Let's be very specific. The case most of interest to us has $n = 1$ and the field being $\mathbb{C}$: $\mathbb{CP}^1$.

So we look at $\mathbb{C}^{2*}$: (z_0, z_1), with $|z_0|^2 + |z_1|^2 \neq 0$. (Now in fact, the classical algebraic geometers liked the complex numbers more than the reals: it is hard to ~~predict~~ compare, over $\mathbb{R}$, the number of intersections of $x^2+y^2=1$, $y = 3x$, and $x^2+y^2=-1$, $y = 3x$. Indeed.)

This is the complex projective line, with homogeneous coordinates $[z_0 : z_1]$. What "is" $\mathbb{CP}^1$? Consider the mapping $\mathbb{C} \xrightarrow{\sigma} \mathbb{C}^{2*}$ given by $\sigma(z) = (z, 1)$. Then the composition $\pi \circ \sigma : \mathbb{C} \to \mathbb{CP}^1$ is an injection, for if $(z, 1) = \lambda(\tilde{z}, 1)$, then $z = \tilde{z}$. And since σ is surely continuous, there is a topological "copy" of $\mathbb{C}$ sitting inside $\mathbb{CP}^1$. What does $\mathbb{CP}^1 - \pi \circ \sigma(\mathbb{C})$ look like? If $(z_0, z_1) \in \mathbb{C}^{2*}$, and if $z_1 \neq 0$, then $(z_0, z_1) \sim \left(\frac{z_0}{z_1}, 1\right)$, so $\pi \circ \sigma\left(\frac{z_0}{z_1}\right) = [z_0 ; z_1]$. If $z_1 = 0$, then $(z_0, 0) \sim (1, 0)$ (for $\lambda = \frac{1}{z_0}$, since not both homogeneous coordinates can be 0). Thus $\mathbb{CP}^1 - \pi \circ \sigma(\mathbb{C}) = \{[1:0]\}$. But, look, all the topological spaces involved are connected or continuous images of connected sets,