

# GPS: A Turn by Turn Case-in-Point

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## EXECUTIVE SUMMARY

*This case examines GPS navigation as a case-in-point of what technology, sold on the promise of what it can do for society, is also doing to society. Conventional wisdom insists that there are better things to do than find directions from here to there without turn by turn directions. While it may be true that losing the ability to find one's own way may be no great loss, as a tributary feeding into the river of what's going on across the board of human skill erosion, it's a symptom of far more serious summing going on.*

**Keywords:** *2<sup>nd</sup> Law of Thermodynamics, Device Paradigm, Dissipative Structure, Entropy, GPS, Least Effort, Reverse Adaptation, Technological Imperative*

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## BACKGROUND

*The Pawnees had a detailed knowledge of every aspect of the land they would traverse. Its topography was in their minds like a series of vivid pictorial images, each a configuration where this or that event had happened in the past to make it memorable. This was especially true of the old men who had the richest store of knowledge in this respect. (Weltfish, 1965, p. 207)*

*My wife leased a 2002 Acura MDX with one of the first OEM in-dash nav systems. I have been a convert ever since – we've leased four Acuras now with in-dash nav, and I will not own a car without it. The software has improved with every vehicle. Even in my hometown, I use the "go home" feature constantly. GPS user testimonial circa 2005. (Cooley, 2005)*

The Global Positioning System (GPS) originally consisted of 24 satellites orbiting the earth at an altitude of about 20,200 kilometers (12,550 miles). As of March 2008, the number of actively broadcasting satellites has been increased to 31, with a couple of additional older satellites kept orbiting as spares. With an unobstructed line of sight to a minimum of four satellites—at least six are always visible from almost anywhere on the Earth's surface—GPS offers precise, reliable location and time information, any time of day or night, under any weather conditions.

Provided both satellite and receiver clocks are perfectly synchronized and accurate, distance from any satellite to the GPS receiver's location can be determined by the difference in time

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between when a signal is sent to when it's received multiplied by the speed of light. Position on the Earth's surface could then be determined by triangulating the signals from just three satellites. Distance to one satellite results in a sphere centered on the satellite. Distance to a second satellite, produces a second sphere intersecting the first in a circle. The signal from a third satellite intersects the previously formed circle (usually) at two points, one at, or near, the Earth's surface and the other in space. The surface intersection is where you are. Using three satellites, however would require that the GPS receiver clock be as accurate as the cesium clocks onboard the satellites (since a light signal travels 300,000 kilometers in one second, a receiver clock inaccuracy of 1/1000 of a second would produce a distance error of 300 kilometers, or 186 miles). As this would be prohibitively expensive for a mass marketed product, the signal from at least one more satellite is used to correct for the inaccuracies in the receiver clocks.

## SETTING THE STAGE

There's a lot more to it, but this case is not about the complex details of how civilian GPS navigation devices, estimated to more than double from 500 million units in 2010 to 1.1 billion in 2014, technically gather and massage the information that offer users turn by turn directions and a lot more. It is about what our increasing dependency on GPS technology, as case-in-point of what technology, sold on the promise of doing more and more *for* us, is doing *to* us in the form of mental, physical, and social erosion as the subtitle of MIT distinguished professor Sherry Turkle's latest book, *Alone Together: Why We Expect More from Technology and Less From Each Other*, contends (Turkle, 2011).

If you had Googled "GPS Navigation" on February 11, 2011, you would have gotten "about" 20,500,000 results. One blogger in a 2008 "Hot Deals" forum on In-Car Navigation Systems assures the user that "your days of getting lost are over! Finding an address or any one of 1.6 million points of interest [POIs] such as the nearest gas station or restaurant is a snap anywhere in the U.S. or Canada. Just enter information on the X4-T's 4.3 inch touch screen and let the voice prompt and detailed map guide you to the destination...[As a plus] "the X4-T's built-in MP3 player will entertain you with your favorite tunes en-route" (Thietlong, 2008).

That was in 2008, an eon ago in techno-time. In the summer of 2009, *New York Times* technology and culture reporter, Jenna Wortham, titled her article "Sending GPS Devices the Way of the Tape Deck?" Not only are expensive, in-car, navigation systems joining the tape deck and analog television in the once-upon-a-time-in-technology museum, soon to join the pile is the standalone portable navigation device (PND). The GPS navigation app (software application) is now included in the Big Box retailer style, all-under-one-roof, digital age Swiss Army Knife, smartphone. Though at the moment many still prefer dedicated GPS devices, the shortcomings of GPS, and everything else, all in one gadget, are shrinking. Convenience trumps all, techno-deficits included. As one user told Wortham, "The simplicity of having one device and not needing to pull the Garmin [dedicated GPS device] out of my glove compartment is enough" (Wortham, 2009).

The thrust of virtually all reviews of technology, online, or in print, swirls around what the latest instantiation pouring out of the innovation cauldron will do for us that the current stuff can't, or that the competition can or can't do. Device criticism centers around not doing enough for us. Case-in-point is an end of September 2009 review by popular *New York Times* technology columnist, David Pogue, on a turn-by-turn GPS Navigation app for Apple's iPhone called "iGo My Way 2009" available on the App store (Pogue, 2009).

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