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SPECTRUM POLICY PROGRAM

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The CARTOON Guide to Federal Spectrum Policy

What if the government regulated spoken words the way it regulates the airwaves?

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Why a *CARTOON* guide?

Thanks to the computer revolution, radios are evolving from being dumb to smart devices, which allows wireless networking and communication based on dynamic sharing of frequency bands. This radio revolution calls for radically different government regulation of public access to the radio spectrum,* popularly known as the "public airwaves." Increasingly, access to spectrum should be regulated based on free speech ("unlicensed") rather than exclusive speech ("licensed") regulatory principles.

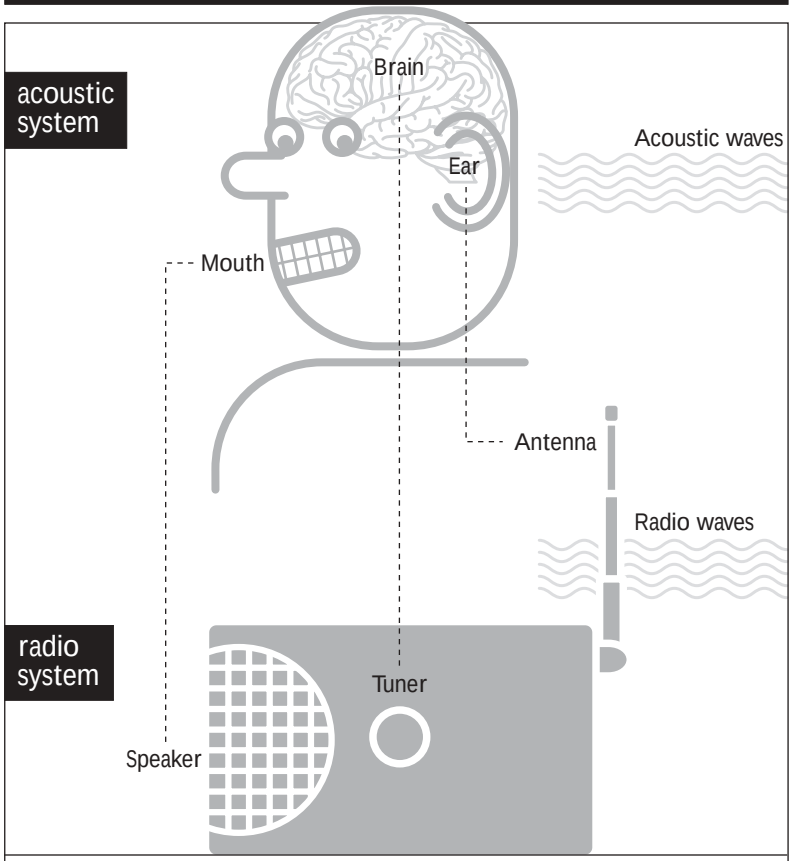
Not surprisingly, recipients of exclusive government licenses to use the spectrum (called "licensees") are furiously opposed to any proposal that requires them to share their spectrum with users lacking a license. Never mind that their licenses are for short terms and convey no ownership rights, or that license-free sharing need not conflict with their currently offered services. The licensees know that exclusive rights to use the public airwaves are worth a king's ransom, and the prospect of your paying them a toll every time you communicate on those airwaves has them salivating like Golum in *Lord of the Rings*.

To prevent additional unlicensed sharing of spectrum, licensees commission arcane engineering and economic analyses to prove that licensing is the only possible way to allocate spectrum without creating chaos. How can the public evaluate these self-serving claims?

Fortunately, the public does understand the acoustic spectrum—the medium that human mouths and ears use for communication. **This Cartoon Guide seeks to use the public's intuitive grasp of the acoustic spectrum to bring the public into the policy debate over unlicensed access to the radio spectrum.**

*The word "radio" refers to devices such as cell phones, and WiFi networks that transmit information over radio waves.

The acoustic speech analogy



When we listen to someone talking to us, the sound waves are analogous to the radio waves used in wireless communication. Both use waves to send messages between transmitters and receivers. The acoustic spectrum involves lower frequencies than the radio frequency spectrum, but this has no effect on the physics involved. Our ears are tuned to pick up acoustic waves, just as radio receivers are tuned to receive radio waves.

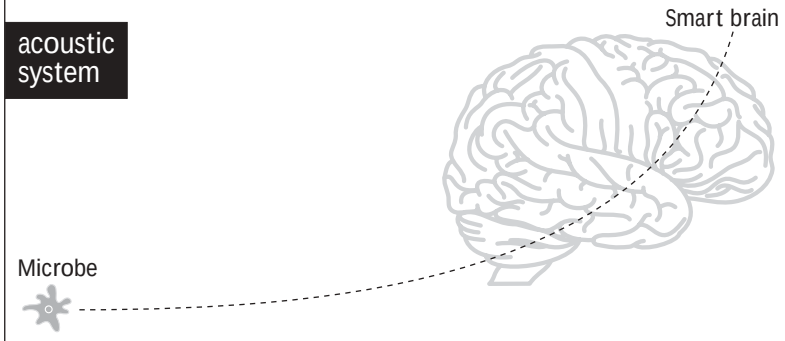
The major difference between acoustic and radio communication is that humans and other animals have evolved exquisitely sophisticated tools for processing sounds. Our brains can pick out sound waves from the surrounding background noise and quickly interpret them with phenomenal accuracy.

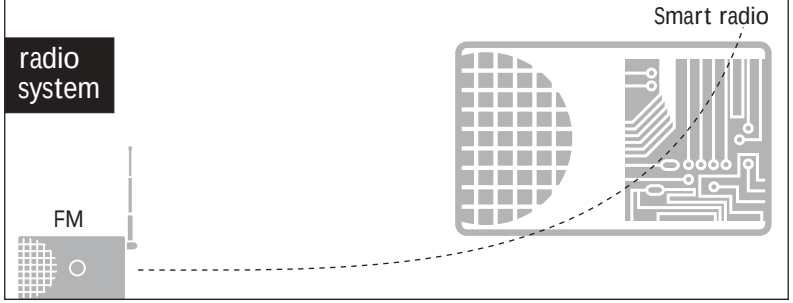
The evolution of acoustic and radio systems

Radios have historically been far less intelligent than human systems for communication. Because radio devices haven't been smart enough to distinguish among overlapping signals, government regulates the radio spectrum to minimize interference in ways that would be inconceivable for acoustic communications.

A smart brain allows the human ear to distinguish between different speakers. Similarly, a smart computer processor allows a radio receiver to distinguish between the signals from different transmitters. Human acoustic systems have a brain to analyze sound waves, whereas radios have until recently had no advanced computer processors to analyze radio waves. But as the computer revolution comes to radio, this is rapidly changing. **Radios are developing the discriminatory powers of the human communication system.**

As this happens, many of the government's onerous restrictions on radio speech become unnecessary. **Yet the government continues to regulate the spectrum as if we live in a world of dumb radios.**





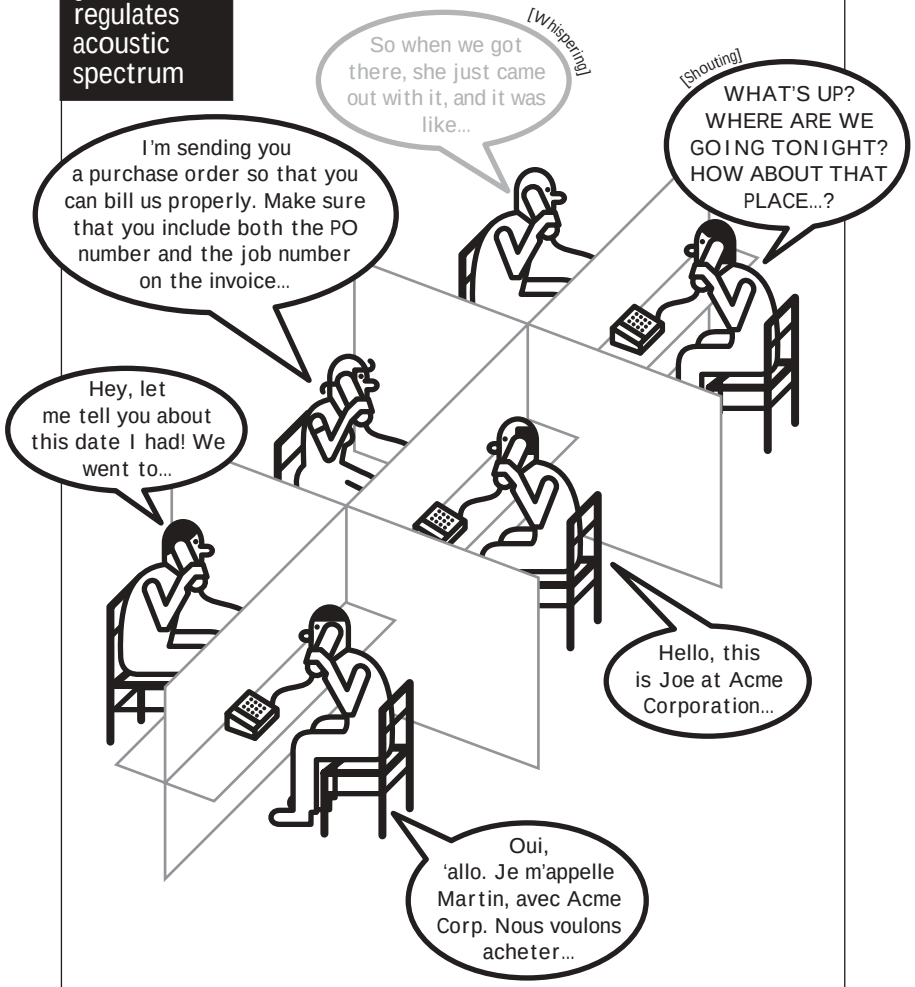
What if the only allowed speaker was a loud speaker?

Loud and soft speakers can coexist.

The government grants loud speakers the exclusive right of speech.

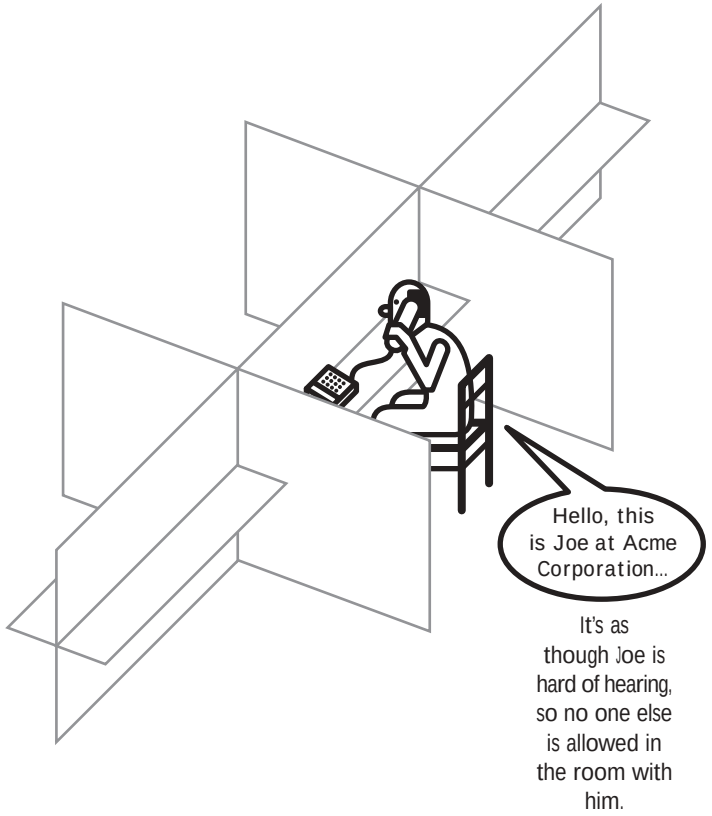
What if the human body lacked a smart receiver?

How the government regulates acoustic spectrum



More than one person can speak at the same time on the same frequency and no one need ask the government for permission to speak.

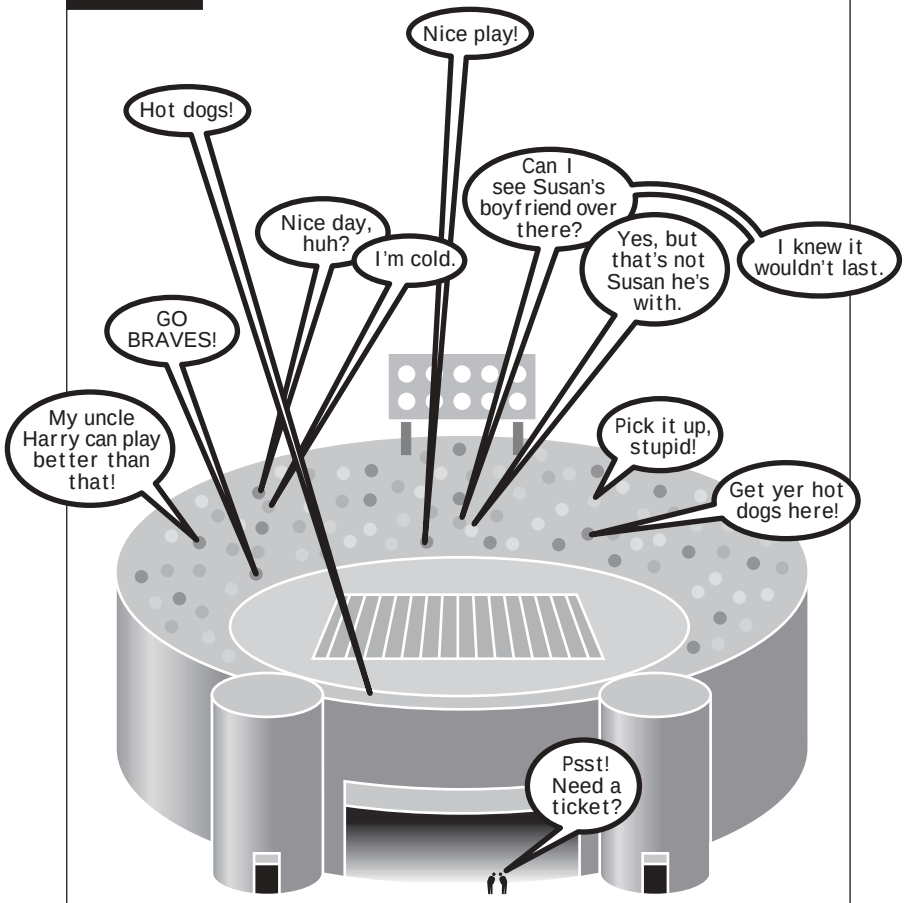
How the government regulates radio spectrum



Only one person, with the government's approval, can speak at a time.

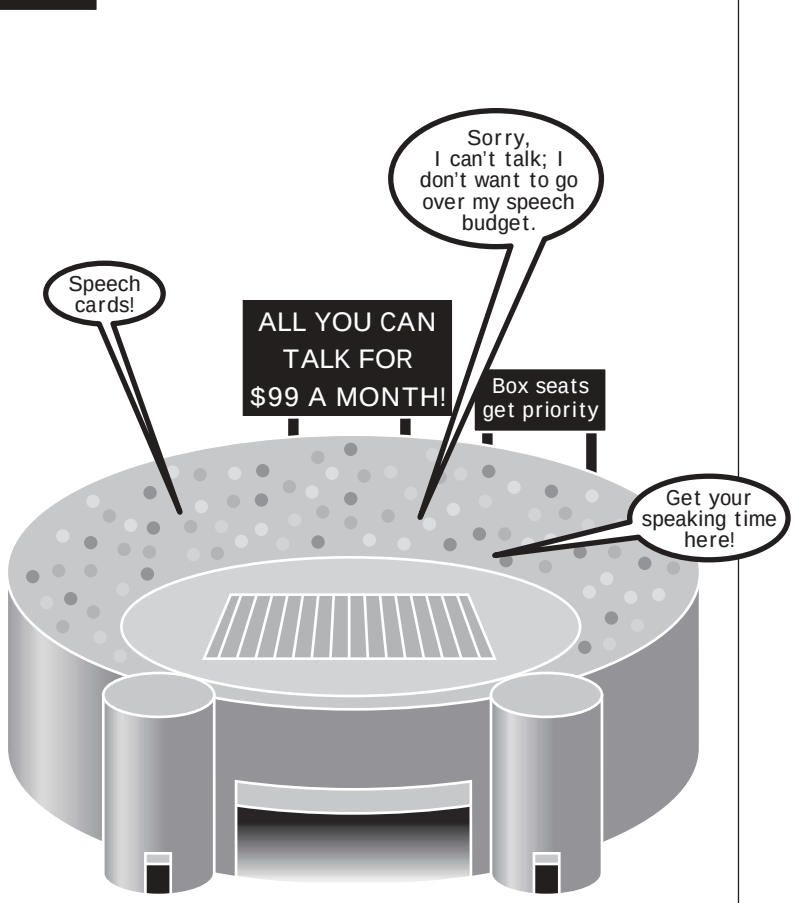
What if you had to pay to speak?

acoustic spectrum



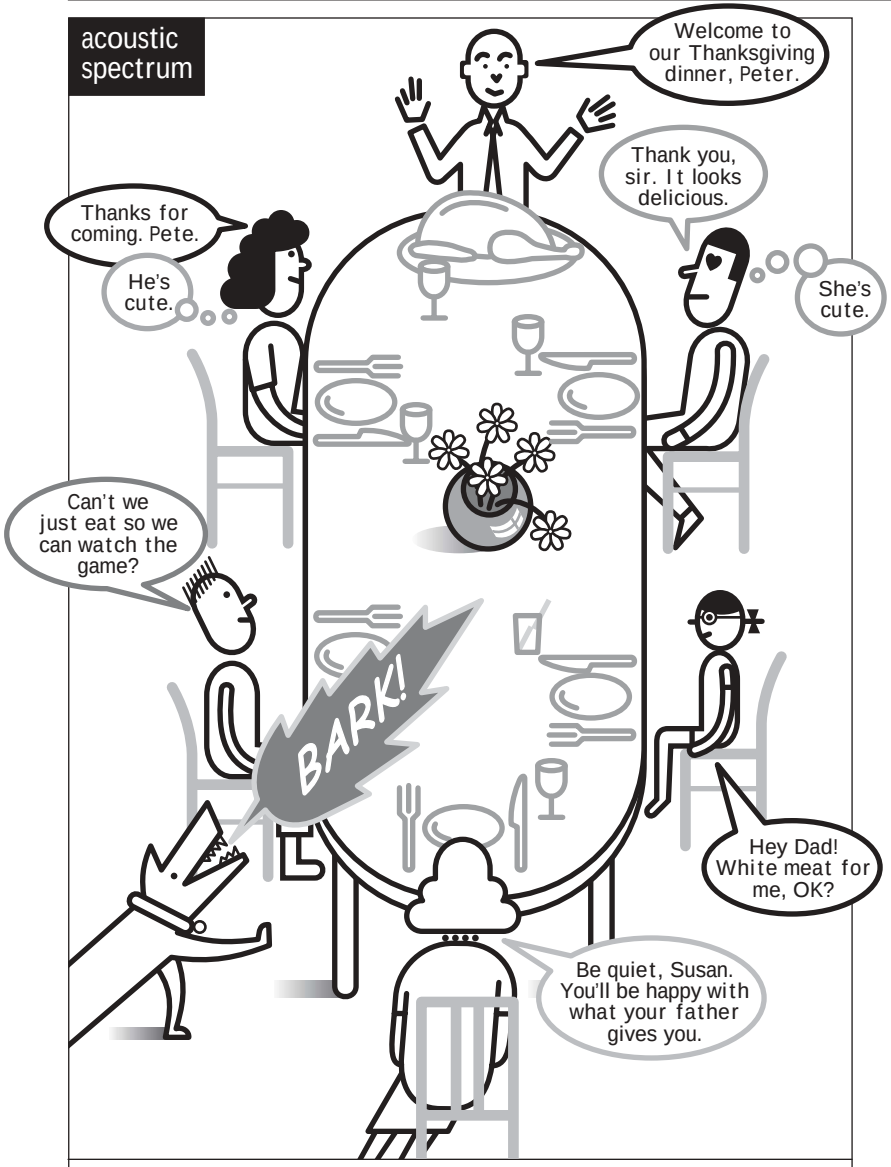
No one pays or requires government permission to speak.

radio spectrum

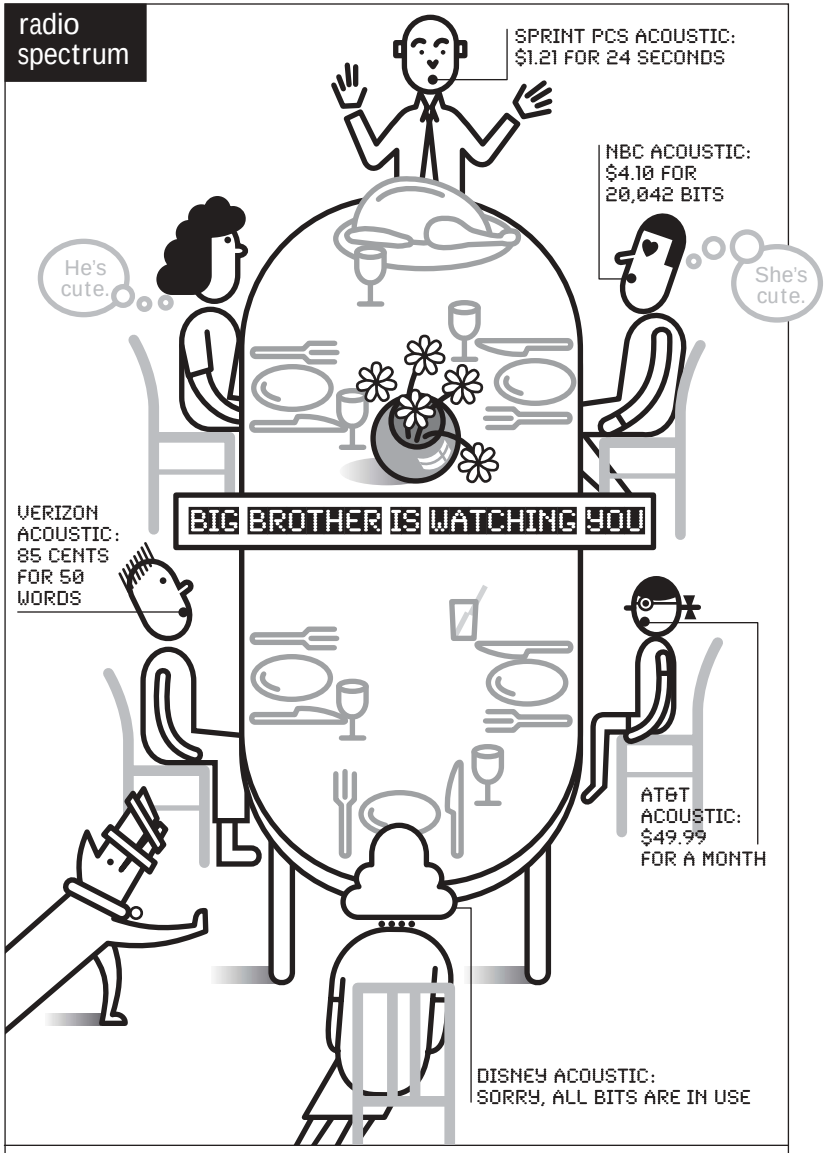


Speakers pay the government or a government licensed private party for the right to speak.

What if you wanted to speak in your own home?



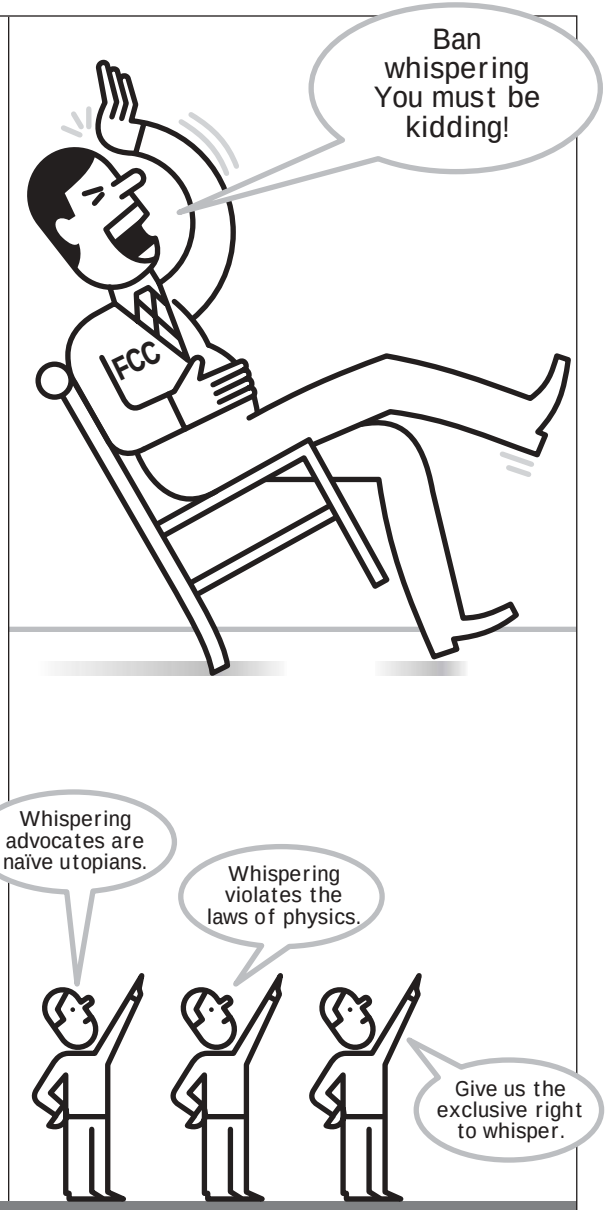
No one can restrict you from speaking in the privacy of your own home.



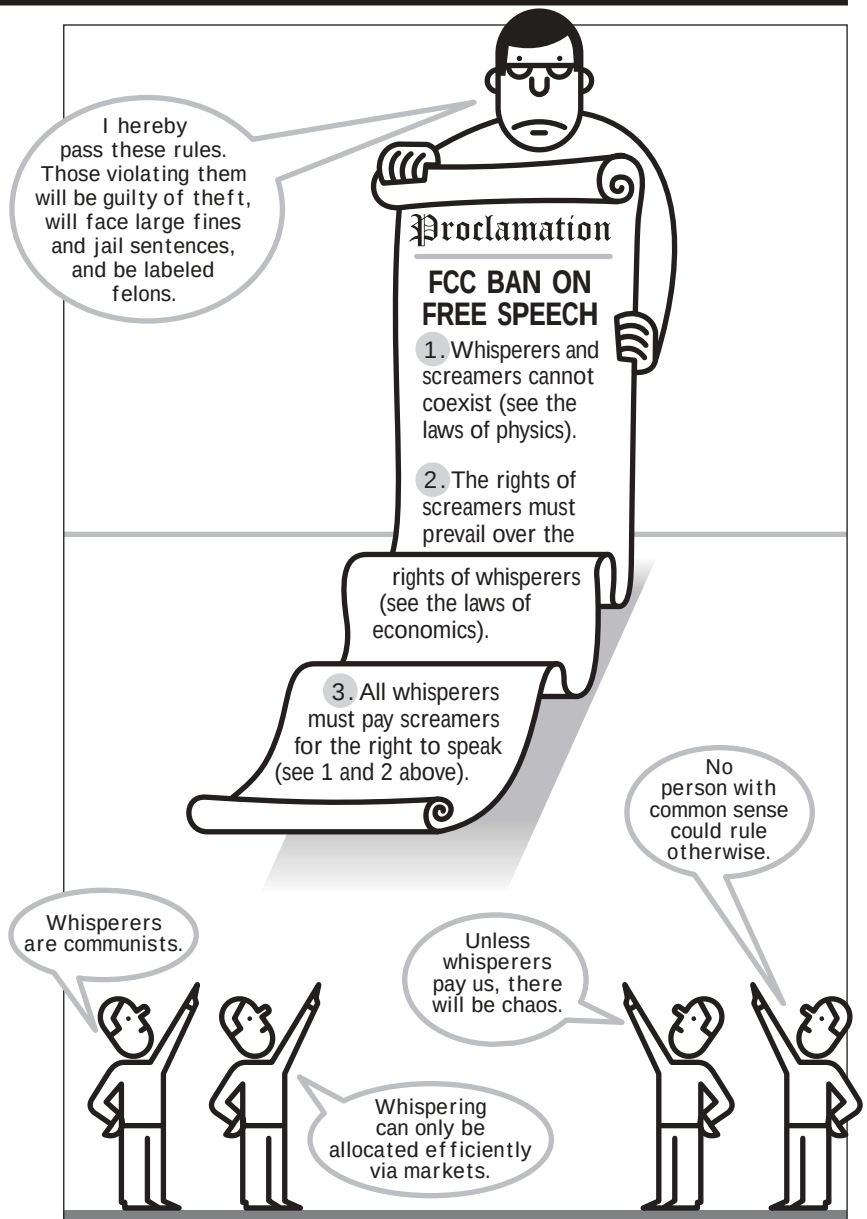
The government grants use of the airspace on your private property to licensees who can force you to both get permission and pay to speak.

The Federal Communications Commission

Lobbyists for spectrum license holders have written thousands of pages of F.C.C. comments ridiculing proposals to allow low-power transmissions ("whispering") within their frequency bands. For example, high-power TV broadcasters argue that such low-power unlicensed underlays for uses such as WiFi would create harmful interference with their signals and lead to an inefficient allocation of resources. By lobbying against unlicensed underlays, they hope to hinder potential competitors and create a vast new market for themselves.



INCUMBENT SPECTRUM LICENSEES (LOBBYISTS)



INCUMBENT SPECTRUM LICENSEES (LOBBYISTS)

Is licensing the only efficient way to allocate spectrum?

The economic windfall for incumbent licensees if they can (a) win spectrum flexibility for themselves, and (b) prevent unlicensed spectrum use by others, has been estimated to be as high as **$1trillion.** (For details, see the companion *Citizen's Guide to the Airwaves*.) The result is that incumbent licensees and their vendors furiously oppose additional allocations of unlicensed spectrum. Here are quotes from their comments to the FCC.

Sharing the TV band with unlicensed RF devices is not feasible on both technical and economic grounds.

National Association of Broadcasters (by Stuart J. Lipoff, an engineer hired by the NAB), Comments, Docket 02-380, April 17, 2003

[The FCC] must not lose sight of its fundamental obligation to protect users of licensed services against interference. Unless the Commission satisfies this basic tenet of spectrum management as a prerequisite to developing a framework for unlicensed use, any initiative to explore the concept of licensed underlays would do little more than generate…harm to consumers and inefficient use of spectrum.

Cellular Telecommunications Industry Association, Reply Comments, Docket 02-380, May 16, 2003

Licensing, not unlicensed use, is the statutory model. Thus, it would be contrary to law for the Commission to permit additional unlicensed operations… Permitting such operations as an 'underlay' to licensed services is also inconsistent with sound policy and technical reality.

Cingular, Comments, Docket 02-380, April 17, 2003

Motorola, Comments, Docket 02-380, April 17, 2003

There is no readily apparent technological solution that would enable unlicensed secondary use without causing harmful interference to licensed services.

Any sanctioning of 'underlay' operations must take into account the licensee's right to exclusive use of its spectrum—including the right to modify its service offerings to meet changes in business plans and the marketplace—and the right to operate free from harmful interference…Unlicensed devices, by definition, have no spectrum rights…Any changes in this approach would be a drastic reversal of precedent and harmful to consumers and licensees alike.

Sprint, Comments, Docket No. 03-66, September 15, 2003

Unlicensed authorization of opportunistic use or underlays will preclude licensees from making the most innovative and efficient use of the radio spectrum over time. As unlicensed devices emerge in a licensed band, the ability of licensed users to introduce their own innovations inevitably will be stifled.

Wireless Communications Association, Comments, Docket 03-66, September 15, 2003

Once unlicensed devices begin to operate in an [underlay], it may be difficult legally or politically to shut down the operations even if they begin to cause interference or otherwise limit the licensed user's flexibility… In making such decisions, the [FCC] will need to be sensitive to the potential impact…on the expectations, business plans, and investment made by licensed spectrum users.

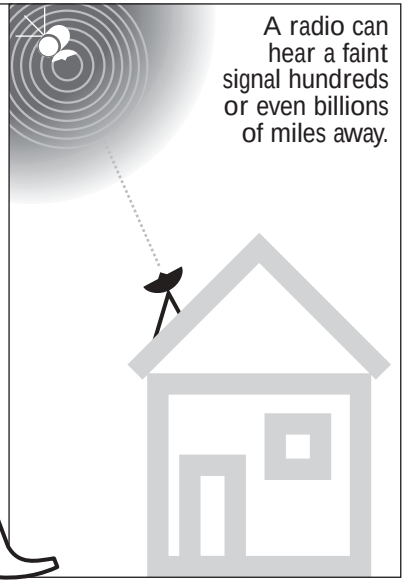
FCC Spectrum Policy Task Force Report, Docket 02-135, November 2002

Some limitations of the human acoustic analogy

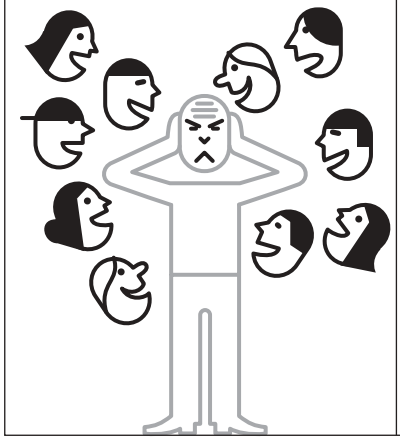
Radios are evolving to have greater signal detection and discrimination powers than humans.

Humans cannot hear distant or very soft sounds.

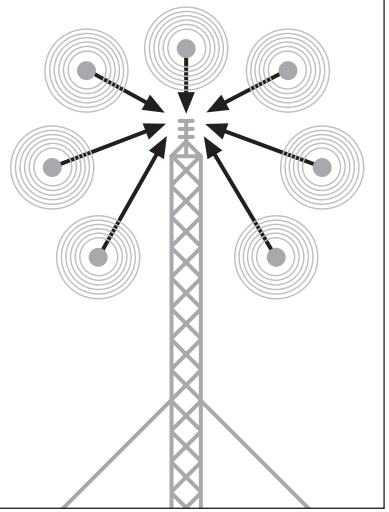
A radio can hear a faint signal hundreds or even billions of miles away.



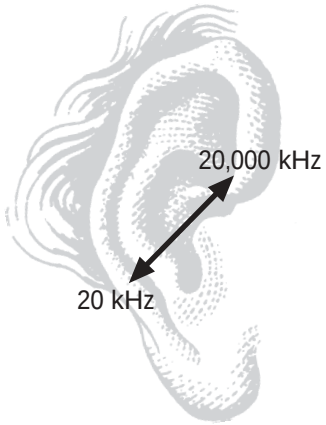
Humans can only make sense of one or at most a couple of conversations at a time.



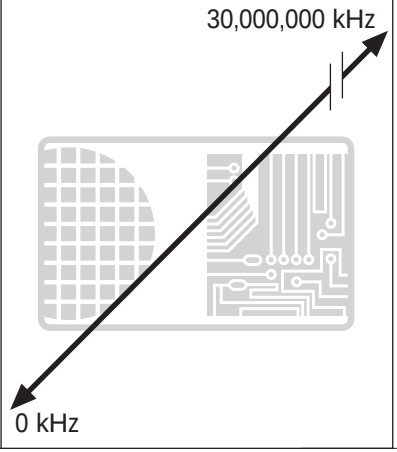
Radios can listen to hundreds of conversations at a time.



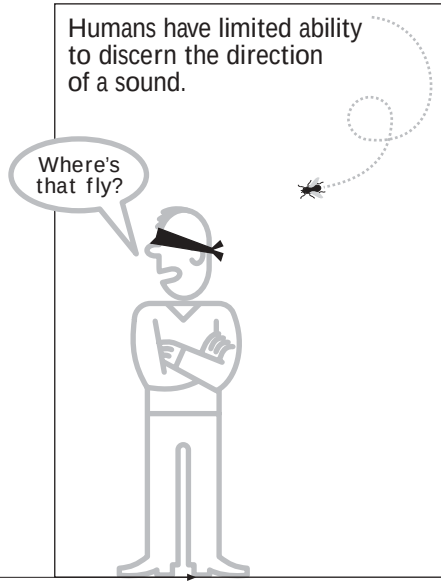
Humans can only hear a small part of the acoustic spectrum.



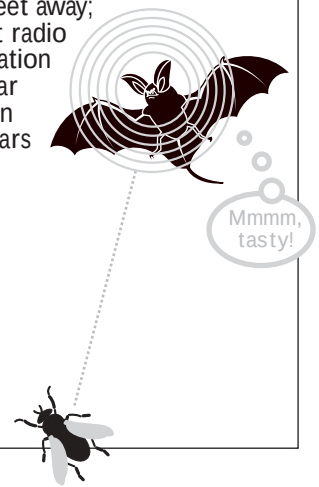
Smart radios may one day be able to detect signals across the entire radio spectrum.



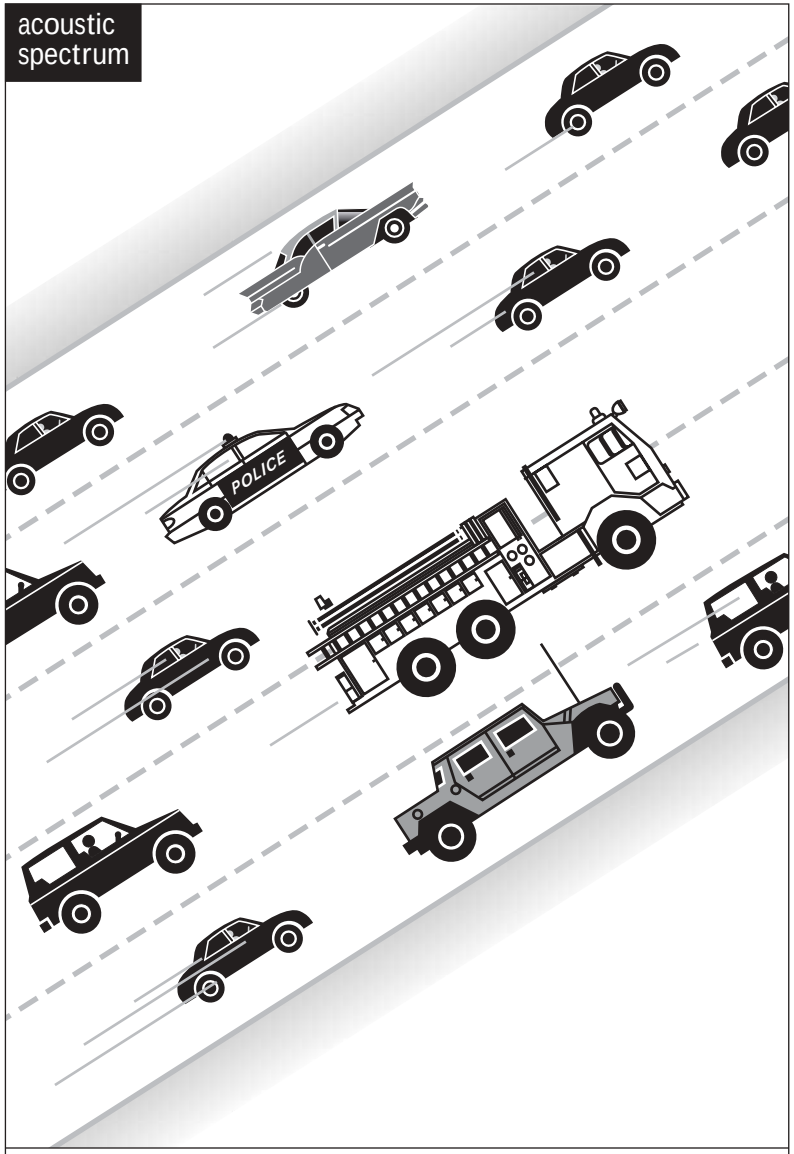
Humans have limited ability to discern the direction of a sound.



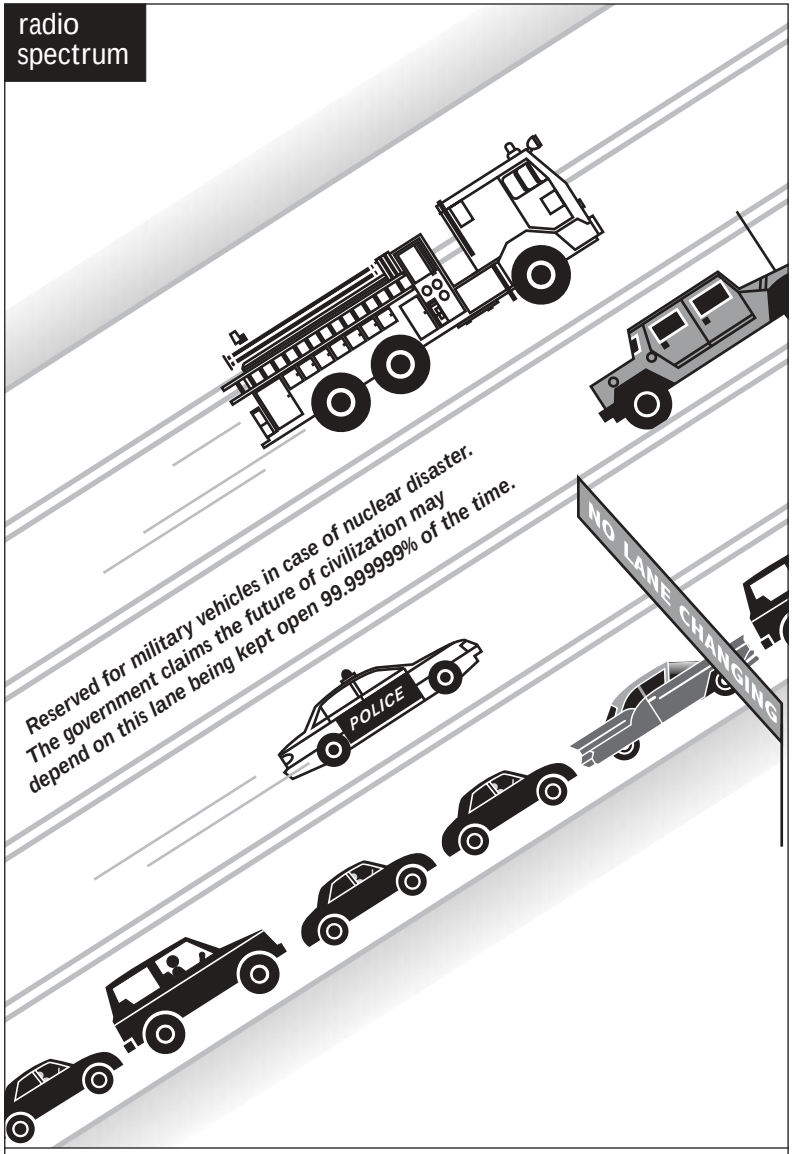
Many animals such as horses and bats have far greater spatial discrimination than humans. A bat can hear the location of a fly 20 feet away; a smart radio the location of a star a million light years away.



What if the government regulated public roads the way it regulates public airwaves?



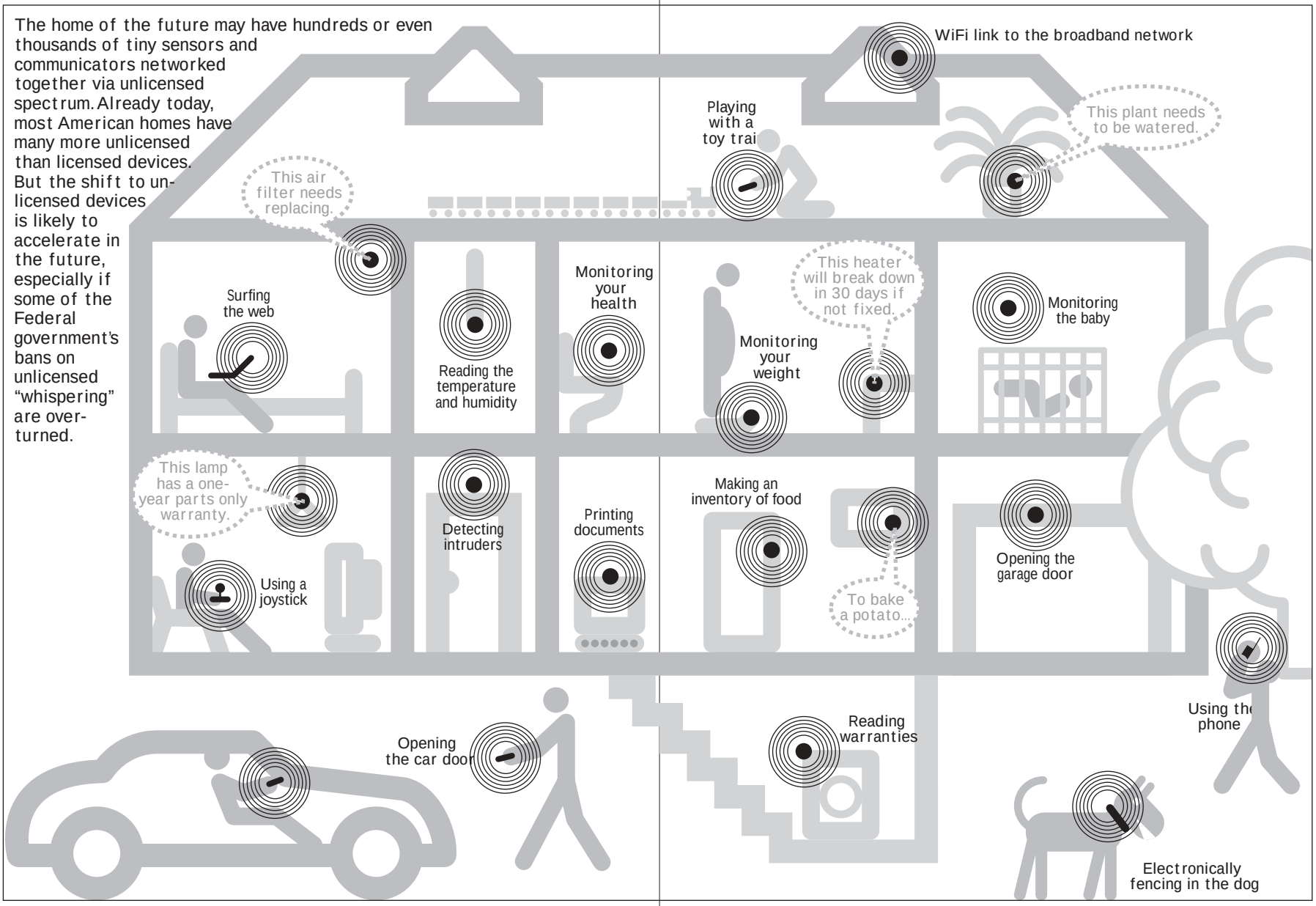
Public safety and military vehicles share the roads with other vehicles.



The government forces all public traffic into one lane, and reserves the other lanes for exclusive government use.

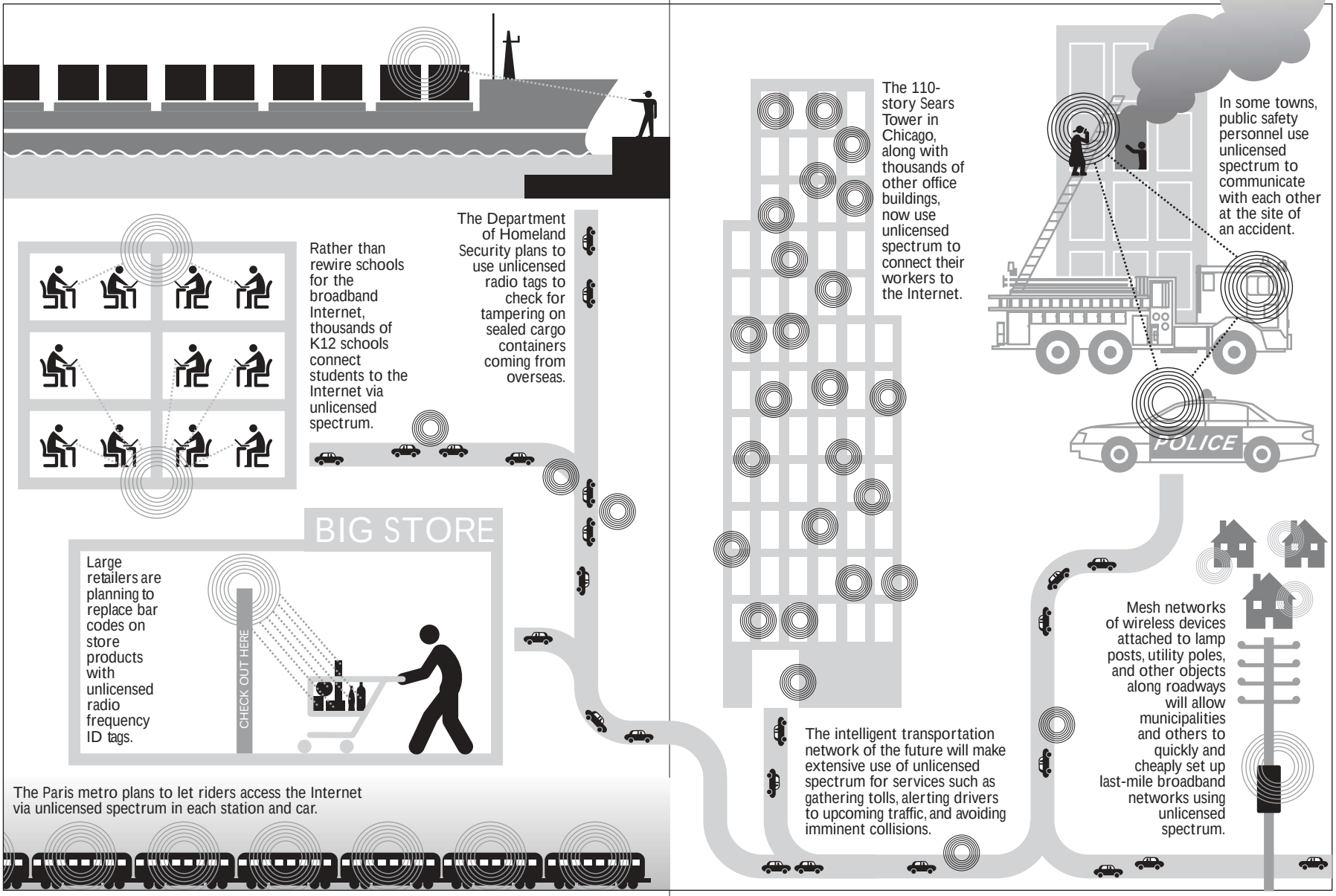
Uses of unlicensed spectrum in your home

The home of the future may have hundreds or even thousands of tiny sensors and communicators networked together via unlicensed spectrum. Already today, most American homes have many more unlicensed than licensed devices. But the shift to unlicensed devices is likely to accelerate in the future, especially if some of the Federal government's bans on unlicensed "whispering" are overturned.



Uses of unlicensed spectrum at work, school, and play

Future telecommunications networks may make extensive use of unlicensed spectrum, especially if the Federal government stops treating unlicensed users as second-class citizens.



Action you can take

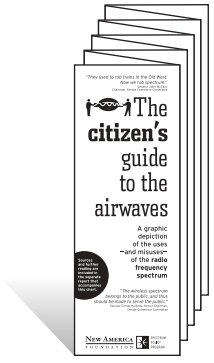
In George Orwell's *1984*, the price of a monopoly license on speech (called "Big Brother") was the death of Western Civilization and democracy. Big Brother, like a Federal Communications Commission licensee, had exclusive control of speech within citizens' homes, work places, and public spaces.

No one is expecting that a Big Brother will emerge with the same type of exclusive control of the radio spectrum. But even if this power is allocated among several dozen corporations, the prospect is frightening. The Spectrum Policy Program at the New America Foundation hopes that the American people will not only take an interest in the future of the public airwaves but also express their views to their local member of Congress. **Please tell your member of Congress to (1) stop the giveaway of the public airwaves to private corporations, and (2) support an unlicensed reserve for free speech.**

Additional information

For a serious look at the spectrum policies lampooned here, see ***Radio Revolution*** http://www.spectrumpolicy.org/RadioRevolution and ***The Citizen's Guide to the Airwaves*** http://www.spectrumpolicy.org/CitizenGuide

The Radio Revolution



The Citizen's Guide to the Airwaves

For more about spectrum policy, including New America Foundation publications and current FCC rulemaking, see http://www.spectrumpolicy.org