NEXT STOP:
POP-UPS
The Influence of Paper Engineering on Visual Media
by Bernadette Puleo
NEXT STOP: 
POP-UPS

The Influence of Paper Engineering on Visual Media
NEXT STOP:
POP-UPS

The Influence of Paper Engineering on Visual Media

by

Bernadette Puleo

In partial fulfillment of the requirements for the degree of:
Master of Fine Arts: Visual Arts – Graphic Design
Marywood University, Scranton, Pennsylvania

Copyright © 2011 by Bernadette Puleo

All rights reserved.
I would like to thank all those who were so generous in taking time out of their busy schedules to answer my questions about paper engineering. These people ranged from paper engineers, artists, designers, collectors to curators. I found this community of movable paper lovers were warm and enthusiastic. They embraced my interest, were very willing to share their enthusiasm with me and welcomed me with open arms. This story would not have been possible without them.
We live in a time when the future of print is uncertain at best. It is a time when media is combined, melded, and molded. What was printed in ink, can now be digitally transmitted with E-Ink. Yet, humans crave the tactile. People love hide and seek and the element of surprise. For generations paper engineering has been used to create the pop-up and other forms of movable books that have delighted readers of all ages. Those very advances in technology that are diminishing the importance of print as a medium also allow products that employ the use of paper engineering to become more accessible in the commercial market. Today there are books and other print products that include sound chips and lights. Tomorrow, paper products will certainly become more integrated with digital content to create a multi-media experience. One example is augmented or mixed reality technology which has been developing since the mid–1990s. It is now starting to become more commercially viable. This technology enables a viewer, when opening a page of a book or greeting card, to see an actual 3D computer generated image pop out from the paper on a computer screen in front of them. The viewer must have a webcam in order to partake in the experience.

Paper engineering today is also utilized in the design of promotional material. Philip Bell, a pop-up designer and engineer, produced a pop-up tour book for the Baltimore Chamber of Commerce. In Switzerland, a series of six souvenir books called Stand-Up Switzerland, promoting Switzerland and its wonders, is published in several languages. A high end pop-up brochure for the German Chancellor’s office was designed by Refeka, an award-winning German company that is a leader in paper engineered promotional products.

Another venue where movable paper is utilized is in advertising. When Fruit of the Loom’s Pop-Up Panties ad ran in several ladies magazines, it was met with great success. Pushing the boundaries of digital media and print,
Graphics, the producers of the ads, collaborated with E-Ink Corporation to produce the first digital magazine cover, the 75th Anniversary Issue of Esquire Magazine.

With new technology and the expansion of global trade today, the mass production of novelty books and other forms of engineered and interactive paper allows for accessibility on a much broader scale than ever imagined at an affordable price. Paper engineering and other novelty devices have long been used in the greeting card industry. Today, there is a proliferation of paper engineered greeting cards, many of which include sound chips. These products are commanding high prices in the marketplace.

Paper engineering in the form of the pop-up also influences other media, such as film. In 2009, nine students from two rival universities in Dundee, Scotland, created an animated film, The Happy Duckling, that was set in an pop-up book environment. It has won many awards for its originality.

At the other end of the spectrum, book artist, Julie Chen, explores the moveable book form as part of her exquisite handmade books, such as “Panorama”. Her extraordinary books are printed on a letterpress.

No study of paper engineering could be complete without acknowledging the achievements of the king of the contemporary pop-up book, Robert Sabuda. With the publication of his intricately detailed pop-up books such as “Alice’s Adventures in Wonderland”, Robert Sabuda revived this art form and helped it reach the popularity it enjoys today.

PART ONE

There’s Nothing Like the Present
Although the focus of this paper is the present and future of movable books and related print media, it would be remiss if it did not include a few historical facts. “The earliest known book to use a movable part was produced in the 13th century by Catalan mystic and poet Ramon Llull of Majorca who used a revolving disc or volvelle to illustrate his theories.” Books with movable parts produced during this era, were made for the purpose of educating and conveying ideas to literate adults in a more precise way than could be achieved with a static illustration. One of the earliest movable book that survives today is Peter Apian’s “Astronomicum caesareum” (The Emperor’s Astronomy) printed in 1540. Its beautifully illustrated volvelles were designed to calculate astrological and astronomical data. Movable books made exclusively for children weren’t produced on a large scale until the late 19th century and then only for educational purposes and to teach moral values.

The popularity of movable books ebbed and flowed through the centuries. Economics and leisure time along with literacy and labor costs had a direct impact on the number of books produced since its early beginnings.

When asked the question, “To what do you attribute the resurgence of the pop-up book’s popularity and the growth it enjoys today?”, several pop-up book artists, engineers and collectors will answer, Waldo Hunt. Hunt was an advertising man, who was captivated by the pop-up books made by Czech artist and paper engineers, Vojtech Kubasta. Because of the complications of directly importing his books into the United States during the mid 20th century, Waldo Hunt decided to start his own company with the purpose of producing pop-up books and related print media such as advertising inserts, greeting cards and table decorations. Started in 1965, Graphics International became the leader of the new golden age of pop-up books. Waldo Hunt eventually sold Graphics International to Hallmark and started another company in the 1970s, Intervisual Books, Inc. This company continued to vanguard pop-up book design, production and packaging in the United States. One of the paper pivotal engineers who came out of this company is David A. Carter, author of many pop-up books made for children and adults that we enjoy today.
Although there have been many exhibitions of pop-up books in major university libraries, for the first time, from June 14, 2010 to September 30, 2011, the Smithsonian Institution Libraries at the Museum of American History in Washington, D.C. hosted an exhibit of the art and history of paper engineering entitled, *Paper Engineering: Fold, Pull, Pop and Turn*. Curated by Stephen Van Dyk of the Cooper-Hewitt, National Design Museum Library, the purpose of this exhibit was to showcase the history and diversity of movable books. He stated that the importance of this show was multi-faceted. It was to do a few things.

“One, to indicate that the mechanisms are old. Two, to show that they are not only for children. In fact they were originally made for adults. Three, to show they have different purposes. Four, to show it was a way in which people communicated. Five, to show they reach in creative ways. They are enticement to discovery. And six, to show that it is an art form.”

Susan R. Frampton, Program Coordinator of the Smithsonian Institution Libraries added to the list of the exhibition’s purposes. She felt in addition to bringing public awareness to the genre of movable books, it also brought awareness to the existence of the Smithsonian Library itself. The show demonstrated “that movable books were designed to illustrate complex subjects in ways that static books couldn’t.” She lastly added that the exhibit was meant to show “the fun side of the genre.” In viewing the exhibit one could truly get the sense that movable books have a long history, and that some very beautiful and complex movables were done as far back as the 1500s. The accompanying video to the exhibit explaining how pop-ups books are made, was very successful in educating the viewers. People’s comments, as they viewed the books in the exhibition, all expressed amazement. In one instance a child said, “It’s made of paper!” to which the adult answered, “That’s what’s so cool about it!” The show was well organized and indeed educated the public as to how many different devices are used to make paper move.
The Movable Book Society was founded in 1993 and is directed by Ann Montanarro. This organization touts a membership of 450 people worldwide. It provides a forum for collectors, artists, curators, book sellers and book producers. Their newsletter, Movable Stationery is published quarterly. The organization sponsors biennial conferences and the Meggendorfer Prize for outstanding paper engineering. The winner for the 2010 award went to “ABC3D” by Marion Bataille. The Movable Book Society not only Creates a social network for people who in one way or another are associated with this genre, but it also brings an awareness as to how many professionals there are making a living in this field. The artists, whether they work commercially or produce limited edition books are extremely creative, skilled and devoted to their art/craft. When asked about the importance of the Smithsonian exhibition, Montanaro responded by telling about an email she received from a mother after she and her child went to see the exhibit. The mother is now encouraged that people could make a living at paper engineering. The reason being is that her 13 year old child is obsessed with making pop-ups.

There have been many other exhibits of movable books in the recent years. One was hosted by the Grolier Club, an exclusive club to which only serious book collectors can belong. From March-May 2010, Beyond the Text: Artists’ Books from the Collection of Robert J. Ruben occupied the second floor of this institution. This exhibition goes beyond exemplifying how important movables are to the creative process. Of the 69 books exhibited, at least 23 of them had some kind of movable device. Most memorable was Julie Chen’s “Panorama.” When asked about her use of pop-ups in this book, Chen responded that she didn’t “intend to use pop-ups or other technologies for their own sake. I consider the experience that I want the reader to have and use whatever means I feel will be effective.”

Despite the fact that the first movable books were made for educated adults, today the majority of pop-up books published are for the children’s market. Movable Stationery, Movable Book Society’s quarterly newsletter always lists from 20 to 40 new titles in their new publications section. In addition to a plethora of new stories, many contemporary classic books such as “The Very Hungry Caterpillar” by Eric Carle, that was originally published in 1969 with flat illustrations, was converted to a pop-up book in 2009, to celebrate its 40th Anniversary. Another extraordinary example, is “Brava, Strega Nona!”. Written and illustrated by Tomie dePaola in 1975, this heartwarming tale, which had won a Caldecott award was recently published as a pop-up by master paper engineers, Robert Sabuda and Matthew Reinhart.

One of the most popular pop-up book artists/engineer for the younger set is David A. Carter. In his bug series, of which there are 28 titles to date, 19 employ many hide and seek movable mechanisms, such as pull tabs and flaps, along with traditional pop-ups. They are not only fun, but many are educational as well. In a recent interview Carter did say that because of the economic downturn since 2008, his publisher requested that he do “more books a year that will be less expensive”.1

Carter is not only is a master of cute pop-up books for young readers, where the text, pop-up and illustrations are of equal importance,2 he is also a master paper sculptor. He has designed and engineered a wonderful series of five pop-up books for all ages. They are called the “Red Dot Series”, which took him seven years to make. These books have a modern art style to them, with little or no text and mostly solid bold color paper sculptures that pop-up from the pages. “Here,” he says, “paper engineering is king.”3

In contrast, Robert Sabuda, many times starts with a beloved popular story, such as “The Twelve Days of Christmas”, “The Wonderful Wizard of Oz”, or “Alice in Wonderland”, to name a few, and turns them into pop-up master pieces. The complexity of his paper engineering along with his beautiful illustrations have attracted many adults to collect these books, which are also loved by children. With the support of Robin Corey, his publisher, Robert Sabuda’s work is instrumental to the growth of the pop-up book’s popularity it enjoys today. Robert Sabuda is a purist in that he uses only pop-ups and no other movable devices in his books. He also considers his books four dimensional art, as there is height, width, depth and the element of time involved in his paper engineering.4

Chuck Fischer has also published pop-up books for the cross-over market, because his classical illustration style lends itself to his Christmas and Biblical topics that are enjoyed both by adults and children. Some of his titles are “Angels”, “To The Beginning” and “Christmas Around the World”. He envisions the pop-ups in illustration form but does not engineer them. That task is left to paper engineer, Bruce Foster who creates the pop-ups from Fischer’s illustrations. Even though these two collaborators are located in different states, modern technology allows them to easily work with each other through email. To illustrate the fact that contemporary paper-engineered books have become more complicated, Bruce Foster said in an interview that one of his more recently engineered books, “Big Frog Can’t Fit In”, “… was so complicated that I had to send a 20-page instruction PDF to the assembly plant to show how to glue it.”5

And then, there are a number of pop-up books strictly for adults. Some of these border on soft porn, such as the “Pop-Up Book of Sex” and “The Pop-Up Kama Sutra: Six Paper-Engineered Variations”. And then, there are other books that are just meant to appeal to adults, such as, “The Pop-Up Book of Phobias”, “The Pop-Up Book of Celebrity Meltdowns”, “The Spirit: A Pop-Up Graphic Novel”. Also, there are pop-up books of famous architecture and artist’s work. There is even a pop-up book of flower bouquets, “Paper Blossoms Pop-Up Book: A Book of Beautiful Bouquets for the Table” by paper engineer Ray Marshall, that lays flat so that it may be used as a centerpiece.

On the more serious side, there are many book artists who employ pop-ups and other movable mechanisms in their limited edition, handmade books. These books are purchased by avid collectors as they can cost thousands of dollars each. Two of these artists who are popular today are Julie Chen and Shawn Sheehy. Julie Chen has officially been making limited edition, letterpress books since 1987, when she established Flying Fish Press. “Often the reader must engage in unexpected physical actions such as the unfolding
or sliding of pages, the turning of a wheel, or the tilting of a box in order to fully read/ view a piece.” states Chen in her Artist Statement.6

Shawn Sheehy’s books are a sculptural delight. He is “mostly attracted to creating pop-ups” because he enjoys the “engineering challenge involved in developing intricate dimensional forms that fold flat.”7 “Making pop-up books for adults permits playing in the borderslands between ‘youth culture’ and ‘adult culture’ and thus striking out into new artistic territory.”8 In a unique situation, Shawn Sheehy was asked to design pop-up books for American Girl. As companion books to their dolls, American Girl felt it was important to add interactivity to these books in order to add another layer of interest. Only two books were published at the time of the interview because of the current downturn in the economy.9

The technology exists today that allows sound and light to be added to the movable book experience. However, the consensus from the professionals, is that these extras shouldn’t be added gratuitously as they add to the cost of production. When asked if the idea to add blinking lights to his firefly spread in his “Beach Bugs” book was his or his publisher’s, David A. Carter replied that it was his. In fact, his publisher cringes when he wants to add a light or sound element. Adding lights costs $0.75 in production costs for each book.”10 Also, for collectors this element could pose problems, since they are battery operated. Stephen Van Dyk, of the Cooper-Hewitt, National Design Museum Library, specifically mentioned three books where he feels light or sound is successful. They are: “Star Wars: A Pop-Up Guide to the Galaxy” by Matthew Reinhart, where Darth Vader and Luke Skywalker’s light sabers actually glow; “Birdscapes: A Pop-Up Celebration of Bird Songs in Stereo Sound” by Miyoko Chu, where birds sing with the viewing of pop-up illustrations of their habitats; and “Graceland: An Interactive Pop-Up Tour” by Chuck Murphy.11

Today’s production technology has not aided in the making of pop-up books. Pop-ups are still hand assembled and die cutting is used over laser cutting because it is faster. Although, the cutting is more precise with the laser. Some advances in printing and cutting technology do allow for more complex pop-up books to be produced more efficiently. During the design process of paper engineering, cutting and gluing white paper with white glue remains the method of choice. Because of advances in digital technology, virtual pop-up books are appearing. Although they are nice to look at on the computer screen and have a degree of interactivity, they do not have to be engineered by the laws of physics. They also lack the tactile, 3D experience one has when actually holding a book. One very nice site from Japan is ecodazoo.com. By clicking and navigating, these virtual pop-up books teach conservation and lessons about the environment through imaginary animals. They were created in Papervision, a real-time 3D engine for Flash.12

Another example is a virtual pop-up book from the Please Touch Museum in Philadelphia that explores selected exhibits at the museum. The viewer can use his/her mouse to turn the pop-ups so they can see them from all angles. The question is, are these virtual books as visually exciting as the real thing?

FIGURE 3.9 Cover and spread from “Big Frog Can’t Fit In”

FIGURE 3.10 Spread from “Angels”

FIGURE 3.11 Spread from “The Spirit: A Pop-up Graphic Novel”

FIGURE 3.12 through 3.14 Spreads from “Star Wars: A Pop-up Guide to the Galaxy”
As early as the 1960s, pop-up ads were being used in magazines. The Wrigley’s Gum ads, designed by Waldo Hunt’s Graphics International company, were inserted into Jack & Jill Magazine. More recently, pop-up ad inserts have been appearing in many magazines because design software and laser equipment have reduced the cost of producing this type of advertising. The two big design and production firms behind most dimensional advertising today are Structural Graphics in Essex, Connecticut and Americhip in Torrance, California. In 2008, Fruit of the Loom ran a series of pop-up insert ads in which the panties take on the forms of flowers and butterflies. When Mars was introducing their new 3 Musketeers® with Mint Bar, they wanted to deliver the experience of the new product in a print ad. Structural Graphics produced a magazine insert with a photo of a girl with a pop-up arm holding an actual size wrapped 3 Musketeers® bar. The viewer can then peel and sniff the image of the bar to get a scent of the candy. As a direct result of this ad, fourth quarter sales, projected at $8MM came in at $20MM.

On the other side of the country, Americhip has designed many 3D magazine insert ads. Some standouts include a “Dancing with the Stars” ad in which they used a self-winding spinning device that enables the paper dancer to twirl around when the page is opened. In 2004, Americhip created a multi-sensory insert ad that not only included a pop-up, but also, music and scent. It was for the launch of a new diet Pepsi drink called Jazz.

Paper engineered promotional collateral has worldwide appeal. Pop-ups and other movable elements are used in media kits, direct mail pieces and other promotional work. Refeka, a German design firm that also specializes in this genre. Their purpose is to “Lead in the creative pulses of paper engineering - that is our aim. For us creativity is the merging of technique and art. For continually innovative services.”

Structural Graphics, patents many of their movable devices. Devices such as their Extendo® and The Flapper® are registered. Still others are trademarked, such as their Book-Cube™, 4-Window Pull™, MagnaPop™ and Popper™. Structural Graphics has a YouTube channel, where they broadcast their solution of the week. Alex Bates, Creative Director of Structural Graphics said that his company never worked on a TV commercial, “...but we did duplicate a pop-up book that was used in a Lexus commercial entitled “The Safest Accident.” Today, Structural Graphics stays true to its founding principal which is to leverage the same whimsy, joy and excitement found in pop-up books and apply that to direct mail media kits and advertising. They currently produce about 1,500 different designs a year and own an assembly facility in Mexico. They have won many design awards through the years, which includes first place award at the NAMA Convention (National Ag Marketing Association) for the John Deere paper tractor project. This paper replica tractor, unfolds to reveal a USB drive that holds their style-guide. It is not only effective in it’s delivery system but also is a great keepsake.

FIGURE 4.1 Jack & Jill pop-up magazine insert ad by Americhip

FIGURE 4.2 Direct mail with pop-up cube by Refeka

FIGURE 4.3 Alex Bates, Creative Director of Structural Graphics

FIGURE 4.5 Wall of promotional work at Structural Graphics

FIGURE 4.4 Pop-up promotional mailer by Refeka

FIGURE 4.5 A wall of promotional work at Structural Graphics
FIGURE 4.6
Four-page insert ad with pop-up by Structural Graphics.

FIGURE 4.7
Mailer featuring Bookcube® by Structural Graphics.
One of the first greeting card companies that exclusively produced pop-up cards in this country was PopShots, Inc., started in 1977. Their small line of cards were miniature paper engineered art forms. Today the company is known as Up With Paper, committed to continue making pop-up cards that “wow” their customers. Even though their cards represent only one tenth of one percent of the entire greeting card industry in America, they have won more than 45 of the International Greeting Card Association’s coveted LOUIE Awards honoring design excellence. When asked in an interview, if Up With Paper incorporates lights and sound in their cards, George White, President, responded that lights and sound were introduced in a 2010 test market. The cards with sound “were a big success, the light cards much less so.” As a result, they will be introducing an everyday pop-up card line with sound in January 2011. However, the clever paper engineering will always be the most important factor driving their business.

Up with Paper also owns a pop-up book division, Jumping Jack Press. Bruce Foster, is the paper engineer for many of the company’s cards and books. Their latest publication is “Snowflakes: A Pop-Up Book”, illustrated and engineered by Yevgeniya Yevertskaya.

Another company that produces unique pop-up cards is Santoro, a London-based company. Their Swing Cards, of which there are 83 designs, open up to form a 3D image with movable parts that swing back and forth. Their newest pop-up innovation is Popnrock. These cards not only open up to amazing 3D paper engineered sculptures, but they rock back and forth when nudged because they are designed with a curved base. To add to the movement, some of the pop-up elements move in harmony with the rocking motion. To prove that these pop-up cards are more than just a greeting card, they won the 2010 Gift of the Year award from The Giftware Association.

There are many more small pop-up card companies all of which are unique in their own way. The Original Pop Ups is a subdivision of Second Nature, Ltd. of England. Their unique cards pop-up to create a self-standing centerpiece. They are designed to be used as a floral arrangement, balloon weight or table decoration. They are spring loaded with an elastic band triggered to automatically open when removed from the envelope. Paper Magic Group is another greeting card company which includes pop-ups as part of their line. Graphic3, Inc., was the first to "pioneer the use of rubber band activated structural mechanisms that make greeting cards pop-up" on their own. They also produce pop-up polygon desk calendars. Their cards are exclusively engineered by Lowell Hess. Robert Sabuda, produces an exclusive line of holiday cards for MOMA (Museum of Modern Art) in addition to his own holiday and everyday pop-up cards. He even designs pop-up Christmas centerpieces and ornaments.

American Greetings have been including many innovative cards with movable paper devices in their Carlton Cards brand for a number of years. This brand is the traditional card using only paper engineering. Inventions, on the other hand, includes cards featuring electronic components and links to digital content. Some of these cards include movable paper, some do not. For Mother’s Day 2010, they introduced a line of pop-up cards with sound. These cards had elaborate pop-ups and were retailing for $9.99 each. They were displayed on an end cap in Target stores, in order to give full exposure to the customers. More recently, Inventions introduced a new line called Dance Machine. These cards feature a character with a spring mounted head and have a body with movable parts that dances to music upon opening. They retail for $7.99 each.

American Greetings hired Shawn Sheehy, book artist, to conduct a week-long workshop with their designers. He said, “Pop-up and interactive cards are a hot product for them and they have to pump out a large volume of card designs.” He enjoyed giving a workshop to students that have a professional interest in making pop-ups.
FIGURE 5.3 Swing card by Santoro

FIGURE 5.4 Pop a rock card by Santoro

FIGURE 5.5 The Original Pop-Ups by Russ

FIGURE 5.6 Inventions Dance Machine by American Greetings, 3 views
The pop-up/movable paper phenomenon has had a major influence on movies, TV commercials and music videos in recent years. The general consensus among industry professionals is that there is a basic love for pop-ups by the people who direct and produce this other form of movable media.

In 2007, movie director Kevin Lima “loved pop-up books so much that he wanted to incorporate a real pop-up book experience” into his Disney movie, *Enchanted*. Bruce Foster, paper engineer, was hired for the task. He was able to engineer the pop-up just using the art guidelines for the movie. Image was applied after the engineering was completed. RealFX a CGI production company, then filmed Foster’s paper engineered dummy and used the digital pop-up pattern pieces to create the CGI of the pop-up. The challenge was to factor in the weight of the paper since a computer has no sense of thickness. Because they were so successful in imaging the opening scene of the castle, director, Kevin Lima then wanted to add more pop-up scenes to the movie. These scenes were more problematic for Bruce Foster to engineer, because he had to work with existing film clips. The difficulty occurs because there is no background image behind the object you are cutting away to create the pop-up. “Also, another problem with working with film is that in a physical book a pop-up usually goes beyond the borders of the book. In film that is not possible. The image can't rise above the movie screen. The big disappointment was that there was no pop-up book published to be released with the movie.”

A short animated film, *The Happy Duckling* (2008), entirely set and animated in a pop-up book environment was done by a group of students at two rival schools, School of Media Arts & Imaging, University of Dundee, Scotland and Computer Arts University of Abertay Dundee, Scotland. This charming, nine minute animated adventure, really has the look and feel of a paper pop-up book, including pull tabs and other devices. It won numerous awards including best animation at the Heart of Gold International Film Festival in 2010.

One television commercial that is set in a pop-up/movable paper environment is “The Safest Accident” by Lexus. For this commercial a “giant, full-sized book frame for green screen, with tabs and wheels that could be manipulated by actual stage hands. And the actual pop-up book with moving parts was a mere six feet high, which was then married to the green screen frame.” The concept was the brainchild of Team One. It was directed by Oskar Holmedal of Stylewar, a directors’ collective and supervised by Andy Hall at “a52”, a high end visual effects company.

Some other TV spots that are set in a movable paper environment are “Mastercard’s Seven Wonders”, illustrated by Stephen Knowles and directed by Christian Bvilacqua, “Sherwin-Williams Bens and Paint Chips”, directed and produced by BuckNY, Coca-Cola mixing live action/pop-up by Direct2Brain, a visual FX Company; 3 mobile SkypePhone produced in Europe; and Ikax’s “Movable Catalog” commercial for Swedish audiences.

Music videos that are set in a pop-up book environment are Fergie’s “Clumsy”, directed by Marc Webb with Rich Lee and Aesop Rock’s “Fast Cars”, directed by Asif Mian. In both cases the live performer walks through and performs in a pop-up book environment.
Many colleges and universities offer courses in paper engineering. Pratt Institute in Brooklyn, New York offers a full semester elective in introductory paper engineering, a course created by Robert Sabuda and now instructed by Kyle Olmon, one of Robert Sabuda’s protégés. When asked if he incorporates light and sound in his syllabus, Olmon responded by saying, “The students that participate in my course come from various disciplines within the university and bring with them very unique and diverse skill sets. If they have a background in electronics or fiber or another relevant field I will always encourage them to incorporate their technical know-how as long as it is appropriate for the design.”

At Mills College in Oakland, California, Julie Chen, book artist teaches semester long classes in bookmaking which includes paper engineering. Undergraduate courses in book arts and a graduate degree in Creative Writing and Book Arts are offered. There, in addition, she teaches many workshops nationwide. Because Chen is such a proponent of movable parts as a means to convey an idea in her artist books, she shares that enthusiasm with her students.

There are a plethora of workshops that teach paper engineering to enthusiasts young and old all over the country. In 2010 the Center for Book Arts in New York City offered workshops in paper engineering, such as Animated Pop-Up Structures, Pop-Up Paper Engineering Basics and Beyond and Carousel Books. At the National Museum of Women in Washington, DC there is a year-long arts curriculum called ABC Art Books Creativity, in which fourth grade students develop visual literacy by creating an artist book. This course is taught by Carol Barton, who has authored and published instructional books on paper engineering. “The Pocket Paper Engineer Workbook, Volume 1 Basic Pop-Up Forms” and “Volume 2 Platforms and Props” are valuable teaching tools for anyone that is beginning to explore paper engineering. Barton’s simple-to-make and understand, step-by-step projects offer a good foundation from which to spring board ideas. Barton is working on Volume 3 which she will publish in the near future. She not only conducts workshops for children and adults, but also for teachers. She feels that instructing teachers on teaching paper engineering to children “is the most incredible way to teach several subjects such as trial and error, problem solving, 3D design, movement, mechanics and building processes.” In 2010, Leah Buechley, Director of MIT’s High-Low Tech Lab gave a workshop at the Fuller Craft Museum in Brockton, Massachusetts on how to create electronic paper structures. This is a cutting-edge approach in bridging electronics technology with paper craft. Buechley’s primary objective is to expose and engage diverse audiences to new technology through familiar craft processes.

There are software programs that assist in designing pop-ups. One is Pop-Up Workshop. With this software, a person creates a design for a pop-up card in the computer. After the design is finished, it can be printed out and physically made. A recently launched website, ZooBurst.com features a storytelling application that allows practically anyone, novice or experienced, to author a live digital pop-up book. The author can use the library of clip art provided on the website or one’s original art. The creator of this application is Craig Kapp, a Researcher in Residence at the Interactive Telecommunications Program (ITP) at NYU. Kapp’s application is to be used in the classroom where teachers help their students create books as a means to learn the art of storytelling. The application was updated in 2010 to include multi-language features, links to outside websites within the talk bubbles in the book, sound effects and voice recordings.


Teaching and Learning

FIGURE 7.1 Student work from Pratt Institute, NY

FIGURE 7.2 Student work from Pratt Institute, NY

FIGURE 7.3 Julie Chen’s workshop at Garage Annex School, MA

FIGURE 7.4 Page from digital pop-up book, ZooBurst.com

FIGURE 7.5 Student work from Pratt Institute, NY

FIGURE 7.6 Student work from Pratt Institute, NY
The future is already here – it is just unevenly distributed.

WILLIAM GIBSON

Nobody can predict future trends with absolute accuracy, especially when it comes to technology. Today, e-readers are gaining in popularity and will possibly replace the book as we know it. But the hottest gadget we use today may be a dinosaur in two years. The following chapters showcase what is cutting edge at the time of this publication in the field of movables and explain how it may affect the book or other printed media that have a 3D or movable component. Public acceptance of new scientific and technological breakthroughs that are yet to come are the key to what succeeds and what doesn’t.
Imagine paper that responds to touch without any physical wiring. That’s what designer/scientist Jai Qi created for her “Electronic Popables” book in the summer of 2009 at the MIT High-Low Tech Media Lab under the supervision of Dr. Leah Buechley. In her experimental book of paper-based computing, pop-up cities light up and pop-up venus fly traps close when one’s finger touches the center of the flower. All this is achieved using embedded circuitry made from copper tape, conductive fabric and paint, snap-on electronic sensors and actuators. Complex interactions are powered and programmed using a removable Arduino (a type of microcontroller). Conductive paint seems to be the key, as “it enables a designer to paint or sketch functioning circuitry just the way he/she would sketch or paint an electrical schematic or a decorative drawing.” When the paint is fully dry, it becomes bonded to the paper.

Jai Qi’s reason for this exploration is simple: “...while it would be difficult – perhaps impossible – to replicate a pop-up onscreen, physical books present compelling canvases for embedded computing....their three-dimensionality and mechanical interactivity – make them ideal for computational and electronic augmentation.” The difference between Jai Qi’s exploration and other integrated or mixed media we see appearing in the marketplace today is that her Electronic Popable is designed to be an “independent, interactive artifact.”

![FIGURE 1.1 Jai Qi](image1)

![FIGURE 1.2 Cover “Electronic Popables”](image2)

![FIGURE 1.3 Lily Pad Arduino](image3)

![FIGURE 1.4 A page from the book showing the pull tabs that activate the lights.](image4)

![FIGURE 1.5 A page with embedded sensor responds to pressure in different locations.](image5)

![FIGURE 1.6 A page from the book depicting the New York City skyline. A bend sensor—the flap in the shape of a boat in the foreground—controls the lights in the skyscrapers.](image6)

![FIGURE 1.7 Capacitive sensor triggers nitinol-driven flytraps. A user touches a sensor.](image7)
Between 2009 and 2010 the field of Augmented Reality (AR) has grown exponentially.

One of the developers of Augmented Reality is MXR (Mixed Reality Lab), a spin-off research company owned by the National University of Singapore. Originally the viewer needed to wear goggles to experience this technology which includes elements of the real world and the virtual world that are interactive in real time. Since Augmented Reality is such a huge topic, only the effects it has on the book, greeting card and direct marketing business will be covered. All the aforementioned come under the umbrella, marker or markerless Augmented Reality. The pop-ups in AR are viewed on the computer monitor when a webcam "sees" the marker or other target on the physical book or other tangible paper object. Today the AR images may be viewed on a smart phone that has an webcam installed. In the future, this will help to keep the expense of paper moveables down, while continuing to emulate the pop-up/3D experience. MXR, in 2008 was on the verge of creating virtual 3D pop-ups for children’s books. These are yet to be produced, but as recently as 2010 Simon & Schuster published a young adult book that incorporates Augmented Reality. The book is entitled, The Search for Wondla, authored and illustrated Tony DeTerlizzi. Simon & Schuster coined the term Wondla-Vision for the required software needed to activate the AR for the book.

Structural Graphics, a design firm that specializes in 3D direct mail and media kits, is slowly beginning to use AR in some of its work. A piece designed for Stryker Diagnostics includes a removable "call-to-action" card with a AR marker printed on it. The "call to action" instructs the recipient to bring the card to a trade show where, when the card is placed under the webcam, gives a 3D demo of a hip or knee replacement device which Stryker produces. In this stage, AR is still cost prohibitive to produce on a large-scale basis for such products.

There are some other commercial applications for this technology emerging. One of the first AR marketing campaigns was done by General Electric with the purpose of promoting its smart grid campaign that shows how wind turbines and solar energy will fuel our future energy needs. Another campaign that is using AR is the Calvin Klein’s X Mark Your Spot Underwear campaign. Launched in March, 2010, this ad campaign, that is running in 12 editions of GQ magazine beginning with the April 2010 issue, has a marker printed on the ad page. When this ad is placed under the webcam, the monitor will show a cube popping up from the page which will eventually navigate to videos of some well known actors modeling the underwear.

In January, 2010, Wallpaper* magazine published its first issue that incorporates AR. As the pages of this magazine are turned under a webcam, the pages will come to life with added dimension and images. The purpose of this issue is to "showcase a series of other people’s work with AR – a quest to uncover the practical, creative and dynamic possibilities of this interactive technology."

After seeing the work of Camille Scherrer, a 2008 graduate in media and interaction design at the ECAL/University of Art and Design at Lausanne, Switzerland, Louis Vuitton partnered with her to create AR animation for the new “Louis Vuitton: Art, Fashion and Architecture” book. This book uses AR in a beautiful, artistic way, emulating moveables which is the umbrella under which pop-ups reside. Her groundbreaking work uses “high-performance software that eliminates..."
the need for typical AR markers9, which gives the books more of an aesthetic appeal. In her own book, “Le Monde de Montagnes”, she enhances the story telling by adding an extra component, the AR animation, to produce a beautifully designed product. An earlier work of hers is “The Haunted Book”.10

The biggest growth area today is AR greeting cards. Using Total Immersion software, Hallmark introduced a Valentine’s Day line of augmented reality greeting cards in January 2010. Starting with only six designs, they now offer 100 different cards for all occasions. The cost of the card is only $2.99 as opposed to more expensive paper-engineered cards which can cost $5.99 and up. The user, who needs to have a webcam, can then enhance the experience of the card by seeing the AR component on their monitor. Not only do the characters pop-up from the card but they also talk.11
Video-In-Print® technology or HD4.1TM VIPTM, patented by a California design firm, Americhip embeds a screen into paper that can show video images. They first showcased this technology in a media kit produced to promote Discovery Channel’s new mini-series, Life. The viewer could watch a video preview of the series by just opening up the hard cover book included in the media kit.1 In September, 2010 Entertainment Weekly, ran an ad produced by Americhip for CBS/Pepsi that was the first-ever, using Video-In-Print® technology. It plays over 25 minutes of video that showcased CBS’s Fall 2010 line-up. This technology not meant to be thrown away, either. It can be reused. It uses a cell phone type screen that runs on a lithium battery. The battery can be recharged through a USB. This also enables the viewer to download their own videos into this devise.” This is cutting-edge technology that is still in its infancy. Americhip’s branding tagline is Multisensorize®. In an 2008 interview with Martin Lindstrom, branding expert, Tim Clegg, CEO of Americhip states the importance of “getting attention in a cluttered environment.”3 That’s what multi-dimensional and multi-sensory advertising is all about.

Hallmark and American Greetings are also using this technology for their greeting cards. Hallmark launched Video Greetings in January 2010. By pushing a button, the recipient can watch a mini movie or animation that lasts between 30-60 seconds.4 Available in limited quantities, these cards retail for $29.99. American Greetings introduced Inventions5,6 cards with embedded video displays. One card retailing for $12.99 has a slide show of generic art while “Over the Rainbow” plays in the background. This technology mixes paper with digital engineering technology rather than paper engineering for an enhanced user experience.

FIGURE 3.1 Discovery Channel direct mail promotion

FIGURE 3.2 Embedded Video-In-Print® ad for CBS

FIGURE 3.3 Hallmark in-store display

FIGURE 3.4 American Greetings Innovations video greeting card.

FIGURE 3.5 Hallmark in-store display
The Apple iPad is a game changer. It is a portable tablet device in which media can be displayed and read with ease. The look and feel of a paper book or magazine can now be displayed in digital media with the added feature of movement. This opens many new doors for picture books. By moving, shaking, and turning the iPad the illustrations on the screen come to life around the text. One of the most adventurous endeavors to date is “Alice for the iPad” – a 52-page version of Alice in Wonderland by a small company called Atomic Antelope. Reprinting Sir John Tenniel's illustrations and Lewis Carroll's text, both of which are in the public domain, this app retails for just $9.99.


Another pop-up book to appear as an app for the iPad is by Chuck Fischer. Fischer, is a traditional mural artist/decorative designer/illustrator who paints with latex and acrylic paint. He has illustrated many pop-up books with paper engineer, Bruce Foster. But, in 2010, for the first time in many years, he is not working on an actual paper pop-up book project. Instead, he’s working with software engineers to create a highly interactive version of his latest pop-up book, “A Christmas Carol” by Charles Dickens as an iPad app. It will be released at the same time as the physical book. “Little, Brown and Company, my publisher, gave the rights to the digital media back to me, since they were not interested in pursuing digital media.” The app enables him to provide a lot more visual imagery than the physical book allows as he is not limited to a certain number of pages. He is still, however, creating all his work by hand in his traditional techniques for this project.

David A. Carter, a popular and prolific paper engineer and illustrator who has published many pop-up books is currently working on an iPad app, which at the time of this writing is yet to be released. This is, perhaps, the beginning of a major shift of how movable picture books will be read and enjoyed in the future.
FIGURE 4.2 Illustrator Chuck Fischer at Books of Wonder, NY

FIGURE 4.3 Scenes from "A Christmas Carol" iPad App
To celebrate its 75th Anniversary, *Esquire Magazine* published a limited edition issue unveiled on September 8, 2008 that featured E-Ink on its cover.1 What is E-Ink? E-ink can be used on many of the same surfaces as regular ink but it is essentially a special type of electronic display. Because the ink contains white particles that have a negative charge, the electronic ink display can be changed on demand.2 Today it is best being utilized in the increasingly popular e-readers. The advantage over a backlit digital display is that it uses less energy and is easier on the eyes of the reader. And because of its changeable attributes it’s the perfect vehicle for the future of periodicals. The other key attribute is that the substrate is flexible and very thin.3 The Apple iPad, because it’s a computing tablet in addition to being an e-reader does not use E-ink technology.

An offshoot of E-Ink is Ink-In-Motion, a flashing electronic display that combines motion with the visual appeal of ink-on-paper.4 This technology is becoming very popular as point-of-purchase displays because it adds the extra element of movement to the graphic. As Martin Lindstrom, author of “Brand Sense”, said, “Our eyes are attracted to movement.” That’s what makes this technology so effective in attracting customers.

Right now, E-Ink is being used in a limited way, but as the technology improves and becomes more affordable, it should grow in popularity.
When asked if paper engineering in the form of movable books and other printed items, such as direct mail, greeting cards and advertising, will prevail, many of the professionals in the field answer, “yes” or “I hope so.” There are many reasons for this. New technology, in most cases, adds another layer to the users’ experience, but doesn’t necessarily replace the old experience. Ground coffee survived after instant coffee was invented, radio survived after television came on the scene and movie houses survived after the invention of video tapes and DVDs. Nothing can replace the “wow” factor and the unique experience of a good paper-engineered product. There are, however, many practical matters that effect the production of paper-engineered objects. Labor costs are crucial, since at the present all paper-engineered products must still be assembled by hand. Finding places in the world where cheap labor exists may become more difficult in the future. The assembly of paper-engineered products used to be done in Columbia and other South American countries. Now, most assembly facilities are in China. It is David A. Carter’s dream that robots will be programmed to assemble these paper-engineered wonders. Also the declining availability of paper affects its rising cost, as we are starting to witness today. Martin Lindstrom, branding expert said, “If we’re killing a tree, let’s get the best out of it.” Paper-engineered products make an attempt to do so by transforming ordinary paper into something extraordinary.

Alex Bates of Structural Graphics, feels that paper-engineered products will survive because “humans love to play with things they can hold,” and because they are drawn to their “fiddle factor.” It is becoming more important, however, that clever paper engineering is combined with a digital component in order to attract a customer’s attention. Structural Graphics recently registered a new service mark that reads, “Bridging the digital with the dimensional” and also the reverse, “Bridging the dimensional with the digital.”

Ann Montanaro, founder and president of the Movable Book Society feels that people will always be “interested in the intricacy of the mechanical itself.” In fact, paper-engineered products may become even more innovative “in order for them to compete with digital media,” says Bruce Foster, paper engineer. Paper-engineered products may, however, make up a smaller part of the market share as we move into the digital age.

Shawn Sheehy, book artist/paper engineer has many thoughts about the subject. “Pop-up books will remain relevant as a reaction to computers. People and cultures have always had sacred texts. So, there is a long history of regarding books as sacred. With the expansion of digital media, humans feel a sense of loss. This feeling of loss supports the idea that books have a greater sense of preciousness.”

Steven Van Dyk explained, “In the folded paper realm, there’s still much to do.” He considers pop-up books an affordable and portable form of art — an art form of this time. Robert Tabuda said, “I think that young people (and their parents and caregivers) are overwhelmed by our increasingly electronic world. A pop-up book is a nice break from that but still the offers interactivity and magic we associate with electronics.” Although most paper engineers making a working today are self taught, there is a new crop of designers that are formally taught in schools of higher learning, not to mention the increase of interest by enthusiasts who take workshops with the pros. It seems plausible that an increasing number of paper engineers will mix traditional and electronic/digital media in the future because it will become more available to them. But, there will also be those paper engineers who will remain purists and only work with paper as their medium. Either way, paper engineering and its influence will continue on into the foreseeable future.

In closing, a quote by Ellen G. K. Rubin, “The Pop-Up Lady”, who is the premier collector and historian of all things movable, says it all. “A picture is worth a thousand words, but a pop-up is worth a million.”
The photos in this section illustrate some of the mechanisms used by paper engineers. The spreads are selected pages from the study tour reports that were designed, engineered, and hand assembled as a fulfillment of a class requirement for the Marywood MFA program. There are a variety of examples ranging from a vovelle, the earliest form of moveable to scanamation, the most current innovation in moveable paper.
FLAPS

This is one of the earliest and simplest form of movable devices. A illustration hides under a flap. When the flap is lifted the hidden illustration is revealed.

PULL TABS

A sliding paper tab, ribbon or string is pulled or pushed to reveal a new image. Or, they can be used to activate movement of the image. Shown here are examples of the first type.
DISOLVING IMAGE
Pull the tab and an image changes into a completely different one.

SCANAMATION/ILLUSIONARY MOVEMENT
As the page opens an image manually animates through the lined acetate.

WATERFALL
An embellishment of the pull-tab activated flap. Several flaps open onto each other sequentially as the single tab is pulled in the opposite direction.4

VOVELLE or ROTATING DISC
Possibly the first type of movable to be used in a book. An illustrated paper disk is attached to a page using paper or grommets and revolves around a central pivot. When turned, images or information is revealed through the opening in the page.5
Pop-Ups... spring to life in three dimensions rising from the surface of the page.

V-FOLD
This versatile form is what most people think of when they hear the term “pop-up.” The folded paper unfolds as the page is opened, to give the illusion that it is popping up from the page. By adding on to the basic v-fold, a paper engineer can create very elaborate pop-ups. Many of these sometimes unbelievable pop-ups are enjoyed in books produced today.

MULTIPLE V-FOLDS
V-folds can become more complex by folding the paper in both directions to create a more dimensional look. Or more elements can be added to create more movement.

![FIGURE G.9 Study tour book, Fall 2008](image1)
![FIGURE G.10 Study tour book, Spring 2009](image2)
![FIGURE G.11 Study tour book, Spring 2010](image3)
![FIGURE G.12 Study tour book, Fall 2009](image4)
FLOATING LAYERS
This mechanism is best understood when seen from the side. When viewed from the underneath you will see that the open spaces from two parallelograms and a trapezium. Hinged multi-tier paper supports lift an illustration off the page, creating the illusion that it is floating over the surface.7

OPPOSING ANGLES WITH A TENT
Similar to a floating layer but more complex. The mechanism that supports the tent is a double v-fold that allows the tent to twist when the page is opened.

BOX & CYLINDER
A box-like cube or rounded cylinder rises from the center of the page spread as the book is opened.8 Shown here is a pop-up box with a parallel plane and some other add-ons.
HINGED
This mechanism is constructed with two pieces of paper that are hinged together. It opens up as the page is opened. This spread also contains hidden elements. A illustration on a card can be removed from the envelope that is adhered to the page.

COIL or SPIRAL
The spiral is cut from a single piece of paper. One end of the spiral is attached to the let side of the base page, the other end is attached to the right.

DOUBLE LAYER
This technique is mostly used in carousel books, in order to create the illusion of depth.
CHAPTER SEVEN


CHAPTER TWO


CHAPTER THREE


FIG 3.4 Great Steam Grid Animated Reality Campaign, screen captures from video http://go.imaginagemag.com/imaginatv/?g=animated_reality (accessed January 30, 2011)

CHAPTER SIX


FIG 6.4 Alex Bates, Creative Director, Location: Structural Graphics Headquarters, Photo: Bernadette Puleo 2010


GLOSARY

FIG 4.1 Spread from study tour book, Fall 2008, Bernadette Puleo

FIG 4.2 Spread from study tour book, Fall 2008, Bernadette Puleo

FIG 4.3 Spread from study tour book, Fall 2008, Bernadette Puleo

FIG 4.4 Spread from study tour book, Fall 2008, Bernadette Puleo

FIG 4.5 Spread from study tour book, Fall 2008, Bernadette Puleo

FIG 4.6 Spread from study tour book, Fall 2008, Bernadette Puleo

FIG 4.7 Spread from study tour book, Fall 2008, Bernadette Puleo
PART ONE

CHAPTER ONE
2. Exhibition Brochure, Paper Engineering: Fold, Pull, Pop & Turn, (Smithsonian Institution Libraries, 2010), Pg. 6
3. Pop-Up and Movable Books – A Tour through Their History from the Nineteenth Century to the Present Featuring examples from the Weaver Collection University of North Texas, Libraries, 2010), Pg. 6

CHAPTER TWO
1. Van Dyk, Stephen. Phone Interview. 14 Sept. 2010
2. Carter, David A. Phone Interview. 50 July 2010
3. Carter, David A., Phone Interview. 50 July 2010
5. Montanaro, Ann. Phone Interview. 14 Sept. 2010

CHAPTER THREE
1. Van Dyk, Stephen. Phone Interview. 14 Sept. 2010
2. Carter, David A., Phone Interview. 50 July 2010
3. Carter, David A., Phone Interview. 50 July 2010
5. Montanaro, Ann. Phone Interview. 14 Sept. 2010

CHAPTER FOUR
5. 3 Musketeers Mint Bar http://americhip. com/cgi-bin/complex2/proddisp.pl?db=americhip&catid=1&PRID=3 (Accessed September 27, 2010)
8. Bates, Alex, Personal Interview, 5 Aug 2010
10. Van Dyk, Stephen, Phone Interview, 24 Aug 2010
11. Montanaro, Ann, Phone Interview. 14 Sept. 2010

CHAPTER FIVE
2. White, George, Phone Interview. 42 Aug. 2010
Bibliography

Abstracts

Books
Foster, Bruce, Home Page. http://paperpops.com/
Scherrer, Camille. Interactive Designer-Camille Scherrer Video. http://www.youtube.com/watch?v=LyKk3uI
""
Bibliography cont.


Staff Sections: Technology. New Sciencet Vol. 205, Issue 2744, (23 Jan 2010) p17-17, 1p

Newspaper Articles


Ong, Bao. Pop Culture Phenomenon Newsweek (26 Sept 2005) p9
