of the communicative drawing.

Identification efficiency: An architectural drawing consists of subject matter and background. The subject matter is the graphic representation of the project usually in orthographic projection (plan, section, elevation, and so on). Together with this graphic representation is the complementing background information (dimensioning, notation, and titling). In the process of reading and analysing an architectural drawing, two stages of identification, each involving one of the categories mentioned above, must precede the analysis of the code message in the drawing. The first, *external identification*, concerns the background information and is therefore independent of the graphic representation itself. The message in the background is basically linguistic (title, labels, legend, and scale). The second, *internal identification,* concerns the graphic representation itself. Its message is therefore basically graphic (see Bertin (1983)). These two stages of identification are indispensable and must precede any study of the effectiveness of the message in an architectural drawing itself.

[3] See Language and Drawing in Forty (2000).

Rules of construction: The general rules of graphic construction, proposed by Bertin (1983), can be used as criteria for graphic representation in the communicative drawing. He notes:

> ***To represent the information in a single image***, *or in the minimum number of images necessary (to render it perceptible in its entirety, in the minimum number of instants of perception), is the first rule of graphic construction.*
>
> ***To simplify the image without reducing the number of correspondences*** *is the general rule which applies to any information having one or several reorderable components.*
>
> ***To simplify the image by reduction*** *and thus create a clear and efficient message is the general rule which applies to any information having several ordered components Bertin (1983: 171).*

By this, Bertin's rules could mean 'simplifying the drawing without reducing the information'. This suggests to the architect to economise on means and effort in the creation of graphic in architectural drawings, in order to provide straightforward information.

Rules of legibility: Even when following the rules of construction, however, the drawings can still be efficiently or poorly understood. Efficiency of a drawing depends on the different senses between the elements constituting the graphic, such as differentiation according to size and thickness of lines, size and shapes of symbols, the amount of black, grain and texture of shading, colour, and so on. The rules that permit the accomplishment of the different senses are referred to as the rules of legibility. They include graphic density, angular separation, and retinal separation (see Bertin (1983)).

First, graphic density depends on the quality of information within the drawing and its distribution. Intense density of graphic runs the risk of over-cluttering and decreases representational clarity and dimensional precision, while too-low density may not provide enough information. Secondly, angular legibility concerns meaningful perceptible differentiation on the plane. In order to be legible, the drawing should permit clear lines which determine angles. Angular differentiation between the line used within the drawing should be cleared; this includes lines used to define the graphic or figure itself (plan, section, or elevation), and lines used for additional composition (dimensional lines or identification lines). Finally, retinal legibility refers to the different sense of thickness, hues, and texture within the drawing. According to Bertin (1983), it is optimum if separation of subject matter from background is achieved. For example, in the difference between the walls drawn with a bold thick line and a thin line, retina legibility would be restored either by a reduction in the visibility of the background, or by an increase in the visibility of the subject matter.

The application of Betin's rules may be further informed by Dana Cuff (1979) classification of drawing in terms of the three types of metaphor: (1) drawing as spatial illusion, (2) drawing as text, and (3) drawing as manipulation.

She notes that the drawing as spatial illusion creates space and takes on all the qualities of a three-dimensional object. As text, the drawing has something to tell or inform us; we can read it, it makes information clear. This metaphor refers to **a drawing's communicative aspect and the viewer's interpretation of the work. Drawing as manipulation describes a determinist drawing which requires, allows, or leads the viewer to do something. The drawing requires filling in and completion by the viewer** Cuff (1979, my emphasis).

These three metaphors correspond roughly to three distinguishable, yet interdependent and interactive systems that are tacitly at work in all design drawings: representation, communication, and visual appeal. Cuff (1979) explains that, firstly, the representation involved in an architectural drawing emerges metaphorically as a spatial illusion. It has two components: the conventions of the drawing itself and the perceivable world it represents. One may say that a representation is not a faithful record of visual experience, but the faithful construction of a relational model[4]. Secondly, the communication system within the drawing considers the message intended and the predicted interpretation: the drawing as text. Finally, the last system, visual appeal, is connected to the final metaphor: drawing as manipulation. She notes,

> *An important aspect of visual appeal entails engaging the viewer, and is tied to the notion that drawings are manipulative, active agents and can direct attention. Decisions to heighten a drawing's visual appeal generally impose on the other system in a positive way. A composition, for example, may require reordering so the eye is enticed to move across the page. This potentially benefits the drawing's 'legibility' (communication). Cuff (1979: 9)*

From this analysis of the functioning of the architectural drawing, Cuff suggests criteria and means of creating a drawing that is, she claims, "good and right". The three systems may be considered as the key to graphic decision making in developing a communicative drawing. She concludes that "Drawing should be the representation of a potentially perceivable world; drawing should communicate to viewers; drawings should be visually appealing. The weight attached to each of these three systems reflects the values of the culture and the profession" Cuff (1979: 9).

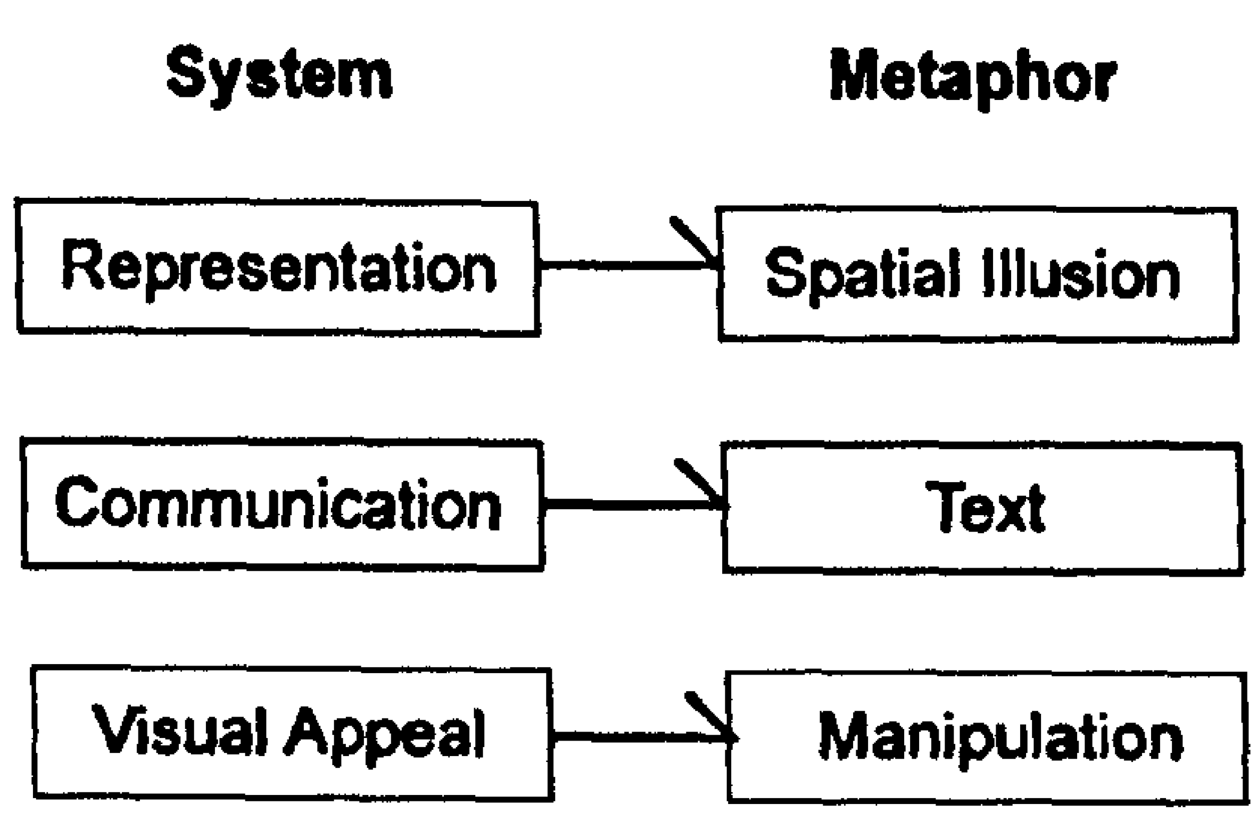


Figure7.6: Systems and Metaphors in design drawing Cuff (1979: 9)

[4] See more in Gombrich (1960: 90).

Complementary to Bertin (1983) and Cuff (1979) approaches, Tufte (1983) introduces the term of 'Graphical Excellence' which gives the viewer the greatest number of ideas in the shortest time with the least ink in the smallest space. He **claims that the graphical excellence should consist of complex ideas communicated with clarity, precision, and efficiency** Tufte (1983: 51, my emphasis). He notes,

> *Visually attractive graphics also gather their power from content and interpretations beyond the immediate display of some numbers... Beautiful graphics do not traffic with the trivial. ... On rare occasions graphical architecture combines with the data content to yield a uniquely spectacular graphic. Such performances can be described and admired but there are no compositional principles on how to create the one wonderful graphic in a million. Tufte (1983: 177)*

The strategies or systems proposed by Bertin (1983), Cuff (1979), and Tufte (1983) provide ideas of how to approach the graphical production of architectural drawing, by a set of specific 'rules'. However, the focus should be on making architects more aware of the context of drawing and the issues that might improve their communication with a potential audience. In this context, Dewar (1999) discusses the public information symbol, as an example of something that is intended to provide information accurately and quickly without using words. He suggests that creating a comprehensible symbol that depicts a real object into a pictorial language is not enough, and that the performance of potential audience must also be considered. He suggests, "The symbols must be meaningful, legible, learnable, memorable and used consistently, therefore users and designers should share a common 'visual vocabulary'" Dewar (1999: 298).

It suggests that the audience may need aspects in the drawing that do not rely so much on the tangible or technical dimensions of the building, but those that capture and convey the **experience** of the built object. This can be related to Arnheim (1970) research on visual experience of the potential audience, He notes,

> *The elusive quality of such experience is hard to capture with our language, which commonly describes objects by their tangible, material dimensions. But it is a quality invaluable for abstract thought in that it offers the possibility of reducing a theme visually to a skeleton of essential dynamic features, none of which is a tangible part of the actual object. Arnheim (1970: 12)*

The drawing, through the use of appropriate graphic representation, should be able to link the audience's experience to the ideas of how the planning and spatial organisation of the built object would be. For example, the drawing might convey to the audience the experience of what it is like to live in the building, thus allowing them to interpret the conveyed message in their own way. In this way, the audience can imagine the space through individual interpretation, without the limitation in different classes, background, and cultures. As Koler (cited in Dewar (1999)) suggests,

> *What we need is not a dictionary of pictures, but knowledge of the kinds of information that different cultures have found useful to convey with picture. We also need to know the cognitive processes underlying the interpretation of symbols. The mechanisms by which people make inferences and draw conclusions from symbols require study, and we need to know the 'syntax of picture writing', as well as how people code, interpret and use symbols. Dewar (1999: 302)*

This confirms that an architectural drawing and its graphic representation should be drawn and codified according to the basic understanding of everyone. Any information that is codified from different sources should be used very cautiously because it may affect the audience's interpretation.

In summary, a number of lessons and advantages can be learnt from the way that drawings have been analysed by others. The development of the communicative drawing may be informed through the following techniques:

1. The role of texts and images as architectural graphic within an architectural drawing should not be separated. Using them becomes a code that is easier for the audience to understand than symbolic geometry or technical codes in orthographic projection. The appropriate use of texts and images will allow the drawing to be interpreted and understood more simply.
2. The drawing should be represented in a manner in which graphics are constructed efficiently. The graphic representation of the project (orthographic projections) and its background dimensions (dimensioning, notation, and titling) should be considered together.
3. Information should be graphically represented in a single sheet or the minimum number of images necessary; as well as should be recognised at the first glance. It should be simplified without eliminating the essential information. The represented graphic should consist of a complex idea communicated with clarity, precision and efficiency.
4. A drawing depends on the sensory differentiation between the elements constituting the graphic; colour coding, diagrammatic techniques, and pictograms are suggested as potential elements of a communicative drawing.
5. The graphic representation should be linked to the experience of the potential audience and allow for interpretation by different types of people. Everyday objects, for example, could be used as a code that links the drawing to the audience's knowledge and past experience.
6. By referring to Cuff (1979), the drawing should be perceivable, straightforwardly communicate with viewers and visually appealing.

In the next section, the lessons learnt from the three applications, as well as literature reviews and the first empirical test are analysed in order to develop an alternative method for an architectural plan drawing: the so-called communicative drawing.

7.6 Criteria towards Communicative Drawing

The study of the map, diagram and graphic representation has informed ideas and techniques in developing a communicative drawing. We now turn to three previous chapters (historical overviews, theories of communication, a study on environmental psychology research) as well as to the results of the first empirical test (in particular the qualitative findings) to further inform the development of the communicative drawing.

The lessons discussed are summarised in table 7.1. The comments made in the questionnaire can be seen in Chapter five and in Appendix E

Table7.1: Summary of lessons obtained from three chapters of literature reviews and the first empirical test

Topics	Lessons
Historical Overview	1. The Egyptian drawing has shown methods of coding that are based on a shared language and not on a specialised architectural language. The hieroglyphic codes used on the drawings are part of a wider system of signification, and thus the drawings have a communicative value. The codes based on pictorial representation and the incorporation of human elements, which provide a sense of both scale and occupation in an easily understood manner. 2. The Renaissance period has suggested that drawing be based on narrative structures that relate to a building and its meaning appeals to a wider audience. The drawing should not require a specific code to be understood, but be related to social production and public through the events and figures that tell a story within the drawing. Thus, the audience can perceive and experience the drawing within the context of their respective cultural world, and within the conception of space and time on which they are grounded. 3. The technique of the diagram, particularly during the Twentieth century, suggested a possibility in developing the communicative role of a plan drawing. However, the use of the diagram should be more concern with the audience than the architect. The danger of the architects' subjectivity should be addressed. 4. The technical and representational aspect of the drawing may not be compatible and should not be combined. One drawing is created for a specific purpose by certain techniques. Thus, one single drawing may not be enough to explain all stages of architectural production.
Communication Theory	1. A common language of communication is required in the method of coding an architectural plan drawing. This includes a code that can be shared between architects and non-architects, as well as the use of elements constituting the clear and precise graphic, for example, the use of colour coding, shading, icon, sign and symbol. 2. Since the existing architectural codes (technical, syntactic, and semantic)[5] have become internalised, they need to be rethought. External codes should be taken into account which can be applied to the existing architectural context. This not only opens up to architects a different approach and means of speculation, but also provides a potential for non-architects to engage the drawing in a manner which allows for a more faithful communication.

[5] See architectural code in Chapter Three

	3. The personal characteristics of architects and non-architects should be considered when architectural drawings are employed. The architect should carefully allocate drawings as message-vehicle to the relevant group of audience, to the right channel, and to the appropriate context and contact. In addition, in order to achieve comprehensive communication, architects (encoder) and non-architects (decoder) should ideally share the same set of codes or languages.
Research on Environmental Psychology	1. Architects should be aware of the audience and their decoding skills; the disparity between architects and non-architects arises from differences in experience and, most significantly, education. The codes that the architect use should be able to recall or link to the audience's experience of place. This would help the audience in interpreting and understanding the spatial organisation of the potential building. 2. The code should allow different groups of audience to decode the drawing using their own interpretation, relating to their spatial experience, and guide them to understand how the space works. The drawing that communicates better to the lay audience will also help in the production of an architecture that is more accessible and inclusive to the lay audience.
The First Empirical Test	1. Three groups of respondents; lay people, first year and diploma architectural students, suggested some criteria towards a better plan drawing. They agreed that these following aspects would help them to read and understand the drawing better: - Scale indications - Everyday objects or Recognisable icon, such as furniture or human figure. - Text - Less technical drawing - All the information in one place. - Reading keys that indicate room location and so on. - Indications as to how to live in the building or atmospheric information (such as indications as to how occupants move around the space). - Clear description and label - The inclusion of colour and shading 2. Lay people have a difficulty in interpreting and understanding architectural drawings (this includes the architect in some cases); regarding technical and internalised method of coding. Architects and non-architects not only see and read architectural drawings differently, but they also interpret and understand in a different way. The different interpretative systems between them would be attributable to the professional education and experience of the two groups. 3. Some definitive indication of scale is necessary to avoid confusion in reading the drawings.

	4. Some initial drawings are drawn and developed towards a communicative drawing; by following lessons acquired from the first empirical test (See Appendix F).

The lessons summarised in the above table and from the study of map, diagram, and graphic representation, can be used as key ideas to inform the way to propose a set of communicative drawings; this is diagrammatically explained in figure7.7.

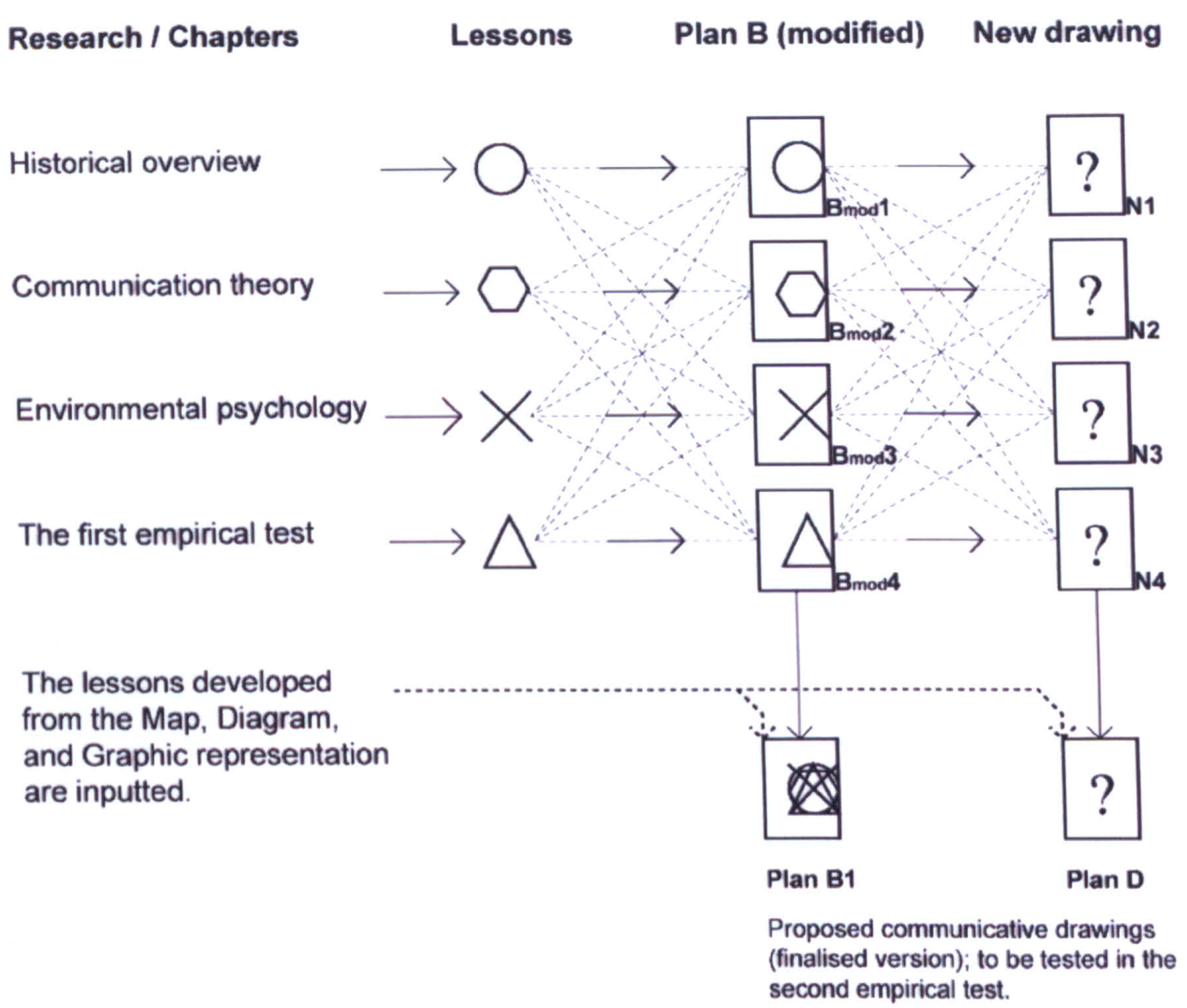
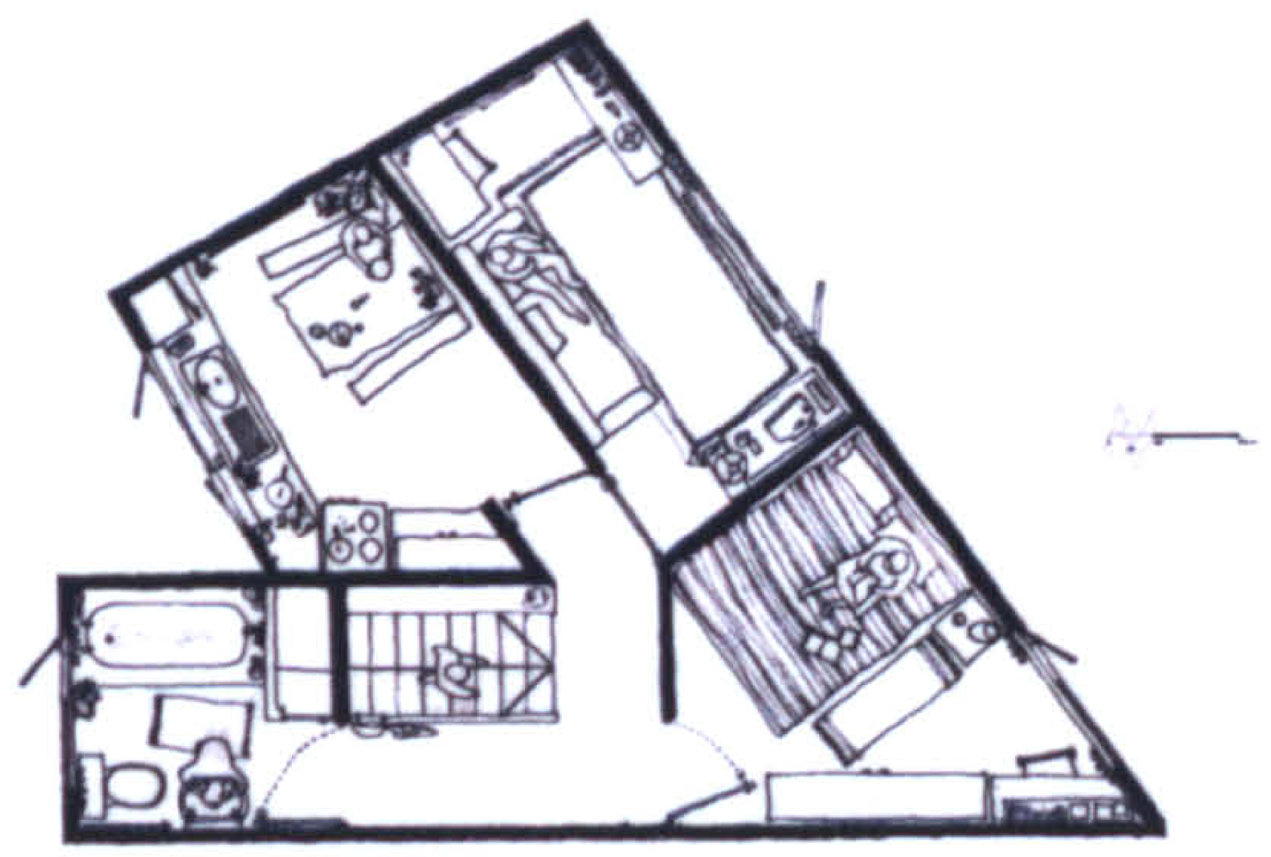
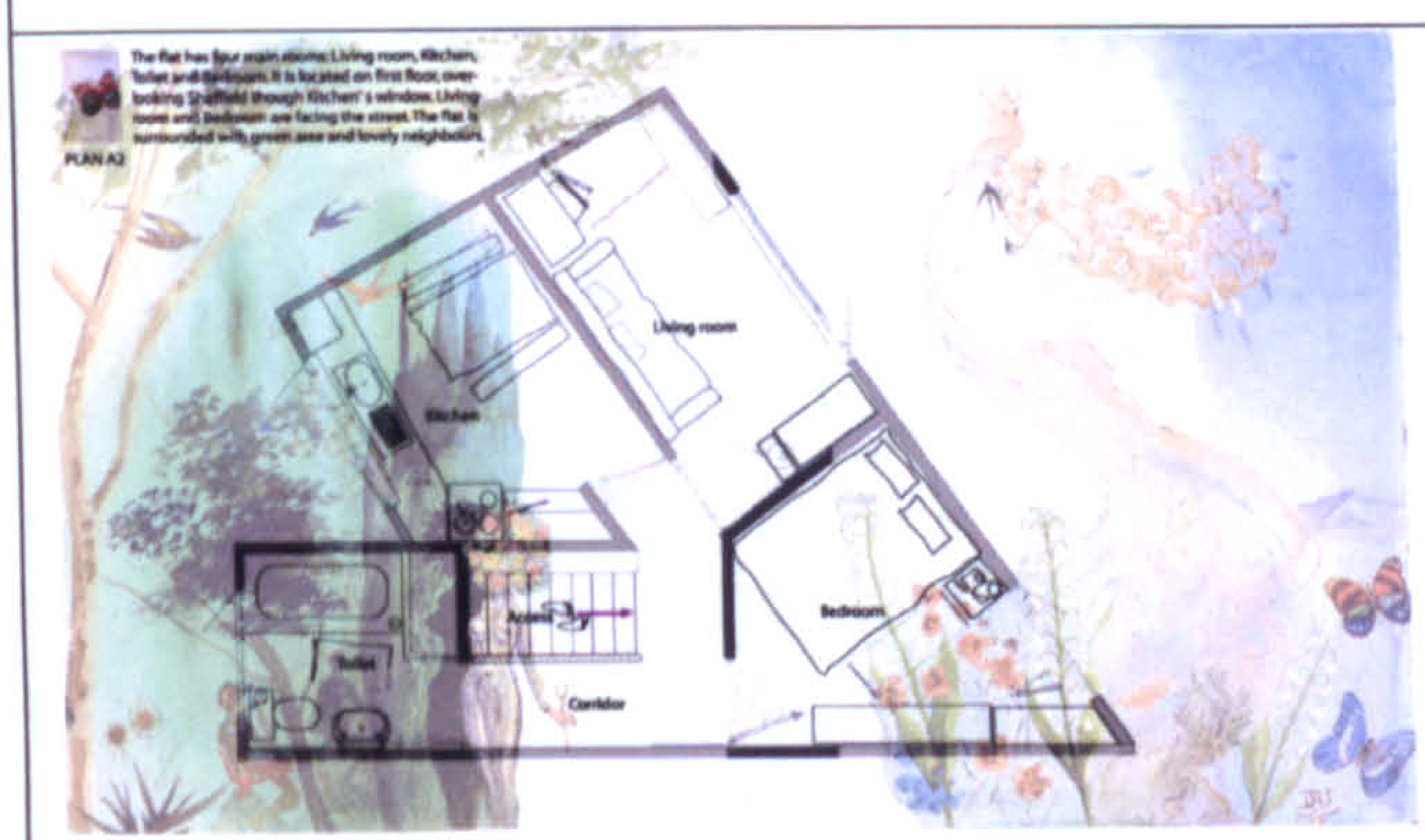


Figure7.7: Synthesis diagram showing how the lessons learnt from previous chapters attribute to the final forms of communicative drawing.

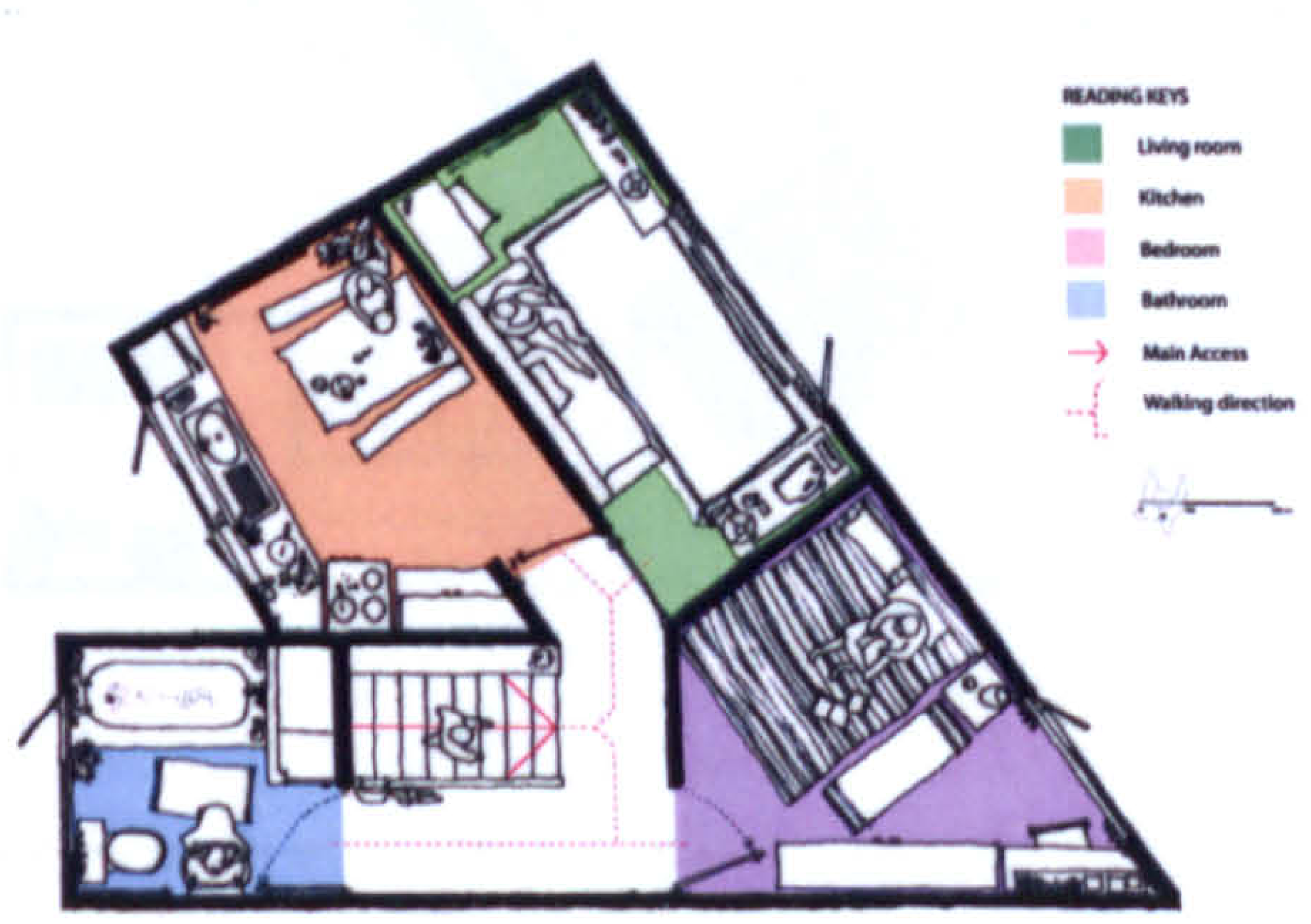
The diagram is not developed though a linear route. It basically shows the four different chapters with each topic delivering lessons that lead to different options in developing the communicative potential of an architectural plan drawing. In order to see how the lessons can be applied into a conventional plan drawing, the lessons obtained are applied to plan B and then correlated to the others. Plan B is used as the reference plan for this proposal because it was previously agreed by most of the respondents from the first empirical test as the best drawing (see plan B in Appendix D). Two processes are applied; first Plan B is modified according to the lessons from the four chapters to give four revised versions (Bmod1, Bmod2, Bmod3, Bmod4), and then four new drawings based directly on the lessons are developed (N1, N2, N3, N4). It should also be noted that the lessons from the map, diagram and graphic representation provide input into the whole process.

The drawings that emerged from this exercise can be summarised and explained as follows (see large version of drawings in Appendix G);

1. Historical overview: Idea of a shared language; Use of narrative; Use of pictorial method.

Plan Bmod1 (modified from plan B) 	A more friendly way of drawing is applied here, because a less technical drawing may be the most effective way of representation and communication. Moreover, the story of the drawing is explained by using human figures and everyday objects, such as furniture. These elements indicate the use of space and perform as a scale reference. Additionally, scale information is also indicated.
Plan N1 (new drawing) 	This drawing is superimposed onto a painting. This is hoped to form and inform a story of the building. The juxtaposition between plan (as a technical drawing) and painting (as an artistic drawing) is suggested. It inputs a passion into a drawing with the hope that the audience might then perceive a plan drawing as a picture, not as a conventional or technical drawing.

2. Communication theory: Common and shared language of communication (external code); Use of elements constituting the graphic.

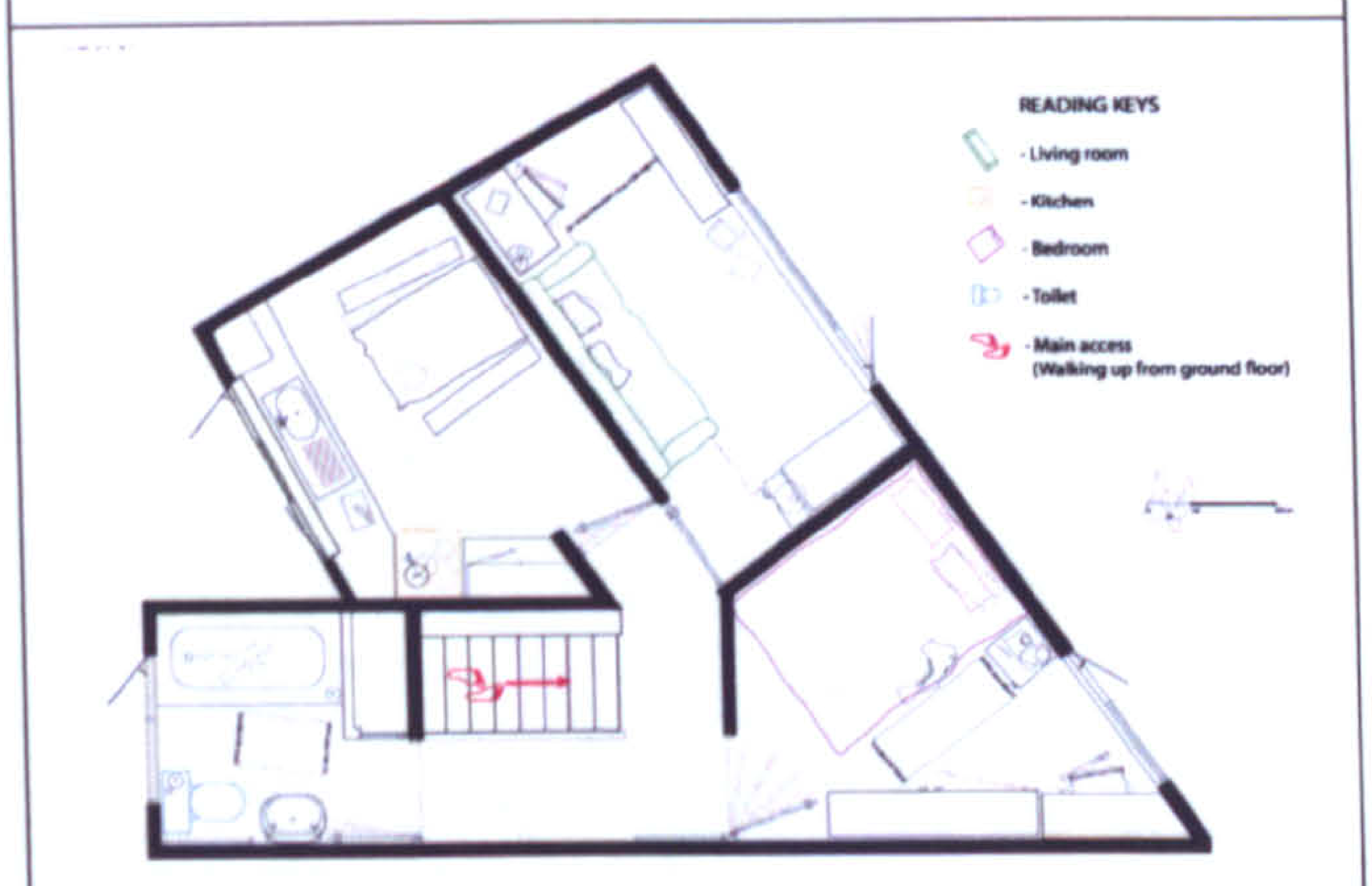
Plan Bmod2 (modified from plan B) 	A sketching technique is used and the drawing is drawn as close as possibility to 'reality', with the hope that the audience may find this easier to decode by association to their own experience. Human figures show existing activities and their interaction with objects and space. Moreover, colour coding is used in order to provide information on a room's location and area boundaries. A simple use of lines informs sense of direction and circulation, which can be shared between both architects and lay people without relation to any specific knowledge. In addition, a scale bar is indicated.

Plan N2 (new drawing)

The drawing is simplified, without reducing necessary information. The main objects are still shown as recognisable icons, which are related to the keys. Colour coding indicates each room's area and emphasizes functions. Footprints are used as a user-friendly sign, which indicate access and circulation within a building. They are easier to understand by both architects and lay people. Scale is referenced through the human figure.

3. Environmental psychology: Shared methods of coding; Codes that recall or link to the audience's experience of place; Codes that are open-ended and allow individual interpretation.

Plan Bmod3 (modified from plan B)

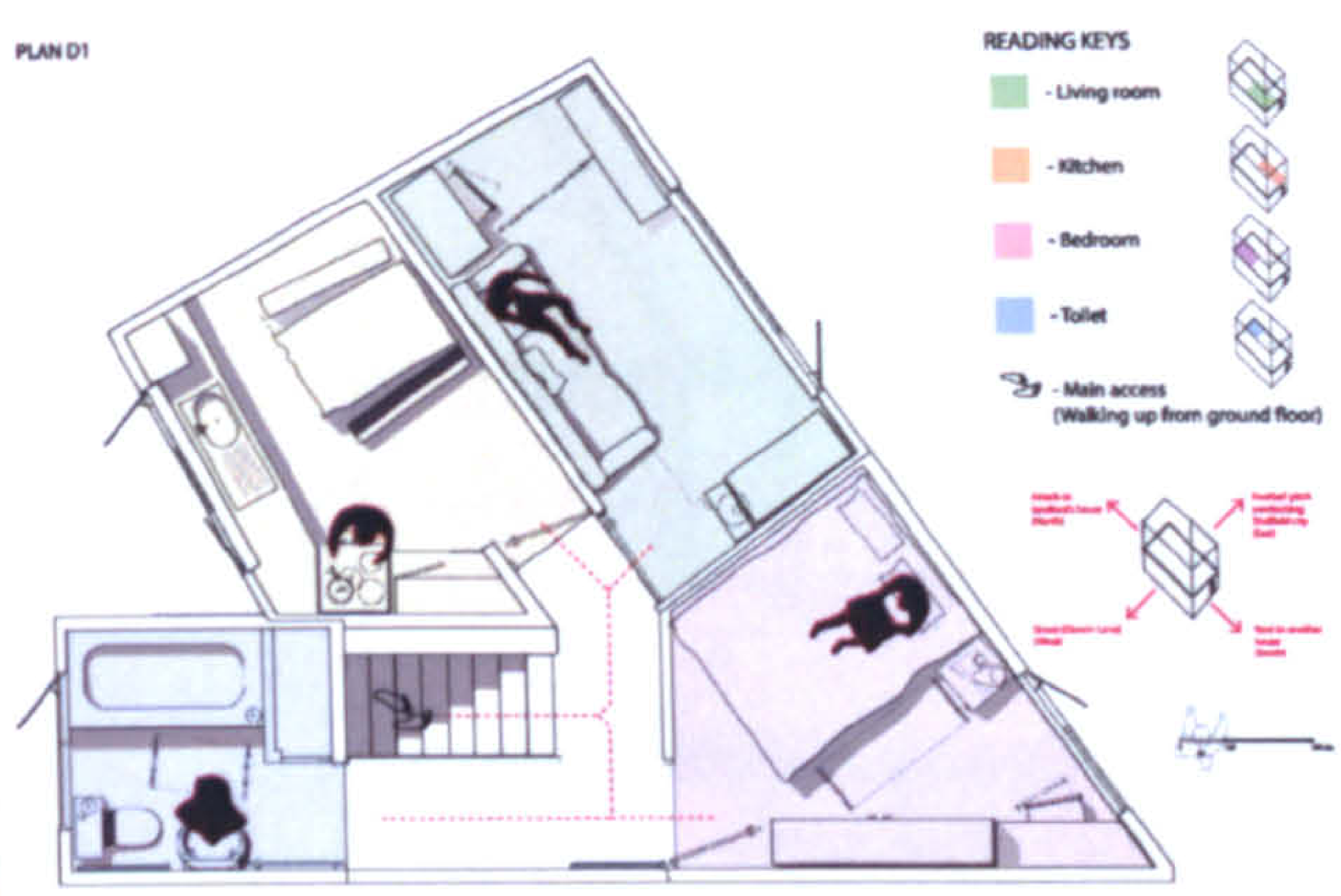


The drawing is explained by the keys. Furniture acts as recognisable objects which are related to the keys and to the audience's experience of space. Colour is used without overwhelming the information and value of the drawing. Freehand technique is applied in order to overcome notions of technicality. Simple code such as footprint is used as an indicator and a shared language. Scale is also given in reference to the human figure.

Plan N3 (new drawing)

The drawing is drawn as a semi-diagrammatic representation; although with the least elements is still informative. Recognisable icons are used to depict a real object in a pictorial form. Colour coding acts as the key in representing the rooms' location and their usages. Common language and reading symbol such as human figures and dash lines explain circulation and how movement around the space is conducted. Scale is referenced by human figures and recognisable icons.

4. The first empirical test: Criteria towards a better plan drawing as obtained from architects and non-architects.

Plan Bmod**4** (modified from plan B)	
	The drawing is informed by qualitative feedback from the respondents. The key that is colour coded explains the drawing. An additional type of drawing, the isometric, gives orientation and explains the relationship between rooms and the building as a whole. Furniture is fully represented; including shading that provides a sense of depth. A scale bar is given, with a human figure as a reference. Human figures indicate activities and how the building might be occupied. Simple codes and signs show movement and how to move around the spaces.
Plan N4 (new drawing)	
	The drawing is produced according to qualitative feedbacks from the respondents. It is less technical. It is colour coded in order to indicate function and explain the building. Written inscriptions are given, which relate to the reading keys. Common language informs circulation and accessibility. An additional drawing, the isometric, operates as a symbol that shows orientation and location. In addition, a scale bar is given.

As shown in the diagram in figure 7.7, these eight different types of alternative drawings are synthesised to the final set of communicative drawings. The choice of the final drawings was made from an analysis of the eight drawings. This was partially subjective, based on the author's understanding of the issues raised in the previous chapters, and partially based on discussions with others as to which of the new drawings they responded to best. It was decided to develop two final proposals of communicative drawing, one of which was a refinement of a drawing used in the first test, the other of which was completely new, so called plan B1 and D, respectively. There was not the time to perform a systematic analysis of the drawings through a new questionnaire.

Plan B1 was developed through the revised versions of plan B modified from all lessons (Plan Bmod1+2+3+4), while plan D was developed through the correlation of plan N1+2+3+4. Both drawings received input from the lessons learnt from the map, diagram, and graphic representation (see figure 7.8 and 7.9 - large version of the drawings can be seen in Appendix I).

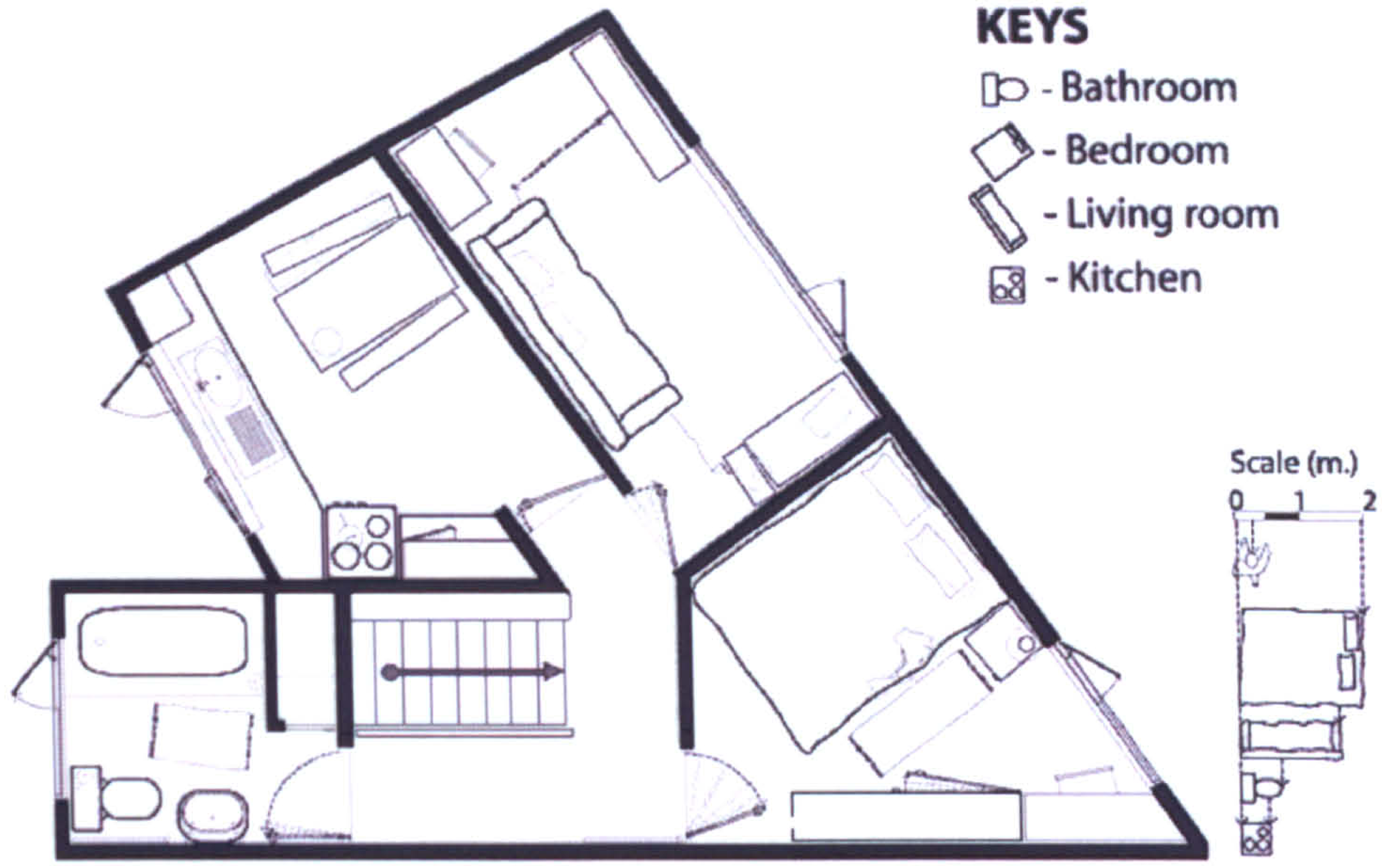


Figure7.8: Communicative drawing: plan B1

Plan B1: This drawing is considered a developed version of plan B. It is primarily drawn in relation to the lessons from previous chapters, reinforced by qualitative feedback from the first empirical test. The elements included may be summarised as:

- Shading and contrast; from graphic representation and qualitative feedback
- Pictogram and common language; from communication theory, environmental psychology and map
- Scale indication; from map and qualitative feedbacks
- Recognisable icon; from environmental psychology
- The use of the freehand technique to overcome notions of technicality; from qualitative feedbacks

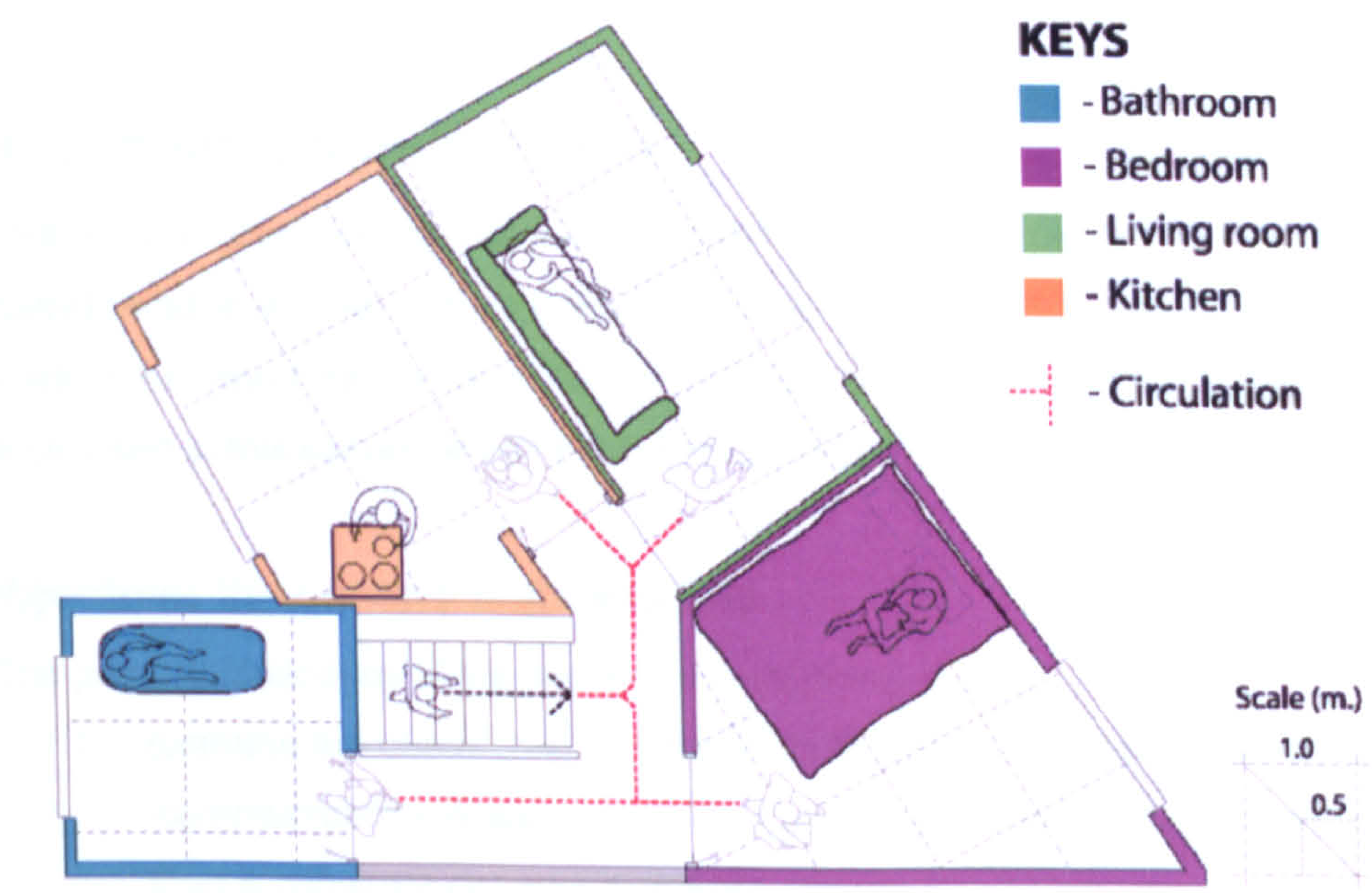


Figure 7.9: Communicative drawing: Plan D

Plan D: Plan D is newly drawn as a semi-diagrammatic drawing that attempts to communicate with the least possible elements; but is still informative. A non-technical language is used in order to provide information accurately, so that the audience can interpret at first glance. Moreover, icons are used to depict a real object as a pictorial language. Thus the elements include:

- Colour; from graphic representation and qualitative feedback
- Diagrammatic representation; from historical overviews and the diagram
- Common language and reading symbol; from communication theory and the map
- Scale indication; from the map and qualitative feedback
- Recognisable icon; from environmental psychology

Therefore, by relating to Dewar's statement quoted earlier, plan D is hoped to be more meaningful, legible, learnable, and can be used consistently: a drawing that both architects and non-architects can share as a common 'visual vocabulary' Dewar (1999).

These two forms of communicative drawing are then used in the second empirical test. It is important to note that the communicative potential of these two proposed communicative drawings is not guaranteed, but it is hoped that the previous research has led to drawings that communicate better. The limits used for the design development of communicative drawings are considered. The drawings are expected to be used (with the aim of being a shared means of communication between architects and non-architects) at the stage of design process rather than of construction process. They may be used as a design drawing which is generally presented at the communication or debate between architects and clients or lay audience in developing the design. The structure of the second test exploring whether this is an appropriate assumption is explained in the next section.

7.7 The Second Empirical Test

This section presents the objective, methodology, and research instrument (the online questionnaire) used in the second empirical test. It is important to note that, since the second empirical test is informed by the conclusions and key findings from the first empirical test, the methodology used in this second empirical test is therefore comparable to the first test.

7.7.1 Objective: the second empirical test

The primary objectives of the second empirical test are to:

1. examine the communicative potential of alternative plan drawings, the so-called 'communicative drawings', and in particular whether they communicate better than a conventional plan drawing.
2. identify whether lay people are able to perceive, interpret, and understand a communicative drawing better than a conventional drawing.

3. identify the difference between using non-architect's language and conventional architectural elements as a method of coding in developing architectural plan drawing.

The objectives are translated into two experimental hypotheses:

1. There is a difference between the way a conventional architectural drawing and a communicative drawing are seen and read by the audience. A communicative drawing should provide a better communication to its audience. Lay people, or even architects, are able to see and read an alternative form of drawing better than a conventional form of drawing.
2. There is a difference in the way a communicative drawing and a conventional architectural drawing conveys and communicates to the audience. Architects and lay people should interpret and understand better with a communicative drawing.

7.7.2 Methodology: the second empirical test

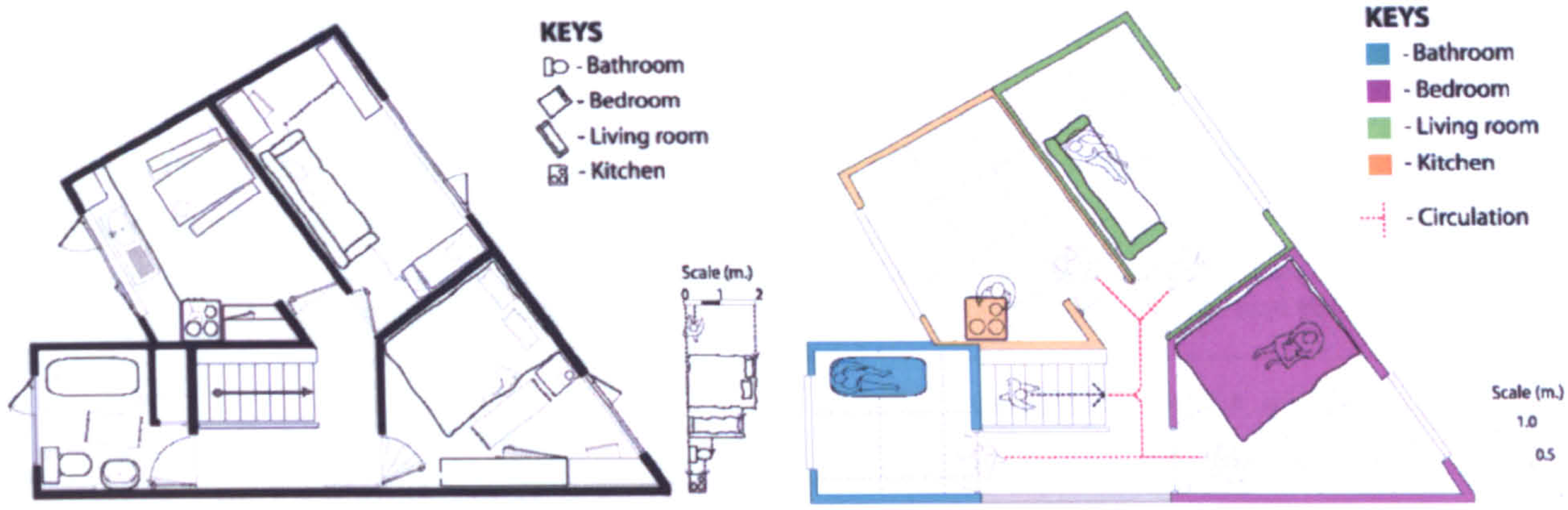
As previously mentioned, the methodology used within the second empirical test is similar to the first empirical test. In the first instance, the same group of respondents are randomly selected, which can be categorised as: (1) Lay people who are non-architects (2) first year architectural students (3) Diploma architectural students. This assures that the educational level and the background of respondents within both empirical tests will not be varied. Secondly, the on-line questionnaire is again used as a research instrument for collecting all data, and similarly to that of the first test, is sent out and received through email.

On the other hand, the structure of the questionnaire itself is different. This can be explained in the following sections through the design and format of the questionnaire and the data collection process.

7.7.3 Designing the Questionnaire: Drawing the line questionnaire 2

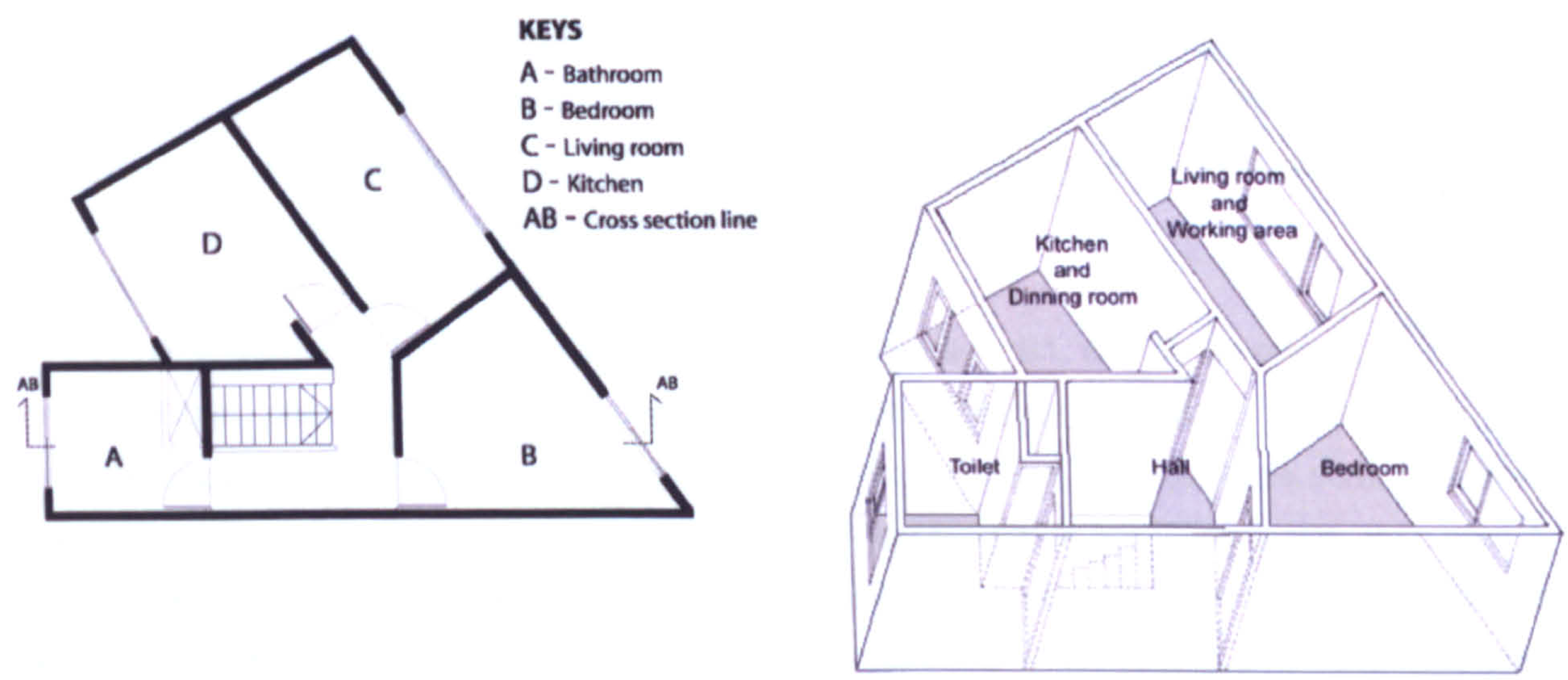
As 'Draw the Line questionnaire 2' is informed by the first empirical test, some of the questions and major factors are therefore related to the first questionnaire. This includes the purpose and type of questions, length and layout of the questionnaire, and the groups of respondent. Some of the questions from the first questionnaire are carried over to the second questionnaire. This allows the results and responses between the two phases of the empirical test to be compared and further analysed. However, some of the questions in the second questionnaire are more specific, and in particular emphasise the issue of how lay people and architects see and interpret a communicative drawing.

Plan B1 and plan D are used as the two main drawings within the questionnaire and are called communicative drawing 1 and 2 respectively. Two conventional drawings are brought in from the first empirical test to be used as a reference and control: plan A (coded language) and plan C (three-dimensional).



(Plan B1) (Plan D)

Figure 7.10: Communicative drawings



(Plan A) (Plan C)

Figure 7.11: Conventional drawing are used as reference drawings

In essence, the second empirical test is divided primarily into four parts. The questions asked within each part are informed and structured by an analysis of the first empirical test.

7.7.3.1 Part One

There are two questions within part one (Questions1.1 and 1.2), which ask respondents to rank the drawings from the easiest to the hardest to understand: 'Which drawing is generally the easiest to understand?' The questions intend to examine immediate reaction from respondents toward the drawings, particularly at first glance.

It is important to note that both questions asked in part one serve a similar purpose to Question 1 in the first empirical test. However, the questions are asked against different sets of drawing. As shown in table 7.2, Question 1 in the first empirical test was asked against plan A, B, and C. The questions of part one in the second empirical test are asked against one conventional drawing and two communicative drawings: plan A, B1, and D. The intention is to use plan A as the control reference by which the communicative potential of the two new drawings may be measured.

Table 7.2: Comparison between questions asked in Q1 (the first empirical test) and Q1.1 and 1.2 (part one of the second empirical test)

The first empirical test	The second empirical test
Question1: A, B, and C	Question1.1: A, B1, and C Question1.2: A, B1, and D

Question 1.1: The question is asked against plan A, B1, and C. It can be noticed from table 7.2, that plan B from the first empirical test has been replaced with plan B1 in the second empirical test. This is hoped to examine whether or not plan B1 (as a communicative drawing) conveys information and communicates with lay people or architects better than plan B (as a conventional drawing). Moreover, by using plan A and C as reference drawings, the hypothesis that plan B1 (a replacement for plan B) may affect the way respondents perceive and interpret conventional drawings (plan A and C) can be tested.

Question 1.2: The question is asked against plans A, B1, and D. By relating to the first empirical test, plans B and C have respectively been replaced with plans B1 and D in the second empirical test. This is hoped to investigate whether plans B1 and D (as communicative drawings) convey information and communicate with lay people or architects better than plan A (as a conventional drawing). Moreover, a comparison between plans B1 and D as an alternative method in architectural drawing, particularly in their potential in conveying and communicating information, is tested. By using plan A as a reference drawing, the hypothesis that plans B1 and D affects the way respondents perceive and interpret a conventional drawing (plan A) is tested.

Part 1: Please rank the drawings from the easiest to the hardest to understand. Please select the appropriate drawing from the drop-down menu.

1.1) Which drawing is generally the easiest to understand?

The Easiest	→	The Hardest
Plan A	Plan A	Plan A

Figure7.12: Question 1.1 asked in part one (See full set of questions in Appendix H).

7.7.3.2 Part Two:

The aim of this part is to compare a conventional drawing with a communicative drawing, particularly in terms of their communicative potential and ability in conveying a message. By examining basic qualities of a conventional plan drawing (circulation, use, and scale) in the first empirical test, the results showed that plan A was best able to provide information on circulation, plan B best explained the use and relationship between rooms, and plan C best communicated information on scale and building appearance. At the same time, however, the conventional drawing also revealed the problem in communicating with the wider audience.

In the second part, the respondents are asked to evaluate the basic qualities of plans; A, B1, and D, against six questions. By attempting to be more precise than the previous questionnaire, the scales are based on five categories, which are measured on a nominal scale[6] from 'very well' to 'very poorly'. The questions are intended to evaluate the drawing's quality in conveying information concerning the basic qualities of plan drawing: circulation, use, and scale, as well as spatial experience (what it is like to live in the building?) (See 2.1-2.4 in Figure 7.13). There are two additional questions (See 2.5 and 2.6 in figure7.13), which ask respondents for their opinion on whether they like or dislike the drawings.

Since the questions in part two are comparable to the first empirical test, the comparison between two phases of the empirical test can be compared and analysed.

Part 2: Please tick the appropriate response. You are being asked to rank the quality of the drawing against the following questions, by indicating whether it describes:
5= Very well, 4= Well, 3= Fair, 2= Poorly, 1= Very poorly.
Please also give your opinion on the last two questions of each section.

Plan A: (5= Very well, 4= Well, 3= Fair, 2= Poorly, 1= Very poorly)

How well does this drawing...
2.1) describe how to move from one room to another? 5 ○ 4 ○ 3 ○ 2 ○ 1 ○
2.2) describe the use of the building? 5 ○ 4 ○ 3 ○ 2 ○ 1 ○
2.3) provide information on scale and size? 5 ○ 4 ○ 3 ○ 2 ○ 1 ○
2.4) describe what it is like to live in the building? 5 ○ 4 ○ 3 ○ 2 ○ 1 ○

[6] See 'nominal scale' in chapter Five.

2.5) What do you like about this drawing?

2.6) What do you dislike about this drawing?

Figure 7.13: Questions asked in part two (See full set of questions in Appendix H).

7.7.3.3 Part Three:

This part of the questionnaire attempts to compare the communicative potential of the two forms of communicative drawings, plans B1 and D. The questions ask respondents to indicate whether the given statement is true, false, or undecided. Since the hypothesis is that a communicative drawing conveys and communicates better than a conventional drawing, some of the questions from the first empirical test are carried over and repeated in the second empirical test (in particular the ones which caused a perceived communication breakdown).

All the questions are focused on the basic knowledge contained within a plan drawing, such as circulation, use of building, scale and dimensioning, architectural symbols, spatial experience, and so on. It is important to note that the results obtained from this section may only provide an idea of how respondents read and interpret the plan drawing, and thus cannot be assumed for the whole context of architectural drawing.

Part 3: Please indicate whether the statement is 'True', 'False', or 'Undecided'. Please tick the appropriate response.

Question asked for plan B1

3.1) This drawing shows a horizontal slice through the building.

True False Undecided

3.2) This drawing is drawn to scale.

True False Undecided

3.3) The stair is enclosed with walls on both sides.

True False Undecided

3.4) The kitchen shares the same wall with the bedroom.

3.5) How many wall cupboards are there in the kitchen.
0 ◌ 1 ◌ 2 ◌ Undecided ◌
3.6) When you walk up the stairs, the bedroom wall will be in front of you.
True ◌ False ◌ Undecided ◌
3.7) Every room has a rug in it.

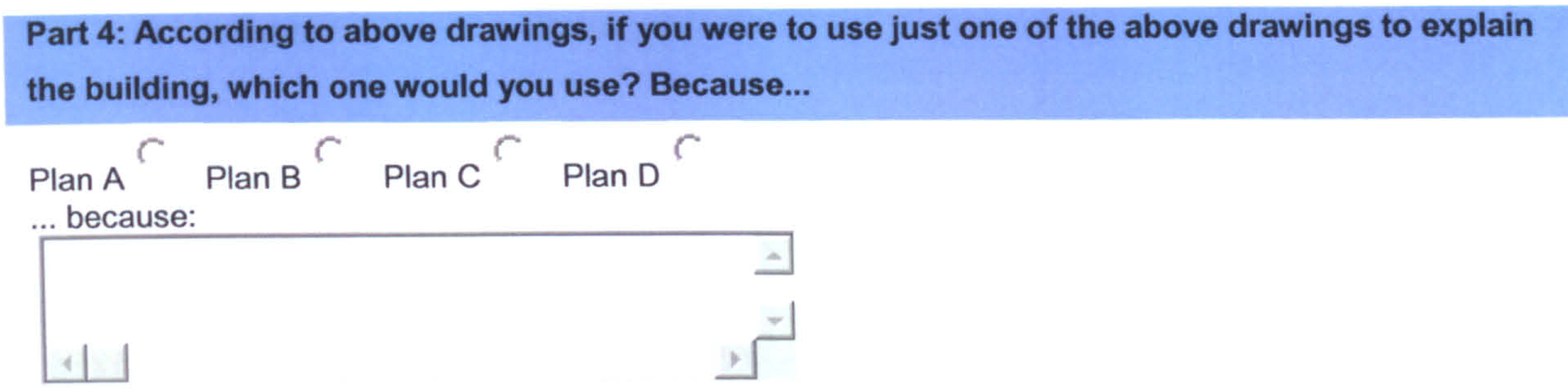
Questions asked for plan D

3.8) This is a one-storey building.
True ◌ False ◌ Undecided ◌
3.9) The width of the stair is 0.6 m.
True ◌ False ◌ Undecided ◌
3.10) Information about the height of rooms is provided by this drawing.
True ◌ False ◌ Undecided ◌
3.11) The stairs are going up to the next floor.
True ◌ False ◌ Undecided ◌
3.12) There are EIGHT doors in this drawing.
True ◌ False ◌ Undecided ◌
3.13) If you walk out from the bedroom, you can walk straight to the bathroom.
True ◌ False ◌ Undecided ◌
3.14) There is a window in the hallway.
True ◌ False ◌ Undecided ◌

Figure 7.14: Questions asked in part three against plan B1 and D (See full set of questions in Appendix H).

7.7.3.4 Part Four:

The last part asked respondents to select only one of the four drawings - plan A, B1, C, and D - to explain the building, and to give reasons for their choice. These reasons and the feedback obtained can be used to analyse the way that the communicative drawings work in relation to conventional drawings.


Part 4: According to above drawings, if you were to use just one of the above drawings to explain the building, which one would you use? Because...

Plan A Plan B Plan C Plan D

... because:

Figure 7.15: Questions asked in part four (See full set of questions in Appendix H).

In conclusion, it is hoped that with the second questionnaire, it would be possible to reveal the communicative potential of the communicative drawings, and to prove the previous hypothesis which emphasised the communication breakdown between a conventional architectural drawing and its audience. The proposal for developing communicative drawing as an alternative method for architectural drawing is examined and analysed in this context. Moreover, both positive and negative responses from the respondents towards the communicative drawing are revealed. This includes the perceived advantages and disadvantages of both conventional and communicative drawing.

Therefore, this is hoped that the second empirical test will be able to discover the question of using the communicative drawing as an alternative method in architectural drawing. However, the results from both tests of questionnaire may be unable to form or revolutionise the whole framework of architectural drawing, but the intention is to provide some comprehensive and inventive ideas in improving the quality of drawing.

7.8 Limitations: the second empirical test

The limitations and problems found within the second empirical test include the same ones identified in the first empirical test (see section 5.6 in Chapter Five). In addition, the following limitation may be identified:

1. The empirical test was carried out twice within the similar group of population at large. Hence, the respondents who have already completed the first questionnaire may know or recognise the structure of the test. This may cause biasness to the whole experimental study. Moreover, the difference between the respondents who have or have not completed the test becomes potentially significant because their approach to the answers may be different.

7.9 Conclusion

In this chapter, some of the major issues in developing a communicative drawing, constructing a questionnaire, and forming a method of data collection were examined. This shows many interesting approaches, particularly advantages and disadvantages, in developing a conventional plan drawing to a communicative drawing. Such an alternative form of drawing will be investigated within the second questionnaire, which will in turn inform the conclusion of this research.

*

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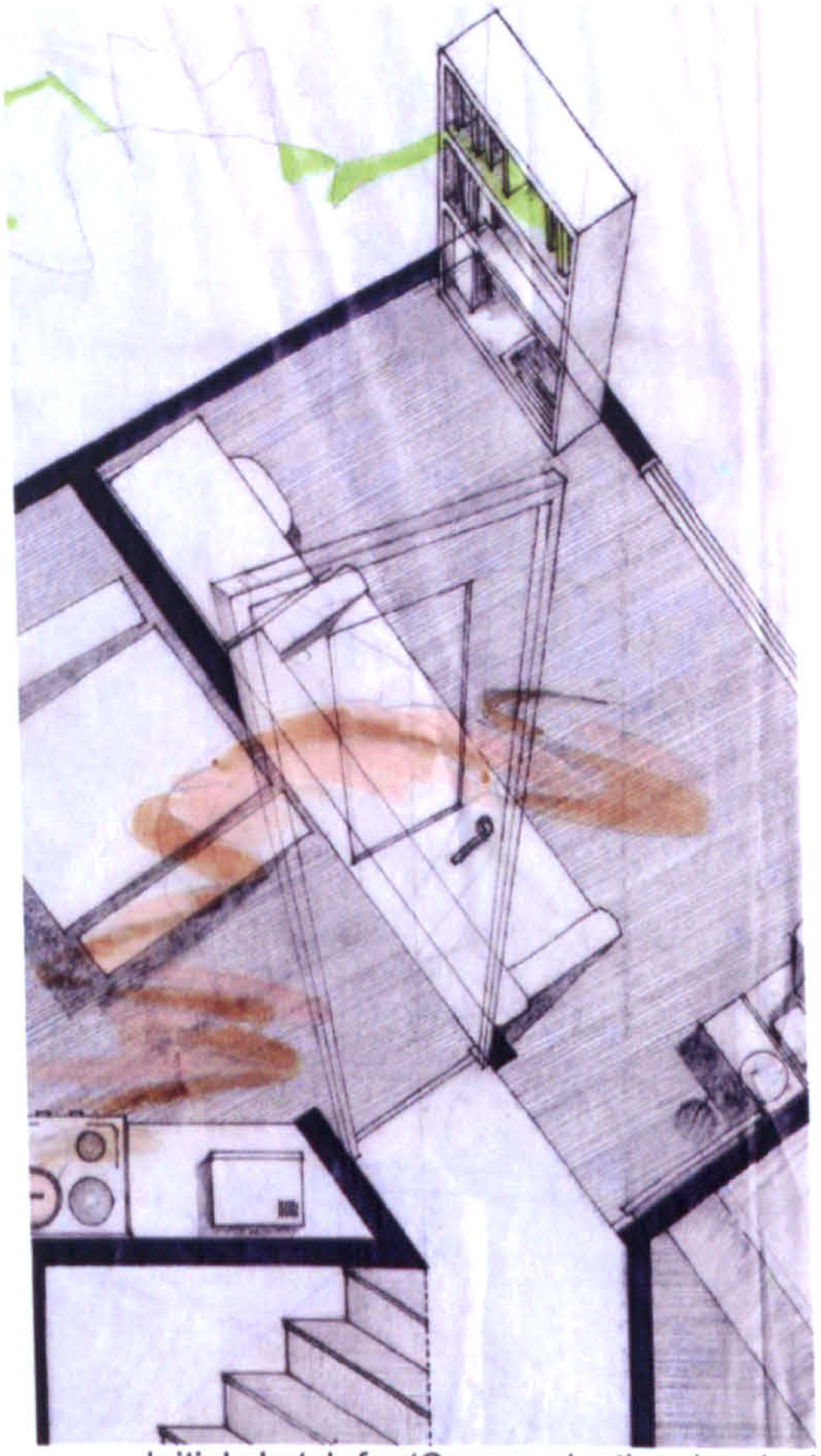
Chapter 8
The Second Empirical Test



Initial sketch for 'Communicative drawing'
(drawn by the author)

Chapter Eight | THE SECOND EMPIRICAL TEST

Results, Analysis and Discussions

8.1 Introduction

This chapter presents and discusses results obtained from the second empirical test, which was conducted through an online questionnaire: 'Draw the Line Questionnaire 2'. The fundamental aim of the questionnaire was to examine the potential of the 'communicative drawing' as an alternative form of architectural plan drawing.

As with the first empirical test, the questionnaire was performed on three groups of respondents: (1) lay people, (2) first year and (3) diploma architectural students. This allows the results obtained from the second empirical test to be compared with the first empirical test and the hypotheses outlined earlier. The chapter is divided into four main sections:

8.2 Description of the respondents
8.3 Quantitative findings
8.4 Qualitative findings
8.5 Conclusion

Firstly, the responses are presented and explained through tables of frequencies and percentile scores. Secondly, quantitative data obtained from three different groups of respondent are presented and discussed. Questions asked in the first empirical test are carried over to the second empirical test, allowing comparative study between results obtained from the first and second empirical tests to be made. This means the communicative potential of conventional and communicative drawings can be rigorously compared. Furthermore, differences in the way respondents act and respond after a conventional architectural drawing has been replaced with a communicative drawing are also examined. This is followed by a summary of qualitative feedback obtained from the three different groups of respondents.

The eventual outcome is hoped to inform the communicative potential of the 'communicative drawing', and to examine whether it influences or affects the way in which respondents see and interpret the conventional plan drawing. This relates to a previous hypothesis, namely that 'communicative drawing has more communicative potential and communicates better than conventional drawing. It could become an alternative form of architectural drawing that improves communication between architects and lay people'.

8.2 Description of the Respondents

There were 482 responses received from the group of lay people, 25 responses from first year architectural students, and 32 responses from diploma architectural students. This is a similar distribution to the first empirical test, though with a slightly higher proportion of lay people.

Table 8.1 shows frequencies and percentages of lay people in accordance with different classifications, for example gender, age, and department of study, while table 8.2 shows frequencies and percentages of architectural students categorised according to their different years of study.

Table 8.1: Summary of description of Lay people

Gender	The second empirical test	
	Frequencies	Percentages (%)
Male	213	44.75
Female	263	55.25
Total	476	100.00
Missing	6	-
Total	482	
Age		
18-30	179	37.21
31-40	140	29.11
41-50	110	22.87
51-60	46	9.56
60+	6	1.25
Total	481	100.00
Missing	1	-
Total	482	
Departments		
Arts	21	4.90
Law	6	1.40
Medicine	126	29.37
Pure science	74	17.25
Social science	19	4.43
Other	110	25.64
Engineering	73	17.02
Total	429	100.00
Missing	53	-
Total	482	

Table 8.2: Summary of description of architectural students

Gender	The second empirical test	
	Frequencies	Percentages (%)
Male	30	52.63[1]
Female	27	47.37
Total	57	100.00

[1] These percentages for gender are in line with the percentage for the School of Architecture as a whole.

Missing (9)	0	-
Total	57	
Age		
18-30	50	87.72
31-40	1	1.75
41-50	3	5.26
51-60	3	5.26
60+	0	0.00
Total	57	100.00
Missing (9)	0	-
Total	482	
Year of study		
First year	25	43.90
Diploma	32	56.10
Total	57	100.00
Missing (9)	0	-
Total	57	

8.3 Quantitative Findings: the Second Empirical Test

This section presents the quantitative findings, which are shown according to the four main parts of the questionnaire. Within each part, the data is analysed and explained in accordance with the three different groups of respondents.

8.3.1 Part One

By using the same method as the first empirical test, the questions asked respondents to rank each drawing from 'the easiest' to 'the hardest' to understand; this is to test the general qualities of the drawing. Two main questions (1.1 and 1.2) were asked against plan A, B1, and C, and plan A, B1, and D, respectively.

As mentioned in Chapter Seven, the drawings used in the second empirical test were different from the first empirical test. They were modified and replaced with 'communicative drawings'; for example, in Question 1.1; plan B (pictorial drawing) from the first empirical test has been replaced with communicative plan B1, whilst in Question 1.2; plan B (pictorial drawing) and plan C (three dimensional) have respectively been replaced with communicative plans B1 and D (see communicative drawings in Appendix I).

Question 1.1: Which drawing is generally the easiest to understand?

This question is designed to examine judgemental views and preferences of respondents 'at first glance'. The results show how respondents superficially respond after a conventional plan drawing (plan B) has been replaced with a communicative plan B1. It is hypothesised that the replacement of drawings would influence the way respondents (particularly the lay people) see and read the whole set of architectural drawings.

Table 8.3: Percentile scores obtained from three groups of respondents: Question 1.1- part 1.

Respondents		Plan A (N)	Plan B1 (N)	Plan C (N)
Lay people	Easiest	21.99% (106)	24.27% (117)	**53.94% (260)**
	Middle	**38.80% (187)**	32.57% (157)	28.42% (137)
	Hardest	**39.21% (189)**	**43.15% (208)**	17.63% (85)
	Total	100% (482)	100% (482)	100% (482)
First year architectural students	Easiest	32.0% (8)	12.0% (3)	**56.0% (14)**
	Middle	24.0% (6)	**40.0% (10)**	36.0% (9)
	Hardest	**44.0% (11)**	**48.0% (12)**	8.0% (2)
	Total	100% (25)	100% (25)	100% (25)
Diploma architectural students	Easiest	**31.25% (10)**	25.0% (8)	**43.75% (14)**
	Middle	**31.5% (12)**	25.0% (8)	**37.50 % (12)**
	Hardest	**31.25% (10)**	**50.0% (16)**	18.75% (6)
	Total	100% (32)	100% (32)	100% (32)

Plan A - Code language / Plan B1 - Communicative drawing 1 / Plan C - Thee dimensions
Question was based on three categories: Easiest, Middle, and Hardest.
N = Number of respondents
Note: Highest percentages are in bold

Three group of respondents agreed that, after plan B (pictorial language) has been replaced with communicative plan B1, plan C (three dimensions) is 'the easiest' drawing to understand; noted by 53.94% of lay people, 56.0% of first year students, and 43.75% of diploma students. On the other hand, 43.15% of lay people, 48.0% of first year students, and half of diploma students all noted communicative plan B1 as 'the hardest'.

As can be noticed, 39.21% of lay people and 44.0% of first year architectural students noted plan A (coded language) as 'the hardest'. The scores received from diploma students show a different pattern: 31.25% of them noted plan A as 'the easiest' and 'the hardest', while 31.5% noted it as 'middle'.

Question 1.2: Which drawing is generally the easiest to understand?

By asking the same question, but against different drawings; Question 1.2 examines how respondents generally respond after conventional plan drawings (plan B and C) have respectively been replaced with communicative drawings (plan B1 and D).

Table 8.4: Percentile scores obtained from three groups of respondents: Question 1.2- part 1.

Respondents		Plan A (N)	Plan B1 (N)	Plan D (N)
Lay people	Easiest	26.14% (126)	14.32% (69)	**59.34% (286)**
	Middle	32.16% (155)	**37.97% (183)**	29.88% (144)
	Hardest	**41.70% (201)**	**47.72% (230)**	10.79% (52)
	Total	100% (482)	100% (482)	100% (482)
First year architectural students	Easiest	16.0% (4)	12.0% (3)	**72.0% (18)**
	Middle	**44.0% (11)**	36.0% (9)	20.0% (5)
	Hardest	40.0% (10)	**52.0% (13)**	8.0% (2)
	Total	100% (25)	100% (25)	100% (25)
Diploma architectural students	Easiest	**37.50% (12)**	15.63% (5)	**46.88% (15)**
	Middle	**31.25% (10)**	28.13% (9)	40.63% (13)
	Hardest	**31.25% (10)**	**56.25% (18)**	12.50% (4)
	Total	100% (32)	100% (32)	100% (32)

Plan A - Code language / Plan B1 - Communicative drawing 1 / Plan C - Thee dimensions
Question was based on three categories: Easiest, Middle, and Hardest.
N = Number of respondents
Note: Value of the percentile scores obtained from valid percentages and highest percentages are in bold

Most of the respondents found plan D 'the easiest' drawing to understand; noted by 59.34% of lay people, 72.0% of first year students, and 46.88% of diploma students, whilst plan B1, similar to Question 1.1, was noted as 'the hardest' by 47.72% of lay people, 52.0% of first year students, and 56.25% of diploma students. Again, 41.70% of lay people and 40.0% of first year architectural students noted plan A (coded language) as 'the hardest' to understand, while the scores shown in plan A, given by diploma students, seemed consistent; 31.25% of them noted plan A as 'middle' and 'the hardest', while the rest (37.50%) noted it 'the easiest'.

Even a brief examination of these results leads to some interesting conclusions. Firstly, the development of the communicative drawing B1 cannot be seen as a success in Question 1.1 and 1.2, with it being deemed the most difficult to understand by all three groups in both tests. The reasons for this are examined below. On the other hand the communicative drawing D, which at first sight might appear the most abstract of all, performs extremely well, particularly for lay people and first year students. Interestingly, its acceptance by diploma students is less pronounced, with less than half finding it the easiest to read. At the same time a third of them still find the most conventional of the drawings (plan A) the easiest to read, far more than the other two groups. This gives a clear indication that architects, as represented by the Diploma students, will stick with what they know best and what has been deemed to be 'proper', whilst lay audiences are more receptive to alternative modes of drawing.

Generally it can be noted that the results obtained from lay people and first year architectural students appear to be comparable, and that these two groups are quite different from the results from the diploma students. This might be related to an argument raised in the first empirical test, noting that 'the group of first year students may be considered as being similar to non-architects in regard to their level of architectural knowledge'. An analysis of these differences, and the comparison between the first and second empirical test will be carried out in a later section of this chapter.

8.3.2 Part Two

The questions in part two asked respondents to rank three drawings, plans A (coded language), B1, and D (communicative drawings), from 'very well' to 'very poorly' concerning certain qualities and the ability to convey information related to a plan drawing. There were in total six questions asked against each drawing and, as mentioned, some questions were carried over from the first empirical test. The first four questions were focused on four basic keys of the plan drawing;

- Circulation (Question 2.1, 2.7, and 2.13)
- Use (Question Q2.2, 2.8, and 2.14)
- Scale (Question Q2.3, 2.9, and 2.15)
- Spatial experience (Question Q2.4, 2.10, and 2.16)

The last two questions asked respondents to give critical feedback; whether they like or dislike the drawing. The feedback obtained from these two questions are summarised in the section of qualitative findings (see also Appendix J). The outcome of this part is therefore hoped to inform the qualities between a conventional drawing (plan A) and communicative drawings (plan B1 and D), particularly in terms of their ability to communicate the basic information required of a plan drawing.

<u>Question 2.1, 2.7, and 2.13</u>: How well does plan A, B1, and D describe how to move from one room to another?

Table 8.5: Percentile scores obtained from three groups of respondents: Question 2.1, 2.7, and 2.13- part 2.

Respondents		**Q2.1** **Plan A (N)**	**Q2.7** **Plan B1 (N)**	**Q2.13** **Plan D (N)**
Lay people	**Very poorly**	4.84% (23)	3.15% (15)	1.89% (9)
	Poorly	12.00% (57)	16.39% (78)	2.10% (10)
	Fair	26.11% (124)	**33.61% (160)**	6.92% (33)
	Well	**29.05% (138)**	30.25% (144)	29.56% (141)
	Very well	28.00% (133)	16.60% (79)	**59.54% (284)**
	Total	100% (475)	100% (476)	100% (477)

First year architectural students	Very poorly	8.0% (2)	4.0% (1)	**0.0%**
	Poorly	**44.0% (11)**	28.0% (7)	4.0% (1)
	Fair	32.0% (8)	**56.0% (14)**	4.0% (1)
	Well	12.0% (3)	8.0% (2)	36.0% (9)
	Very well	4.0% (1)	4.0% (1)	**56.0% (14)**
	Total	100% (25)	100% (25)	100% (25)
Diploma architectural students	Very poorly	0.0%	6.3% (2)	3.1% (1)
	Poorly	15.6% (5)	18.8% (6)	3.1% (1)
	Fair	**31.3% (10)**	**34.4% (11)**	3.1% (1)
	Well	**31.3% (10)**	28.1% (9)	43.8% (14)
	Very well	21.9% (7)	12.5% (4)	**46.9% (15)**
	Total	100% (32)	100% (32)	100% (32)

Plan A - Code language / Plan B1 - Communicative drawing 1 / Plan D - Communicative drawing 2
Question was based on five (nominal) scales: Very poorly, Poorly, Fair, Well, and Very well.
N = Number of respondents
Note: Value of the percentile scores obtained from valid percentages and highest percentages are in bold

Conventionally, for the architects, plan A as a basic architectural drawing should provide adequate information on the circulation. However, the results turned out to be quite opposite to what might be assumed. According to three groups of respondents' results, the communicative plan D has turned out to be far better in describing and communicating the circulation than plan A (conventional or technical drawing). More than half of lay people and first year students, as well as 46.9% of diploma students, found plan D to be useful in adequately describing information on circulation. Interestingly, half of diploma students still noted plan A as 'well' and 'very well'; without responses in 'very poorly'. This shows the students' confidence in the conventional drawing, as previously mentioned in part one.

Question 2.2, 2.8, and 2.14: How well does plan A, B1, and D describe the use of the building?

Table 8.6: Percentile scores obtained from three groups of respondents: Question 2.2, 2.8, and 2.14- part 2.

Respondents		Q2.2 Plan A (N)	Q2.8 Plan B1 (N)	Q2.14 Plan D (N)
Lay people	Very poorly	14.47% (69)	1.48% (7)	1.05% (5)
	Poorly	22.43% (107)	4.03% (19)	2.51% (12)
	Fair	**31.45% (150)**	18.22% (86)	15.90% (76)
	Well	21.80% (104)	**44.92% (212)**	**42.68% (204)**

	Very well	9.85% (47)	31.36% (148)	37.87% (181)
	Total	100% (477)	100% (472)	100% (478)
First year architectural students	Very poorly	20.0% (5)	0.0%	0.0%
	Poorly	**36.0% (9)**	0.0%	0.0%
	Fair	32.0% (8)	8.0% (2)	8.5% (2)
	Well	12.0% (3)	**56.0% (14)**	**48.0% (12)**
	Very well	0.0%	36.0% (9)	44.0% (11)
	Total	100% (25)	100% (25)	100% (25)
Diploma architectural students	Very poorly	18.8% (6)	3.1% (1)	0.0%
	Poorly	21.9% (7)	6.3% (2)	3.1% (1)
	Fair	**37.5% (12)**	12.5% (4)	28.1% (9)
	Well	12.5% (4)	**53.1% (17)**	**46.9% (15)**
	Very well	9.4% (3)	25.0% (8)	21.9% (7)
	Total	100% (32)	100% (32)	100% (32)

Plan A - Code language / Plan B1 - Communicative drawing 1 / Plan D - Communicative drawing 2
Question was based on five (nominal) scales: Very poorly, Poorly, Fair, Well, and Very well.
N = Number of respondents
Note: Value of the percentile scores obtained from valid percentages and highest percentages are in bold

Again, Table 8.6 shows the communicative drawings performing better than the conventional drawing, though in this case it is plan B1 which comes out best across the groups. This is maybe not surprising given the amount of 'everyday' information on plan B1 which gives a clear indication as to how the spaces might be used. However, it is interesting to note that communicative plan D performs almost as well; it may be argued that the lack of specificity in this plan compared to plan B1 actually makes it a more useful drawing; where plan B1 determines fixed usage in fixed places, plan D gives a more open suggestion as to how rooms might be used without overly determining it.

Question 2.3, 2.9, and 2.15: How well does plan A, B1, and D provide information on scale and size?

Table 8.7: Percentile scores obtained from three groups of respondents: Question 2.3, 2.9, and 2.15- part 2.

Respondents		Q2.3 Plan A (N)	Q2.9 Plan B1 (N)	Q2.15 Plan D (N)
Lay people	Very poorly	**45.24% (214)**	2.52% (12)	0.42% (2)
	Poorly	29.81% (141)	9.66% (46)	5.65% (27)
	Fair	11.84% (56)	28.15% (134)	17.36% (83)

	Well	7.82% (37)	**39.29% (187)**	**41.84% (200)**
	Very well	5.29% (25)	20.38% (97)	34.73% (166)
	Total	100% (473)	100% (476)	100% (478)
First year architectural students	**Very poorly**	32.0% (8)	**0.0%**	**0.0%**
	Poorly	**36.0% (9)**	4.0% (1)	4.0% (1)
	Fair	16.0% (4)	20.0% (5)	28.0% (7)
	Well	16.0% (4)	**64.0% (16)**	**36.0% (9)**
	Very well	**0.0%**	12.0% (3)	32.0% (8)
	Total	100% (25)	100% (25)	100% (25)
Diploma architectural students	**Very poorly**	**34.4% (11)**	0.0%	0.0%
	Poorly	21.9% (7)	9.4% (3)	6.3% (2)
	Fair	25.0% (8)	21.9% (7)	15.6% (5)
	Well	18.8% (6)	**46.9% (15)**	**50.0% (16)**
	Very well	0.0%	21.9% (7)	28.1% (9)
	Total	100% (32)	100% (32)	100% (32)

Plan A - Code language / Plan B1 - Communicative drawing 1 / Plan D - Communicative drawing 2
Question was based on five (nominal) scales: Very poorly, Poorly, Fair, Well, and Very well.
N = Number of respondents
Note: Value of the percentile scores obtained from valid percentages and highest percentages are in bold

There is remarkable consistency here in the rejection of plan A as providing useful information on scale. All three groups of respondents judged plan A as describing the scale and size of the building 'very poorly'; 45.24% of lay people, 36.0% of first year students, and 34.4% of diploma students. None of first year and diploma students noted plan A as doing the job 'very well'. On the other hand, the two types of communicative drawings were noted as 'well' and 'very well' by three groups of respondents, with no responses in 'very poorly' from first year and diploma students.

Again this might come as a surprise: plan A as conventional drawing should technically be able to adequately describe information on scale and size of the building. The discrepancy may be explained by the attention given to developing scaling keys for the two communicative drawings, in particular that for plan D which draws on conventions from mapping and relates the scale to the human body. This advantage learnt from the communicative plan D is considered one of the recommendations for improving the communicative potential of architectural plan drawings.

<u>Question 2.4, 2.10, and 2.16</u>: How well does plan A, B1, and D describe what it is like to live in the building?

Table 8.8: Percentile scores obtained from three groups of respondents: Question 2.4, 2.10, and 2.16-part 2.

Respondents		Q2.4 Plan A *(N)*	Q2.10 Plan B1 *(N)*	Q2.16 Plan D *(N)*
Lay people	**Very poorly**	**58.32% (277)**	5.92% (28)	4.38% (21)
	Poorly	29.47% (140)	10.99% (52)	7.72% (37)
	Fair	8.00% (38)	27.27% (129)	26.51% (127)
	Well	3.37% (16)	**39.75% (188)**	**39.67% (190)**
	Very well	0.84% (4)	**16.07% (76)**	**21.71% (104)**
	Total	100% (475)	100% (473)	100% (479)
First year architectural students	**Very poorly**	**60.0% (15)**	**0.0%**	**0.0%**
	Poorly	36.0% (9)	12.0% (3)	8.0% (2)
	Fair	4.0% (1)	28.0% (7)	32.0% (8)
	Well	**0.0%**	**44.0% (11)**	**36.0% (9)**
	Very well	**0.0%**	**16.0% (4)**	**24.0% (6)**
	Total	100% (25)	100% (25)	100% (25)
Diploma architectural students	**Very poorly**	**62.5% (20)**	0.0%	3.1% (1)
	Poorly	18.8% (6)	9.3% (3)	31.3% (10)
	Fair	15.6% (5)	**56.3% (18)**	**37.5% (12)**
	Well	3.1% (1)	28.1% (9)	21.9% (7)
	Very well	0.0%	6.3% (2)	6.3% (2)
	Total	100% (32)	100% (32)	100% (32)

Plan A - Code language / Plan B1 - Communicative drawing 1 / Plan D - Communicative drawing 2
Question was based on five (nominal) scales: Very poorly, Poorly, Fair, Well, and Very well.
N = Number of respondents
Note: Value of the percentile scores obtained from valid percentages and highest percentages are in bold

Again, there is clear preference for the communicative drawings, with Plan D marginally the best. The majority of respondents clearly agreed that plan A is 'very poor' in describing the spatial experience of the building; claimed by 58.32% of lay people, 60.0% of first year students (without any responses in 'very well' and 'well'), and 62.50% of diploma students (without any responses in 'very well'). One might have expected Plan B1, with more hints as to how to live in the space, would have performed best, but the results suggests that the amount of information in Plan D works well. It appears to have enough information to clearly denote occupation, but not so much as to over-determine the potential occupation or to confuse the reader (as suggested by Bertin's (1983) rules for graphic system in Chapter Seven). This suggests that plan D leaves enough open for the audience to intepret the occupation of spaces according to their own preferences and experiences. Interestingly, communicative plan B1 and D were the least appreciated by diploma students. Their acceptance was less pronounced, with only 6.3% found them the easiest to read and understand.

To conclude from four sets of questions, the results obtained from part two clearly illustrate the different quality and potential of communication between a conventional architectural drawing (plan A) and communicative drawings (plan B1 and D). All three groups of respondents provided a similar pattern in their results. Interestingly this is also fairly consistent across all four questions, suggesting that the communicative drawing - in particular plan D - has the ability to communicate most of the basic information required of a plan. This is different from what we found in the first test, where different drawings came out best depending on the information being asked of it, and thus where we found the need for a range of drawings to get across all the required information. The advantages of the communicative drawings found in this part are taken into the recommendations for the improvement of the communicative quality of architectural drawings discussed in Chapter Nine.

Since some of the questions in part one of the first empirical test were also asked in part one and two of the second empirical test (see Table 8.9)[2], the comparison between 'part one' of the first empirical test and 'part one and two' of the second empirical tests can be made. This means the conventional drawings used in the former test are compared with the communicative drawings in the latter using statistical analysis. It is thus hoped to significantly verify the way in which the conventional plan drawing and the communicative plan drawing communicate with the audience. This will test the main hypothesis as to whether the communicative drawings have more communicative potential and communicate better than the conventional drawings.

[2] It is important to note that question 3, 4, and 6 in the first empirical test (Group III, IV, and V) were based on three categories, while the questions in the second test were based on five nominal scales. In order to make their comparison, therefore, the system of scale used in the second empirical test was transformed from five scales to three categories. This method of transforming and recoding a set of data into new values is called 'transformation of data' (see Norusis (1995)). Norusis (1995) notes that too many cross tabulations will result in too many expected values in a table being less than 5 and also the observed significant level based on chi-square distribution may not be valid. That is why the transformation of the data is required here. As Diamantopoulos and Schlegelmilch (1997) note, "In applying the two sample chi square test, ensure that no more than 20% of the cells have expected frequency of less than 5, and no cell has expected frequescy of less than 1. If more than 20% of the cells have expected frequencies of less than 5 and/or at least one cell has an expected frequency of 1 or less, try to combine categories so as to reduce the number of cells in the contingency table Diamantopoulos and Schlegelmilch (1997: 177).

Table 8.9: The questions asked in 'part one' of the first empirical test compared with 'part one and two' of the second empirical test.

Group	The first empirical test	The second empirical test
Group I	**Question 1: (plan A, B and C)** Which drawing is generally the easiest to understand?	**Question 1.1: (plan A, B1 and C)** Which drawing is generally the easiest to understand?
Group II	**Question 1: (plan A, B and C)** Which drawing is generally the easiest to understand?	**Question 1.2: (plan A, B1 and D)** Which drawing is generally the easiest to understand?
Group III	**Question 3: (plan A, B and C)** Which drawing clearly describes how to move from one room to another?	**Question 2.1(A)/ 2.7(B1)/ 2.13(D):** How well does plan A, B1, and D describe how to move from one room to another?
Group IV	**Question 4: (plan A, B and C)** Which drawing clearly describes how the use of the building?	**Question 2.2(A)/ 2.8(B1)/ 2.14(D):** How well does plan A, B1, and D describe the use of the building?
Group V	**Question 6: (plan A, B and C)** Which drawing clearly provides information on scale and size?	**Question 2.3(A)/ 2.9(B1)/ 2.15(D):** How well does plan A, B1, and D provide information on scale and size?

The questions were asked against plan A, B and C within the first empirical test, while against plan A, B1, C, and D in the second empirical test; using plan A and C as reference drawings.
Plan A= Coded language   Plan B1= Communicative drawing 1
Plan B= Pictorial language   Plan D= Communicative drawing 2
Plan C= Three dimensional

8.3.2.1 Comparative Study: Comparing 'Part 1' of the first empirical test with 'Part 1 and 2' of the second empirical test

In this section, the conventional drawing (plan A) and the communicative drawings: plan B1 (a modified version of plan B) and plan D (considered a better version of the conventional plan drawing), is statistically compared. In regard to the main hypothesis concerning the communicative potential of the communicative drawings, the following hypothesis was tested:

Hypothesis (e): *'The communicative drawing has greater communicative potential and communicates with the audience better than the conventional drawing'.*

By using the same statistical method as the first empirical test, the analysis is explored by the results of a Chi square test. The test is used to prove that two independent samples (the communicative drawing versus the conventional drawing) are not equal. As can be noticed, the hypothesis(e) indicates the direction of the expected differences (directional hypothesis), the one tailed[3] test at 95% confident interval (α = 0.05) was therefore used to detect any difference

[3] A one-tailed test is appropriate when a directional alternative hypothesis is specified. Its region of rejection is entirely at one end of the sampling distribution. Thus, the p-value of a one-tailed test is equivalant to half of the p-value of two-tailed test (see Diamantopoulos and Schlegelmilch (1997), Siegel (1956), Howell (1992), Dancey and Reidy (2002)).

between two forms of drawings (see Diamantopoulos and Schlegelmilch (1997)). Thus, if the p-value is less than the significance level ($p \geq 0.05$), the null hypothesis (H0), which means the two forms of drawings have equal communicative potential, is rejected. The results of Chi-square test are shown in the following section, according to two groups of respondents: Lay people and Diploma architectural students. The first year architectural students were not included in this analysis because their responses were found to be similar to those of lay people in the first empirical test.

a) Lay people

The percentile scores and results of Chi-square test are presented in table 8.10. The test examines the differences in communicative potential between the conventional and the communicative drawing and the way in which they communicate with lay people at a basic level.

Table 8.10: Percentile scores and results of the Chi-square test, comparing the conventional drawing used in part one of the first empirical test with the communicative drawing used in part one and two of the second empirical test - Lay people.

Group	Q	Test / Drawing	Percentile scores (%)			Chi square test	
			Best / Easiest	Medium / Middle	Worst / Hardest	X^2 value	P-value
I	Q1 Plan A	First / Conventional	18.10	26.41	55.49	4.498	0.052
	Q1.1 Plan B1	Second / Communicative	27.27	31.70	41.03		
II	Q1 Plan A	First / Conventional	18.10	26.41	55.49	3.102	0.106
	Q1.2 Plan B1	Second / Communicative	14.32	37.97	47.72		
	Q1 Plan A	First / Conventional	18.10	26.41	55.49	52.321	0.000*
	Q1.2 Plan D	Second / Communicative	59.34	29.88	10.79		
III	Q3 Plan A	First / Conventional	44.77	28.20	27.03	1.723	0.211
	Q2.7 Plan B1	Second / Communicative	46.80	33.64	19.56		
	Q3 Plan A	First / Conventional	44.77	28.20	27.03	44.719	0.000*
	Q2.13 Plan D	Second / Communicative	89.12	6.83	4.05		
IV	Q4 Plan A	First / Conventional	5.65	21.47	72.88	118.239	0.000*
	Q2.8 Plan B1	Second / Communicative	76.33	18.23	5.44		
	Q4 Plan A	First / Conventional	5.65	21.47	72.88	127.763	0.000*
	Q2.14 Plan D	Second / Communicative	80.54	15.90	3.56		
V	Q6 Plan A	First / Conventional	11.83	22.25	65.92	69.686	0.000*
	Q2.9 Plan B1	Second / Communicative	59.71	28.19	12.20		
	Q6 Plan A	First / Conventional	11.83	22.25	65.92	97.756	0.000*
	Q2.15 Plan D	Second / Communicative	76.63	17.37	6.10		

Questions were based on three categories: Best / Easiest, Medium / Middle, and Worst / Hardest.
Answers of very well and well were interpreted as Best/Easiest, answers of fair were interpreted as Medium/Middle, answers of very poorly and poorly were conducted as Worst/Hardest.
Results show that the communicative plan is better than the conventional plan are underlined.
X^2 value = Chi square value ($p \leq 0.05$) df = 2
P value = Significant level (one-tailed), * The test proves the significant difference at $p<0.05$ level

The chi square test revealed significant differences in communicative potential between the conventional plan A and the communicative plan D; in particular the questions in group II, III, IV, and V. The results were significant at ($p<0.05$). The test significantly indicated that the communicative plan D has more potential in conveying information and communicates with the audience better than the conventional plan A in the following aspects.

In group II, significant differences between plan A and D in providing adequate information of a plan drawing were recorded ($p=0.000$). The results significantly showed that more than half of lay people found the communicative plan D far more useful than the conventional plan A; as well as plan B1 (see Table 8.10). This significantly verified that the communicative ability of plan D is better than the other two drawings in conveying basic information of a plan.

In group III, again, significant differences were found between plan A and D ($p=0.000$). The communicative plan D significantly showed more potential in explaining circulation and how to move around the building. As can be noticed from the percentile scores, plan D was noted by lay people as the best, while plan B1 only showed a slight difference from plan A. Because of the use of common language and symbols, learnt from the study of Environmental Psychology and Graphic Representation, plan D appears to be able to communicate more directly with lay people; it helps them to see and read information on circulation better.

In group IV, significant differences in communicative potential were found between not only in plan A and plan D ($p=0.000$), but also in plan A and plan B1 ($p=0.000$). The test significantly indicated that both communicative plans B1 and D explain the use of the building better than the conventional plan A. This can also be noticed from the percentages of the conventional drawing that were the inverse of those of the communicative drawings. The use of furniture as recognisable icons in plan B1 and the use of colour-coding in plan D help to indicate each room's location and the use of each room to lay people far better than the conventional plan A.

Again in group V, there were significant differences in communicative potential between the communicative and the conventional plans ($p=0.000$). Both communicative plans B1 and D showed far better communicative ability in showing scale and size of the building over the conventional plan A. As can be noticed from the percentages, there was clear preference for plan D as the easiest drawing in reading scale information (76.63%). One might have expected plan B1, with the use of furniture as a scale reference, to have performed best, but the percentile scores suggested that the use of a grid system and a scale indication with reference to human body in plan D apparently became useful for lay people to relate to the spatial experience of the rooms and to read the scale of the drawing.

However, the results also showed no significant differences between the conventional plan A and the communicative plan B1 in providing a basic information of a plan drawing in questions group I (p=0.052) and II (p=0.106), as well as in showing circulation in group III (p=0.211). This can be interpreted that the communicative potential of plan A and B1 concerning these aspects are considered similar by the lay audience.

Therefore, it can be concluded that the communicative plan B1 was useful for lay people in certain aspects: in describing how the building is used and in providing information on scale and size, while plan D was found to be useful in more aspects: in providing basic information required of a plan and in reading circulation, use, and scale of the building. Moreover, the test suggests that the presence of the communicative drawings, particularly the communicative plan D, affected the way lay people see, read, and respond to other drawings in the same context; as can be seen by the fact that plan A received the lowest percentile scores across five groups of questions. The main finding is the 'success' of plan D across all the questions, suggesting a real potential has been found for this method of drawing as a means of communication to lay audiences.

b) Diploma Architectural Students

This section examines the way in which the conventional and communicative drawings - used in the first and second empirical tests respectively – communicate with the diploma students. By referring to the hypothesis (e) noted in the previous section, the aim is to test whether the communicative drawings convey information and communicate with diploma students better than the conventional drawings.

Table 8.11: Percentile scores and results of the Chi-square test, comparing the conventional drawing used in part one of the first empirical test with the communicative drawing used in part one and two of the second empirical test – Diploma students.

Group	Q	Test / Drawing	Percentile scores (%)			Chi square test	
			Best / Easiest	Medium / Middle	Worst / Hardest	X^2 value	P-value
I	Q1 Plan A Q1.1 Plan B1	First / Conventional Second / Communicative	27.00 25.00	37.80 25.00	35.10 50.00	5.295	0.071
II	Q1 Plan A Q1.2 Plan B1	First / Conventional Second / Communicative	27.00 15.63	37.80 28.13	35.10 56.25	8.271	**0.016***
	Q1 Plan A Q1.2 Plan D	First / Conventional Second / Communicative	<u>27.00</u> <u>46.88</u>	<u>37.80</u> <u>40.63</u>	<u>35.10</u> <u>12.50</u>	16.185	**0.000***
III	Q3 Plan A Q2.7 Plan B1	First / Conventional Second / Communicative	63.90 40.60	27.80 34.40	8.30 25.0	14.271	**0.001***
	Q3 Plan A Q2.13 Plan D	First / Conventional Second / Communicative	<u>63.90</u> <u>90.60</u>	<u>27.80</u> <u>3.10</u>	<u>8.30</u> <u>6.30</u>	24.632	**0.000***

IV	Q4 Plan A	First / Conventional	7.90	36.80	55.30	101.843	0.000*
	Q2.8 Plan B1	Second / Communicative	78.10	12.50	9.40		
	Q4 Plan A	First / Conventional	7.90	36.80	55.30	96.179	0.000*
	Q2.14 Plan D	Second / Communicative	68.80	28.10	3.10		
V	Q6 Plan A	First / Conventional	7.90	13.30	78.90	105.159	0.000*
	Q2.9 Plan B1	Second / Communicative	68.80	21.90	9.40		
	Q6 Plan A	First / Conventional	7.90	13.30	78.90	119.349	0.000*
	Q2.15 Plan D	Second / Communicative	78.10	15.60	6.30		

Questions were based on three categories: Best / Easiest, Medium / Middle, and Worst / Hardest.
Answers of very well and well were interpreted as Best/Easiest, answers of fair were interpreted as Medium/Middle, answers of very poorly and poorly were conducted as Worst/Hardest.
Results show that the communicative plan is better than the conventional plan are underlined.
X^2 value = Chi square value ($p \leq 0.05$) df = 2
P value = Significant level (one-tailed)
* The test proves the significant difference at $p<0.05$ level

The chi square test revealed significant differences in communicative potential between the conventional drawing and the communicative drawings in the questions group II, III, IV, and V. The results were significant at ($p<0.05$) and can be interpreted as follows.

In group II, significant differences between the conventional drawing and the communicative drawings were found. At ($p<0.05$), firstly, the results significantly indicated that the conventional plan A was found by diploma students to be more useful than the communicative plan B1 in providing adequate information of a plan drawing ($p=0.016$). This gives a clear indication of the diploma students' preference towards their conventional plan drawing and relates to what has been assumed before, namely that the architects often follow what the culture prescribes and what they know best. However, when plan D is included in the analysis, the results significantly suggest the better communicative potential of plan D over that of the conventional plan A ($p=0.000$). This may come as a surprise because the conventional plan A is generally considered as the fundamental drawing that conveys basic information of a plan drawing, but in this question plan D was found to be the easiest to read by diploma students. The diploma students, who represent the architects and are assumed to be dominated by an orthodox culture, begin to show a preference for an alternative drawing over their conventional one. This suggests that plan D retains enough of the conventional aspects – in particular in its use of abstraction – to be recognisable and non-alienating to architects, whereas plan B1 which is nominally the most friendly and user-orientated of the drawings breaks too many of the conventional rules to be acceptable to an architectural audience.

In group III, again, there were significant differences between the conventional plan A and the communicative plans B1 and D. The results significantly showed that diploma students found the conventional plan A easier to read and for them it conveys information on circulation better than the communicative plan B1 ($p=0.001$). At the same time, the communicative plan D significantly showed better communicative potential in explaining circulation than the conventional plan A ($p=0.000$) in the same aspects. Interestingly enough though, the percentages clearly showed that plan D has turned out to be far better in describing circulation than both plan A and plan B1. The use of common language (dash lines and human figures showing their movement) and reading keys, which draw on lessons learnt from the communication theory and the conventions from map, provide clues for the audience, whether lay or professional, to locate themselves in plan D in order to understand how to move through the space.

In group IV, significant differences between communicative plans B1 and D and the conventional plan A were recorded (p=0.000). The results significantly showed greater communicative ability of both communicative drawings in explaining the use of the building than that of the conventional drawing, with plan B1 recording the better results in this aspect. This may be explained by the use of the furniture in plan B1 that clearly indicates the functions and potential uses of each room in the building. The furniture acts as recognisable objects which work as an interpretative key and relates to the reader's experience of space.

Again, both communicative plan drawings significantly showed greater potential in group V; particularly in adequately conveying information on scale and size of the building. Significant differences between the conventional and the communicative plans were found (p=0.000). One might have assumed that the architects generally consider plan A as the best in conveying information on scale, but the diploma students found the communicative plan B1 and D far better than the conventional plan in this question. This can be noticed from the percentages of the conventional drawing which were the inverse of those for the communicative drawing. However, this contradiction may be explained by the attention given to developing scaling key for the two communicative drawings, in particular plan D which considers the relation of scale to the human body.

The test also showed that there is no significant difference between the communicative plan B1 and the conventional plan A in the question group I. This means the ability in providing basic information of a plan drawing of both the communicative plan B1 and the conventional plan A are considered equal by diploma students.

Even though the diploma students did not consider the communicative plan B1 as useful as the conventional plan A in providing a general aspect of a plan and its circulation, they found plan B1 useful in explaining use and scale of the building. This suggests that the communicative plan B1 had a minor effect on the diploma students' way of seeing and reading the conventional drawing at first glance. However, when the more specific questions were asked, the communicative plan B1 was found to be useful but they found plan D best in explaining more of the aspects: in providing basic information of a plan, showing circulation, and explaining use and scale of the building. This can be noticed from the percentages of plan D received across all questions and were the inverse of those for the conventional plan A in group II, IV, and V.

In conclusion, in considering the hypothesis (e), which aims to examine the potential and use of the communicative drawing, plan D is shown as the most successful in representing an architectural drawing. The statistical analysis shows that for both lay people and diploma students, the hypothesis is shown to be true: *'The communicative drawing has greater communicative potential and communicates with the audience better than the conventional drawing'.*

It is important to note that, the analysis of the difference between lay people and diploma is not carried out because the test is mainly focused on the comparison of conventional to communicative drawings.

8.3.3 Part Three

This part examines the way in which three groups of respondents interpret and understand communicative drawings at the level of specific and detailed questions. In this context, the analysis focuses on communicative plans B1 and D. 14 questions were raised against the drawings and the respondents were asked to indicate whether the given statement is 'True', 'False', or 'Undecided'. The aim was to investigate whether the communicative drawings are able to convey information and to communicate with the respondents.

As mentioned, the questions that considered problematic issues found in part two of the first empirical test were carried over to this part; Questions 3.1, 3.2, 3.3, 3.8, 3.10, 3.12, 3.13, and 3.14. This allows results obtained from two empirical tests not only to be compared, but also to test whether the communicative drawing could provide a better communicative potential or communicate better than the conventional drawing. A comparison is made between the conventional drawings of the first empirical test and the communicative drawings used in the second empirical test, and the different techniques used in plans B1 and D are also examined. The results are shown in the form of tables of percentages and as graph; according to three different groups of respondents.

Table 8.12: Percentile scores of plan B1 obtained from three groups of respondents – part 3

Plan B1	Laypeople			First year students			Diploma students		
	Right %	Wrong %	Undecided %	Right %	Wrong %	Undecided %	Right %	Wrong %	Undecided %
Q 3.1: The drawing shows a horizontal slice through the building.	**79.00**	12.89	8.11	**50.00**	36.36	9.09	**90.00**	10.00	0.00
Q 3.2: This drawing is drawn to scale.	**68.74**	12.17	19.09	**78.26**	4.35	17.39	**70.97**	9.68	19.35
Q 3.3: The stair is enclosed with walls on both sides.	**61.90**	16.19	21.90	**69.57**	8.70	21.74	**80.00**	13.33	6.67
Q 3.4: The kitchen shares the same wall with the	**73.92**	16.51	9.57	**77.27**	9.09	13.64	**93.55**	0.00	6.45

bedroom.									
Q 3.5: How many wall cupboards are there in the kitchen?	29.45	32.07	**38.48**	13.64	40.91	**45.45**	32.26	**38.71**	29.03
Q 3.6: When you walk up the stair, the bedroom wall will be in front of you.	**67.25**	12.00	20.75	**60.00**	0.00	40.00	**77.42**	9.68	12.90
Q 3.7: Every room has a rug in it.	**84.27**	3.05	12.68	**95.45**	0.00	4.55	**76.67**	0.00	23.33

Questions were based on three choices: Right, Wrong, and Undecided
Note: Value of the percentile scores obtained from valid percentages and highest percentages are in bold

Table 8.13: Percentile scores of plan D obtained from three groups of respondents – part 3

Plan D	Laypeople			First year students			Diploma students		
	Right %	Wrong %	Undecided %	Right %	Wrong %	Undecided %	Right %	Wrong %	Undecided %
Q 3.8: This is a one-storey building.	**73.11**	10.14	16.75	**82.61**	0.00	17.39	**74.19**	9.68	16.13
Q 3.9: The width of the stair is 0.6 m.	**59.09**	11.24	29.67	**60.87**	4.35	34.78	**74.19**	6.45	19.35
Q 3.10: Information about the height of rooms is provided by this drawing.	**87.71**	1.97	10.32	**81.82**	4.55	13.64	**93.55**	0.00	6.45
Q 3.11: The stairs are going up to the next floor.	**68.79**	16.55	14.66	**78.26**	13.04	8.70	**87.10**	3.23	9.68
Q 3.12: There are EIGHT doors in this drawing.	**87.47**	3.07	9.46	**91.30**	4.35	4.35	**93.55**	0.00	6.45
Q 3.13: If you walk out from the bedroom, you can walk straight to the bathroom.	**69.97**	9.67	20.36	**72.73**	4.55	22.73	**75.86**	3.45	20.69
Q 3.14: There is a window in the hallway.	**72.81**	12.53	14.66	**82.61**	13.04	4.35	**83.87**	6.45	9.68

Questions were based on three choices: Right, Wrong, and Undecided
Note: Value of the percentile scores obtained from valid percentages and highest percentages are in bold

As can be noticed from tables 8.12 and 8.13, laypeople were able to answer most questions correctly. Particularly with plan D, more than half of them managed to answer all questions correctly (see Figure 8.1).

However, there was one question showing lay people's difficulty in interpreting and understanding the communicative plan B1: that is Question 3.5. The question asked 'How many wall cupboards are there in the kitchen in plan B1?' Only 29.45% of them were able to answer correctly, while 38.48% and 32.07% gave undecided and wrong answers respectively. This suggests that even though plan B1 provides 'everyday' furniture as a recognisable icon for the audience to be read as human-scale furnishing, but, as Bertin (1983) suggested in Chapter

Seven, the overloaded information could confuse the audience's interpretation and ability to decode. This can also be found in lay people's written comments: 'It is too complex and messy. It contains too much detail and a bit cluttered' (see Appendix J). It also points to the necessity of having symbols which are part of a shared language; in this case it is clear that the notation of the cupboard doors is ambiguous for all groups.

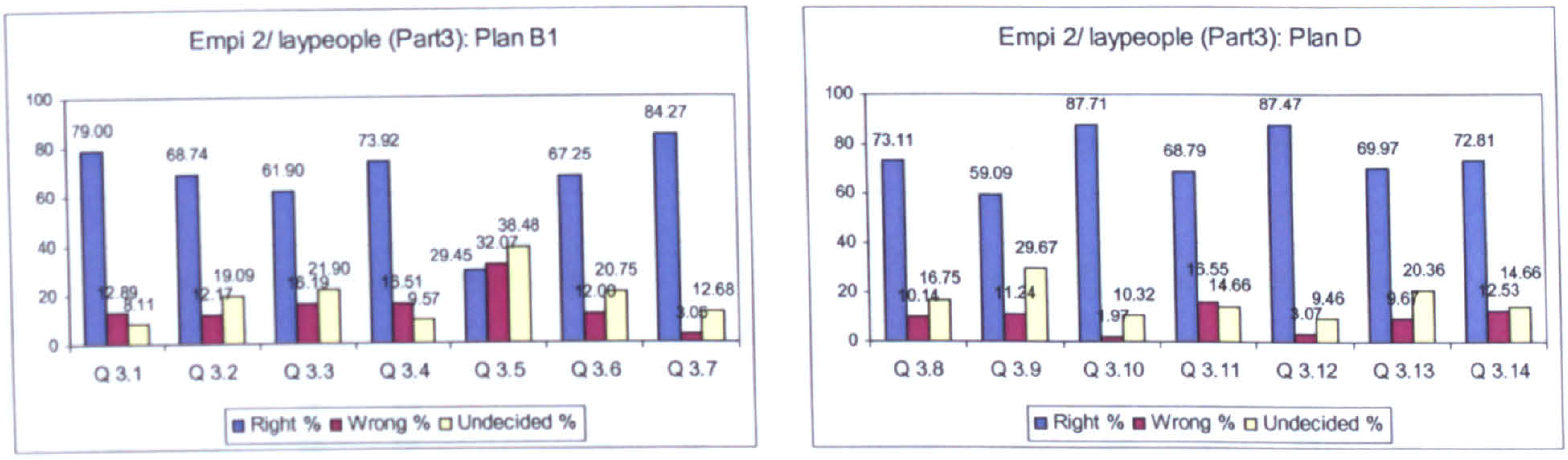


Figure 8.1: Graphs comparing percentile scores between plan B1 and D – Lay people

Simultaneously, first year architectural students also answered most questions correctly; with high percentile scores. Particularly in plan D, more than 60% of them answered all questions correctly. Interestingly, none of them scored wrong answers in Questions 3.6, 3.7, and 3.8 (see Figure 8.2).

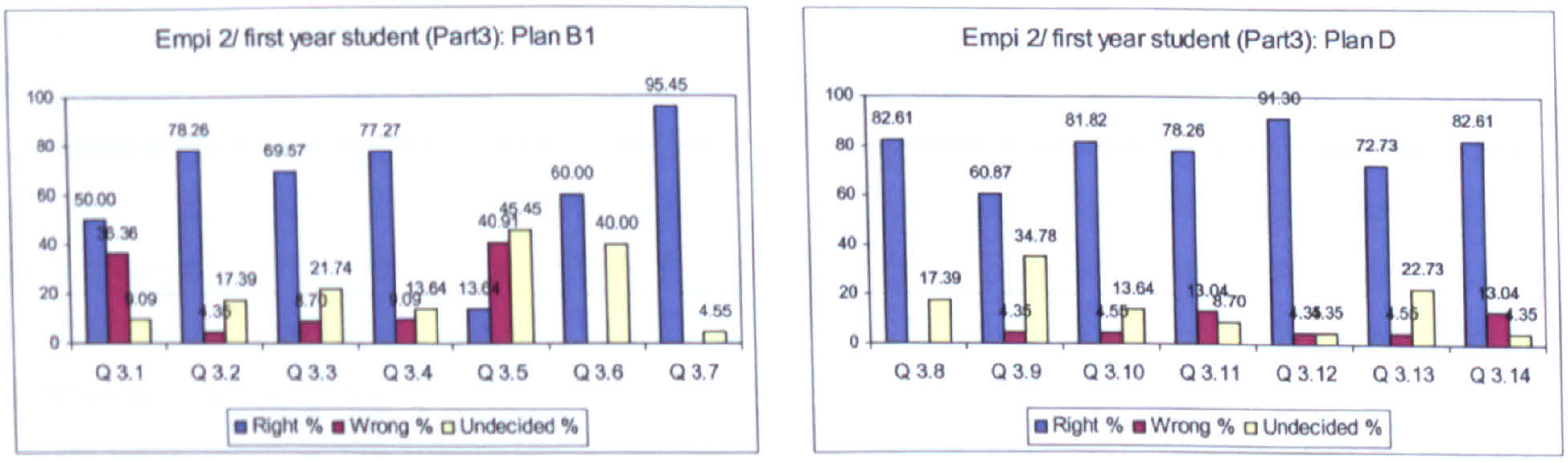
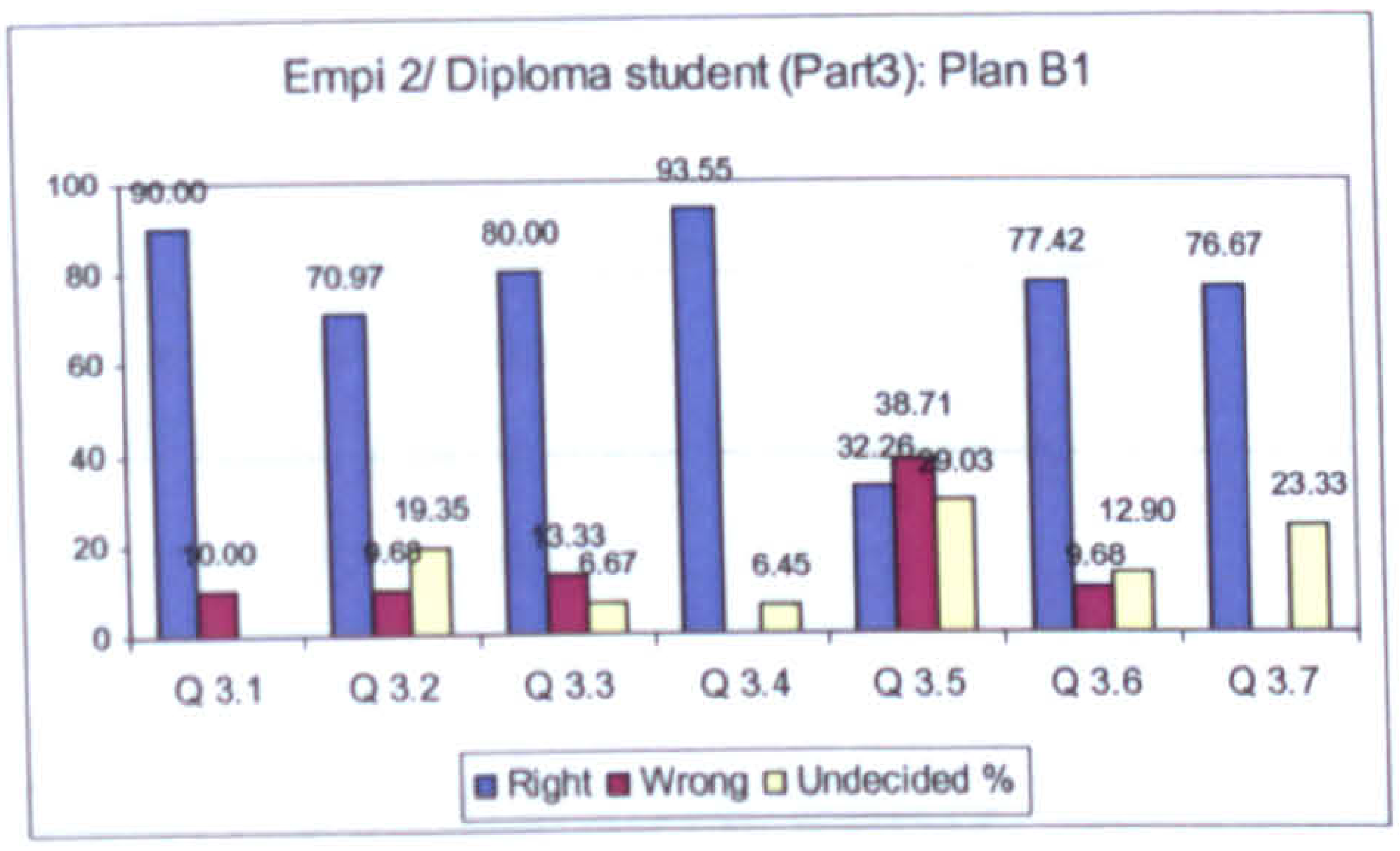


Figure 8.2: Graphs comparing percentile scores between plan B1 and D – First year architectural students

Again, there were some questions showing first year students' difficulty in interpreting and understanding plan B1. Firstly, In Question 3.1, only half of them were able to point out that plan B1 shows a horizontal slice through the building, while 36.36% gave the wrong answers. Secondly, 13.64% identified the number of wall cupboards in plan B1 correctly in Question 3.5, whilst the rest recorded undecided (45.45%) and wrong answers (40.91%). It may come as a surprise that, in Question 3.1 and 3.5, the scores of correct answers received from the first year students were less than those from lay people. Finally, even though there were no wrong answers in Question 3.6, 40.0% of first year students were undecided in reading and understanding plan B1. Thus these questions showed the poor quality of plan B1 as a communicative tool in explaining basic characteristics of a plan, including indicating scale information, and in using architectural elements and symbols which could cause ambiguity in the interpretation.

Consequently, figure 8.3 showed that diploma students managed to answer most questions correctly with very high percentile scores. Particularly in Question 3.4, 3.7, 3.10, and 3.12, none of them scored wrong answers. Similarly with lay people and first year students, diploma students found a problem in reading plan B1 in Question 3.5. 36.36% of them managed to identify the number of wall cupboards in the kitchen correctly, while almost half of them (40.91%) and 22.73% respectively answered the question wrong and were undecided.



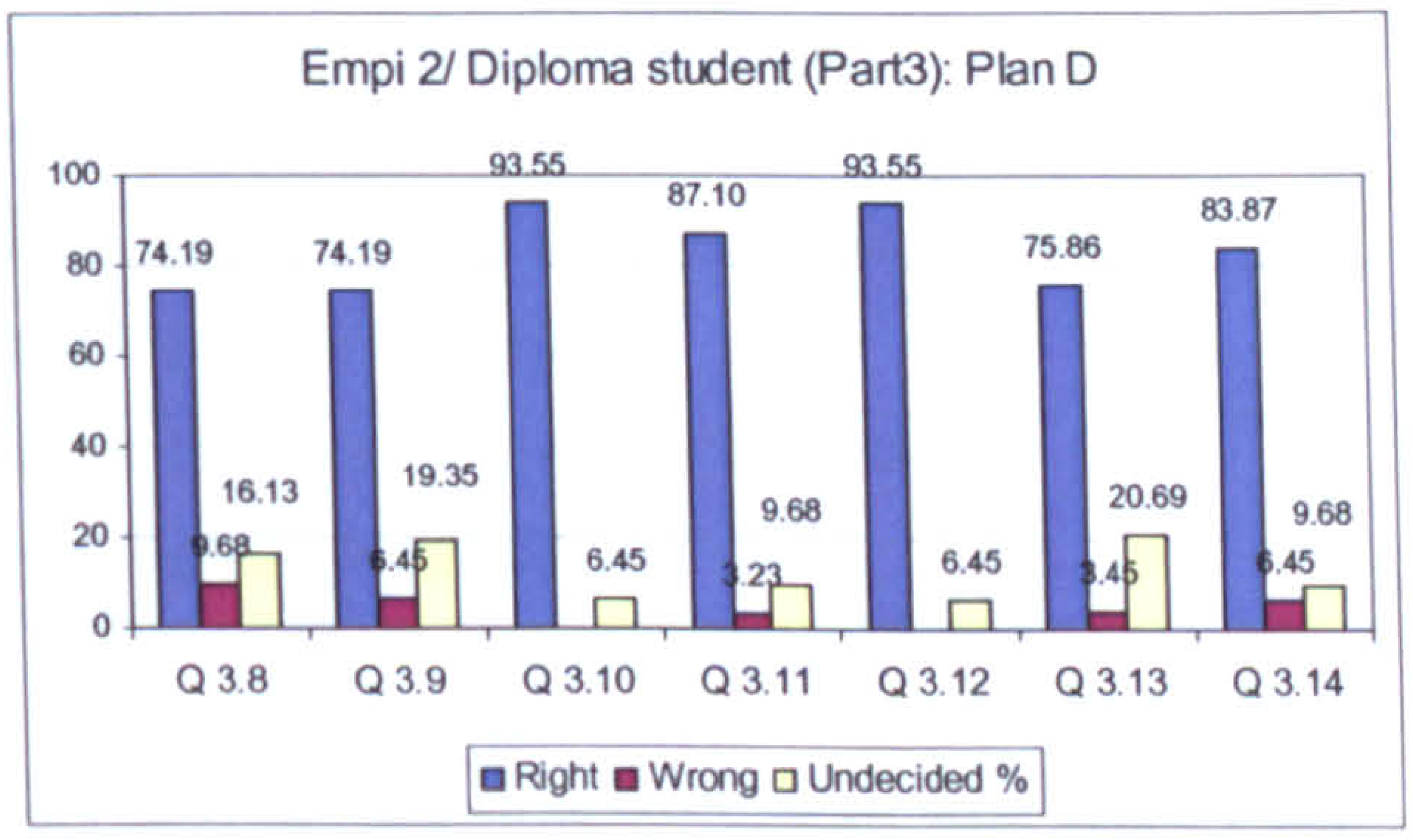


Figure 8.3: Graphs comparing percentile scores between plan B1 and D – Diploma architectural students

To conclude from above percentile scores obtained from three groups of respondents, they suggest the differences in communicative potential between communicative plans B1 and D. Plan B1 which was developed from plan B (pictorial drawing) and reinforced by the qualitative feedback from the first empirical test has shown problems in communicating and conveying adequate information in Question 3.1, 3.5, and 3.6. On the other hand, plan D which was newly drawn as semi-diagrammatic drawing revealed its greater communicative potential in relation to the questions asked. Plan D, a non-technical drawing with the least number of elements, clearly gives enough information to answer quite specific questions whilst not so much as to confuse. The different role and techniques as a communicative drawing of plan B1 and D is analysed in a later section.

As previously mentioned, there were eight questions carried over from the first to the second empirical test (see Table 8.14). This allows 'Part two' of the first empirical test and 'Part three' of the second empirical test to be compared using statistical analysis.

Table 8.14: Questions carried over from the first to the second empirical test.

The first empirical test	The second empirical test
Q7: The drawing shows a horizontal slice through the building. (asked against **plan A)**	**Q3.1**: The drawing shows a horizontal slice through the building. (asked against **plan B1)**
Q8: Information about the height of rooms is	**Q3.10**: Information about the height of rooms is

provided by this drawing. (asked against **plan A)**	provided by this drawing. (asked against **plan D)**
Q9: If you walk out from the bedroom, you can walk straight to the bathroom, or turn to the living room and the kitchen. (asked against **plan A)**	**Q3.13**: If you walk out from the bedroom, you can walk straight to the bathroom. (asked against **plan D)**
Q15: This drawing is drawn to scale. (asked against **plan B)**	**Q3.2**: This drawing is drawn to scale. (asked against **plan B1)**
Q17: The stair is enclosed with walls on both sides. (asked against **plan B)**	**Q3.3**: The stair is enclosed with walls on both sides. (asked against **plan B1)**
Q24: This is a one-storey building. (asked against **plan C)**	**Q3.8**: This is a one-storey building. (asked against **plan D)**
Q26: There are five doors in this drawing. (asked against **plan C)**	**Q3.12**: There are eight doors in this drawing. (asked against **plan D)**
Q27: There is no window in the hallway. (asked against **plan C)**	**Q3.14**: There is a window in the hallway. (asked against **plan D)**

8.3.3.1 **Comparative Study:** Comparing 'Part two' of the first empirical test with 'Part three' of the second empirical test

The aim of this section is to examine the differences in communicative potential between the conventional and the communicative drawing, in particular when they communicate with the audience at a more detailed level. Similar to the previous section of comparative study, a statistical test is used to verify whether the communicative drawings convey information and communicate with the audience better than the conventional drawings. Thus, the same hypothesis was tested:

Hypothesis (f): *'The communicative drawing has greater communicative potential and communicates with the audience better than the conventional drawing'.*

By using the same statistical method as the previous comparative study, the analysis is explored by the results of Chi square test and two groups of respondents are analysed in this section: lay people and diploma students.

a) Lay people

The percentile scores and results of Chi-square test are presented in table 8.15. The test examines the differences in communicative potential between the conventional and the communicative drawing and the way in which they communicate with lay people at a more detailed level.

Table 8.15: Percentile scores and results of the Chi-square test, comparing the conventional drawing used in part two of the first empirical test with the communicative drawing used in part three of the second empirical test - Lay people.

Questions	Drawing / Test	Percentile scores (%)			Chi square test	
		Right answer	Wrong answer	Undecided	X^2value	P-value
Q7 Plan A	Conventional / First	85.71	8.47	5.82	1.654	0.218
Q3.1 Plan B1	Communicative / Second	79.00	12.89	8.11		
Q8 Plan A	Conventional / First	95.47	1.07	3.47	3.992	0.068
Q3.10 Plan D	Communicative / Second	87.71	1.97	10.32		
Q9 Plan A	Conventional / First	88.04	6.25	5.71	11.254	**0.002***
Q3.13 Plan D	Communicative / Second	69.97	9.67	20.63		
Q15 Plan B	Conventional / First	41.53	10.66	47.81	19.140	**0.000***
Q3.2 Plan B1	Communicative / Second	68.74	12.17	19.09		
Q17 Plan B	Conventional / First	33.42	29.89	36.68	16.312	**0.000***
Q3.3 Plan B1	Communicative / Second	61.90	16.19	21.90		
Q24 Plan C	Conventional / First	64.44	5.35	30.21	5.881	**0.026***
Q3.8 Plan D	Communicative / Second	73.11	10.14	16.75		
Q26 Plan C	Conventional / First	81.45	10.22	8.33	4.136	0.063
Q3.12 Plan D	Communicative / Second	87.47	3.07	9.46		
Q27 Plan C	Conventional / First	94.15	2.23	3.62	16.583	**0.000***
Q3.14 Plan D	Communicative / Second	72.81	12.53	14.66		

Questions were based on three categories: Right, Wrong, and Undecided
Value of the percentile scores were obtained from a valid percentage
Results show that the communicative plan is better than the conventional plan are underlined.
X^2 value = Chi square value ($p \leq 0.05$) df = 2.
P value = Significant level (one-tailed)
* The test proves the significant difference at $p<0.05$ level

Table 8.15 showed that there are significant differences in communicative potential between the conventional and the communicative drawings. The results were significant at ($p<0.05$) and can be interpreted as follows:

Some results indicate that lay people found certain aspects of the conventional plan better than the communicative plans. In (Q9 plan A – Q3.13 plan D), significant differences were found between plan A and plan D (p=0.002). Lay people found the conventional plan A more useful than the communicative plan D in conveying information on circulation. At the same time, significant differences were also found in (Q27 plan C – Q3.14 plan D) (p=0.000). Lay people found the conventional plan C significantly better than the communicative plan D in showing the symbol for a window; lay people who have no architectural knowledge found the window drawn as three-dimensional object easier to read and recognise than that drawn in two-dimensional format.

However, in more questions the results revealed that lay people found the communicative plans better and easier to read and understand than the conventional plans In (Q15 plan B – Q3.2 plan B1) and (Q17 plan B – Q3.3 plan B1), significance differences between plan B and B1 were found (p=0.000). Lay people found the communicative plan B1 significantly better than the conventional plan B in indicating information on scale, and easier in reading architectural elements. One might assume that the conventional plan B, which was drawn as a pictorial drawing with furniture included, would be best in conveying information on scale and showing architectural elements. But the use of scale related to furniture and human body, as well as the consideration of graphic legibility, in the communicative plan B1 appeared to be better in conveying information on these aspects. In another question (Q24 plan C – Q3.8 plan D), significant differences between the conventional plan A and the communicative plan D were also found (p=0.026). The results significantly indicated that lay people found plan D easier than plan A in ascertaining the building's levels. This may be explained by the use of human body, showing gestures and movements, in plan D which suggests how to move around the space not only horizontally but also vertically.

What is interesting is that the questions in which the communicative drawing performed better than the conventional drawings were exactly the questions that presented most problems to the lay audience in the first test – such as the questions with the highest proportion of wrong answers. This suggests that the communicative drawings have gone some way to addressing the most obvious areas where communication breakdown occurred in the conventional drawing so that, for example, there is a marked increase in correct answers against Question15 and 17.

Finally, the results also showed no significant difference between the conventional and the communicative plans in explaining terminology of a plan and its general characteristics in (Q7 plan A – Q3.1 plan B1) and in (Q8 plan A – Q3.10 plan D), as well as in showing architectural symbols in (Q26 plan C – Q3.12 plan D). It should be noted that all these questions were answered with a high proportion of correct answers in the first test, and so there was not much room for significant improvement through the introduction of the communicative drawing.

In conclusion, the results showed the potential of communicative drawing to overcome most of the problems found in the first empirical test. The communicative drawings, in particular plan D, appeared to communicate better at both a general and more detailed level, confirmed in most cases by statistically significant results. It can be noticed that the difference between these conventional and communicative forms of drawings affected lay people's way of seeing and reading, as well as their system of interpretation. This is because they convey different information in different ways, which in turn need different levels of knowledge to decode it. The conventional drawing tends to explain in basic terms 'what the plan means', whilst the communicative drawings tend to indicate 'what is in the plan'. The differences between the two are significant enough to suggest that some of the techniques, and the background to the development, of the communicative drawings should be taken into account in considering alternative methods of architectural drawing which would communicate better with a lay audience.

b) Diploma students

In part two of the first empirical test, most questions were answered correctly by diploma students, and there was thus not much room for improvement with the introduction of the communicative drawings. A statistical analysis was therefore not seen to be useful here and thus this section broadly compares the conventional drawings with the communicative drawings based on their percentile scores.

Table 8.16: Percentile scores comparing the conventional drawing used in part two of the first empirical test with the communicative drawing used in part three of the second empirical test – Diploma students.

Questions	Drawing / Test	Percentile scores (%)		
		Right answer	Wrong answer	Undecided
Q7 Plan A	Conventional / First	**100**	**0**	**0**
Q3.1 Plan B1	Communicative / Second	90.00	10.00	0
Q8 Plan A	Conventional / First	**100**	**0**	**0**
Q3.10 Plan D	Communicative / Second	93.50	0	6.50
Q9 Plan A	Conventional / First	94.70	0	5.30
Q3.13 Plan D	Communicative / Second	75.90	3.40	20.70
Q15 Plan B	Conventional / First	47.40	15.80	36.80
Q3.2 Plan B1	Communicative / Second	71.00	9.70	19.40
Q17 Plan B	Conventional / First	**100**	**0**	**0**
Q3.3 Plan B1	Communicative / Second	80.00	13.30	6.70
Q24 Plan C	Conventional / First	92.10	0	7.90
Q3.8 Plan D	Communicative / Second	74.20	9.70	16.10
Q26 Plan C	Conventional / First	**100**	**0**	**0**
Q3.12 Plan D	Communicative / Second	93.50	0	6.50
Q27 Plan C	Conventional / First	**100**	**0**	**0**
Q3.14 Plan D	Communicative / Second	83.90	6.50	9.70

Questions were based on three choices: Right, Wrong, and Undecided
Note: Value of the percentile scores were obtained from a valid percentage and results show that the communicative plan is better than the conventional plan are underlined.

Table 8.16 shows that diploma students found the conventional plans A, B, and C easier to read and understand than the communicative drawings; particularly in the questions that 100% answered correctly in the first empirical test. These questions concern certain aspects, for example the ability in explaining basic information on a plan drawing, showing architectural symbols and elements, and ascertaining the floor level and circulation. Even though in the questions that were not answered correctly by all the diploma students, (Q9 plan

A - Q3.13 plan D) and (Q24 plan C-Q3.8 plan D), they still found the conventional method more useful than the communicative plan D in explaining circulation, interpreting architectural symbols, and ascertaining the building's levels.

However, there was only one question, (Q15 plan B – Q3.2 plan B1), that diploma students found the communicative drawing more useful in conveying information on scale and size of the building. This shows an interesting point because scale was one of the most problematic issues found in the first empirical test, particularly in plan B, for diploma students. In the second empirical test, however, the communicative plan B1 has shown its greater ability in explaining scale information over the conventional plan B. Even though these two plans have furniture as a scale reference, the scale indication with reference to a recognisable object and human body drawn in plan B1 appears to help the diploma students to interpret and read the drawing more easily than looking at the conventional scale bar shown in plan B.

In general, however, the percentages received from diploma students showed how well the conventional drawings communicate with them, as well as suggesting how minor the role of communicative drawings is in affecting their way of seeing and interpreting the conventional drawings. The results give an indication that the diploma students tend to follow what they are accustomed to. For them, the conventional plans that have been prescribed as a proper drawing seem to be more practical and useful for them to read than the communicative drawings that are drawn unconventionally and offer such open and wider interpretations. It shows how architects tend to get set in their ways, whereas for lay people, the professional acceptance of certain codes is of little interest: they are concerned with clarity. However, it is notable that this preference is only shown in part 2 of the second empirical test, which is concerned with the detailed reading of plans. As we have seen above, in part 1 of the second empirical test, which was concerned with the more general reading of the plans, the communicative drawing generally performed better with diploma students. This suggests that Diploma students and architects are more comfortable with the known codes and techniques when it comes to describing the more technical and operational aspects of drawings, but are open to alternatives when it comes to the broader aspects of the plan.

To conclude part three, the comparisons made in the groups of lay people and diploma students showed the differences in communicative roles between conventional and communicative drawings and how the two forms of drawings convey information in different levels. For lay people the communicative drawings were able to convey information at the more detailed level, where it may be argued the use of previously accepted codes in the conventional drawings was based on an assumption of too much prior knowledge. In reconsidering afresh the codes used in the communicative drawings, the research has attempted to address the problem that lay people have a different knowledge and experience base. This appears to have been successful, particularly in that the results show that communicative drawings helped lay people to read and understand the drawing better particularly in areas that had been found problematic in the in the first empirical test, for example in ascertaining scale, architectural elements, floor levels, and architectural symbols. Some of the written comments also show that lay people preferred and accepted the communicative drawings because they are unconventional, user-friendly, simpler, and seem to be more communicative than a conventional method of drawing (see Appendix J).

On the other hand, the results obtained from the diploma students revealed different preferences; they preferred the conventional method and did not consider an alternative method to be more useful for the more detailed aspects of the plan's interpretation. This suggests a relationship between architects, as represented by diploma students, and their conventional tool. Their comprehensive knowledge and what has been taught and prescribed by architectural culture make it hard for them to accept the communicative drawing as a replacement of the conventional drawing.

8.3.4 Part Four

The questions in part four asked three groups of respondents to decide which drawing - plan A, B1, C, or D - they would select, if they were to use just one of those drawings to explain the building. The outcome is hoped to inform the type or form of drawing that the respondents most prefer and consider as the most communicative.

As shown in figure 8.4, the communicative plan D was chosen by all three groups as the most communicative drawing; by 59.03% of lay people, 76.0% of first year students, and 56.25% of diploma students. On the other hand, plan A received the least responses; only 9.87% of lay people, 4.0% of first year students, and 9.38% of diploma students. This clearly shows the preference of three groups of respondents towards different forms of drawings, particularly between the conventional drawings and the communicative drawings. By comparing these two forms of drawings in the same context, the respondents prefer the communicative drawing more than the conventional or a technical one. It may come as a surprise that the percentages from lay people and diploma students were almost consistent. One might assume that diploma students would choose the conventional plan drawing to explain the building, but the alternative method of drawing turned out to be their first choice. Even the three dimensional drawing (plan C), which is drawn conventionally as a presentation drawing was less highly rated by all three groups than communicative plans B1 and D.

Although this finding was apparently simple, it may also be the most important. The initial acceptance of a drawing by a lay audience is crucial in the overall communication between architect and client or user. If the drawings are found to be impenetrable or alienating, then the whole process of communication will founder at an early stage. The research indicates that the conventional drawing is by far the least popular and that the communicative drawing plan D appears to have an immediate acceptance; at a more detailed level we have also seen how it also appears to be able to convey the majority of information required of a plan, whereas in part one on the first empirical test, we saw that different drawings were needed to convey different aspects.

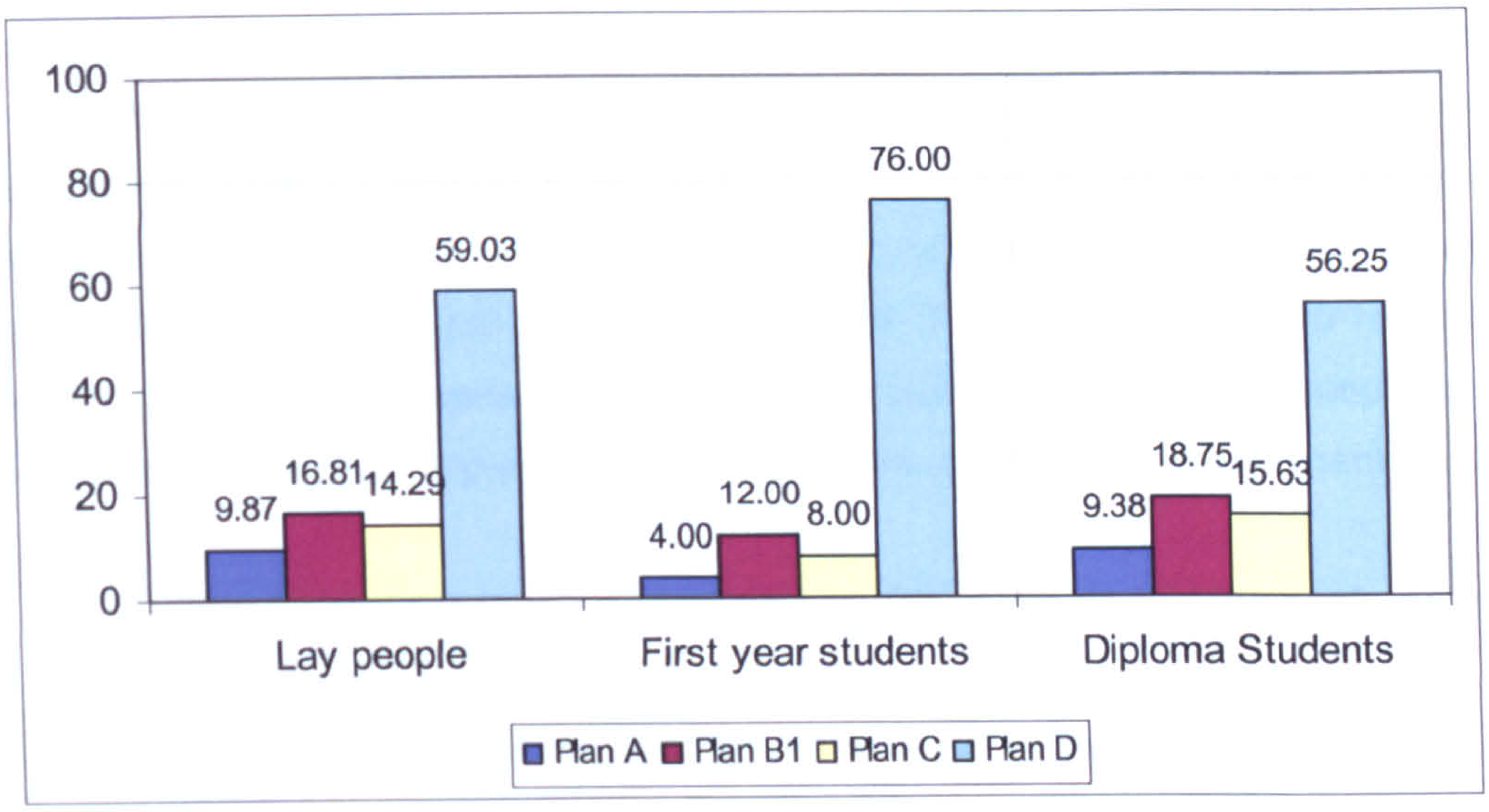


Figure 8.4: Graphs showing percentile scores obtained from three groups of respondents - part 4.

Plan A = Coded Language / Plan B1 = Communicative drawing 1
Plan C = Three dimensional / Plan D = Communicative drawing 2
Note: Value of the percentile scores obtained from a valid percentage

In the following sections, qualitative findings obtained from 'Draw the line Questionnaire 2' are summarised. This is hoped to support the quantitative results and to inform the way that respondents react to and interpret both types of drawing.

8.4 Qualitative Findings: the Second Empirical Test

The qualitative findings were summarised from 'part two' (Q2.5 and 2.6-plan A, Q2.11 and 2.12-plan B1, and Q2.17 and 2.18-plan D) and 'part four' of 'Draw the Line Questionnaire 2'. In part two, two questions were asked against three different mediums of drawings: plan A, B1, and D - (1) 'What do you like about this drawing?' and (2) 'What do you dislike about this drawing?' In part four, the question asked the respondents to choose one of the drawings: plan A, B1, C, and D to explain the building, and to supply a reason for this choice.

The feedback is summarised in the following sections and concentrates on the critical views from the respondents about how they respond to the communicative potential of conventional and communicative drawings.[4] This includes the problems they found in seeing and interpreting both forms of drawings. This feedback will also be fed into the recommendations later discussed in chapter Nine (See qualitative feedback in Appendix J).

[4] It is recognised that the qualitative feedback in this second test, as well as in the first test, could usefully be subjected to a protocol analysis which would more rigorously analyse the types and regularity of responses. Whilst such an analysis was thought to be beyond the scope of this thesis, the appendices (E and J) provide a useful resource for further research.

8.4.1 Summary of Qualitative Findings

8.4.1.1 Qualitative feedback received from part two

In part two, the feedback received from the three groups of respondents turned out to be similar to that of the first empirical test. Most lay people responded to the drawings with their immediate reaction. Their comments were related to their everyday life and their experience of place. Instead of commenting on the physical features of the drawing, lay people tended to respond about how they would use or inhabit the space. This can be related to Hershberger's (1988) research previously discussed in chapter Four, which noted that lay people tended to base their comments on the responsive meaning. Some of the written comments were (see Appendix J):

- *'Plan B1 gives a much clearer idea of use of rooms and the scale; i.e. it can fit a double bed into bedroom'.*
- *'I cannot tell whether my double bed would fit in the bedroom in plan A'.*
- *'Plan B1 would put me off buying the apartment because it makes the apartment seem smaller'.*
- *'If it was on a house brochure, I would not view the property'.*

On the other hand, the architectural students, particularly the diploma students, responded differently. Because of their interest, knowledge, and experience in architecture, their comments were more aligned to architectural viewpoints and terminology than their individual experience of place. They tended to comment on basic terminology and physical features of a plan drawing, particularly on four basic keys of a plan drawing: circulation, use, scale, and spatial experience. This can be found in the written comments from diploma students: *'Plan A lacks of dimensions, while plan B1 gives a sense of scale and inhabitation; furniture provides stronger sense of scale and represents the use of the space well'* (see Appendix J). They also showed a conventional view in differentiating the conventional method from an alternative method of drawing:

- *'Plan A is more like an architectural plan'.*
- *'Plan D looks less technical and so less official than an ordinary architectural drawing'.*

The feedback received from architectural students showed a predictable and a typical pattern which revealed their knowledge structure and preference in architectural drawings; this relates to Wilson (1996) argument that, during the course of architectural education, students develop increasingly abstract and more differentiated concepts to organise their knowledge. Architectural students are 'taught what to like' Wilson (1996) and how to act and respond to an architectural drawing.[5]

[5] Some of the comments received from diploma students were not really related to the specifics of the exercise, but showed sterotypical attitudes of the 'arrogant architect', including some strongly judgmental views against the drawings: *'The people drawn in plan D are pathetic', or 'Colour coding is only for the simple-minded person'* (see Appendix J).

The outcome of qualitative findings in part two can be related to Wilson's research into the question of whether design professionals think differently to the public. She notes, "There are two distinctly different systems of construct under consideration: conceptualization and evaluation. The first is a system of concepts with which to organise and understand architecture that is essentially descriptive, objective and non-evaluative, which the second guides subjective evaluative judgement" Wilson (1996: 33). She relates that the former is associated with non-architects, while the latter is associated with architects. In the qualitative feedback, lay people mostly gave descriptive and non-evaluative feedback, while architectural students tended to give more subjective and evaluative judgements, which relates to their knowledge and trained experience.[6]

8.4.1.1 Qualitative feedback received from part four

In part four, qualitative feedback received from three groups of respondents turned out to be more consistent. Their comments on four different types of plan drawings can be summarised as follows:

Plan A (coded language): They commented that even though plan A looks simple and easy to understand, it also looks too cold, unfriendly, and vague. It thus does not communicate well with others. However, they found that the arrangement of the rooms within plan A is open to the individual; it is less prescriptive in its usage than the other drawings

Plan B1 (communicative drawing 1): They noted that plan B1 is very descriptive and immediate recognisable. However, though it gives the most information, it may contain too much information for one drawing, and is seen as messy and busy.

Plan C (three dimensional): This plan shows a three-dimensional image and gives a good feeling of how it would be to move around the flat. One commented: *'It clearly show which way the staircases is going, with no confusion like the other three'* (see Appendix J).

Plan D (communicative drawing 2): Most of them commented that plan D is simple, but informative. It is easy to understand without technical knowledge and provides all the necessary information without too many details. It shows the best balance of information and is user friendly, as well as more attractive and interesting. *'To a normal person, it is clear and easy to understand at a glance'* (see Appendix J). However, some have complained that the colour and human figure were meaningless.

The feedback summarised from the three groups supports the potential of communicative drawings in helping the audience with different backgrounds and levels of knowledge, to interpret and understand the architectural drawings better. The simple, minimal, but informative plan drawing, such as the communicative plan D, is considered the type of drawing showing the most potential in developing and working as an alternative form of an architectural drawing. It was agreed by most respondents that it communicates well and conveys information better than the other drawings. Thus, this supports the previous main

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[6] See Devlin (1990) and Groat (1982) in Chapter Four

hypothesis, which noted that *'communicative drawing, in particular plan D, has more communicative potential and communicates better than conventional drawing. It could become an alternative form of architectural drawing that improves communication between architects and lay people'.*

8.5 Conclusion: the Second Empirical Test

The communicative plan D has shown the most capability in communicating with lay people and architectural students in the second empirical test. By comparing it with the conventional plan and other drawings, it revealed a greater potential in communicating most aspects required of a plan drawing. Its clear and informative graphic representation provides the audience more open suggestions and interpretations than can be found in the basic terminology of a plan drawing. Its apparently unorthodox way of making drawing, which was suggested and developed out of previous sections of this research, allows the audience to read and interpret this drawing in a different and unconventional way.

On the other hand, the communicative plan B1 was less successful in the majority of the questions, suggesting that the attempt to develop the pictorial notation had not really worked. However, plan B1 was found useful in communicating certain aspects, such as explaining how the building is used and indicating the scale and size of the building.

The comparative sections showed significant differences in communicative potential between the conventional and communicative drawings, and in the way in which they communicate with the audience. Lay people generally preferred the communicative drawings, and this preference was shared at a general level by diploma students. However, when it came in part two to the detail of the drawing, diploma students reverted to what they knew best, slightly preferring conventional drawings. This gives an indication of diploma students' characterisation and socialisation during their years of study in architectural school. As Frascari (1984) notes that, for architects, the meanings within the drawing are learned only by experience. Architects believe that the conventions of drawing are the basis for architecture understood as existence.

The empirical test informed the direction in using two different forms of drawings to convey information and communicate with the audience. The relationship between the conventional drawing and the building is generally thought of as a Cartesian representation based on visual matching of lines. (see Frascari (1984)) The real nature of conventional drawings is the fact that they are only the results of construction, or anticipation of construction. On the other hand, the aim of the communicative drawing is to encourage perceptual judgement of the building and its uses, and so allows the audience to be more interpretative. It is a kind of a transformation that can be found in diagrams as a means to the predicting of architectural events; that is on the one hand it offers a conceptualised transformation for the architects, and on the other hand provides experience for the audience or the possible users.

This shows several layers of thought potentially contained on one drawing. Whilst the research does not claim that communicative drawing might define the future architectural drawing, it suggests the process of transformation of the drawing from one system of representation to another, from drawing of building as objective matter to the drawing of experience or event of the (possible) building.

The lessons leant from the second empirical test are also fed to the recommendations for improving communicative potential of architectural drawings discussed in chapter Nine.

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Chapter 9
Conclusions

'Goodegory'
'Allegories of the Good and the Bad Architect' from Phillibert De l' Orme's Premier Tome de l' Architecture (1567)

'The good architect ambling through a beautiful garden, an ensemble of buildings richly decorated and sculptured, built according to classical rules. He has three eyes, fours ears, four hands – signifying the wide range of abilities that make a good architect. Impressive words are not for him. He is concerned with learning from the past, observing the present and anticipating the future, in order to avert badness wherever possible' (cited in Teut, 1981: 13).

Chapter Nine | CONCLUSIONS

9.1 Introduction

This chapter summarises the entire research and arrives at conclusions from investigations in the hope of suggesting an alternative method to architectural drawings which helps in bridging an apparent communication gap between architects and non-architects. The summaries and key findings from each chapter are organised into sections here, from both theoretical and empirical approaches. The suggested implications are consequently given in relation to the main aim of the research. This is then followed by direction for further research and the conclusion for this chapter.

9.2 Summary and Key Findings

As previously mentioned, the fundamental aim of this research arose from the premise of a communication problem between architects and non-architects, particularly when their communication is through an architectural drawing as a means of representation. The apparent problem was initially investigated and revealed to us that the perceived communication breakdown stems from the way architects and non-architects encode and decode information, respectively. It was seen that because the architectural drawing is too internalised and abstract, non-architects are unable to comprehend the message. Hence, the research attempted to investigate the communicative potential, and problems, of a conventional drawing through a set of empirical tests, in order to derive an alternative method of representing architectural drawing. This alternative is hoped to provide more efficiency and clarity in the process of communication in order to bridge the apparent communication gap between the architectural context and the public realm.

The research was divided into two major parts:

a) Reviews of literature and relevant theories
b) Empirical test

9.2.1 Deriving from Reviews of Literature and Relevant Theories

The study first began with the study of the relationship between architects and their drawing, explaining its importance and influence in relation to architects and their profession. This was followed by reviews and discussions on types of drawing, which attempted to provide a basic outline of the subject for the readers of this research, particularly non-architects. Other forms of representation that could be related to the communicative role of architectural drawing were also discussed. As a starting point, the perceived problem in reading and understanding an architectural drawing for both architects and non-architects was proposed, and approaches were suggested to theoretically and experimentally investigate this problem.

Chapter Two proposed a theoretical foundation for extending the understanding of architectural drawing, by examining historical evidence and ideas. Five critical periods in time, when architectural drawing performed a central role and influenced architects and non-architects, were reviewed. This chapter revealed the breakdown of communication between architects and non-architects, and indicated when and why architectural drawing failed to perform as a communicative application. The juxtaposition and conflict between technical and representational methods of drawing identified major reasons that led to the breakdown. However, the lessons not only indicated the problem, but also provided some ideas and evidence that could be used to develop the communicative potential of today's architectural drawing.

Chapter Three reviewed basic communication theories, which were then linked to the structure of basic communication in architectural drawing. The concept of communication process drawn from Berlo (1960) and Jakobson (1958) were selected as the key for constructing an argument of the communication process between architects and non-architects. Both concepts were found to be complementary to each other and subsequently became appropriate methods for constructing and analysing the communication model in architectural drawing. As a result, the communication model in architectural drawing was drawn and three main findings were revealed:

a) The architects, the conveyed message, and the audience are not only the important factors in constructing comprehensive communication, but also the code (that is used as encoder and decoder) and the context (where the drawing is conveyed) should be considered.
b) By relating to Umberto Eco's analysis (see Broadbent et al. (1980)), the architectural code and its method of codification used in an architectural drawing should be considered.[1]
c) According to the basic theory of communication, the personal characteristic of the audience became a crucial matter and required further analysis.

Therefore, it was concluded from the study of the communication theories that careful consideration of appropriate methods of coding or the sharing of language is crucial in order to provide a comprehensive communication between the two parties. In particular the use of 'external codes', such as those from outside the normal architectural context, was seen as potentially important.

The next chapter, Chapter Four, discussed the differences in personal characteristics between architects and non-architects; particularly in terms of their way of seeing and interpreting architectural drawing. With the study of the differences in their means of perception and interpretation, it was hoped to uncover where the perceived breakdown of communication emerged. Based on the research in environmental psychology, in particular the way people

[1] See Umberto Eco's analysis on the method of codification of architectural object in Chapter Three.

relate to the built environment, it suggested that the concepts and constructs of preference and interpretative schemes by which architects and laypeople relate to the built environment (architectural buildings) can be adapted and related to architectural drawings. It was identified that the perceived breakdown of communication between architects and laypeople may emerge from the differences in values and interpretative scheme, as well as from differences in their past experience and educational background. It was thus suggested that the apparent problem in communication is not because of misinterpretation, but because both parties with this parameter are very different and possess different values of interpretation.

The first four chapters thus set the broad theoretical background for the research. It was decided to test the findings through an empirical study which was recorded in Chapter Five. The test fundamentally aimed to examine the communicative quality of a conventional architectural drawing, as well as to discover where and why communication breakdown occurred.

9.2.2 Deriving from the Empirical Tests

The outcome from the first questionnaire provided some clues and initial ideas for developing an alternative method or a shared language for architectural drawing. In addition, the results also informed the construction of the second questionnaire in the second stage of the empirical test.

The findings from the first test were presented in Chapter Six. It can be summarised that, at a basic level, both lay people and architectural students agreed that the drawing presented by a coded language (plan A) seemed to be one that clearly provided information on circulation and how to move around a building; the pictorial drawing (plan B) was the easiest to understand and provided information on overall graphic representation, as well as on use of a building; the three-dimensional drawing (plan C) showed most clearly a building's appearance.

On a more specific or detailed level, the group of diploma architectural students scored best on the questions that tested their understanding of the drawings. They were followed by the group of first year architectural students and then lay people, who scored the least amount of correct answers. The results showed that the ability of the respondents in (a) reading a plan drawing, (b) interpreting architectural symbols, and (c) understanding information on scale, seemed to be problematic issues which needed to be taken into account. In particular, there were significant differences between lay people and diploma students in the actual understanding of the drawings.

A comparative study between lay people and architectural students was also carried out, using statistical analysis. At a basic level, it was seen that lay people see and read a conventional architectural drawing in the same way as first year architectural students; but in a significantly different manner from that of diploma students. Lay people and the freshmen students responded to the drawing similarly at first glance, whilst diploma students responded differently (they possessed more experience and familiarity) and based their response on professionally developed knowledge. Looking at it from a more detailed level, the statistical analysis furthermore showed some significant differences in the way a conventional architectural drawing is interpreted and understood by lay people and architectural students. Some questions revealed the differences in their interpretative systems, particularly in the way in which they interpret and understand architectural symbols and in their basic knowledge of codes and elements of a plan drawing. Particularly, comparing lay people and diploma students in fact revealed the most interesting results. Most of the questions were answered correctly by diploma students (100%), while lay people showed 'inconsistency' in their responses. This suggested that the difference between these two sets of results was due to different levels of knowledge, experience, and professional background. However, both groups seemed to find a difficulty in interpreting and understanding questions that involved architectural symbols and the indication of scale. These issues were taken into account before the second stage of the empirical test proceeded.

Consequently, Chapter Seven was informed by the previous literature reviews and the findings from the first empirical test. In an attempt to develop a shared architectural language, three non-architectural applications were selected as guidelines in developing an alternative method for architectural drawings. The qualitative feedbacks obtained from the first empirical test were also included. As a result, two alternatives, the so-called communicative drawing, were developed; at the same time the second phase of questionnaire was constructed. The second questionnaire was designed to investigate the communicative potential of these new communicative drawings in relation to conventional drawings, as well as to test the main hypothesis of the research. The second empirical test thus initially examined and compared conventional architectural drawings and communicative drawings. It identified whether lay people see and understand communicative drawings better than conventional drawings. Four drawings were used in the second questionnaire: (a) two communicative drawings, which replaced conventional drawing from the first empirical test and (b) two conventional drawings, which acted as a reference drawings.

The findings from the second empirical test were presented in Chapter Eight. The results obtained from these three groups of respondents showed that at a basic level, the replacement or existence of the communicative drawings affected both lay people and architectural students' reactions, preferences, and their interpretation of conventional drawings.

Part two of the test focused on basic qualities in a plan drawing: Circulation, Use, Scale, and Spatial experience, which were tested against two communicative drawings and one conventional drawing. All three groups of respondents agreed that the communicative drawing had more potential in describing four basic qualities of plan drawing than the conventional architectural drawings. Both forms of communicative drawing seemed to show more potential in conveying information and in communicating with the audience. It can be concluded that the majority of the respondents prefer the communicative drawings over the conventional drawings.

The questions in part three focused on the specifics of the drawings; this aimed to examine the system of interpretation and the subsequent understanding of the respondents. The results obtained from both lay people and architectural students showed that the comprehension achieved from the communicative drawings was better than with conventional drawings. This showed the advantages of communicative drawings which enabled the respondents to not only see and read a plan drawing better at the basic level, but also to interpret and understand it better at a more detailed level.

Part four of the test showed that the majority of the respondents agreed that plan D (Communicative drawing 2) had the most potential in communication and best explained information about a building. This might have important implications for practice, in particular since plan D may be seen as the drawing that is most different from a conventional plan drawing.

A comparative study between the first and second empirical test was also conducted by using statistical analysis; with a comparison of the quality and communicative ability of conventional and communicative drawings. The statistical analysis revealed a significant difference in the way two forms of drawing are seen and read, particularly in relation to the basic qualities of a plan drawing, by lay people and diploma architectural students[2]. The communicative drawings from the second empirical test obtained more positive results than the conventional drawing used in the first empirical test. Plan D (Communicative drawing 2) was the most successful drawing that clearly conveyed all basic information on the qualities of a plan drawing, whilst plan B1 (communicative drawing 1) and plan A and C (conventional drawings) seemed to be less popular. Thus, it was concluded that the existence of the communicative drawings significantly influenced the way of seeing and reading by both lay people and diploma students; they evaluated the basic quality of the new drawings in a different way.

Examining in more detailed level of understanding the drawings, a significant difference between the way conventional and communicative drawings convey and communicate with lay people was identified. Lay people's responses were significantly affected by the introduction of the communicative drawings. Half of the questions (four from a total of eight questions) showed that laypeople interpreted and understood the communicative drawing better than the conventional ones. What is interesting is that it was these four questions that thrown up interpretative problems in the first test, for example on issues of scale and the understanding of architectural symbols. This showed that in general, communicative drawings improved the way

[2] As will be seen, first year architectural students performed more like lay people than they did like Diploma students; it was decided therefore to make the comparison between lay people and Diploma students.

information is interpreted and understood, though it should also be noted that some of the questions still showed a better understanding from conventional drawings. As had been noted before, this suggests that one drawing cannot achieve everything, and what this research shows is that architects need to be more aware of the importance of using different methods of drawing to convey particular types of information.

Furthermore, results obtained from the diploma architectural students revealed some very interesting results. There was only one question showed that diploma students found the communicative plan more useful than the conventional plan. This suggests that the presence of communicative drawings apparently had minor effect on the way diploma students interpreted and understood conventional drawings. As can be noticed from the rest of the questions, diploma students see little difference between these two forms of drawings; but they seem to prefer the conventional architectural drawings slightly more than the communicative drawings, with the suggestion that this preference is based on what they have been taught as the acceptable method of drawing architectural plan. This shows that the communicative potential of drawings within architectural circles is circumscribed by the normative systems of values and methods that are developed in architectural education.

Finally, it is interesting to note that the most significant characteristic of lay people is their disposition to view communicative drawings from a sensibility and perspective different from that of architects. They appeared to appreciate the alternative method of drawing as an explanative and communicative object, whilst architects considered it less positively as a non-conventional method of drawing. With the communicative drawings in the second empirical test, lay audience began to use their individual experiences to respond to the questionnaire and attempted to break through the barrier between the image and the represented building by beginning to visualise themselves in the imagined building (see Brown and Yates (2000)). This suggests that the lessons from the more theoretical research in the first four chapters and Chapter Seven had been useful for the preparation of the communicative drawings.

9.3 Implications

It is hoped that the research has eventually achieved its major aim and objective, that is to establish a means by which architects and non-architects can effectively share and exchange ideas. The research has revealed the capability of the so-called communicative drawing to enable a more faithful and accessible form of communication to be made with a lay audience. This type of drawing suggests the way a place is experienced, the interaction between a person and a place, by indicating activities and experience in that place. It shows that lay people actually appreciated the set of communicative drawings more than the conventional ones. Their appreciation and satisfaction, as well as some positive qualitative feedback, respond to the main hypothesis of the research, which states that an alternative method could help to improve and enhance comprehension between non-architects and architectural drawings. Despite the limits of the communicative drawings concerned[3], the findings showed that such unconventional/communicative drawings have potential implications for the way in which buildings are perceived and interpreted. By referring to Environmental psychology discussed in chapter Four, it is expected that people would reflect the same value, preference to interpretation of the drawing, as they would in the interpretation of the building. Hence, the drawing with a more comprehensive approach and a more communicative potential, I suggest, would potentially lead to a more inclusive approach to architecture and the design process.

Therefore, this in turn supports and informs the recommendations for an architectural drawing's format, which are presented in the next section.

9.3.1 Format of Architectural Drawing

This section makes recommendations for the improvement of the communicative quality of architectural drawings. Whilst these recommendations are based on an analysis of the plan, it may be seen that many of them can be equally applied to other types of drawing. The recommendations are based not only on the results of the tests, but also on the study of external applications in chapter Seven: Map, Diagram, and Graphic representation. The recommendations focus on two aspects: (1) message and code, (2) drawing and its graphic representation.

9.3.1.1 Message and code

As we have seen, the code and its context are the significant factors of the message that is conveyed through an architectural drawing. The code should be considered in regards to, firstly, the complexity of a code. Too complex codes may easily be mis-comprehended, especially if there is a disparity in education or socio-professional background between architects and the audience. Message elements, secondly, are usually structured by architects' subjectivity, which is meaningful for them but insignificant and incomprehensible for others. Thus, the audience is limited by architect's choice of code, and the lack of knowledge and experience of the audience limit a potential in communication even further. The code should be flexible and extensive; a code element that is structured in a very particular way is not recommended. Finally, the style and type of a message which is often related to the type of a building. The more complex the building type, the more complex its illustration and depiction, and the more specialisation required in the details of the message. Thus, the conveyed message has to be described in the simplest way, but without losing meaning and force behind it.

These issues, singularly or collectively, should therefore be considered in choosing the mode of coding an architectural drawing.

[3] See p. 173, Chapter Seven.

9.3.1.2 The drawing and its graphic representation

The success of the communicative drawing in the second test also suggests that certain recommendations based on the analysis of graphical representation be considered. The criteria for graphic representation can best be summarised by referring to Bertin's rules of graphic construction and findings acquired from the empirical studies of the research:

a) The first recommendation is that an architectural drawing should be represented with the least possible elements but the reduction of the elements should only be made to the extent the message is still clearly conveyed and efficiently communicated.

b) The graphic density should be considered in the formation of an architectural drawing. This depends on the quantity of information within a drawing and its distribution. Increasing density may decrease the representational clarity; as we have seen, the map and diagram were influential examples that show a balance between graphic representation and the quantity of information conveyed. A graphic that is too dense risks overwhelming the audience (examples can be found in the qualitative feedback obtained from both empirical tests).

c) The use of colour, which is often overlooked by architects, becomes another element that improves the communicative ability of an architectural drawing, as suggested in the qualitative feedback.

d) Dimensioning was one of the major problems found in the study of both conventional and communicative drawings. The research showed that relying solely on standard dimensioning systems such as a measured scale may not be enough. Scale can also be conveyed through the incorporation of everyday objects and/or human elements within the drawing. These provide not just an explicit description of use and movement, but also an implicit scalar relationship; lay audiences appear to be able to relate to these elements more directly.

e) Even though an architectural drawing is fundamentally based on graphical modes of representation, written text, such as notation and titling, is still necessary and acts as one of crucial aspects in the format of architectural drawing. This aspect is often underestimated. The written text acts as an instruction within the drawing and as an explanation of the graphical information the drawing represents. As recommended in RIBA handbook, "As a general rule, all notations should be clear, concise, and consistent" (cited in Fawzy (1991). However, the research recommends that the use of written text should be related to the quantity and quality of graphic representation. This is because architectural drawing is considered primarily a non-verbal language and for greatest efficiency, graphical representation should be used.

f) The inclusion of a common language, such as the use of everyday objects, furniture, colour, or basic symbols and elements, was found to be useful for the audience in reading and understanding architectural plan drawing. These aspects were suggested by both architects and non-architects in the qualitative sections of the empirical studies. In particular, the lay audience seemed to relate easily to the drawing by using these elements as a shared code or language.

g) The use of diagram increased a communicative potential of architectural drawing, as can be noticed in particular in the development of plan D. Its open-ended characteristic allows it to be liberally interpreted by everyone in the audience. However, it should be drawn and used in a comprehensible manner and be prioritised towards the audience, particularly that of the lay audience, and not as an internalised abstraction as has been the case in some architectural examples.

h) The more user-friendly or less technical way of drawing is suggested in order to overcome notions of technicality. This may include the use of a sketch or the inclusion of art or external language that can act and be applied as a shared language.

i) The architect should be aware of the way that the lay audience may prioritise architecture and its occupation. In particular, the drawing should allow the viewer to relate their own experiences of what is being depicted. In this, the lessons from the map appear useful, in that the map allows open possibilities of occupation to be projected.

Finally, this research suggests two more implications which are related to architectural education and architectural profession and practice.

9.3.2 Architectural Education

This research, particularly in findings obtained from both empirical tests, informs potential recommendations for programmes of architectural education. The disparity between the way in which architects and non-architects perceive and interpret conventional and communicative drawings suggests that certain aspects of the present architectural education need to be re-examined.

The study of architects' characteristics in the earlier chapter, together with findings obtained from the second empirical test, suggests that architectural students are clearly influenced and convinced by the norms of architectural culture. This is why architectural students, who have been dominated by a certain culture and value system, have a specific way of seeing and a distinctive system of interpretation, which differ from lay people. Architectural students are introduced to architectural culture at a very early stage, and the standard methods of orthodox drawing therefore are part of that culture. Hence, I suggested, they eventually see these as the only proper way to draw the world. This research suggests that these prescribed methods of drawing are not communicative and this is failing the students.

Because of the controlling influence of the mainstream architectural culture, students are not able to make a critical judgement about architectural representation. They assume that only the conventional method of drawing is right and anything else is wrong. According to this research, for example, Plan A (coded language) was the drawing that most students prefer, even after the communicative drawing was introduced.

Such attitudes formed during their architectural education, eventually influencing their professional practice, propagates unawareness to their audience in terms of clients and users. As Nicol and Pilling (2000) note, "While we (architects) are good at selling our concepts to other architects, we have developed a secret code that few others understand. **We are frequently seen as poor listeners and, accordingly not very client-focused**" Nicol and Pilling (2000: XVII, my emphasis). As Cuff (1991) notes that this problem arises from the system of education itself. The design studio, for example, where architectural students work long hours at the drawing board, results in students becoming isolated from the outside world, knowing only how to talk to other architects.

The investigation of communicative drawings suggests that the key to a successful communication, via an architectural drawing, is not only the drawings' ability to deliver a high standard of graphic representation, but also their ability to represent values and aspirations of the audience it serves. This suggests that students need to learn to be more aware of the context in which they communicate, because the communicative situation made with their tutor or their peers and that with non-architects or the public is totally different. Perhaps, the priority in the school of architecture should not only be given to 'design as product' that encourages only visual and graphic output, but design as dynamic and interactive (see Nicol and Pilling (2000)). Most importantly, Lawson (2001) notes, architectural students need to be aware of the way that lay people prioritise and perceive architecture.

Therefore, a small but important part of this research is part of a much wider debate around architectural education. It is envisaged that the recommendations resulting from this research will help foster positive attitudes toward architects and others, encouraging understanding, and thus improving relations, among those in the architecture profession, others in related professions, and the general public. As Jeremy Till (2004) notes on the current situation in architectural education (which he asks for a change) that:

> *The present structure does not take into account the new architectural and social conditions. It aims to produce a certain type of fixed architect. But the world has moved on, we need a different type of architect to face up to new fluid conditions....**You cannot teach all the knowledge required to be an architect. But you can teach people to develop judgement in order to face the new conditions.** Till (2004: 16, my emphasis)*

He points out that the profession does not own education and it has to get over the expectation of the school producing "oven – ready chickens" Till (2004). Therefore, the challenges in education become significant. Rather than educating architectural students towards achieving the goal of the 'signature architect' within the normative terms of architectural education, another goal might be better used in understanding the needs and values of the user and client; (see Parnell (2003)) this will inevitably influence the way that architectural representation is approached (see Nicol and Pilling (2000: XVI)).

9.3.3 Architectural Profession and Practice

By focusing on the context of architectural profession, this research calls for today's architects to question their values, self-conceptions, and their methods of communication within practice. Findings from this research have suggested positive ways of improving communication towards clients and the public at large. This can be related to an argument made by Nicol and Pilling (2000). They note that because of the rapidly shifting context of practice and societal conditions, an architect has to update his or her knowledge and skill many times over a lifetime. This research suggests that they need to become more skilled in the human dimensions of professional practice. As Whiteman (1987) notes, **"To draw architecture without a concern for the intense problematic of human values is to propose a building in antithesis to the structure of human experience in architecture"** Whiteman (1987: 145).

The research suggests that the subjective stance of an architect, through which they generally draw from their own imagination and often prioritise their own experience of space, tends to marginalise and negate the experience of others. By attempting to resolve this situation, the research suggests that an architect must collaborate with others or the external audience in order to develop an appropriate means of communication. The experimental studies indicate that an architect's communicative tool (an architectural drawing) needs to be more flexible and adaptable, concerns human and social values, and provides for other alternative options.

In addition, the role of the audience, which directly affects that of the architect's, needs to be taken into account. At present, clients wish to be more involved in design-making decisions, and this inevitably affects the way that drawings are produced, and the process of both making architectural drawings and products. Nicol and Pilling (2000) conclude from the reports of Latham and Egan (see Latham (1994), Egan (1998)) that, "Clients are becoming increasingly knowledgeable and demanding in their dealings with the construction industry and architects. The traditional client/ architect/ contractor relationship has changed radically. Clients are no longer content to rely on the architect as primary advisor" Nicol and Pilling (2000: 3).

Nicol and Pilling suggest,

As a result there have been calls in the media, and elsewhere, for architects to demonstrate greater sensitivity in their designs to the needs of building users and society, and for them to communicate more clearly the meaning behind their works. ***Not only must architects develop interpersonal skill in relationship to clients and other professionals, but they must also become better at listening and responding to, and communicating with, building users and the public.*** *Nicol and Pilling (2000: 3. my emphasis)*

In conclusion, it is hoped that this research will make a modest contribution to the need for better communication. The implications suggest the potential of a small but important shift that could enable the architectural profession and education to communicate better, with benefits to both the profession and user alike. This shift could be better validated and informed through further research which is explained in the next section.

9.4 Directions for Further Research

Four basic directions for future research, which are derived from this thesis, can be summarised as follows:

1. **Other drawings**: In order to limit the scope of the research and allow constancy in comparison, the research concentrated on plan drawings. In further research, other types of architectural drawing could be examined. Whilst it is suggested that the general principles of this research will remain, other drawing types, and in particular the use of three-dimensional drawings, could usefully extend the research. This might lead to more alternatives of communicative drawings. In addition, the other communicative drawings, such as the shopping mall or gallery plan, that are generally used by a lay audience or the public should also be examined. Examples of these plans are briefly surveyed and discussed in Appendix K.
2. **Wider group of respondents**: As previously mentioned, the respondents participating within this research were considered as self-selected. They were generally highly educated. More research is required to investigate the responses of a wider cross-section of the general public rather than the self selected body. This is because people on the street might have a different perception and interpretation from the more educated population within the university. Their disparity will lead to different responses and, at the same time, allow the research to examine the differences between non-architects and architects further. Based on the difference in knowledge level and professional background between the general public and educated body, it is hypothesised that the communicative gap between them will become wider and the difficulty in communication between architects and non-architects, via an architectural drawing, will increase.
3. **Other cultures**: The construction of this research is primarily based on western culture and systems of education. Future research could be conducted within other cultural contexts, such as in Thailand, where different representational methods and expectations are in place, and where different professional and educational value systems exist. The comparison between these two cultural contexts might contribute important ideas, as well as offering further lessons back to the Western contexts.

4. Further research could include **a protocol analysis** of the written feedback received in both empirical tests. This would attempt to verify the difference in language used and associated architectural preferences between lay people and architects.

9.5 Conclusions

This research reveals some important insights into the role and structuring of architectural drawing, and also makes some suggestions as to ways of developing architectural education and practice. However, the research is only one of many expressions of interest. It is hoped that the range of perspectives presented and examined here will contribute to the ongoing research and debate on this subject and will offer some valuable insight into this field.

The research has suggested that an architectural drawing might become a bridge between architects and non-architects, school and practice, and profession and community; but this will only happen if its communicative potential as part of a shared social exchange can be fully realised. It is hoped that this small insight will help in the repositioning of architecture and architectural education as a relevant social enterprise.

I hope that the idea of this alternative method of drawing will encourage architects to be more aware of their clients and the users of the built environment, as well offering non-architects more opportunity to be involved within the architectural context. Since the conventional code is internalised architecture, the alternative method of drawing may lead architecture to become more inclusive and responsive to the user. The developing of the alternative method could help change professional attitudes and challenge us as architects to work in a different relationship with clients and the public at large. My hope is that this research may make a small but important contribution to the betterment of the built environment.

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Appendices

Appendix A | The First Pilot study

The questions carried out in the first pilot study were asked against three different drawings: A, B, C, and D (see drawings in Chapter Five).

Questionnaire - PhD. Research

Name.................. .... **Sex** ☐ Male ☐ Female
Age ☐ 0-18 ☐19-40 ☐ over 40
Occupation..
(If you are student please specify school and field of study below)
School................................**Year**..................................
Field of study...

Part 1: Please answer the following questions against the drawing.

Q1: From drawing A, which is the main entrance of the flat?

1) A
2) B
3) C
4) D
5) I don't know (If you choose I don't know, Skip to the next Question)

Why do you think so?..

Q2: If you enter the main entrance door, which area are you in?

1) Hall
2) Lobby
3) Living room
4) Boiler room
5) I don't know (If you choose I don't know, Skip to the next Question)

Why do you think so?..

Q3: From drawing A, which is the living room's window?

1) E
2) F
3) G
4) H
5) I don't know (If you choose I don't know, Skip to the next Question)

Why do you think so?..

Q4: If you look out from the living room's window, what do you see?

1) Football pitch
2) Garden and Lawn
3) Parking area
4) Neighbour's house
5) I don't know
(If you choose I don't know, Skip to the next Question)

Why do you think so?..

PART 2: Please answer the following questions.

Q1: Which drawing are the easiest and the hardest to understand?

Please rank drawings (A-D) from the easiest to the hardest.

Drawing ...... (Easiest)
Drawing ......
Drawing ......
Drawing ...... (Hardest)

Q6: Which drawing has the most information for you?

Please rank drawings (A-D) from the most to the least.

Drawing ...... (The most information)
Drawing ......
Drawing ......
Drawing ...... (The least information)

Q7: If I told you that all drawings are of the same space, what is your reaction?

....
....
....
....
....
....

Thank you for your co-operation

Soranart Sinuraibhan
School of Architecture, University of Sheffield

Appendix B | The Second Pilot study

QUESTIONNAIRE (Re-Draw the line) – (PLAN)

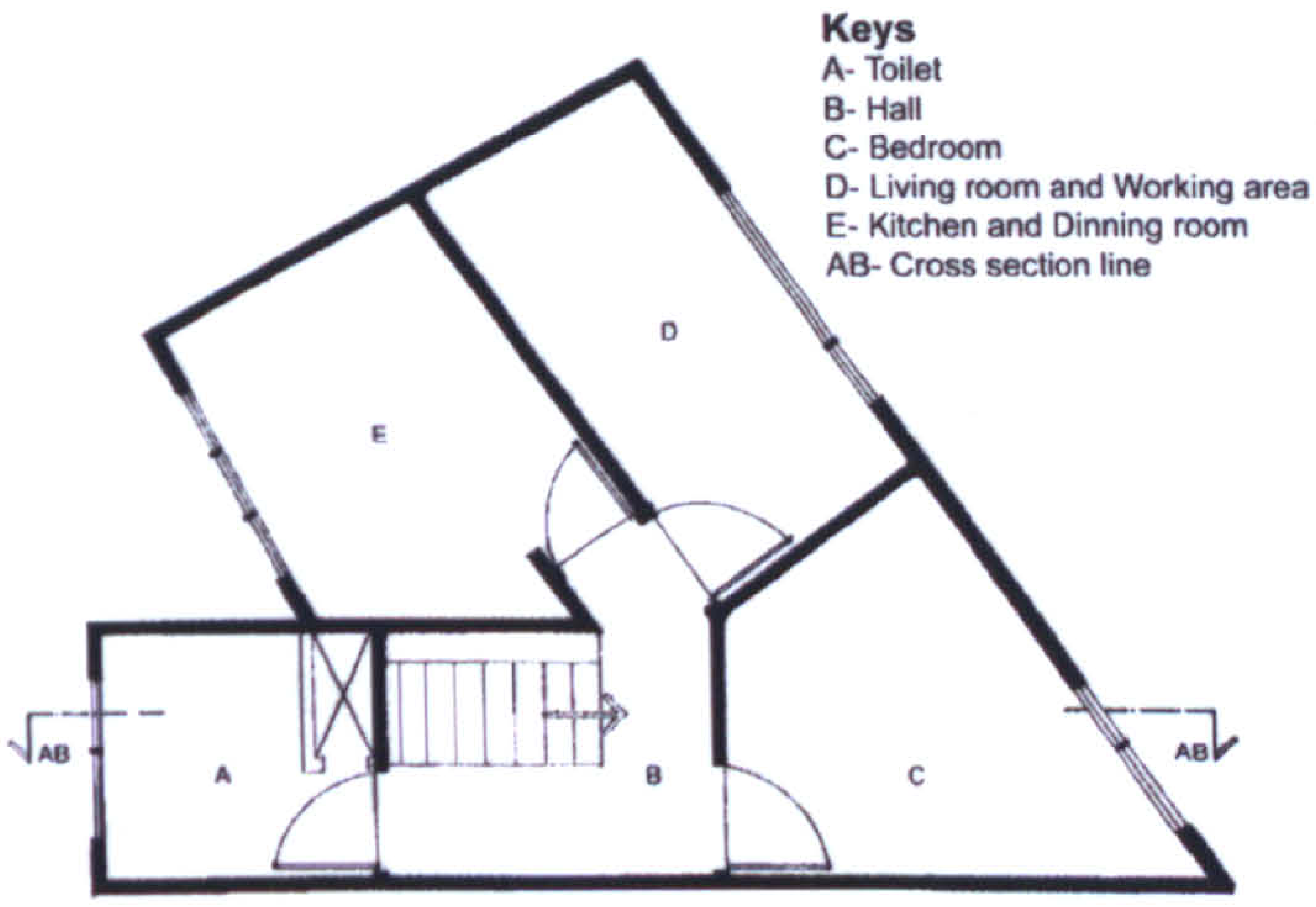
Name:...

Gender: Male / Female

Age: 18-25 / 25-30 / 31-39 / 40-49 / 50 or older

Education level:..........................Field of study..............................

Occupation:...



This is a plan drawing of a residential flat. Please read the keys to understand the drawing and answer the following questions;

1. How can you walk from kitchen to toilet?

A) From the kitchen, turn left, go straight and turn right, the bedroom is on the left, walk straight to toilet.

B) From the kitchen, turn right, go up stairs and go straight to toilet.

C) From the kitchen, turn right, pass by living room's door, go straight and turn right, walk straight to toilet.

D) From the kitchen, go straight and walk up stairs in hall area and go up straight to toilet.

E) I don't know

2. **How many doors and windows are there on this floor?**

   A) 5 doors 4 windows **B)** 4 doors 4 windows **C)** 4 doors 5 windows **D)** 4 doors 9 windows **E)** I don't know

3. **Which room is the smallest room in this flat?**

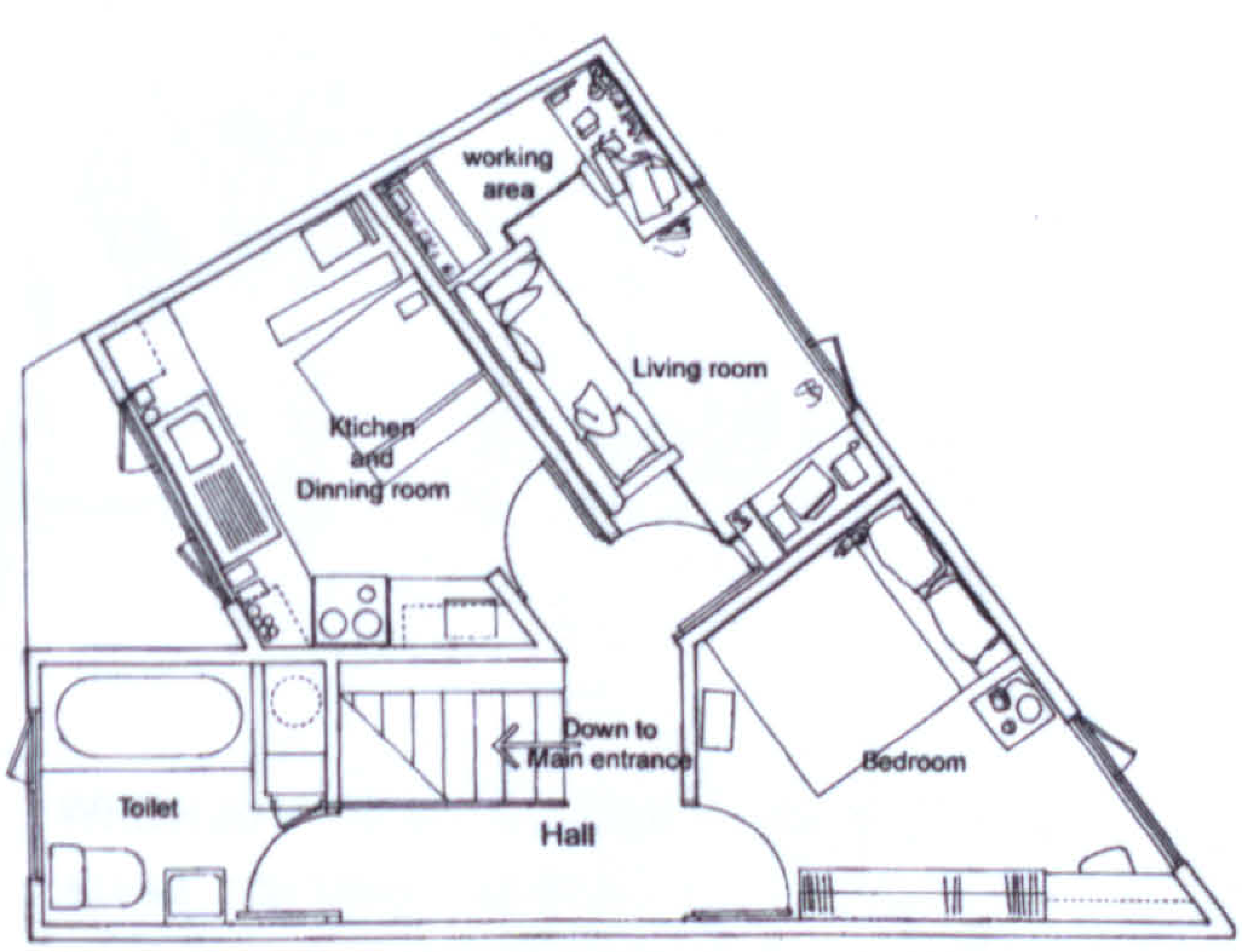
   A) Hall **B)** Toilet **C)** Bedroom **D)** Living room **E)** I don't know

4. **Does the plan drawing provide clear information for you to understand what the building looks like?**

   Very clear Clear Moderate Not quite clear Unclear

5. **Does the plan drawing have enough information for you to understand how the building is organized?**

   Very clear Clear Moderate Not quite clear Unclear



1. How can you walk from kitchen to toilet?

A) From the kitchen, turn left, go straight and turn right, the bedroom is on the left, walk straight to toilet.

B) From the kitchen, turn right, go up stairs and go straight to toilet.

C) From the kitchen, turn right, pass by living room's door, go straight and turn right, walk straight to toilet.

D) From the kitchen, go straight and walk up stairs in hall area and go up straight to toilet.

E) I don't know

2. How many doors and windows are there on this floor?

A) 5 doors 4 windows **B)** 4 doors 4 windows
C) 4 doors 5 windows **D)** 4 doors 9 windows **E)** I don't know

3. **Which room is the smallest room in this flat?**

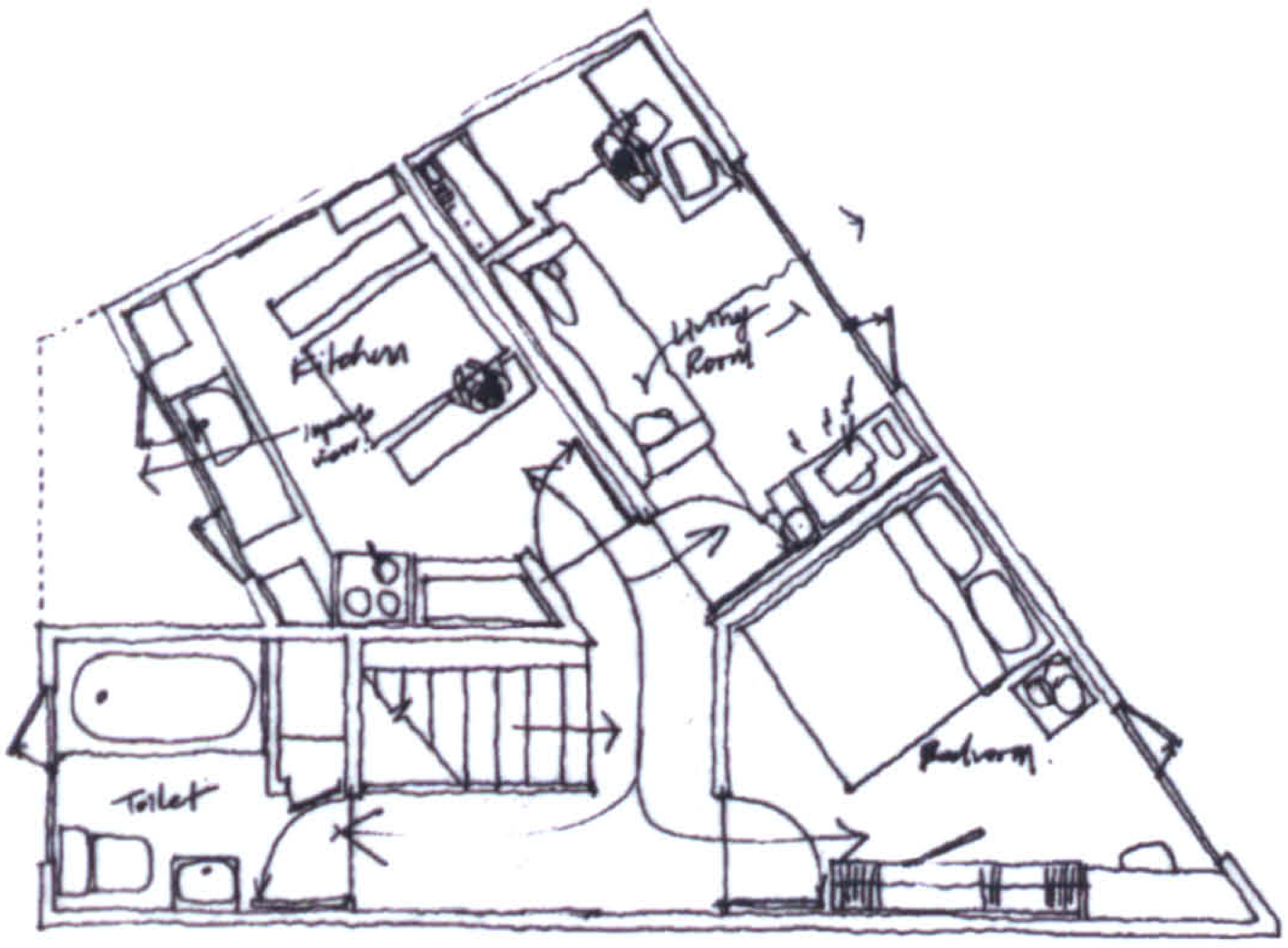
   A) Hall **B)** Toilet **C)** Bedroom **D)** Living room **E)** I don't know

4. **Does the plan drawing provide clear information for you to understand what the building looks like?**

   Very clear Clear Moderate Not quite clear Unclear

5. **Does the plan drawing have enough information for you to understand how the building is organized?**

   Very clear Clear Moderate Not quite clear Unclear



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1. How can you walk from kitchen to toilet?

A) From the kitchen, turn left, go straight and turn right, the bedroom is on the left, walk straight to toilet.

B) From the kitchen, turn right, go up stairs and go straight to toilet.

C) From the kitchen, turn right, pass by living room's door, go straight and turn right, walk straight to toilet.

D) From the kitchen, go straight and walk up stairs in hall area and go up straight to toilet.

E) I don't know

2. How many doors and windows are there on this floor?

A) 5 doors 4 windows **B)** 4 doors 4 windows **C)** 4 doors 5 windows **D)** 4 doors 9 windows **E)** I don't know

3. Which room is the smallest room in this flat?

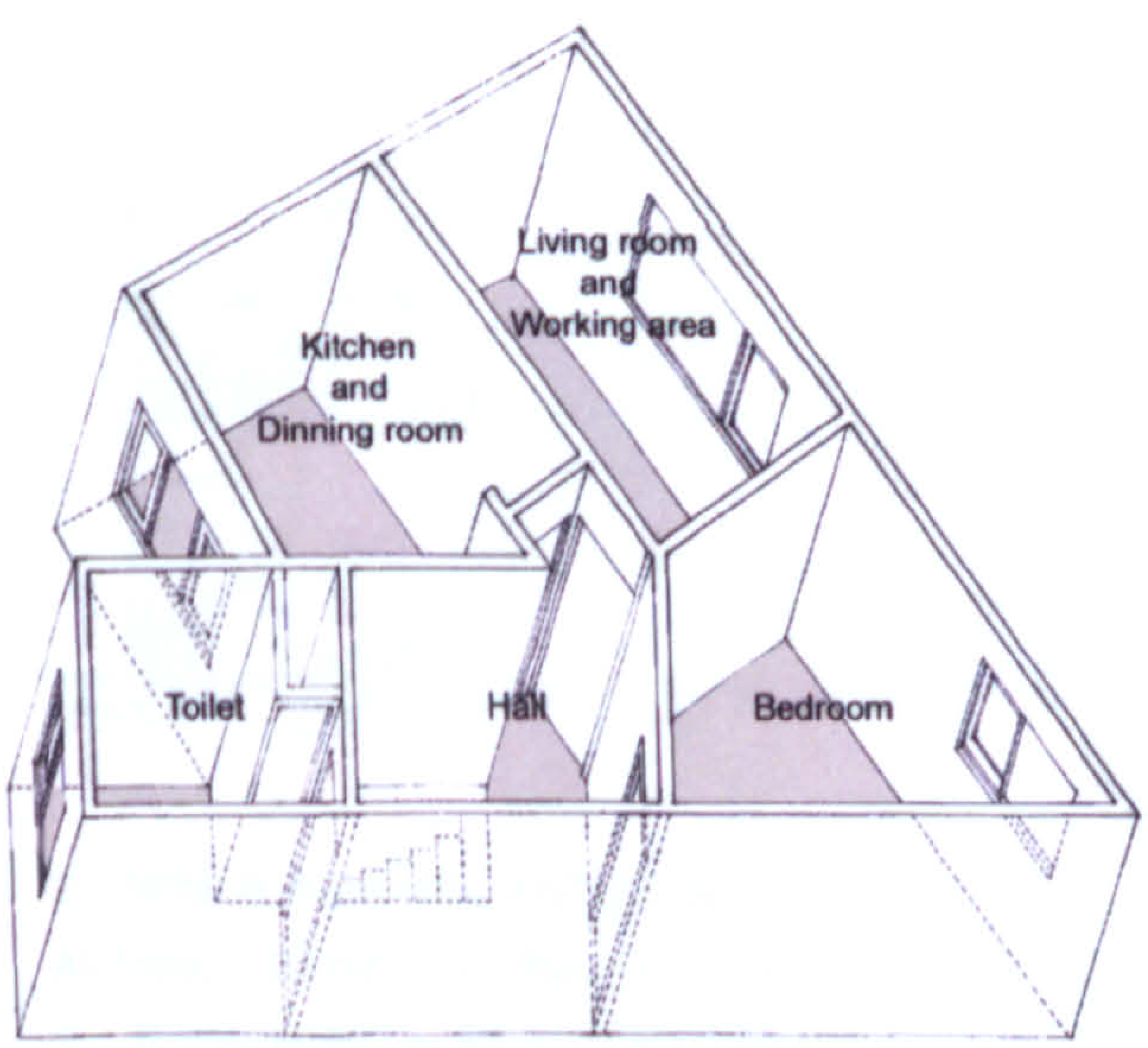
A) Hall **B)** Toilet **C)** Bedroom **D)** Living room **E)** I don't know

4. Does the plan drawing provide clear information for you to understand what the building looks like?

Very clear Clear Moderate Not quite clear Unclear

5. Does the plan drawing have enough information for you to understand how the building is organized?

Very clear Clear Moderate Not quite clear Unclear



1. How can you walk from kitchen to toilet?

A) From the kitchen, turn left, go straight and turn right, the bedroom is on the left, walk straight to toilet.

B) From the kitchen, turn right, go up stairs and go straight to toilet.

C) From the kitchen, turn right, pass by living room's door, go straight and turn right, walk straight to toilet.

D) From the kitchen, go straight and walk up stairs in hall area and go up straight to toilet.

E) I don't know

2. How many doors and windows are there on this floor?

A) 5 doors 4 windows **B)** 4 doors 4 windows

C) 4 doors 5 windows **D)** 4 doors 9 windows **E)** I don't know

3. Which room is the smallest room in this flat?

A) Hall **B)** Toilet **C)** Bedroom **D)** Living room **E)** I don't know

4. Does the plan drawing provide clear information for you to understand what the building looks like?

Very clear Clear Moderate Not quite clear Unclear

5. Does the plan drawing have enough information for you to understand how the building is organized?

Very clear Clear Moderate Not quite clear Unclear

Thank you very much for your help.

Soranart Sinuraibhan
School of architecture, The University of Sheffield

QUESTIONNAIRE (Re-Draw the line) – (SECTION)

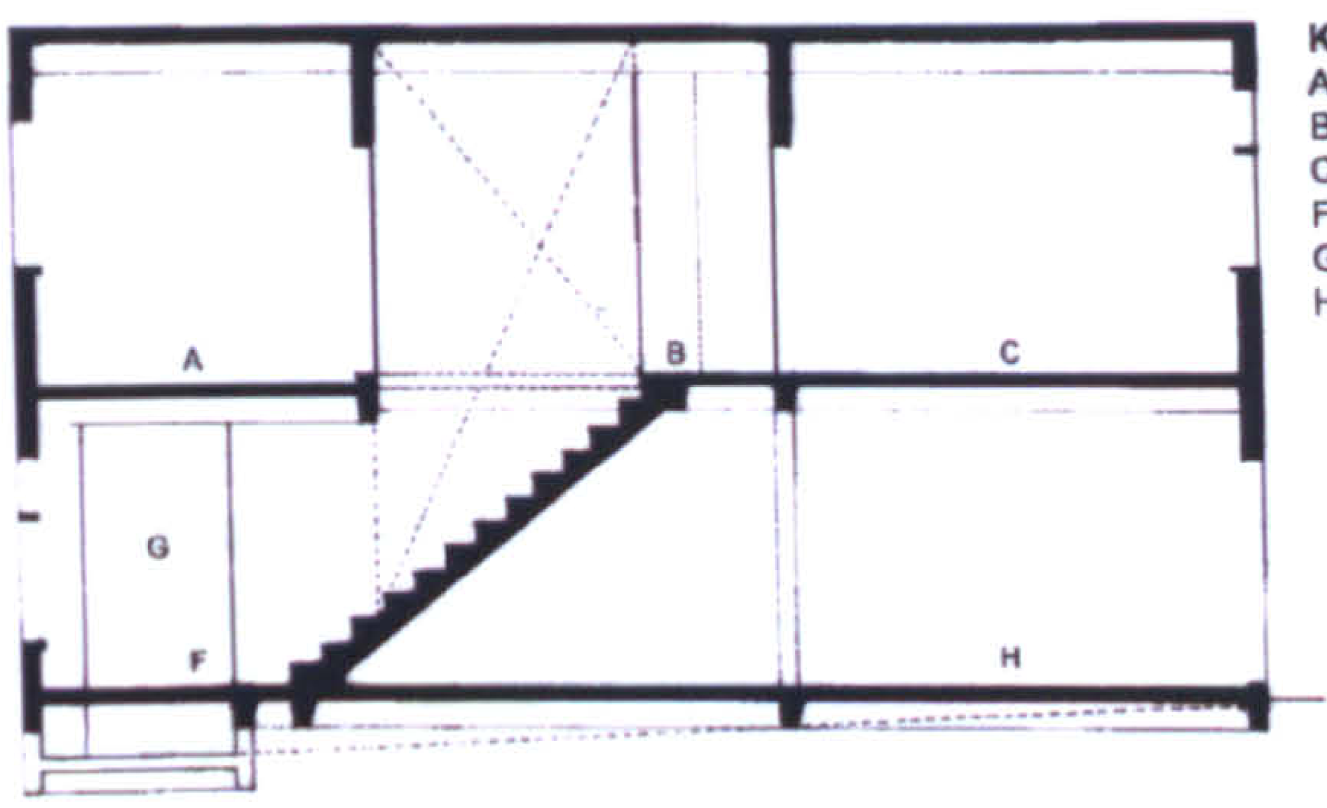
Name:..

Gender: Male / Female

Age: 18-25 / 25-30 / 31-39 / 40-49 / 50 or older

Education level:..........................Field of study...............................

Occupation:..



Keys
A- Toilet
B- Hall
C- Bedroom
F- Stairs up to first floor
G- Main entrance hall
H- Utilities room

This is a section drawing of a residential flat. Please read the keys to understand the drawing and answer the following questions;

1. **Which pair of rooms are one above and the other?** (First floor room first)

   A) Toilet – Utilities room **B)** Bedroom – Stairs
   C) Bedroom – Utilities room **D)** Hall – Toilet
   E) I don't know

2. **Which room has <u>not</u> got an external window?**

   A) Toilet **B)** Hall **C)** Bedroom **D)** Main entrance hall **E)** I don't know

3. **If you walk up stairs from the ground floor, what are you going to see in front of you?**

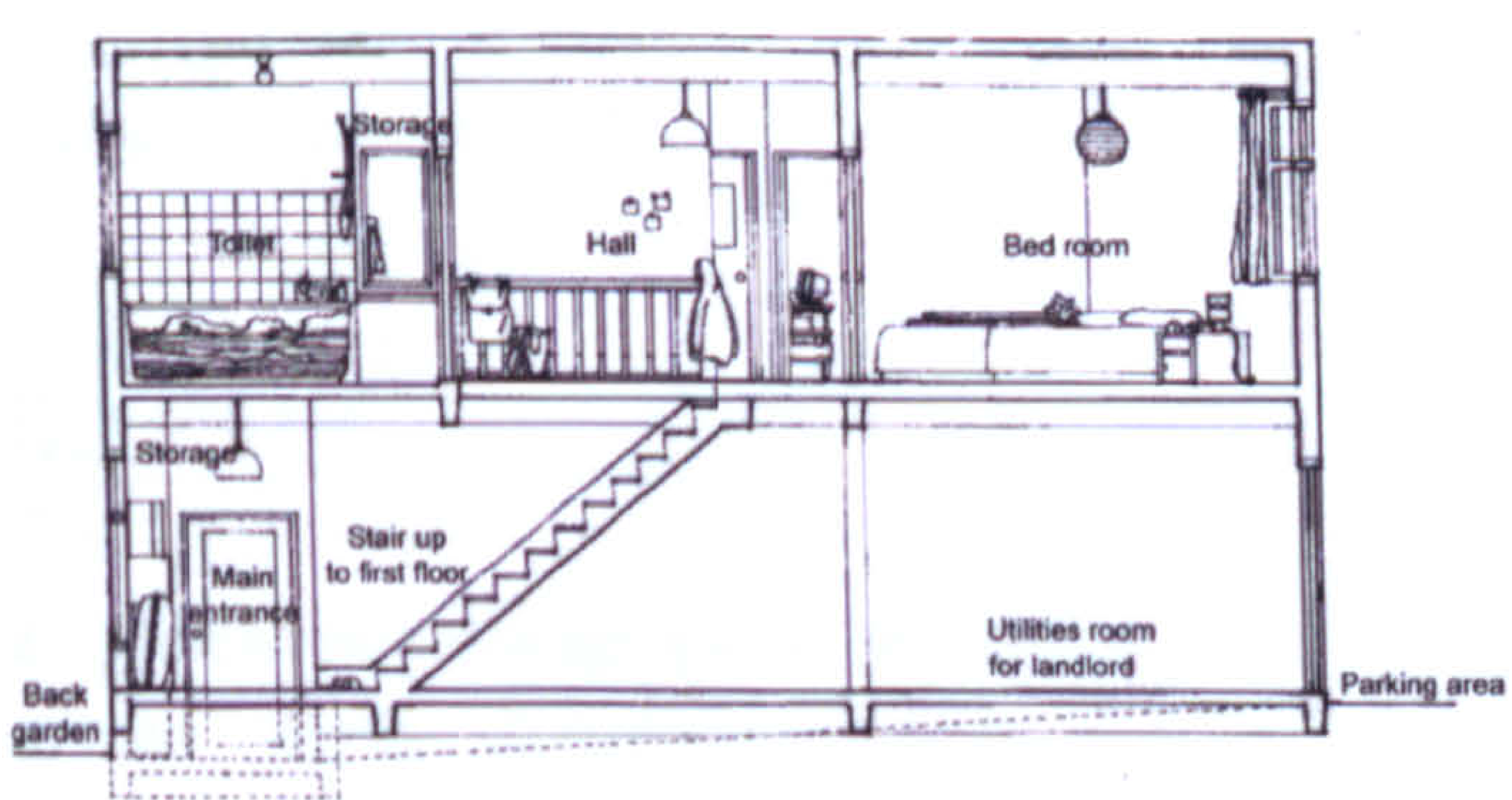
   A) Door **B)** External wall **C)** Internal wall **D)** Window **E)** I don't know

4. **Does the section drawing provides clear information for you to understand what the building looks like?**

   Very clear Clear Moderate Not quite clear Unclear

5. **Does the section drawing have enough information for you to understand how the building is organized?**

   Very clear Clear Moderate Not quite clear Unclear



This is a section drawing of a residential flat. Please read the drawing and answer the following questions;

1. **Which pair of rooms are one above and the other?** (First floor room first)

   A) Toilet – Utilities room **B)** Bedroom – Stairs
   C) Bedroom – Utilities room **D)** Hall – Toilet
   E) I don't know

2. **Which room has <u>not</u> got an external window?**

   A) Toilet **B)** Hall **C)** Bedroom **D)** Main entrance hall **E)** I don't know

3. **If you walk up stairs from the ground floor, what are you going to see in front of you?**

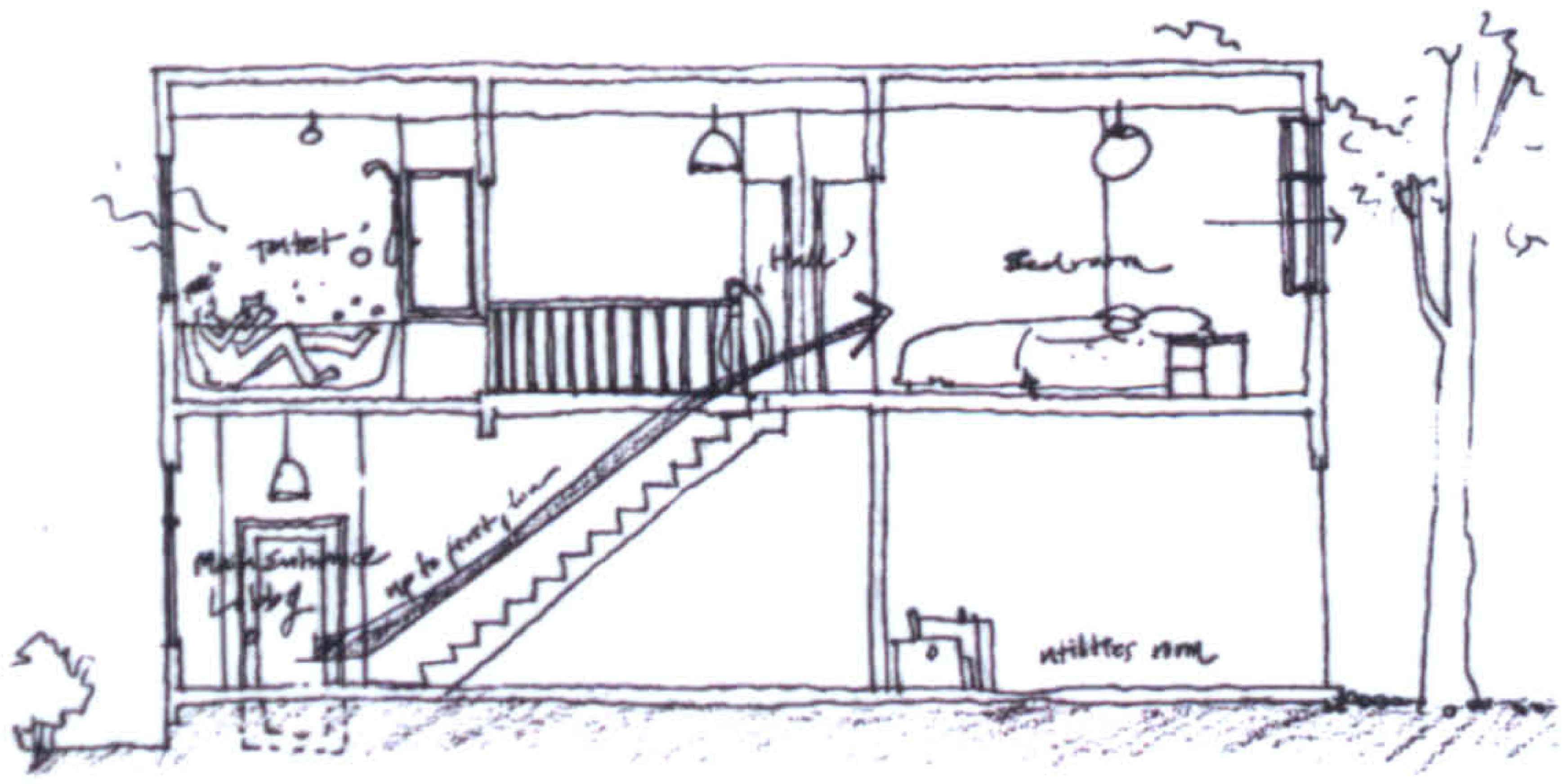
   A) Door **B)** External wall **C)** Internal wall **D)** Window **E)** I don't know

4. **Does the section drawing provides clear information for you to understand what the building looks like?**

   Very clear Clear Moderate Not quite clear Unclear

5. **Does the section drawing have enough information for you to understand how the building is organized?**

   Very clear Clear Moderate Not quite clear Unclear



This is a section drawing of a residential flat. Please read the drawing and answer the following questions;

1. **Which pair of rooms are one above and the other?**

(First floor room first)

A) Toilet – Utilities room **B)** Bedroom – Stairs

C) Bedroom – Utilities room **D)** Hall – Toilet

E) I don't know

2. **Which room has <u>not</u> got an external window?**

A) Toilet **B)** Hall **C)** Bedroom **D)** Main entrance hall **E)** I don't know

3. **If you walk up stairs from the ground floor, what are you going to see in front of you?**

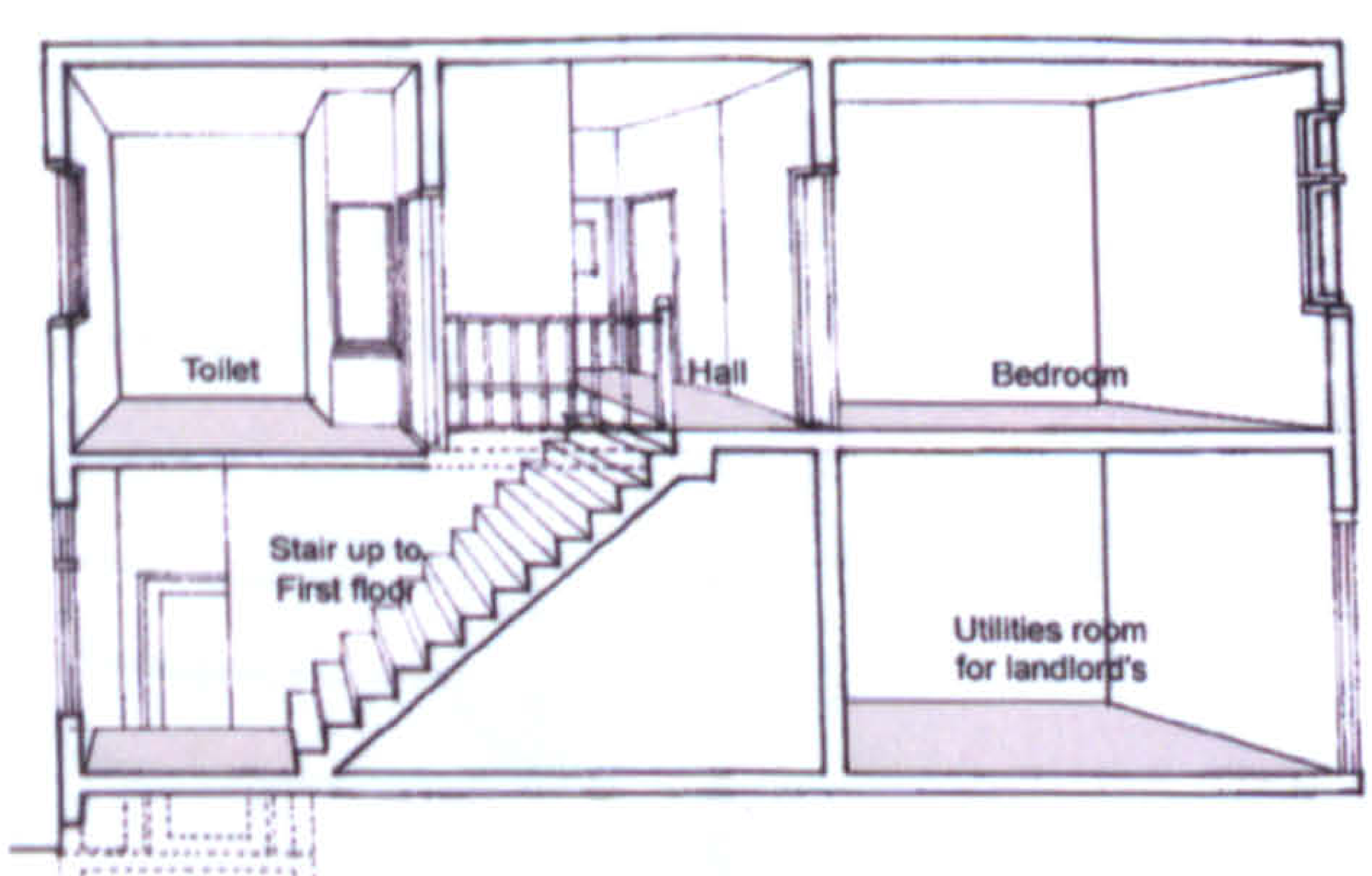
A) Door **B)** External wall **C)** Internal wall **D)** Window **E)** I don't know

4. **Does the section drawing provides clear information for you to understand what the building looks like?**

Very clear Clear Moderate Not quite clear Unclear

5. **Does the section drawing have enough information for you to understand how the building is organized?**

Very clear Clear Moderate Not quite clear Unclear



This is a section drawing of a residential flat. Please read the drawing and answer the following questions;

1. **Which pair of rooms are one above and the other?**

(First floor room first)

A) Toilet – Utilities room **B)** Bedroom – Stairs

C) Bedroom – Utilities room **D)** Hall – Toilet

E) I don't know

2. **Which room has <u>not</u> got an external window?**

A) Toilet **B)** Hall **C)** Bedroom **D)** Main entrance hall **E)** I don't know

3. **If you walk up stairs from the ground floor, what are you going to see in front of you?**

A) Door **B)** External wall **C)** Internal wall **D)** Window **E)** I don't know

4. **Does the section drawing provides clear information for you to understand what the building looks like?**

Very clear Clear Moderate Not quite clear Unclear

5. **Does the section drawing have enough information for you to understand how the building is organized?**

Very clear Clear Moderate Not quite clear Unclear

Thank you very much for your help.

Soranart Sinuraibhan
School of architecture, The University of Sheffield

QUESTIONNAIRE (Re-Draw the line) – (PERSPECTIVE)

Name:...

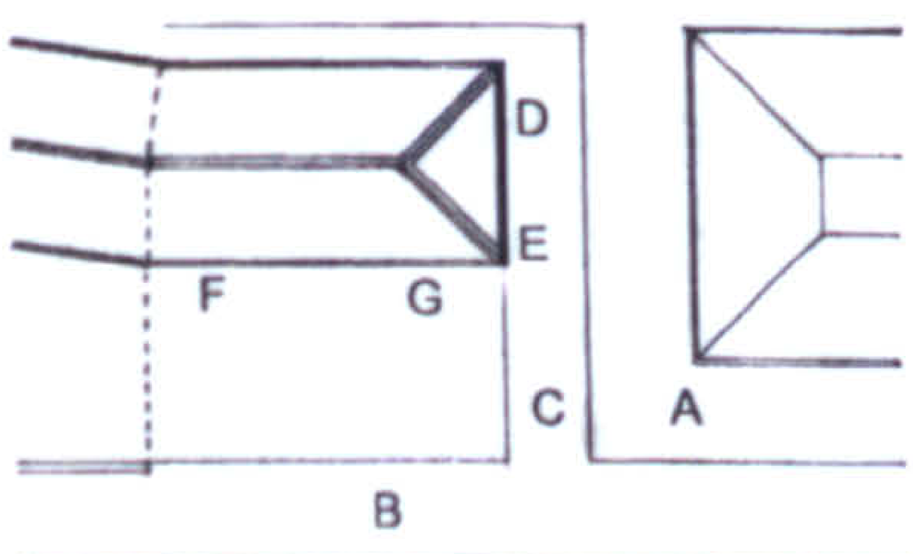
Gender: Male / Female

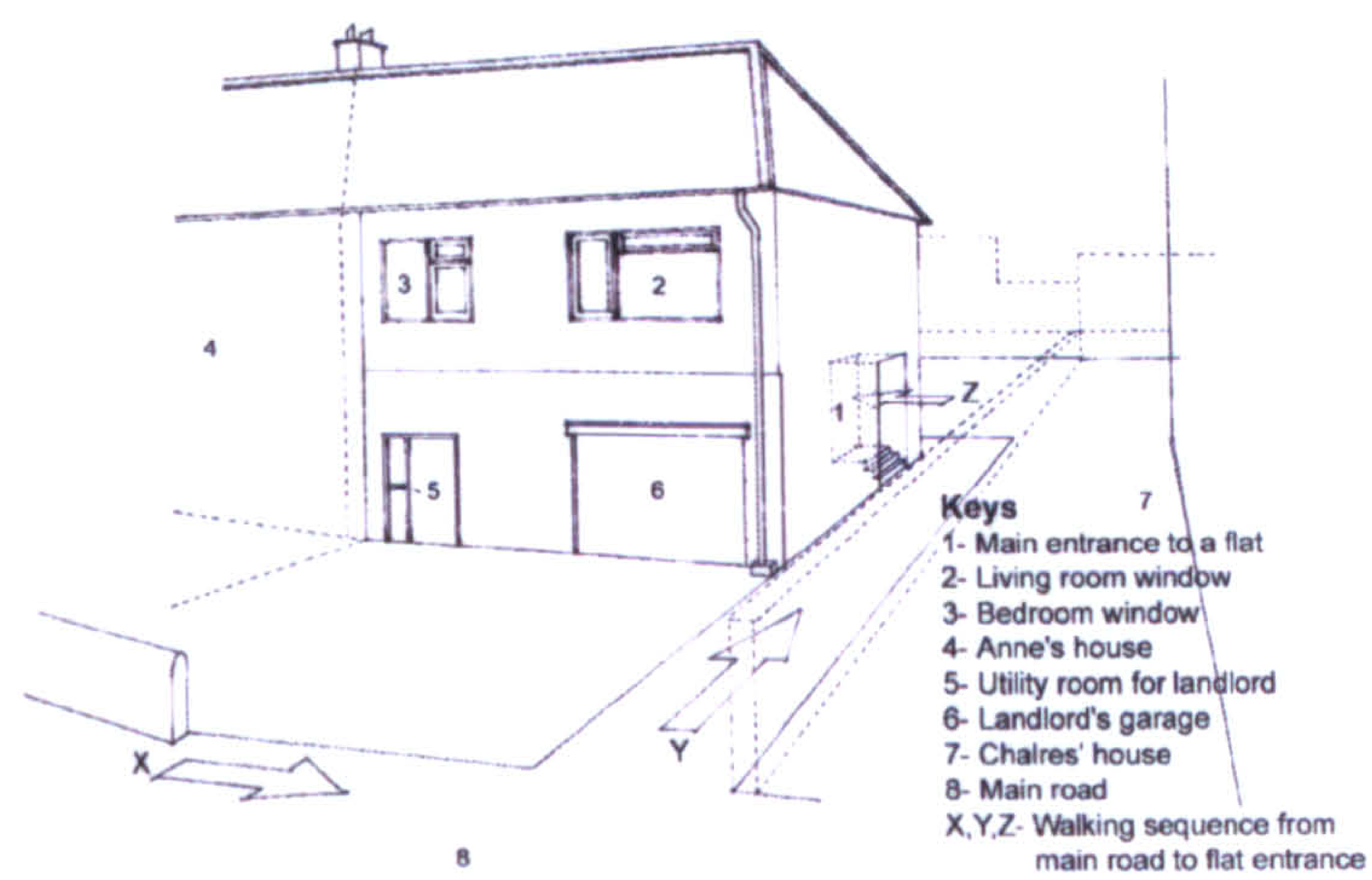
Age: 18-25 / 25-30 / 31-39 / 40-49 / 50 or older

Education level:..........................Field of study...............................

Occupation:...

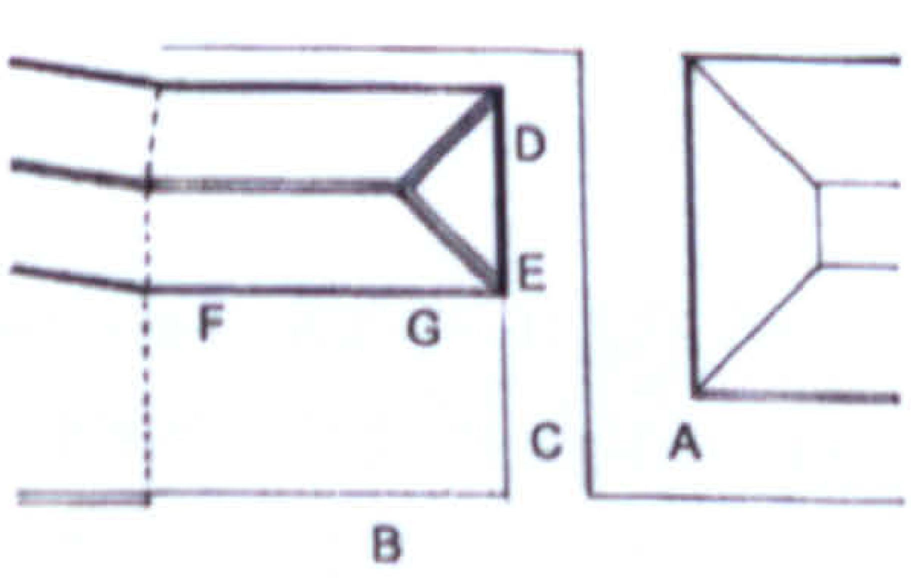
This is a perspective drawing of residential flat. Please compare the layout drawing on the left with perspective drawing on the right and answer the 1-3 questions;

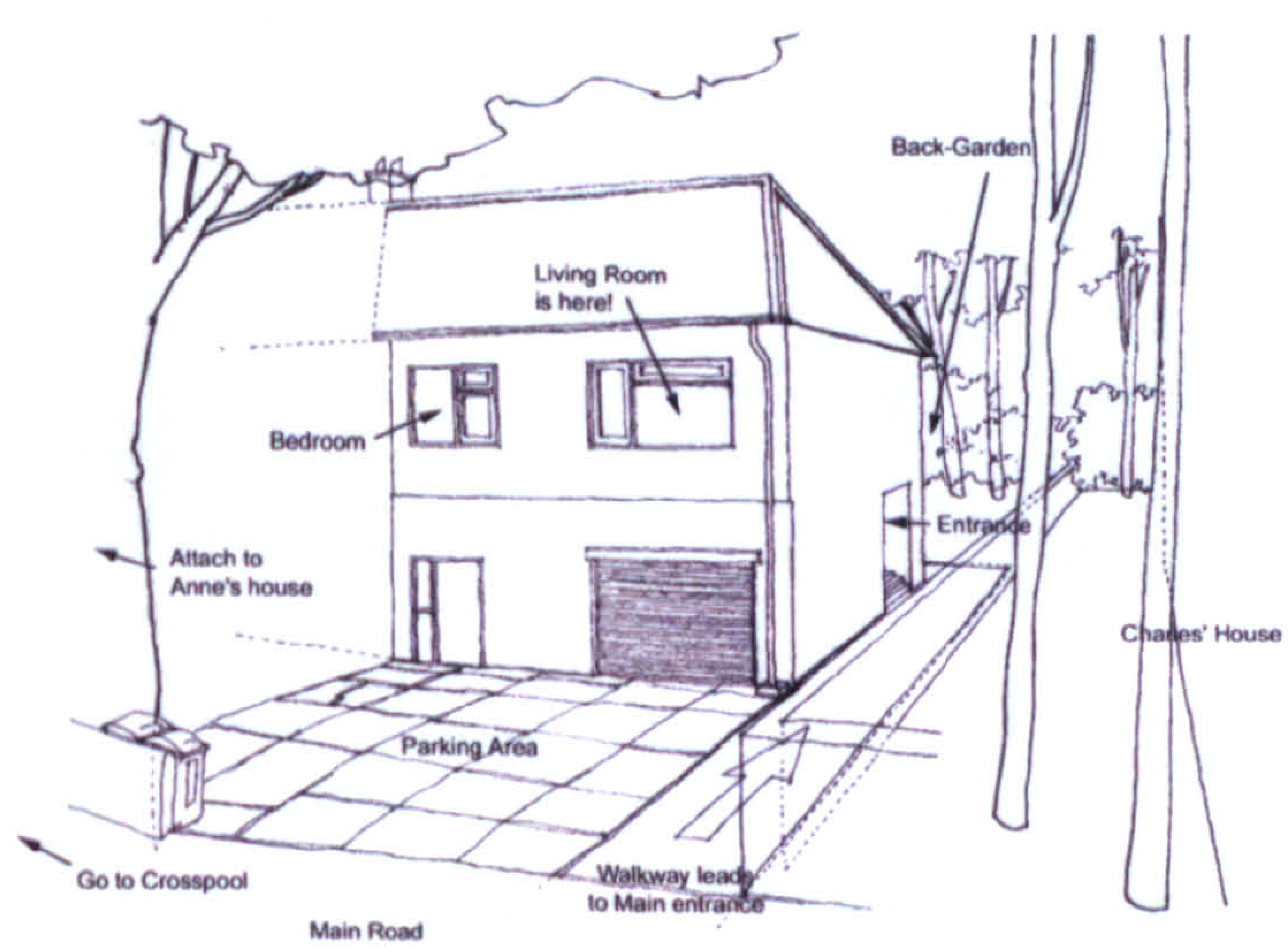




From the layout drawing above;

1. **Which is the location of main road?**
   A) A B) B C) C D) D E) I don't know
2. **Which is the location of main entrance?**
   A) C B) D C) E D) F E) I don't know
3. **Which is the location of living room window?**
   A) D B) E C) F D) G E) I don't know
4. **Does the perspective drawing provide clear information for you to understand what the building looks like?**
   Very clear Clear Moderate Not quite clear Unclear
5. **Does the perspective drawing have enough information for you to understand how the building is organized?**
   Very clear Clear Moderate Not quite clear Unclear

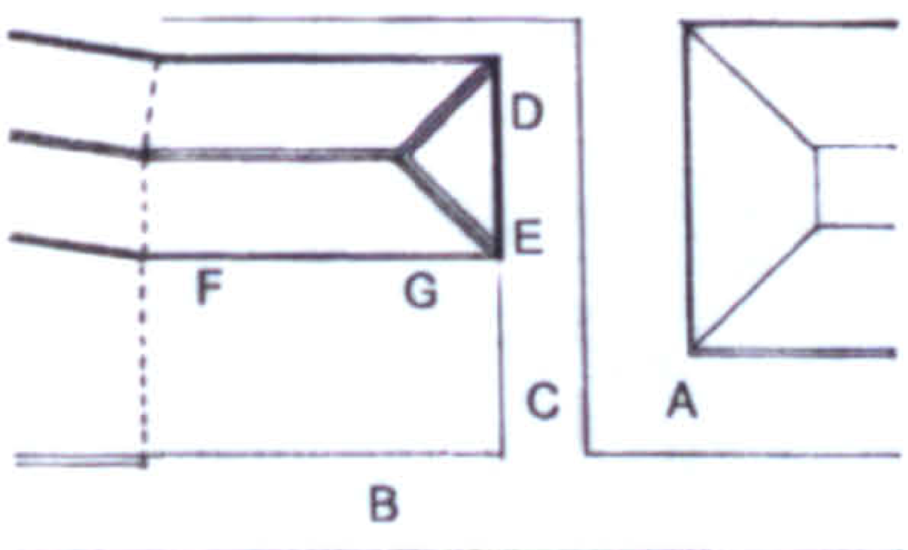


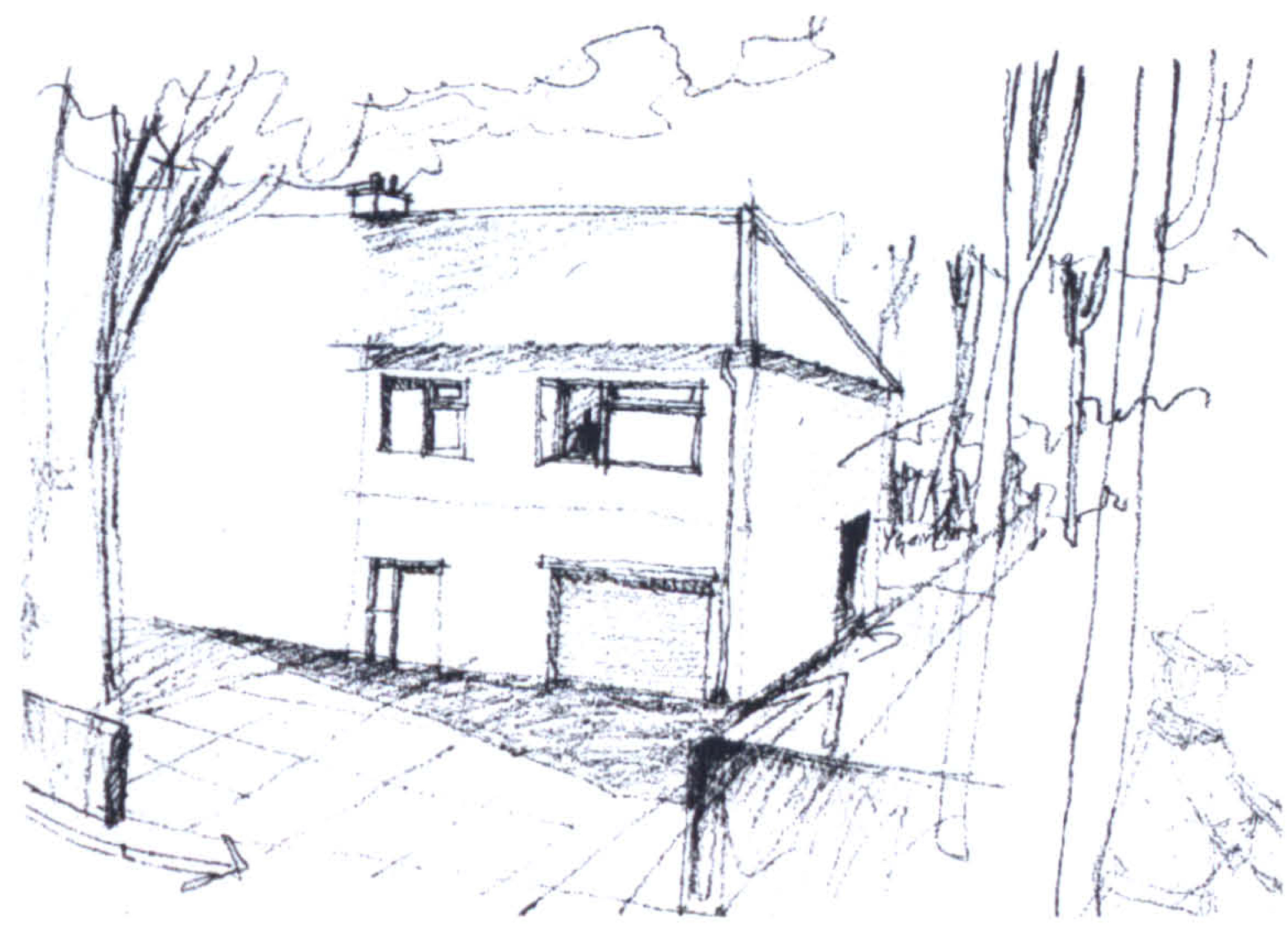


From the layout drawing above;

1. **Which is the location of main road?**
   A) A B) B C) C D) D E) I don't know
2. **Which is the location of main entrance?**
   A) C B) D C) E D) F E) I don't know
3. **Which is the location of living room window?**
   A) D B) E C) F D) G E) I don't know
4. **Does the perspective drawing provides clear information for you to understand what the building looks like?**
   Very clear Clear Moderate Not quite clear Unclear
5. **Does the perspective drawing have enough information for you to understand how the building is organized?**
   Very clear Clear Moderate Not quite clear Unclear

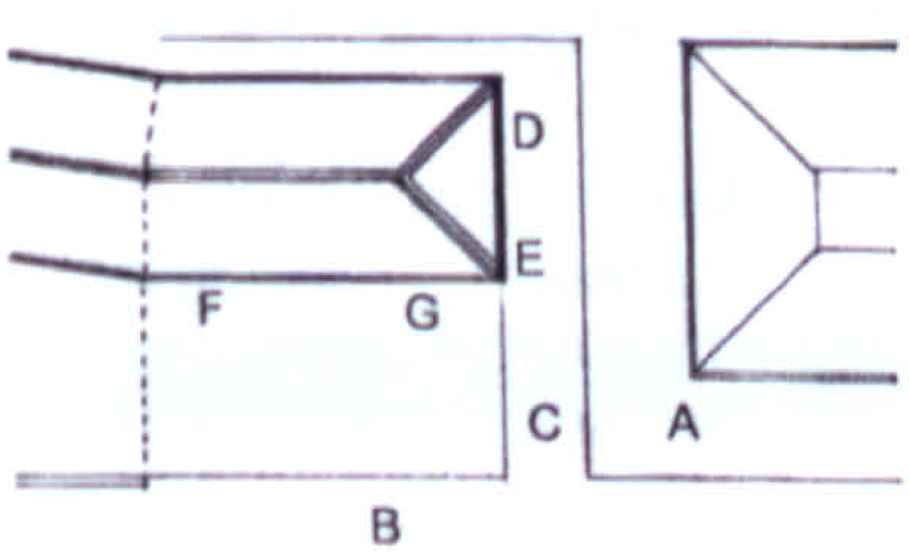
This is a perspective drawing of residential flat. Please compare the layout drawing on the left with perspective drawing on the right and answer the 1-3 questions;





From the layout drawing above;

1. **Which is the location of main road?**
   A) A **B)** B **C)** C **D)** D **E)** I don't know
2. **Which is the location of main entrance?**
   A) C **B)** D **C)** E **D)** F **E)** I don't know
3. **Which is the location of living room window?**
   A) D **B)** E **C)** F **D)** G **E)** I don't know
4. **Does the perspective drawing provides clear information for you to understand what the building looks like?**
   Very clear Clear Moderate Not quite clear Unclear
5. **Does the perspective drawing have enough information for you to understand how the building is organized?**
   Very clear Clear Moderate Not quite clear Unclear



From the layout drawing above;

1. **Which is the location of main road?**
   A) A **B)** B **C)** C **D)** D **E)** I don't know
2. **Which is the location of main entrance?**
   A) C **B)** D **C)** E **D)** F **E)** I don't know
3. **Which is the location of living room window?**
   A) D **B)** E **C)** F **D)** G **E)** I don't know
4. **Does the perspective drawing provides clear information for you to understand what the building looks like?**
   Very clear Clear Moderate Not quite clear Unclear
5. **Does the perspective drawing have enough information for you to understand how the building is organized?**
   Very clear Clear Moderate Not quite clear Unclear

Thank you very much for your help.

Soranart Sinuraibhan
School of architecture, The University of Sheffield

Appendix C | Draw the Line Questionnaire 1

The questionnaire can be found at:

http://www.shef.ac.uk/architecture/research/postcur/q3_net/plan.html

The University of Sheffield

School of Architecture

Questionnaire - Re draw the line

I am second year PhD. architecture student. I am conducting research into how architectural drawings communicate to non-architect. The research is attempting to examine whether the non-architect is able to understand architectural drawing or not.

Can you please take 10-15 minutes to look at the drawing and answer the following question?

If you have any other opinion on the questionnaire or the research, please do not hesitate to contact me at: arp00ss@sheffield.ac.uk

Thank you very much for your co-operation.

Soranart Sinuraibhan.

This questionnaire is divided into 2 parts

Part1: There are 3 drawings provided. Please rank the drawings in order from the best to the worse against given the 6 questions.

Part2: Please indicate whether the given sentence or statement is true or false against the drawings provided.

Please proceed to The Questionnaire>>

Your details: Please give some details of yourself, which will help to classify your answer. These details will remain completely confidential. (Please tick appropriate box)

Gender

○ Male ○ Female

Age

○ 16-18 ○ 19-21 ○ 22-24 ○ 25+

Faculty(where relevant)

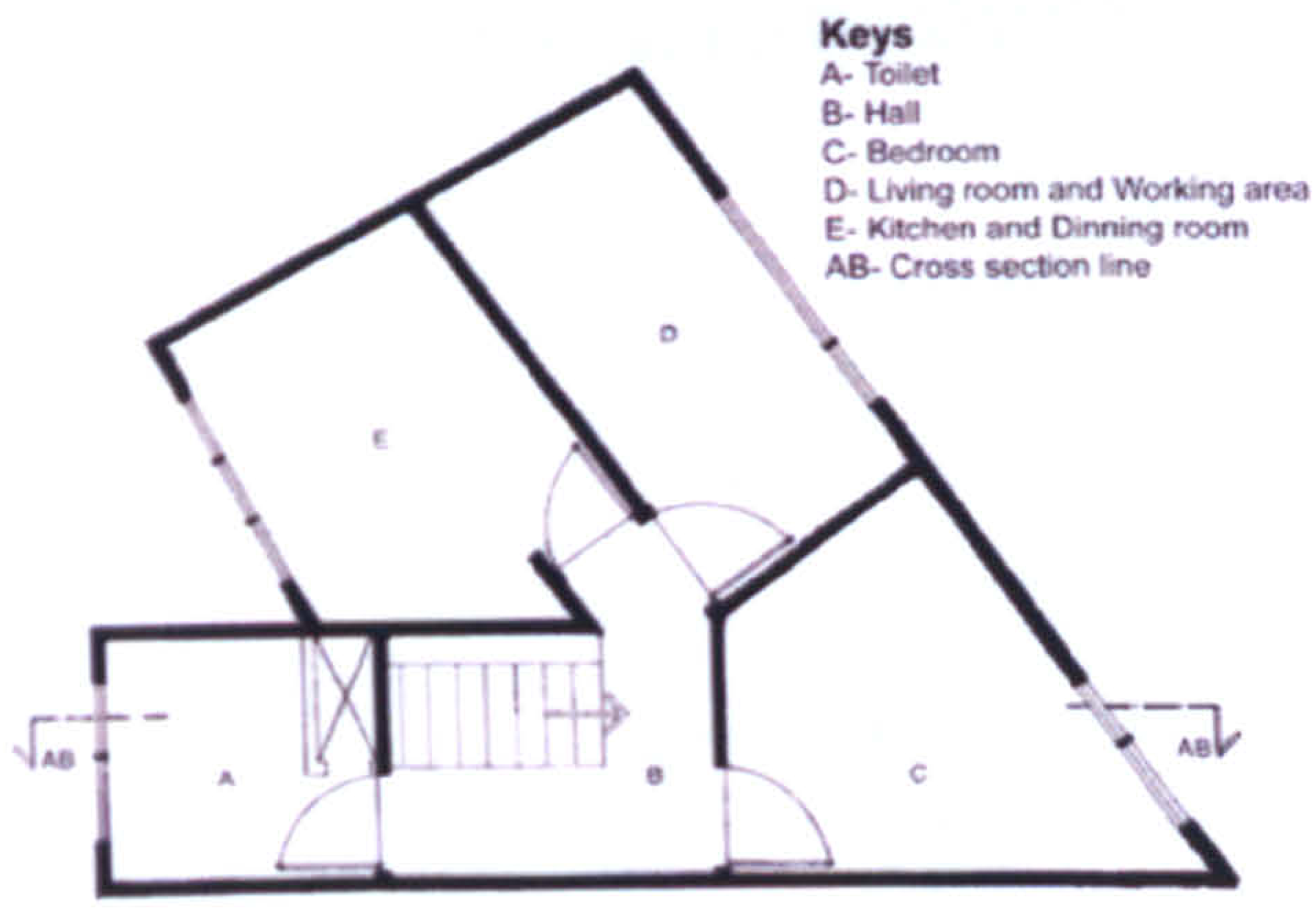
○ Arts ○ Law ○ Medicine ○ Pure Science ○ Social Science

○ Other, Please specify

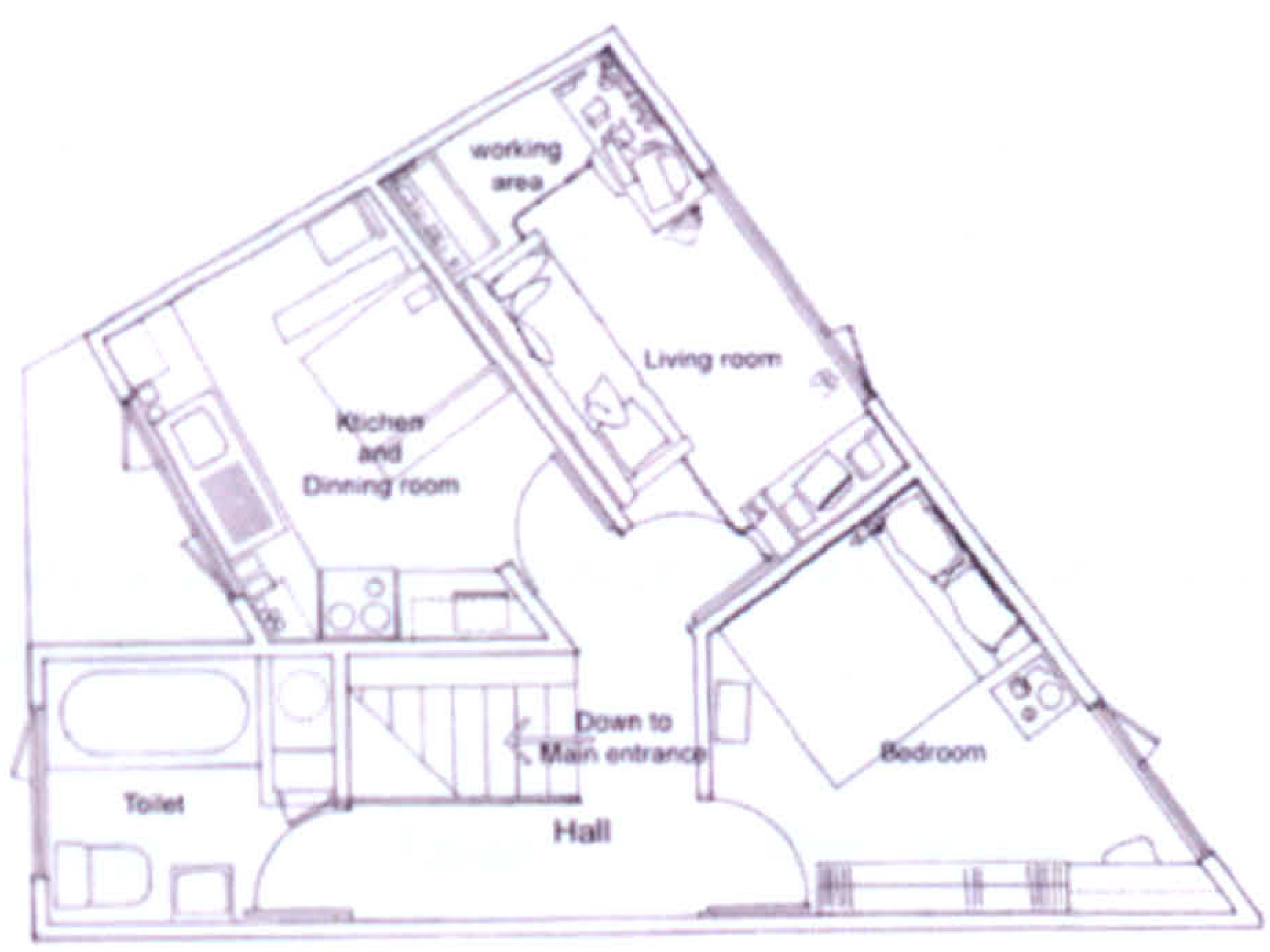
Year

○ 1st ○ 2nd ○ 3rd ○ 4th ○ Other, Please specify

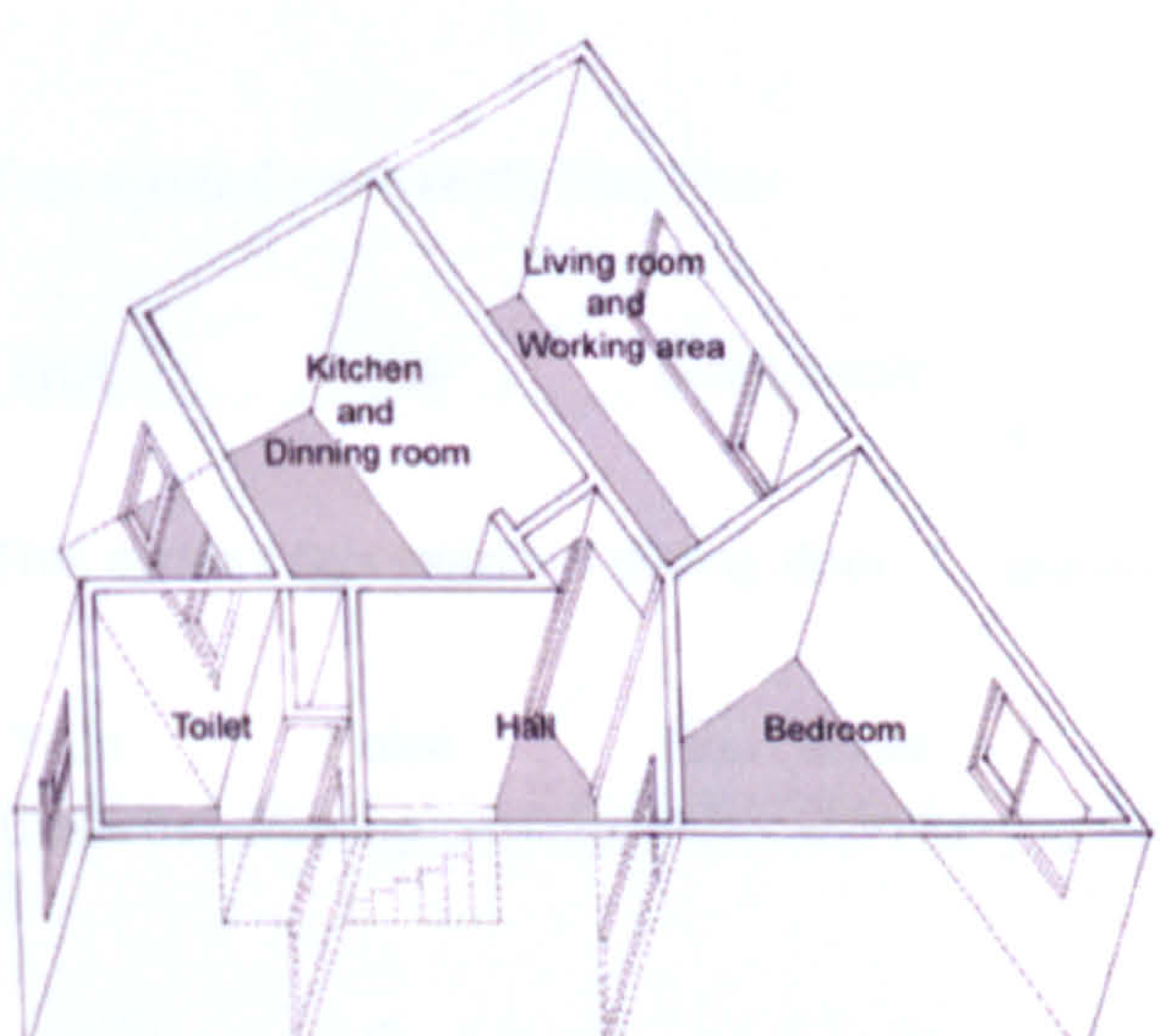
Part 1: Please rank these drawing against the following questions. Please choose the drawing type (A, B, or C), in order from the best to the worse, in the drop down menu provided.



Plan A



Plan B



Plan C

1) Which drawing is generally the easiest to understand?

A	A	A
Best	→	Worse

2) Which drawing clearly provides information on the relationship between rooms?

A	A	A
Best	→	Worse

3) Which drawing clearly describes how to move from one room to another?

A	A	A
Best	→	Worse

4) Which drawing clearly describes how the use of the building?

A	A	A
Best	→	Worse

5) Which drawing clearly shows what the building may look like?

A	A	A
Best	→	Worse

6) Which drawing clearly provides information on scale and size?

A	A	A
Best	→	Worse

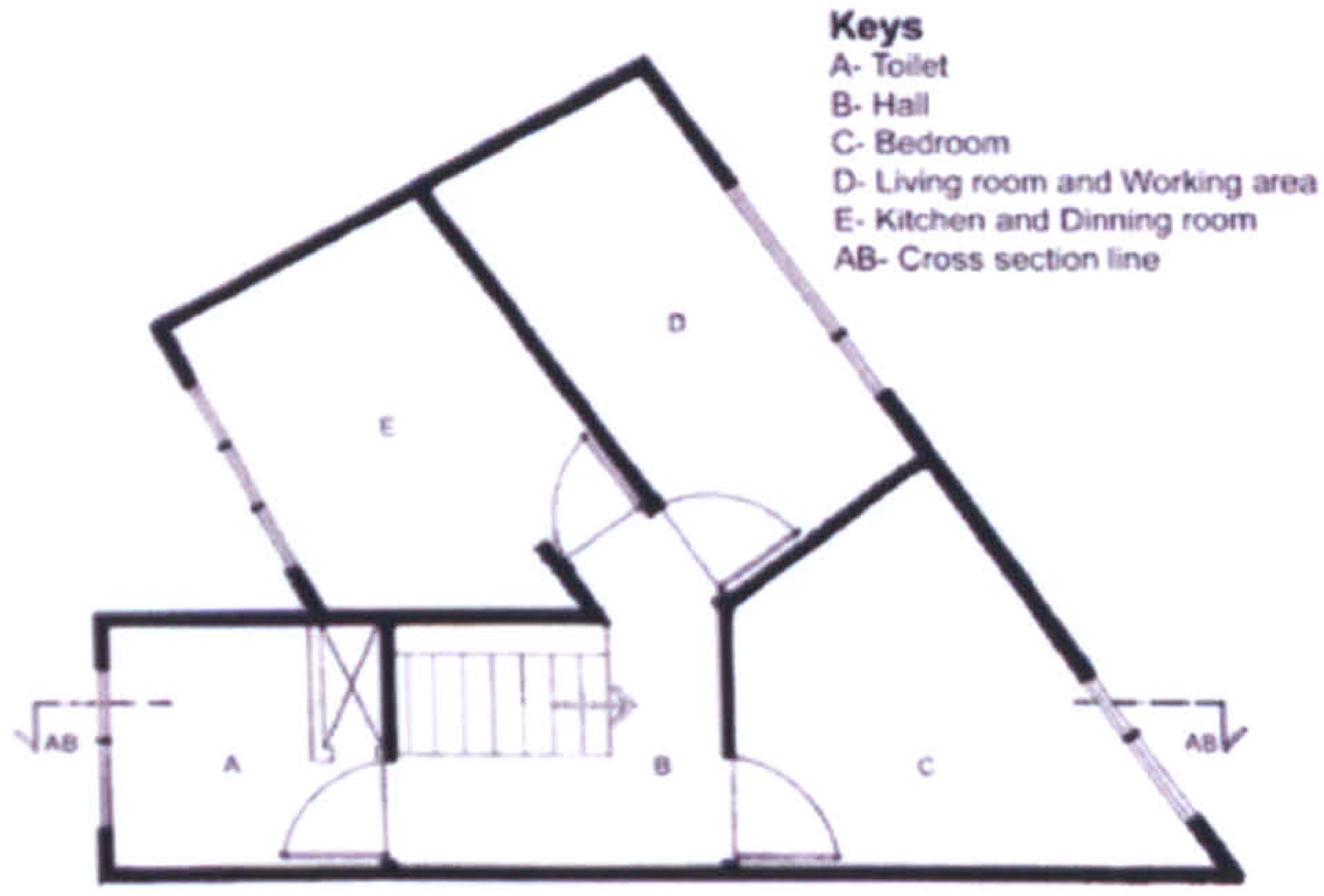
PAGE

NUMBERING

AS ORIGINAL

Part 2: Please indicate whether the given sentence or statement is true or false. Tick the appropriate box to indicate 'True', 'False' or 'Don't know' (which also indicates 'not enough information')

Plan A



7. The drawing shows a horizontal slice through the building.

True False Don't know

8. Information about the height of rooms is provided by this drawing.

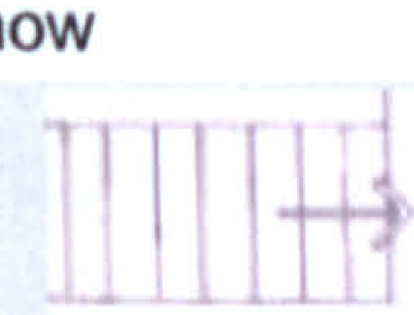
True False Don't know

9. If you walk out from the bedroom, you can walk straight to the bathroom, or turn to the living room and the kitchen.

True False Don't know

10. This symbol represents a window. 

True False Don't know

11. This symbol represents tiled floor. 

True False Don't know

12. This symbol represents a sliding door. 

True False Don't know

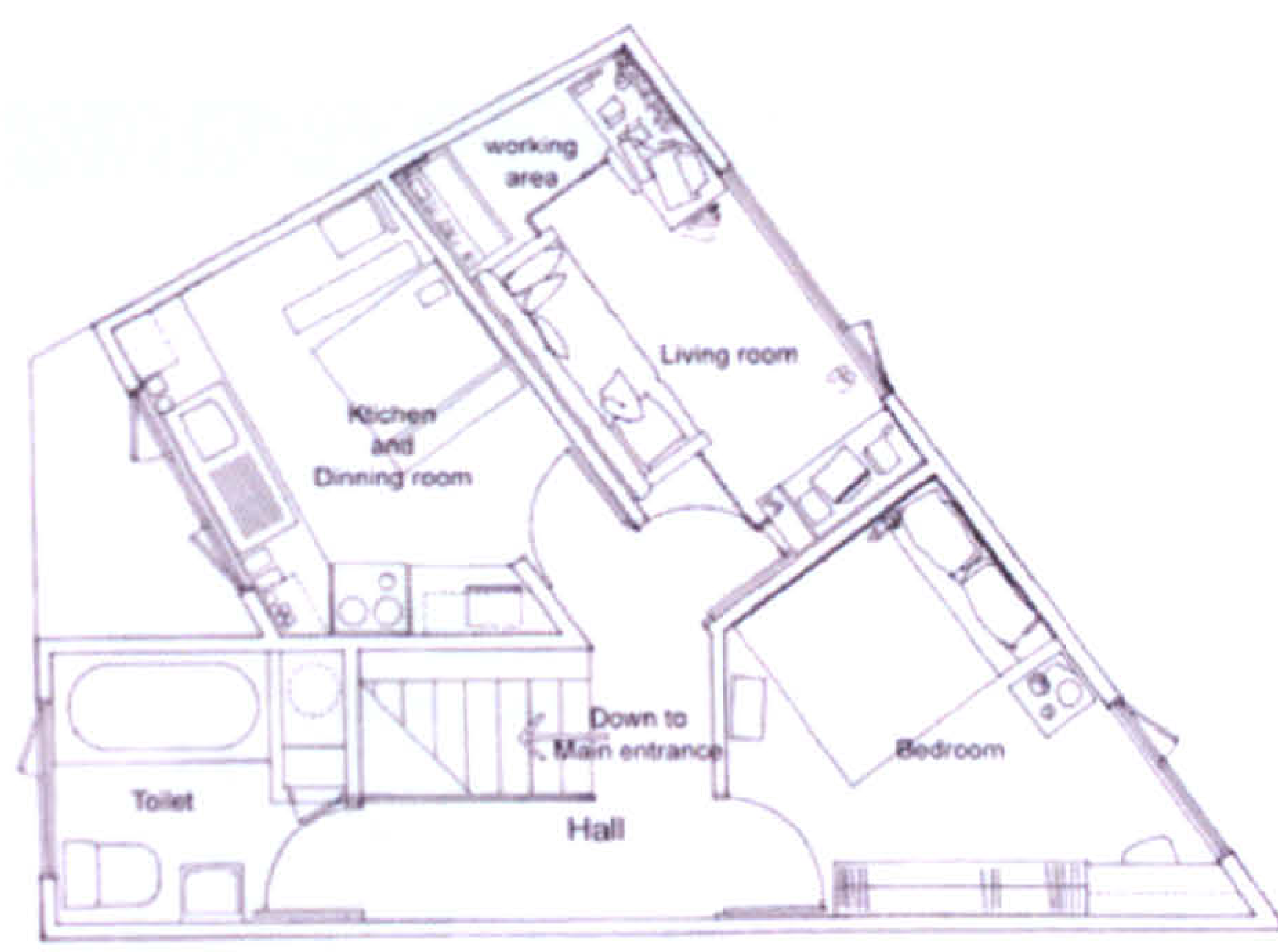
13. Does the drawing provide information for you to understand what the building may look like?

Yes - WHY No - WHY? (Please give your opinion in the box below)

14. Does the drawing provide information for you to understand how the building is used?

Yes - WHY No - WHY? (Please give your opinion in the box below)

Plan B



15. This drawing is drawn to scale.

True False Don't know

16. All the rooms lead off the hallway.

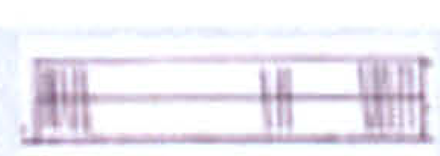
True False Don't know

17. The stair is enclosed with walls on both sides.

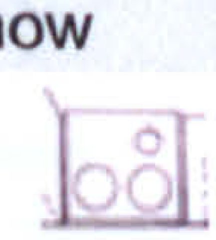
True False Don't know

18. You can look outside the house when you are washing dishes.

True False Don't know

19. This symbol represents a book shelve. 

True False Don't know

20. This symbol represents a cooker. 

True False Don't know

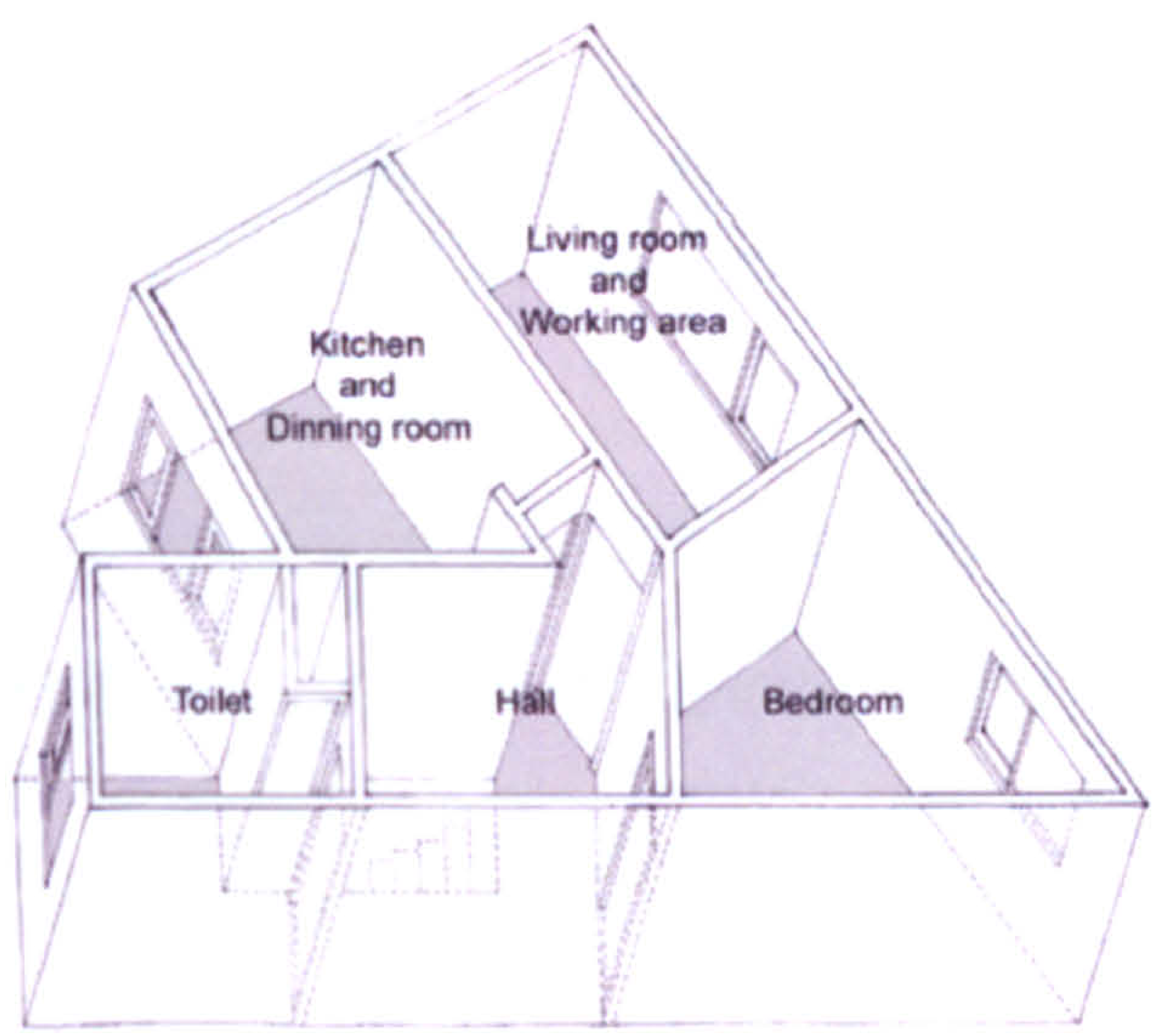
21. Does the drawing provide information for you to understand what the building may look like?

Yes - WHY No - WHY? (Please give your opinion in the box below)

22. Does the drawing provide information for you to understand how the building is used?

Yes - WHY No - WHY? (Please give your opinion in the box below)

Plan C



23. This is the ground floor level of the building.

True False Don't know

24. This is a one-storey building.

True False Don't know

25. The toilet is the smallest room.

True False Don't know

26. There are 5 doors in this drawing.

True False Don't know

27. There is no window in the hallway.

True False Don't know

28. This drawing provides information about how to move around the building.

True False Don't know

29. Does the drawing provide information for you to understand what the building may look like?

Yes - WHY No - WHY? (Please give your opinion in the box below)

30. Does the drawing provide information for you to understand how the building is used?

Yes - WHY No - WHY? (Please give your opinion in the box below)

31. What will make you understand architectural drawing better?

THANK YOU VERY MUCH FOR COMPLETING THE QUESTIONNAIRES;

After you finish, please **PRESS SUBMIT BUTTON** below

Submit

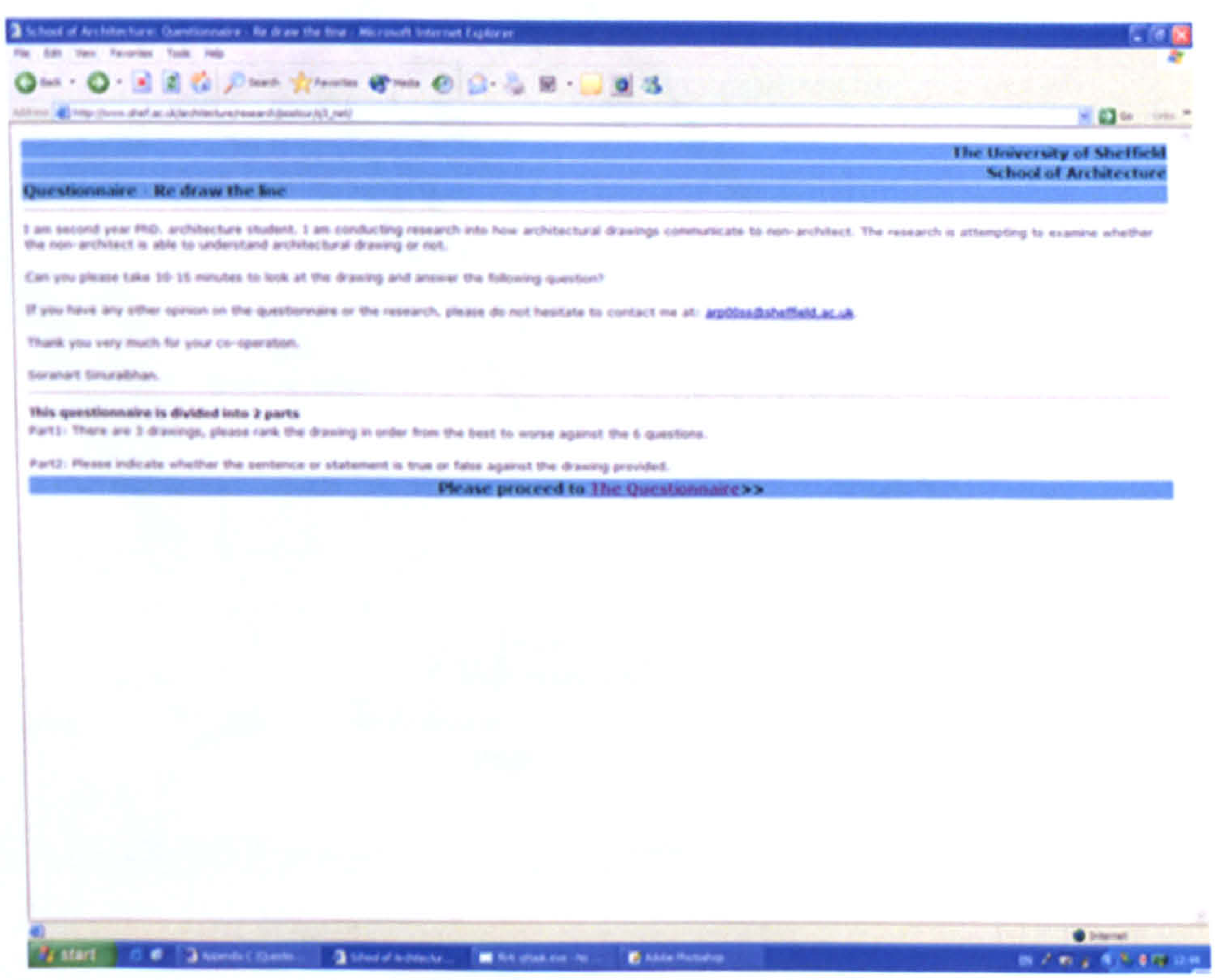
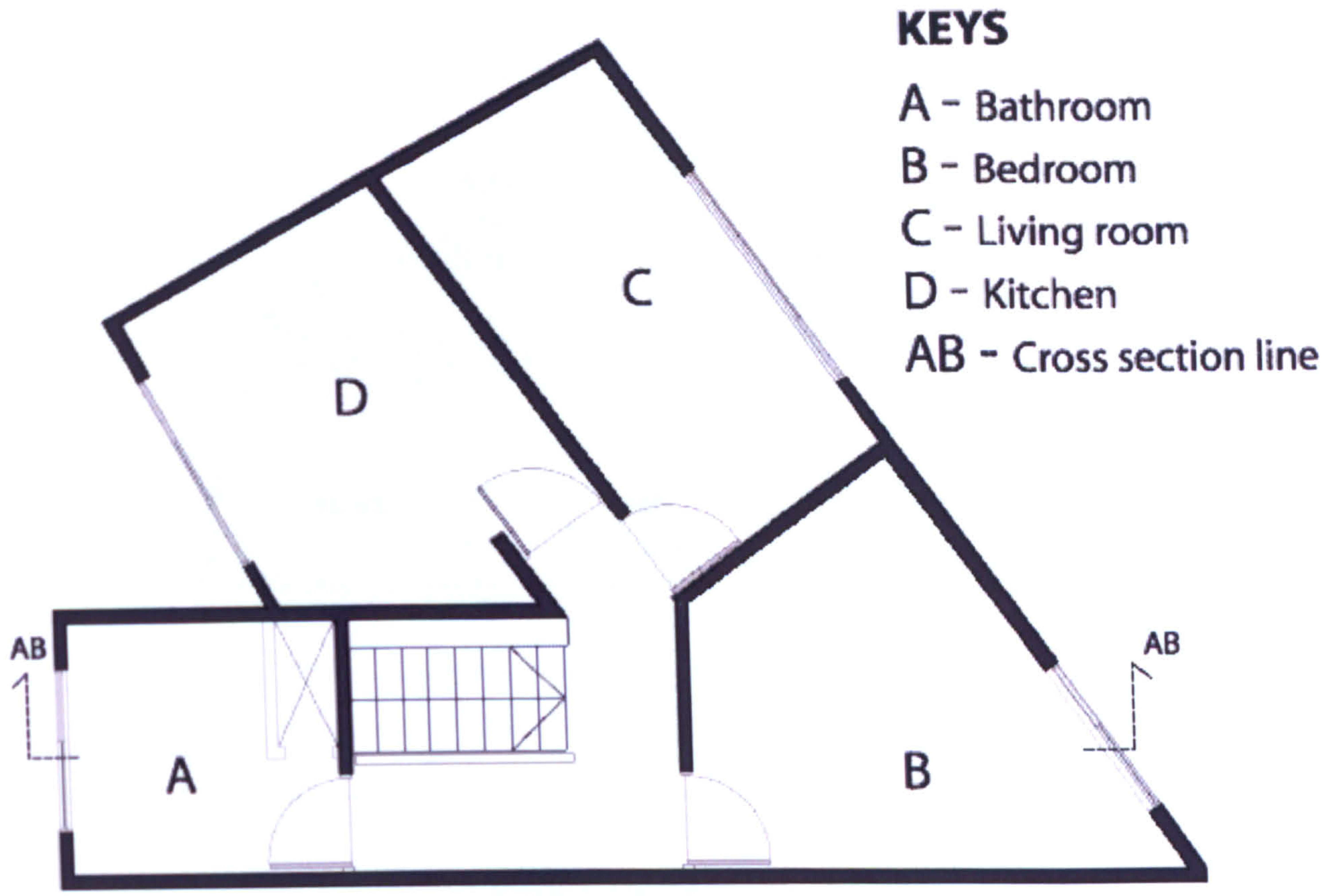
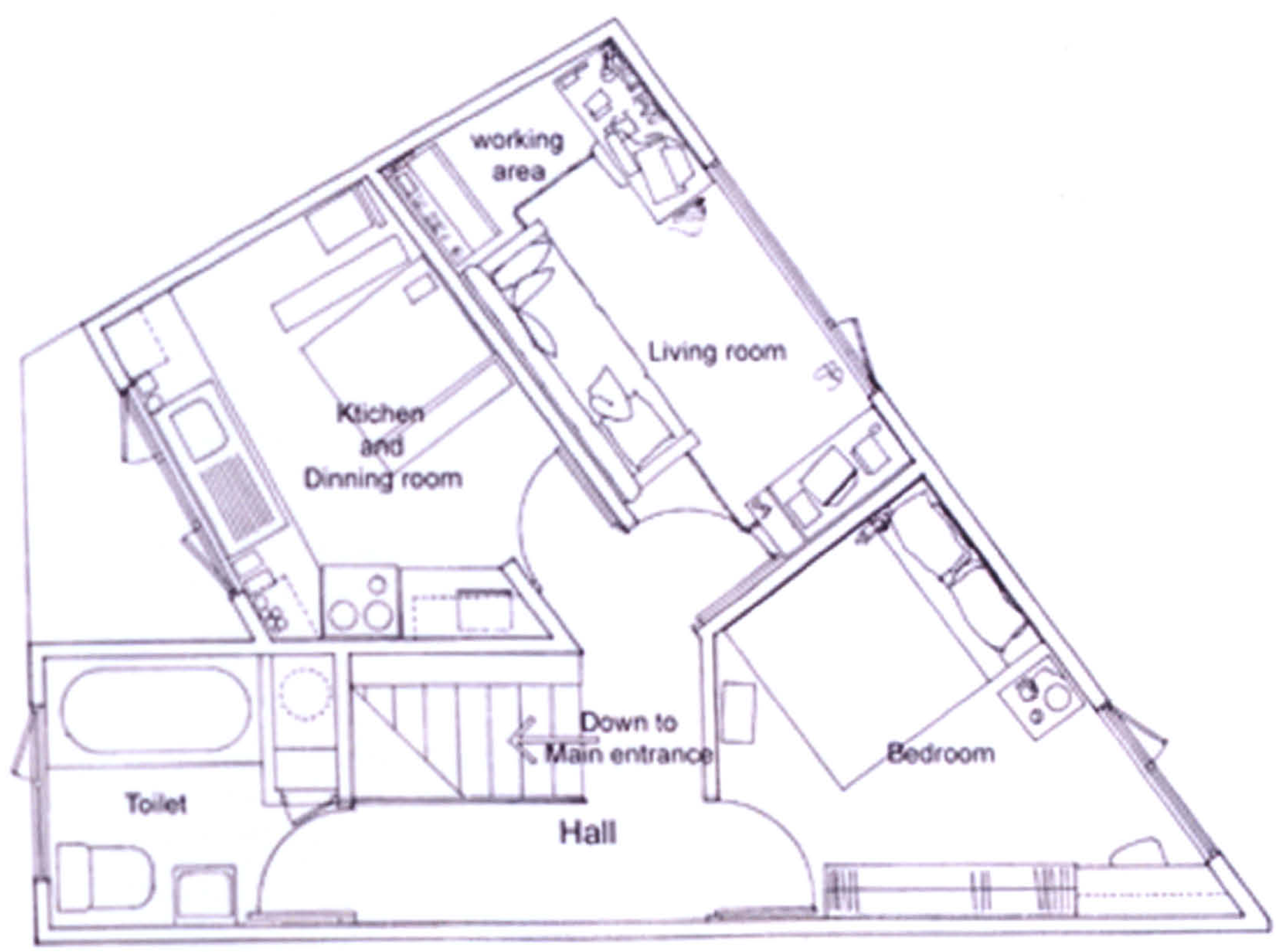


Figure C.1: Introduction page of 'Draw the Line Questionnaire 1' as it appears on the internet.

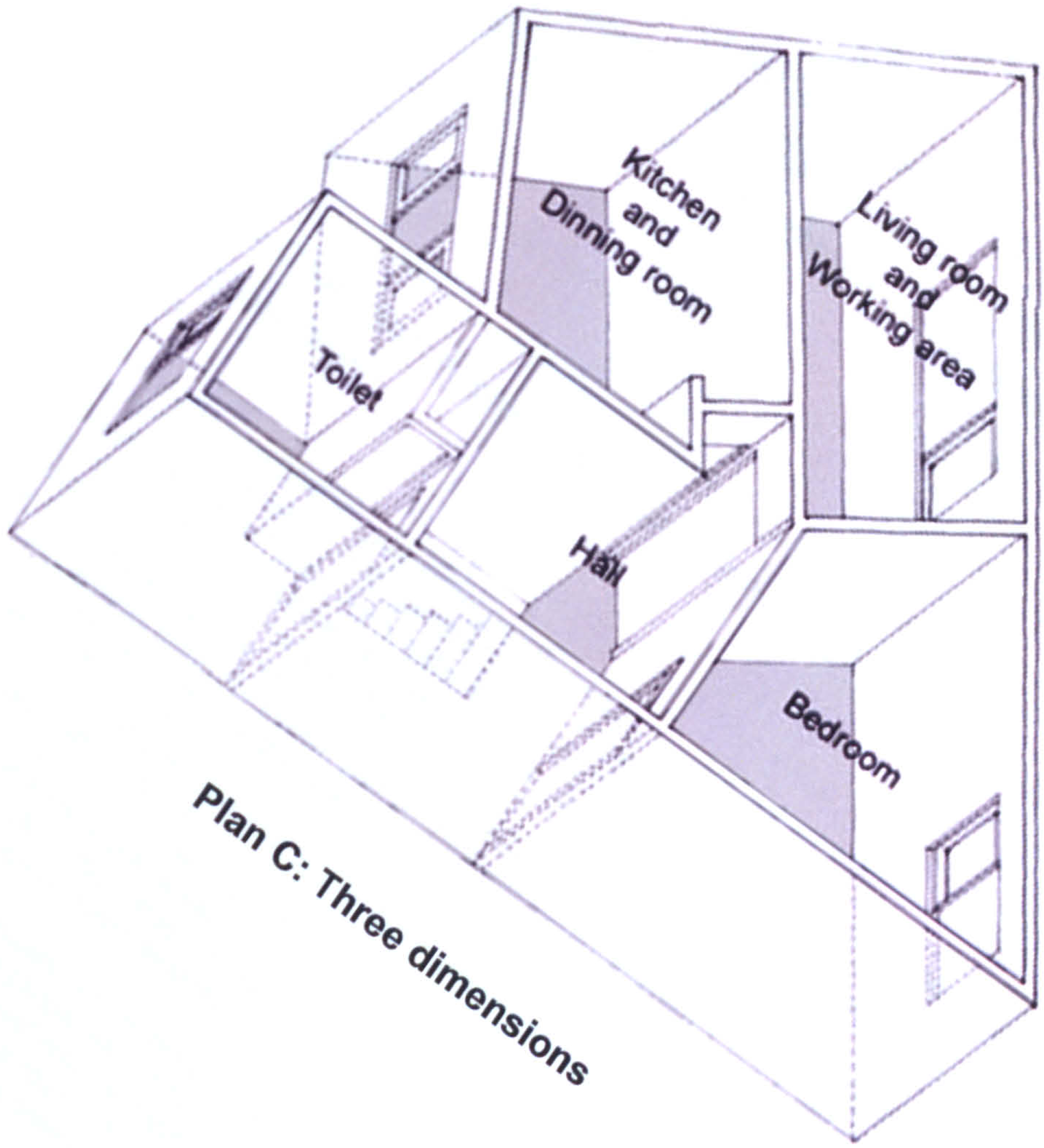
Appendix D | Drawings used in 'Draw the Line Questionnaire 1'



Plan A: Coded language



Plan B: Pictorial language



Plan C: Three dimensions

Appendix E | Qualitative feedback – Draw the Line Questionnaire 1

The feedback is summarised from questions: 13-14 (Plan A), 21-22 (Plan B), 28-29 (Plan C), and 31 in Draw the Line Questionnaire 1, and presented according to three different groups: lay people, first year architectural students, and diploma architectural students.

Lay people

Question 13: Does plan A provides information for you to understand how the building may look like?

Answers: **'YES'**

- "Yes but little idea of scale and no height information."
- "Yes, but not as nicely as C above (the 3D one). It only gives a vague idea because information such as what the roof looks like or what the colours might be are not given."
- "It is the necessary (minimum) information that a person needs to have a picture of what the building may look like. What else may you need?"
- "The relative floor area is very clear, but the absolute scale is not. This building is probably adjoining another along the bottom wall, as there are no windows in this entire wall."
- "It gives a basic view of what the building may look like but provides little else in the way of information to the viewer."
- "It tells me quite a lot about the floor plan of the building, and relationship between rooms, access points etc, but nothing of the scale - why was no scale provided?"
- "Yes. Simple and easy to understand, however give no 3D information."
- "Where the doors are and how the walls are angled with respect to one another."
- "Provides information about shape of room (gives idea of width v. depth ratio e.g. long thin room, square-ish, although no exact dimensions, and no idea of height), location of windows, doors, and stairs."
- "Yes, but only very crudely: It does not provide information about height of the rooms, which I have to infer from what I know about typical flats etc. Also, I am not really good at 3-d imagery, so "seeing with my mind's eye" how the rooms will look like is difficult if they are (as is the case here) not always on a rectangular plan. 3-d drawing of the type provided previously is better. But, for most practical purposes, this drawing is sufficient."

Answers: **'NO'**

- "No heights or measurements on the drawing."
- "**It is a plan and not a picture** – it is technical drawing, there is no information regarding internal/external colour or texture of the walls/wall coverings.
  2 There is no indication of the roof type/shape.
  3 There is no orientation and therefore **no indication of from where the sun is coming**. The assumption is made that the house is north facing.
  4 There is no scale so we know nothing of the size of the building or each room."
- "It gives no vertical information - **I can only guess as to ceiling heights and the overall impression of space in the room, assuming the indicated doors and stairs are of a standard size.**"
- "Far too little information other than a very basic floor plan, hard to decided on what thing will really look like."
- "It is just a horizontal section and gives no details of the 3-D information. Certainly one wouldn't know by the drawing how the building looks like from outside."
- "It provides some information about how the building may look, but not a complete view. It provides no elevation detail. It provides sufficient information to understand how it might look inside this apartment."
- "No depth, height or perspective. **I can't tell whether the bedroom would accommodate 1 bed or 10 - except by making assumptions based on the door size.**"
- "It's just a plan, there's no scale, no side views etc."

- "It takes time to visualise what the rooms will look like because of the 2D nature."
- "Obscure use of keys and symbols: **presumably Q11 represents Stairs, but are they going up or down?** Not obvious to the uninformed, but probably a useful shorthand for building professionals, useless for non-expert clients. The missing elevation along the cross-section line would help a bit though."
- "This drawing provides layout information, but it is hard to identify the scale, and hard to imagine the three-dimensionality of the building."
- "No scale **(though you can guess from the size of the doors and staircase)**. No information about exterior (or interior) finish. Clearly we are looking at the top floor, **but no information about whether the building as a whole has 2 storeys or 22!"**

Question 14: Does plan A provides information for you to understand how the building is used?

Answers: **'YES'**

- "Yes as **it tells you the names of the rooms but does not give you how the rooms will be used and related."**
- "It shows well the layout and relationships of each room type."
- "I would assume it is a building for people to live in. Having said that, I wouldn't know whether or not other floors might be used for office areas."
- "All drawings provide information as to what each room is to be used for - this is textual - without these descriptors it would be hard to tell as there is no scale. Only drawing B provides some non-textual information that might suggest usage."
- "It tells you what each room is, the kitchen, etc. Although, it would be better if the sink and the toilet were pointed. So, it is easier to plan where to put the furniture."
- **"Common sense will tell you that it is part of a residential building and probably 2 or more storeys high (because of the staircase). It is on the top-floor."**
- **"It provides a list of the rooms which makes it clear that it is for living in by an individual or couple."**
- **"The 'KEY' helps."**
- "It is there but it is harder to match it up. It takes time to read the legend and associate it with each room."
- "In general, shows residential rather than commercial use. Provides information about how each room may be used but not e.g. where toilet would be located, how you'd fit a bed into bedroom (whether indeed that's double or single), what size table you could get in the dining area."
- "Each room is earmarked for a certain purpose. Although his does seem to be just fairly random allocation from this plan."
- "The layout provides useful information about movement from room to room. The simplicity helps too. But a lack of objects in the room makes it more difficult to imagine specific uses."

Answers: **'NO'**

- "Room use is not explicit in the drawing. Relationships between rooms and intended uses are absent in the drawing."
- **"From the stairway leading up into the storey (and the domestic rooms labelled on the plan) I assume that this is a flat above another storey, perhaps above a shop. It is a hassle to have to look up the label for each room in order to find out what it is."**
- "It give names of rooms, but it not much else to help you."
- "No, not really. There are no dimensions or idea of scale."
- "It does only insofar as I know how a conventional kitchen, bathroom, etc. look like. So it is sufficient in telling me how the building MAY be used, rather than how it actually is used."
- **"It is strictly for experts."**
- "Information is there but does not hit you - you have to read the Key."

Question 21: Does plan B provides information for you to understand how the building may look like?

Answers: **'YES'**

- "Yes but it is quite complex and **too much detail** in my opinion. It depends at what stage this may be used - if in latter stages then possible very good."
- "It does because many details are given."

- "This drawing gives a good impression of what the interior will be like, and I assume that the objects in it give a realistic scale."
- "It gives you not only an idea of a general plan, but also how things may be laid out within that plan. It gives you some idea of what you would see if you went into the building. **It also has day to day object like a bed / sink which you know the size of, on which to gage the other sizes of rooms etc."**
- "Yes but it doesn't give as good as idea of the basic design as the one above with it's different tones of colour."
- "It provides some information about how the building may look, but not a complete view. It provides no elevation detail. It provides sufficient information to understand how it might look inside this apartment, although it would be clearer if the walls were solid black as in plan A."
- "Gives you a visual idea of real space usage in the completed building."
- **"The furniture and appliances provide a sense of scale."**
- "Rooms and objects shown in relation to one another. Clearer idea of scale (if it is drawn to scale) and how things might fit in - **bloody tiny flat though I wouldn't want to live there."**
- "See response to Q29 ... only this one is more obscure than C.I have answered False to Q15 because although everyday objects are shown, no absolute scale is given. **It could be a doll's house, which would also explain why it has no roof."**
- "I automatically assume this is drawn to scale, it gives me an idea of size and what the building will look like once it is in use. It is probably more important to someone who is not involved in the actual construction."
- "The objects in the room help me to understand how large each room is by providing a reference point. That helps a great deal in understanding how the building will look."

<u>Answers</u>: 'NO'

- "Not completely - only an outline layout, no height information."
- "As with the Plan A, the structure and 3D geometry of the building is not explicit."
- "It is just a horizontal section and gives no details of the 3-D information. Certainly one wouldn't know by the drawing how the building looks like from outside."
- "It's much too cluttered, there is no key and yet there are lots of non-standard symbols."
- "No, again there's only a view from above, though in this plan there are chairs, cookers etc. so at least I can get an idea of how big each room is."
- "No scale, and not obvious that drawing is to scale at all (though it probably is, from doors etc.) No information about finishes, or overall height of building (as in Plan A). Is furniture layout illustrative, or is this an accurate representation of a furnished apartment? We aren't told."
- "Better than A, if to scale, in that it is now obvious that this is a SMALL flat."

<u>Question</u> 22: Does plan B provides information for you to understand how the building is used?

<u>Answers</u>: 'YES'

- "Yes as again all the rooms are labelled and it shows how to go from room to room."
- "Yes shows the layout and the inter-relationships of room except for what maybe down the stairs."
- "There are both textual and non-textual descriptors."
- "Room names and furniture provide much more information about intended room use and it is easier to imagine being in the building and using it."
- "It is full of domestic objects, with each room very clearly labelled."
- "No only is there an idea of rooms, but now you can see what will happen in each part of the rooms."
- **"Items appear to be drawn to scale so gives a good idea of scale and how the building could be utilised."**
- "The use of each room is clearly labelled, plus the items in the rooms provide redundancy which helps."
- "Although I have answered 'no' to the questions regarding the symbols I can assume a lot about what the drawings are meant to represent without having a key and therefore I can see how a person may live and use such a building."
- "Because the contents of the room are shown."
- "Positioning of appropriate objects guides knowledge of room function."
- "Some immediate indication of purposes of each room is given. Better than C in terms of **relation to size of everyday objects."**
- "This shows pictorially rather than just in words what the finished building could look like. I find this a lot more accessible than the previous one. It also gives me a better idea of the use of space. **I also don't have to refer back to a key and that makes things easier."**

- "From room labels, clearly a residential apartment or flat. Furniture does not add any information, unless it is an accurate representation of furniture that is actually supplied."

Answers: 'NO'

- "The issues of scale still worry me - how can I be sure that all the objects drawn are to the same scale (this was a real problem with a recent plan of this kind supplied to me by a design company - they got the scale wrong and ordered things that would not fit!!)."

Question 29: Does plan C provides information for you to understand how the building may look like?

Answers: 'YES'

- "3D effect is useful to show the way the booking may look but does make it difficult to see all features."
- **"No information about the number of stories, could be one level of a larger multi-level building."**
- "Slightly better idea than A or B - although it isn't quite as clear to me that the drawing is to scale."
- "It provides 3D information missing in the previous plans, making it easier to picture the overall impression of the building."
- "I use less imagination to see the final building as the drawing is 3D."
- **"It does help you get some idea's of dimensions as you can work from the size of a door.** However it lacks detail to get a good idea of what to expect should you walk in."
- "Because there it's just the basic structure of the building instead of one with objects in it as above you get a better idea of what the building itself looks like."
- "It provides some information about how the building may look, but not a complete view. There is insufficient elevation detail - this provides almost as little elevation information about the building as in plans A and B. There isno information about the shape of the roof, or the ground floor."
- "Easier to see the scale and comprehend the size of rooms - particularly in relation to drawing A but only in a very limited way, at least now I can see how tall is, but I also don't know if there's another floor on top of this one (not shown in the plan)."
- "You get a clear idea of how this section of the building appears - even though I'm not sure what's going on underneath. This is because the 3 D look helps the imagination to create an impression of the walls height and basic appearance of the rooms."
- "3D view gives a real feel of the spaces."
- "Includes both plan and elevation information."
- **"Drawing the doors gives the drawing scale."**
- "Gives the added height dimension, although again can only assume that it's drawn to scale and judge by 'average' height (e.g. no high Victorian or low cottage-style ceilings); gives better idea of what it might look like from outside. Again gives idea of size of room but doesn't show what furniture/fittings may/may not fit in each room."
- **"It looks like what it will look like. BUT IT IS NOT A DRAWING OF "A BUILDING" Like all the others, this could be just one floor of a multi-storey building. Who knows what is at the bottom of the stairs? A cellar? 35 other floors? A door to the outside? But at least it is clear the stairs do go down** ... not clear in A"
- "Scale seems a lot clearer in this picture as you tend to assume you know roughly how high the walls will be. The windows and the final shape are also much clearer than the other pictures."
- **"It is difficult for me (and I think most people) to visualise a three-dimensional structure based on a two-dimensional drawing.** This drawing eliminates the need for that. But in doing so it obscures other essential information, so there's a cost. And **I'm not sure why I would really need to visualise it three-dimensionally."**

Answers: 'NO'

- "It doesn't show a real picture of the building, it is difficult to see the space within the house because the wall are in the middle. **Too little detail, confusing to the eye."**
- "It provides a 3-D image of the floor but it does not provide information regarding how many storeys the building may have."
- "I don't find this any more useful than the others, I have the same problem regarding the scale, but this time **there are parts of several rooms I can't see!"**
- **"Perspective gives less confidence in the scale** - e.g. the bathroom looks too small to fit a bath in this picture."
- "Same as the others: you have to guess the scale, and there's no information about finish or total height **(given absence of stairs going up, we are on the top floor, but how many floors are**

there below us)? (Note: in answer to Q25, I presume the hall doesn't count as a room? Because, discounting the stairs, it probably has less floor area than the toilet)."

Question 30: Does plan C provides information for you to understand how the building is used?

Answers: 'YES'

- "Yes shows how the main rooms are used, but **no information about what maybe down the stairway.**"
- "Textual descriptors provided."
- "To an extent - given the room names. You have to guess as to what will be in the rooms though. It helps to understand how the building is used, but is not as strong as Plan B."
- "Rooms are clearly labelled."
- "It's clearly defined by the labels in each room (as opposed to in a separate key) what they are intended for."
- "Yes in as much as you can see how furniture etc may fit and how a person could move around."
- "Yes, rooms are labelled. **The stairs help me to see that they go down somewhere.**"

Answers: 'NO'

- "No, because it doesn't tell me where some facilities will be located (toilet, sinks...)."
- "It does help somewhat to get a perception of how things would work, but still lacks information to get the whole picture."
- "The labels on the rooms are arbitrary are they not?"
- "Some of the walls seem to hide the size of the rooms, so thinking about where furniture might fit etc. .... actually it doesn't look like any furniture would fit."
- "I think this is the least informative drawing about how the building will be used. The iconicity of this drawing means that it is easy for me to see a window, but the three-dimensionality obscures the doors and room shapes, making it more difficult to see how to move from room to room, what would fit in each room, etc."

Question 31: What will make you understand architectural drawing better?

Answers:

- "**Don't know if I need to?** But possible measurements / scale on them."
- **"A scale model."**
- "Nothing really, **Plan B is the one I would prefer (maybe because it's the type that I have seen before).**"
- "In what sense? If to gain a 'picture' of what the building may look like then
  there is an overall need for context
  1 - Scale bar
  2 - Orientation arrow
  3 - Front, back and side elevation drawings
  4 - Colour to provide texture and type of wall coverings
  (I'm a geographer so I would consider a drawing of this type no more than a map - a particular kind of map but a map nonetheless, therefore I would view a document of this sort in a spatial and visual context, consequently the drawing needs additions to place it within a more meaningful context, at present **it is detached and abstract.** However, this is all depended on what the purpose of the drawing is for. I can gain a good impression of its basic layout as it is. What I cannot do is get a 'feel' for how the building relates to the wider environment - colour, size, orientation etc.)"
- **"Undertaking a degree in architecture. Anyway, I don't consider that I need to understand them better"**
- "**Colour ! Or perhaps an enhanced/cleverer method of shading different room /** furniture features."
- "A scale bar, so that absolute sizes can be imagined. Clear labelling of each room. Clear labelling of entrances/exits to the property."
- **"Education. An explanation by the person who has done the drawing."**
- "I like C best. It gives a good idea of each rooms purpose and an idea of scale. **B is far to clustered looking and therefore takes time to understand which room is which. A is to basic and doesn't offer as much information in as user friendly a way."**
- **"A crash course perhaps?"**

- "I am not an architect, but have had a little experience with architectural drawings. For non architects: It helps to have the uses of rooms specified as in plans B and C, rather than a key as in A. It can help to have objects inside the rooms, as in plan B, but the walls should be clearer (e.g. solid black) as in plan A, so as to help distinguish them and clearly show the shape of the rooms. Plan B is quite cluttered - **fewer objects in the rooms would be sufficient."**
- "How about **3D models or 3d images on a screen?"**
- "Plans of type A with a scale and the scale outlines of typical objects like cookers and beds that I can move around for myself and see how things fit. Sounds basic doesn't it, but the only way I have been able to get this is to do all the measuring myself. When I did employ a bathroom designer, they got the measurements and the scale of the objects wrong and **there was no room for the bidet!"**
- **"Labels on the plan - not everything but the main features** (i.e in this case the rooms to be labelled) **so that you quickly grasp what is going on and can then refer to a Key for the details."**
- **"I understand it quite well thank you."**
- **"I don't need to understand architectural drawing."**
- **"having an architect explain it"**
- "A variety of simple drawings (A, B & C), and **no arty rubbish** (e.g. the architecture degree show has impenetrable to a layman)."
- "I liked the B **has all the information you need in one place** - the room, what shape the room is and a suggestion about where everything might fit. **I don't have to look up a legend - even without actual measurements of a room, I can tell approximate size since I know approximately what size a sink or a bed etc. is.** I don't know what else I would want to know or that would make me understand that drawing better. **Any of the symbols that I couldn't guess, I would just ask the architect."**
- **"Having more than one of these drawings to compare is the best thing as they all show up different features better. Also having someone there to go through them with me at first would be a great advantage."**
- "I believe I've got a fairly good understanding of them - I used to be fascinated by architectural drawings, and spend plenty of time with them, as a kid. I think contrasting different types of drawings (of the some space) - like it is done here - helps you understand them better. Similarly, **contrasting a drawing with a photograph would help."**
- **"I don't think three-dimensional drawings help. I think they are misleading, because they make a building seem more "real" without actually adding much information. Arbitrary symbols often make it difficult to understand architectural drawings - but this could be solved fairly simply with a key,** so I suppose someone has thought of that. I notice that context helps me to identify the objects in the second drawing which otherwise might be difficult - **If I saw the cooker symbol by itself, I don't think I would know it is a cooker, it could be a tabletop with objects on it.** But for some of the items in the second drawing, there just isn't enough context or similarity for me to be able to understand what the object is."
- "Plan A was clearly intended to be accompanied by an elevation, so presenting it on its own isn't fair: with its elevation, I would have rated it best. If you want people to understand "what the building will look like", then you need to provide that information: the appearance of a building is governed by the exterior finish, which is not given in any of these plans. If I were considering buying this flat - which I wouldn't: too small – I would want to see lower floor plan (where's my front door?), information about finishes, information about services **(is there gas? Where's the stopcock? What about the meter(s)?), locations of power points (can I plug in my computer in the bedroom?)**, etc. But these are problems with THESE PARTICULAR drawings; I'm not convinced that all drawings are equally bad. I detest the 3D things like C: they hide bits, and **the perspective always looks wrong.** But I don't have strong feelings about A or B."
- "I think I can understand all these drawing with ease though they all have strengths and weaknesses depending on what you might want to get out of them. None of them give you a view or information on the outside of the building. It could be a 2 story house or a multi-storey set of flats! However if you knew this then this information would not be seen as necessary in these drawings."

First year Architectural Students

Question 13: Does plan A provides information for you to understand how the building may look like?

Answers: 'YES'

- "Yes in terms of orientation of windows and there relationship to each other
- "Yes, because you can see at what angle the walls meet, and **you can roughly tell the scale from the windows and doors.** The uses of the rooms also help to give an idea of the size of the building. It doesn't however help that much in understanding the height of the building or the roof line".
- "Yes, but I'd have to guess at the height of the building, **using the width of the doors as a reference for scale."**

Answers: 'NO'

- "It only gives information on the ground floor layout."
- "It shows how the interior will look, but doesn't give a very good impression of the outside."
- "Because this horizontal section doesn't provide the height, just I can understand only interior structure of the building."
- "No indications of heights, materials, or interior views."
- "Because it is shows only one dimension, and that is from above."
- **"Hard to visualise in 2 dimensions."**
- "It shows only a plan of the rooms. There is no scale or anything like furniture plans to give any idea of how large the rooms are or how high the rooms are."
- "It only gives a floor plan of the building. It is very difficult to visualise what the final finished building may look like. Also it really gives no real indication on what the building will look like on the outside."
- "Layout, position of apertures, circulation only indicated. Nothing about size, surfaces, heights."

Question 14: Does plan A provides information for you to understand how the building is used?

Answers: 'YES'

- "It clearly shows the layout of the rooms and how they link into each other."
- "Yes, as the key shows you what each room's use is. It seems to represent a small domestic dwelling of some kind."
- "Because this building has bedroom, living room and work area, I can guess this building is used for residential architecture where the resident can work."
- "Yes - it names each room so you can work out how it is used, though the size of individual living space/work space and kitchen/dining space isn't clear."
- "Some - obviously a living space, quite small, with at least 2 floors. Room use only indicated by the key, not on the drawing."
- "Because each room has a function (kitchen etc) so that is **an indication to how people will move throughout the house and use various rooms."**
- "It has the different rooms labelled and the key telling you what the labels stand for helps to give an indication of how the rooms within the building may be used."
- "In terms of function attributed to each space."

Answers: 'NO'

- "No because the room titles are part of a separate key making it difficult to imagine."
- "It could be the dwelling of a registered hermit or could be a foster home or show house there is no information given as to use."
- "Areas are not clearly defined."

Question 21: Does plan B provides information for you to understand how the building may look like?

Answers: 'YES'

- "Yes in terms of orientation of windows and the interior but no information on the exterior."
- Like plan A, it shows the angles at which the walls meet, and the position of the windows in the walls. **The furniture also gives a rough idea of scale."**
- "Yes, but I'd have to guess at the height of the building, using the width of the doors as a reference for scale."
- "Provides more information of interior layout."
- "It does in a way as you can see exactly how the internal setting may work. It doesn't, however give any real indication of what the building would look like from the outside."

Answers: 'NO'

- "Can't tell how the building will look from eye level. Don't know kinds of materials used or size of building."
- "Only in the way that the windows can be positioned, but there is no information regarding the height of the building, the materials and roof etc."
- "As above, it doesn't show any of the outside so I can't really visualise what it would look like! I can get a rough idea of the shape of it from the outline, but not a clear picture."
- "This drawing is also about interior structure."
- "No info on cladding, decor."

Question 22: Does plan B provides information for you to understand how the building is used?

Answers: 'YES'

- "The inclusion of furniture and appliances shows how the space may work as a house and how it will be used."
- "Yes, to a degree. The interior furnishings are drawn in, but we make assumptions of our own regarding their purpose."
- "More so than the first one in my opinion, as well as showing the rooms it shows how each room is used, giving a very good idea of what is going on in the house."
- "Yes, and more than Plan A, as not only does it give the uses for each room, but also what items each room houses, and so **gives more information as to the activities that may occur there."**
- "The things in the building such as bed, sink and so on are usually in the house."
- "Each room is clearly labelled, with specific furniture included, so you can tell which part is which - i.e. living room/workspace."
- "Because each room has the furniture drawn into it, and therefore we can see how people will use each room and the appliances/furniture within it."
- "Furniture and labelling provide an indication of layout and the use of the space."
- "The rooms all have the common fittings inside them and show how they might fit in and be used in that environment."
- "In terms of the functions indicated for each room."

Answers: 'NO'

There was 'NO' answer received from the first year students.

Question 29: Does plan C provides information for you to understand how the building may look like?

Answers: 'YES'

- "Yes because the size and style of windows and there relationship to each other is included.
- "Its 3D so it helps, and it also shows the style of windows so you can imagine what it would look like."

- "It doesn't let you know how many other floors the building has, but it does show the shape of the building better than plans A and B, because it is shown in 3d."
- "It is easier to percept the shape of building and I can imagine the situation in which I would be in the house."
- "More so than the others as it is 3D and shows the external shape clearly, with the others I'd sort of guess/imagine it."
- "But only a slice through the entire building as it is clear that more 'building' exists underneath this one."
- "The nature of the drawing helps to visualise it in 3d."
- "It shows how the windows would fit into the walls and gives a much clearer indication of what it might look like as a result."

Answers: **'NO'**

There was 'NO' answer received from the first year students.

Question 30: Does plan C provides information for you to understand how the building is used?

Answers: **'YES'**

- "Yes because it shows more clearly the different possible flows throughout the house due to the perspective of the stairs."
- "Yes, as it names the rooms, but not as much as Plan B, because you don't know what facilities there are in each."
- "Because of the words such as bedroom, kitchen, dining room and so on."
- "It names each room so you can work out how it is used, though the size of individual living space/work space and kitchen/dining space isn't as clear as in B."
- "It is clear how residents will circulate around the building."
- "Rooms are clearly labelled."
- "It gives an indication of what the rooms are used for, but not how the space within might be used."

Answers: **'NO'**

- "Because the walls are 3D they block out some of the detail such as the doors, making it difficult to see how the rooms link to each other.

Question 31: What will make you understand architectural drawing better?

Answers:

- "Having a scale included (a line scale)."
- "**Artist's perspectives**. Colour textures, things like people and cars to give impressions of scale and so on."
- "If a combination of the three drawing types were used then I would understand it much better."
- "Giving the most information in the clearest, most uncluttered way. Having a scale to gauge the sizes better."
- "I think symbols like wardrobe, sink help people to understand more easily. If two kinds of drawings are provided, it will be more helpful."
- "A cross between B and C, or both together, so you can see the 3D shape, and the detailed 2D interior."
- "A little bit of internal fixtures and fittings detail, clear lines, not too dark and heavy, large scale."
- "Clearer, more concise drawings with particular attention paid to one dimension drawings - I feel these are easier to comprehend, as 2 or 3 d models detract attention from the purpose of the drawings: To show how the building is used."
- **"Studying architecture."**
- **"Completing my architecture course."**
- **"Having it explained to me."**
- "An introduction to the general shortcuts used to represent different things, and the different types of drawing that can be used."
- "Maybe putting in representation of an average height person in the drawing."

Diploma Architectural Students

Question 13: Does plan A provides information for you to understand how the building may look like?

Answers: **'YES'**

- "Yes, but only in a very basic way, for instance, no height values are given, neither are there any details as to roof forms, window forms and details etc. One may assume it is of "standard" construction, but there is nothing on the drawing to necessarily suggest this."
- "Because I am used to reading architectural drawings and can fill in the gaps from my own experience of reading plans. When I look at a plan I view it as a 3D entity in my head."
- **"Basic spatial arrangements are readable."**

Answers: **'NO'**

- "It just gives the volumetric idea of the spaces it does not show the aesthetic."
- "It only shows building layout. Colour, light and other such important features required to inform the look of the building are missing."
- "Most people will never see the building from this angle. Difficult to imagine 3D space without further information. Would also benefit from exterior context."
- **"Because I am trained to visualise plans in 3Dimensions, I can begin to imagine how the building functions and works diagrammatically.** I may even form opinions relating to the volumes and the light etc... But there is no information apart from words and doors to give any description of scale and use. There is no atmospheric information. No information that tells me anything about the space's context or the materiality of its interiors. It is a diagram. It is to some scale, in proportion, but that is all. **A bit like a road map, it is a diagram."**
- "I would need additional drawings - section, perspective/elevation to understand the building's proportions. Though it does convey a good basic understanding."

Question 14: Does plan A provides information for you to understand how the building is used?

Answers: **'YES'**

- "By the key given as to which room is which, and therefore what one might expect: a) to be installed there (eg. toilet) and b) how it might be designed (eg. Larger windows in living areas)."
- "It is obvious where different functions take place if not how they will in the actual spaces."
- "Apart from doors, which help me to form an opinion of scale (**I learn and remember how big a door usually is**), this diagram with its text, does tell me which room is which and how they relate to one another. **I think I know what a kitchen is and what a toilet is. I can see that there are some stairs and some windows. I have to circulate through a hall space to move between each of the rooms.** With regards to how the building is used – That is left to my imagination again. **Probably as an architecture student, I will be better at imagining how this space MIGHT be used.** But it always amazes me how in reality, we do not tend to understand/visualise our surroundings in plan - and spaces take on a whole new character when we walk through them. Scale, Light, Volume, textures, context etc... I think that plans cannot convey all of these elements which play on the senses."
- "The room labels indicate a certain mode and level of usage to me that may not be as intended but is suggestive non the less."
- "I can see how the rooms relate to one another and imagine how I would use them."
- "Configurations of spaces are clear."

Answers: **'NO'**

- "The labels could be anything."
- "Not very well at all. No further information than 'living room', 'bedroom', 'toilets' etc...Who uses them? What is in them?"

Question 21: Does plan B provides information for you to understand how the building may look like?

Answers: **'YES'**

- "A clearer use has been defined in my mind that it is of residential use, and appropriate residential aesthetic may be used."
- "With the addition of furniture I can better understand how much space each room has and how much furniture I can fit in it. **Objects which I can identify with help me to better relate to the size and circulation through the spaces.** I have a better understanding of what the interior space MIGHT look. But there is no information to really describe what the BUILDING looks like. Especially volumetrically and externally. no texture, etc..."
- It gives information about the internal layout and furnishings means I can visualise walking around the interior. Externally the information is limited due to the lack of context."

Answers: **'NO'**

- "It only shows building layout. Colour, light and other such important features required to inform the look of the building are missing."
- "Although provides more than first drawing, there is not enough information to allow one to visualise space in 3 dimensions. No idea of finishes, lighting, heights, etc. However, gives better idea of scale of rooms."

Question 22: Does plan B provides information for you to understand how the building is used?

Answers: **'YES'**

- "By the symbols."
- "How furniture may be expected to be laid out. However, the end-user will always arrange things as (s)he wants, so one cannot necessarily tell "how a building will be used" from such a drawing."
- It is obvious where different functions take place and how they will do so in each room.
- "Yes, although users are still unknown I can now guess more about them and how they might live."
- Diagrams which I can begin to recognise, such as a bed, seats and a desk help me to understand how the space might work. Words actually placed within the rooms are easier to read, rather than having to look away at a key. 'Down to main entrance', 'working area' etc... help me to identify what each area is and what use or function it has, or what might take place there."
- "The furniture layouts make the intended building usage very explicit. It demonstrates clearly the intension for habitation of the designer."

Answers: **'NO'**

There was 'NO' answer received from the Diploma students.

Question 29: Does plan C provides information for you to understand how the building may look like?

Answers: **'YES'**

- "Strong indication as it is brought into the 3d plane."
- "Window and door details are now shown (such as ceiling height), but height of walls is still inconclusive, still less any roof, surroundings, finishes etc."
- "It is the only drawing to have volume. It is a 3dimensional representation which shows the area of windows. It helps me to better understand how much wall space I might be able to use, whether a room will be dark or light. It also begins to show both the interior and the exterior. Although there is no context, I can begin to imagine more of a connection. I cannot really imagine how big the rooms are in area, and how much furniture I could fit in, nor how I would move around the space."
- "The 3D nature of the drawing is suggestive of the physical mass of the building and its internal form but tells little about the other floors and external form/context."

Answers: **'NO'**

- "It only shows building layout. Colour, light and other such important features required to inform the look of the building are missing."
- "Again not enough information - appears to be empty boxes."
- "It doesn't show it in context or show the lower floor."

Question 30: Does plan C provides information for you to understand how the building is used?

Answers: **'YES'**

- "As it is brought into the third dimension."
- "Again, only by the names of the rooms, and how the architect (not the end-user) expects them to be used."
- "It is obvious where different functions take place if not how they will in the actual spaces. The fact that this building is not on the main floor is more apparent from this drawing."
- "Only through the words really."
- "To a certain extent in that there are room names which are suggestive as to the intended use."

Answers: **'NO'**

- "Because the walls are 3D they block out some of the detail such as the doors, making it difficult to see how the rooms link to each other."
- "Perspective is an illusion, which distorts information within the drawing. So it may not be able to convey a clear message."

Question 31: What will make you understand architectural drawing better?

Answers:

- "Symbols."
- "A three-dimensional approach is much more useful to understand the building in its appearance and use-patterns. Three-dimensional drawing gives an idea of dark corners in a room that may exist, but more technical renderings in 2D (eg. plans, sections and elevations) may be necessary for construction."
- "**One drawing can not describe every aspect of a building;** drawing B with shaded walls would be better than the other drawings you have shown to explain the plan of the building."
- "I feel that what "the building may look like" can only be done with a 3 dimensional coloured drawing."
- "Drawings supplemented or incorporating 3D visualisations and possibly examples of materials."
- "I do not think that any one drawing can describe every aspect of a space. I also think that **diagrams are short hand for expressing information to people, in particular professionals who are used to reading plans.** Contractors understand working drawings, where as a planner may better understand simple plans and elevations. No single drawing, model, photograph tells us the truth. They are each an abstraction, which highlights a particular point(s). Therefore a number of different representations should be used together in order to convey differing aspects of a space. Words, sketches, textures, sections, photographs, etc..."
- "To answer the question, I think the addition of textures, colour might help people to visualise the warmth, atmosphere of the space. Perspective sketches could help create an artificial sense of depth. But other tools such as sketches which may not need to be to scale, which give the space a greater narrative could be used."
- "Context - the floor below, the buildings adjoining etc. Also some indication of habitation - i.e. furniture, people... **things that make the drawing come alive.**
- **I feel perfectly able to understand these drawings"**
- "Contextual perspectives."

Appendix F | The initial sketch for 'Communicative drawing'

After 'Draw the Line Questionnaire 1' was conducted, the further research aim was to create a set of communicative drawing. The drawings shown below were drawn and developed as an initial sketch for 'communicative drawing', which hopefully convey information and communicate better than the normative plan drawing.

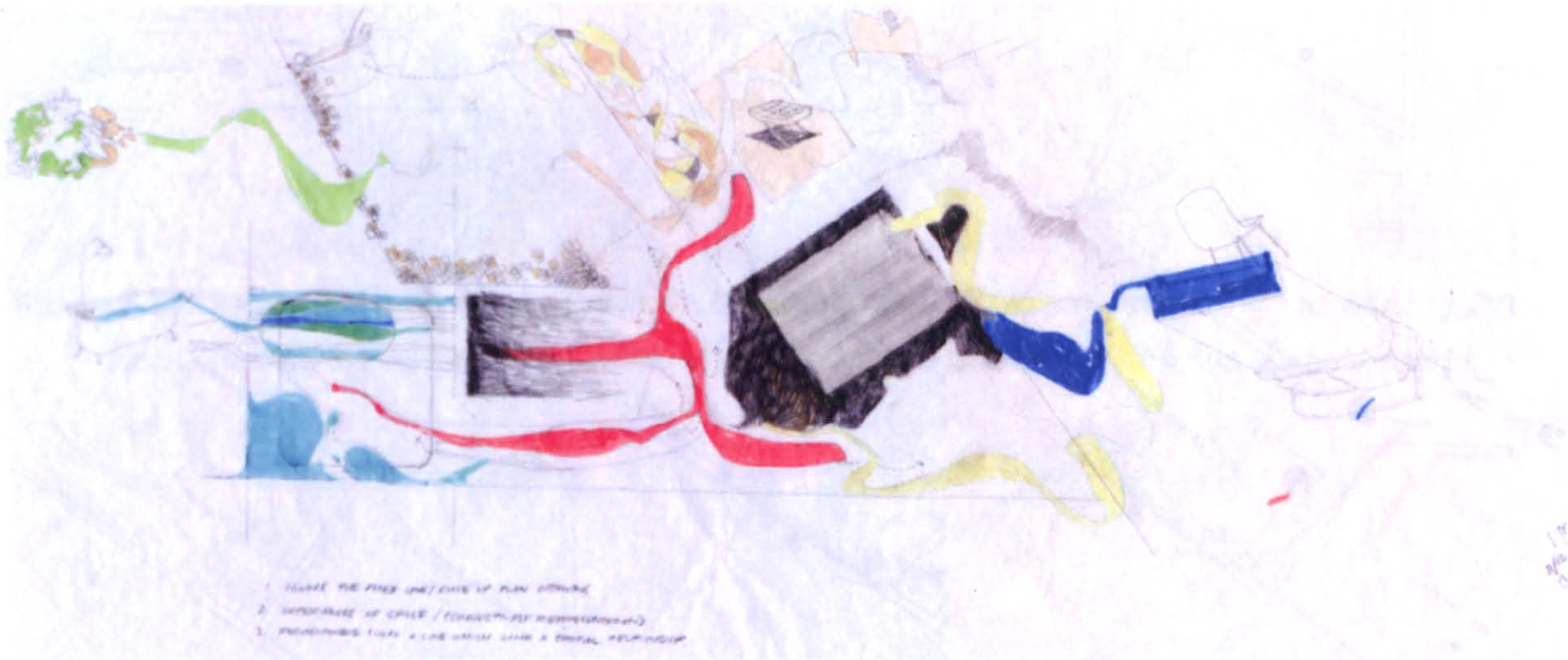


Figure F.1: 'Abstract drawing' – denotes meaning and atmosphere within the building.

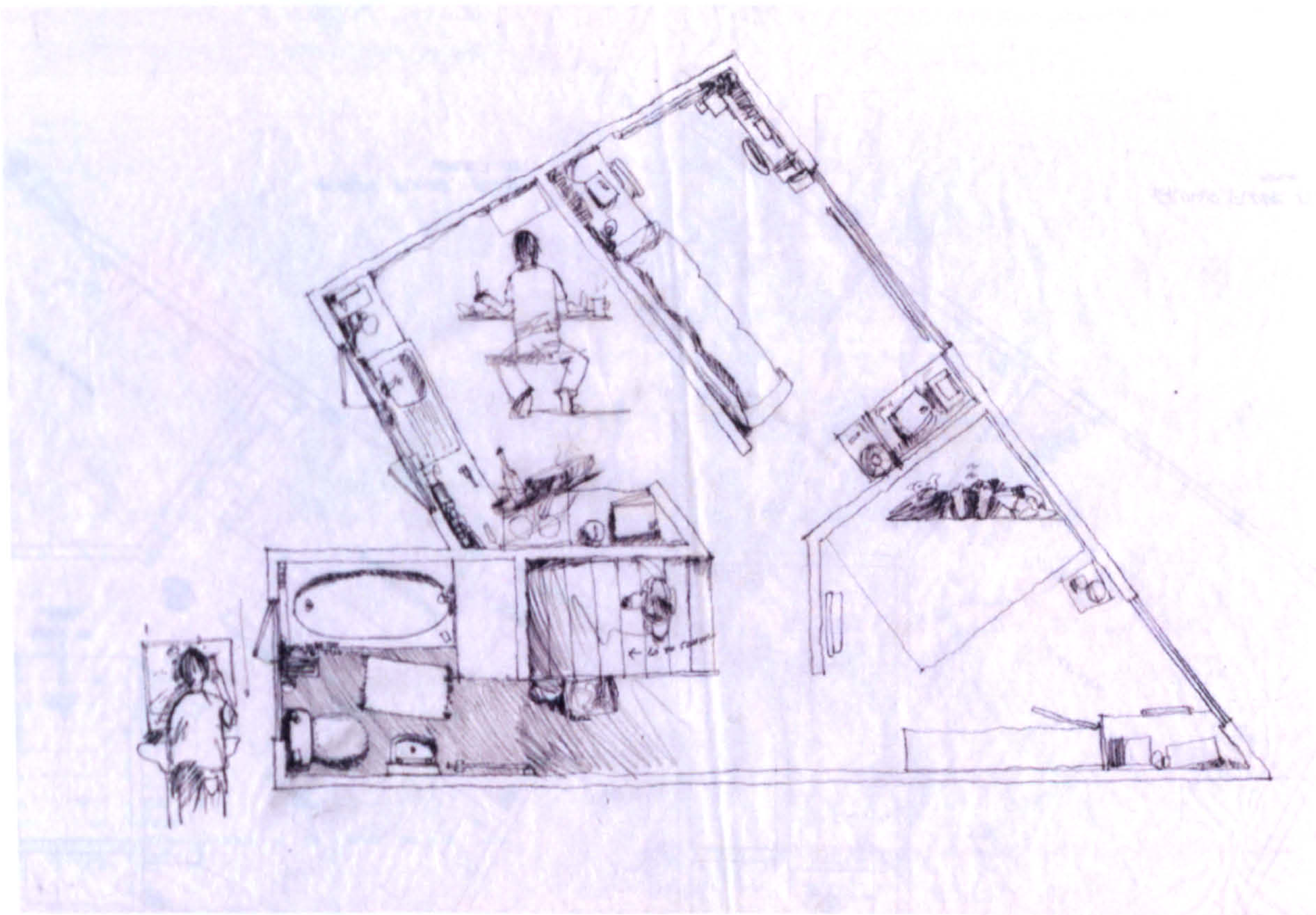


Figure F.2: 'Sketch' - considered as a friendly way of communication. Everyday-life activities and objects are included. This is hoped to recall experience of space of a viewer.

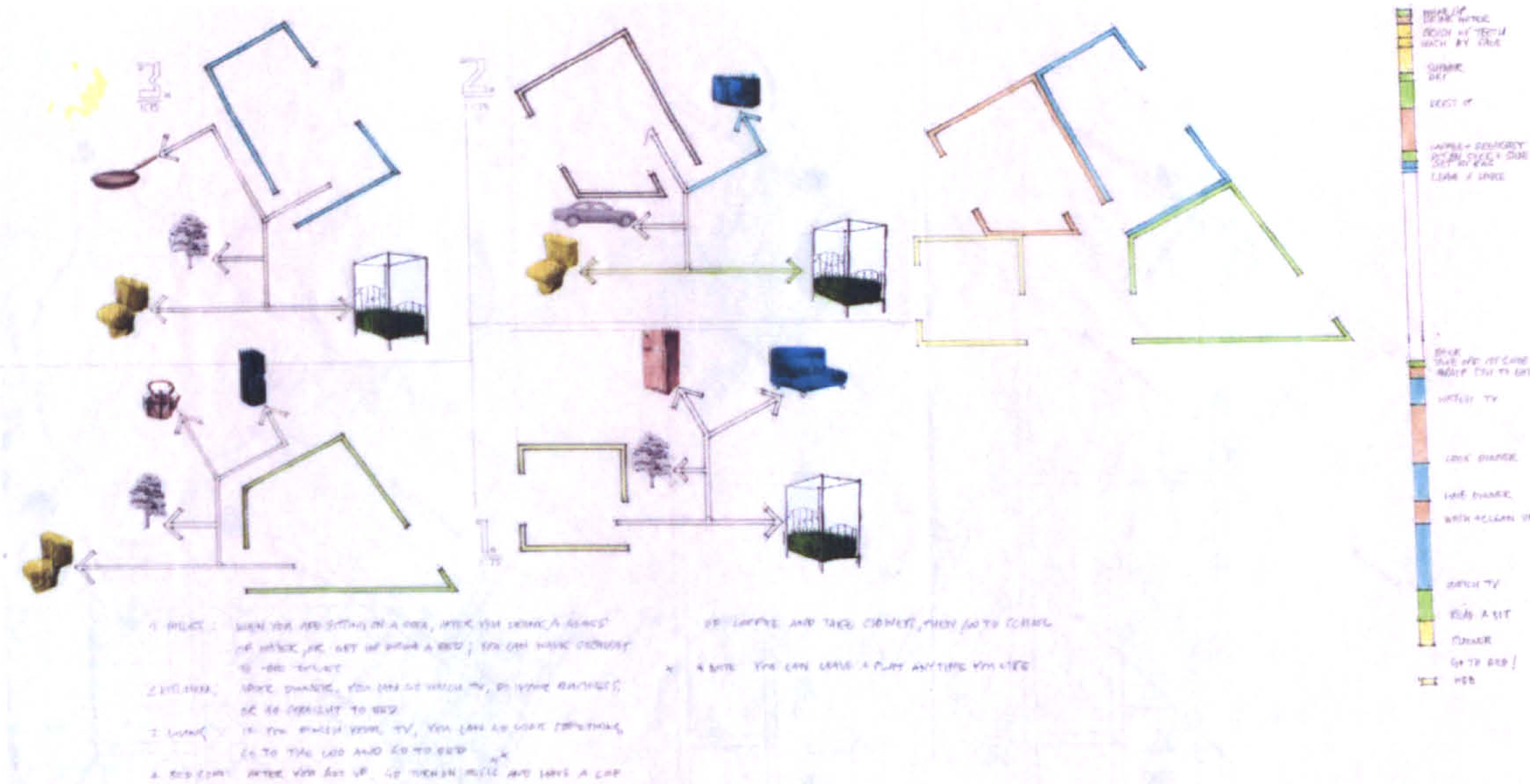


Figure F.3: 'Diagrammatic drawing' – drawn as the diagram and used everyday objects as a recognisable icon in guiding the viewer how to move around the space and explain how the space is used.

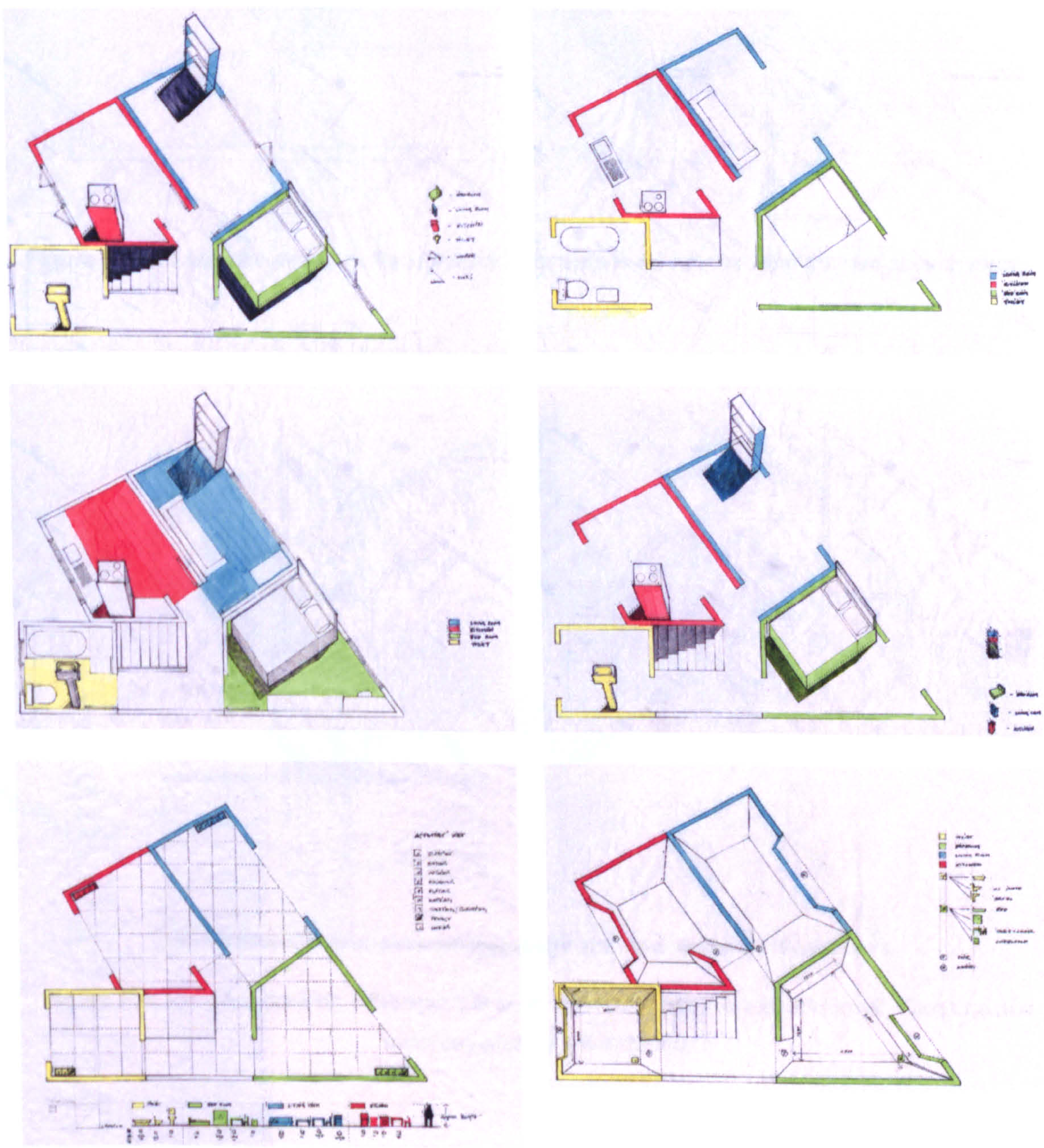


Figure F.4: Colour coding, symbol, and reading keys are used.

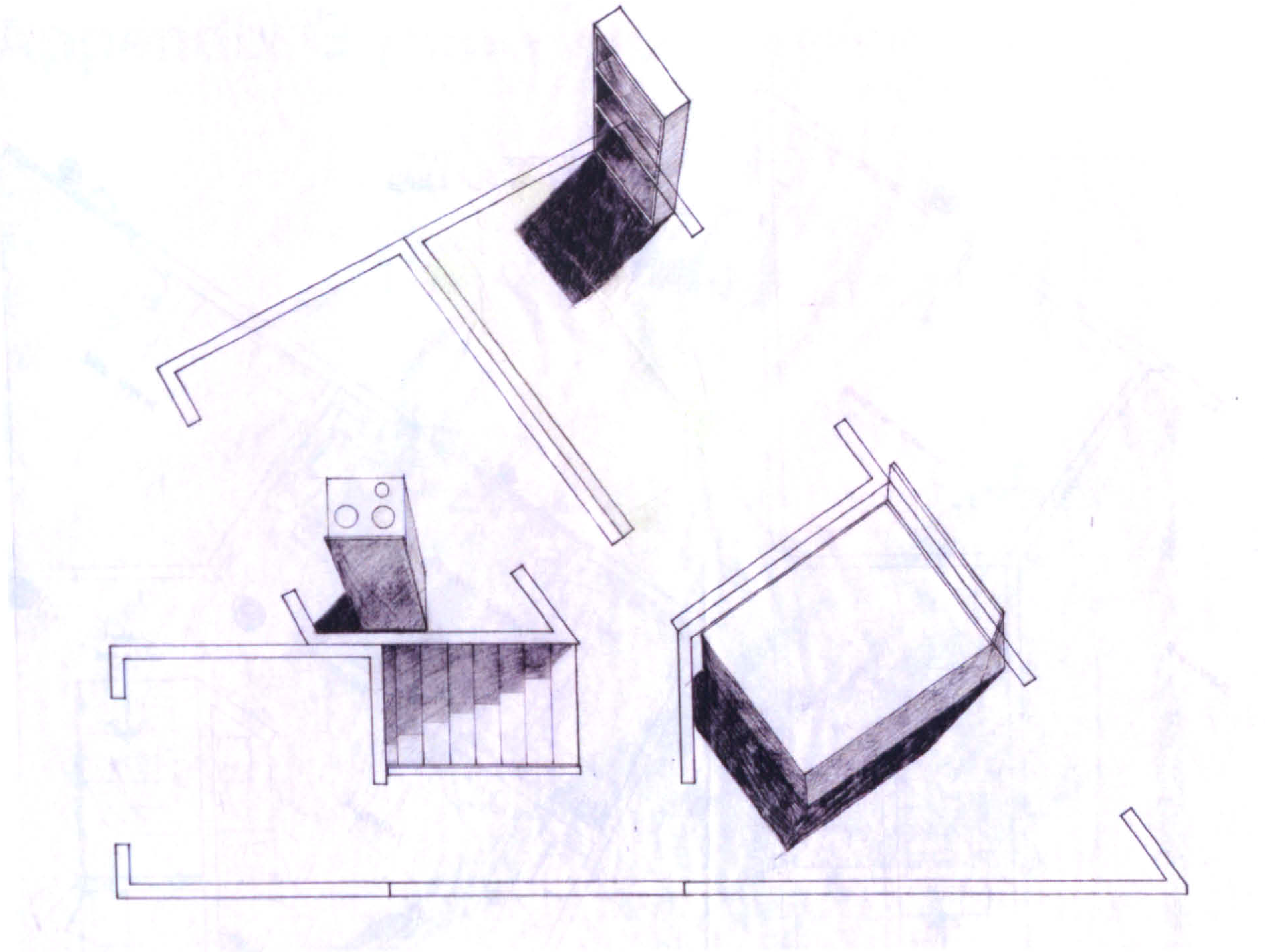


Figure F.5: A basic plan drawing. Recognisable icons are used representing the use of each room.

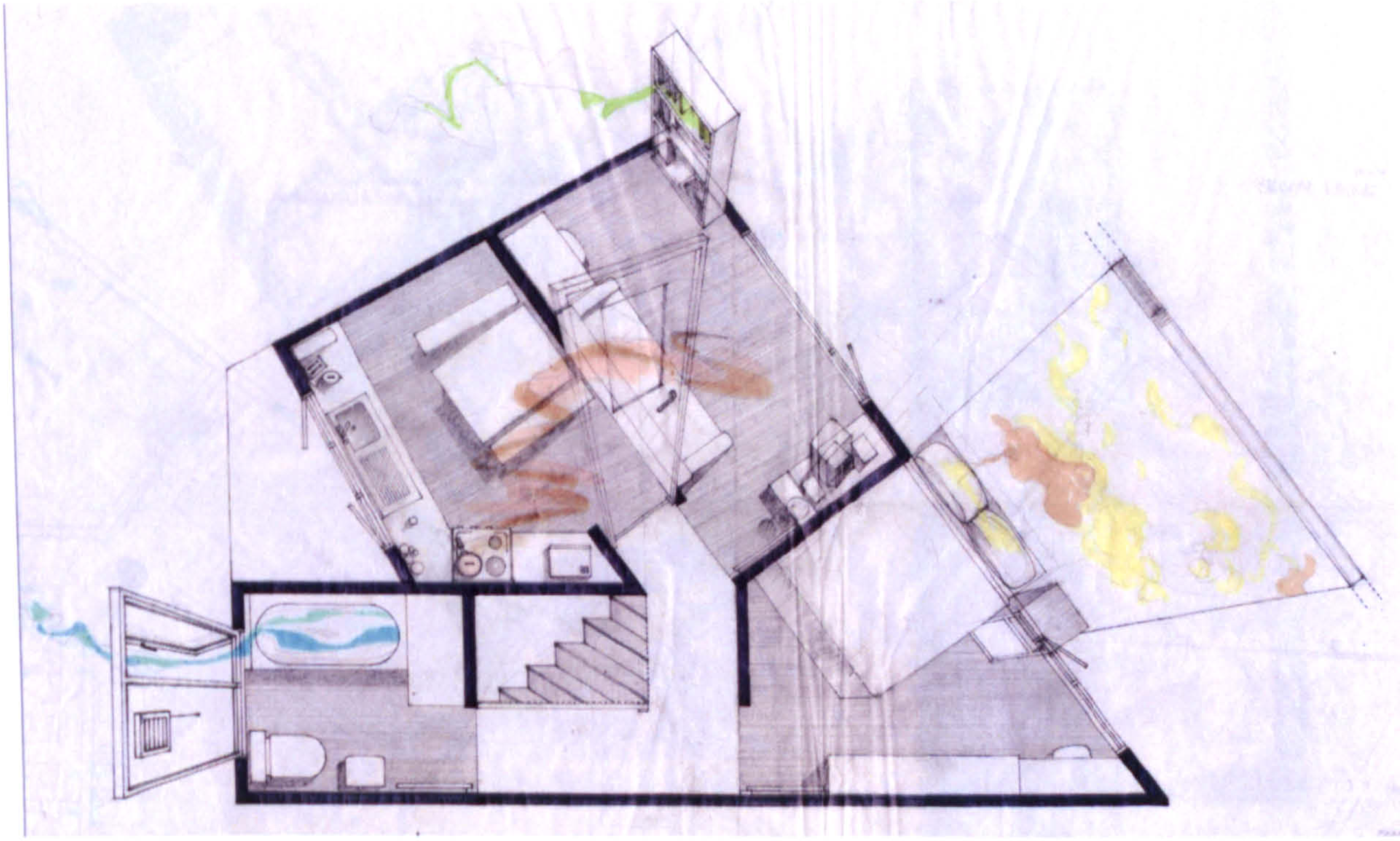
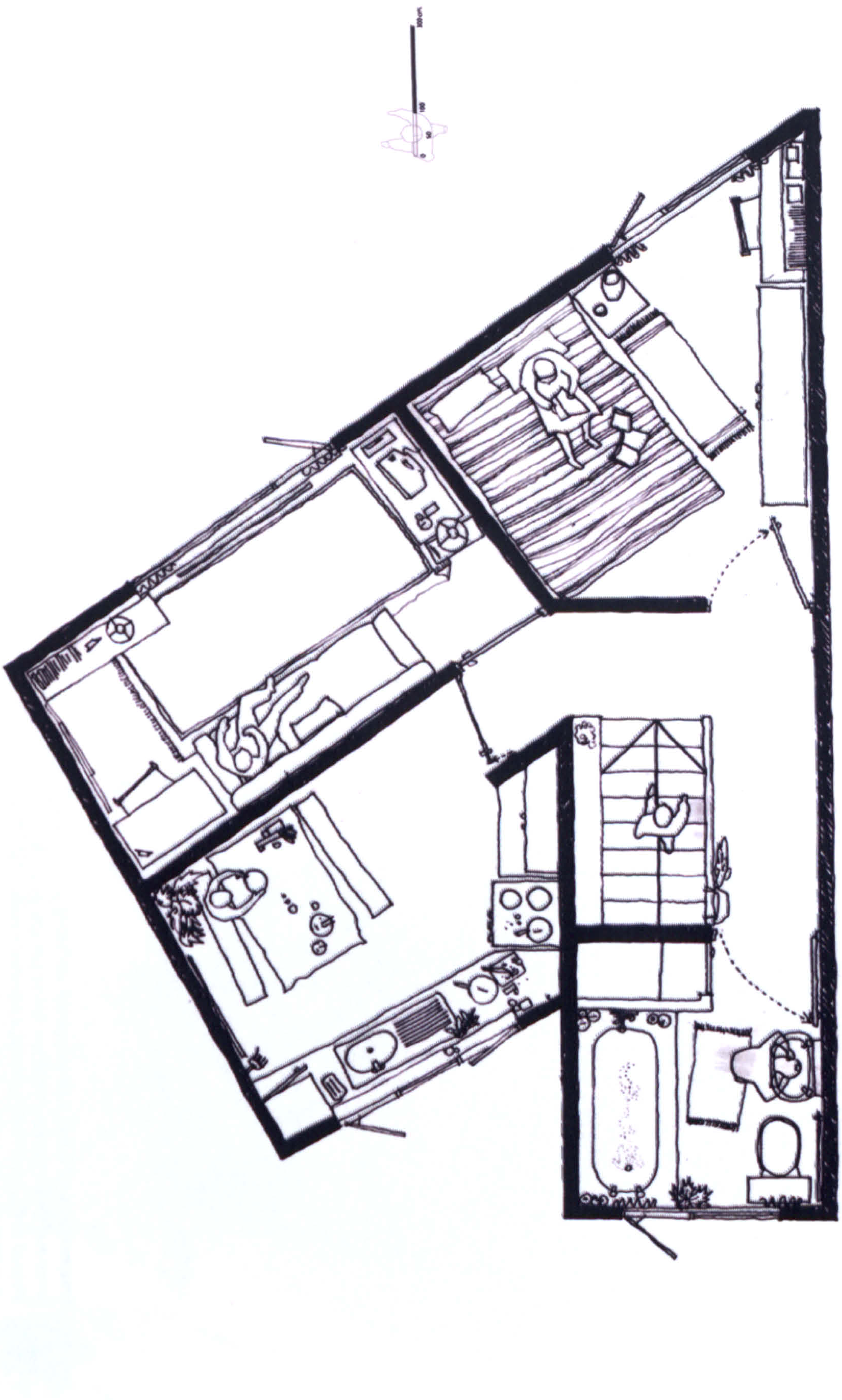
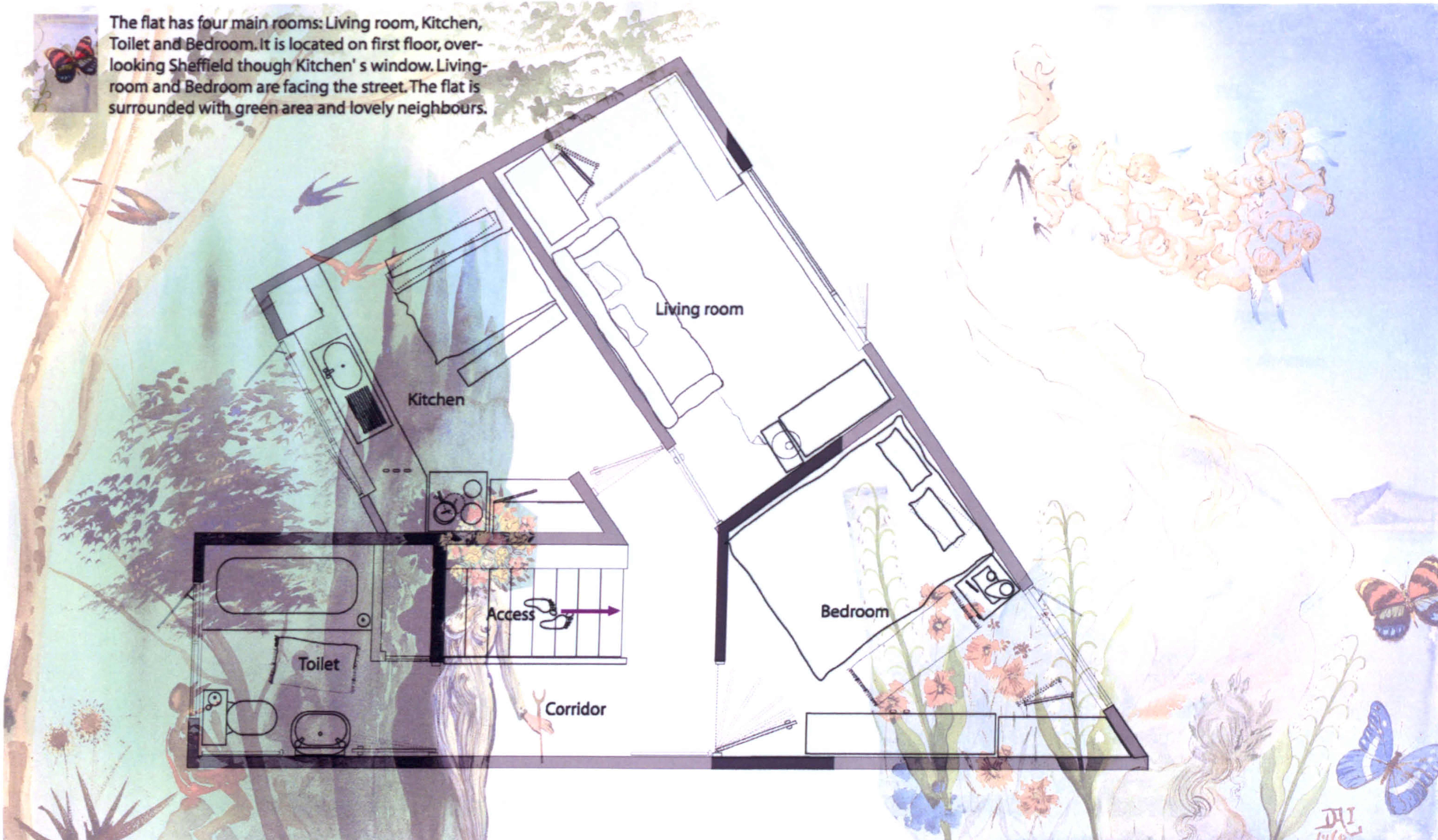


Figure F.6: Extruded drawing – the space is seen and made into more dimensional. Furniture and everyday objects are included.

Appendix G | Proposals for 'Communicative drawing'



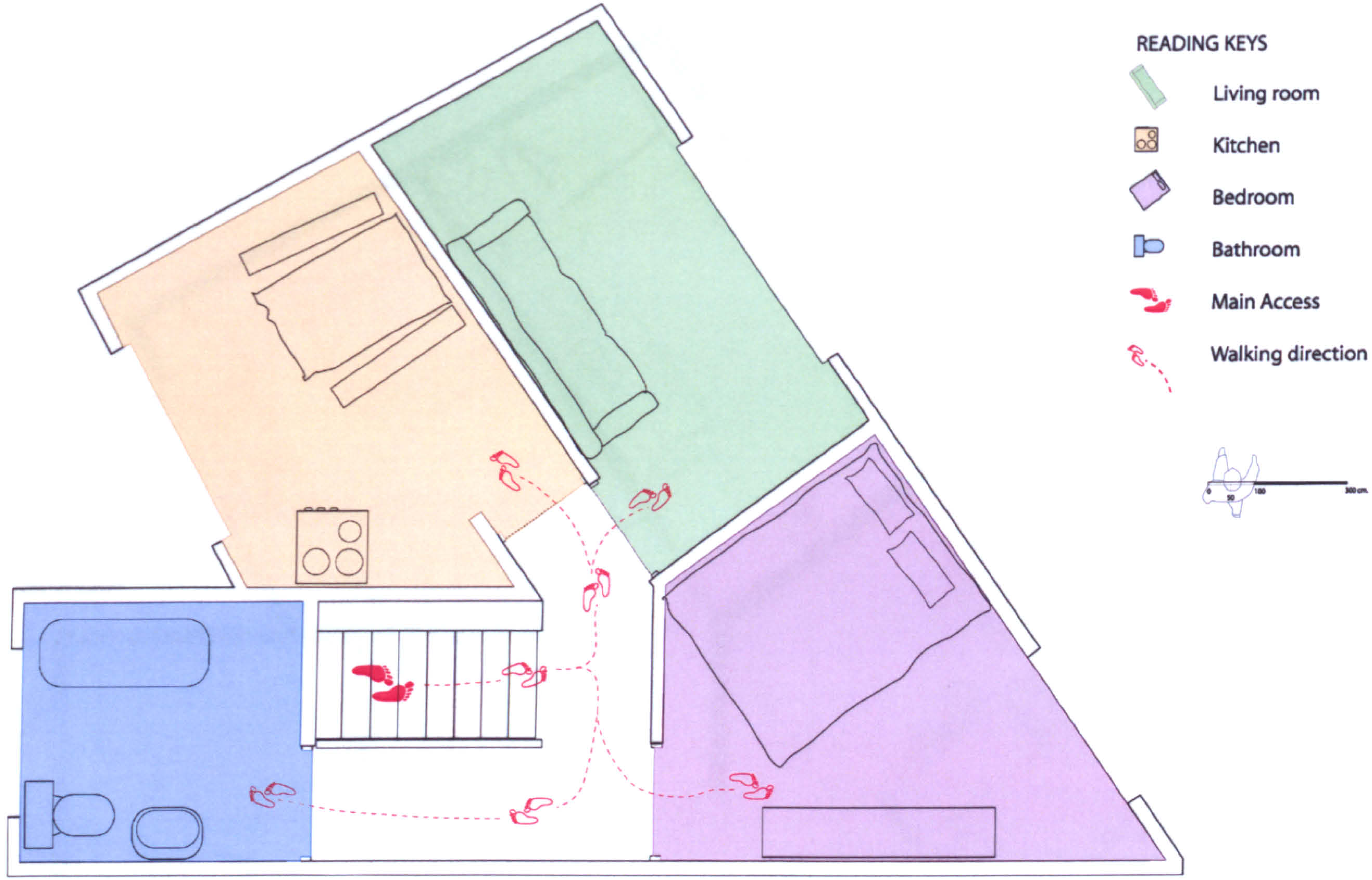
Plan Bmod 1


The flat has four main rooms: Living room, Kitchen, Toilet and Bedroom. It is located on first floor, overlooking Sheffield though Kitchen' s window. Living-room and Bedroom are facing the street. The flat is surrounded with green area and lovely neighbours.
Living room
Kitchen
Bedroom
Access
Toilet
Corridor

Plan N1


READING KEYS
Living room
Kitchen
Bedroom
Bathroom
Main Access
Walking direction

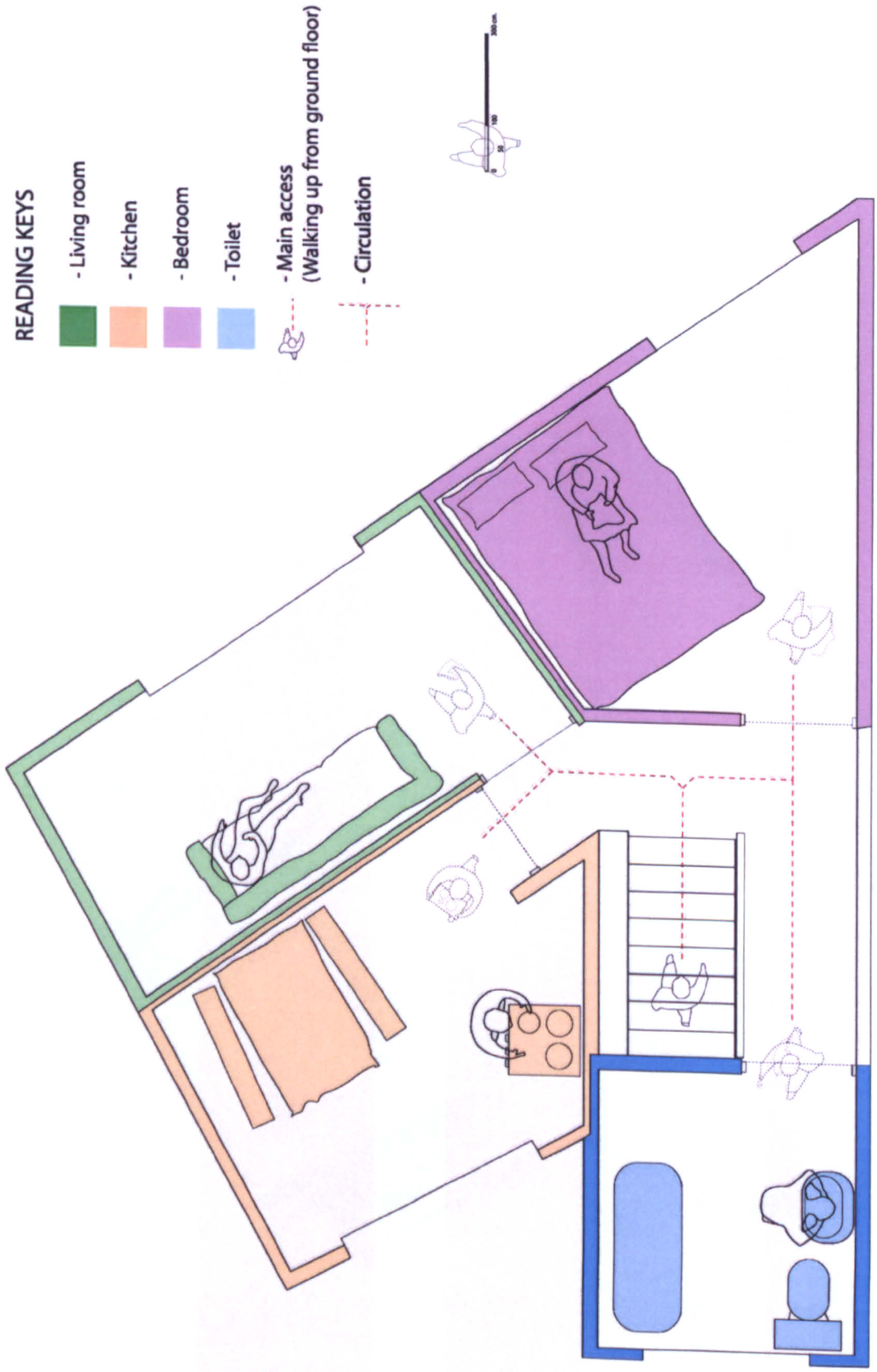
Plan Bmod 2


READING KEYS
Living room
Kitchen
Bedroom
Bathroom
Main Access
Walking direction

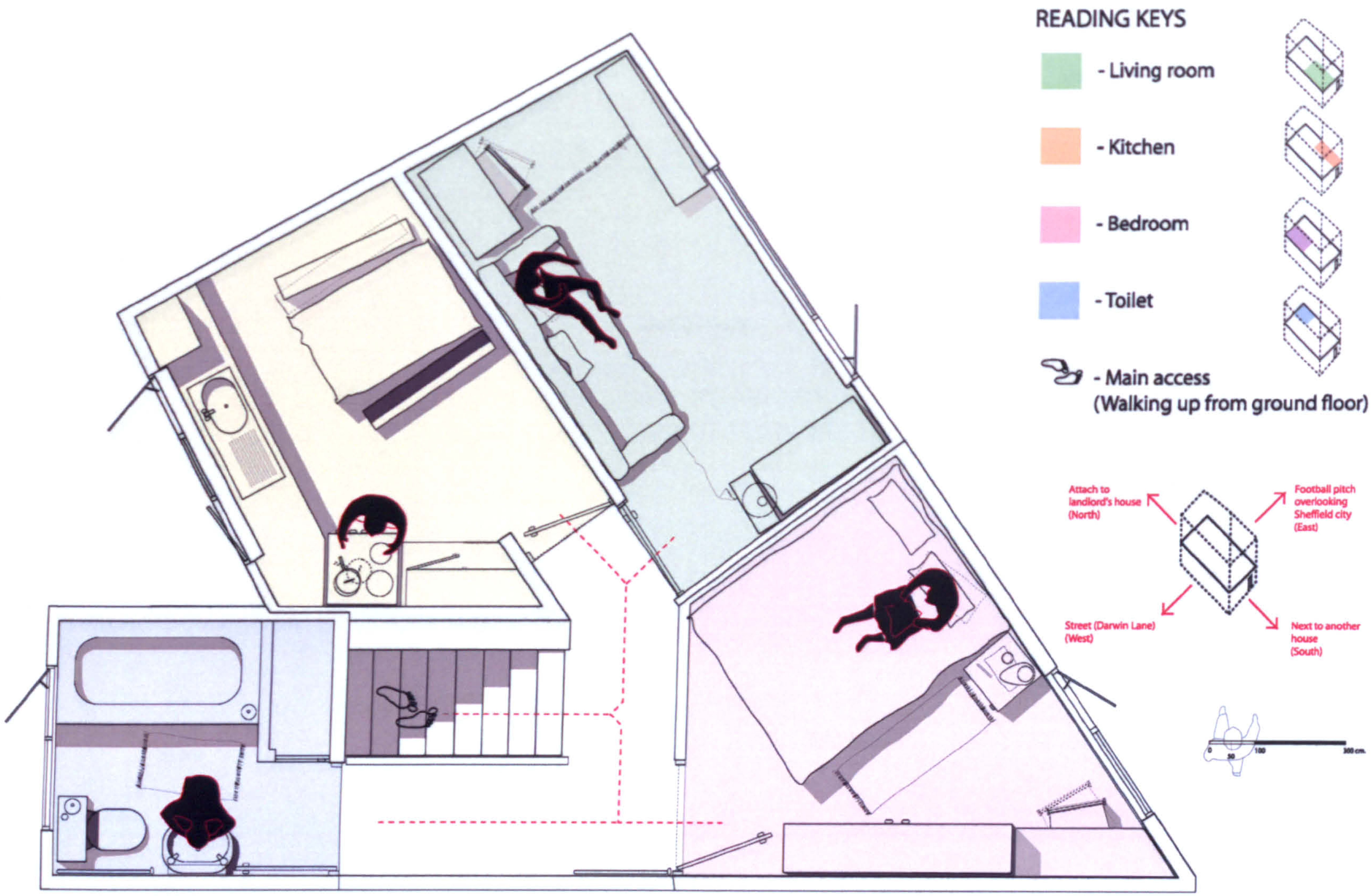
Plan N2


READING KEYS
- Living room
- Kitchen
- Bedroom
- Toilet
- Main access
(Walking up from ground floor)

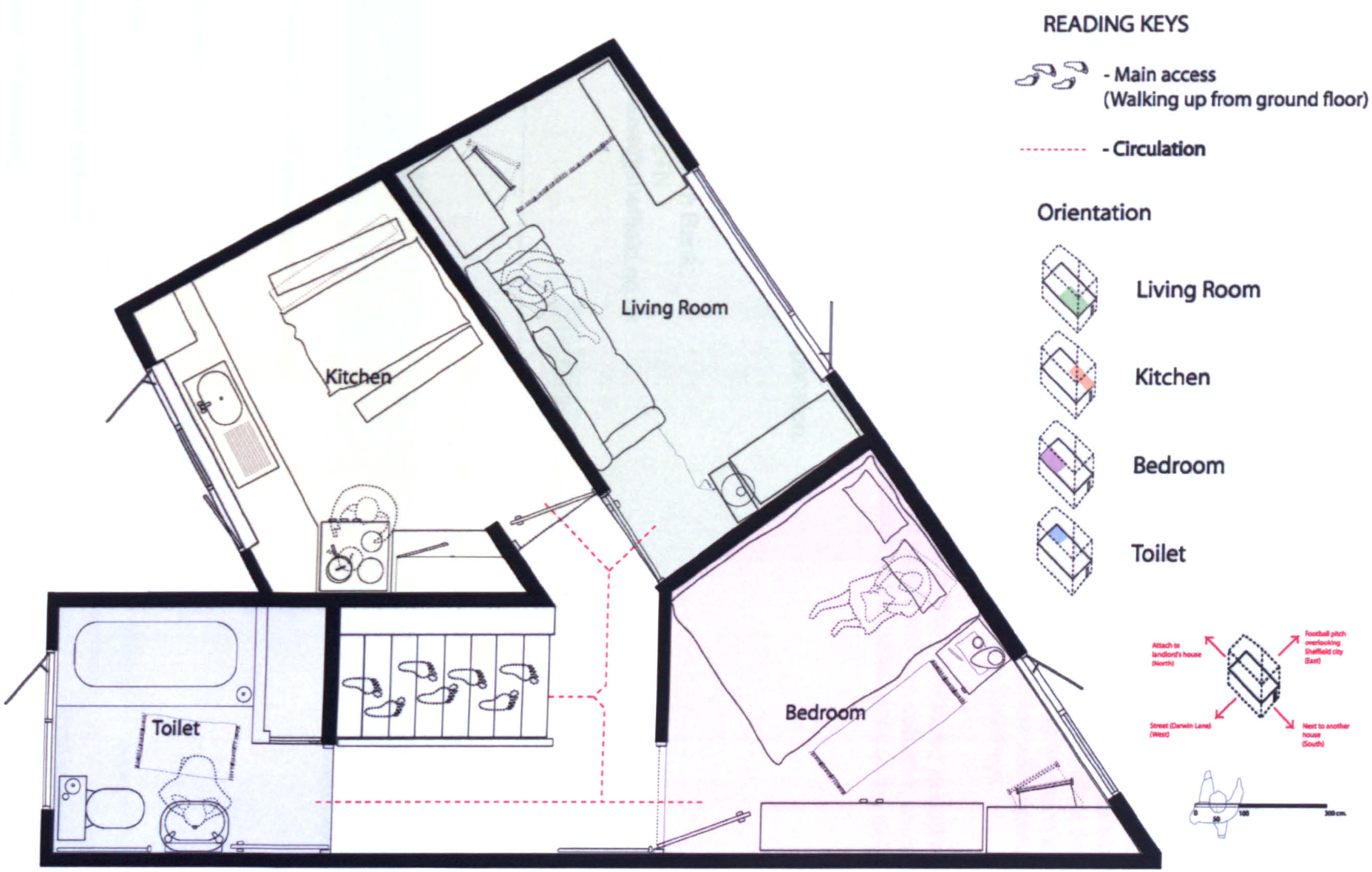
Plan Bmod 3


READING KEYS
- Living room
- Kitchen
- Bedroom
- Toilet
- Main access
(Walking up from ground floor)
- Circulation

Plan N3


READING KEYS
- Living room
- Kitchen
- Bedroom
- Toilet
- Main access
(Walking up from ground floor)
Attach to landlord's house (North)
Football pitch overlooking Sheffield city (East)
Street (Darwin Lane) (West)
Next to another house (South)
0
50
100
300 cm.

Plan Bmod 4


Kitchen
Living Room
Toilet
Bedroom
READING KEYS
- Main access
(Walking up from ground floor)
- Circulation
Orientation
Living Room
Kitchen
Bedroom
Toilet
Attach to landlord's house (North)
Football pitch overlooking Sheffield city (East)
Street (Darwin Lane) (West)
Next to another house (South)
0
50
100
300 cm.

Plan N4

Appendix H | Draw the Line Questionnaire 2

The questionnaire can be found at: http://www.shef.ac.uk/architecture/research/postcur/dtl/

School of Architecture, University of Sheffield

Draw the line
Questionnaire 2

This questionnaire forms a further stage in my PhD. research into the way in which architectural drawings communicate to lay people. The research aims to understand how lay people read and understand architectural drawings. I have found that what architects take for granted is often a mystery to non-architects. My objective is to improve the quality and style of drawings in order to make them easier to understand; this will hopefully mean that lay people will be better informed in the process of designing buildings.

I would be very grateful if you could take the time to fill in this web-based questionnaire. It should take 5-10 minutes to complete, at the end of which you can submit it electronically. You will be making a small but important contribution to the betterment of the built environment!

Thank you very much for your cooperation.

S. Sinuraibhan
School of Architecture
Arts Tower, Western Bank
Sheffield, S10 2TN
Email: arp00ss@sheffield.ac.uk

Go to the Questionnaire

School of Architecture, University of Sheffield

Draw the line
Questionnaire 2

Please provide your details below:

Gender: ○ Male ○ Female

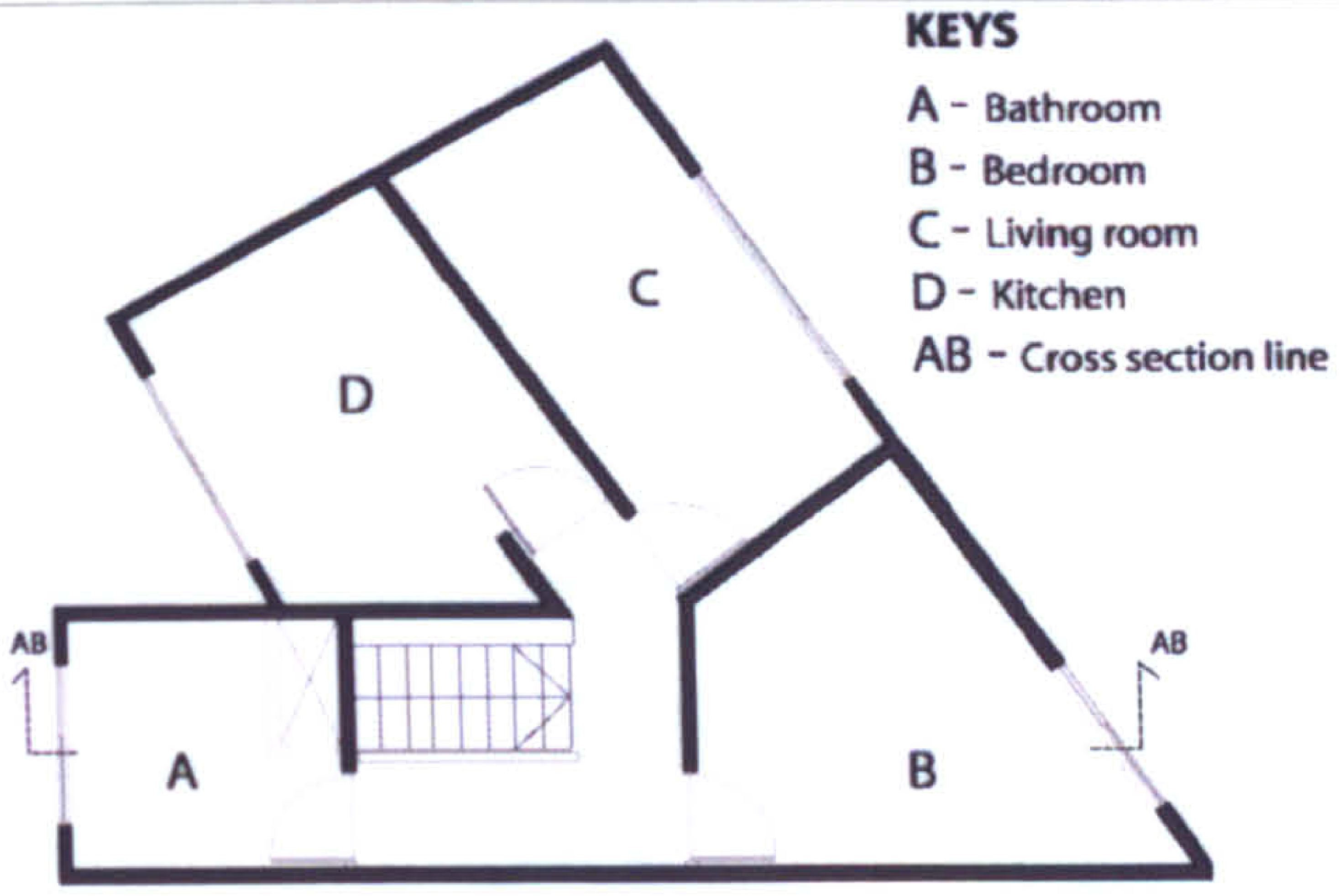
Age: ○ 18-30 ○ 31-40 ○ 41-50 ○ 51-60 ○ 61+

Department / School: ______ (Please specify)

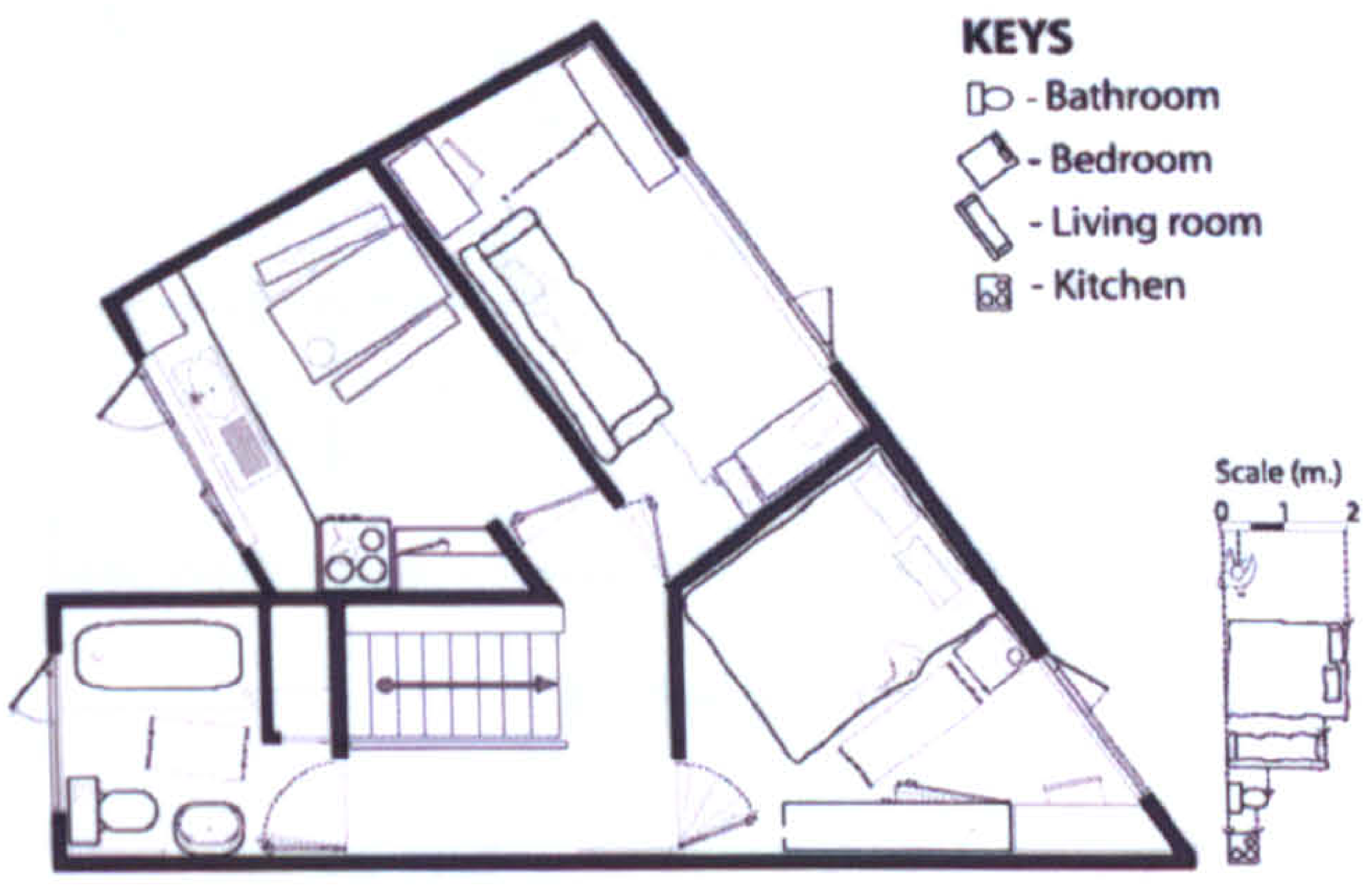
Year: (If student) ○ 1st ○ 2nd ○ 3rd ○ 4th ○ other

Part 1: Please rank the drawings from the easiest to the hardest to understand. Please select the appropriate drawing from the drop-down menu.

1) Plan A, B, and C represent the same apartment.

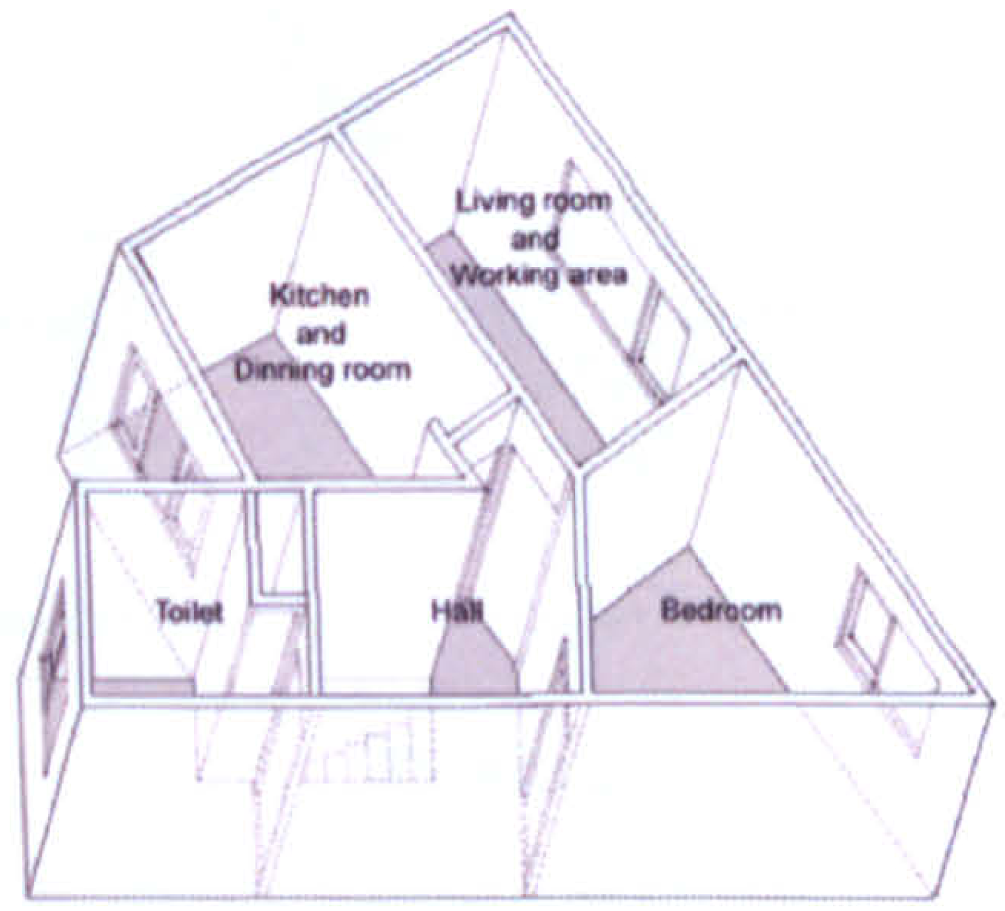


PLAN A



PLAN B

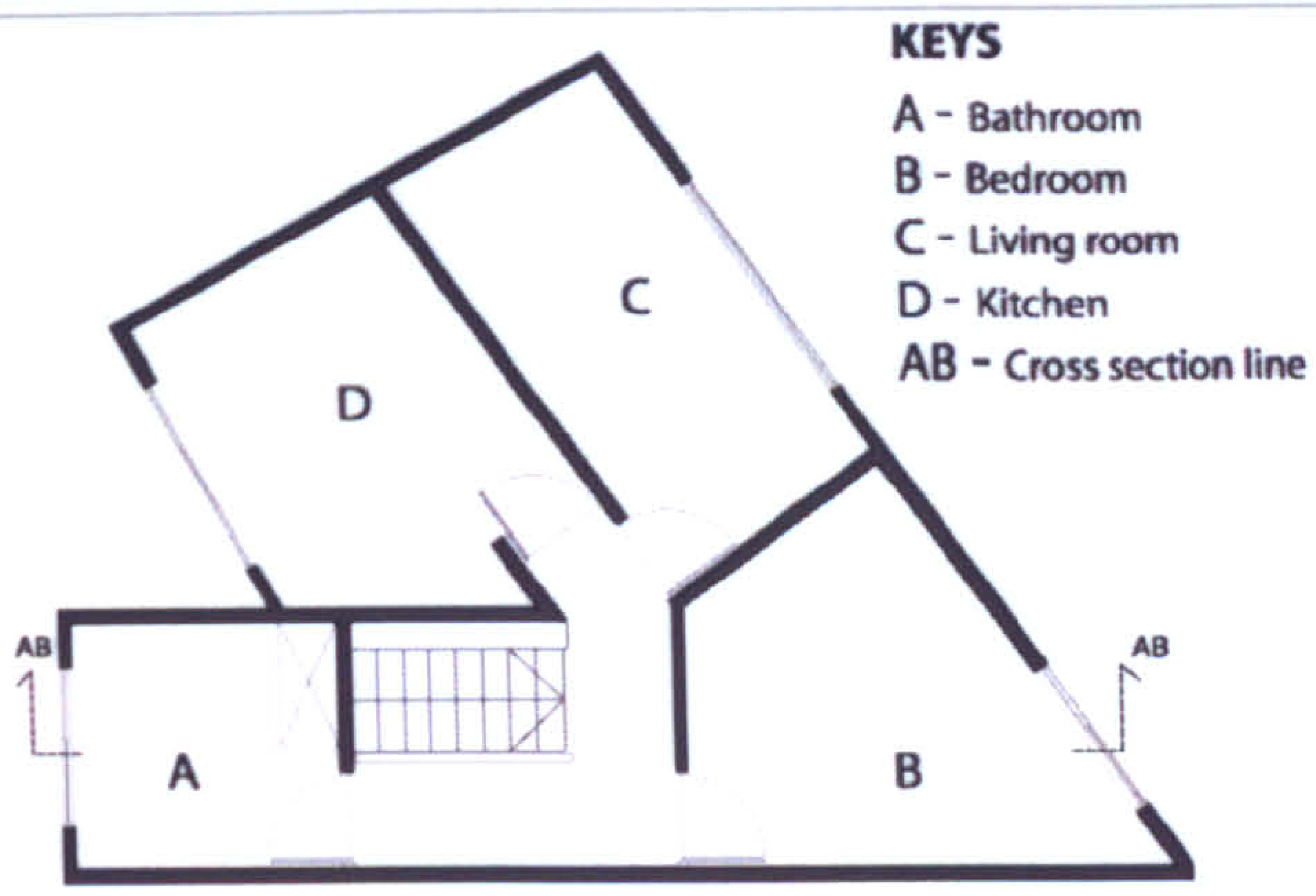
CLICK HERE to see full-size image



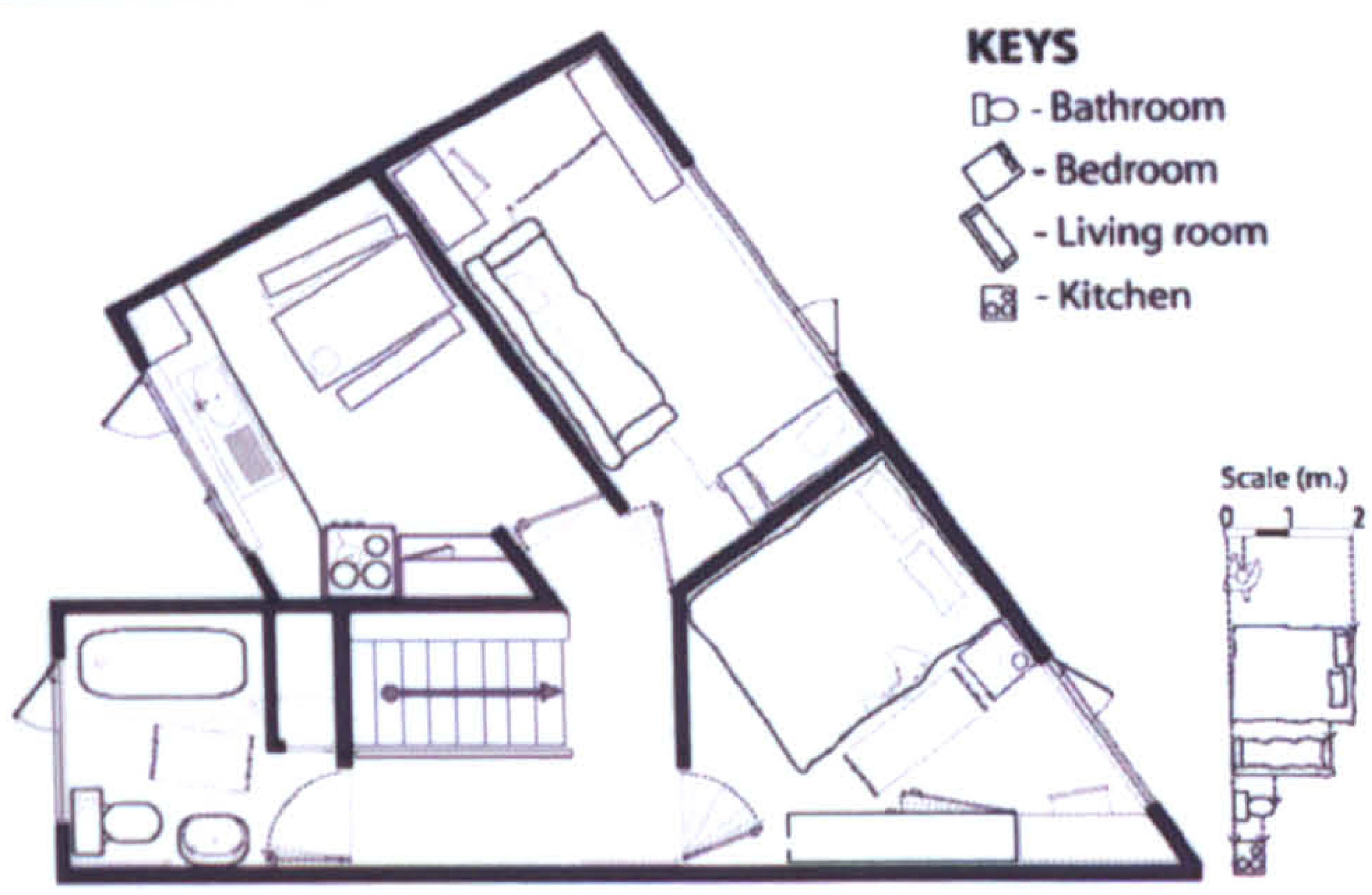
PLAN C

1.1) Which drawing is generally the easiest to understand?		
The Easiest	→	The Hardest
Plan A	Plan A	Plan A

2) Plan A, B, and D represent the same apartment.

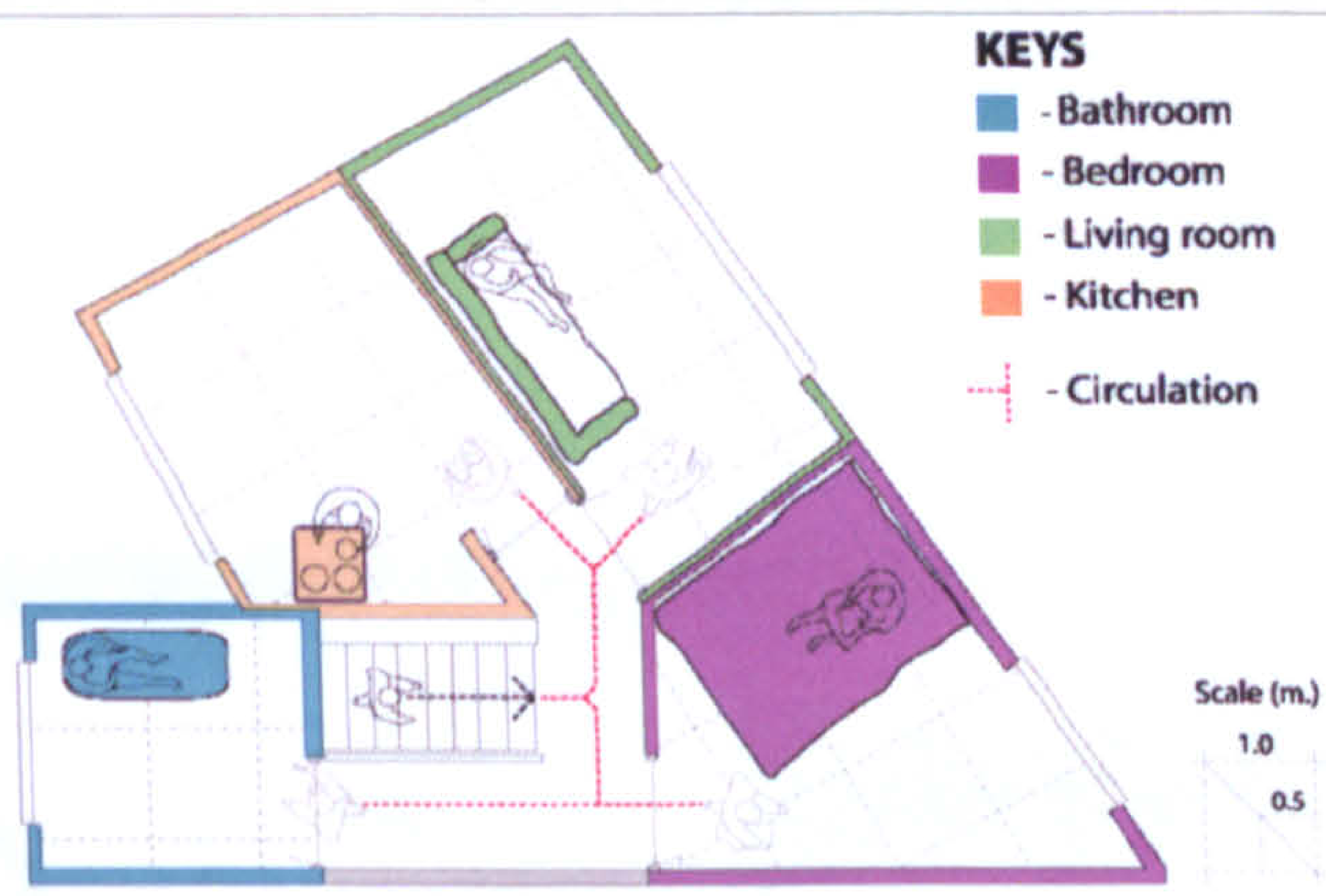


PLAN A



PLAN B

CLICK HERE to see full-size image



PLAN D

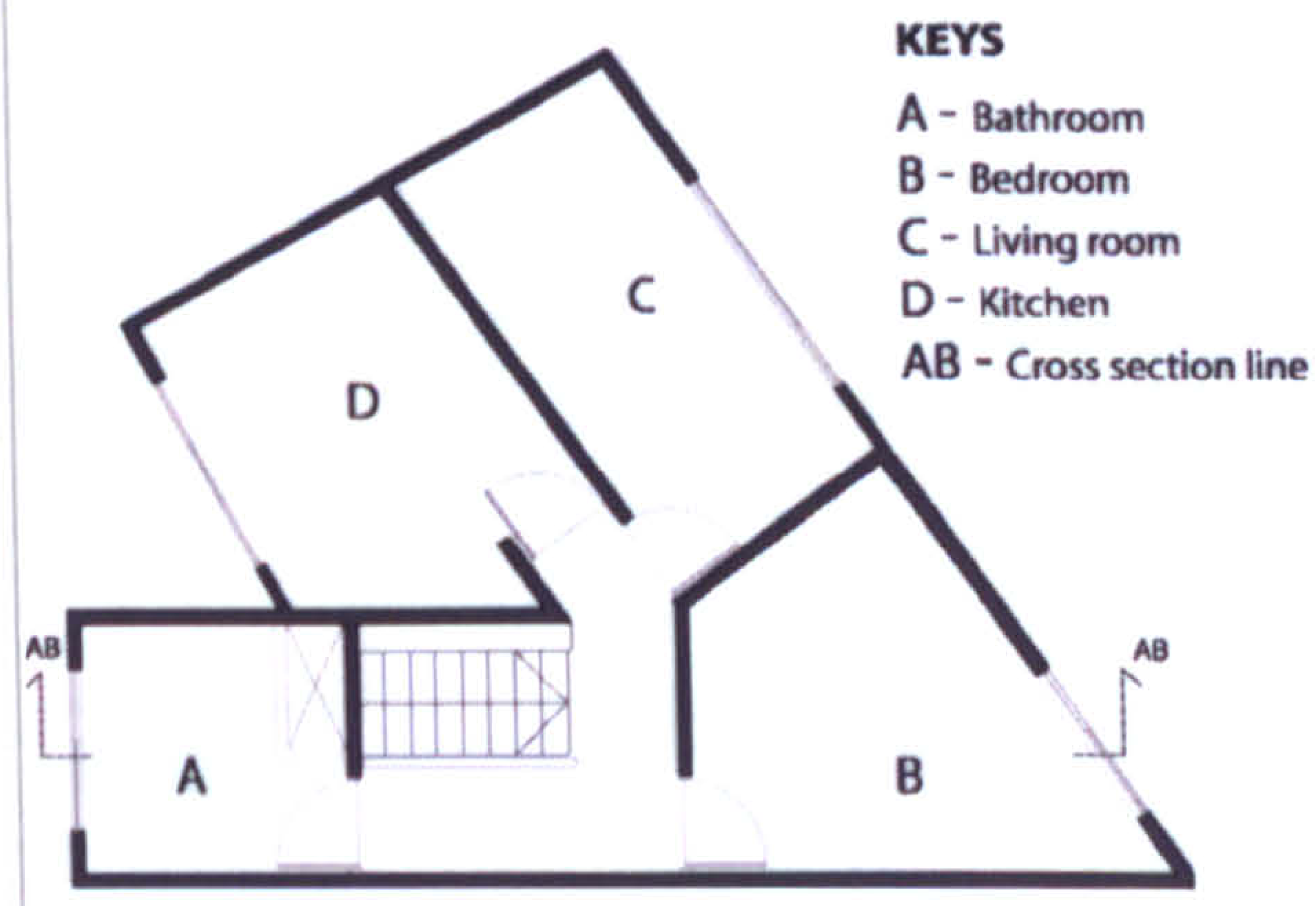
CLICK HERE to see full-size image

1.2) Which drawing is generally the easiest to understand?

The Easiest	→	The Hardest
Plan A	Plan A	Plan A

Part 2: Please tick the appropriate response. You are being asked to rate the quality of the drawing against the following questions, by indicating whether it describes:
5= Very well, 4= Well, 3= Fair, 2= Poorly, 1= Very poorly.
Please also give your opinion on the last two questions of each section.

Plan A: (5= Very well, 4= Well, 3= Fair, 2= Poorly, 1= Very poorly)



Plan A

How well does this drawing...

2.1) describe how to move from one room to another?

5 4 3 2 1

2.2) describe the use of the building?

5 4 3 2 1

2.3) provide information on scale and size?

5 4 3 2 1

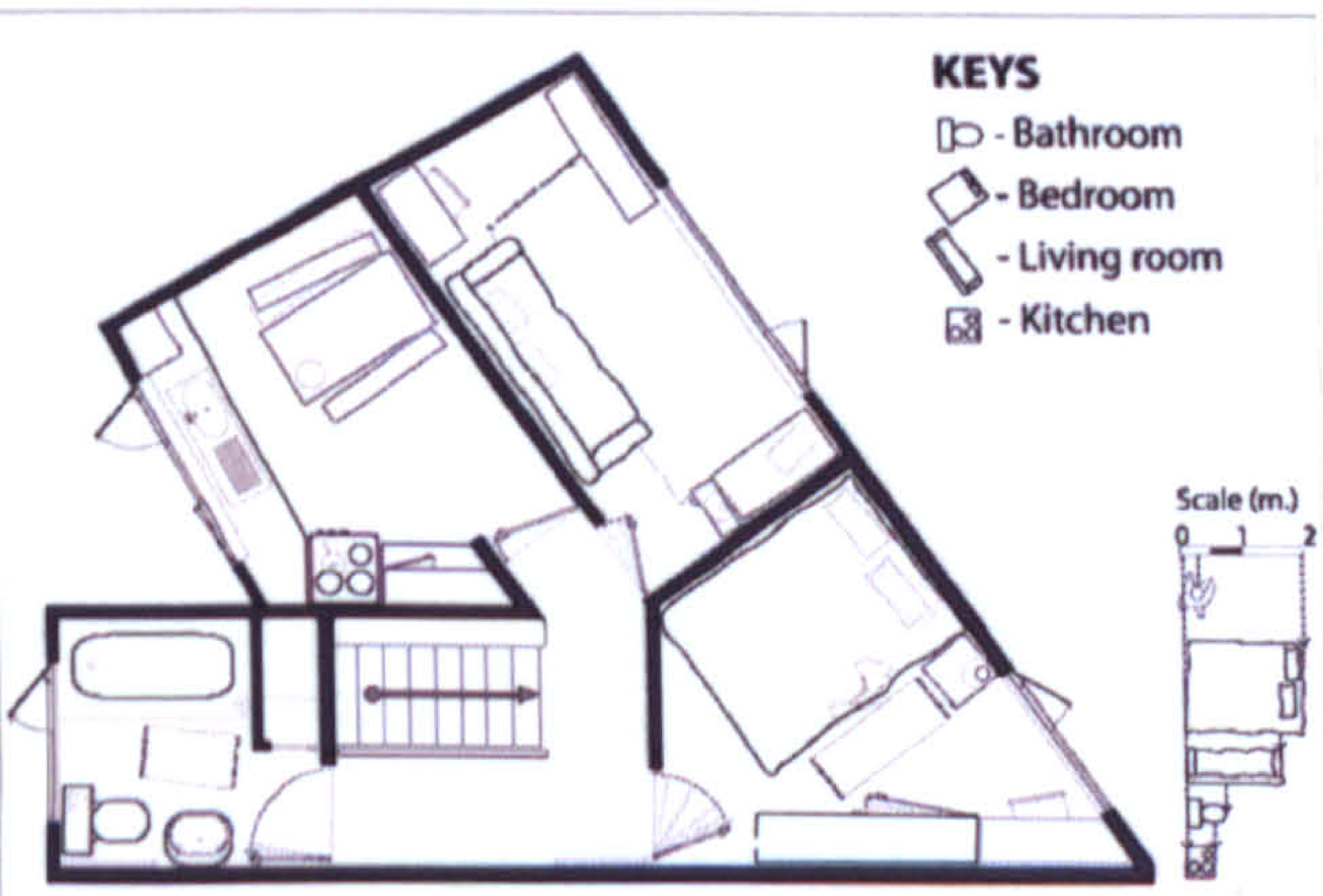
2.4) describe what it is like to live in the building?

5 4 3 2 1

2.5) What do you like about this drawing?

2.6) What do you dislike about this drawing?

Plan B: (5= Very well, 4= Well, 3= Fair, 2= Poorly, 1= Very poorly)



Plan B

CLICK HERE to see full-size image

How well does this drawing...

2.7) describe how to move from one room to another?

5 4 3 2 1

2.8) describe the use of the building?

5 4 3 2 1

2.9) provide information on scale and size?

5 4 3 2 1

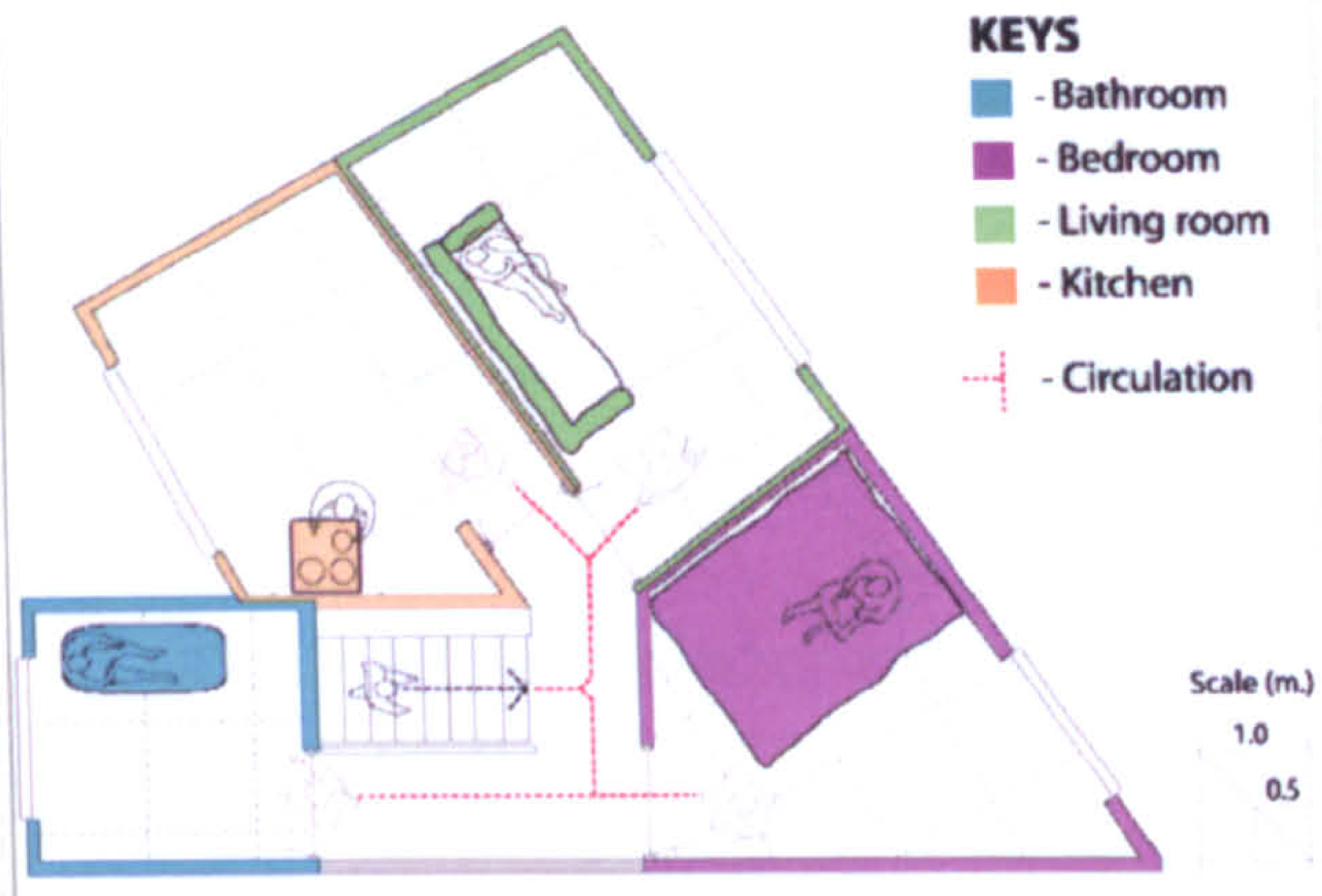
2.10) describe what it is like to live in the building?

5 4 3 2 1

2.11) What do you like about this drawing?

2.12) What do you dislike about this drawing?

Plan D: (5= Very well, 4= Well, 3= Fair, 2= Poorly, 1= Very poorly)



Plan D

CLICK HERE to see full-size image

How well does this drawing...

2.13) describe how to move from one room to another?

5 4 3 2 1

2.14) describe the use of the building?

5 4 3 2 1

2.15) provide information on scale and size?

5 4 3 2 1

2.16) describe what it is like to live in the building?

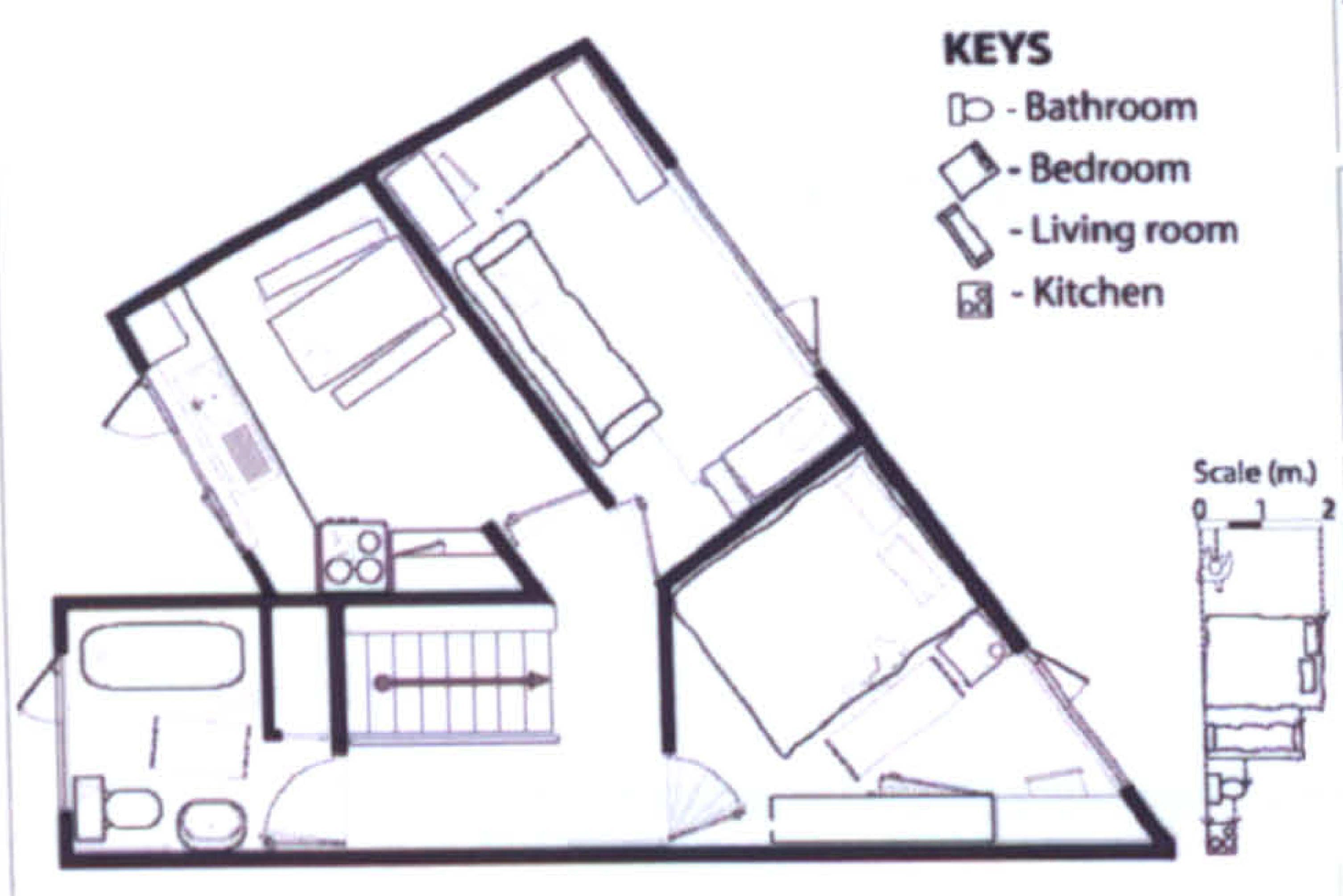
5 4 3 2 1

2.17) What do you like about this drawing?

2.18) What do you dislike about this drawing?

Part 3: Please indicate whether the statement is 'True', 'False', or 'Undecided'. Please tick the appropriate response.

Plan B:



Plan B

CLICK HERE to see full-size image

3.1) This drawing shows a horizontal slice through the building.

True False Undecided

3.2) This drawing is drawn to scale.

True False Undecided

3.3) The stair is enclosed with walls on both sides.

True False Undecided

3.4) The kitchen shares the same wall with the bedroom.

True False Undecided

3.5) How many wall cupboards are there in the kitchen.

0 1 2 Undecided

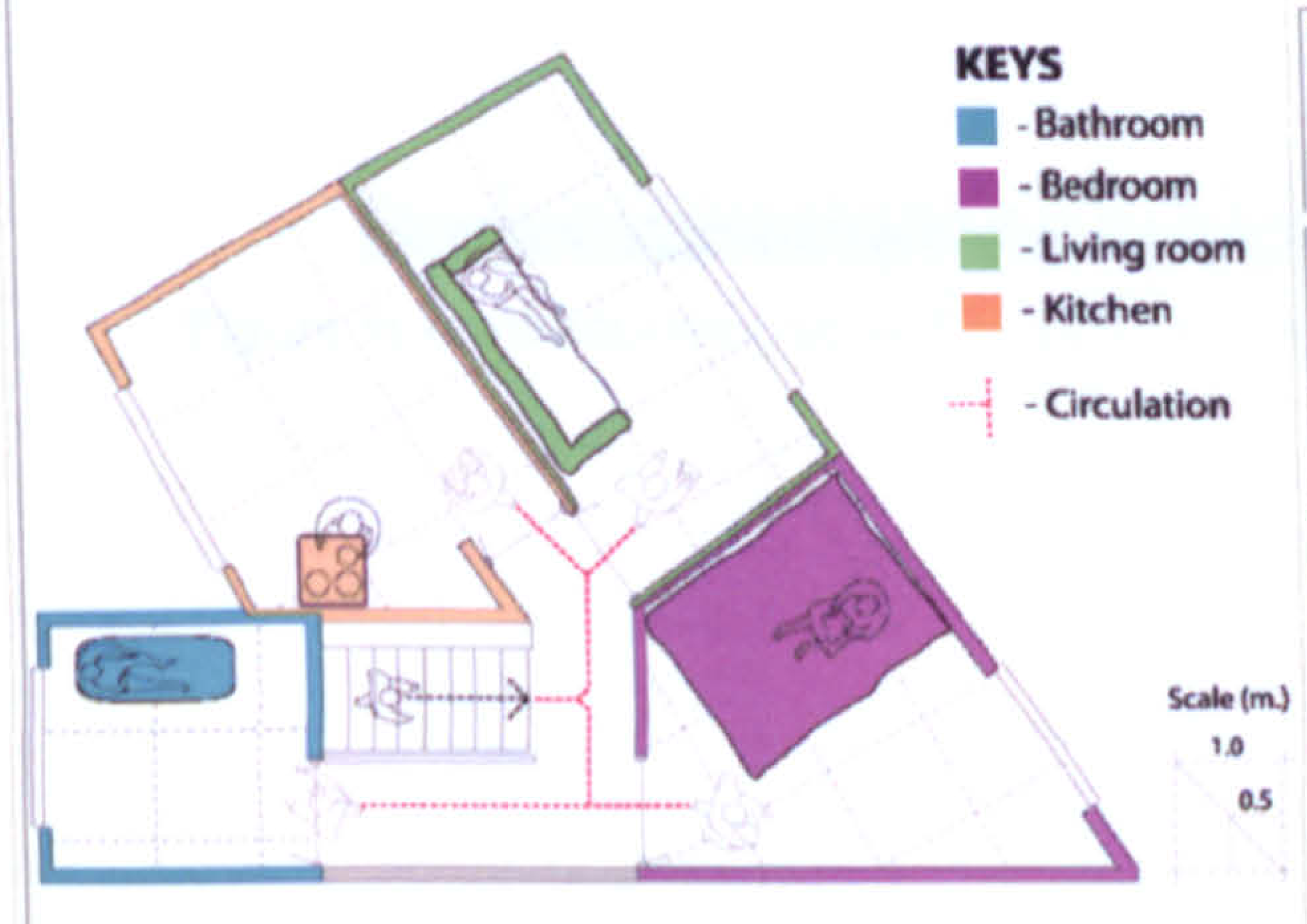
3.6) When you walk up the stairs, the bedroom wall will be in front of you.

True False Undecided

3.7) Every room has a rug in it.

True False Undecided

Plan D:



Plan D

CLICK HERE to see full-size image

3.8) This is a one-storey building.

True False Undecided

3.9) The width of the stair is 0.6 m.

True False Undecided

3.10) Information about the height of rooms is provided by this drawing.

True False Undecided

3.11) The stairs are going up to the next floor.

True False Undecided

3.12) There are EIGHT doors in this drawing.

True False Undecided

3.13) If you walk out from the bedroom, you can walk straight to the bathroom.

True False Undecided

3.14) There is a window in the hallway.

True ◯ False ◯ Undecided ◯

Part 4: According to above drawings, if you were to use just one of the above drawings to explain the building, which one would you use? Because...

Plan A ◯ Plan B ◯ Plan C ◯ Plan D ◯

... because:

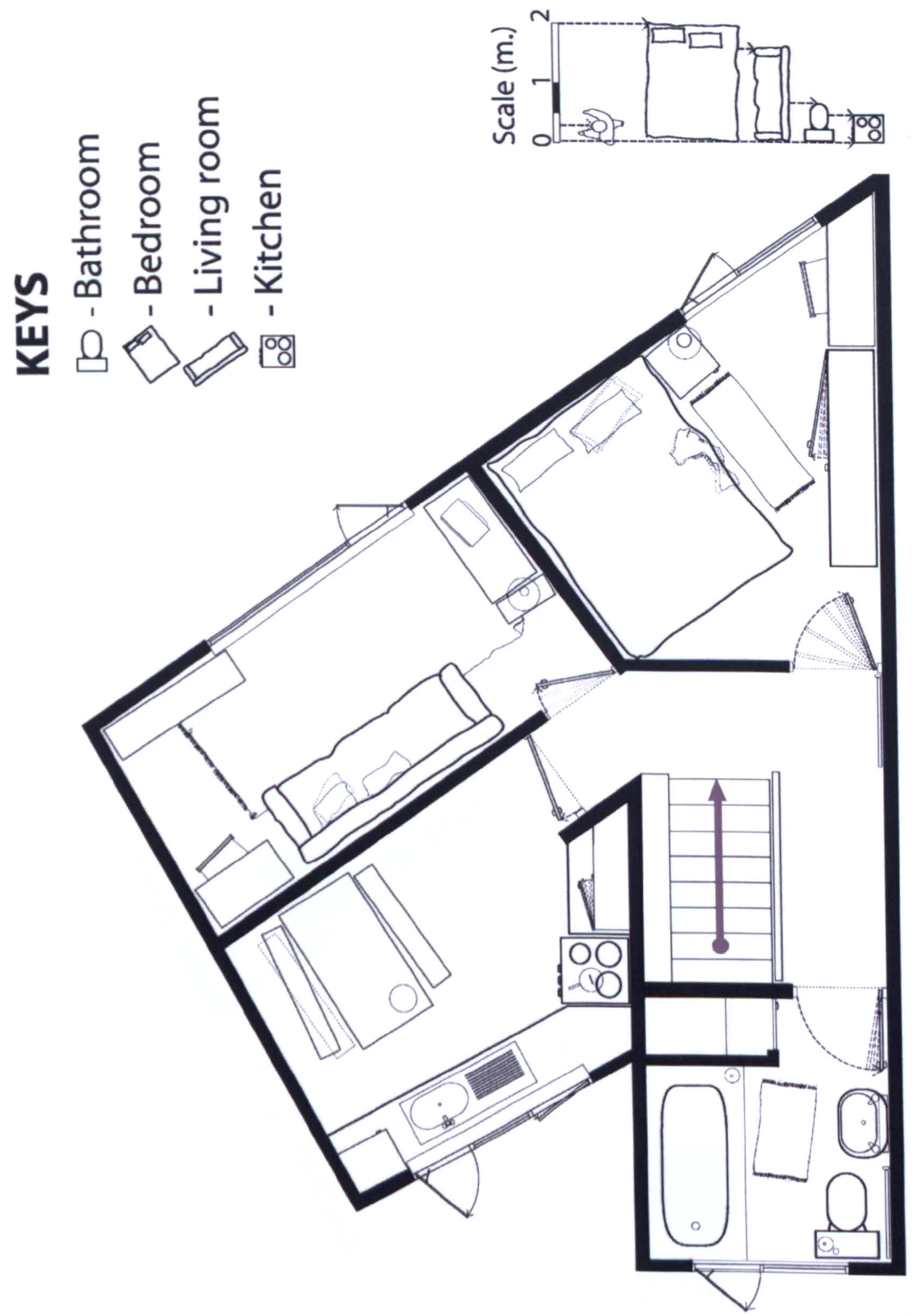
THANK YOU VERY MUCH FOR COMPLETING THE QUESTIONNAIRE

Please **PRESS SUBMIT** button below

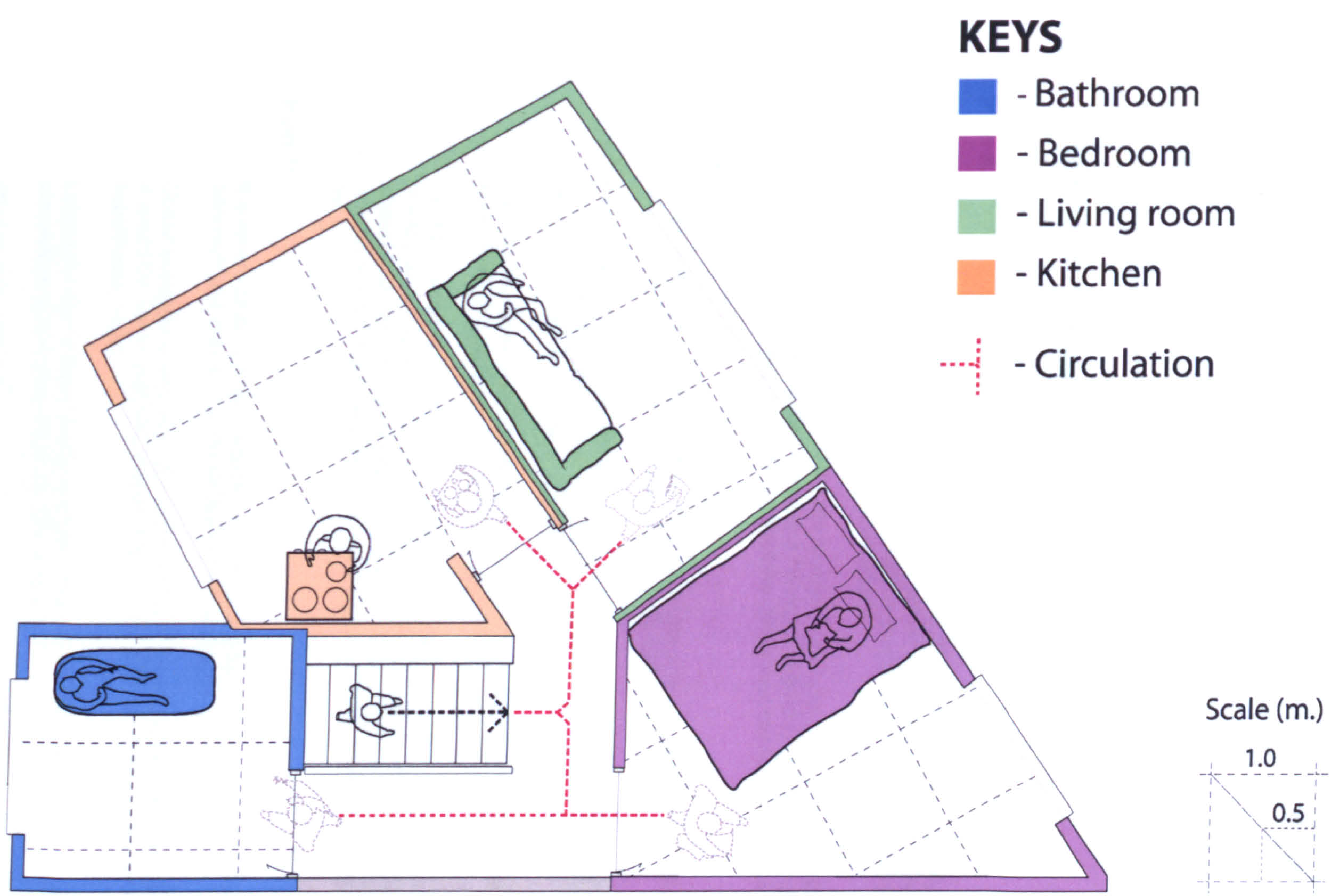
Submit

Figure H.1: Introduction page of 'Draw the Line Questionnaire 2' as it appears on the internet

Appendix I | Communicative Drawings used in 'Draw the line questionnaire 2'



Plan B 1


KEYS
- Bathroom
- Bedroom
- Living room
- Kitchen
- Circulation
Scale (m.)
1.0
0.5

Plan D

Appendix J | Qualitative feedback - Draw the Line Questionnaire 2

The feedback is summarised from 'part two' (Q2.5 and 2.6-plan A, Q2.11 and 2.12-plan B1, and Q2.17 and 2.18-plan D) and 'part four' of 'Draw the Line Questionnaire 2', presented in the following tables according to three different groups of respondents: lay people, first year, and diploma architectural students.

Lay people

Part two

Question: What do you like about this drawing?

Plan A

- Lay people agreed that, by using a simple lines, plan A looks clean and uncluttered. It is easy to indicate layout, shape, and size of rooms (in relation to other rooms). It is simple and easy to see at a glance what each room's purpose is, as well as the general layout of the building. It gives an impression of space.
- One respondents says **"It allows me to decide on how I would use each room i.e. layout of furniture etc. But it needs a fair imagination to get a feel for the size of the room."** It is plan, clear, and suggestive; rather than dictates space use.

Plan B1

- It was claimed by lay people that **"Plan B1 gives a much clearer idea of use of rooms and the scale; i.e. it can fit a double bed into bedroom."**
- It has a better indication with the use of keys. At a glance the audience can see what room is used for what purpose and what scale it is on. One of them says **"The drawing becomes a house not just a drawing."**
- It is easy to visualise the placement of objects, and relative sizes. Nice sub-plan for scale. Perhaps slightly quicker to determine which room is which.
- Lay people claimed that it is able to get a very clear and rapid impression of how the building would be like when furnished. Moreover, the scales and sizes are given which is a good selling point and actually show the size of the building. The use of scaled representations of furniture gives a good indication of how much space there will actually be.

Plan D

- It is clean, clear, and the easiest to understand, claimed by lay people. It is visually attractive and striking. It is simple and self explanatory.
- Colour coding is a nice idea. The use of colours to demarcating different rooms is useful. It would be more helpful in a bigger diagram. By this, it displays necessary rather than superfluous detail.
- Laypeople say **"Colour brings it to life - figures and furniture show scale - circulation grid shows what it's like to live in."**
- **"Colours separate boundary of each room - helps me to visualise them. I like the walking people. I like the use of some household objects but not too many. Stairs are clearly stairs. I can understand the up arrow on the stairs now."**
- Colours draw the eye to the appropriate area and furniture does not make the space seem cluttered.

- It is simpler than plan B, but still displays adequate information. It is less cluttered than Plan B, but still gives a clear idea of what furniture you can fit into a room. The use of man walking is good to show movement between rooms. Lay people claimed that **having human figures in it makes comprehension of the space much more readily accessible.** Dotted scale on floor is useful, while grid lines make approximate sizing possible and show room shapes well.

- Moreover, it is a good plan, takes human element into account with movement arrows. It is not too suggestive on furniture layout - but gives enough for an idea. There are descriptions on the room without using word labels, it is useful for people who cannot read or unable to interpret the Keys.

Question: What do you dislike about this drawing?

Plan A

- Lay people claimed **"It looks cold and 'unfriendly' looking. It is a very cold feeling about design for future use."**

- It is too simplistic and unattractive, which is not very informative. There was no scale or indication on how furniture and fittings would fit into each room. One of lay people complained that he has to keep looking at key to remind himself on each room's usage. Most of them did not realise that the stairs were stairs.

- They did not understand stair direction, scale, or how the stairs are drawn. As they say **"The way the stairs are represented, such that you don't know whether they go up to the flat, or down to it. Lack of a sense of scale."** They did not understand what cross section line is, and also the symbols/arrows at the two windows. They suggested that a bit more detail would be helpful.

- It has no real information. Thus people who are not used to technical drawings could find it hard to interpret and to visualise as a building. One claimed that he cannot tell whether his double bed would fit in the bedroom. Rooms need labelling with words not letters

Plan B1

- It is claimed by lay people as too complex and messy. It contains too much detail and a bit cluttered. Reading key is redundant, while the pictograms make them feel patronised.

- One says **"It would put me off buying the apartment because it makes the apartment seem smaller."**

- **"If it was on a house brochure, I would not view the property."**

- It is difficult at first glance to see which room is which, and the key to scale is a little patronising. The scaled representations of furniture also make the plan look cluttered. It has too much unnecessary subjective detail, such as door detail, which is too complex.

- Lay people claimed that it is actually able to see what rooms are without frequently referring to key. It is a bit fussy and takes a minute to recognise shapes. They suggested that it should be coloured (like plan D), rather than black and white, in order to emphasise areas.

- They suggested **"This type of drawing can be misleading if you want to use the space in different ways from an architect. Also depends on what stage you are viewing plans. It is easy to get bogged down with detail such as where the cooker should go, which is not important for example for a planning application."** It needs prior knowledge to understand that the arrow and lines represent stairs.

- It does not look professional from a structural stand-point. It is more of an interior designer's idea. It is too busy which distracts from gaining a perspective if size and layout. It takes a lot longer than plan A to understand. It is messy and just one person's idea. It does not relate to my furniture still doesn't make reference to any other part of the building or relationship to outside.

- The furniture layout is making assumptions about how I will use the space. It is for me to decide on space use, as it is displayed the flat looks very small, cramped with poorly designed furnishing. The actual scale bar is unattractive and complex to look at, while it serves the purpose it does not give an immediate visual impact. The pictures of the furniture are not simple to understand, it would be better just to have a box called bed. Although it is clear it takes a while to think about it.

- The symbol for doors and windows makes it more difficult to get a quick overview of the place. I also dislike the key symbols for the rooms. It does not provide you with an immediate picture of what is where. It takes more time to grasp the whole picture as one tends to look at the details rather than the bigger picture. It is not a matter of like and dislike each picture serves a different purpose. The purpose this picture serves best is showing the available space in the rooms once furnished.

Plan D

- Plan D, claimed by lay people, gives a misleading impression of space by omitting some furniture. It lacks of details and more furniture. It is slightly too stylised - since only representative items of furniture are included, it is still difficult to imagine how it would work fully furnished. Arty and designed furniture gives an impression of what each room is used for, but provides nothing to indicate potential issues with living in the building. They asked whether the colour scheme or the pictures of people necessary. Some of them thought that the colour codes and the figures of people are unnecessary and distracted. They are not helpful and take away from looking at the space of the room. They do not feel the people characters add much value and seem confusing.

- One says **"Colours are not to my taste!" "The gridlines and colours make me feel dizzy and queasy when I concentrate on them."**

- One claimed that it is patronising style. It does not make reference to any other part of the building or relationship to outside. They do not want lines suggesting movement from room to room, as they claimed that they could work that out. The rooms should be labelled and have a key. Stairs need labelling. The direction the door opens is needs to be more explicit. The scale is unclear. This sounds really critical but I do like this plan.

- Others claimed **"It is not a strong point, but I would not personally feel the need for having any furniture in the drawing. It may be good to suggest the usage of the rooms, but it can make it harder to play around with ones own ideas."**

- **"Although it is clearer to visualize movement within the build. I found the colour coding too busy. The black and white plan was easier on the eye."**

- **"I do not see the need for the people in the drawings. The scale of the drawing can be worked out and I like the squaring but would still like to see the lengths of the outer walls."**

- **"I prefer the one with furniture in because can see how it would be like to live in it and what might fit in better (assume too pretty - not very professional (but my 13-year-old daughter thinks there's nothing wrong with it!)."**

Part Four

<u>Question</u>: If you were to use just one of the drawings to explain the building, which one would you use? Because...

Plan A

- Lay people choose plan A because it is simpler then others. However, one claimed, it depends on who you were explaining the building to. If you were trying to sell it, I think Plan A would be better as it gives the buyer space to use there imagination as to what furniture and where they could have. It leaves more scope for personal style, use, and design. It allows for imagination and does not limit discussion on how to use the space.

Plan B1

- Plan B1 was selected because it is informative. It shows use as well as dimensions of the apartment although it is not as immediately clear other plans (e.g. plan D), but it contains the most information. It offers information to allow you to picture yourself in the room; however, colour would be a useful additional option. This plan is the easiest to visualise the size of the rooms and their intended purpose, even though it looks a little 'messy'. It is similar to plan A (which I like if it has a scale), but it just provides a bit more information. The combination of A and B or of B and D should work well.

- One claimed that **"You get a sense of what it would actually be like to put things in the room without having to measure your stuff, and it makes it seem more real. It gives you more information and a better idea of what can be achieved in each room. Also it gives you a better scale as you can see what happens to a room in terms of space and access when you add fixtures and fittings."**

Plan C

- It is three dimensional and some thought that it is the clearest plan drawing. It is simple, to the point, and easy to understand. It clearly shows which room is which without having to consult keys, furniture or colour codes.

- One say, **"I did find that none of the diagrams showed what it would be like to live in the building in any sort personal sense." "I can understand things better in 3D"**

- It gives a good feeling of how it would be to move around the flat, position of walls and light from windows. It doesn't give that much info on how furniture could be placed though. It gives a better sense of space, if we are assuming that the images are representations of paper plans. However, one suggested, the mix of plan C and D could be very informative, particularly if certain items could be turned on and off (colour figures etc.). It is easier to see the room sizes in relation to each other, however this used in conjunction with plan D may be the most effective. It's easier to visualise the height and actual size of the rooms because it is three-dimensional. It gives much more relevant detail, I prefer it 100%!

- It clearly shows the dimensions of the building. It looks more like a real building, and displays more of a feel to each room, also covering the scale of the whole floor.

Plan D

- Most lay people selected plan D because it is the most informative. It is easy to understand **(less mathematic)** without any technical knowledge of it's clarity and provides all the necessary information without too much detail (less cluttered)

- One claimed, **"It was the one I found simplest and quickest to understand. Visually simple, but interesting."**

- It has the best balance of information and there is no ambiguity about any aspects of the drawing. It gives more detail about the overall impression and scale, which is very easy to work out. Some claimed that this plan is simple and human. It is User friendly and eye catching. **It is the easiest at-a-glance plan to understand. It is actually comfortable to look at and think about.** Most lay people think (outside of their personal preference) that it is easily the best one for use for lay persons. It has just enough information to make a judgement on it.

- Colour is easier on the eyes. It is not full of too much information on how to use the rooms. The use of colours separates each room and the grid on the floor makes it easy to visualize the actual space. Colour works very well and clarifies the problems of the previous plan. It conveys most of the key information in a manner that is readily understood but not overly simplistic.

- It shows all relevant details and holds the eye with the colour. It is the quickest to interpret. One claimed that he would spend more time looking into it and it appeals to him. It brings the house to life as a living space and so describes it much better. The figures of people add a good sense of scale. It gives you a little bit more info than a traditional drawing but not so much as to confuse or clutter. It is an easier diagram to follow. It is less appearance of a technical drawing and more of an information drawing about the space.

- They claimed **"The diagram is very easy to understand. The grid on the floor provides scale, the room usage is clearly suggested, without being too regimented and overly stuffed full of furniture to indicate use. Less is more!"**

- **"This plan allows the viewer to create a mental picture of the location more easily. As a lay person, it makes sense to me."**

- **"I think this would be the one which most visually easily expressed the use of the building with clear information. It is also attractive, so would be persuasive. However, I would also want to see an elevation to give me context for how it fit in." "The 'building' plan A it is simple. The 'lived building' plan D because it has a human face."**

First year architectural students

Part two

Question: What do you like about this drawing?

Plan A

- **It is more like an architectural plan. It is** clean, simple, and easy to understand where the structure is very little visual confusion. It allows you to see proportion, without complicated detail. Each room is clearly laid out and so the plan is easy to follow. It clearly indicates where windows and doors are.

Plan B1

- **This drawing is descriptive style and self-explanatory.** It gives a sense of what it would be like to be inside. It shows that the furnishings and internal layout has been thought about as much as the concrete elements. There is furniture provided, which strongly offers sense of scale and represents the use of the space well. The way that scale is indicated with a visual aid shows how people can live in the space. It has immediately recognisable symbols, as well as the good use of different line weights.

Plan D

- **It is vivid and very easy to understand.** Colour coded explains use of building and makes it easy to see which room is which on the key. It is quick to interpret. The route of the people as well as human figure, they are all informative. **The human figures to give sense of what it is like to be there more than other drawings.** Particularly, the figures carrying out relevant activities makes it seem more real. Moreover, this gives the sense of the scale of the space. It shows how spaces interact with one another and how user may move around.

- One claimed **"I like how circulation has been included and how furniture has been added to suggest what the room would be used for."**

Question: What do you dislike about this drawing?

Plan A

- **Other than telling you about which room is which and where the walls are this plan tells you very little.** It tells nothing of the space. It lacks of information and dimension, You cannot really imagine what the space will be like. It makes a little sense as a house; only communicates walls and doors, nothing about feeling, uses/practicality. It is not very exciting, a bit bland and uninteresting. It is difficult to imagine as a 3D space to live.

Plan B1

- First year students claim **"we are very much restricted by the architects choice or configuration of the furniture etc."**

- **"Adding plan furniture makes the design look complicated and distracts from the construction purpose of the plan."**

- It is too cluttered and is not very easy to read. Although it looks innovative but it is quite busy, and this reduces clarity. This is mainly due to the use of wavy lines against straight lines. It gives visual confusion, at a glance, which takes time to understand. It looks a bit boring and hidebound. It has odd scale and some of the symbols are relatively ambiguous, which are not easy to understand. There is no colour and no explanation of different levels. Windows and doors look ambiguous.

Plan D

- The drawing is deceitful. Colours grate a little visually. Circulation paths seem a little over explicit of a relatively obvious flow through the building. Some furniture could have been included. It feels somewhat loose and undecided.
- One claimed **"Although describes how one moves between the spaces and is an improvement (is some fashions) from the above, one is next prompted to ask why and how this movement is influenced by the space. Thus, the design and drawing simply lead to more questions that need to be answered."**
- **"I thing it would be better if the floor was coloured in order to indicate the use of space, rather than the walls."**
- **"It looks less technical and so less 'official' than an ordinary architectural drawing."**
- It is not descriptive enough. It could be more 3D.

Part Four

<u>Question</u>: If you were to use just one of the drawings to explain the building, which one would you use? Because...

Plan A

- It is simple and easy to understand.

Plan B1

- One claimed **"Having seen the other plans and seen how movement in the building would be, I would use B1 because all furniture is incorporated and thus it is easy to picture the room."**
- It gives you a realistic feel and scale of the building and you can tell where the windows and the doors are. It is the most dynamic and engaging and encourages you to think about how the building is used.

Plan C

- It clearly shows which way the staircase is going with no confusion, unlike the other three. This plan combines the qualities of an architectural plan and 3D-section, so it allows the greatest understanding of the building and provides the most valid information.

Plan D

- It may not necessarily clearest, but communicates most without confusing. It has balance of information and clarity. Room use, scale, structure, and circulation are all easy to comprehend. The element of humanity in gives enough information for the students to understand.
- **It is the most self-explanatory.** It is more attractive and its information provided is just enough. It is the clearest, most descriptive, and helpful. It gives better information about the scale of spaces because of the human figures used and also it makes more sense about the use of spaces because of the colour.
- One claimed **"Although there are aspects which one has highlighted as conspicuous in their absence, one feels this model is more useful in explaining**

this scheme because of the fact that it shows (on a basic level) how one will act and react to the fundamental physical environment within this building."

- It clearly shows which room is which, rough sizes of rooms and how items would fit within them, give a little information about how items could be laid out in each room but allows the client to make up their own mind about final layout. It is the most simple and shows clearly what is happening.

Diploma architectural students

Part two

Question: What do you like about this drawing?

Plan A

- Simplicity and quick to read. It is easy to follow. The size of the spaces in relation to each other can be seen very easily. Furniture arrangements are up to the individual.

Plan B1

- The drawing can be understood without having to use the key. It has instant idea of scale and more detail on use once the furnishings are recognised. The use of furniture gives better sense of scale and inhabitation. Furniture and fittings are shown to great detail showing how the rooms could be occupied. It has personal scale of objects.

Plan D

- It is honest about being diagrammatical. It is very easy to understand and more visually appealing, as each room can be easily identified through the colours. The use of colour-coding, key items of furniture, people, and dotted lines gives clarity for ease of understanding. Colour coded is easy to read quickly. A simple furniture diagram allows you to see usage at a glance. Rooms instantly recognisable, circulation apparent - implies the thought that has gone into the building and therefore how it might be used.

Question: What do you dislike about this drawing?

Plan A

- It is uninformative. It is only by using the key that you are able to understand what the spaces are supposed to be used for. It lacks of scale and relevant details. It is dull and uninteresting. There is no life to it, no idea of what the building is really like. They claimed that they have to refer to the key for room types.

- It contains no indication of how the spaces are to be inhabited or their character. One claimed **"There is no scale, except if you assume door sizes and stair width which can be related back to the human body."**

- **"It is not possible to know if it describes what it is like to live in the**
- **building."**

- It gives no idea of atmosphere or quality of space. It is empty. The space on the drawing has not been used to its full advantage; a single letter in each room is a waste.

Plan B1

- Some of the elements of furniture and decoration are not necessary and lead to some confusion over amounts of space. Some of them did not like the way doors are drawn.
- The plan is cluttered, which is not what it may be like in reality. It is unclear, due to too much information and messy lines. The key and scale are difficult to interpret
- One suggested **"There is no need to use a key as the addition of furniture makes the use of each room self evident. The key only clutters the drawing. The scale alone would be sufficient without the various objects drawn underneath. It is not necessary to put so many items in the rooms."**

Plan D

- It lacks of technical/structural information and the colouring splits walls in odd way.
- The people are pathetic. It could do without the people. The grid overlaid onto it seems unnecessary. It is a bit meaningless in terms of the experience of the building.

- They asked **"Is there a risk of it implying that the activities/furnishings selected for each room are the only ones there?"**

- Colour coding is for the simple-minded. It shows nothing about character, textures, colours, materiality or other architectural qualities such as light and shadow or three dimensional volumes. Colours although helpful actually add yet another layer of information that you have to take in.

Part Four

Question: If you were to use just one of the drawings to explain the building, which one would you use? Because...

Plan A

- It is clear.

Plan B1

- It gives the most information. A lot of information is contained in a one drawing. You can see roughly where the kitchen sink, fixed bathroom furniture, etc. can be located and therefore what other space there would be.

Plan C

- It shows plan and three-dimensional image. It explains the set-up of the apartment clearer. It is a lot easier to understand.

Plan D

- **Clarity. Minimum amount of furniture helps judge scale and size of room when occupied.** It conveys the most information in the most easy to understand manner. **It explains the basic plan, scale and circulation of the building and also individual room functions best.** It is less prescriptive but at the same time being more descriptive.
- One claimed **"I would find it easiest to explain simply but it has enough depth to make assumptions or conjecture about how the building might be used."**
- **"To a normal person, it's clear and easy to understand at a glance. If it were to someone in construction industry then 'plan A'"**
- It is legible to scale. It is the best presented graphically. It gives some idea of inhabitation and use whilst not being too cluttered.

Appendix K | Existing communicative plans

This section briefly surveys existing communicative drawings, particularly plans, which have already been used by/for lay people. For example, art gallery plan, shopping mall plan, or domestic pattern books. This is to demonstrate an awareness and some critique of these existing communicative plans.

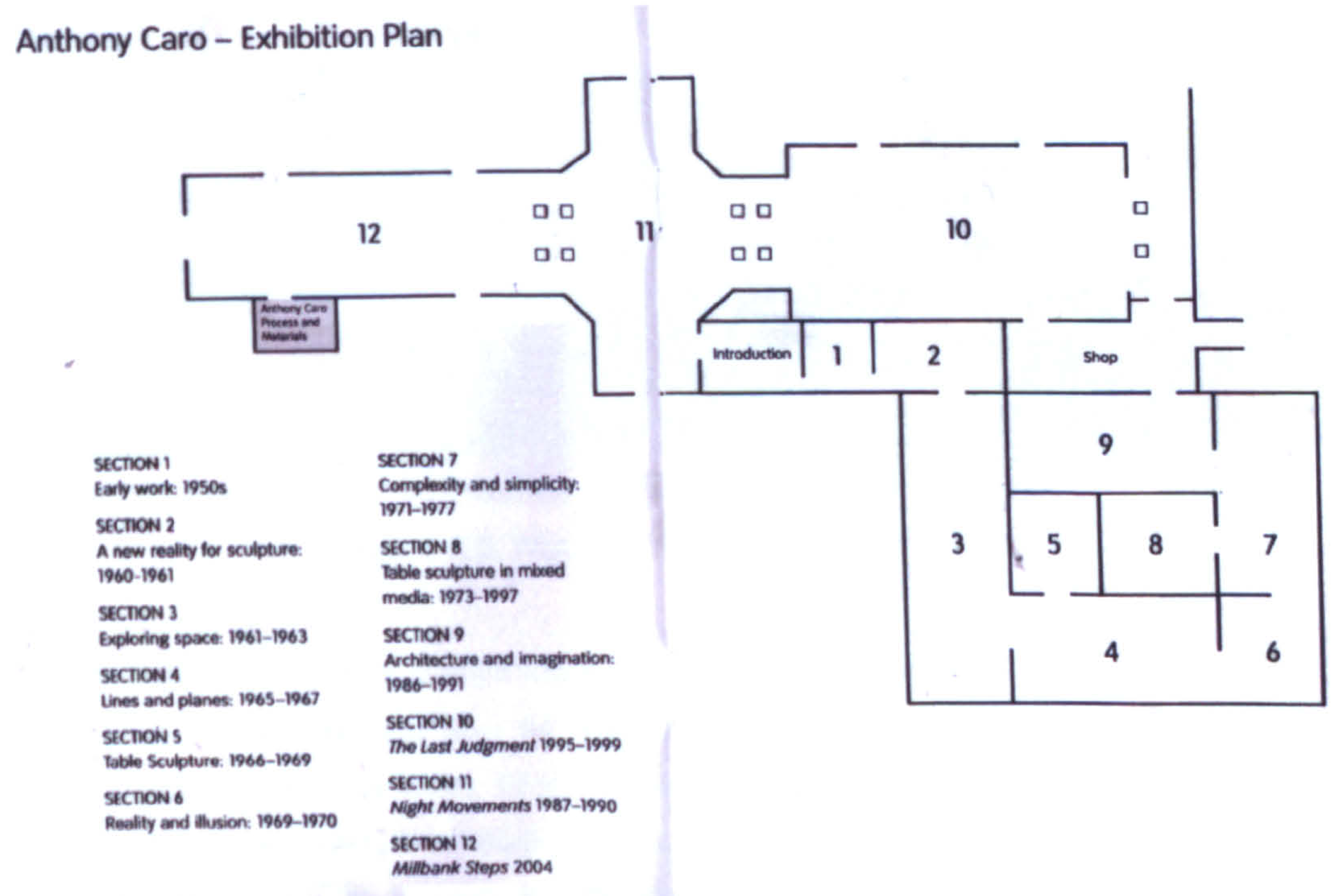


Figure K.1: Plan of Anthony Caro's exhibition at Tate Britain.

The first example is Anthony Caro's exhibition plan held at Tate Britain. This plan is minimised to the least elements in order to clearly show the viewers' circulation and walking direction. Reading keys and numbers are used in order to indicate function and location of rooms. As we shall see, this plan's characteristic and its method of codification are similar to the architectural plan drawing, but the fact that it is economised by sufficiently conveying only relevant information within a single image (as suggested by Bertin's (1983) rule for a graphic system) allows legibility and provides clear and comprehensible information for everyone to understand.

However, by comparing with the communicative plan D, this exhibition plan does not provide information on scale and sense/experience of space. This can be related to one character of maps, mentioned in Chapter Seven, that the viewers can gain direct information (where is A or B) but it lacks of information on the experience of space (what is it like to be in A or B).

Figure K.2: Map of Meadowhall Shopping Mall

The map above briefly shows location and direction of shops in the shopping mall. The map indicates what is in the plan and how far from one shop to another. It does not represent specific architectural conditions such as walls, floors, windows, but instead certain information that attracts the visitors at first glance. However, the limitation of this map is that it cannot be read and understood without visiting the shopping mall. This is relatively different from the communicative drawings drawn within this research, which suggests and conveys information of how to live in the building rather than only showing what is in the plan.

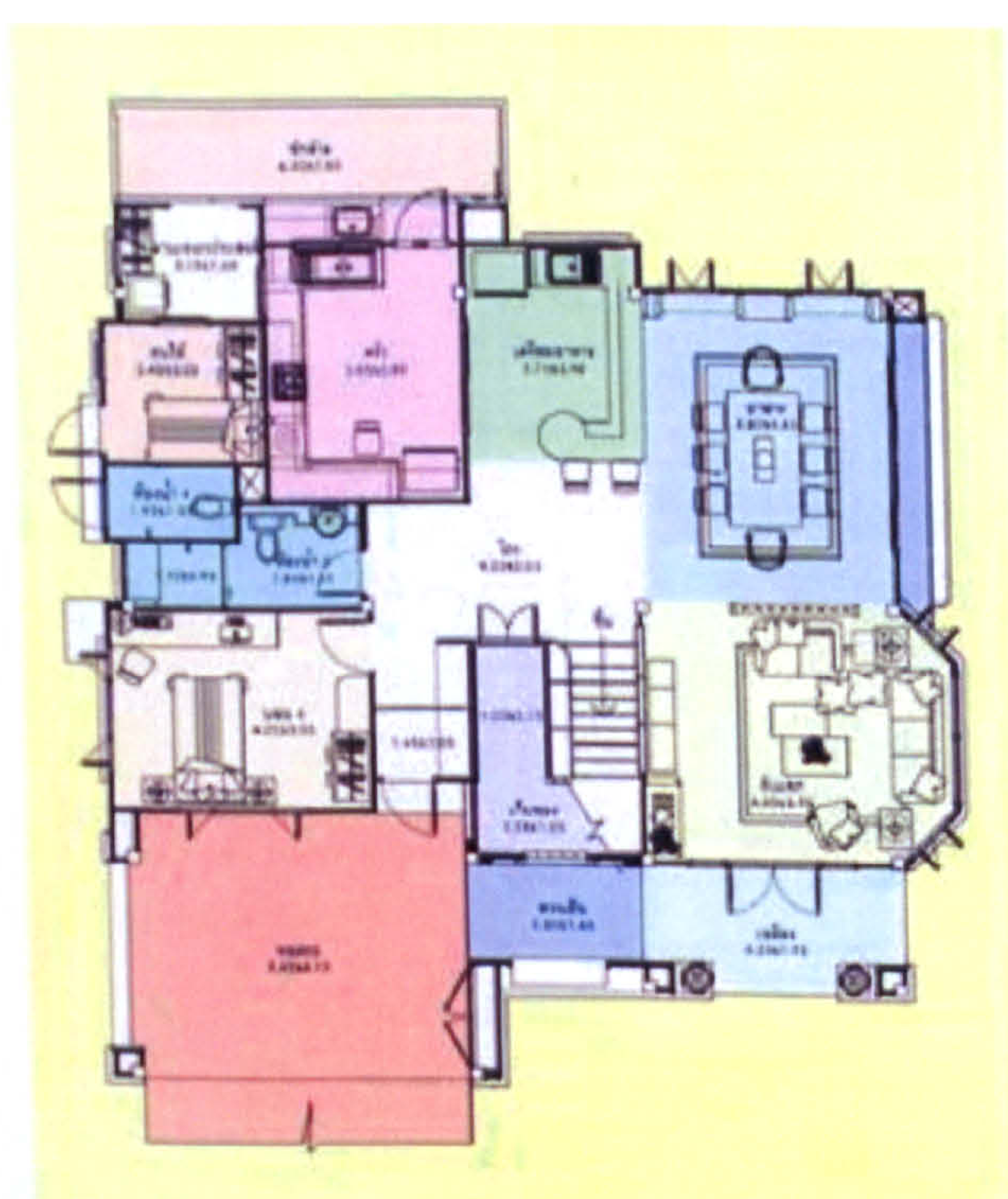


Figure K.3: Ground floor plan of two storey house

The ground floor plan shown in Figure K.3 is drawn for the clients who want to buy this house in Bangkok, Thailand. As can be noticed, it contains most of essential aspects which are suggested by this research as a communicative drawing, e.g. colour, furniture, reading keys. However, there are still architectural codes included which some may find a little difficult to read and understand, as well as there is no scale indication which relates to the human body.

Therefore, regarding examples of existing communicative plans, the use of these plans depends on the intention of the creator and the circumstance in conveying information. As we shall see, they concern and focus on a different approach from the communicative plan D and B1 drawn within this research. The communicative plan D and B1 aim to represent experience of or events in the possible building, while examples of existing communicative drawings shown here are briefly informed and concern the viewers' expression at first glance rather than provide clear information. Hence, the matter of making the communicative plan depends on who is it for or which stage of the design process should it be used. One drawing cannot be used at all stages of the design process or represent all aspects of a building. The most important aspect is awareness by the creators (architects), as I suggested earlier, towards the reader of the drawing and user of the building. This would improve communication and leads the relationship between architects and the public through the use of architectural drawing better.

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