MAGNETIC POLARIZATION (aka Magnetization)

Here is an unmagnetized lump, say an iron filing: 
How does it respond to an external applied field?

(a) First let’s sketch the 
applied field without the 
lump present:
The field lines are uniformly 
separated, indicating a 
constant magnetic (B) 
vector field.

(b) Here is the extra (new) 
field induced when the 
lump is placed in the 
above applied field:
The lump creates its 
own North & South poles, 
and the resulting field 
pattern is called a “dipole”.
If the applied $B$ is not too large, then the lump’s 
magnetization is $M = X B$, where $X$ is the lump’s "susceptibility". 
$X$ is huge for iron (a ferromagnet), but small ( & sometimes 
negative) for most other materials.
(c) The total (physical) $\mathbf{B}$ field is the sum (as vector fields) of the previous two pictures. Note the two high-field regions where the field lines come closest together.

(d) Minimizing the energy shows that a 2nd lump would be attracted to these high-field regions, explaining a tendency to "chain together" in the applied field:

(e) Due to microscopic domain flipping, iron usually retains residual magnetization (a weaker version of pattern (b) above), even after removing any applied field. Just like a compass needle, such a lump tends to rotate to align with whatever new field may be applied.

- Each of the above polarization phenomena provides fruitful analogies for humans in the external media environment: we are the ferromagnetic lumps responding to, and modulating, the media magnetic field.