

## Chatty chips bridge digital divide

**H**ewlett-Packard researchers have shown a dot about the size of a hanging chad from a hole punch. It is actually a computer chip with enough memory to store music, video, photos, or hundreds of pages of text without a battery. It communicates wirelessly with a special receiving device that touches the chip, which might be placed on artwork, a photo, jewelry, or virtually any other physical object. "Memory Spots," as they are called, are 1.4-millimeter-square electronic chips that can add multi-media to mono-media.

Like Radio Frequency Identification (RFID) tags, Memory Spots are powered by radio fields sensed by special electronic reading devices. Ultimately, reading and writing technology could be added to smart phones or other handheld devices.

Massachusetts Institute of Technology researchers call this technology "things that think." Chips can be used to store information about an object or to command it to do something. Many of these chips automatically communicate with computers or computers with sensors that report temperature, moisture, or other physical conditions.

The first generation of chips store about 512,000 bytes of data. Scan a chip stuck on a photograph of a child and hear an audio recording of the child laughing. Scan a prescription drug bottle with a chip on top, and a brochure about the drug appears on screen, and you hear usage instructions. Chips could be used to read and modify electronic medical information in a medical patient's ID bracelet. Gillette and Procter & Gamble have tested chips in packaged consumer goods to better track inventory. Sylvania has a chip accessory that attaches to a lighting fixture, allowing the fixture to be turned on and off remotely. Some U.S. cities are putting chips into water meters to reduce reading costs.

In contrast to RFID tags, which store only a few hundred or a few thousand bits of information and are readable from distances of tens of feet, the HP Memory Spots can be read only at extremely close range but store up to hundreds of thousands of bytes of information. HP says that the technology is intended to serve a different purpose from RFID and other tags used as tracking devices for commercial products or shipments.

Memory Spot chips may be priced as

low as ten cents each when manufactured in volume. Memory Spots can be affixed to all kinds of objects. But today a clunky prototype receiver is attached to a laptop via cable. Memory Spots aren't ready for sale—expect them in two to five years.

- Researcher In-Stat says RFID chip sales should reach \$2.8 billion in 2009, up from \$300 million in 2004. Researcher Lucero estimates the number of chips being placed on objects for home automation tasks, such as turning out lights, will triple in 2006:

- Wi-Fi or Wireless Internet technology lets mobile computer users surf the Web. But chips can also use Wi-Fi to communicate. That is how automated electric, gas, and water meter-reading systems work. One such system was installed in a vineyard to monitor soil moisture levels.

- RFID chips hold less data than a Memory Spot but can transmit it much farther. RFID is perfect for tracking packages in stores or warehouses. Wal-Mart has mandated that key suppliers use RFID tags on shipping pallets.

- Motorola spin-off Freescale Semiconductor has led the development of ZigBee. In 2007, ZigBee chips (like RFID) will be incorporated into products such as light fixtures and other home automation products.

- Z-Wave is a rival to ZigBee, and Home-Pro and Intermatic have brought more than 100 home automation products with Z-wave chips to market.

Other technological and cost barriers must be overcome before intelligent, wireless communicating smart chips are in widespread use. But researchers are working to solve the technological problems and thus bridge the gap between the physical and digital worlds.

### DID YOU HEAR?

- The online banking customer base grew to 40 million during the fourth quarter of 2005, a 27-percent increase over 2004. Online bill payment services have grown 36 percent during the same period (comScore Networks).
- U.S. book publishing numbers have plunged by 18,000 titles to 172,000 new titles and editions in 2005. This is the first decline in book title output since 1999 (Bowker Statistics).
- Broadband adoption increased 59 percent among U.S. households with incomes between \$30,000 and \$50,000 from March 2005 to March 2006. It increased 40 percent in households making less than \$30,000 a year. (Pew Internet and American Life Project).
- Exports of American recovered paper to China and Hong Kong have grown tenfold to \$694 million in 2005 from \$66.9 million in 1998 (American Forest & Paper Association).
- Households with children under age 14 are more likely to have a desktop computer than a TV, and kids are more likely to own a video game than a TV. Video-game systems are owned by children in 40 percent of the households polled. By age 7, children are integrating personal music devices, digital cameras, and DVD players into their daily activities (NPD Group).
- 202 million disposable cameras were sold in the 2005, down from 218 million in 2004 (Photo Marketing Assn.).
- In 2004, 46 percent of bills were paid by check and 25 percent paid online. In 2005, 37 percent of bills were paid by check; 35 percent were paid online. The remaining 28 percent were paid with cash, debit cards, or other payment methods (Harris Interactive).
- More than 107 million telephone numbers were registered with the national do-not-call registry by the end of 2005 (Federal Trade Commission).

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## SHORT TAKES: FACTS AND OPINIONS

Will the inside of airplane cabins look like buses and subway cars? America West, which merged with US Airways in 2005, had introduced the first advertisements on tray tables in the airline industry, the first airline gift cards, and the first in-flight meals for purchase. Now, US Airways plans to sell advertisements on its air-sickness bags. Somewhere between the in-flight magazine and the safety card, the bags occupy every seat back pocket—and barf bags have a lot of shelf life because passengers aren't barfing in planes as much as they once did. US Airways has not decided how much to charge for the ads—which might feature anti-motion sickness medications or other products that come to mind for someone who reaches for one of the bags.

*Anything that stimulates the market for print is okay in our book. Let's see them replace a barf bag with a barf Website. Advertising will appear anywhere and everywhere, and that includes your monthly bills and statements (which may also make you barf).*

Ads are showing up in the strangest places, as the above item indicates. ABC's "Desperate Housewives" once used dry-cleaning bags to promote the series. In September, more than 35 million eggs will be marked with phrases such as "CSI: Crack the Case on CBS" and "The Class, New Grade-A CBS Comedy" as part of a deal between the CBS Marketing Group and EggFusion, an egg-coding company. The campaign is part of what CBS is calling its "Outernet strategy," an effort to reach viewers "outside their homes as they go about their daily lives." EggFusion, based in Deerfield, IL will use inkjet technology to print expiration dates and "On-Egg Messaging."

*How many marketers will scramble to shell out ad dollars for the funny side up?*

Project Gutenberg has reported that partners are on track to make 1 million e-books available in 2009, with more released in subsequent years. About 100,000 will be permanently available at the Project Gutenberg sites on the Internet. The Gutenberg books, typed and scanned into computers by thousands of volunteers, are mostly those that are no longer protected by copyright. They include fiction, nonfiction, and reference books, and will be available for worldwide readers in about 100 languages.

*It is predicted there will be 10 million e-books available by 2020.*

Levi Strauss & Co. is testing radio frequency identification chips to track inventory. But, LeBenetton ended a test of RFID chips in its retail line after Consumers Against Privacy Invasion and Numbering (CASPIAN) launched a boycott. CASPIAN says numerous patents by RFID technology developers describe ways to link unique serial numbers on RFID-tagged items and track consumers for marketing or advertising purposes. The group cites a patent describing how RFID tags could be used to track individuals in public places. The removable 2- by 4-inch tags on garments function like intelligent bar codes and improve inventory management.

*Electronic adjuncts to printed documents will be used for many applications. Potential for abuse should not delay development and deployment. Safeguards can be built into any system.*

Whirlpool, Panasonic, and Microsoft want household appliances to link wirelessly to home networks via the Internet. Prototypes are being tested by consumers who receive updates on their laundry via cell phones, computers, and TV sets. Messages warn if a lint filter is clogged or a load is too large. The latest washers and dryers are part of a wave of innovative household products that apply a new breed of electronics. Dishwashers will now rely on dirt-sniffing sensors, not timers, to turn themselves off. Vacuum cleaners will now determine how much soil and grime is on the floor so that suction levels can be adjusted accordingly. State-of-the-art microwaves will detect the weight of popcorn and then apply the right amount of heat for the perfect pop. Laundromat operators will notify customers remotely when their loads are done, instead of having them wait for the buzzer to sound. At Georgia Tech, a program called LaundryView allows students to receive cell phone calls and e-mails when their laundry's rinse cycle is done. They also can find out which washers and dryers are available via a Website.

*The number one thing consumers say they want is a laundry robot to do all the work. College kids call such robots "mom."*

## EDSF REPORT

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## A TRIO OF TEXTBOOK CASES ON TEXTBOOKS

A Government Accountability Office report has found that college textbook prices have increased at twice the rate of inflation in the last two decades. In academic year 2003-04, students and their families spent more than \$6 billion on new and used textbooks. According to the GAO, the average estimated cost of books and supplies for a first-time, full-time student at a four-year public institution in 2003-04 was \$898—26 percent of the cost of tuition and fees. It was not unusual for a single textbook to cost more than \$100. The most widely purchased textbooks on college campuses usually appear in new editions every three years, and these new editions usually cost 45 percent more than a used copy of the previous edition. Reports by the Public Interest Research Group and the GAO concluded that many factors affect textbook pricing, including bundled features such as CD-ROMs and workbooks shrink-wrapped together. Publishers state that the additional book features are what professors and schools specify.

In Connecticut publishers are now required to provide pricing information to faculty before professors place orders, making educators more aware of the final cost to students. While organizations and campaigns such as [MakeTextbooksAffordable.com](http://MakeTextbooksAffordable.com) work to lower the cost of textbooks, there are some things students can do to reduce the amount they spend. For instance, the California Public Interest Research Group recommends buying online at such sites as [www.campusbookswap.com](http://www.campusbookswap.com), which allows students to buy and sell used books from and to each other. Other popular sites include: [www.textbookx.com](http://www.textbookx.com), [www.half.com](http://www.half.com), and [www.bigwords.com](http://www.bigwords.com). One must consider shipping expenses when buying online. Used textbooks are typically priced at 75 percent of the retail price of a new book and prices range from \$10 to \$80, with the average price about \$40, according to the National Association of College Stores. Many college bookstores list online the textbooks required for each course. Students need to shop early when they buy used books, because they sell out quickly once classes start.

Rice University's Connexions has announced an on-demand printing agreement with QOOP Inc. that will allow students and instructors anywhere in the world to order high-quality, hardbound textbooks from Connexions. in most cases for less than \$25. The deal positions Connexions to take the lead in open-source textbook publishing as soon as it completes software needed to feed each of its titles to QOOP's on-demand publishing platform. Connexions plans to offer more than 100 titles for online purchase by year's end.

From its inception, "Connexions has used the Web to go beyond print," said Connexions founder Richard Baraniuk. Connexions lets pupils and instructors make cross-disciplinary intellectual leaps with a simple mouse click, following knowledge wherever learning takes them. But being Web-based is also about access, and because Connexions' materials are freely available to everyone, they needed an easy, low-cost way to let people use a book if that's the medium from which they are most comfortable learning, according to Baraniuk, the Victor C. Cameron Professor in Electrical and Computer Engineering at Rice.

QOOP's on-demand service will allow Connexions' users to order customized course guides and a variety of fully developed Connexions textbooks. Standard paperbacks will take just 3-5 days to produce and ship, and traditional hardbacks will take about a week to produce. QOOP ships directly to customers. This fast turnaround is partly due to Connexions early adoption of Creative Commons open licenses: because all content on the site is authored

under these licenses, there are no copyright conflicts to negotiate.

Today, because college textbooks are so expensive, more and more students are fleeing the market for new books in favor of used or even borrowed books. Publishers have responded to this trend by raising prices, which has only created a downward spiral. One downside to the increased use of (older) books is that some technical fields are advancing so rapidly that these dated books are often dangerously out-of-date, and students leave the class unprepared for what awaits them in the job market. The customized textbook is among the answers to this situation. This year, the Connexions' site has attracted more than 500,000 unique visitors each month.

Connexions adapts the open-source software concept to scholarly academic content, allowing anyone to freely publish course materials in a single place online. Connexions uses Content Commons, an online repository that contains thousands of scholarly modules, manuscripts roughly equivalent to two or three pages from a textbook. Connexions provides free software that allows anyone to reuse, revise, and recombine the modules to suit their needs. This feature gives people the option of creating customized courses, custom textbooks, and personalized study guides. Connexions is funded primarily by Rice and the William and Flora Hewlett Foundation, which donated \$2.25 million to the program.

A high school in Vail will become Arizona's first all-wireless, all-laptop public school. The 350 students at the school will not have traditional textbooks but will use electronic and online articles as part of traditional teacher lesson plans. The Vail Unified School District said the use of electronic materials moves teachers away from marching through a textbook each year. Students will soon need to pass Arizona's Instrument to Measure Standards to graduate from high school. The AIMS' test now makes the state standards dictate the curriculum, not textbooks. The move to laptops is not cheap—laptops cost \$850 each, and the district will loan them to 350 students for the academic year. The district projects 750 students at the high school eventually and a set of textbooks costs \$500 to \$600 for each student. The computers most often used are laptops and at the schools with laptops, students were more engaged than at non-laptop schools.

### A note to readers

We hope you enjoy this EDSF REPORT and benefit from the research the Foundation sponsors and provides to you at no cost. EDSF is a major supporter of industry education: since 1999, EDSF has awarded more than \$300,000 in scholarships to qualified students worldwide who are interested in careers in document management and communications.

EDSF initiatives promote and advance the document systems marketplace. They are funded by donations from individuals and companies that truly care about our industry and its future. We hope that you may be similarly motivated to donate so that EDSF can continue its important work. Contact Jeanne Mowlds at [jmowlds@edsf.org](mailto:jmowlds@edsf.org) or call +1 310-265-5510.

## Inkjet mechanics

South San Francisco-based EoPlex Technologies has a technique for producing mechanical components using inkjet printers. Instead of reproducing a poster using thin layers of ink, EoPlex builds components by sandwiching thin, patterned layers of ceramics, metals, and other materials on top of each other and curing the individual layers as the structure takes shape. These printed components, which consist of hundreds of layers, can also contain integrated moving parts, hinges, or sealed air chambers. EoPlex predicts that sensors and computers will become ubiquitous, and inkjet printers are applicable because they can be programmed to print a variety of electronic components.

Some inkjet systems produce 3D prototypes. British inkjet manufacturer Xaar has collaborated with researchers at the University of Manchester to develop spray-on human bone cells. Xaar is also working with Sweden's Thin Film Electronics to create memory chips that can be sprayed (rather than lithographed and chemical etched as chipmakers do today). EoPlex will incorporate inkjet technology but now concentrates on screen printing where fluid is transferred directly onto a surface.

The company's processes can produce components measuring less than 50 microns thick (about the width of a human hair). In the near future, EoPlex will be able to print "mechanical" components under 10 microns in thickness. After about 300 printed layers, the finished product emerges. The first products made by EoPlex that will hit the market will probably be fuel cells.

## Mobile power

Will fuel cells recharge our cellphones, PDAs, MP3 players, and other hand-held devices? Picture a lightweight, disposable fuel cell in a flexible plastic shell a little larger than a deck of cards with a cable to connect it to the device that needs recharging. Squeeze the sides, plug in the cable, and a chemical reaction produces electricity. An Israeli firm, More Energy, a New York subsidiary of Medis Technologies, is producing these fuel cell systems on a semi-automated line, with mass production scheduled for Ireland in the first half of 2007.

The portable fuel cell provides 20 watt hours of total energy, usually providing a standard cellphone with ten full charges, each worth about three hours of use time. The fuel cell has a simple chemical basis: sodium borohydride, mixed with an electrolyte, potassium hydroxide, and a small amount of alcohol. When a user squeezes the cell, the electrolyte goes to the electrolyte chamber and the fuel to the fuel chamber. Oxygen from the air reacts with the fuel to produce electrical energy. The energy pack can be stored for a year, and once activated, can last two months.

Batteries have not been able to keep up with consumer demand for portable power, but Energizer thinks there is life in batteries and will introduce a portable, battery-based recharger, "Energi to Go." The recharger, at \$19.99, is meant for cellphones and comes with two disposable lithium AA batteries that provide about one and a half charges before they are used up.

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*Chatty chips*

*Mobile power*

*Inkjet mechanics*

*Textbook cases*

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