

OBLIQUE PERSPECTIVE

Car Wars

The Case for Reduced Complexity Vehicles

by John Wharton, Applications Research

I was meeting Dave Ditzel at the Tied House after work for a beer. As usual, I got there 20 minutes late.

"Hi, Dave. Sorry I'm late," I said. "The traffic was atrocious, and the parking was worse."

"You should get a bike," Dave replied.

"Say what?"

"A bike. Cycle. Motorcycle. Like me. If you drove a motorcycle instead of a car, you'd get here on time. You could zip through traffic, and it would be easier to park."

"Really?" I replied. "I haven't given that much thought. How long have you been riding motorcycles?"

"Pretty much since I joined Sun." Faithful attendees of past Microprocessor Forums will remember Dave as one of Sun's top architecture evangelists. "But you know, motorcycles really *are* superior to automobiles along just about every technical dimension you can measure. They're a whole lot smaller, and simpler, so they're cheaper to build, they accelerate quicker, go faster, get better gas mileage, and cost a whole lot less to maintain. Someday *everybody* will be driving motorcycles."

"I didn't know that," I responded. "Do go on."

Simplicity in Motion

"It's the engine, mostly," Dave continued, munching on a plate of *Calamari Crisps*. "Motorcycle engines don't have as many cylinders as cars, so they have a lot fewer parts. Think about it. My cycle's only got two cylinders, versus what, six for your Toyota? That's two-thirds fewer spark plugs, and two-thirds fewer pistons, piston rings, valve stems, valve seats, lifters, distributor points, cams, camshaft bearings—everything."

"Spark plugs?" I pondered. "You're telling me your vehicle is better than mine because of how many *sparks* it produces?"

"No, it's not just the ignition, it's the whole system. With a smaller engine, the starter motor needs less power, so the battery can be smaller, too." Dave took a sip of beer and continued. "Motorcycles just need two tires, while a car has four—five, if you count the spare. Those extra tires are a total waste, except maybe when you're stopped or get a flat. And the efficiencies add up. Having just one drive wheel lets you completely eliminate the differential. All in all, motorcycles can be built for a fraction of what it would cost to build a car with comparable performance using the same technology.

"Which raises another point," Dave continued, after

a slight pause. Clearly he'd run through this line of reasoning before. "Motorcycles can use newer technologies than cars. Since they're simpler to design and use fewer parts, motorcycles will be the first vehicles to exploit new alloys, ceramic engine blocks, and carbon-fiber composites when these new materials are developed."

New Versus Old

Somehow, I felt compelled to stand up for the car industry. "Cars *do* have *some* merits, Dave. In fact, I kind of like cars, even if they *are* technologically inferior and harder to park. They're easier to drive, and give a smoother ride. They carry more baggage, and I can lock things in the trunk when the car is unattended. A professor I know even kept a *refrigerator* in his back seat! Maybe it does take longer to get somewhere, but since a car body is enclosed, I can do other things while I'm driving. Like listen to the radio, or talk on the phone."

"An enclosed body?" Dave asked, draining his pint of Tied House Stout. "Have you ever thought how much all that extra sheet metal must cost? Or how much trouble it is to maintain? You gotta wash it every month or two—at least!—and cars are *always* being taken to the body shop to fix smashed fenders or dented doors or to get their bodies repainted. With motorcycles there *is* no body, hence no sheet metal, and no maintenance. See? More cost efficiency, which means more savings."

"Maybe so," I answered, "but that sounds to me like NexGen saying the Nx586 doesn't have a floating-point unit, so you don't have to worry about Pentium-like FDIV errors. It's the sheet metal that you say raises the manufacturing cost that defines the interior space that makes cars so much more comfortable to ride in.

"And cars can carry more passengers, too. If I'm with friends, and we decide to go somewhere, with my Toyota I can take two or three people with me—in the T-bird, five or six. It's the interior seating that keeps passengers warm and dry in bad weather. Motorcycles just don't have that capacity. Plus, cars have air bags now, so they're much safer. My brothers are doctors; they've convinced me that motorcycles are much too dangerous."

Capacity Constraints

"*Comfortable Interior Seating Capacity?*" Dave asked. "*And total avoidance of Risk? Is that what you want?*" Dave pondered his empty glass. "Gee, John, you *are* turning conservative. But those are non-issues. Statistically, weather doesn't matter. Here in the Valley, it's

sunny at least 90% of the time. And 90% of the trips you make, you're alone. And safety-wise, people hardly ever crash. In defining a vehicle architecture, you should optimize for the most common case, not make key design choices based on infrequent, worst-case scenarios.

"But as to total passenger bandwidth, John, there you're wrong. It's simple math. The net passenger throughput of a vehicle depends on three factors: the number of passengers you can carry, the number of trips you make, and the time it takes for each trip. Sure, with a motorcycle, you may need to make more trips to perform the same amount of work, but motorcycles are inherently faster, so each trip takes less time. Cars usually top out at 75 to 100 MPH, while a good motorcycle built with the same technology can do 150—easy! They *could* go even faster than *that*, except then they'd need a new, optimized fuel, and it's not there yet. Most filling stations only stock low-octane gasoline targeted for cars."

"According to your reductionist arguments, shouldn't motorized unicycles go faster still?" I asked. "But I'm not sure your playing field's level. Motorcycles may well outperform autos on a controlled-condition test track, but life's not a superhighway. Sometimes you gotta stop because of contention for the use of an intersection, or to let passengers in or out. Sometimes your effective speed is constrained by a truck or a slow-moving bus. The real-world speed limit is still just 60 or 66 MPH, you know, and that's not likely to go up much in the years ahead. To me, it seems misleading to define throughput metrics ignoring buses and passenger I/O."

History Repeats

But Dave did have at least one valid point, I thought. "I'll concede you this, Dave: if I were a startup vehicle vendor, it probably *would* be a lot quicker for me to design a new motorcycle than a complete automobile, and it probably *would* be cheaper to tool up a factory for motorcycle production, too, so the time-to-market might be less." Motorized bicycles were invented long before full-scale automobiles evolved, I seemed to recall.

"But those seem to me to be very short term advantages. As volumes ramp up, a better-selling vehicle should benefit from greater economies of scale. It seems like the trend over the past hundred years has been for each new generation of vehicle to get steadily more sophisticated, not simpler. Vendors have historically added complexity to their vehicles, rather than strip them down," I went on.

"Honda, BMW, Alfa Romeo—each of these companies started out building motorcycles, but they didn't find real financial success until they began competing for the automobile market. Honda's building Acuras now, and you can't get more complex—I mean, more 'comfortable'—than that. Isn't your 'wave of the future' just a return to the outmoded ways of the past?"

Dave fell silent for a moment. "Alfa really *is* a nice piece of engineering. But just because a few companies caved in to market pressure doesn't mean the technical merits of cycles aren't there. Smaller's still better."

Legacy Systems

It was getting late, and I thought it was time to wind things down. "Okay, Dave, let's suppose everything you say is true. Suppose cycles *are* technically more efficient than cars, on every count, and that's what users want. Then motorcycles should account for a steadily increasing slice of the domestic vehicle pie, and I don't think that's the case. In terms of unit volume, I doubt if 'reduced-complexity vehicles' have *ever* had more than a 2% market share, and that doesn't seem to be changing. And within that 2%, the best-selling cycle should be the one with the best design, and I doubt that's true either.

"Might it be that buyers make their purchasing decisions based on something more than engineering efficiency?" I asked. "Could it be that consumers look beyond aesthetic technical merit in choosing their modes of transportation? Might they be motivated by comfort, convenience, and usability more than you give them credit for? And if so, then why should we think motorcycles will have greater market penetration in the future than they have in the years gone by?"

Dave scowled. "You wanna know why motorcycles don't sell better? I'll tell you why. *Incompatible licensing policies!* In most states, you need a different kind of license to drive motorcycles than cars. You take Driver's Ed in high-school, they just teach you how to drive autos. With most people, when their license expires, they update it with a later version of the same thing. Before you can drive a bike you gotta go back to the DMV and pass a whole new exam for a whole different license. Nobody does that, it's not worth the bother, so they keep the vehicles they're used to, and the legacy systems live on."

Future Portability

But as we stood up to leave, Dave brightened up. Perhaps the beer had mellowed him out. "But all that's about to change, John. There's a new program under way in Washington state. They're adopting a new, vehicle-neutral licensing scheme. You'll get one standard license and then port it from one platform to another, with no re-education or red tape. That'll make the difference! Under that new program, motorcycle sales will start taking off, *real soon!* Real, real soon, now; just wait and see..."

Maybe the new program from Washington will indeed pay off, I thought. But I'm not holding my breath. ♦

The author would like to thank Dave Ditzel for inspiring the foregoing parable, for graciously allowing his name and identity to be used herein, and for suggesting and embellishing several of the pro-cycle arguments. In real life, Dave drives a small, efficient sports car.