Mixing Specific and More Universal Design Media to Deal with Multidisciplinarity

By Karel Vandenhende[*]

In this paper, we investigate which strategies designers use to be able to deal with multidisciplinarity in architecture, and by which media designers communicate in this changed conditions. From a literature review, we learn that designers have to use an unpredictable, often long and iterative process in which the cycle of concept, testing, evaluation and conclusion is repeated until a satisfactory solution has been formulated.[1] This turns the design process in an almost endless sequence of models, drawings, texts, images, samples, mock-ups, renderings and other media. And at the same time, designers have to be able to check if all these different investigations match with each other. On the one hand, designers seem to use all kinds of different and distinct media and many different forms of representation to investigate the wide variety of constraints. And on the other, they synthesise all these investigations with diagrams and schemes that bring together all the separate design investigations, and make it possible to match the results from the distinct disciplines. In architecture today, designers seem to combine specific representations, or jargon, together with more universal standard media, at the same time integrating the peculiar and the general.

Introduction

Recently, architecture seems to be marked by boundlessly crossovers. Today, new types of programs, new technologies, new contexts and new criteria all come together in a single project.

By reviewing research and publications about the design process and about design media, we investigate which strategies designers use to be able to deal with multidisciplinarity in architecture. And more specifically, which design media do they use during the design process. We will see that we can identify two types of media: on the one hand, designers seem to use all kinds of different and specific representations and many different forms of representation to investigate the wide variety of constraints. And on the other, they synthesise all these investigations with more universally understandable diagrams and schemes that bring together all the separate design investigations, and make it possible to match the results from the distinct disciplines.

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[*]Professor, KULeuven, Belgium.

1. Hilde Heynen, Smets Marcel and Shannon Kelly, *Research by Design in Architecture and Urbanism* (Leuven, 2010).

We used this dichotomy to redefine an assignment as a project in phases, to help architectural design students to know what to do and when. To know what design document to make on which moment.

Literature Review

Design Problems: A Multitude of Requirements

Architectural design is a form of problem solving in which designers have to deal with many requirements. Ranging from constraints concerning the distribution of towns to constraints concerning the distribution of light fixtures.[2] In the case of the design of an Indian Village, Christopher Alexander[3] stated that he worked with up to 140 requirements. Indeed, architecture deals not only with solids, but also with voids.[4] Not only with qualities, like characteristics, composition and poetry, but also with quantities like dimensions, configurations and rational logics.[5]

Not only with the house, but also with details; its rooms and even its furniture, and also with its context; its neighbourhood and the city.[6] Or in other words, there are not only the programmatic requirements concerning the quantities of spaces on the one hand, and the qualities of the corresponded places on the other. There are also requirements concerning the materialisation; the qualities of what we can call 'objects' and the quantities of their corresponded masses. And finally, on each scale, there are also requirements concerning context and detail.

This multitude of requirements makes designing and design research complex, and it makes educating students how to design not an easy job. How do designers manage to deal with all these constraints?

The Design Process as an Iterative Process: A Cycle of Divergence and Convergence

Concepts are the underlying ideas and theories that inform the design process. These emerge from a combination of research, analysis, and intuition. Designers may start with a general idea and then refine it through a process of iteration and experimentation. Unless the design proves completely successful, as Lawson[7] formulates it, one of two things happens to halt this evolutionary phase. Either the solution reveals itself not good enough to meet several requirements, or so many modifications need to be made that the idea behind the solution is lost and abandoned. In either case, the designer is likely to choose the revolutionary step of starting a new investigation.

2. Christopher Alexander, *A Pattern Language* (New York: Oxford University Press, 1977).
3. John Chris, Jones, *Design Methods* (New York: John Wiley & Sons, 1992).
4. Francis D. K. Ching, *Architecture: Form Space and Order* (New York, 1979).
5. Brian, Lawson, *Design in Mind* (Reed: Oxford: The Architectural Press, 1997).
6. Eliel Saarinen, *Time Magazine* (2 July 1956).
7. Lawson, *How Designers Think* (Oxford: The Architectural Press, 1980).

The significance of producing multiple options or alternatives cannot be overstated. According to Marples,[8] the nature of the problem can only be found by examining it through proposed solutions, and it seems likely that its examination through just one proposal leads to a very biased view. It is likely that attempting at least two vastly different answers is necessary to gain a complete understanding of the problem's actual essence by comparing smaller parts of the problem.

More recently, Nigel Cross[9] has confirmed that designers seem reluctant to abandon early concepts, and to generate a wide range of alternatives. While designers' primary focus should be to find a solution to the design problem, it can be advantageous to examine several concept solutions during the process. This multi-solution method can lead to a more thorough evaluation and comprehension of the problem. Or as Heylighen[10] puts it; "the ill-defined nature of a design problem appears to necessitate the generation of alternatives to explore and understand its full complexity". As stated by Lawson,[11] it may be more advantageous for designers to apply divergent thinking liberally rather than being too restrictive with it. Most people find it easier to think in a convergent manner when required. In fact, reason is more easily managed than imagination, and the outputs of imaginative thinking can easily be examined rationally later.

Designing is thus an iterative process in which the cycle of concept, test, evaluation and conclusion is repeated until a satisfactory solution has been formulated.[12] Designers begin by creating an initial solution, then they assess that concept through drawings, models, or other media. Based on this assessment, they either modify their solution or create a new one. This is followed by another cycle of evaluation, and the development of further variations, and so on.

Leading to More Architectural Quality

When examining what contributes to quality in architectural design, the most effective solutions appear to be interconnected, encompassing multiple elements at once. High-quality designs are not simply a collection of separate solutions addressing individual constraints, but instead, they aim for concepts or solutions that span multiple constraints at the same time. These ideas are also known as integrated or composite solutions.

The concept of integration has been expressed in various ways by different authors in the past. According to Rasmussen,[13] a building's appearance is only one of several factors of importance. In a good building, the plans, sections, and elevations must be in harmony with each other. Architecture is viewed as an indivisible entity, something that cannot be separated into distinct parts.

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8. D. Marples, *The Decisions of Engineering Design* (London: Institute of Engineering Designers, 1960).

9. Nigel Cross, *Designerly Ways of Knowing* (Basel: Birkhäuser, 2007).

10. Ann Heylighen, "Less is More Original," *Design Studies* 28 (2007): 499-512.

11. Lawson, *How Designers Think*, 1980.

12. Heynen, Marcel and Kelly, *Research by Design in Architecture and Urbanism*, 2010.

13. Steen Eiler Rasmussen, *Experiencing Architecture* (Cambridge: MIT Press, 1959), 9-33.

Ideas encompassing multiple topics are also called integrated[14] or composite.[15] Zumthor[16] believes that architecture is at its most beautiful when everything is in harmony, when everything refers to everything else, and when removing a single element would destroy the entire structure. In this way, form is a reflection of the location, the location is unique, and the use reflects this and that. In quality architecture, form, construction, appearance, and function are no longer separate entities. They belong together and form a whole. Siza views design as a delicate balance of all the different aspects of the project, including social, functional, environmental, economic, and contextual issues.[17] And Kersten Geers from Office KGDVS states that internal consistency is the main criterion to distinguish good from bad architecture.[18]

Different Media

Today, during the design process, designers must strive to address a vast number of constraints simultaneously. Many of these constraints are so specific that they have to be evaluated using various media. For example, it can be challenging to compare the context of a building with the detail of a door handle or to align objective measurements (represented in technical drawings) with subjective experiences (conveyed through associative images).

On the one hand, designers seem to use all kinds of different and distinct media and many different forms of representation to investigate the wide variety of constraints. And on the other, they have to synthesise all these investigations with diagrams and schemes that bring together all the separate design investigations, and make it possible to match the results from the distinct disciplines.

Digital versus Analogue

When talking about design media in architectural education; the question whether we should focus on digital or analogue media easily pops up. But both have their advantages and disadvantages. Virtual media are efficient and easily adaptable. Analogue media incorporate tactility and express better the designer's chosen position. In fact, more important is to use the right model on the right moment in the design process.

Typical media for testing the quantities of a concept are objective, detailed, sharp, universal and measurable. Bottom-up drawings made with typical cad-software are excellent for this.

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14. Jones, *Design Methods*, 1992.
15. G. Goldschmidt and D. Tatsa, "How Good are Good Ideas? Correlates of Design Creativity," *Design Studies* 26, no. 6 (2005).
16. Peter Zumthor, *Atmospheres: Architectural Environments - Surrounding Objects* (Basel: Birkhauser, 2006).
17. Alvaro Siza, *Simplicity is Always Complex* (Abitare.com).
18. Kersten Geers, *Architecture as a Craft* (2011).

But for testing the qualities of a concept, like the characteristics of architectural objects and places, design media should be like the way you experience a building while visiting it. This means that media for testing qualities should be subjective, holistic (top-down), unfocused (faded), personal and associative (relative). Like hand drawn sketches and schemes, made with paint, or soft pens or crayons. The ambiguity in sketching also stimulates typical creative processes like "analogy", "mutation" and "combination". Sketches have the benefit of being open to interpretation at the start of the design process, but it is the combination of sketches and other media that leads to high-quality design outcomes. The thickness and "unsharpness" of sketching forces the designer to concentrate on the main lines of the design. While the exactness of hard pencils, fine pens or cad-software lets the designer focus on detailing. It's this combination of simplicity and complexity that makes a "work" comprehensible and exciting at the same time.

Mixing Media

While searching in a design process, designers quickly hop from one investigation to another. And at the same time from one medium to another, often on the same drawing. In a drawing of a first design, Le Corbusier[19] combined the three floor plans together with sketches that showed the interior and exterior of the villa (Figure 1).
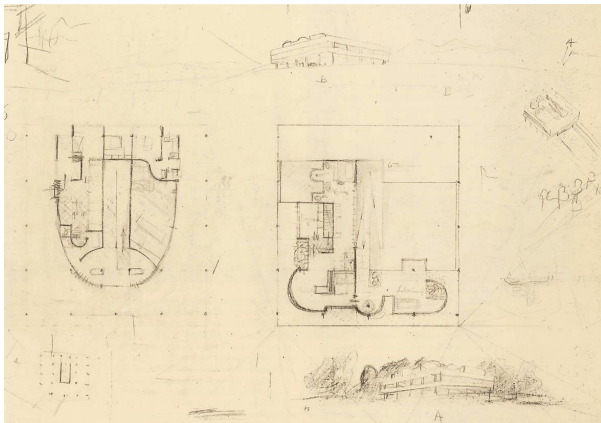

Figure 1. *Part of the Drawing of the First Design of Le Corbusier for the Villa Savoie in Poissy, Near Paris, September 1928 (FLC 19583 ©FLC-ADAGP)*

Many architects and theorists have discussed the use of multiple design media during the design process. Caruso believes that different forms of representation, such as overall concepts, perspective views, and solutions for details, can help to

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19. Karel Vandenhende, "The Innovation Paradox: Starting from what is 'Known' to Facilitate the Discovery of the 'Unknown'," in *Conference Proceedings EPDE2013* (2013).

make the diversity of constraints more apparent.[20] Lawson[21] agrees that design drawings in architectural practices often incorporate multiple media, with 2D plans and sections appearing alongside sketches and diagrammatic marks on the same piece of paper. Neutelings[22] also recognizes the importance of various modes of representation in the design process and believes that the skill required to design is closely linked to the different media available. Different forms of representation are used for specific aspects of the design process, such as using thick felt pens for organizational charts, relief models for facade studies, computer drawings for proportional measurements, and volumetric models for massing. Each medium has its own moment and logic in the design cycle. By repeatedly visualizing and testing the design using different media, the circumscriptions become narrower and by each time drawing and constructing an as yet unknown facet, the design becomes more exact and clear-cut. In the beginning there are only vague blurs behind a steamed-up window; in the end your imagination can even smell the beeswax on the parquet floor. The combination of text, images, sketches, and drafts can inspire new ideas and help architects to connect different pieces of information.[23] However, it can be challenging to create a single model that encompasses all aspects of a design, as different models and scales are needed to represent each aspect.[24]

According to Nollet,[25] a building starts with an idea and a drawing. Drawing in an environment. The drawing as a guide. Early and naive at first, later detailed and unambiguous. First we draw by hand resulting in an open vision.

As the project progresses, 'external' CAD drawing tools are used. In the design we use two-dimensional sketches and collages. The model serves as a three-dimensional test of what has been drawn. The detailing of the building is mapped out with precision, because on site the implementation details form the backbone of the construction file.

Mixing Specific and More Universal Design Media to Deal with Multidisciplinarity

Designers not only shift between analogue and digital, and between context and detail. They also shift between analysing and synthesising. Or in other words, between divergent and convergent thinking.

Typical media for analysis are specific and detailed. Typical media for synthesis are more general and more abstract.

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20. Adam Caruso, "Over Maquettes en Beelden," *Oase: "Models/Maquettes"* no. 84 (2011). 138-139.
21. Lawson, *Design in Mind*, 1997.
22. Willem-Jan Neutelings and Riedijk Michiel, *At Work* (Rotterdam: 010, 2005).
23. Heylighen, *Less is More Original*, 2007, 499-512.
24. Job Floris and Teerds Hans, *On Models and Images An Interview with Adam Caruso* (Oase, 84, 2011), 128.
25. Thomas Nollet, www.tomasnolletenhildehuyghe.be, 2015.

The drawing and the model are both important tools in architectural design, but they serve different purposes. The model is more detailed and helps with analysis and exploration of different design options, while the drawing is a simplified representation that shows what the designer intends to create. The sketch is a type of drawing that highlights only the most relevant aspects of the design, and can be used to convey the designer's vision. Both the drawing and the model have limitations, and the designer must use each one in the appropriate way to effectively communicate their ideas. The drawing, and particularly the sketch, shows what the designer is trying to do. The medium of drawing forces the designer to draw only what is truly relevant to the design. It depicts what the designer wants to make - a potential future that will in coming cases only be depicted on paper.[26]

A diagram, compresses a lot of information about a proposition or argument into a small space. It is a visual compression that illustrates the essential insight into a single picture, a single instant. It is a general and abstract medium ideal for testing the coherence between investigated constraints. Many people who might find it hard to read a complex analysis of a situation can grasp it quickly in a diagram, a picture in this case being worth a thousand words. Diagrams are inevitably reductive and simplistic.[27]

A "parti" refers to the primary concept or idea behind a building. It is usually depicted in a diagram that shows the overall floor plan organization and implies the building's design and aesthetic feel. The diagram can show aspects like the building's massing, entrance, interior circulation, spatial hierarchy, relationship to the site, core location, zoning between public and private spaces, solidity or transparency, and many other factors. The emphasis placed on each factor may vary depending on the specific project. The design process is the struggle to create a uniquely appropriate party for a project. Some will argue that an ideal parti is wholly inclusive - that it informs every aspect of a building from its overall configuration and structural system to the shape of the doorknobs. Others believe that a perfect parti is neither attainable nor desirable." Use your parti as a guidepost in designing the many aspects of a building. When designing a stair, window, column, roof, lobby, elevator core, or any other aspect of a building, always consider how its design can express and reinforce the essential idea of the building. The two critical components of floor plan organization are handling the distinction between solid and open spaces and addressing circulation. In the early stages of design, consider spaces such as bathrooms, storage areas, mechanical rooms, elevator shafts, and fire escapes to be solid. These core spaces are often grouped together or placed close to one another. Open spaces, on the other hand, refer to the main program areas of a building, such as lobbies, laboratories, worship spaces, exhibit galleries, reading rooms, assembly halls, gyms, living

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26. Michiel Riedijk, "Architecture, Drawing, Model and Position," in *Architecture as Craft*: *Sun* (2011).
27. David Graham Shane, "Urban Diagrams and Urban Modelling," in *The Diagrams of Architecture* (Chichester: Wiley, 2010), 80-87.

rooms, offices, manufacturing spaces, and others. Effective floor plan organization involves creating meaningful relationships between these core and program spaces. Additionally, the circulation system should connect the program spaces, stairs, and elevator lobbies in a logical and attractive manner. Circulation should not only be functional, but it should also provide an enjoyable experience for building users through pleasant surprises, beautiful views, cozy nooks, pleasing lighting changes, and other enjoyable elements.[28]

Methodology

This paper started with a literature review to understand the strategies that designers use to deal with multidisciplinarity in architecture and specifically, the types of design media that they use during the design process. We could identify two types of design media used by designers. Specific and diverse representations used to investigate a wide range of constraints and more universally understandable diagrams and schemes used to synthesize the separate design researches.

The dichotomy found in the first part will be used in the second part of the paper to redefine an architectural design assignment as a project in phases, with the aim of helping architectural design students understand the design process better. This would enable the students to know when to make different design documents and the specific moments when they are needed.

Case Study

In a specific case, and as an experiment, we redefined the assignment for the first year architecture students of one design studio in the first bachelor. The question to design a "townhouse" was divided up into different phases, alternating research with more detailed media like drawings and models on the one hand, with more abstract and general diagrams on the other. The purposes of the different new assignments and at the same time the resulting documents, do not concentrate on a designed house as a result, but they focus on different parts of the design process.

The project was organised in a rhythm of 3 design weeks, each of them consisting of 3 design afternoons. Students worked together in a studio, whereby almost every design afternoon, a tutor passed by to review their work, individually, or in group.

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28. Frederick Matthew, *101 Things I Learned in Architecture School* (MIT Press: Cambridge, 2007).

Week 1: Massing the Volume in its Site

The site is a left-over plot in the historic heart of Leuven. The students were asked to carry out volume studies in combination with possible functional organisations.

The assignment started with a site visit for taking photos, measuring the surrounding buildings and recording the wider environment. This was used to make an environmental model and an analysis. In the photo analysis students defined the characteristics of the place, strong and weak. These could then act as a personal source of inspiration for the design of the house. The environmental model could be used while designing to test possible volumes for the house (Figure 2).

On the one hand, students examined in models and drawings how the program could fit into the site. On the other hand, they try to clarify an associated concept with a simple diagram (Figure 3).
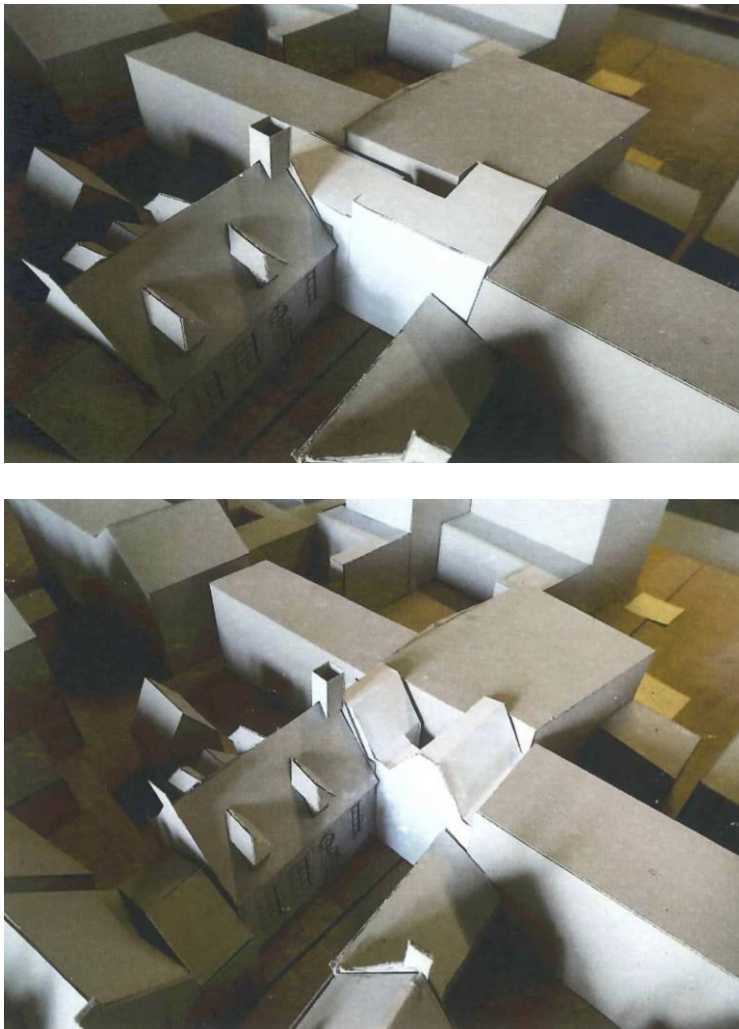
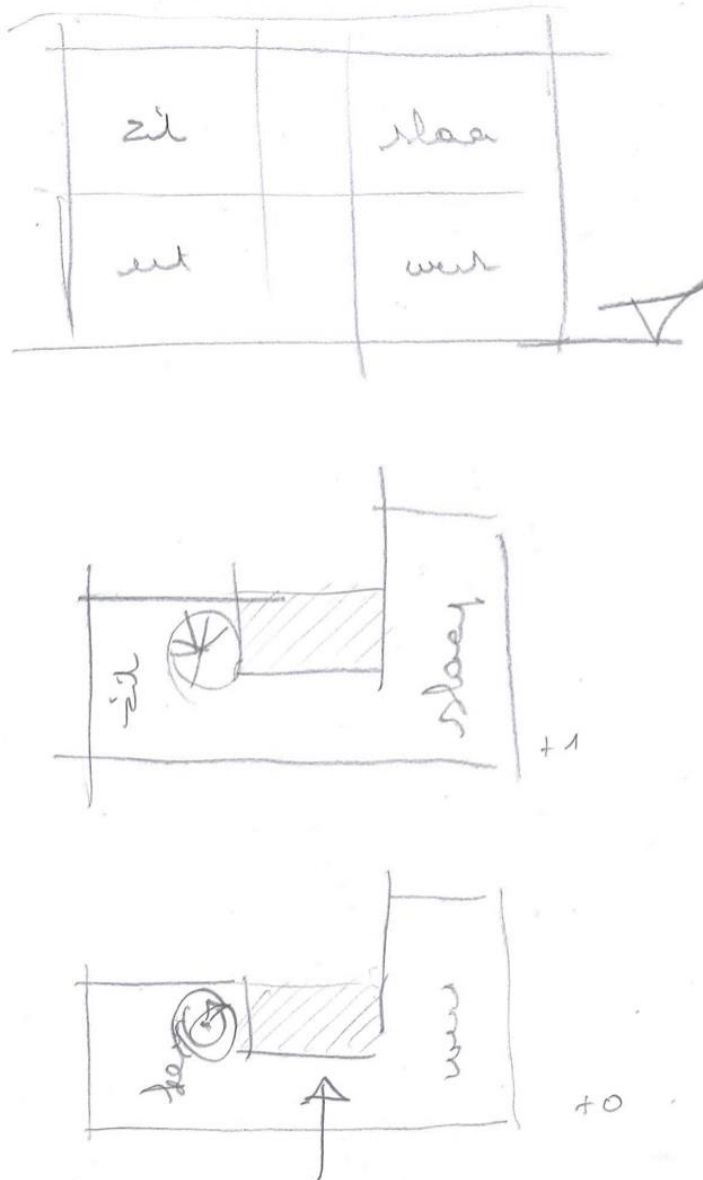**Figure 2.** *Two Volume Studies on a Model by Student S.P. in Week 1*

Figure 3. *Concept Diagram with Section and Plans by Student S.P., Week 1*

Week 2: Examining the Spatial Configurations and the Structure

In week 2, the students examined the interior within the volume they worked on in the previous week. Spatial configurations were tested in sketches and perspectives (Figure 4). And the structure was tested in structural plans (Figure 5). And finally, the design was also summarised in a concept diagram (Figure 6).

The objective for this week is to investigate and design the spaces and their coherence in the residential building. The research of the first week is the starting point for this.

Students investigated which qualities each space must possess, depending on the function. Qualities like scale, proportion, light, texture, and relationships with

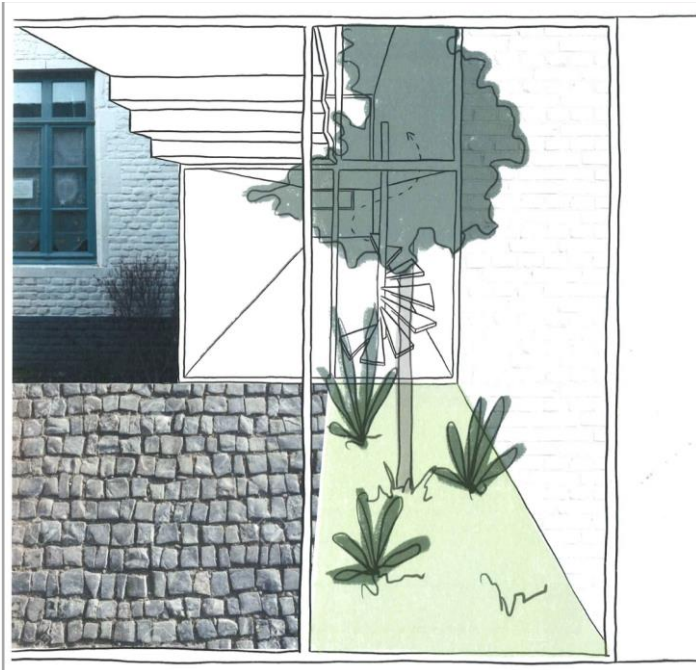other interior or exterior spaces were tested. All this to get to possible configurations of these spaces.

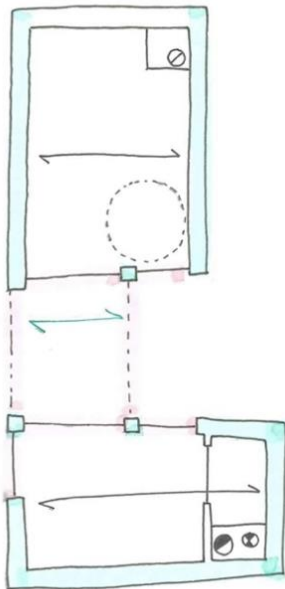**Figure 4.** *Collage of Interior by Student S.P. in Week 2*

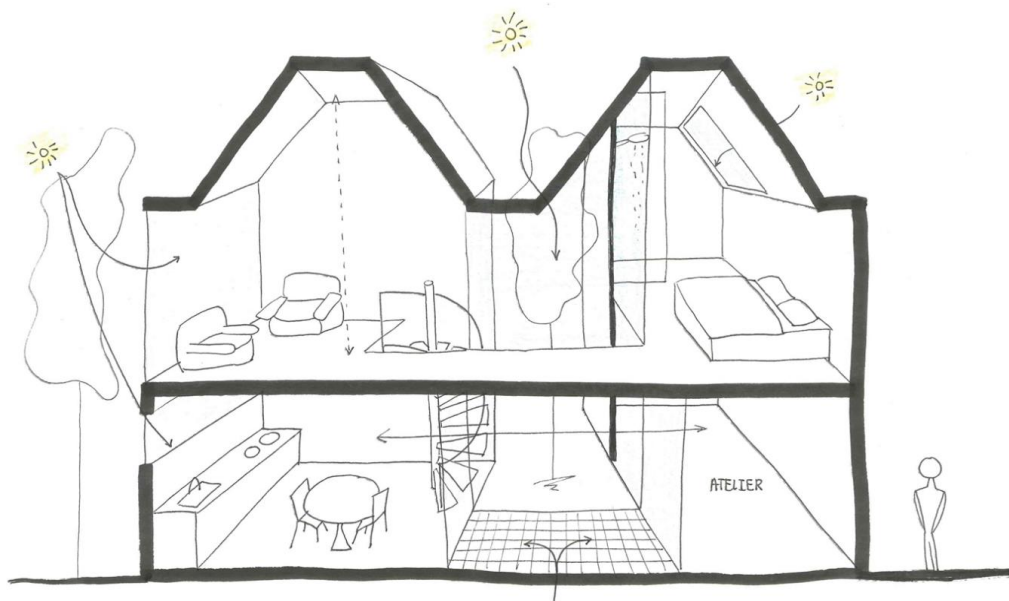**Figure 5.** *Structural Plan by Student S.P. in Week 2*

Figure 6. *Perspective Section as Concept Diagram by Student S.P. in Week 2*

Week 3: Elevation and Final Plans

In the last week, elevations were further elaborated on a model (Figure 7), and the plans were finalized (Figure 8). Different variants were examined and compared. Finally, also the concept diagram was updated (Figure 9). On the one hand, the emphasis in this week lies on elaborating the façade. On the other hand, on providing feedback and elaborating a complete preliminary design.

The starting point is again the research of the previous week, which is further refined through the themes of detailing, composition and materiality. Qualities like materials, textures, facade depths and openings were investigated. Also how the facade organises the relationship between interior and public space and how the house will be perceived from outside by others.
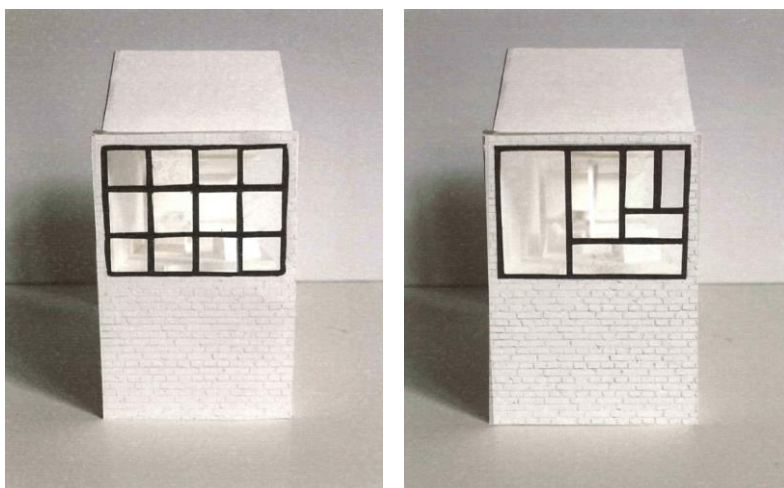

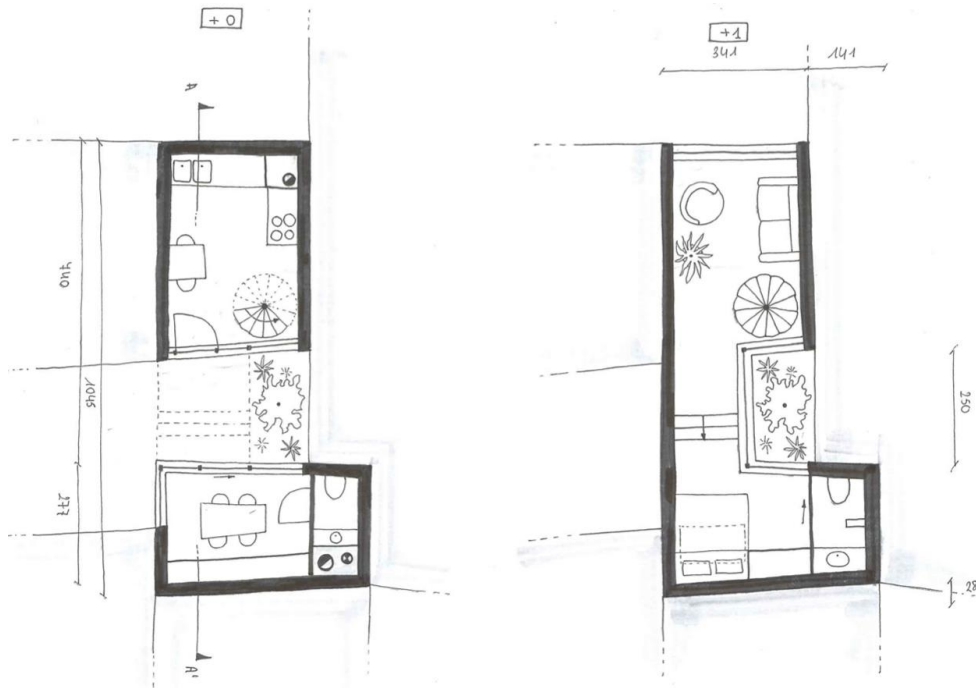**Figure 7.** *Elevations on Model by Student S.P.in Week 3*

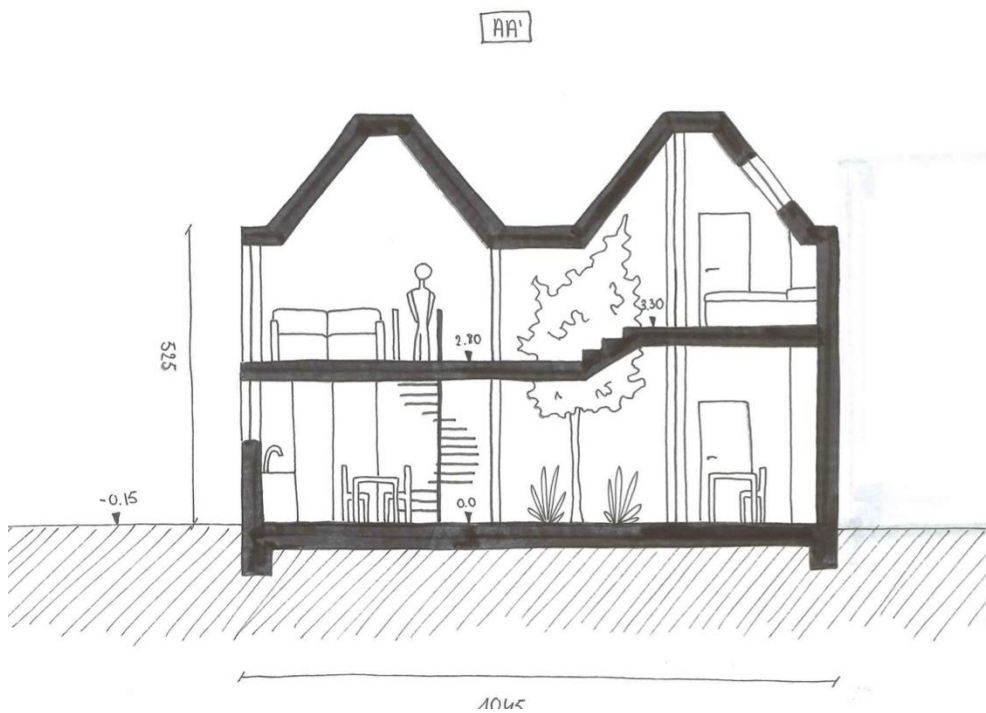**Figure 8.** *Final Plans by Student S.P. in Week 3*

Figure 9. *Final Section as Concept Diagram by Student S.P. in Week 3*

Results

At first sight, the design research and design results seem to be similar to that of any well executed design process. And in fact they are indeed similar to an exemplary design process.

But for the students, this was different than they are used to. The definition of the assignment as a project in phases, that only at the end turned into a real design project, helped the students a lot to shift the focus away from the final result to direct it to the design process itself. It helped them to know what document to make on which moment. What to do and when. Using mainly detailed models and drawings for specific investigations.

The diagrams used to examine the concept turned out to be mainly simple sections and plans. But some students at certain stages in the design process also combined a plan diagram and a section diagram in a "perspective section diagram". Or they only used a section diagram for their concept by using some furniture indications to prevent the need for a plan diagram, thereby reducing the concept drawing to the essence of the design.

Conclusions

In literature about the design process, we could distinguish two types of design media used by architects. On the one hand, designers seem to use all kinds of different and distinct media and many different forms of representation to investigate the wide variety of constraints. And on the other, they synthesise all these investigations with diagrams and schemes that bring together all the separate design researches, and make it possible to match the results from the distinct disciplines.

Using this knowledge to redefine an architectural assignment assisted architectural students in gaining a better comprehension of the design process, enabling them to determine when to create what kind of design documents.

In architecture today, designers seem to combine specific representations, or jargon, together with more universal standard media, at the same time integrating the peculiar and the general. They mix the languages of the different disciplines in architecture together with a more universal comprehensible architectural language.

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