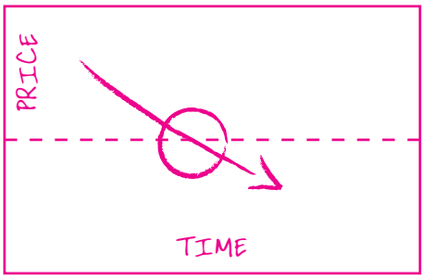
A CRASH COURSE IN INNOVATION

by Chris Anderson

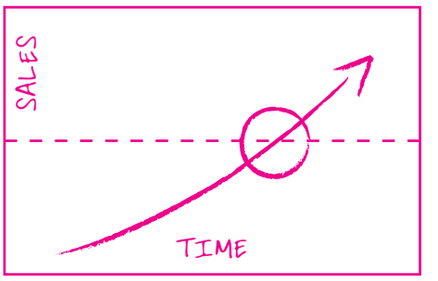
The four collisions that make a breakthrough technology

With technology trends, timing is everything. Even when the direction of an invention's path is clear, the pace at which it climbs largely determines who will profit most from its ascent. Move too early and you simply pave the way for more prudent competitors. Move too late and the market is already flooded. But move at just the right time and the technology's wave carries you with it, expanding into new domains. If only those sweeping curves were alike, and thus easier to predict. Well, they are, in one key way: As the history of innovation shows, the arc of nearly all important technologies is defined by four milestones. Arriving at each one starts a chapter in the technology's life that offers new opportunities and leads to new implications. If you miss one, there is usually another with its own potential yet to come. Plot them on a chart and these milestones show up as intersecting lines. Call them collisions.



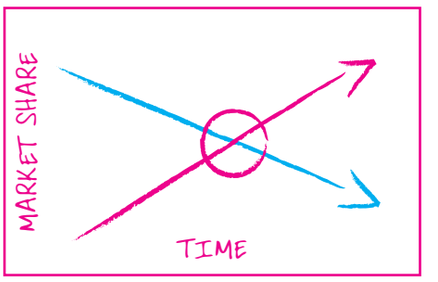
→ *Collision 1: Critical Price*

The first is when a technology collides with a **critical price**. That price is often a psychological threshold - a drop below $1,000 enables a product to make the move from office to home, say, or below $400 to move from early adopters to the mainstream. This is typically the initial milestone because the slope of the price decline is steepest in the early days of the manufacturing learning curve, when economies of scale kick in. Each market has its own critical price, but what's useful is that these thresholds are relatively predictable; they tend to reflect consumer behaviour and economics more than the details of the tech at hand. For instance, sales of VCRs reached 10 million a year when their average price fell below $400. Fifteen years later the DVD player, which did not offer as radical an improvement in consumer benefit, had to fall further - to $200 - to sell as many units.



→ *Collision 2: Critical Mass*

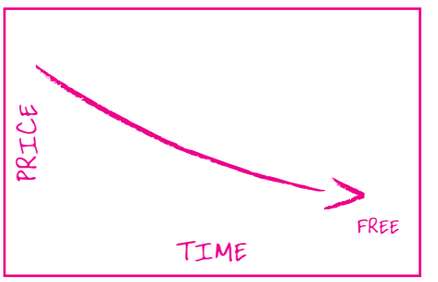
The second defining point is when a technology hits **critical mass**. Almost all technologies exhibit price elasticity - as the price falls, sales rise. So Collision 1 tends to lead to Collision 2, breaking out of the technophile core to the mainstream. Critical mass is that moment when you go from reading about a tech to knowing people who use it, when word of mouth gets going. This moment varies from market to market. For many consumer products, it's at about 20% of homes; for business tech, it's at 10% of offices, which are often more conservative.



→ *Collision 3: Displacement*

Collision 3 is **displacement**, when a technology on the way up hits one on the way down (as LCD's are doing to CRT monitors, and broadband to dial-up). These are cases where a better system has arrived to serve the same market. Typically, bets made a critical mass pay-off at displacement as the next technology comes to dominate the market.

Finally, the fourth collision is with **zero**. Many products become commodities as they mature and their price approaches zero. Think of the cost of a megabit of storage or a Wi-Fi chipset. The former leads to what would once have been considered frivolous: carrying 10,000 songs in your pocket. The latter leads to ubiquity, in the form of Wi-Fi built into every laptop and soon everything from phones to stereos, the building blocks of a wireless future. In both cases, the super-abundance of silicon chips and megabits created new products, features, and markets previously unimaginable.



→ *Collision 4: Price nears Zero*

Chris Anderson *(canderson@wiredmag.com) is Wired's editor in chief.*

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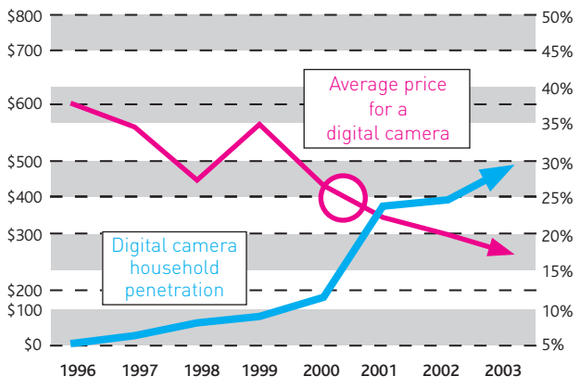
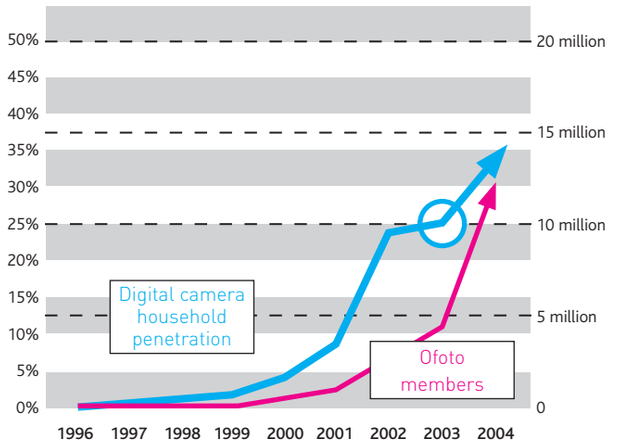
CASE STUDY: DIGITAL CAMERAS

The textbook example of an emerging technology



→ *Collision 1: Critical Price*

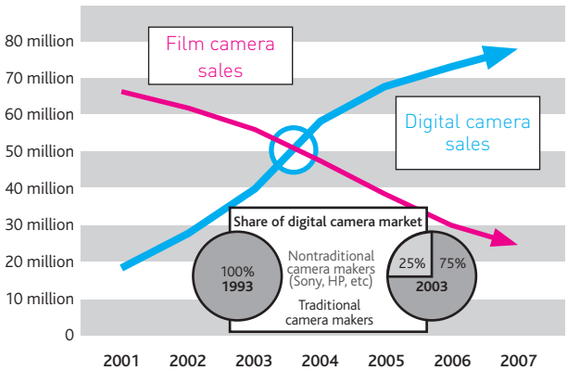


→ *Collision 2: Critical Mass*

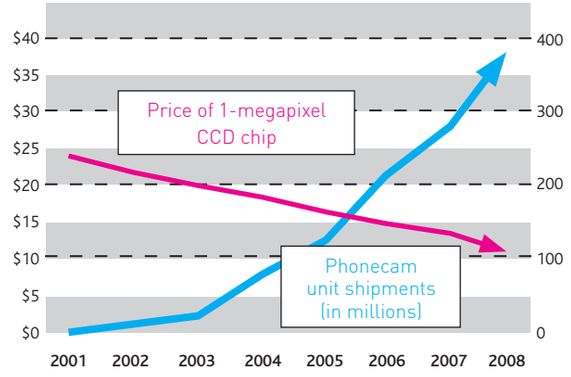
In its decade-long history, the digital camera has gone through all four collisions. When consumer digital cameras were introduced in the mid-1990's, they were low-resolution, hard to use, and expensive. By 2001, the first multimegapixel digicams hit the market for less than $400. That proved to be the critical point for consumers, and sales took off (→ Collision 1). As digicams caught on, consumer behaviour changed. Home printers and e-mailed pics were fine for the occasional shot, but filling a photo album with keepers was a chore. As a result, as digital photography reached critical mass, subscriber growth accelerated at online photo services such as Ofoto, which offer the convenience of drop-off developing without the drop-off (→ Collision 2).

By mid-2003, digicams had won: Sales exceeded those of film cameras. Traditional camera makers evolved, but slowly. In the breach, computer and consumer-electronics companies released innovative and inexpensive designs, and by 2003 they had claimed a quarter of the market (→ Collision 3).

Digicams - and their underlying CCD chips - are selling millions a year, and as a result the chips are getting really cheap, really fast. This takes us to the final chapter in the saga: the commoditisation of the underlying technology. As the price of CCD chips approached zero, cellphone makers built them in for little extra cost. Phonecams now outsell digicams. Ubiquity arrives by an unexpected route (→ Collision 4).



→ *Collision 3: Displacement*



→ *Collision 4: Price nears zero*

Sources : Consumer Electronics Association, IDC, iSuppli, NPD Group, Ofoto.