Cutting the Cord

A cellular phone's size disguises the considerable amount of activity going on inside. In a digital phone, your voice is converted by the phone's processor into a stream of 0's and 1's that are transmitted to a base station, received, relayed, and reconverted back to the original sound (actually, an extremely good approximation of that sound) by the receiving phone. Along with sending your words, your phone transmits an identifying code and determines the nearest base station. Hand-off algorithms are employed to help maintain a continuous conversation as the phone's location changes. (Note that E.T. didn't phone home until **after** landing.)

Photo courtesy of Tiny Love.

Even when a cell phone is stationary, obstacles such as buildings and trees, as well as other signals, interfere with transmission and reception. In a much simpler world with one cellular telephone and one antenna, one complex number can represent the resulting variation (in amplitude and phase) in a signal. With multiple phones and multiple antennas, a large matrix of numbers is needed to represent all the variations. The size of these matrices makes exact computation impractical, but they are being successfully modeled using random matrix theory. The modeling makes possible an analysis of system performance and a determination of limits on system capacity with the goal of optimizing the system design. An interesting new technology allows broadband service by having multiple antennas even on a single cellular phone.

For more information: *The Cell Phone Handbook*, by Penelope Stetz.

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