Analog Artists

Die-hard engineers stay passionate about their craft in a world gone digital

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In a world consumed by all things digital, a few Silicon Valley die- hards cling to their love of analog technology.

It sounds almost quaint and old- fashioned, as if they've stubbornly hung onto vinyl records and vacuum tubes. After all, the digital revolution is celebrated far and wide, and everyday, devices like the camera, the telephone and the television are starting to speak the computer's language of ones and zeroes.

But the more things turn digital, the more the world needs the analog domain. ``Everything you live, eat, breathe, smell, hear is entirely analog,'' said Peter Henry, an analog engineer at National Semiconductor.

The digital world takes analog signals and compresses them into its code. Every little bit, boiled down and behind the scenes, is either a one or a zero. It's black or it's white, in the words of another National engineer, the appropriately named Nick Gray. By contrast, ``analog,'' he said, ``is shades of gray.''

The sound that emerges from someone's vocal chords or from a musical instrument, travels on an analog wave. When that sound reaches someone's ears, it's analog as well. It's only when that sound is recorded onto a compact disc, or compressed to send to a wireless phone, that it's digitized. ``Behind those digital systems, there is an army of analog elements working away slavishly to serve the king,'' said Barrie Gilbert, a fellow at chipmaker Analog Devices Inc.

With the rush to the digital domain, analog engineers often feel like out-

casts. The public doesn't understand their work; the media doesn't want to write about it. Young engineers coming out of college don't opt to specialize in analog.

``It's definitely the path less chosen,'' said Erroll Dietz, a senior design manager at National, a Santa Clara company that's one of the largest players in the $20 billion-a- year analog business.

After some computer conferences, the analog engineers convene ``dinosaur parties,'' said Peter Henry.

One television interviewer asked National chief executive Brian Halla, ``Isn't analog irrelevant?''

``Not only is it not irrelevant,'' Halla thundered, ``we're on the threshold of the next analog revolution.'' All the digital computing power in the world is ``worthless,'' Halla said, unless those computers can take in and put out analog signals to interact with the real world.

``At the end of the day, the real world is analog,'' Halla said. ``Fifteen or 20 years ago, people were saying everything analog can be digitized. That's true. But even though the whole world goes digital, the real-world signals will still be analog.''

Halla inherited a vibrant analog business at National, one built by the sort of men who gave analog designers their reputation for eccentricity.

Signs of free-thinking are evident around the National campus. Bob Pease, whom Widlar brought on in 1976, maintains a cubicle overflowing with papers -- sparking the interest of the local fire marshal -- and has spoken proudly of his penchant for dropping computers off of rooftops. (He denies this last act is a protest against the digital world though in one of his books, he advises, ``If the computer persists in lying to you . . . junk that digital piece of disaster!'')

Pease, National's staff scientist, does make some allowances for the digital age. He uses a computer and even maintains a Web page at www.national.com/rap.

Tom Redfern, whom Electronic Design News named a ``genius in the field,'' joined National in 1971 and now is a fellow. For the audio group, which makes devices that go into speakers, amplifiers and other sound system products, Redfern installed a ``portal'' into their cubicle area, with tall speakers and colorful rock 'n' roll style photos of the group. It's proven to be a popular congregating point.

``It's fantastic to have a place to write when it's impossible to describe something,'' said Brendan Whelan, known to his colleagues as ``Elvis.'' Whelan's photo is among those on the wall though you wouldn't necessarily know it -- the picture shows him with long hair blowing straight back, while Whelan now sports a shaved head.

Analog designers, more than most people in Silicon Valley, talk of passion, of art, of creativity in their work.

Redfern speaks of the excitement of sending a design to the lab where it will be etched into silicon.

``You know you will have something in your hand fairly soon,'' Redfern said. ``It must be what sculptors feel like when they finish their work.''

Part of that feeling of ownership comes because they work in much smaller groups. While hundreds or even thousands of people will collaborate to create a microprocessor or a major software program, the analog engineers work in teams of four or six people.

``You find a lot of analog guys want to be the only developer on the project,'' said Erroll Dietz. ``They tend to be more like artists. It's hand-crafted. A lot of pure analog layouts are done by hand.''

Pat Brockett, the executive vice president of National's Analog Products Group, said the difference between digital and analog designers ``is the difference between a guy building a house with bricks, and a stonemason building a cathedral.''

But just because it's art doesn't mean it's genteel. They're as competitive as anyone in Silicon Valley.

``I like to go into situations where there's a real strong competitor and pull market share from them,'' said Pat Tucci, a director of system products design -- and the son of a real- life stonemason.

``You get to know your competitors,'' Tucci said. ``You get to socialize with them. And you just like to beat them. It makes the parties more interesting.''

They also have that Silicon Valley pride and idealism. ``Silicon Valley is changing lifestyles around the world,'' said Peter Henry. And his work is a part of it: ``You walk into a stereo store, and there it is: People are listening to stuff that's pumping through your pipes,'' he said.

``The ultimate high,'' Redfern said, ``is when people accept it, when people buy it and the company makes money.''

``The money's necessary,'' he added. ``It's not sufficient. You want your child to flourish and be accepted in the world.''

And make no mistake, the engineers think of their products as their babies. Erroll Dietz is a large man, and he holds out a meaty finger, and there, between two lines of his fingerprint, rests what appears from a foot away to be a speck of dust.

It's not. It's an ``op amp,'' a tiny device that can be used to amplify electronic signals in devices from cell phones to PCs, and it is one of the most common tools produced by analog designers. Dietz has made the world's smallest op amp -- known as ``silicon dust''; it's about the size of one letter printed on this page.

Put the amp under a microscope and you'll see 50 tiny transistors, invisible to the naked eye, on a colorful pattern of circuits that Dietz and two designers drew.

His first name and the names of his designers, Lorraine and Dawn, also appear in little block letters. Artists like to sign their work.

The device sells for about 50 cents.

Dietz, like many of his colleagues, nearly pursued a career in music, and he still plays tenor and soprano saxophone -- when his workaholic habits and his devotion to his two young children give him the time.

He got his start as an engineer by building Heath Kits, a once-popular way to make homemade radios. Heath Kits are no more, a victim of the digital revolution. Kids today, Dietz laments, play with PCs and don't build their own gadgets as much.

The analog arts blossomed in the years following World War II, according to Barrie Gilbert at Analog Devices. ``World War II was a time of tremendous innovation,'' said Gilbert, a native of England. ``If you're being bombed every day, as my hometown was . . . you become inventive.''

Analog tools enabled such technology as radar, Gilbert said. But over the ensuing decades as increasingly tiny transistors made digital computers possible, hot young scientists followed the money into the digital realm.

``Everyone wants to do Web programming,'' Dietz said. ``No one wants to pick up a soldering iron and work the problem out.''

When people can do that work, companies will do anything to hire them. Analog Devices CEO Ray Stata let Gilbert establish an 11-person design center in Oregon to woo him. National has small centers around the world, from Fort Collins, Colo., to Bangalore, India, to the newest one in Delft, Holland, which opened last year.

To young people looking at engineering careers, the analog gurus beckon with the lure of individuality and fun.

They don't say they can turn the tide away from digital. Nor do they want to.

``I am not an anti-digital lobbyist,'' Gilbert said. ``I don't want to change the world and get rid of digital. It does valuable things. It's changed the face of society.''

But he echoes the sentiments of analog designers everywhere when he adds: ``I just don't like doing it.''

From analog to digital -- and back

Digital cellular phones are among the most common machines using analog and digital technology. While digital technology has enabled the phones to get smaller, the analog technology is still needed to capture and transmit people's voices.

Analog, as shown in this simple wave, is a varying range of air vibrations, resulting in sound. -- Sound waves cause a coil to vibrate in the microphone, converting the sound waves into an electrical signal. -- The phone digitally records a voice in real time and compresses it into little packages that are sent out on the air. When another phone receives those packets, it expands them again. -- The signal generates a varying magnetic field around around an electromagnet in the speake, causing a diaphram to vibrate,

converting the electrical signal into a sound you hear. -- Digital phone technology can compress eight people's voices over one analog signal.

Analog or digital

Many of the appliances used in everyday life are shedding their analog roots and turning digital. Turntable / CD player Typewriter / Computer Television / HDTV Radio / Real Audio

Vcr / dvd

Conventional Oven / Microwave

Analog audio

Our ears pick up electrical vibrations in the form of sound waves traveling in the air around us. No modern electronic equipment can copy these signals perfectly. -- Analog systems store sound by making copies of the sound waves as grooves on a vinyle record or as magnetic patterns on a cassette tape. -- Digital sound systems store electrical signals as a sequence of ones and zeros. There is no tape hiss or needle pops or clicks.

http://sfgate.com/cgi-bin/article.cgi?f=/c/a/1999/02/01/BU78272.DTL

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