Calculated Bananas

Defining a new introductory course in visual design for first year architecture students

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Abstract. A novel introductory course in visual design is presented that combines the teaching of various subjects and skills around the development of digital fruit. – A mandatory subject for first year architecture students at Graz University of Technology, the course is jointly offered by two institutes and combines the teaching of hand sketching, descriptive geometry, computer aided design, generative algorithms, image processing, desktop and online publishing and networked collaboration. The ambitious pedagogy uses information technology to provide links and synergies between the different subjects. The digital fruit are developed in a collaborative environment that fosters the evolution of new kinds of forms and structures through exchanging and crossbreeding of CAAD data. The paper reports on the experiences gained during the first installment the course in which 130 students were enrolled.

Keywords. Creative collaboration: evolutionary processes; digital fruit; complex geometry; methods of representation.

Introduction

“Ausgerechnet Bananen” is the title of the German version of the popular song “Yes, we have no bananas” from 1923. As the German word “ausgerechnet” means “calculated”, a babel-fish re-translation into English (which doesn’t honor the fact that it also colloquially is understood as “of all things”) produces the title of this paper: “Calculated Bananas”. Coincidentally perhaps, 1923 is also the year in which Le Corbusier published “Vers une architecture” while at the Bauhaus in Weimar the first exhibitions with international contributions took place. The functionalist avant-garde propagated that architecture and art embrace the principles of mechanization. Also in 1923 Fred Newmeyer’s silent movie classic “Safety last”, a sarcastic parody of the functional city, reaches German cinemas – its German title: “Ausgerechnet Wolkenkratzer” (“calculated skyscrapers”). This year marks the 80th anniversary of these coincidences and it also is the first year in which a new introductory course in “methods of representation” is taught at the architecture department of the university of the authors. Its motto is “calculated bananas”. So why bananas, of all things? And why calculated?

First principles of representation

Arguably, representation is not a secondary subject in architecture, but one linked to the very essence of architecture as an academic discipline. Plans and models were and are to this day the precondition of any discourse about architecture. Thus the art and practice of representation, of choosing the appropriate abstractions to describe a project, is an essential skill. It is an integral part of any design development.

Our approach to teaching basic methods of representation in architecture is to focus on first principles and to apply them in design development. So what are the first principles?

Geometry stands out as one of the key subjects related to representation. Historically, geometry used to be at the core of most engineering disciplines. It provided the common language for their different design activities. Today information technology can be said to have taken over this role of the common language, providing an even broader common ground for the exchange of project data, including, but not limited to geometry. Thus a first principles approach will have to put considerable emphasis on geometry, but will teach it as part of a broader digital repertoire. Interestingly, the advent of advanced geometric modeling programs and a corresponding trend towards free form structures in avant-garde architecture has created a renewed need for people with sound training in geometry. This is quite at odds with the fact that descriptive geometry has vanished from the curricula of many architecture schools.

In our case, the first half of the one-year course is taught in collaboration with the institute of geometry and puts the main emphasis on descriptive geometry, which is taught using hand drawing and CAAD side by side. Based on a firm foundation in descriptive geometry and CAAD the second semester – the focus of this paper – explores digital technology as an immensely powerful tool with many representational possibilities, but also with its own inherent logic. This exploration is all about fruit. (This is where the bananas come in!)

“I know how to spell ‘banana’, but I don’t know when to stop…”

Fruit are fascinating in many ways. Bananas, apples, pears, etc. all are well recognizable by their shapes and colors and their appearance can rather easily be modeled and rendered on the computer. Using fruit rather than buildings as design objects also creates a healthy distance to architectural conventions that allows one to focus on essential formal characteristics.

Current modeling programs provide NURBS-based tools to create free-form surfaces. Modeling the surfaces of fruit rather than some arbitrary shapes students are challenged to be precise about how the surface patches are joined and what degree of geometric continuity is maintained between them. While there is a lot of formal invention and playfulness involved in creating the hybrid new digital fruit and the rendering of their growth and perishing processes that students were required to do (see figures 1, 2) they also require a high level of skill and control.

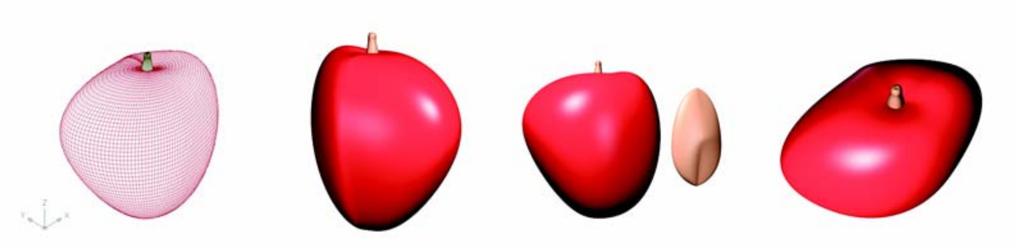

Figure 1. Mango by Christian Freißling. A result from assignment 3

Figure 2. Banango by Elisabeth Scharinger. A result from assignment 4 (hybrid fruit) which among others was based on the mango model from Figure 1.

But the computer cannot only be used to represent the outer appearance. Contrary to popular belief representation with digital media does not have to be superficial at all. As soon as the focus is put on the inner structure, on the fact that no two fruit look the same, that they are results of intricate growth patterns, the modeling can take on a different meaning. Once plants are modeled based on their structural growth characteristics (Lintermann, 1999), they can be subject to arbitrary mutations and crossbreeding. With the introduction of algorithms the forms start to take on a different quality, they become liquid architecture in the sense described by Novak (1991).

To enable the students to work in this manner a set of programs was developed that allows the existing constructed freeform surfaces to be the starting points of growth processes. Rather than branching out in some tree-like fashion the algorithms are intended to grow the form inwards, in a way supplying a reverse-engineered inner structure, thereby also deriving a sort of genetic code of the form that can be sampled and re-used.

With the genetic code of the fruit digitally encoded one can start to mess with it freely across the boundaries of categories and species. One can start to identify methods and attributes in a new way, one can judge the value of inheritance, gauge how much mutation is permissible, how much variety can exist within the new virtual organisms. In all this the sensual dimension remains paramount: What do skybananas taste like? How can you tell whether applescrapers are ripe?

The hot house

The virtual fruit are developed through a series of structured phases that introduce representational methods and techniques. At the time of this writing, the phase with the algorithmically defined fruit that gave the paper its title is just starting. As can be seen on the figures, the course has produced stunning results. But while the results are a welcome affirmation of the educational approach, this approach is focused on the process rather than products.

The process takes place in a database-supported collaborative environment in which students are allowed and encouraged to take over each other's files. The environment applies the principles of creative collaboration as defined by Schmitt (2001). They exchange notes, they rate each other's work, they compete with each other to produce the page design for the final project. In other words: The fruit are grown in a collaborative hot house, produce and seeds are freely distributed among the gardeners. In the end there'll be an exhibit and a publication: "Vers une grate-banane calculée".

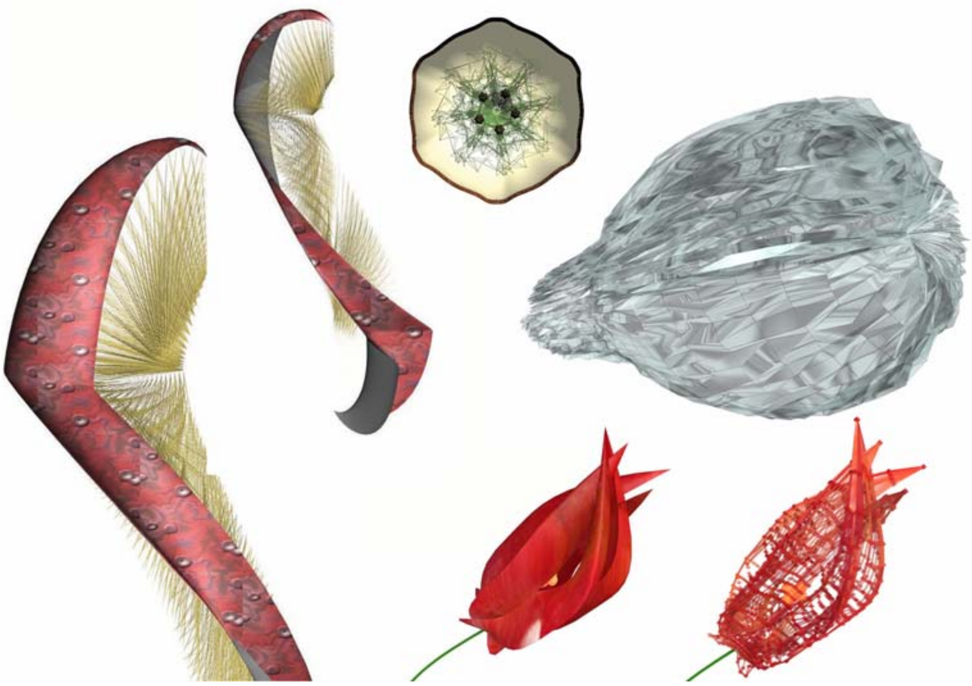

Figure 3. Explorations of algorithmically defined inner structures of the virtual fruit (projects by Martin Feichtner, Julia Lainer, Johannes Pointl, Ines Seethaler).

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References

Lintermann, B., Deussen, O., 1999: Interactive Structural and Geometrical Modeling of Plants, IEEE Computer Graphics & Applications, vol 19(1), jan/feb 1999

Novak, M.: 1991, Liquid Archtectures in Cyberspace, *in* M. Benedikt (ed.): *Cyberspace: First Steps*, Cambridge/MA: MIT Press

Schmitt, G.: 2001, Learning and Creative Collaboration, *in* M. Engeli (ed.): *Bits and Spaces*, Basel, Boston, Berlin: Birkhaeuser, pp. 37-39