

## **Chapter 7**

### **Two Users of Popup Workshop**

Chapter 6 discussed the user testing of Popup Workshop including descriptions of the methodology, the users and the results. However, with 5 users making 42 pop-ups, the conclusions were largely drawn from the work of the children in aggregate. Individual children and pop-ups were mentioned as examples, but the analysis was based on an overview of the work all of the users did. As valuable as it may be to step back and look at the user testing from afar, it can also be a good exercise to take a more detailed look at a few pop-ups from a few children. This demonstrates how a particular child uses a particular method at a particular time and it allows a more intimate glimpse into the way children express their personalities through their pop-up making.

This chapter presents an informal case study of two of the test participants. It begins by introducing the users and defining some of the criteria for their selection in Section 7.1. Sections 7.2 and 7.3 follow the users through the creation of two pop-ups each with descriptions and observations of the process. The chapter concludes with an examination of the pop-ups described here using the craft framework of Chapter 2 and with a look at how each user incorporated the Popup Workshop software into her crafting style.

#### **7.1 Overview**

One approach to this chapter would be to take one child and chronicle her pop-up making experiences from start to finish. However, another method presents itself in the particular case

of the children participating in the user tests. This study was fortunate to have a set of fraternal twins as participants. These girls, Peggy and Emily, represent children of the same gender, age and family background. They both spent enough time in testing to show changes in their pop-up design and construction abilities. In addition, the girls were very different in their approaches and in the styles of the pop-ups they produced, making them good candidates for this type of evaluation.

The girls also had very different personalities. Probably most telling was that Emily was the “crafty one”, according to Peggy. Emily did crafts for fun. She was considered the artistic twin and, concurrent with the testing, she was taking a painting class. In contrast, Peggy indicated that when she did crafts it was usually because Emily pulled her into the activity. Peggy also expressed some lack of confidence when it came to artistic pursuits, often apologizing for her drawing ability, for instance.

Emily was interested in telling stories and said that she wanted to be an author when she grew up. Peggy on the other hand said that she had no particular vocational goals, since they would obviously change later on.

In terms of other personality traits, it was obvious from the start that Peggy kept her work area in order, putting markers away and throwing away scraps of paper. Emily, on the other hand, left her work area a mess of paper scraps, markers, and craft knives. Emily was very talkative. She and the researcher had long discussions about music, books, movies, and anything else that came into her head. Her work style was impulsive, quick and intuitive and she was always willing to try something, then redo it if it did not work. Peggy, however, was all business, and often quiet. She took a great deal of time thinking about each step and wanted to have things right the first time.

These personality differences were expressed in the pop-up making styles of the girls. Peggy was deliberate, organized, did not talk much and thought everything out before executing it. She did not mind following someone else’s directions, indeed she often preferred it. This was demonstrated by her choice in reading matter about pop-ups, which was most often instructional. Peggy was interested in mechanisms and each of her pop-ups became an exploration of one or

more elements. Peggy spent a lot of each session thinking about what to do next. She did not appear to spend time planning what she would do outside the sessions. This was probably because craft was not a big part of what interested her. Emily, on the other hand, was a crafty person, as her sister said. Peggy made a quite perceptive remark about her sister's work, "[Emily] had every single pop-up lesson thing, she had every single one planned. I can't believe that." Peggy was unbelieving because she was supposed to be the organized one. In fact, Peggy was wrong in one way. Emily did have every pop-up planned in that she knew what the subject of every pop-up would be and how it would fit into her story. However, in her work she was much more disorganized and free-form. Peggy planned. Emily just cut. She was more interested in looking at pop-up books than instructional books. Her work was story-driven, not element-driven.

During the user testing, Peggy made four pop-ups and Emily made ten. To keep this discussion a reasonable length, two representative pop-ups were chosen for each of the girls, one from the early period of testing and one from near the end<sup>1</sup>. The two early pop-ups chosen were the first that each of the girls made. The later pop-ups were Peggy's fourth (and last) and Emily's eighth. Emily's last two pop-ups were either unfinished or did not use Popup Workshop, making her eighth pop-up the most useful example of her late work.

Section 6.3 summarizes basic data about the users and their testing, but it is worth repeating some of the information relating to Peggy and Emily here. Peggy attended 8 1-hour user testing sessions, which was the number that the researcher had told her parents was the minimum. This translated to about 7 hours of working on and with pop-ups. She did not leave the testing early, although she had that option, but she did not wish to continue for extra sessions as she had no specific projects in mind. In contrast, Emily was intent on making a book. This book was never bound, but each pop-up in her series was related to the others. Emily had a good idea where the book was going and wanted to continue after Peggy stopped. Emily therefore attended 13 sessions, some of which were two hours in length, and accumulated nearly 16 hours of work time, more than any other user. This should be kept in mind when the later pop-ups are examined.

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<sup>1</sup> The entire course of their work during user testing can be seen in Appendix F

## 7.2 First Pop-ups

Both Peggy and Emily made their first pop-ups during their first sessions while exploring the software, and completed the folding and decoration during their second sessions. The researcher explained the controls and how they were grouped, and the girls each tried adding and changing various elements to their pop-ups, as well as using the replication and decoration tools. In spite of the similarity of these sessions, radically different pop-ups were created, and the differences in their working styles became apparent.

### 7.2.1 Peggy: Abstract Face

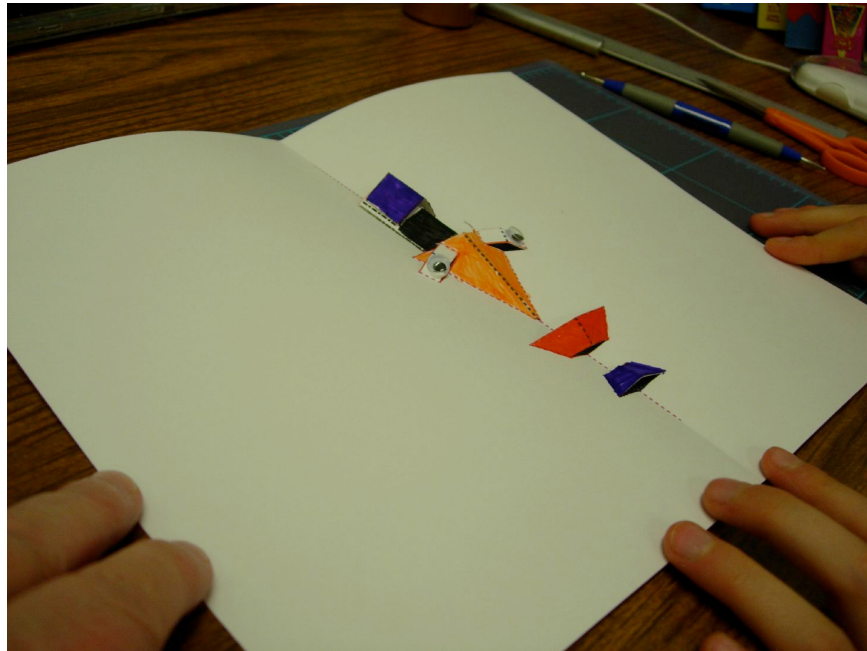


Figure 7.1: This is a view of Peggy's first pop-up that shows the double tent forming the hat (at the top of the design).

Peggy's first pop-up was an abstract face with all of the elements made with the software and then colored with markers. Figure 7.1 shows Peggy's first pop-up when complete<sup>2</sup>.

<sup>2</sup> For more pictures of the pop-ups described here, and all other pop-ups that the girls made, the reader is

Peggy started the pop-up by creating a beak. She then used this beak to investigate change by changing the points on the beak, watching the effect of the changes in the Viewer Window. She colored the beak orange, then experimented with the replication feature by adding a step to one side of the beak and replicating it on the other side. The next element she added was the larger tent with the smaller tent on top of it. When she did this, the Viewer Window showed the smaller tent on the underside of the larger one, as it was using the alternate solution for the constraint problem<sup>3</sup>.

At this point, Peggy made two discoveries. First, she found that the tents could be colored with fill, but that the fill must be done on the tent itself and not on the gluing strip that is shown on the base sheet. This was a mistake that most of the children made on their first attempt to color a 180° element with fill. It presented no subsequent difficulties, but tended initially to be a surprise. Second, Peggy discovered that when the pop-up was completely open in the Viewer Window, the beak and steps disappeared into the page but the tents were still popped up. This was an important discovery that demonstrated a major difference between 180° elements and 90° elements. Although that difference played no direct part in the design of her first pop-up, it was an integral part of her next pop-up, *Table and Chairs*, enabling the backs of the chairs to come to an upright position with their seats folded down when the pop-up was fully opened. (See Figure F.22.)

At that point, while using the Viewer Window to observe the pop-up, Peggy turned the pop-up upside down and remarked that, “Actually, I like upside down better....Makes him look like a freaky old guy.” She was thinking of the tents as a beard, but upside down they became a hat. From that point on, although she would rotate the design to look at it from different angles, she always returned the Viewer Window pop-up to the position rotated 180°, and used that view to do her work, planning on turning the pop-up around. The Editor Window does not rotate, but by using the Viewer Window in this way, Peggy got the orientation of the pop-up that she wanted.

directed to Section F.4 for Peggy and Section F.5 for Emily.

<sup>3</sup> See Section 5.4.4 for a description of why this scenario occurs.

She made a suggestion for changing the program at this point concerning the Viewer. She wanted a zoom feature that would allow her to examine the design more closely.

She used the change feature to tweak the sizes of the elements, then added the angled steps last. When the design was complete, she removed the fill colors that she had been using, declaring that the design was more interesting in white. Figure 7.2 shows Peggy's first pop-up as printed.

During the next session, Peggy cut and folded the pop-up and glued on the tents. This process presented no difficulties for her, although the small steps on each side of the beak took some time to fold properly. She attached the smaller tent to the larger tent before gluing them both onto the base page. In the process, Peggy tried the larger tent both as designed and rotated  $180^\circ$ , which would have put the smaller tent on the other end, but decided on the original design. Finally, she colored the pop-up using markers and added plastic "googly" eyes. She called him "Mr. Freddy" and said that he was an "alien guy". Overall, the pop-up took 46 minutes of actual work time.

This pop-up was unusual in several respects. First, it contains two  $180^\circ$  elements. Ursula used one  $180^\circ$  element in her second pop-up (the first one that she designed on the computer) but most children waited to use them until later in their sessions, and a tent on a tent construct was quite unusual in any case. This demonstrates Peggy's interest in the elements themselves early in the testing. Second, Peggy used the Viewer Window to reorient the design in progress and to plan for a pop-up that was rotated  $180^\circ$  from the Editor Window representation. No other child did this. Finally, the entire design was cut, folded and glued before Peggy added color. This is often not the most convenient way to decorate a pop-up, but it did allow her to see the results on the completed pop-up.

Peggy also demonstrated her general style of pop-up making with this first pop-up. Her interest in the elements themselves became obvious from the beginning. For example, she experimented with the way the centerline changed when she changed the sides of the beak, and with the difference between the step and the tent when the pop-up was opened. In addition,

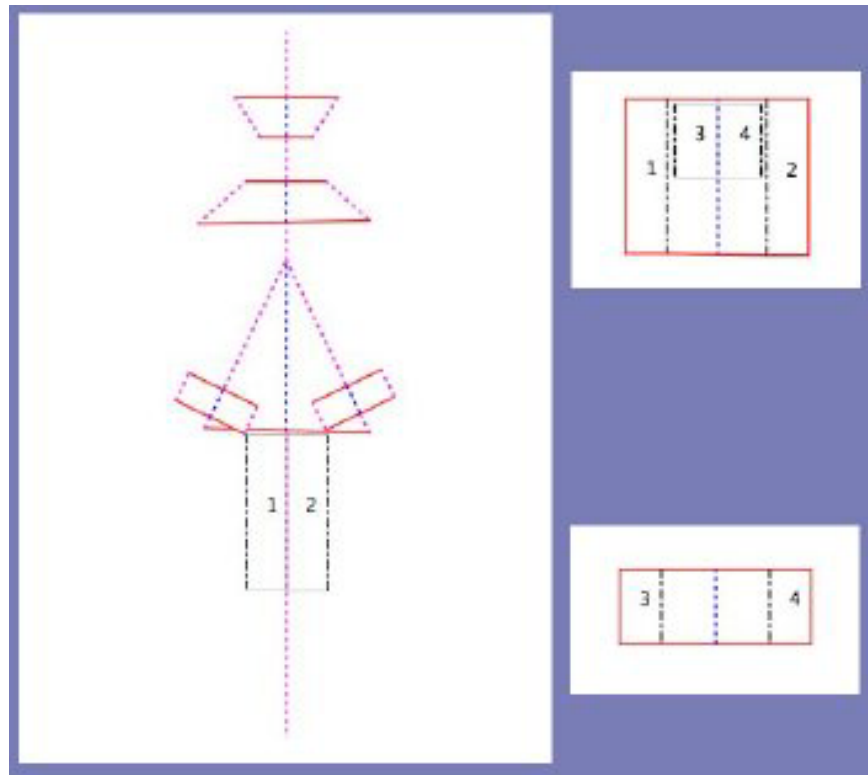


Figure 7.2: Peggy's first pop-up was printed in three sheets. On the left is the base sheet with two angled steps, two steps on a beak, and the base for the larger tent. Above right is the sheet for the large tent with the base for the small tent. The sheet for the small tent is shown below right.

Peggy was very deliberate and took her time in making the design, both with the computer and in her work by hand. She used the change feature a great deal, spending time changing the central beak and seeing what happened to the steps on its sides, and changing the size and position of the tents. Peggy read both the tool tips available for controls and in the help area, and used the Viewer to observe every change she made, rotating, opening, and closing the pop-up, which led to the inversion of this first design. In choosing colors and decoration, Peggy was deliberate in choosing colors for each piece and picking just the right size of googly eyes.



Figure 7.3: Emily's first pop-up, Freddy Squarehead. Note that she has cut around the hair at the top of the step so that it rises above the page with the face.

### 7.2.2 Emily: *Freddy Squarehead*

The first pop-up that Emily made was a face that she called *Freddy Squarehead*, shown in Figure 7.3. All elements were made with the computer, although the top of the large step was altered to follow the hair line in the final cutting, and computer coloring and line drawing was used throughout. Figure 7.4 is the image that Emily printed to make her first pop-up.

When Emily started experimenting with the software she discovered the color selector and the fill button first and colored the base page before doing anything else. She played with all of the elements, trying each in turn. In the process, Emily added a tent and another on top of it and a v-fold, but deleted them. Before deleting the v-fold, she tried to color it and discovered that she needed to add fill to the v-fold on the extra page, just as her sister had learned. When the design

was complete it contained only 90° elements.

Emily was very concerned with the colors, and spent a lot of time getting the design completely filled. She also discovered the computer-drawn lines as she was doing the fill coloring, since they are in the same area of tools. Emily used computer-drawn lines on four of her pop-ups, more than any other user, and this first pop-up showed her fascination with both these and the fill colors.

In drawing the character's hair and ears, Emily asked if she could cut around them:

**Emily:** Could I cut around his hair?

**Researcher:** Yes you could....I don't see why not. You can change that top part of the cut easily enough...

...

**Emily:** His ears don't need to cut out.

**Researcher:** His ears are on the fold so...

**Emily:** Could I cut them out?

**Researcher:** You know you could. You could cut them out and bend them up kind of up this way.

**Emily:** Hmmm. OK.

**Researcher:** That would work.

In the end, she chose not to cut around the ears and, although we concluded that she could have done so, they would not have moved. She also wanted to write words on the pop-up when it was complete.

During this first session, Emily showed a great interest in the tools and materials and particularly in the craft knives and the self-healing mat. She kept checking the mat to see if she could feel the lines she had just cut, trying to figure out how it worked, and trying to think of ways to damage it. Emily also used the knife to cut around the hair, even though she had scissors, and using them might have been easier. She continued this throughout the testing sessions, always using the knife. She also cut out small designs of animals on scrap paper as a time filler when she was thinking or allowing a pop-up to dry. Emily was also interested in the type of paper (card stock) that was being used, asking where she could buy it.

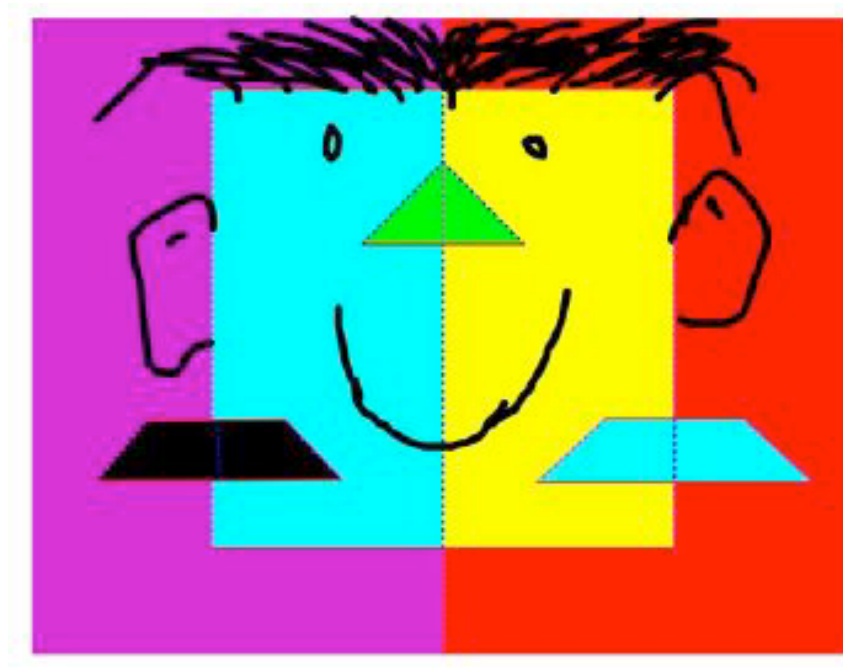


Figure 7.4: Emily's first pop-up was printed in one sheet. This contains a step, two angled steps and a beak. Emily used both software-drawn lines and fill colors in her pop-up.

Emily's style was much more free and quick than Peggy's. Instead of spending time thinking about which color to use, she tended to apply it to see if she liked it. This may be a result of her more extensive craft and art experience, particularly her experience in painting. This is reflected in the short amount of time it took for her to produce her first pop-up—just 33 minutes—with about half of the time spent learning and using the software and half spent cutting and folding the pop-up. It should be noted that her pop-up went together quickly as she had no pieces to attach and the elements were large.

Emily also demonstrated two qualities which would play a large role in her subsequent pop-ups. First, she was concerned with the story that a pop-up told, as evidenced by the writing of a caption on each pop-up she made, beginning with Freddy Squarehead, her first. Second, she was more concerned with the aesthetics of color and general shape than with the mechanical details of how particular elements work. She used the change feature and the Viewer window less

often than Peggy, being less concerned with the exact shape of the element. However, she was more inclined to change the way lines were cut after they were printed. In the case of her first pop-up, she changed the cut at the top of the large step to follow Freddy's hair.

### 7.3 Later Pop-ups

In Peggy's case, the selection of a second pop-up to contrast with her first was obvious. Her final pop-up was not only technically interesting, but was the pop-up that she picked as her favorite in the email follow-up. It does not have as much detail work as her campground (Figure F.23), but is perhaps the most aesthetically pleasing of all her pop-ups.

As previously noted, Emily was making a "book" in which the central character in each pop-up had some relationship with the character in the previous pop-up. Her final pop-up (Figure F.38) was a simple, although interestingly asymmetric, exploration of the software which she never completed. Her penultimate pop-up was the final page of the book and, although visually interesting, was designed and created without the use of the software, rendering it less useful for the purposes of comparison (Figure F.37). Her eighth pop-up, *Bart the Elephant*, is a complex pop-up made both by hand and with the computer and serves the purpose of comparison well.

Be aware that the comparisons are between Emily's first and eighth pop-up and Peggy's first and fourth. Emily had more experience with making pop-ups by the time she made Bart and this is obvious in the complexity of the piece.

#### 7.3.1 Peggy: *Sun, Tree, and Cloud*

Peggy's final pop-up was the *Sun, Tree, and Cloud* shown in Figure 7.5.

Peggy's pop-up began with her desire to make a wheel. She was inspired by a wheel in *Pizza*<sup>4</sup> that changed the ingredients on a pizza (with worms, bugs, snails and other disgusting

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<sup>4</sup> Both Peggy and Emily used several of the books provided as references for users. Two were pop-up books: *Pizza!* by Jan Peřínkowski [86] referred to here as *Pizza* and *Animal Popposites* by Matthew Reinhart [92] referred to as *Popposites*. Instruction books used were: Barbara Valenta's *Pop-O-Mania: How to Create Your Own Pop-Ups* [123] and referred to here as *Valenta, Elements of Pop-ups* by David A. Carter and James Diaz [15] referred to as *Carter, Paper Engineering for Pop-Up Books and Cards* by Mark Hiner [50] referred to here as *Hiner*, and finally *Pop Up!: A*



Figure 7.5: The *Sun, Tree and Cloud* when complete. Note the rotating multiple-layer wheel and floating cloud. A central section of the tree's leaves can be moved with a slider.

ingredients). She spent time with *Valenta* and *Carter*, and particularly liked the moire pattern produced by one of the wheels in the latter. She soon settled on using the wheel as a sun in an outdoor scene. Peggy had developed a love of the *Carter* book and returned to it often during sessions.

Peggy thought about having a cloud that would move over the sun.

**Peggy:** Let's...Ooo...we could have a cloud pop-up!

**Researcher:** Yeah...

**Peggy:** A cloud pop-up here. Oo, Oo, I'm gonna get kind of complicated! We could have the sun over here [*points to the left side of the page.*] and it could spin in the middle and changes color, and we could have the cloud over here and we could move the cloud back and forth.

This idea presented difficulties as the sideways motion of such a cloud is difficult to produce. She and the researcher spent some time with instruction books and pop-up books looking Manual of Paper Mechanisms by Duncan Birmingham [6] and referred to here as *Birmingham*.

for a similar motion. (One of the elements examined in this process was the slider in *Valenta*, which was later used in this pop-up as part of the tree.) A bear paw made of an attached plane on an extremely shallow v-fold in *Pizza* seemed to offer the best solution, and Peggy moved on to consider a tree as part of the scene.

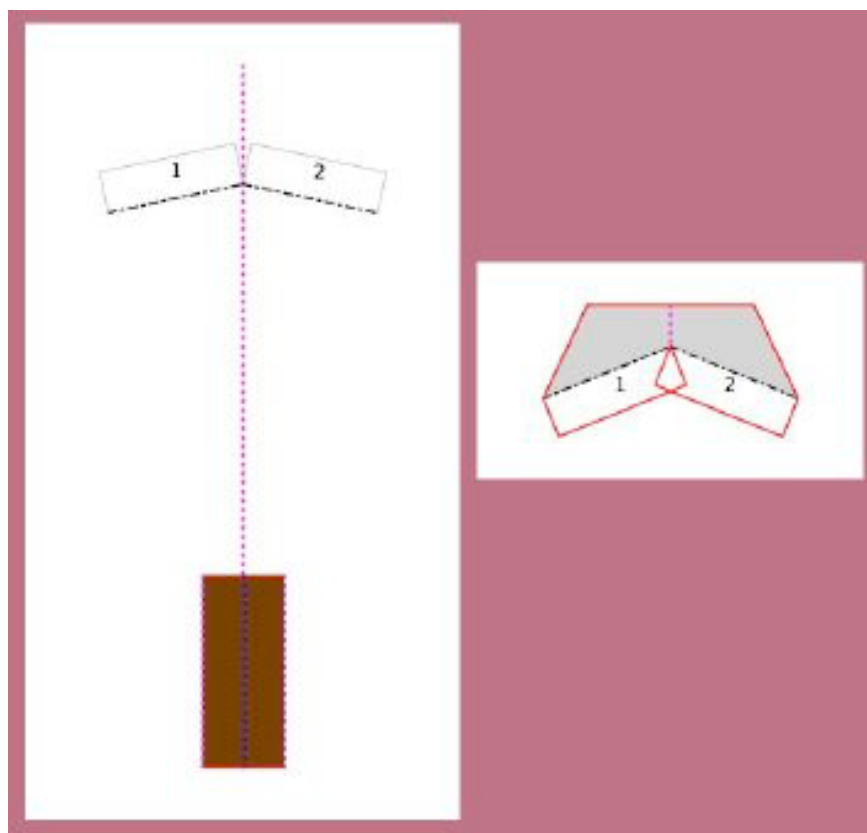


Figure 7.6: Peggy's last pop-up was printed on two sheets. On the left is the base sheet with the step that is the tree trunk and the base for the v-fold that will support the cloud. On the right is the v-fold itself.

Peggy added a trunk for the tree using a step, adjusted its size and colored it with the software. During this process, the researcher showed her the constraints for the centerline of a step. The v-fold for the cloud was added next. After a great deal of playing with the shape, she decided to print it and try it, as it could always be changed later.

There was a month-long break in testing for the Winter holidays, and when Peggy returned

to testing, she had lost much of the flow of her work. The cloud as originally conceived was to be on one side of a fairly flat v-fold. This would make the cloud “flap down” over part of the sun. When Peggy started work again, however, she placed the cloud over both sides of the v-fold, creating a platform element. This was a natural evolution, as she had used v-fold platforms in two of her previous pop-ups. The final result was not the sideways motion that she had originally wanted, but the cloud “floats” over the paper to produce a nice effect, and she was pleased with the result.

Peggy next turned to the sun. She decided to use oranges and yellows and collected the colored paper she needed. She used a compass to make the larger circles and a circle template to make the smaller ones. The first step was to cut the curved sections out of the base page that would allow the wheel underneath to show through. Peggy drew these shapes freehand. When cutting them, each cut-out section must be bounded by two lines. She found that she did not have an even number of boundary lines, which would leave an extra boundary line or uneven sections at the end of the process. Luckily, Peggy discovered this about half-way through the cutting process and was able to redraw the remaining cut lines to remove the extra line and make the sections all the same size.

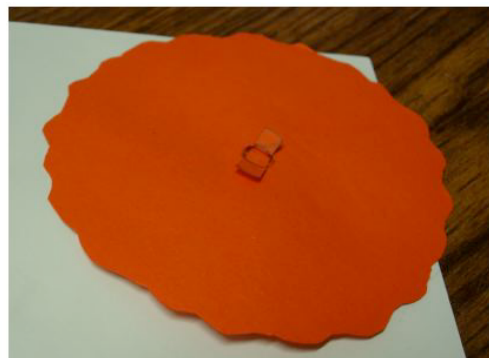
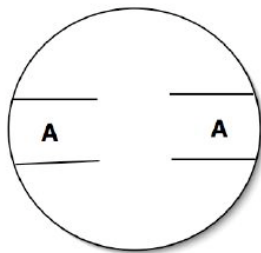


Figure 7.7: A paper brad holding the sun on the back of Peggy’s final pop-up: The brad is a circular piece, cut to produce four sections on the outer rim. Opposite sides marked “A” are folded out and placed in the hole of the wheel, then folded back in to hold the wheel on the brad, and the rest of the brad is glued to the back of the base page. The wheel shows through cutouts in the base page.

In making the wheel itself, Peggy used much the same process. The wheel could have been made from a solid sheet with the curved stripes glued on, but Peggy decided it would be easier to make two wheels, with one cut out to make the stripes. This time, she counted first to see that the number of cuts would produce the stripes she wanted. She also planned for the fact that the stripes on the circle had to curve in the opposite direction of those in the base page to produce the moire effect.

In the final session with this pop-up, Peggy attacked the construction of the pivot. The researcher had found examples of the construction of paper brads for attaching wheels in two of the instruction books, *Hiner* and *Birmingham*. *Valenta* included a wheel, but used a metal brad that would show on the center of the wheel and Peggy decided against it for that reason. *Hiner* and *Birmingham* used the same sort of construction, a small circle of paper, with cut lines to produce wings that would fit in a circle cut in the wheel. The only difference was that in *Hiner* the cuts were angled. Peggy looked at *Hiner*, but used the *Birmingham* brad in the end. See Figure 7.7 for a close-up of her brad on the completed pop-up and a diagram of the brad construction.

Adding leaves to the tree was done with markers, although Peggy also considered feathers or coils for the branches and leaves. She added a slider, a mechanism that she had seen in *Valenta* when looking for something to move a cloud sideways. The slider moves a patch of leaves in the tree from side to side.

The final stages of construction consisted of adding eyes and a smile to the cloud, and using sequins and gems to decorate the tree, the wheel, and make a flower garden. Peggy seemed to really enjoy this process. She saw the pop-up as a fun sort of outdoor scene that a younger child might make and remarked “I’ve been too busy being a 12 year old. I need to go back to being a 5 year old.”

At 2 hours 17 minutes of work, this pop-up took considerably longer than her first effort. Much of that time was spent in deciding on the types of elements to use and constructing the wheel.

There are some important things to note about the construction of this pop-up. First,

Peggy was still element-directed. The original idea for the pop-up was the use of a wheel and the nature of the scene came later. Second, Peggy showed herself to be very good at following directions and at puzzling through complicated relationships of form. The brad that holds the wheel is not an intuitive construction, and the wheel itself presented interesting problems such as the number of cuts to make the holes for each wheel and the direction of the curves to produce the moire pattern. Third, although Peggy frequently declared that she could not draw and that her sister had the talent in the family, she created the curves for that wheel freehand and did an extremely good job at it. Fourth, she enjoyed making the pop-up. Particularly while decorating the final result she was smiling and playing in a much less serious way than usual. And finally, in dropping the original design of the cloud in favor of a platform, she demonstrated the way in which a craftsman might fall back on a familiar way of operating when things get puzzling—as the pop-up seemed to Peggy when coming back to it after a month’s absence.

This final pop-up of Peggy’s represents an advance over her first in several respects. First, in comparison with Peggy’s first pop-up, this design was made much more consciously. Her first pop-up originated with random experimentation with the software. During this process, Peggy discovered the similarity of the design to a man with a hat and proceeded to enhance the likeness. This later pop-up, however, began with both the desire to use a particular element, and the idea for the subject, an outdoor scene, with all the design aimed at creating that scene. Second, Peggy used handmade elements as a part of the design. In fact, the sun wheel was the originating idea for the pop-up. And finally, Peggy built on discoveries that she had made earlier in using the v-fold platform for her cloud.

### 7.3.2 Emily: *Bart the Elephant*

Emily’s eighth pop-up was *Bart the Elephant* (see Figure 7.8). Bart was built on the two printed sheets shown in Figure 7.9.

Emily had mentioned making an elephant several sessions earlier while working on her



Figure 7.8: Bart the Elephant with Emily's other characters living in his ears. Note the handmade ears in two layers of v-folds, and the folded v-fold for the trunk.

moose<sup>5</sup>. She wanted an elephant because she could have all the other characters she had introduced living in his ears. Her concept for the elephant at first was that the trunk would pop up and the ears stick out so that the other characters could be inside them. The pull-tab she was using for her moose pop-up took multiple gluings with waits in between to allow it to dry so she started on the elephant during these drying periods.

Emily suggested using a v-fold for the elephant's trunk and she and the researcher talked about v-folds to see if that was a good choice.

**Emily:** I kind of want something where his like trunk pops up like this [elephant trunk motions], and his ears go out like that and everyone is going to be in his ears.

<sup>5</sup> The series of pop-ups for Emily's book began with *Freddy Squarehead*. Each character related to an earlier one. *Cinnamon the Cat*, who doesn't like Freddy, was next. The two unfortunate characters following were *Mr. Mousy*, Cinnamon's dinner, and *Mr. Mousy's friend Mr. Tweedy Mo*, eaten last week. This was followed by *Howard the Giraffe*, Cinnamon's aunt's second cousin twice removed. *Tap Dancing Cow #47* tap-dances on Howard's back. *Moosey McMooseMoose* is the cow's ex-boyfriend. They all live in *Bart the Elephant's* ears. The final pop-up shows all the characters except Cinnamon sliding down the *Slide of Ignorance*.

**Researcher:** Oh that's good!...Like a narrow v-fold?

**Emily:** Yeah, but it'd have to be all funny, you know, like, unless it's a perfectly straight trunk.

**Researcher:** That's true. It could be like off to the side or something...

**Emily:** Or could we do like v-fold, like, like this and another fold like that and another fold like that.

**Researcher:** You probably could. You probably could. Actually, I think you can take a v-fold and fold it.

Emily had used v-folds for the beak of her bird and as platforms under the cow, but had not experimented with them much. She wanted to fold a v-fold to simulate the curve of an elephant's trunk, and the researcher helped her locate a page in *Birmingham* which showed a v-fold that was folded once in the center. She deduced from this example that a v-fold trunk could be folded more than once.

Using the software, she added the trunk v-fold and made changes until it was the right size, length, and had the backward slope that she wanted. She used an angled step for the face at first, but by using the viewer she saw that it would collide with the trunk. Next, she tried using a tent for the face and it still collided with the trunk. The researcher suggested using a beak, as it would not stick up so far on the pointed end. She tried this and although it appeared to collide slightly in the Viewer Window, Emily decided that when the trunk was bent the elements would not hit each other.

At this point, Emily was also playing with ideas for the ears, using the software. Putting v-folds on the side of the beak was unsatisfactory as they did not look realistic. Emily played around with v-folds for a while and spent some time looking at the whale pop-up in *Popposites*, as it has flippers composed of multiple v-folds. She played a bit more with v-folds on the computer, but could not get quite the angle or shape that she wanted. Finally she announced:

**Emily:** But I've got an idea. An idea that's like....What I was thinking is like I just chop chop chop chop chop chop chop chop [*indicating the shape of an ear*] and I attach from like here [*the trunk*] with I don't know string or something to here so it gets pulled out.

**Researcher:** Oh. That's interesting.

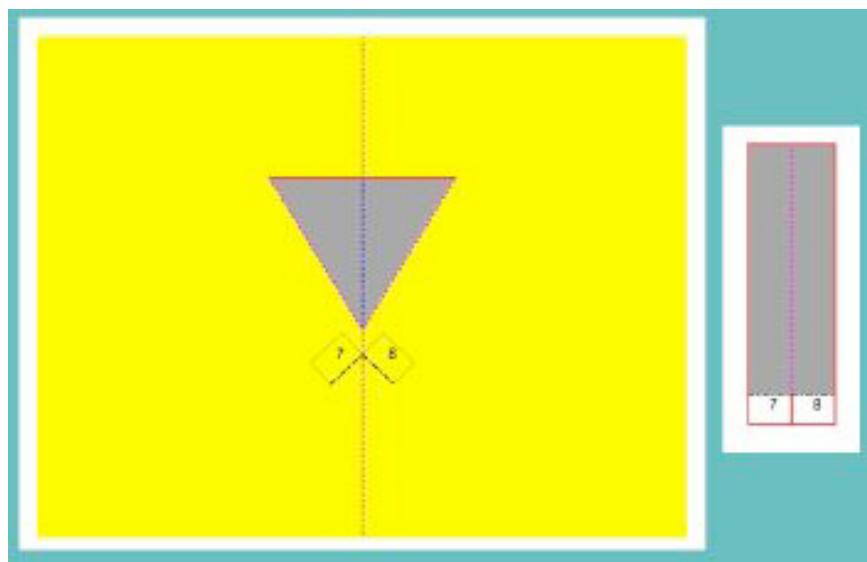


Figure 7.9: Emily's eighth pop-up was printed in two sheets. The base sheet on the left contains a beak and the base for a v-fold. The v-fold itself is shown on the right.

**Emily:** 'Cause the trunk goes out.

**Researcher:** The trunk goes out as you open it, right?

**Emily:** Uh. yeah. *[opening and closing the pop-up and looking at the Viewer Window]* So it would kind of pull the ears out.

**Researcher:** If you just added extra pieces you mean, and attached them with string?

**Emily:** Yeah.

This problem solved, she colored the elephant with fill colors and it was printed. The printer was low on yellow ink and the trunk piece printed well but the background did not. Quite a bit of time was spent at this point in finding a name for the elephant. "Bart" was leading the list of possible names at this point. Subsequently, the researcher printed the elephant when the printer had been fixed. This produced an extra printout of the trunk.

The extra printout of the trunk was used in the next session when Emily started to work on the trunk. Since the trunk was folded back on itself, the back of the sheet was visible and needed to be colored as well. Emily tried coloring it with markers, but it was not a good match, so she glued the two trunks together, colored sides facing out, which also strengthened the v-fold piece.

She folded the trunk and it did indeed work well. Emily used scotch tape as well as glue to fasten the trunk to the base page, as she was concerned that the small base of the v-fold would not hold with glue alone.

Emily mentioned that tusks would be nice, so she made some and attached them to the base on either side of the center fold. These are not standard elements, although they might be considered a form of attached plane. The tusks, being parallel to the center fold, fold back when the pop-up is closed. Emily decorated the background with smiley faces and wrote the text on the page.

When Emily started to think about the ears, she decided that having a head around the face would make it look better, not only as a way to connect the pieces, but also to hide the scotch tape at the base of the trunk. She made the head in two pieces, one to surround the lower part of the face, and one for the top of the head above the beak representing the face. The lower part of the head presented problems in cutting holes for the trunk, beak and tusks. The holes needed to be positioned exactly where the pieces would stick through the head. Emily solved this problem by marking the points at the end of the cuts with the knife while positioning the head over them. She added the elephant's smile as a final touch for the face.

Emily eventually decided against using the string idea for the ears and made v-folds instead. These were unusual in design and could not have been made with the program, as they attached to the base page and to the inside of the beak, rather than to the fold between the base page and the beak. It took some time for her to explain her idea to the researcher, who was stuck on the idea of the v-fold being on the outside of the beak:

**Emily:** ...I could do a v-fold that goes around this part [*the beak*] and then sticks up like that. Do you think that would work? Would it pop-up by itself?

**Researcher:** [*hesitantly*] It probably would.

**Emily:** Like especially if I glued one side to the back of this [*the beak*] and put a crease right here. [*along the beak fold*]

**Researcher:** It would have to fit either this way on here or this way on here. [*Indicating along the beak fold on the outside of the beak.*] It would

have to be on this fold.

**Emily:** But would it be possible to, um, to put one side attaching here *[outside on the base page]* and the other side going around there *[inside of the beak]* so it's kind of going around like this. *[cups both hands like a v-fold around the side of the beak].*

**Researcher:** Oh...(pause) Yeah, it might be. Want to give it a try?

She and the researcher discussed the technique of not creating a center fold for the v-folds before they were attached, but instead allowing them to fold as the pop-up was closed. In this way the centerline is automatically created in the correct place even if the v-fold is asymmetric or off-center. Emily made two prototypes for the ears before making the ones she used so as to find the proper size and shape.

Since the other characters were to be placed in Bart's ears, Emily decided to make small pockets by attaching still more v-folds to the ears. She cut several sets by hand before they were the size she wanted. It was interesting that she used the knife to score the folds for the gluing tabs on these v-folds. This is a delicate technique, requiring careful knife-work to avoid cutting through the paper, but was faster as she already had the knife in hand. She attached the new v-folds for the ear pockets, closing the pop-up in order to produce the center folds in the correct place.

The final step in making Bart was to make small versions of all the characters that she had previously introduced, and gluing them to the ears.

This was an amazing pop-up as it contained several layers of elements, only two of which were made on the computer. It took 2 hours and 49 minutes of work, but over 2 1/2 long (2 hour) sessions as she was working concurrently on the moose at first.

Some important items to note are, first, that Emily was story-driven. She felt that she needed to connect all the characters before the end of the book, and Bart was the place to do it. Second, Emily had learned how to make a v-fold well enough to put two levels of v-folds for the ears and to fold one for the trunk. She not only bent the trunk v-fold, but attached the v-folds for the ears in a novel way, using the inside of the supporting beak. Third, she used the Viewer

Window in the software to determine that elements were colliding and to fix the problem.

The advance in design and construction over her first pop-up, designed entirely with the software and using only 90° elements, is remarkable. By her eighth pop-up, Emily was using a variation on the v-fold for the trunk and making v-folds by hand for the ears. The software had become only a tool to create the background color and a base for adding the rest of the elements that make up the bulk of the design.

## 7.4 Conclusions

In examining the construction of these four pop-ups, there are two vantage points from which to look. First, the framework of craft derived in Chapter 2 can be used to guide and structure the observations. Second, ways in which the software facilitated Peggy and Emily's paper engineering can be examined.

### 7.4.1 Craft Framework

Both Peggy and Emily exhibited increases in their knowledge of pop-ups during the testing sessions. In the case of v-folds, Emily was specifically suggesting v-folds for Bart's trunk and ears as she started designing the pop-up and she was also able to look at the whale pop-up in *Popposites* (a very complicated pop-up) as an example for how it could work. Peggy had learned how to make a platform using a v-fold while constructing her second pop-up and used it repeatedly thereafter, in particular in the construction of the cloud in her final pop-up. Both girls exhibited an ability to either know which element would produce the effect desired or to find one in the pop-up books or instruction books provided. For example, Peggy was not sure how to produce the sideways motion that she wanted from the cloud, but was able to find something approximating that motion in one of the commercial pop-up books. Emily thought that a v-fold might be foldable into her trunk, and was able to find confirmation in an instruction book, and extrapolate from one fold to two.

In terms of skill, for both girls the amount of embellishment added to the basic pop-ups by

hand increased significantly between the beginning and end. Much greater skill (and time) was applied to the construction of the later pop-ups, as seen in Emily's crafting of a double layer of v-folds for Bart's ears. Emily had become proficient in the use of the knife which she used to good effect in producing hand-cut v-folds for Bart's ears, as well as to cut out all of the characters to be attached. Peggy, on the other hand, showed a great deal of ability to copy a complicated design for a wheel that used multiple layers of colored paper, curved slits in the base page and colored bars on the wheel itself, and a paper brad to attach the wheel and allow smooth rotation.

Appreciation is much harder to evaluate than the other two competencies. However, three observations confirm its development in both Peggy and Emily. First, the later pop-ups had some purpose and the girls exhibited a desire to produce a particular product. In one respect, appreciation is indicated by a directed approach to the craft, a desire to proceed in a definite direction rather than to produce a random object. This comes out of an ability to envision the final product and to decide what should go into it. Emily demonstrated this by producing a series of pop-ups featuring related characters. Her pop-ups became part of an ongoing project, and as a result, when she came to Bart, she knew quite clearly what she wanted: a trunk that folded, and ears that flapped and held the other characters. Peggy, being more element-driven, wanted something that could be moved by hand, and ended up with both a wheel and a slider in her final pop-up.

A second characteristic of the growth of appreciation is the use of materials and ideas obtained from others, a development of an aesthetic that allows the craftsman to see the value in another's work and adapt what works for her. The girls used pop-up and instructional books and chose what they liked. Not surprisingly, this differed between them, with Peggy preferring instructional books, particularly *Carter*, and Emily looking almost always at the pop-up books themselves. Being sisters, they commonly played off each other. Emily adapted Peggy's v-fold as a platform idea and used it in her *Tap Dancing Cow #47*, while Peggy often asked what her sister was doing, although she did not copy from Emily. They would look at each other's pop-ups when they arrived for sessions and critique them.

Third, over the course of the testing, each developed her own style, part of the process of

growth in the craft. Emily's style was more pronounced, but she had longer to work, and working on a multiple pop-up project allowed her works to be more related. Emily's style consisted of story-driven ideas, usually one or two simple elements (although Bart was unusually complex), bright colors, and flaps hiding surprises. Peggy's style was element-driven, focusing on the mechanics of the elements and how that influenced the pop-up experience. Her pop-ups contained more complex combinations of elements and less use of color than did Emily's.

#### **7.4.2 Software Interaction**

There were some particular occurrences where features of the software were seen to support Peggy and Emily's pop-up making. The Viewer Window provided two important examples. Peggy designed her first pop-up upside down by viewing her Editor Window actions in the inverted Viewer Window. Without this, she might have eventually rotated the pop-up, but it would have been after the pop-up was printed. Emily used the Viewer to good effect when designing the beak that would be the elephant's face so as to avoid collision with the trunk. In this case, Emily could see the collisions as they occurred and make the corrections before printing.

Another important feature was the printing of the pop-ups themselves. In the case of these pop-ups in particular, Emily printed two trunks for Bart, since she later made some changes and reprinted the entire design. The extra trunk was fastened to the back of the first to produce a single trunk that was colored the same on both sides.

In discussing the effects of the software, one should finally note that it accommodates different interests and styles, as evidenced by the differences in Peggy and Emily. For Emily, the software provided bright colors, lines, and basic shapes that she could modify to make her characters. In Peggy's case, the change feature and the Viewer Window allowed her to experiment with changes in the elements that could be examined to see how the shapes and movement changed.

And finally, the software did not appear to keep Peggy and Emily from experimenting, designing beyond its capabilities, and developing their own elements and designs. Peggy extended

the v-fold to make a platform; Emily folded a v-fold for the trunk. For both girls, the first pop-up was largely an exploration of the software, and by the end, the software provided a base on which the hand work of pop-up building could proceed.

## 7.5 Summary

Stepping back from the analysis of Chapter 6, this chapter has taken a closer look at how two users made pop-ups, the changes in their pop-ups over time, and how the software facilitated their learning process. Focusing on a smaller segment of users and pop-ups allows a more detailed view of the pop-up making experience.

This chapter looks at the work of Peggy and Emily, who are twin sisters. Although they have similar backgrounds and are the same age, they have very different interests and personalities and presented a good basis for the comparison of the work of different children. Two pop-ups were selected from the work produced by each girl for more detailed study: the first that each made, as well as a later pop-up from each.

Both of the first pop-ups were made when the girls were first exploring the software. Peggy showed a more element-driven approach to pop-up design, producing an abstract face using an unusual configuration of one tent on another tent. She also spent a great deal of time experimenting with the Viewer Window, and in fact used the window to design the pop-up rotated 180°. Emily, on the other hand, was more captivated by the fill and draw tools. Her pop-up was colorful, and marked by an alteration to the top cut line of the large step.

The second pop-ups chosen were Peggy's fourth and final work, and Emily's eighth. Peggy made a sun from a wheel element that she copied from an instructional book, along with a cloud sitting on a v-fold, and a tree with a step for the trunk and a slider among the leaves. Emily's pop-up was of an elephant and was distinguished by its use of v-folds, both folded in the trunk and handmade layered v-folds for the ears.

There was development for both Peggy and Emily in the competencies of knowledge, skill, and appreciation as gleaned from the changes seen in pop-up making between their two pop-ups.

In addition, the Viewer Window and the ability to print multiple copies of a pop-up aided each of them. The girls exhibited great differences in styles and personality, but each was able to not only use the software effectively, but to produce more complex pop-ups at the end of testing than they did at the beginning.