GAMES IN VIRTUAL BLOCKLAND

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Abstract. The paper discusses with an example the educational potential and limitations of students using a CAD system as an immersive environment for the rapid exploration of design compositions through play with a small vocabulary of blocks.

Figure 1. Approaching The Secret Place

1. Prologue: Growing Up with Blocks

Playing with blocks is a part of most people’s growing up. The child’s set of brightly-coloured wooden blocks to touch, taste, throw and place is a fundamental part of the exploration and realisation of space and the extent of the body. They take many forms: there are rough-faced ‘off cut’ blocks from the carpenter’s shop: no two blocks the same size, some rectilinear, others at strange angles of the ‘piece left over’. There are ‘classic sets’ of blocks: Froebel blocks, designed in Germany in the 1830’s by the founder of the Kindergarten, Friedrich Froebel; the colourful blocks of Enid Blyton’s Noddy land; the precise plastic blocks of Lego and Leggoland. There are blocks of the toyshop, blocks of the art gallery, and blocks for puzzles, such as Piet Hein’s SOMA set of interlocking blocks in a 3x3x3 cube.

Sets of blocks prescribe a vocabulary of elements with which to work: 21 one-inch cubes, 6 half cubes and 12 quarter cubes in Gift 5 of the Froebel blocks. The shapes available limit the nature of what can be built, while the number of blocks in the set limits its extent. There are rules, too: the rules of gravity control the way towers can be built (horizontal plane on to horizontal
plane); the keys and sockets of Leggo blocks control the form of Leggoland. Blocks make patterns of shape and colour, and cause further patterns of light and shade. The blocks take on meaning as houses, battleships, cars, shops, cradles, spaceships. Froebel wrote of 'forms of life' (representing real-world objects) and 'forms of beauty' (abstract patterns).

What is being learnt in these games? There is learning about the human body: the reach of the arms, the dexterity of the fingers. There is learning about the senses: the relative view of objects near and far, the smell of woods, the feel of smooth and rough texture, the sound of the 'clack' as block is placed on block. There is learning about the world: gravity, friction, balance. There is learning about spatial relations: scale, symmetry, balance, geometry. There is learning about number: set theory, the meaning of number, the visual expression of number (such as is learnt in demonstrating Pythagoras' Theorem with Cuisenaire rods). There is learning about abstractions: seeing three blocks in 'L' shape as a chair, a line of blocks as battleship. There is learning about language: the verbal description of the block world, the idea of rules of configurations as operating within a language. And there is learning about design: conjecture and refutation (can I balance one more block on this tower?), discovery, creativity, and the hermeneutic circle of understanding. For the child, this play is also research.

2. Virtual Blockland

What happens when we move from a physical to a virtual (electronic) world? We lose the tactile sense; we lose the smell and the sound; we lose the subtlety of light and shade; we lose the quick head movement to look around corners and get a different view. We open new possibilities: we can shape our own blocks; have an infinite number of them; fix or free the spatial relations; merge them; defy gravity; change their colour; and obtain views that could only be gained by flies on ceilings or worms under the floorboards in the physical world. Playing games with virtual blocks is not the same as playing games with physical blocks, but it, too, opens avenues of imagination, fun and discovery.

The interest still lies in both arrangements of blocks (Froebel's 'forms of beauty') and their interpretation as real-world objects (Froebel's 'forms of life'). There is a fine line between exploiting the freedom of the virtual world and moving too far from the kinds of elements one finds in the real world to readily make these interpretations. In the following game for architecture students we seek interpretations as objects from the built environment: shops, hotels, houses rather than cars, battleships and aeroplanes.

There are some rules in this game: there is a limit on the number of different blocks a player may have, although a single 'block' may be made up of
several disconnected elements as long as the spatial relations between them remains constant. In the first game, the blocks represent blocks of 'matter'; we play with the virtual blocks as if they were solid objects existing in space. This is close to playing games with physical blocks. We imagine moving between and amongst them. In the second game, the blocks represent not matter but spaces: enclosed hollow forms that can be rooms (or caves) with connections between them. We imagine an enclosing envelope wrapped around the blocks, dividing 'inside' from 'outside'. We imagine moving through them and from block to block. Both games are played with a vocabulary of just five different blocks, although they may be duplicated.

3. Game 1: Playing with Blocks as Matter

First the blocks are made. Each element has its own interpretation and we give them names ('forms of life', from the start). By combining elements more complex readings arise.

![Figure 2. A Vocabulary of Five Virtual Blocks](image)

The Colonnade: a barrier, not solid yet it does not invite penetration.
The Platform: a place, somewhere to be, yet it is exclusive because of the specific entry point.
The Door: the wall is solid and forbidding but the door invites entrance.
The Block: helps define space with the help of the other elements.
The Sail: an undulating tension structure suspended above the ground and other elements. By closure from above it acts to define a space (possibly by the shadow it casts).

This choice is not arbitrary. Rather, it comes from a 'two and fro' between the individual elements and experiments with their arrangement. Which blocks allow for interesting configurations? Which blocks allow for interesting interpretations? With them, arrangements are tried and tested. Each has different ideas and motivations. The number of arrangements is large; here we describe a few of them. The interpretations are those of one of the authors (Schumacher) as a student; the reader may have others.

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¹ The software here is Modelshop. FormoZ was used for the 'spaces' examples.
Autodesk, Canvas and MacDraw have also been used at various times for 2D games, using only plan views.
In *The Path*, the blocks are to be experienced in sequence and support each other in creating a sense of destination: the path passes the Block which marks the entrance. At the Block, the path turns and faces the Door; thus the approach to the door is always straight on and not oblique. The Door marks the point of passage from the plain 'exterior' to the layered, complex 'interior'. The Colonnade links the door to the platform and defines the path from the entrance to the Platform. The Sail covers the last part of the journey to the Platform intensifying the feeling of arrival. The Platform is the end of the journey, it is a place set apart by the path/process needed to reach it, by its height above the ground and the enclosure by the Sail.

![Figure 3. The Path (left) and The Place (right)](image)

In *The Place*, the elements work together to define a single space. The first arrangement made the Platform the focus, this arrangement creates a space between the blocks. Entrance via the door is to a space defined by the Door, Block and Colonnade acting as walls, the Sail as a roof and the Platform as a barrier.

![Figure 4. The Theatre (left) and The Resort (right)](image)
With the reuse of chosen arrangements the arrangement itself is of lesser importance than the possibilities of the spaces 'left over'. The scale is not lost, but the possibilities become more complex and varied. In The Theatre, the blocks in pairs between the Doors act as entrance markers, and the platforms at the bottle neck between the Colonnades act as a stage with the Sails above them acting as a sound shell. Only one end need house the play, with, the opposite 'stage' being a bar or refreshment area. In The Resort, each part would be a room with ablutions located on the Platforms and the area between the Door and Platform being the main living space. The Blocks locate the entrances (and could carry room numbers) and suggest a porch in front of the rooms. A double room can be made with two of the arrangements facing each other, giving the room two entrances and two Platforms. The Sails heighten the sense of enclosure the further an occupant enters their room.

![Figure 5. The Square (left) and The Secret Place (right)](image)

*The Square* acts as a courtyard, node of activity, and meeting place. Each of the smaller 'places' could acts as bars/coffee houses, or just as smaller more secluded places to be, with the Sails reinforcing the sense of 'cosy' space. In The Secret Place, the original five blocks are brought together and overlapped in a new arrangement, each in contact with at least one other. Now the Platform acts as the focus; it is the site the other elements emphasise and enrich. With this arrangement reflected on both axes, the sense of opening and closing as people moved down the resulting colonnade creates formally joined secluded spaces; places for secret meetings.

Finally, in these few examples amongst many, is *The Night Club*. The left end is the entrance, marked by the Blocks and a porch made by the Sails reaching out over pedestrians. These outer Platforms could be used as offices, a ticket booth, or as balconies for patrons to see and be seen. The interior has four spaces. The first is a foyer/reception area, the next (perhaps a sunken
area) a dance floor or an auditorium to watch live shows, and the ‘bottleneck’ is a place to sit or stand, to mingle, meet, drink, and eat, with the Platforms acting as bars or serveries for food or balconies for the patrons. The Blocks house video screens, display posters or speakers. The second large space could have live shows whilst the other held dancing. The platforms here house bars, DJ's, sound mixers and seating.

Figure 6. The Night Club

4. Game 2: Blocks as Space

The blocks of space are defined in a similar way to the blocks of matter. Each space has its own character and use possibilities:

- The Passage: a long narrow space suitable as a passage.
- The Niche: a small space for specific functions.
- The Box: a medium space for general use.
- The Hall: a large space for general use.
- The Room: a complex, curving space.

Figure 7. Five Space Blocks, and Odd Plans: A kiwi, a scooter, a bobsled or a bear's head (clockwise from top left)

Initial ideas were generated as 2D drawings referring to the 3D spaces; some configurations were created which were attractive 2D graphics but poor uses of the spaces. A compact configuration appears best suited to the internal spaces, whereas an articulate plan creates interesting negative shapes between
the volumes, with a curving of the inner side of the plan contrasting with the stepping of the other side.

*Figure 8.* Two arrangements, 'Compact' (in perspective) and 'Articulate' (in plan)

Uses? The assemblage of spaces in the compact arrangement could be a *Place of Spiritual Significance*, with Hall at the end of a pilgrimage reached after a journey through the previous spatial experiences, beginning at the Room. It could be a *Craft Shop*, the Room as a point of reception, the Niche housing a piece of special interest, and the Box containing the main display area. The Hall would contain storage areas, administration and workshops, and the Passage, by its intimidating nature, would divide the Hall from the public areas of the shop. Or it could be an *Executive Office*. The Room would be the receptionist area. The Box would house secretaries and other administrators. The Passage would then mark the division in an intimidating way between the reception areas to the real seat of power and influence, the Hall.

*Figure 9.* The Bazaar: Overhead perspective and views moving through the street

When the spatial arrangements repeated, the focus shifts from the internal spaces to the negative spaces around them. The interest is then on interpretations of the urban fabric, the public spaces. If these are *Craft Shops*, the group is a work/market area for craftspeople. The spaces are rich in variety and spatial change, with the feeling of a crowded bazaar.

In *The Hilltop Village* a rocky hill top requires a random arrangement to suit the landscape. This results in very complex negative spaces at a human scale. The original blocks here have been repeated, rotated and overlapped to form a new unit.
5. The Instructor's View (Antony Radford)

I began to be interested in finding ways to use computer graphics and modelling as a means for architecture students to learn about form and composition in 1987, working with Professor Robert Oxman and Dr. Rivka Oxman. Since that time the Oxmans and I have continued to build on those ideas, and others have picked them up and taken them in various directions. In my experience, one of the most valuable studies has been these 'virtual block' games. It has become a vehicle for looking at the use of computer modelling, computer graphics and mixed media in presentation; for learning about abstraction and representation; for the consideration of form and meaning; for emphasising architecture as a dynamic (via the idea of people moving through and between elements) rather than static experience; for exploring the grammatical metaphor in design; for demonstrating ideas of derivation and the hermeneutic circle of understanding; and for gaining experience in manipulating and ordering space and form.

Students bring to the class many years of experience, during and since childhood, of playing with form and space and living in the built environment. It is not a beginning class in the sense of introducing new material. Rather, it is a question of refining and heightening perception and awareness of the built environment and of giving students an opportunity to gain confidence in manipulating form and space. The games also provide a vehicle for pointing out and discussing metaphors of design, such as design as conversation
between designer and medium, and metaphors for the designer, such as the
reflective practitioner.

From the teacher’s viewpoint, playing these games improves both
substantive skills (architectural composition) and instrumental skills (graphics
and computer modelling) in a relaxed structure which has proved highly
attractive to most students. Peter Schumacher’s work is amongst that which
comes closest to the ‘ideal’ of the class, particularly in the richness of the
interpretations he makes, but there have been many other examples of good
work and few which ‘miss the point’ of the studies. They appear to benefit
both able and less able students. They are not (and are not intended to be) a
complete education in the handling of form and space in architecture. In
particular, students still have difficulty in handling form in buildings when they
are simultaneously trying to handle a multitude of environmental, functional
and constructional issues. Nevertheless, perhaps predictably, students who
have played well in these games have also tended to do well in later design
work.

There is nothing remarkable about what is being done: it is how, and what
is being learnt in the process, that matters.

6. The Student’s View (Peter Schumacher)

The blocks and arrangements in the examples shown in this paper were
conceived as 3D objects but were originally manipulated in a 2D universe. I
used 2D symbols to represent the 3D forms and manipulated them with a
cognitive interpretation of what I thought were the 3D forms. In retrospect, it
was easier to ‘look into’ the Matter scenes and visualise how it would work.
With the Spaces there was an additional task: first visualise the space, and then
visualise being within it.

When I designed the Sail in 2D I began with a curvilinear quadrilateral
shape. I had a fair idea of how it was going to look, so I was manipulating it to
be high over the pillars and then dipping down to the ground. It was not until I
built a physical model (by laminating thin pieces of balsa wood) that I finalised
the form. That was then used to generate the computer model. In retrospect, I
noticed that each of the blocks represents an element of a building; door, wall,
floor, roof and furniture. This was not a design decision but it may explain why
they were unconsciously chosen and why they worked well together.

For the spaces, from the beginning I wanted to use strong non-traditional
shapes, to use odd shapes and to try and make something sensible out of them.
When using the 2D symbols I had a fairly clear idea of what the intention was
and there was a good level of control. When it came to doing more complex
articulations, such as the merging of the Spaces, it was difficult to look at a 2D
image and ‘see’ how they worked, what it would be like to stand within them.
The manipulation of the spaces was very much a mental exercise with the computer merely acting as a notepad to record ideas. Even when the blocks were modelled in 3D there was still the mental leap of entering into the space. Images generated from within the space helped a little but not very much; maybe a set of virtual reality goggles would help, because the sense of a space relies on peripheral vision to give a feeling of enclosure, openness and of light.

I clearly remember a lecture in another class about a church plan where there was a detailed discussion about the effect of moving through the spaces, the hierarchy of the spaces, and the changing axes. A person would stand in one space and look down the axis of the path, but also get an oblique view into the next space. That was very much in my mind when I was playing the space games. I had also just completed an elective subject on Christianity and Architecture and was exposed to the geometric symbolism used in Gothic cathedrals and their use of spaces to create a sense of the sacred. Landscape Design was running at the same time, and I tried to use these ways of thinking about matter for the landscape design. I used the garden elements (plants, garden furniture etc.) to define different spaces, the same way I had in the matter game.

7. Epilogue: Real and virtual blocklands

The world of blocks has always been a rich world of imagination and exploration. The virtual world is free of the restrictions of gravity, of a closed set of shapes, of a box of blocks which eventually runs out of pieces. It is a colourful world: reds and blues and earth colours, and the easy recolouring of forms allows a dimension of exploration not easily possible in the real world. But the gains are accompanied by losses. They tend to be devoid of the character of individuals; the chipped corners and scratched faces that make individual blocks familiar friends to the playing individual. Working in virtual reality is similar but not the same as working in the real world. Reducing abstraction, increasing the match between block and represented object, is not necessarily beneficial in these games. By reducing the range of mappings between block and possible meanings, the later sophisticated 'space ship', 'car', and other 'special' Leggo sets can be said to reduce rather than enrich the potential for learning about form and design. The same applies to the virtual world.

Reference