In search of the ‘in between’

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Abstract. Our paper presents a teaching project in the context of architectural education which inquires the fusion of learning processes within both physical and digital media. Our approach, situated within an undergraduate program, aims to blur the boundaries between physical and digital activities in order to enhance and amplify their qualities and, by doing so, broadening students' understanding and awareness of extending design-based media. The program relies upon an open, design-driven, game-inspired process. While the games allow to explore form and space by following a set of simple directions, the games’ constraints guide the teaching of specific drawing and representation techniques. The exercises span two semesters of the first year curriculum. Within the exercises we re-approach the embodiment of skill based upon possibilities, paths and strategies to combine design-based media as a conglomerate to draw from rather than as a set of singular techniques.

Keywords. architectural-education; design thinking; hybrid drawing; tooling, games.

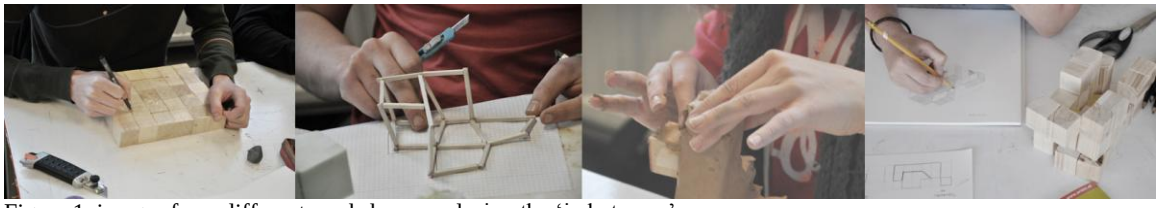

Figure 1, images form different workshops exploring the ‘in between’

Searching for the ‘in between’

‘Extended Drawing’, is a research project that seeks to develop a design-based approach to teach media. Within ‘Extended Drawing’ we use the term design-based drawing to refer to drawing and modelling in all its forms, used as a means to explore and communicate design. It is our contention that creative approaches towards media are to be found in the ‘in between’ of tools. The ‘in between’ is seen as the rather unspecified area where expression, exploration, generating medium and the interpretation of the artefact cross each other in order to reveal new roles and meanings for the drawing, the model as well as the designer.

The ‘in between’ is a state of mind which searches for creative paths to externalise design through combining rules and tools. The ‘in between’ as a teaching concept poses a certain opposition because it equally addresses physical and digital activities and is, as such, underspecified as a technique. The ‘in between‘ even escapes the very possibility of being specific because it is subject to constant change and will always be different. Why? Because it thrives upon a personal dedication to discover one’s capabilities by reconsidering what is familiar through combining it with what is unknown. For the instructors involved the ‘in between‘ means offering possibilities and potential combinations without specifying their conclusion. For students searching for the ‘in between’ confronts them with the development of an attitude and is able to reveal new strategic possibilities and opportunities within their own expressions.

Mediating the physical and the digital by design

Up until quite recently it was maintained that freehand sketching was the ultimate tool to conceptualise design, while CAD and digital modelling were predestined as a tool for refinement and/or production. (Schön, 1983; Garner, 1992; Goel, 1995; Suwa and Tversky, 1997; Bilda and Demirkan, 2003) Concerning this matter Jonson (2005) has argued that design ideation – as a matter of generating, developing and communicating ideas, is more important than the tools shaping them. Jonson considers the 'idea' as the "basic element of thought that can be either visual, concrete or abstract" and regards ideation as the essential part of the design process, both in education and in practice. In this process of ideation, freehand sketching has always been appointed as the principal conceptual tool but the development and evolution of digital media, combined with recent evidence from architectural practice, forces us to reconsider this claim.[1]

Elsen (2010) even dismisses the very idea that there exists one type of free-hand drawing (the 'rough' drawing) and one type of detailed CAD model. Her research couples adaptability and schemes of utilisation with the possibility of moving back and forth between tools and representations. As such she relieves digital drawing from its assumed position at the end of the design process. In this light Coyne (2002) states that "sketching about for ideas suggests a sense-making activity that is not tied to any particular conceptual tool". In his view CAD is not just a narrowly defined technical drawing tool, but a conceptual tool capable of developing new ways of perceiving and conceiving design. That is, CAD may foster new patterns, relationships, or aesthetics expanding, rather than reducing designers' creative options. Within his research Coyne found that inexperience in computing rather than the medium itself seemed to be the limiting factor to explore specific design possibilities.

Over the years architects and other designers seem to have developed a rather ambiguous relationship with the tools they use. Elsen (2010) observed that designers no longer make a clear distinction between freehand drawing and CAD modelling. According to the flow of ideas the content of drawings varies from one rough sketch to a technical sketch, from a rough model to a detailed model which can all be used at the same time of the design process. This notion of appropriating and switching between media poses a challenge to teach design-based media because it implies that the widely held practice of teaching CAD and freehand drawing as separate courses is in effect at odds with the practice of design and is up for reconsideration.

Towards the 'in between'

While the literature reveals that freehand drawing and especially explorative sketching plays an invaluable role in design cognition (Schön, 1983; Garner, 1992; Goel, 1995; Suwa and Tversky, 1997; Bilda and Demirkan, 2003) a discontinuity has blurred the

[1] As a part of the research project a series of interviews with practitioners searches for practice-based knowledge to inform the project. Transcripts of some of the interviews can be found in the self-published 'reflector zine' and 'the conference zine' written, edited and produced by the first author; also see T'Jonck P., (2011)

specific teaching of the craft amongst its digital counterparts. Prensky (2001) asserts that the rapid dissemination of digital technology in the last decades of the 20th century has changed our society in such a way that today's students no longer represent the people our educational system was designed to teach. In his view the 'new' students "think and process information fundamentally different from their predecessors". Within architectural practices the proliferation of digital media has shifted the representational centre of gravity from the physical to an unspecified myriad of possibilities and combinations, both physical and digital.

While acknowledging that digital editing and CAD are equally performative and complementary, 'Extended Drawing' started from the premise that freehand drawing, as a skill, still represents an invaluable asset to (new) designers. The project therefore set out to inquire a gradual fusion of physical and digital expressions by designating the 'in-between' as the common area of investigation. To this end we started searching for a more hybrid approach to teaching design-based media. This ambition meant we had to overcome a basic difference between physical learning and digital learning in order to be able to fuse what used to be taught in two separate courses – one devoted to teaching physical media, the other to digital media. Within architectural design the teaching of freehand drawing can rely on a certain tradition. (see amongst others: Ching, 1943; Eijssen and Steur, 2007; Fraser and Hemni, 1994) Students typically practice the dexterity of drawing (straight) lines, mastering the mathematics of vantage point perspective and embody the skill of constructing perspective planes in order to represent form and space. Invariably this method appropriates basic geometrical shapes as a stepping stone for drawing architectural constructs.

Digital learning is able to rely on non-linear ways of teaching and learning. While a pedestrian CAD course can follow a process of introducing tools and navigation to move on to how to use the drawing and modifying tools, one can also introduce the medium by providing a 3D model to play around with. This enables the students to discover the different software tools by fumbling around with the interface(s). While the learning process within digital media is able to approach the embodiment of skill from different angles, the learning process of freehand drawing is handicapped by its reliance on dexterity and practice. Practice in the sense of repeated exercise of an activity or skill so as to acquire or maintain proficiency in it and practice through applying the theoretical constraints necessary to construct a perspective drawing.

This fundamental difference in learning processes had to be overcome if we were to streamline our our intentions to set up a collaborative approach between the teachers teaching physical media, and those teaching digital media. A solution was found in adding a design-based element through the concept of content-based learning (Brinton, 2003), an idea borrowed from foreign language learning. Within foreign language learning content used to refer to the methods of grammar-translation, audio-lingual methodology and vocabulary or sound patterns in dialogue form. Recently content is interpreted as the use of subject matter as a vehicle for foreign language teaching and learning. As such a language is learnt through the interaction with topics which appeal to the learners as opposed to memorising abstract sentences and situations. Within the confines of the (physical and digital) media courses content used to stand for the specific drawing techniques (projection, perspective, shading, rendering, …) but, transposing the

concept of content-based learning, we can state that in learning how to communicate design through drawings and representations the subject matter becomes designing.

Design-based games to negotiate content and technique

We had to take care that drawing and representation remained at the centre of the courses while at the same time look for ways to infuse design within the drawing curriculum. The concept of improvised game-inspired processes provided an inspirational starting point.[2]

Translating design-based concepts into game-like processes has its precedents both within the area of participatory design and within design teaching. Within participatory design the game element helps to improve the relationship between designers and non-designers. As the games provide the parties involved with a specific role and a guiding framework they are able to negotiate design-based concepts through interaction in a meaningful way. (Habraken, 1987; Brandt, 2006, Picchi and Porcaro, 2006) Within education games playfully introduce architectural concepts by making an abstraction of the elements making up the language of architecture. John Hejduk's (1989) 'Nine Square Problem' is one of the best known examples and seeks to introduce an architectural language by manipulating form, space and their structural concepts. The "Nine Square Problem" was introduced as a pedagogical tool for first-year students and over the years the game has been used and appropriated as a teaching tool within undergraduate (architectural) teaching programs. (Subotincic, 2005; Love, 2003; Adams and King, 2002)

But there is a difference. While the examples cited above try to introduce the language of designing, our media courses have to provide the basic vocabulary elements to talk about architecture. Therefore the exercises have to reduce the element of design in order to enable both teachers and students to maximally focus on the development of drawing and representational skills. In order to work on a design, without forethought as opposed to be driven by rationale, we found a conceptual link in the field of game-driven improvisation where compositions are developed by following an open set of indications or even rules. (Peters, 2009; Cox and Warner, 2004) Improvisation is characterised by a combined process of playing and listening. The performing process is driven by the ability to react meaningfully to musical situations as the music develops itself. (Peters, 2009; Zorn, 2001, 2007, 2008, 2009; Prévost, 2007, Bailey, 1993) Game theory or open form compositions are used as a pedagogical tool as well as a performance technique to guide and/or limit the performing actors involved.[3] In essence these games try to divert

[2] Exploring games as a guiding structure has been investigated within the practice of improvised by several composers such as John Cage, Christian Wolff, Cornelius Cardew, John Zorn, ...

[3] Classic examples focus on basic compositional structure such as A-B-A or A-B-A-C-B where every letter stands for a new movement regardless of its musical concept. Another example is more action related where to play and not play and following and going against as a musical idea is structured as set of rules. The idea behind these and more complex rule based improvisations is to limit, to some extent, performance possibilities and creating an awareness for recognizable movements within the performance both for the players and the listeners.

attention from ‘what to play’ to ‘how to play it’, essentially what we were looking for within the media courses – diverting attention from ‘what to draw’ to ‘how to draw it’.

How does it work? [4]

We developed two exercises, one introductory and one more advanced. The first exercise(codename 14mm) starts with building a set of 30 small cubes (approximately 3x3cm) which are stacked in two storeys of three by five. In order to define a way to move through the model you have to remove single cubes. You start from the short side, moving to the back and upwards, as such defining a linear three dimensional corridor and stairway. Every cube you retrieve has to be re-used on top or on the short side of the model without disturbing the progressing passageway, keeping all 30 cubes. The goal is reaching the top level of your model. [Figure 02, left]

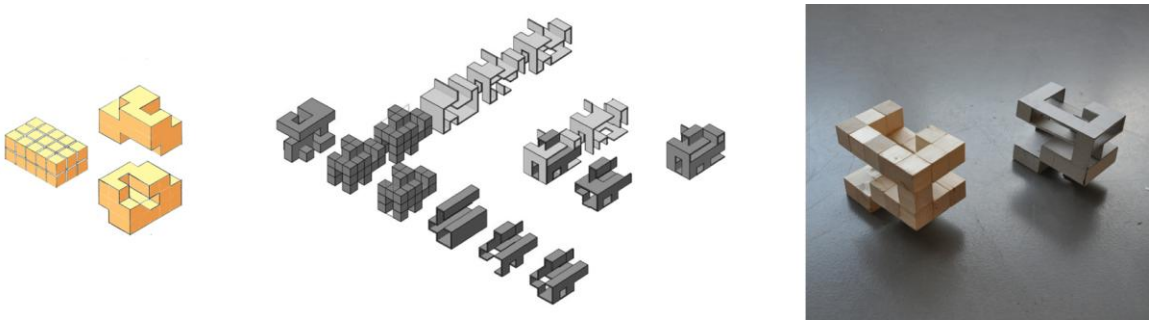

Figure 02, 14mm: basic modelling: by drawing (left), by digital modelling (middle), by physical modelling (right)

As such starts the process of the first exercise and from there on this structure starts figuring as a model to be drawn by hand and to initiate basic CAD drawing. After a few weeks the plans and sections have to be reworked by following an intuitive process of extrusion and extraction, using modelling software.[5] [Figure 02, middle] This phase produces a spatial model consisting of walls and floors which is from there on studied and refined using both traditional freehand sketching, computer drawing combined with digital and physical modelling. The exercise concludes with a combined digital and analogue poster presentation using mixed and collaged techniques.[6]

The exercise has a follow up (codename 24mm) where we introduce advanced digital modelling, curvilinear modelling, free form modelling and context by combining software, physical modelling, freehand drawing and everything in between. Again the

[4] For a more elaborated account of the backgrounds of the exercises and the games we would like to refer to Schaeverbeke R., (2012) and Schaeverbeke R, Heylighen A., (2012)

[5] ACAD 3D

[6] The first run was concluded with a an analogue presentation, last year we defined both a digital and an analogue poster which revealed that concluding the exercise would benefit by joining forces. The next run will be concluded with a collective workshop where a poster will be constructed by using prints, reproductions, renders and drawings into one merged presentation.

game element is used to streamline creativity. Using digital modelling software[7] students develop a mountainous landscape following a set of simple rules based upon perimeter, steepness, peak height and a minimum quantity of hills. After the first virtual model is made the ‘mountainscapes’ are studied by freehand drawings to explore the landscapes and physical models to explicit its form. [Figure 03] The ‘mountainscapes’ lend themselves to introduce basic techniques of curvilinear (digital) modelling doubling as scene or context for three different architectural structures.



Figure 03, 24mm: (mountainscapes) modelling the landscape

These architectural structures are generated by a process of spatial folding and deformation. This time 30 cubes are laid out in a grid of five by six and split in three different parts. The parts have to be ‘spatially’ folded into solid three dimensional structures after which the structures have to be deformed following three different concepts. [Figure 04] The first concept uses planes as a guiding principle and has to be refined by adding texture and materiality. The second one is modelled by shortening and extending sticks on a spatial grid. The third one is remodelled based upon adding volume in a clay-like material and interpreting the model as a hollow solid structure. [Figure 05]

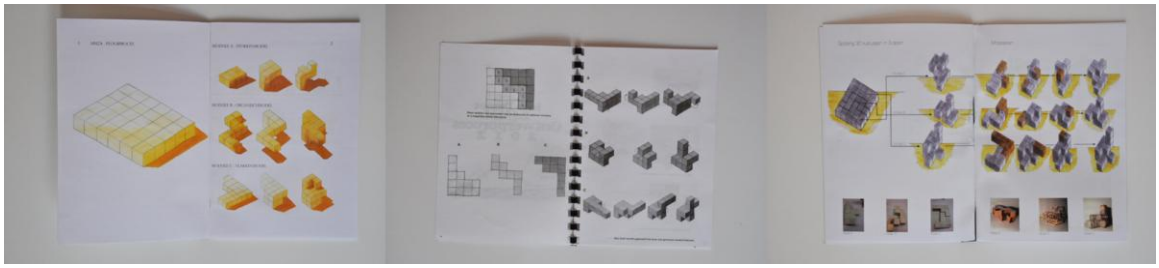

Figure 04, 24mm: modelling

[7] Rhinoceros 3D

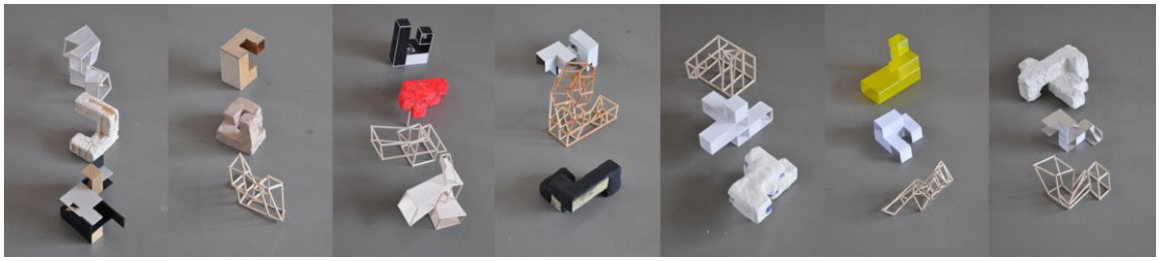
Figure 05, 24mm: architectural shapes (planes, sticks, clay)

Exploring the ‘in between’

The exercises explore the ‘in between’ on several levels. 14mm’s first workshop, modelling the solid structure, addresses the ‘in between’ to introduce the concept of projective representation. 14mm’s first model, consisting of solid cubes, lends itself to illustrate the concept of plans (by lifting up the cubes horizontal rows of cubes); section (opening up the structures vertically) and by drawing a parallel perspective of the model (introducing three dimensional drawing). As such the relationship between physical model and drawing exemplifies a basic concept within design representation. The solid model is also used to introduce and explore vector based drawing (CAD), vantage point perspective (constructing spatial grids), and finally digital modelling. The travelling between the representations reveals similar concepts of drawing and modelling by exploring them by hand as well as digitally. By the time the solid model is to be hollowed out by using digital modelling, the students have been introduced into the basics of design-based drawing approached from different angles rather than through a singular lens.

Developing the spatial model is initiated digitally and refined physically, both through drawing and finally by building a conclusive physical model. The transformed model now consists of floors and walls. The new model’s interior is studied by a combination of freehand and digital drawing. Human scale is added and spatial relations are explored by developing a set of serial images illustrating a walk through the structure.

Finally a set of perspective drawings are compiled from the physical and digital output which introduces a hint of narrative. These images are reproduced and reworked by analogue rendering techniques upon the prints producing a final set of drawings forming the basis for an architectural presentation. The exercise’s synthesis, mixed and collaged poster, uses projections, perspectives and photography to communicate the architectural structure.

24mm addresses the ‘in between’ even more manifestly than its predecessor. From the very start the different models and the contextual landscape are constantly exchanged between computers, models, paper and hands. The landscape is processed digitally and explored through drawings and modelling, while the architectural structures are modelled by hand and then translated into digital models and refined through drawing physically as well as digitally. The exercise consists of four major phases: a generative phase producing landscape, form and siting; an explorative phase to add structure and materiality producing a series of design-based drawings; an (image) editing phase searching to unify the expressions; and finally a publication phase focussing upon graphical design and communication. 24mm introduces concepts of materiality, colour, textures and tones through observation, physical exploration, physical and digital editing

and digital rendering techniques. These studies add content to the different structures and enlivens the contextual 'mountainscape' with organic material. Again a set of images based on the physical and digital explorations is compiled which are further refined by alternating between physical and digital drawing and editing. The aim of the exercise is to communicate a contextualised modelling process through a set of equalised drawings stemming from different media. Finally this set of drawings is synthesised within publishing software producing a booklet and poster.[8] [Figure 06]



Figure 06, 24mm: publishing the process within a booklet

Evaluating the processes

The game-based approach was a key tool in order to collaborate between the digital and the physical teachers involved. The games provide a mediated framework which structures the techniques both teacher groups aim to introduce and as such enable the teachers to find a collective framework to instruct aspects of design-based media by working towards an integrated presentation as opposed to artificially searching for overlaps somewhere at the end of a learning period. Where the disagreement used to start with a seemingly unresolvable difference between physical and digital learning processes, the students now develop a collective artefact through combining drawing, modelling and discovering the 'in between'.

The combination of both exercises intends to offer students a basic vocabulary and some strategies in order to communicate architectural design through personally exploring possibilities to combine and interpret rules and tools. As design is led by the game's overarching rules and process as opposed to relying on the creative response of the students to a specific assignment, the teachers are able to maximise attention to the drawn and modelled output. Comparing the collaborative approach to our former divided method revealed an increase in the quality of the drawings and the final product the students deliver.[9] The games also enable the teachers to follow a student's personal

[8] traditional techniques included charcoal, watercolor, ecoline, acryl, pencils, felt pens and myriad of other possibilities the students brought in, the software was adobe photoshop™ or gimp™.

[9] As we are writing we have tested two completed exercises to four groups of students taught by three (14mm) and five instructors (24mm) The exercises were reviewed by all teachers involved, one of which is the first author. All instructors were taught in the previous system and when we started teaching the system still was in effect. This enables us to compare the differences both from a student's point of view and from a teaching point of view. The comparison is based on the assessment of the output of both physical and digital assignments which is done by negotiating the students' material.

creative flow and progress as opposed to narrowing down someone's assessment to a list of technical abilities and completeness of the output. The new approach, studying architectural content through using media, illustrates possible paths towards image making rather than prescribing a one way route towards an isolated image. As such the new approach enables a student to reveal an embodiment and amassment of a variety of skills which is illustrated by an integrated product as opposed to presenting a set of unrelated plans, drawings and images. The individuality of the design-based approach opened up the spectrum of expressive possibilities which enables the students to inquire techniques and methods by exploration and refinement applied to a personal and designed artefact.

Yet, some issues remain unresolved. One of the ambitions of the 'Extended Drawing' project is to find ways to introduce media in "ways that facilitate emergence and reinterpretation". (Purcell and Gero, 1998) As such the mediation and combination of the tools should add or reveal formal content to the development of the structure by inquiring the generative possibilities of the medium rather than merely exploring inherent pictorial and/or technical issues and qualities. We also have to be aware that the teachers still tend to work alongside each other. In order for the physical and the digital to fully merge into a hybrid entity, the studying and reworking of the artefacts should be based upon a process of constant transformation, where the translation from one realm to the other leads to more refined model. As such the travelling process could open up the generative possibilities of the 'in between'.

Ideally, the media courses promote the exploration and development of a personal signature by developing a preference and a strategy to mix media in order to externalise design. We can only hope that the confrontation with a variety of media and the introduction into several combinative possibilities is able to open up advantages and disadvantages of certain techniques, through applying them and by learning to shape, tune and merge different techniques into a new personal and hybrid unity to inform creativity within designing.

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