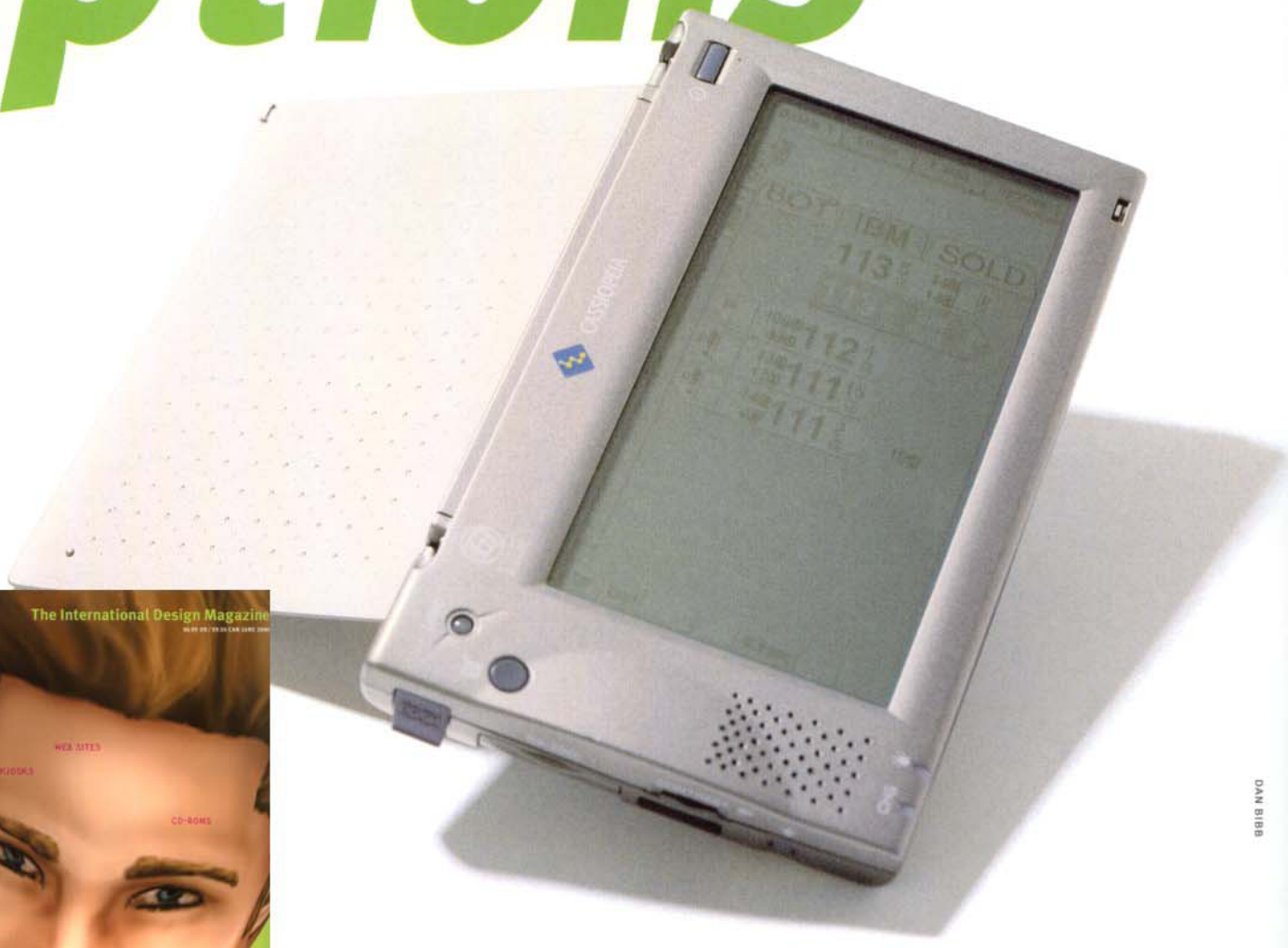
Stock Options



DAN BIBB

Goldman Sachs's handheld transactional device (above) was developed with a proprietary interface (opposite) for use by the company's brokers on the floor of the New York Stock Exchange.

A new kind of "trade" is in progress at the New York Stock Exchange as brokers swap their pencils and paper for electronic transaction devices. by Janet Abrams

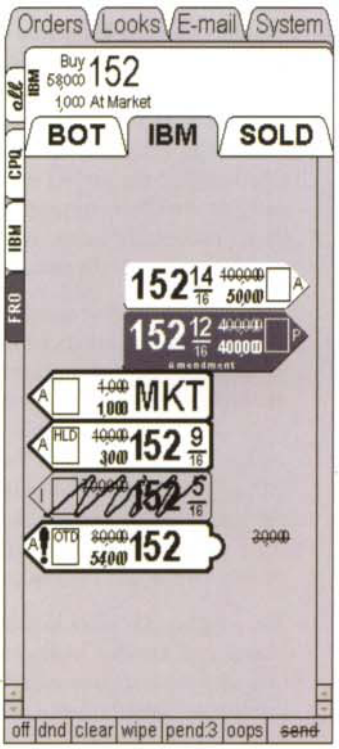
From the visitors' gallery, the trading floor of the New York Stock Exchange looks like nothing so much as a scene from *Brazil*. Obscuring the gorgeous, coffered ceiling high above, skeins of computer cabling and metal ducts snake down a suspended metal space frame into the multisided trading "posts," where overhead monitors and desktop screens emit electroluminescent hues. Down below, (mostly) men in brightly colored, numbered jackets swarm from post to post, exchanging little bits of paper.

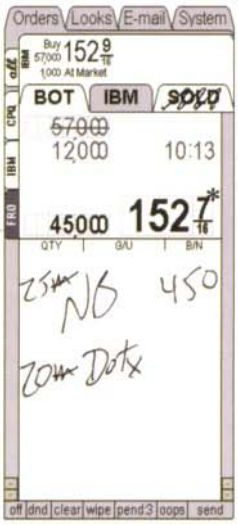
At 4 p.m., when the closing bell sounds, the army of cleaning staff use extra-wide brooms to shove the debris of the day's trading into giant heaps. Here, more than anywhere, the myth of the "paperless office" is vividly refuted. Until very recently, the core activity of trading was conducted exclusively using those most primitive of input devices: paper and pencil. Given the battery of technologies wired into the space, it is remarkable how tenaciously this method has held sway. For this tradition to change, a culture evolved over 208 years would have to change: a complex social structure with its own rules of behavior, coded language and even wardrobe. And it will. This last link in the communication food chain has finally begun to go digital.

Nearly all the trading activity at the NYSE is conducted electronically, with orders piped in from brokerage firms located physically outside the stock exchange to clerks based in the members' booths around the perimeter of the trading floor. But at this point paper customarily takes over. The clerks page the brokers to their booth, where the latter pick up sheafs of order tickets and return them with "execution forms," which trace the trades that fill the order. The individual execution forms are then either scanned in or messengered to typists, who translate the handwritten information and enter it into each firm's database. On a busy day, brokers may make this journey more than once a minute—all day. (Hence the heaving racks of worn footwear in the shoe-repair shop just outside the entrance to the trading floor.)

Each stock, or "ticker," is assigned to a specific post, thereby determining an intricate ballet of broker traffic across the floor. To execute a trade, brokers must stand before the "specialist" who handles that particular stock. The specialist ensures that both sides of the stock (buy and sell) are exposed to the market, if necessary buying or selling that stock himself to keep it trading. Brokers who are "in the crowd," trying to do a deal, scribble executions on printed pads with simple but iconic BOT/SOLD graphics—paragons of vernacular design that are used for the transaction of trillions of dollars' worth of stocks (sometimes, in a single day).

Handheld wireless devices were first used at the NYSE in 1995 for its staff of "reporters" to send data on executed trades to the "tape"—the electronic ticker of stock prices. Now, owing partly to the pressure of limited space in the exchange's four contiguous floors, and the consequent need to improve the speed and productivity of individual brokers, handheld devices for actual trading are coming into use.





Among the most important features of Goldman Sachs's handheld trading device is an application that replaces both the order tickets and execution forms that are customarily used by brokers on the floor of the NYSE.

Right, top: When an order for the broker comes in to the handheld version, it appears as a dark gray "road sign" pointing either left or right (buy or sell), with the most important information—the price—aligned in the vertical center of the screen, in white type on a dark gray background. Each new road sign is automatically positioned vertically within the list according to its price, indicated in large numerals at the blunt end. The fraction, with enlarged upper figure, indicates the sixteenths of a dollar—known as "teenies"—in which stocks are currently traded; the interface can handle any other base, anticipating the NYSE's upcoming switch to decimal trading in the near future.

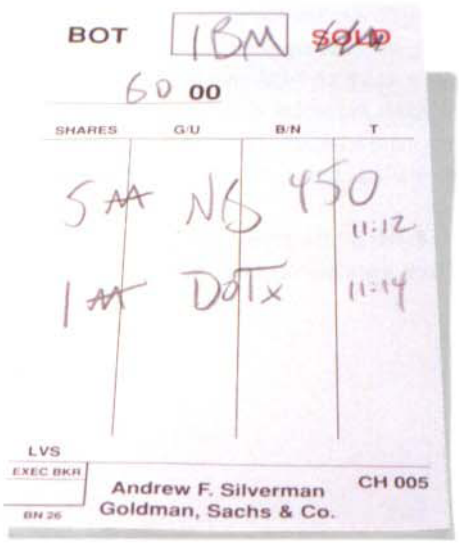
Right, bottom: The electronic execution form bears the words "BOT" and "SOLD." By touching one of these words on-screen with a stylus, the individual broker denotes stocks bought or sold (here, the broker has tapped "BOT" and made a buy). The columns underneath are demarcated for "QTY," (quantity) "G/U" (given up—to whom sold, or from whom bought) and "B/N" (badge number of the individual broker with whom transacted).

NYSE's in-house software engineering group has developed several models of "mobile point-of-sale" devices for use by any member firm—which means they must accommodate a wide range of functionality. Two financial software companies, Axis and NYFIX, are also developing interface designs for mobile transactions. So far, only one brokerage has developed its own model: Goldman Sachs. After nearly three years of research, design and testing, the firm launched its handheld device on the floor in April. It will eventually be rolled out to all 20 of the Goldman Sachs NYSE floor brokers. And it is radical, precisely because its interface emulates so closely the familiar aspects of paper-based trading and the thought processes of the traders themselves.

Brokers generally have resisted the introduction of electronic trading tools, preferring to stick with tried-and-trusted stubby pencils on unassuming sheets of paper. The challenge was to find a way to persuade them to make the transition to digital order-taking and execution without burdening them with a bulky device. "First we had to handle the ergonomic issue," explains Matthew Lavicka, managing director of Equities Technology at Goldman Sachs. "The brokers were skeptical. They felt it would be cumbersome, get in their way."

The Goldman Sachs team surveyed the available off-the-shelf hardware, looking at about 40 different handheld devices that supported Windows CE because it could communicate with the NYSE's internal wireless network (built using Symbol Technologies' 2.4 GHz system). They needed a device that was lightweight, with a decent battery life and no keyboard. (At the time, about 1987, the Palm VII wasn't yet on the market, but even if it had been available, its screen resolution and speed are not sufficient.) They quickly narrowed the field down to the Casio Cassiopeia.

For the handheld's trading interface, Goldman Sachs recognized the need to go beyond the traditional financial GUI, with its rows, columns and pick-lists, and instead



Goldman Sachs wanted a handheld device with an interface that brokers could understand intuitively.

develop a stylus-based interface in which the action of entering information would mimic the paper-and-pencil scribbling the brokers were used to. At this point, Lavicka contacted Brad Paley, of Digital Image Design (DID), to develop a custom interface for the Orders and Executions pages. DID, with offices in Manhattan's SoHo district, has been designing physical and graphical interfaces for the last 15 years, winning several awards for "The Monkey"—an input device for character animation—and "The Cricket"—a 3-D mouse for virtual reality.

Paley, a graduate in economics from UC Berkeley who had worked in interaction design and financial visualization since the mid-1980s, perceived that the task was not simply to develop a new kind of handwriting recognition. More fundamentally, it was to understand the brokers' decades-long practices and find an electronic equivalent, then improve the structure and distribution of the information. The interface design had to contend with the brokers' own highly evolved graphic shorthands: the BLT-like stacks of letters and numerals they use to annotate their complex financial maneuvers.

Paley and his colleague Hai Ng set out to learn the brokers' culture from the inside. Like anthropologists among some endangered tribe, they shadowed the Goldman Sachs traders for months on the floor, listening to their *patois*, observing their body language and compiling a glossary of broker-ese. "We spent days and days pretending we were them, scribbling notes in the same form factor they use," says Paley, holding up one of the palm-size paper pads. "My job was to understand what the brokers are doing on a symbolic level and then find ways to substitute cognitive and perceptual processes for as many of the symbolic manipulations as possible." In other words, DID worked out how to design an interface that a broker could understand intuitively—one that represents an interesting departure from the "spreadsheet" typical of most computerized displays of financial information.

The Cassiopeia is held vertically, like a pad of paper (albeit a few inches taller). Its screen replicates the traditional execution form, which shows "BOT" at the top left and "SOLD" at the top right. Using a stylus, traders choose to execute a buy or sell by touching a tab (in the same position and font as on the paper form). The opposite, unselected tab immediately appears scribbled out.

When an order comes in to the handheld version, it appears as a dark gray, one-way "road sign" pointing either left or right (buy or sell), with the most important information—the price—aligned in the vertical center of the screen, in white type on a dark gray background. As soon as the broker acknowledges its arrival by tapping it, it reverts to black type on white. Each road sign offers an instant summary of the most important information in an order; all of the details can be accessed by tapping a "thumbnail" details page on the road sign.

Each ticker, or stock, has its own individual buy/sell page for entering executions, which can be reached by tapping the tabs on the left-hand border of the screen. Because accurate and fast input is imperative in the trading

The paper form brokers traditionally have used to execute a trade (left). Here, the form shows a "buy" similar to the one shown on the bottom screen on page 49.

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MEL NUDELMAN / NYSE

The New York Stock Exchange (view of the floor, top) has developed several models of "mobile point-of-sale" devices for use by any member firm. Because the NYSE's handhelds (above) have to cater to a much wider user-group than Goldman Sachs's, they must offer more functions, resulting in more densely crowded interfaces.

environment, Paley developed "strokeable numbers," designated with gray borders, which can be increased swiftly by stroking the stylus upward or decreased by stroking down. Another screen, designed but not yet implemented, will superimpose a numerical keypad and number scale on the order page, with a "magnifying glass" that slides up or down rapidly to select a new price.

The screen shows only black and white, so the interface uses various graphic techniques to add richness and maintain context. Strokeable numbers are indicated white on black when they are active, for example, and a finished order remains on the screen but is shown ghosted, with a scribble-through to confirm that it has been completed.

But here's where the handheld makes a definite improvement on a fistful of individual order sheets: The system takes in orders and organizes them vertically according to price. The first road sign for a given stock automatically shows up in the middle of the screen; as more offers come in, they appear above or below it. The right-hand scroll bar allows vertical movement to accommodate a wide range of offers as they come in, without necessitating a reduction in scale, and thus legibility, of individual road signs. "Because these objects are ordered by the same principle that causes the market to work—namely price—we see the behavior of the market in the behavior of the objects," explains Paley. In other words, where the highest "buy" road sign touches the lowest "sell"—the magic horizon—is where the market happens. The Goldman Sachs interface thus gives a graphical representation of an abstraction, "the market," which is really a social construct in constant flux. If this seems self-evident on looking at the interface, it is precisely because it has been designed that way.

Andy Silverman, a Goldman Sachs broker, has been leading a team of clerks and fellow brokers to introduce the handheld on the trading floor, where it has met with considerable enthusiasm. Considering the brokers' initial reluctance, "they've come 180 degrees," Lavicka says.

Silverman likes the fact that the Cassiopeia's direct-view screen offers a degree of privacy and that it fits comfortably in the broker's pocket. Not something that can be said of one of the NYSE's own models—a precursor to its newer, slimline E-Broker that also runs on the Cassiopeia—which took two hands to carry.

Silverman jots a sample stack of figures vertically on a notepad: "2 16 TOP 50 M." Richard Genna, a vice president of Goldman Sachs's Equities Division, translates: "Merrill Lynch wants to buy 50,000 shares. He can pay as high as two-sixteenths. TOP means he's a working buyer with a two-sixteenth top on 50. He might bid us a one-sixteenth on 10,000 because he's trying to get better prices. So there's a lot in that little scribble." Adds Silverman: "And from a design standpoint, you're not asking somebody to turn all that into a bunch of buttons." Instead, with a handheld that can take in the figures as fast as the brokers can scrawl them, the information can be relayed more swiftly than ever. The "send" function allows an executed trade to be sent instantaneously to as many people as need to know about it, which is much faster than walking a paper version to the booth and then scanning it in or phoning it over to the main office. In addition, an e-mail function allows a swift response from Goldman Sachs staff off-site to inquiries from their brokers on the floor.

"We're getting more information in real time as opposed to less information with a lag time," Genna says. And time, he says, is money: "If good or bad news comes out about a stock, five seconds later you have hundreds of people trying to do roughly the same thing. So to be able to access information quickly gives us a huge advantage."

"It's hard to let go of something you've been doing for a long time and do something new," says Silverman. "Brad's given us an ergonomic shorthand. You don't need to learn it. You grab it with your eyes. The bottom line is that it makes the broker more productive, and that makes the firm more productive. We've done for our business what e-mail has done to the Post Office."✦

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