

Stop Motion Animation as a Tool for Sketching in Architecture

Ru ZARIN^a, Kent LINDBERGH^a and Daniel FALLMAN^{a,c}

^aInteractive Institute Umeå; ^cUmeå University, Sweden

Widely acknowledged as an archetypal design activity, sketching is typically carried out using little more than pen and paper. Today's designed artifacts however, are often given qualities that are hard to capture with traditional means of sketching. While pen and paper sketching catches the character of a building, it may not equally well capture how that building changes with the seasons, how people pass through it, how the light moves in between its rooms from sunrise to dawn, and how its façade subtly decays over centuries. Yet, it is often exactly these dynamic and interactive aspects that are emphasized in contemporary design work. So is there a way for designers to be able to sketch also these dynamic processes?

Over several years and in different design disciplines, we have been exploring the potential of stop motion animation (SMA) to serve this purpose. SMA is a basic form of animation typically applied to make physical objects appear to be alive. The animator moves objects in small increments between individually photographed frames. When the photographs are combined and played back in continuous sequence, the illusion of movement is created. Although SMA has a long history in filmmaking, the animation technique has received scarce attention in most design fields including product design, architecture, and interaction design. This paper brings SMA into the area of sketching in architecture by reporting on the planning, conduct, result, and evaluation of a workshop course carried out with a group of 50 students at Umeå School of Architecture, Umeå University, Sweden.

Keywords : *Sketching; Stop Motion Animation; Design; Architecture; Technique; Workshop; Course*

Introduction

Stop motion animation is a basic form of animation that one typically applies to make ordinary physical objects appear to be alive and able to move on their own. When animating a stop motion sequence, physical objects in front of a stationary camera are typically moved in small increments between individually photographed frames. When the series of slightly different pictures is combined and played back in continuous sequence, the illusion of movement is created and the objects seemingly magically 'come alive'.

In its many variations, stop motion animation has a very long history in filmmaking, starting as early as 1897 with *The Humpty Dumpty Circus*, a film in which a toy circus of acrobats and animals comes to life. *The Haunted Hotel* from 1907 was the technique's first commercial success. Other famous stop motion animation milestones include *The Automatic Moving Company* (1912), *King Kong* (1933), and some parts of the original *Star Wars* trilogy (1977-1983). When one mentions stop motion animation these days, people however tend to think of clay-animated movies such as *Chicken Run* (2000) and *Wallace & Gromit: Curse of the Were-Rabbit* (2005). These more recent examples show that despite recent development in computer animation, there seems to be something about stop motion animations that captures the audience (Fallman & Moussette, 2011). Despite its long history in cinematography, the technique has received scarce attention in design-related fields such as product design, architecture, interaction design, and Human-Computer Interaction, which is somewhat surprising given these fields' general readiness to adopt and adapt tools and techniques from other fields and practices.

Our main motivation for bringing stop motion animation into design comes from our interest in developing new tools and techniques for improving sketching skills in different areas of design work (see Fallman, 2003, 2008; Fallman & Moussette, 2011). We have previously applied stop motion animation as a sketching technique in the area of interaction design (see Fallman & Moussette, 2011). To take this work beyond interaction design, we here present, discuss, and compare some of the results and lessons learnt from exploring the use of stop motion animation as a sketching tool together with 50 architecture students for a full week-long course: can stop motion animation be a relevant and useful tool for sketching in architecture?

The Need to Improve Sketching Skills

Why are we interested in sketching? This is because we see sketching as an archetypal design activity (Fallman, 2003); a core professional skill of any designer. By some, it has even been proposed as the very essence of what design work is all about (Black, 1990).

Contemporary design theory typically separates the kind of sketching that is occurring mostly in the early part of design (i.e. sketching as a tool for thinking, for moving forward in the design process) and the drawings that are produced in later stages, mainly for public communication and as presentation aids (Goldschmidt, 1991). The traditional—but nowadays much questioned yet rather insistent—view is to consider sketching simply as a way to externalize 'images' already present in the mind of the designer. Seen in this way, sketching becomes a way in which form, appearance, and character of artifacts that are as yet intangible may be transferred from the designer's mind onto some lasting medium. Sketching is then mainly useful for communication with other designers, customers, and other stakeholders as it provides a shared language which has no equivalent in ordinary, spoken language, but which allows designers to express themselves and share their ideas with others in a visual way (Fallman, 2003).

While the sketches designers produce clearly have communicatory advantages over other means of presenting ideas, especially visual ideas, we argue that sketching should however not merely be thought of and treated as a tool for communication.

In our view, a more fruitful and interesting perspective is to think of sketching primarily as a kind of *inquiry*, and one which to a large extent is unique to design (Fallman, 2003; 2008). We are not the only ones making this claim. Sketching is often referred to as the very essence of what design work is all about (Schön, 1983). Black (1990), for instance, notes that “right from the earliest stages of tackling a problem, designers’ thinking is mediated by the sketches or visible notes that they make to familiarize themselves with the material they are manipulating.” Herbert (1993) argues that sketching is “the designer’s principal means of thinking”; that sketching serves to “direct, order, clarify and record ideas” (Robbins, 1994); or as a central means to inquire about shapes and ideas of buildings and spaces (Rowe, 1987).

It is however important to realize that such ‘familiarization’ is not first and foremost a one-directional externalization from the mind of the designer onto paper, but rather that sketching is a process (Fallman, 2003); sketching is about *reading* and *interpreting* what is forming on the paper in front of you, *explaining* it and eventually *rephrasing* it. Sketching is thus a process in which you as a designer is both “externalizing ideas and interpreting external representations as ideas” (Stolterman, 1999). There is thus more to sketching than externalization of ideas that are already formed in designer’s brain. Quite the contrary, it is a process—for many designers *the* process—through which new ideas are *shaped*. Arnheim (1996) discusses this as a dialectic process between reading/interpreting and explaining/rephrasing, where the sketch itself becomes a ‘middle ground’ between the designer’s vision and how that vision becomes realized into a coherent whole. The difference between the designer’s guiding image and what has actually materialized on the paper might in fact be the key to why sketching is such a useful technique, as it allows for effortless and ‘cost-effective’ experimentation with everything from wholes to particular details as well as with the relationship between them (Arnheim, 1996). Goel (1994) suggests that sketching supports design cognition in ways that more finite and precise representations cannot. Seen in this way, sketching is an important design process, a kind of inquiry, rather than simply a matter of externalization—a document, a sketch—which reports thinking that took place somewhere else (Fallman, 2003).

However, in its traditional sense, sketching is typically both thought about and in practice carried out using little more than pen and paper. When reading this paper, it is important to note that we do not intend to question the vital role of pen and paper sketching: we rather seek to find ways to complement it. This is because that in contemporary design, regardless of design discipline, the artifacts that we work with as designers often tend to have qualities, characteristics, and dimensions that are hard to capture with pen and paper—including transitions between fixed states, dynamic flows, life-cycles, decay, customization, etc. While traditional means of sketching are excellent for catching the overall spirit of say a new building, they may not equally well capture how that building changes with the seasons; how people move and objects pass through it; how light traverses through its rooms from sunrise to dawn; and how its façade changes and subtly decays over centuries. Yet, it is often such fluid, dynamic, and interactive dimensions that we tend to currently emphasize in our design work.

To explore ways of dealing with these qualities while remaining on the level of sketching—i.e. avoiding moving into a solution-oriented phase of model building and prototyping—we have previously explored the potential of stop motion animation as an early-phase sketching technique in interaction design (see Fallman & Moussette, 2011).

This paper brings these ideas into the area of architecture by reporting on the planning, conduct, result, and evaluation of a stop motion workshop course carried out at Umeå School of Architecture, Umeå University, Sweden.

Course Overview, Setup, and Conduct

This project ran over the course of one week, from Monday to Friday, with a group of 50 students on the Bachelor's level (second year) at Umeå School of Architecture, Umeå University, Sweden. The main purpose of the course was to introduce the students to a new technique that later on in their education and career might become useful and also to broaden their toolbox. For us, the main purpose of the exercise was to compare our experiences of using stop motion animation with interaction design students with another category of design students; architecture students.

Because of the short time allotted to the course and the practical, hands-on character of the topic, the schedule was deliberately quite straightforward:

Monday	Introductory lecture to stop motion animation (2 h) Introduction to the hardware and software setup (2 h) Divide students into groups	Auditorium
Tuesday	Meet each group at their equipment kit setups (1 h each) Tutor group work	Multiple locations
Wednesday	Tutor group work	Multiple locations
Thursday	Tutor group work	Multiple locations
Friday	Tutor group work Final event, all groups show their animations followed by Q&A General discussion about the potential role of S.M.A. Course summary and evaluation	Auditorium

Table summarizing the course's rather straightforward schedule

On the first day of the course, Monday, we gave an introductory lecture in an auditorium setting to stop motion animation; its history, its various styles and forms, etc. and we also showed a number of examples the technique used in different ways—most of which are freely available online on YouTube and Vimeo. The examples were then discussed in class and the students had the chance to ask questions about the technique. This introductory lecture lasted for about two hours. The teacher team consisted of three teachers, a researcher and two interaction designers, one of whom worked full-time with the project during the week.

In the afternoon on the first day, still in the auditorium, we introduced the stop motion hardware and software setups (or 'kits') that the students would use throughout the course. We then walked the students through plugging in and setting up their kits and walked them through the software they would use. With one kit properly set up, we recorded a quick animation as an example of the workflow and to get the students going. Students could ask any questions they wanted and we answered to the best of our knowledge and shared a few tips and tricks. Before calling the class off, we divided the 50 students into five groups.



An example of a typical stop motion animation setup

On day two, Tuesday, each team was given an equipment kit and we also provided instructions about the project they were to carry out during the rest of the week. We had decided on a rather open theme (around the concept of 'growth') and a maximum total running time of one minute for their animations. The intention behind these choices was to provide both guidance and restrictions to the students while still remaining as open as possible to allow for their creativity to flourish.

The groups then had to plan and carry out the project on their own during the rest of the week. We visited the groups every now and then and were on constant duty during the week to provide thoughts, comments, guidance, help with the equipment, etc. It soon turned out that the different groups, somewhat expectedly, had interpreted the theme 'growth' rather differently and were working on very different ideas.

On Friday afternoon, the last day of the course, all groups again gathered in the auditorium for a final event. We held a short introduction after which a representative for each group had been asked to provide a short introduction to his or her group's work. The lights were then dimmed and their animation was shown to the audience. When the lights came back on, we asked the entire group to reflect on their process and what they had learnt during the week and we followed up with more specific questions and thoughts based on their own reflections, a process that was repeated for all the groups.

Finally, when all groups had shown their animations, we had a joint group discussion about the course, its setup, its goals and objectives, as well as more philosophical discussion about the potential role of stop motion animation as a way of sketching in architecture and if, when, and how the students thought they could use the technique in their future work.

After the event, the groups' animations were collected into a show-reel that the students (and everyone else) can access over the web (see: <http://bit.ly/wKr0uK>).



Four frames from 'Making a Move'; showing how a building changes over time

Reflections and Discussion

We had initially planned to divide the students into five groups, as this was the number of physical stop motion setups we could gather. Each a setup consisted of a digital camera, a camera stand, and a computer with dedicated software installed from which the camera could be controlled and the movie edited. From our previous experience with the technique (see Fallman & Moussette, 2011) and with group dynamics in general, we knew that up to ten people in each group were probably going to be too many, especially since the groups had relatively little time to complete their tasks. Our experience is that smaller group sizes (of about 5-6) are preferred.

This is because when working with stop motion animations, it is generally a good idea to divide labor between the group members. Often, one person takes responsibility for the camera and the computer; another takes on the role of moving objects in the scene, a third might specialize in prepping material off-scene, and so on. With eight or more people in the group however, some members may start to feel left out, disagreeing sub-groups might emerge within the group, and a lot of time is wasted on coordination. With too many 'chefs' around and all the coordination involved, the risk is also that focus is moved away from improvising as you go along to more planning, more structure, and more scripting. As we were keen to think of the exercise primarily in terms of 'sketching', we did knowingly not include or encourage the students to use narratives, storyboarding, or any other means of thinking ahead. We wanted the students to think while they were shooting the animation, i.e. to use the technique itself as a sketching tool, as a means of inquiry, not as a means of visualizing something they had thought about and decided elsewhere.

Luckily however, in a matter of hours after the initial five groups had been formed, we were able to splinter off two more groups using a combination of borrowed equipment and their own, the average group size was reduced to around seven. After the course, we were also able to reinforce a finding from our previous work with interaction design students; that students with access to better equipment (such as semi-professional cameras) do not generally generate better animations. In fact, we once more saw the opposite tendency; that students with the simplest gear often ended up producing the most interesting results.



Four frames from another animation produced during the course, entitled 'Power Nap'

One of the groups had the initial idea that they would leave the provided default setup altogether and just use the camera on one of their smartphones to record the entire animation. After some time experimenting with this, they returned to the setup. When asked why, they provided slightly diverse answers but one of them involved the problem of lacking live preview—i.e. in real time being able to see what the camera sees from the same software that is used to capture the frames.

Stop motion novices have a tendency to move, morph, blend, and otherwise manipulate objects too fast using too few frames (Fallman & Moussette, 2011). When using a camera, computer, and software setup that allows for live preview you are able to review and play through the animation as it is being created, which also helps you extend the animation into the future by projecting where the object should be placed given the pace and rhythm of previous frames. With live preview, you are able to constantly review and play the animation back and forth as it is being created, which also helps prevent making massive mistakes (such as objects disappearing, the camera is moved, etc.)—and if you make them, help you realize it soon after they are made—which due to the step-by-step nature of the stop motion animation process are extremely difficult to correct afterwards.



A single frame from an animation produced during the course, entitled 'Eggzit'

Compared to our previous work with interaction design students (see Fallman & Moussette, 2011), we also noticed a rather striking difference in some particular skill sets. For instance, while most interaction design students we worked with were already skilled in or could with relative ease acquire sufficient skill in video editing software, the architecture students had with some exceptions little or no experience at all in this area, which became a bit of a stumbling block during the course, requiring a lot of our time and effort as teachers and tutors. On the other hand, we think that lack of these skills might have helped the architecture students in thinking more freely about the technique and how to adapt the technique to their specific advantage.

Another tendency we saw with the architecture students that we have not experienced previously with interaction design students was that a few groups tended to take the examples we showed during the introduction on day 1 rather literally, i.e. 'reusing' ideas rather bluntly without much tweaking. It is difficult to draw any general conclusions from this, obviously, but we may speculate—partly informed by discussing it with the group—that a reason might be a combination of lack of familiarity with the hardware and software setups and the lack of time to invent an entirely new concept.

As a general conclusion, most students were surprised how much work actually goes into producing a minute-long stop motion animation. Although stop motion sequences may look trivial, they still require substantial investment in time, involvement, and engagement. However, what you dedicate in time is balanced by the rather unrestricted creativity of the medium (Fallman & Moussette, 2011). The animations produced were very varied and presented ideas that would have taken weeks or months to realize in another way, i.e. through CAD or 3D animation software, using some special effects applications, or regular video. An interesting characteristic of stop motion animation is hence the linearity between invested time and the output of the process. In some sense, it takes as much time to produce a stop motion animation of an office chair that rotates as it takes to produce an animation that transforms the same office chair into a goat. Substitution material such as foam, cellophane, paper, newspapers, etc. can be used creatively to produce various effects such as puffs of smoke, explosions, morphs, and so on. As the sequence is built frame by frame, stop motion animators can bypass many of the various

physical, material, and technical constraints that come together to make for instance ordinary filmmaking such a complicated and expensive endeavor.

When we discussed the more philosophical sides of stop motion animation with the students as a final exercise in the course, and how they thought they could use it or at least use their experiences of having actually engaged in the process once, a concordant view was that the technique seems very useful to make physical models and objects come alive, and that when they do come alive, new aspects and dimensions of those objects can be revealed that might otherwise have remained hidden and implicit.

The students were also interested in and found value in the aesthetical qualities of the results. Stop motion animations, even those produced by professionals, are seldom perfect; and the results produced by first-timers even less so. The light changes over time; someone incidentally moves the camera; movements in the scene and camera sweeps are not perfect. However, these imperfections seem to come together to give the result—the actual animation—an authentic, funky, sketchy, energetic feel that is difficult to attain using other production means.



A single frame from an animation produced during the course (untitled), where the students used stop motion to allow water to defy gravity

Conclusions

Stop motion animation is a basic form of animation typically applied to make physical objects appear to be alive. Objects are moved in small increments between individually photographed frames and when the series of slightly different pictures is combined and played back in continuous sequence, the illusion of movement is created. While stop motion animation has a long history in filmmaking, the technique has received scarce attention in most design fields including product design, architecture, and interaction design.

We have previously explored the potential of stop motion animation as an early-phase sketching technique in interaction design. This paper has brought some of these ideas into the area of architecture by reporting on the planning, conduct, result, and evaluation of a stop motion workshop course carried out at Umeå School of Architecture, Umeå

University, Sweden, over the course of one week together with 50 Bachelor level second-year architecture students.

Traditionally, sketching is typically carried out using little more than pen and paper. While we do not intend to question the important role of pen and paper sketching, we rather seek to find ways to complement it, as the artifacts that designers work with often have qualities, characteristics, and aspects that are hard to capture with traditional means of sketching—such as transitions, flows, decay, customization, etc. We argue that while pen and paper sketching is excellent for catching the spirit of for instance a building, it may not equally well capture how that building changes with the seasons; the flow of people that pass through the building; how light moves through the rooms during the day, how its façade decays over centuries, etc. Yet, it is often such dynamic and interactive aspects that are being emphasized in contemporary design work.

To discover new ways of sketching these qualities, we have explored the potential of stop motion animation in a different design disciplines. Based on the planning, setup, conduct, and evaluation of our course, we have found some differences and similarities between interaction design students and architecture students in how they approach and make use of the technique for early-phase, open ended, creative purposes.

The technique has a number of interesting characteristics—including that it is easy to set up and run, requires little and relatively cheap equipment, that the work is generally fun and best performed in groups, and that the resulting animations emanate an authentic, energetic, and sketchy feeling—which could make it potentially useful in other design fields as well. More work is however needed before any far-reaching conclusions can be drawn about its applicability and usefulness outside of the particular cases we have described in this paper.

References

- Arnheim, R. (1995). Sketching and the Psychology of Design. In Margolin, V. & Buchanan, R. (Eds.) *The Idea of Design*. MIT Press, Cambridge MA..
- Black, A. (1990). Visible Planning on Paper and on Screen. *Behavior and Information Technology* 9(4), 283—296.
- Fallman, D. (2003). Design-oriented Human-Computer Interaction, *Proceedings of CHI2003, Conference on Human Factors in Computing Systems*, (Fort Lauderdale, Florida, April 5-10), New York, NY: ACM Press, 225—232.
- Fallman, D. (2008). The Interaction Design Research Triangle of Design Practice, Design Exploration, and Design Studies, *Design Issues*, Vol. 24, No. 3, MIT Press, 14—18
- Fallman, D. & Moussette, C. (2011). Sketching with Stop Motion Animation, *ACM interactions*, Volume XVIII.2, March + April, New York, NY: ACM Press, 57—61.
- Goldschmidt, G. (1991). The Dialectics of Sketching, *Design Studies*, Vol. 4, No. 2, 123—143
- Herbert, D. M. (1993). *Architectural Study Drawings*. New York: Van Nostrand Reinhold.
- Robbins, E. (1994). *Why Architects Draw*. Cambridge: MIT Press.
- Rowe, P. (1987) *Design Thinking*. Cambridge: MIT Press.
- Schön, D. (1983). *The Reflective Practitioner: How Professionals Think in Action*. Basic Books, New York NY.
- Stolterman, E. (1999). The Design of Information Systems: Parti, Formats and Sketching, *Information Systems Journal*, Vol. 9, No. 1.