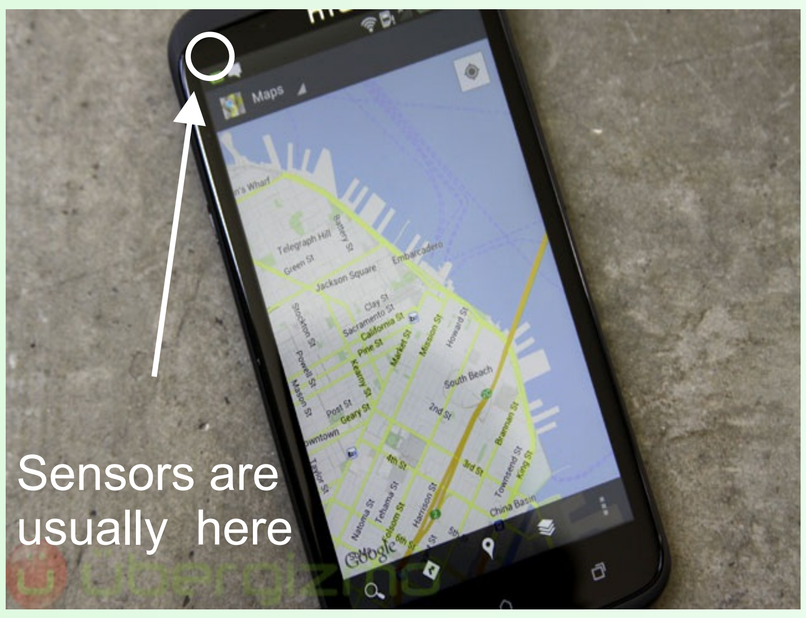
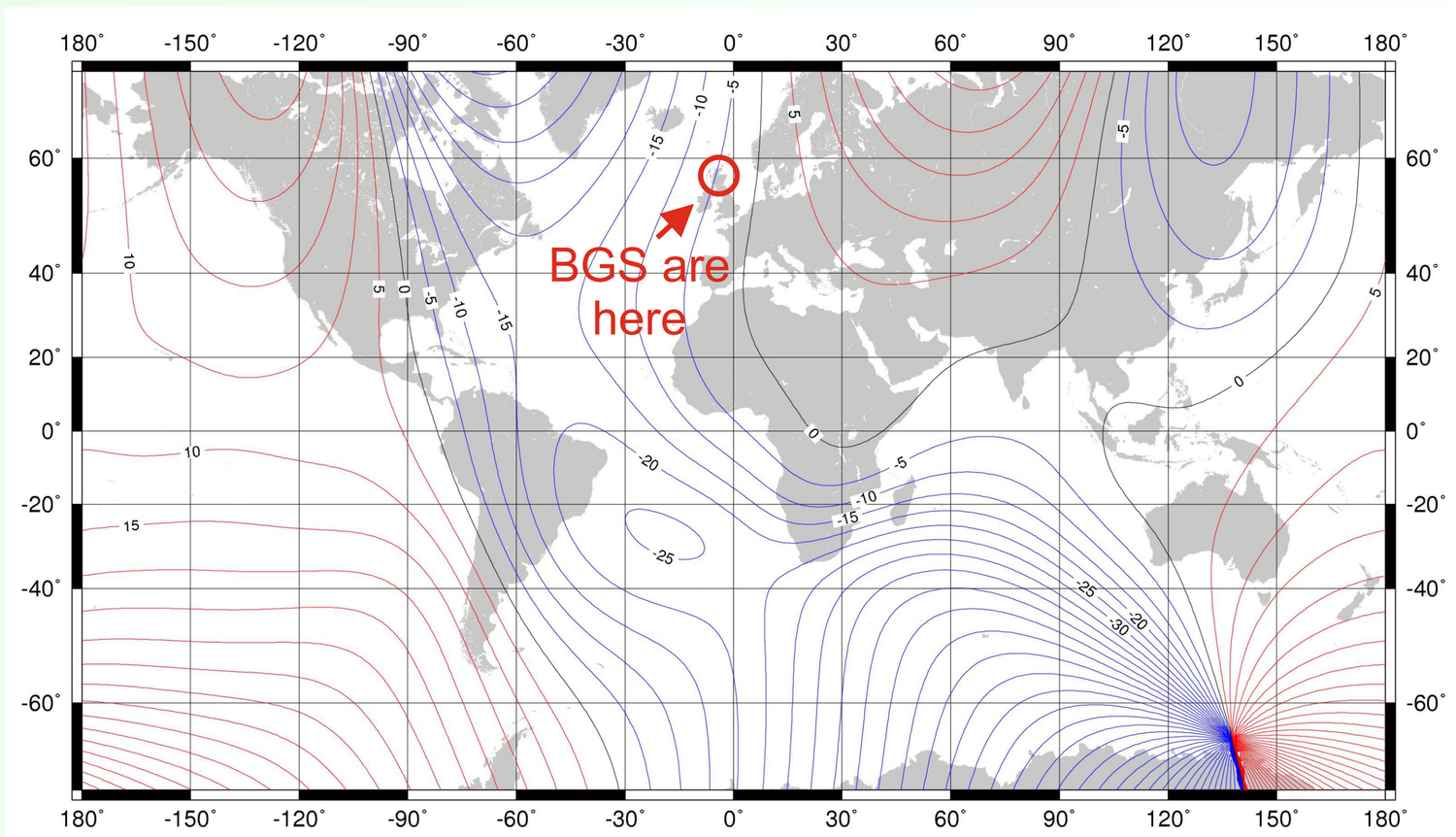
Magnetic Chips:

how does a smartphone work out True North?

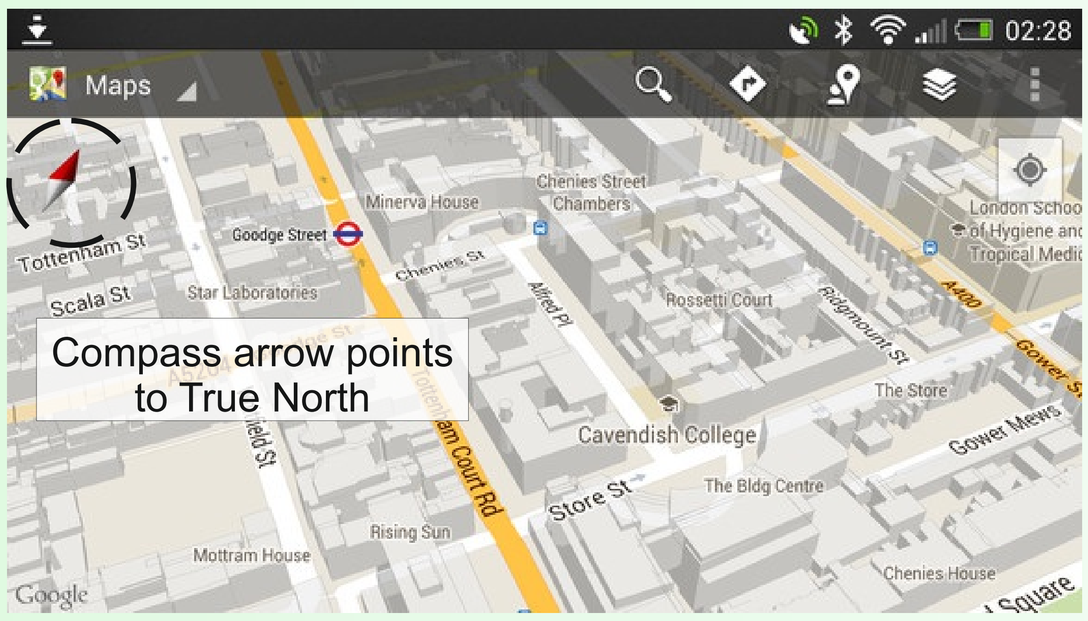


1. Magnetic and gravity field sensors located within your phone measure the direction of **Magnetic North** at the phone's location.

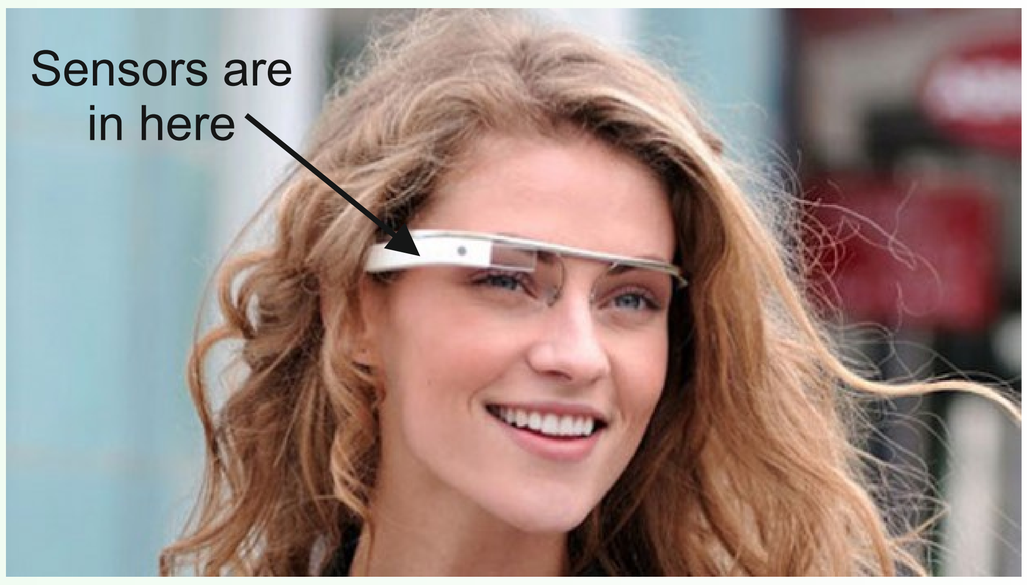


Declination (magnetic variation) at 2010.0 from the World Magnetic Model (WMM2010). Red - positive (east), blue - negative (west), black - zero (agonic line). Contour interval is 5˚ and projection is Mercator. This is an example of an isogonic chart. Credit: British Geological Survey (Natural Environment Research Council).

2. Using a map of declination (provided by BGS and NOAA) and the GPS coordinates of the phone location, software computes the required angle of correction for true north.



3. The internal map can now be correctly orientated to **True North,** which is what most users expect.



The declination angle is small in the UK (< 2°) but can be much larger in California (~15°) or in Brazil (> 20°). For example, Google Glass users in the US could quickly become lost if they didn't correct for True North.

In more detail

There are other ways to sense the Earth's magnetic field besides using a compass or a coil. Smartphones have small magnetic sensors which use the Hall or magneto-resistive effect to sense the strength of the magnetic field in one direction. These types of sensors can be very small (< 1mm long) but are not as accurate as scientific ones.

A typical smart phone has three magneto-resistive sensors, fixed perpendicular to each other, which are used to work out the direction of Magnetic North.

In addition, they have three accelerometers which sense gravity to give tilt information and to help work out the orientation of the phone in three dimensions.

The internal software then uses the location of the phone from the mobile 's nearest base-station or from a GPS reading along with a map of the declination of the magnetic field (produced by BGS and NOAA in the USA) to work out the direction of True North at the user's location. All this is seamlessly built into the mapping software.

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Geomagnetism
www.geomag.bgs.ac.uk

Earthquakes
earthquakes.bgs.ac.uk