August Cover Story: Made you look!

By Shelley Gabert and Katherine O'Brien

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A lenticular update

Pressroom

Remember those neat Cracker Jack prizes with pictures that changed when you tilted the card back and forth? These tiny bits of paper and plastic are among the most familiar examples of basic lenticular printing. Today, printers are using the lenticular process for far more sophisticated effects on applications ranging from labels to posters to packages and even plastic cups. But as we'll see, while the results are a real visual treat, printing lenticular isn't child's play.

Granted, lenticular isn't nearly as difficult as it once was. "Lenticular used to be kind of like black magic," says Mike Chadwick, product manager for KBA's 74 Karat direct imaging (DI) press. "But research and development resulted in new software programs, presses and other technologies that have helped it move more into the mainstream."

Despite these advances, lenticular still requires a great deal of skill. "Unless printers know what they're doing, lenticular can be like water skiing and being dragged by a boat," warns Chadwick. "It's more expensive, more difficult, more sensitive than plastic printing and more prepress intensive."

Lenticular's amazing effects are achieved by combining a digitally reassembled image with a ribbed plastic lens. Key components include interlacing software for manipulating the artwork (and sufficient computing power to handle the resulting files which typically are quite large), extruded plastic sheets of lens material, and prepress and press equipment capable of maintaining extremely tight tolerances.

Lenticular's particulars

A closer look at the lens material offers some insight into the challenge of a printing a lenticular job. According to Lenstar.org, an online resource for designers, agencies and printers, one side of an extruded plastic sheet is embossed with tiny corrugations called "lenticules." The other side of the sheet remains smooth and serves as the printing surface.

Lenticules are all the same size, are spaced equally across the sheet and vary in line-per-inch (lpi) frequency from 10 to 200, depending on the application. Lenticular sheets range in thickness from 0.008 to 0.385 inch.

Printing a lenticular sheet presents the same obstacles as any plastic sheet: It's much less forgiving than paper and far more expensive. In an uncontrolled environment, plastic will shrink and swell. Moreover, plastic is nonporous—if you put ink on top of it, the ink doesn't sink in, it just sits on the surface. So, unless you have a UV press or other drying method, it will be slow going in the pressroom.

While it's possible to print lenticular on a conventional press, most experts agree it's much easier to use a UV-equipped model. "We believe UV is better because of drying and adhesion to the substrate," says John Santie, product manger for sheetfed presses at Mitsubishi Lithographic Presses U.S.A., Inc. (Lincolnshire, IL). "Printers interested in doing lenticular should have UV experience or they are asking for trouble."

What customers want

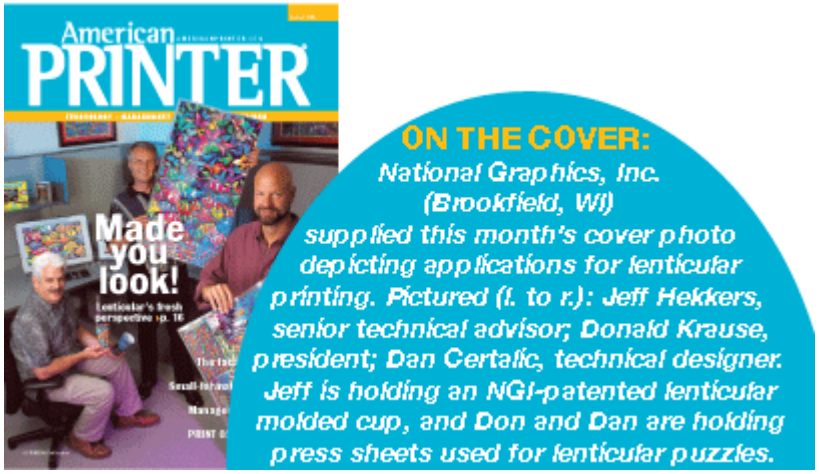
Santie adds that the true lenticular challenge lies in the separations. "Printers need to be educated on what will look good as well as how to determine what the customer really wants," he explains. "The end result definitely impacts what processes a printer should use. The screen ruling or lpi on the lenticular sheet needs to be taken into consideration along with the image."

Beyond the plastic substrate challenges, printers producing a lenticular job must print in exact register—otherwise, the special effect won't work. In a recent article featured in Heidelberg News, Manfred Klenke, owner of Klenke Druck (Dissen, Germany) explained that lenticular effects are achieved by dividing and reassembling an image into strips. "[Thus,] if a [sheet] moves out of register, even by the tiniest fraction, I am left with an unusable product, since the effects are felt across the whole film width."

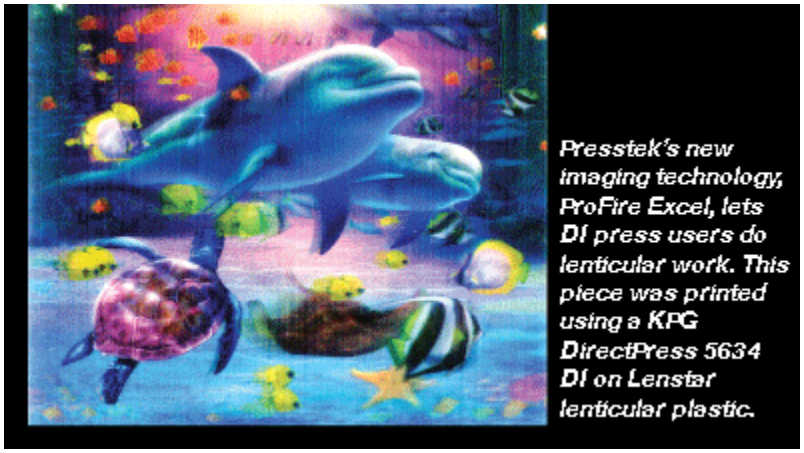
"Cylinders operate differently from press to press and from printing unit to printing unit," Klenke added. "While these deviations are neglible and completely irrelevant in normal printing, they are very important in lenticular printing."

If a few pixels shift on a lenticular sheet, the error is immediately apparent. For example, consider what would happen if the magenta were misregistered on a job featuring a human face. Even if the magenta is placed only slightly ahead of the other colors, it will be the first color seen when the image changes. "The magenta would been seen first, before the other colors, 'caught up,'" Klenke said. "Therefore, extreme precision is necessary."

Klenke's company uses a Heidelberg Speedmaster SM 52 for its lenticular work. "A small-format press goes a long way toward satisfying [precision requirements] he says. "It makes for cleaner printing, more accurate reproduction and a better end product."



Don Krause, president of National Graphics (Brookfield, WI), a company that holds several key lens and lithographic patents for the lenticular process, stresses the importance of aligning the image correctly to the lens. "You can't have any misalignments—the image must be at the proper resolution to the lens, which changes according to the viewing distance, whether it's a handheld piece, a poster view or something wrapped around a curved surface. There's a lot of technology involved; it's not just a matter of putting ink on plastic."



Direct imaging (DI) presses are another viable lenticular option. At Drupa 2004, Presstek introduced ProFire Excel, imaging technology that enables DI presses to print at 300 lpi. This higher registration, when coupled with these DI presses' fast makereadies and precise registration, make them an attractive choice for some lenticular work ranging from a few hundred to a few thousand pieces.

Stephen Sanker, North American marketing director of press products for Presstek, says DI press advantages include single-gripper registration and fast drying times.

"Most shops can't print lenticular, but our DI-enabled presses allow smaller printing shops to take advantage of it as a marketing tool and compete with the bigger printers," he says. KBA's Chadwick cites similar advantages for the KBA 74 Karat DI press. "The press can come up to color in five to 10 sheets, so it cuts down on waste. And, without UV lamps, there's no heating or distortion of the press sheet."

Digispec builds a better mousepad

In 2003, H&H Enterprises (Las Vegas), one of the largest manufacturers of mousepads in the United States, claimed bragging rights as the first North American installation of Heidelberg's Speedmaster CD-74 with UV integration. The company previously printed on paper and finished jobs with the help of three laminators running 16 hours a day. The CD-74 press enabled the company to print directly onto plastic with dramatically reduced drying times.

Now called Digispec, the company recently won a Promotional Products Assn. Intl. (PPAI) (Irving, TX) Golden Achievement Award for a 3-D flip combination on a mousepad.

Digispec first utilized its Heidelberg CD-74 UV press to print on plastics, but two years ago expanded into lenticular jobs with run lengths that range from 125 sheets on up. The company uses a proprietary software to print on Pacur and VPI lenses.

"We produce a much sharper image than many jobs we've seen," reports Monique Favreau, director of marketing. "The key is to focus more on the quality of the image rather than trying to blow out the depth so much that you lose the integrity of the printed product."

Digispec, which sells through a distribution channel, chose to facilitate fast turnarounds.

"Our customers don't need jobs next week, they need them right now," says Favreau. "The Heidelberg does everything all in one pass—lays on the color and coating, then it dries and is ready to go when it comes out the other end."

While Digispec sees lenticular as a promotional tool with untapped potential, Favreau stresses its complexity. "It's not something you can slap onto a boiler plate and mass produce," she declares. "There's a real art to doing lenticular. Even when you have the expertise, it's still a very difficult printing technique."

Lithographix: lenticular for seven years
Lithographix has almost seven years of experience printing lenticular on its 40-inch Mitsubishi presses. Lithographix, a $113 million sheetfed and web printer with facilities in Los Angeles and Carlsbad, CA, serves film, retail, automotive and apparel clients. Lenticular jobs have included Dodger baseball cards, signage and work for the NFL. Jobs are run on 20 x 28-inch sheets, typically at 300 lpi with run lengths ranging from 1,000 sheets to as high as 20,000 or even 50,000 sheets.

“The process requires a very close registration to the lenticules and the files can be enormous,” says George Wolden, vice president of manufacturing. “You [have to] control the color and the interlacing of the file, and then have a press that registers very well.”

The Mitsubishi presses feature a seven o’clock cylinder configuration that reportedly eliminates back tension on the sheet during transfer, reducing fan out and registration issues.

Wolden says lenticular’s challenges extend beyond the pressroom. “Most salespeople and printers oversell the product and they don’t understand the technical parameters and how it’s extruded,” says Wolden. “There also are proofing issues, and lenticular often requires lengthy press checks.”

Universal Lithographers: excellent infeed registration
Universal Lithographers’ (Sheboygan, WI) motto is “If you can dream it, we can print it.” The printer relies on two six-color MAN Roland 706 presses with inline aqueous coating. “We’re not a UV house, but we use infrared (IR) drying and that works well,” says Jerry Keller, executive vice president of the 42-year-old commercial sheetfed printer. Run lengths range from 5,000 to 20,000 pieces at 300 lpi. Coating on the first pass of plastic prevents scratching in the delivery.

Specializing in high-end multicolor production, Universal’s sales are in the $6 million range. Lenticular applications include point of purchase (POP) and point of service (POS) products. Although the printer currently uses Photoshop for its interlacing software, Keller concedes this is labor-intensive approach—the company currently is evaluating dedicated lenticular software.

The Roland 700’s vacuum feedboard table and pneumatic sidelay work very well for the company. Even when the press is running at 12,000 sph, there’s a 65 percent slowdown when it hits the frontlay.

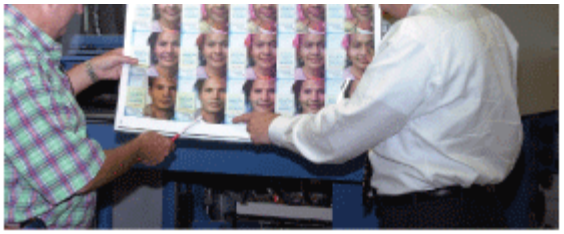
While other presses have a wheel to correct the side position of the sheet, the Roland 700 has a suction pad under the sheet, which pulls sheets laterally and doesn’t mark the substrate. “The quality of the infeed register is the most important part of lenticular printing, and the Roland 700’s sheet handling capabilities and transfer mechanisms are superior,” says Keller.

Blanks Printing: DI press does the trick
In September 2004, Blanks Printing & Imaging (Dallas) installed the first KBA 74 Karat press in Texas. Blanks, a former prepress house, already had two full-size Heidelberg presses at its 90,000-sq.-ft. facility. The 29-inch Karat’s ability to print on plastic substrates, coupled with its quick makeready, are helping Blanks compete in a crowded 40-inch marketplace.

The 63-year-old, family-owned company has an onsite digital photography studio and produces signage, POP, direct mail and catalogs for major retailers.

Before attempting lenticular, the company did some plastic work. Its first lenticular job, a calendar, went off without a hitch.

“We felt great about the press right out of the box,” says Kevin Schrader, Blank’s vice president of operations. “The first job we did was a flip: One image was light and one was very dark and we were sure it wasn’t going to work, but we put it on press and it cancelled out perfectly.”



Blanks Printing & Imaging's Pat Flynn (left), executive vice president, and Kevin Schrader, vice president of operations, admire a sheet from the company's KBA 74 Karat press.

Schrader says the 74 Karat is ideal for lenticular jobs: "The press grips the sheet only once and has the ability to lay down four colors and coatings all in one pass before it releases the sheet, which makes for excellent registration," he explains. "The makeready is quick, which saves money compared to a 40-inch press."

Blanks produces its lenticular jobs on Pacur lenses using HumanEyes software. Jobs have been printed at 100 lpi on 14- and 18-mil substrates on runs from 1,500 to 6,000 impressions.

For more information
Several printers we contacted didn't want to reveal trade secrets—they've worked hard to perfect their lenticular process and want to protect that knowledge. If you're looking for an excellent overview of lenticular effects as well as real-world examples, see Lenstar.org. In addition to printers, the site serves designers, ad agencies and brand marketers. The online group includes major press vendors as well as Sun Chemical, Flint Ink and INX, software developers Flipsigns, Photo Illusion and HumanEyes, and substrate specialists Eastman Chemical and Pacur.

Creating 3-D effects
Introduced at Drupa 2004, HumanEyes (Jersualem) reportedly allows users to easily create special effects—or lenticular—content for commercial print (DI or conventional) output or electronic display. Although the software provides sophisticated morphing, flip and zoom effects, its real forté is said to be 3-D. HumanEyes' patented software can be used for advertising media ranging from 3-D-capable electronic displays to conventional print, packaging, backlit signs and extra-wide-format signs. In addition to lithographic printing, HumanEyes offers software for doing lenticular work on photographic, inkjet and flatbed UV equipment. The company soon will release a solution dedicated to printing on narrow-format DI machines from Heidelberg, KPG and Ryobi. Pricing for the software starts at $3,500. Xpedx (**www.xpedx.com**) distributes HumanEyes software in North America.

Photo credit: HumanEyes

Yum! 3-D images like this one from HumanEyes reportedly give ads five times more stopping power than 2-D pictures.

Highlights of HumanEyes software include:
Ease of use: Only a single standard digital camera is needed to create 3-D effects. Any digital photographer is qualified to work with HumanEyes 3D. Users can capture images once and use this input repeatedly for different printing sizes and viewing distances. Panorama and stereoscopic images are possible at the same time.

Effects creation: Graphic tools are used to assign depth. The software automatically calculates depth and generates any number of multiple viewpoints.

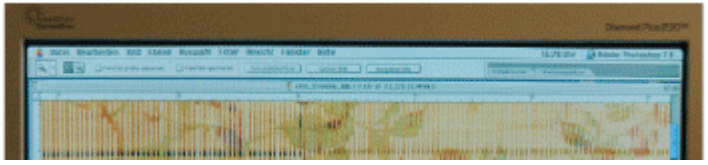
Prepress: HumanEyes 3D utilizes a compressed Postscript output format that reportedly eliminates prepress and network bottlenecks. Postscript output allows for seamless integration with Level III RIPs.

Predictability: Comprehensive proofing tools reduce trial-and-error iterations, resulting in shortened turnaround cycles from start to proof and print. (See **www.humaneyes.com.**)

Lenticular surprise inside!
Victor Anderson, founder of VariVue, is credited with creating the first lenticular image in the 1930s. By the late 1940s, VariVue was cranking out millions of lenticular products including Cracker Jack prizes. In 1986, DIDIK acquired most of the VariVue production line, archive and certain intellectual property. (See **www.didik.com.**)

According to Jeffrey Maxwell, a Cracker Jack prize collector, Toppan Printing and Optographics Corp. also have produced lenticular prizes. (For more Cracker Jack lore, see Maxwell's Web site at **http://members.aol.com/Alphabet26/CJgreetings.htm**)

How lenticular works
The lenticular technique involves placing identical lens strips tightly side-by-side on a special film. Images that have been divided into strips on a computer and reassembled ("interlaced") using special software are then placed behind this film with between two and 25 image sections/strips under each lens strip depending on the desired effect. Different films and plates with an appropriate number of lenses per inch can be used to create special effects. The size and type of lenses used depends on the desired effect, but the price often dictates compromises.



Lenticular printing requires exact registration. Images are divided into strips and reassembled to create motion and other effects.

In a standard image, 3.15 lenses per millimeter of image are used at 80 lpi. A lens strip, which must contain all the phases required for the desired effect, is only about 0.01 inch wide. Lenticular effects include:
Morphing | Transforming one picture (A) into another picture (B). Up to twelve phases are possible. No depth effect can be achieved; the transformation effect is in the foreground.

3-D | This basically involves our two eyes looking at the same object from different angles. Five to 10 source pictures from shifted perspectives or from three to four layers (foreground, picture layer, background) are used.

Zoom | Based on the same principle as morphing. The difference is that the object represented does not appear transformed, but closer or farther away, depending on the angle from which it is viewed.

2/3 flip | Changing an object's viewing angle changes its content: An ugly frog becomes a handsome prince.

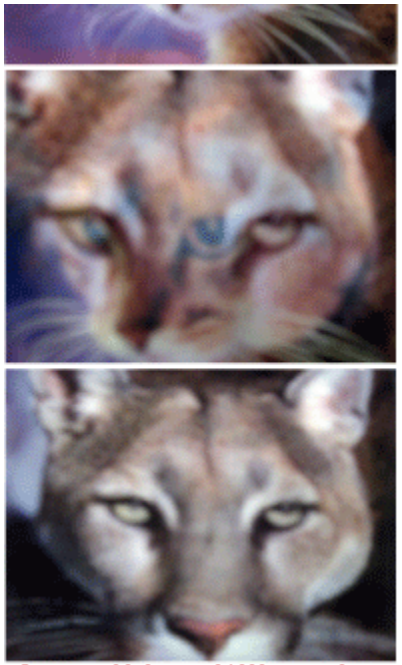
Animation/motion | A small event occurs on the object. A change in perspective creates the impression of movement: A car's folding roof opens and closes.

Many of the effects described can be combined with one another, depending on the originals available, the size of the pictures used and the lenses deployed.

Source: "Astounding effects," Heidelberg News*, Issue 251. For more information on this customer magazine, e-mail* **Heidelberg.news@heidleberg.com.**

Taking lenticular to the next level
National Graphics (Brookfield, WI), was founded in 1977 as a prepress house. In the early 1990s, the company launched its lenticular efforts after a technician prepared a crude motion graphic of a child on a swing. While the effect wasn't visually stunning, according to president Don Krause, "It was enough to entice me to investigate further."

Krause recalls that 15 years ago, lenticular was perceived as little more than a Cracker Jack gimmick. "There was no way of mass producing high quality lenticular on a commercial printing press. It was done photographically—Kodak was heavily involved."



Source: Universal Lithographers

In 1995, National Graphics invented a material with 75 lenticular lenses per inch (lpi) that was said to be the first commercially viable lens for standard lithographic printing presses. Krause says the 18-mil (0.019-inch) lens, based on the company's patented Extreme Vision technology, helped take lenticular to the next level. The company has since developed a much thinner lens, a 7-mil (0.007-inch), 200-lpi material called Crystal.

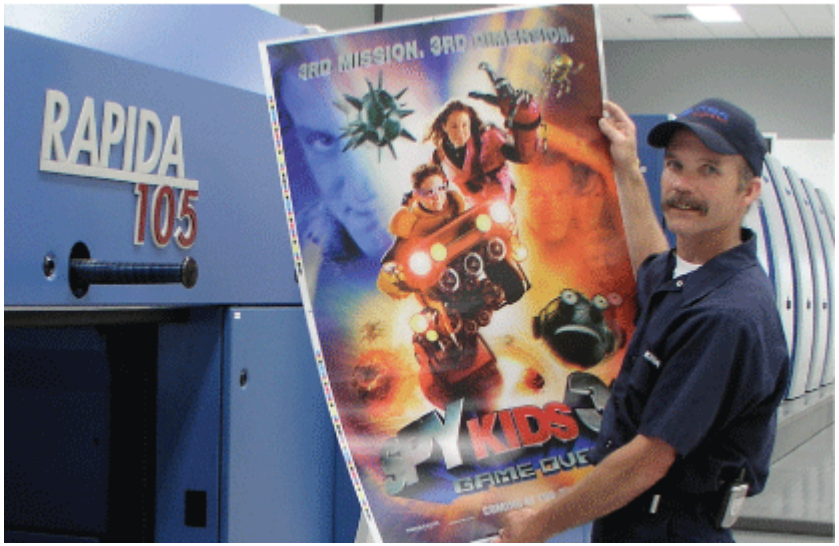
Crystal's thin profile makes it suitable for pressure-sensitive labels—it can be applied to plastic or glass bottles without detaching or fracturing. (See **"Lenticular labels emerge,"** PFFC, July 2003.)

In addition to labels, packaging, posters, and book and magazine covers, the company's technology has been used on toys and in-mold decorating applications. Printers around the world are using National Graphics' Extreme Vision—but all had to meet certain criteria. "We are selective about who we work with because of our patented processes," says Krause. "We [ensure] the printer has the right equipment and press mechanics."

Substrate costs remain the greatest barrier to widespread lenticular use. Since a thinner material is obviously cheaper than a thicker one, National Graphics is working on a 3-mil label material. The company also is developing a technology to create lenticular lenses inline on a printing press. (Lenses currently are created using custom engraved cylinders and an extruding process.) "We'll be able to make a lens [anywhere on a press sheet]," says Krause. The patent-pending process is called Spot Lenticular and is expected to be released next year. For more information, see **www.extremevision.com.**

Lenticular on a larger scale

Big3D.com (Fresno, CA) produced this poster for "Spy Kids 3D" on its 62-inch KBA press. The seven-color UV press can handle a variety of lens materials. Big3D.com produced reflective and backlit litho versions of the poster as well as one printed photographically.



Flipsigns.com, a trade association as well as a lenticular software developer, honored Dr. Tom Saville, founder and president of Big3D.com, with its Ph3D award. The award recognizes excellent achievement in the 3-D and motion print industry. According to

Flipsigns, “The Big3D.com quality is so outstanding that all of the “Spy Kids 3D” posters have the [company’s name listed in the credits] just like the movie stars on the poster.”

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