Participatory Priors with data and Posteriors .
Bayesianisme et inférence.

Data comes from Probability Distributions (*pdf*) could be from many unknown Distributions. We want :
1. an *inference* on Distributions of Parameters $(\vartheta_1,..\vartheta_n) \in \Omega$ (Parameter Space)
2. Find from which Distribution comes the Data.

If Data has type and amount, we have an experiment that could be mastered !

Prior Distributions. (specifying as Bayesian Property)
$f(x \mid \vartheta)$ a pdf where $\vartheta \in \Omega$ is unknown. We call *Inference* finding ϑ.
Experimentation leads to x_i are observations from $f(x \mid \vartheta)$,
$x_i \to \Pr(\vartheta_i \in \Omega) = \xi(\vartheta), \quad \vartheta \in \Omega,$

$$\xi(\vartheta) \in [0;1]$$

also called Prior Distribution on ϑ, a *pdf* that is discrete or continous.
This *pdf* is called Bayesian Statistics.
A Fair or Two Headed Coin is discrete, and Uniform and
Parameter from Exponential Distribution continouous.

If $\vartheta_1 \approx \Omega$ and is unknown, is a non Bayesian Statistic.

Posterior Distribution. (deducted from Bayesian Theorem) (**Demonstration**)
The random sample from Distribution is $x_i \to f(x \mid \vartheta)$,
a *pdf* of $\vartheta = \xi(\vartheta)$, Prior *pdf* on Ω.
The *Joint pdf* $\to f_n(x_1,x_{2,}..x_n \mid \vartheta) = f(x_1 \mid \vartheta)f(x_2 \mid \vartheta)\ldots f(x_n \mid \vartheta)$
We have the $n+1$ *Joint pdf* of $x_1,x_2\ldots x_n,\vartheta$, as the form $f_n(\vec{x} \mid \vartheta)\xi(\vartheta)$

$$g_n(\vec{x}) = \int_\Omega f_n(\vec{x} \mid \vartheta)\xi(\vartheta)d\vartheta$$

The Posterior conditional *pdf* of ϑ that is x_i as

$$\xi(\vartheta \mid \vec{x}) = \frac{f_n(\vec{x} \mid \vartheta)\xi(\vartheta)}{g_n(\vec{x})}$$

From the Bayes Theorem where $\vartheta \in \Omega$.
Here $\xi(\vartheta \mid \vec{x})$ is the Posterior Distribution of ϑ as depending on x_i.

We see $\xi(\vartheta)$ as a Prior *pdf* (relative likeyhood of $\vartheta \in \Omega$ and $\xi(\vartheta \mid \vec{x})$ relative likelyhood that $X_1 = x_1, X_2 = x_2,..X_n = x_n$.).