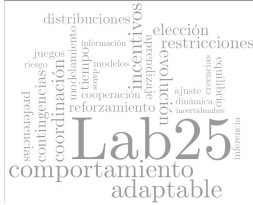
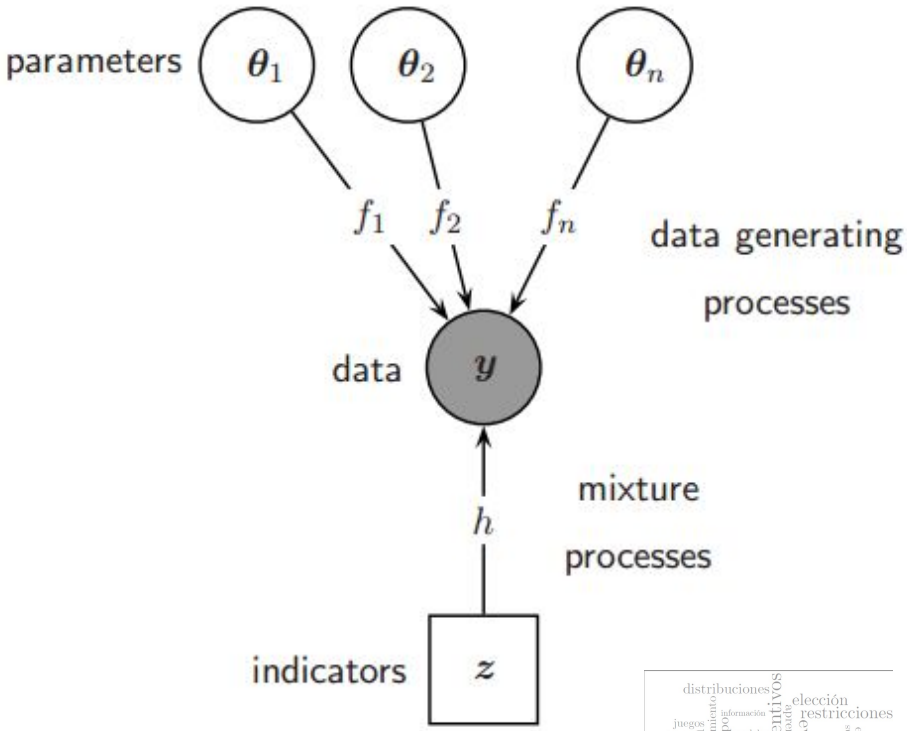


Modelos Bayesianos de Mezclas Latentes

¿De dónde vienen los datos?

En esta presentación se utilizan los materiales presentados en el libro ‘Bayesian cognitive modeling: A Practical course’ por Michael D. Lee y Wagenmakers (Ver Capítulo 6; página 77)

Modelos de Mezclas Latentes



"The key assumption is that observed **behavioral data (y) do not come from a single source**, but instead arise as a combination of outcomes from different cognitive processes (f1,f2,...,fn) controlled by potentially different cognitive parameters (θ1,θ2,...,θn). How the behaviors that are produced by these different processes come to be combined is controlled by a mixing process h that itself is indexed by parameters ψ."

(en Bayesian methods in cognitive modeling, por Michael Lee)

Ejemplo 1:

Puntajes en un Examen

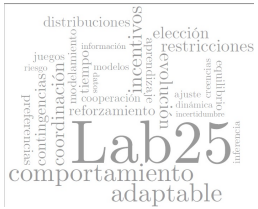
Las calificaciones observadas son resultado de...

a) el conocimiento de los participantes

b) el azar

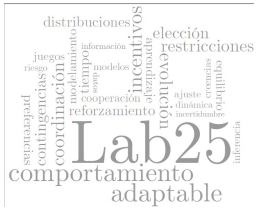
?????

Datos:



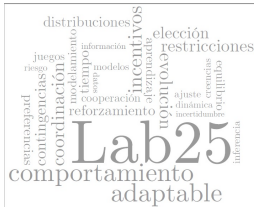
	21		35
	17		36
	21		39
	18		36
	22		35
	31		
	31		
	34		
	34		
	35		

Datos:



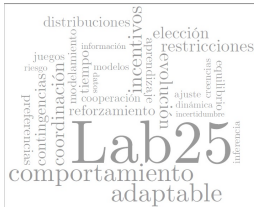
.52	**21**		.87	**35**
.42	**17**		.9	**36**
.52	**21**		.97	**39**
.45	**18**		.9	**36**
.55	**22**		.87	**35**
.77	**31**			
.77	**31**			
.85	**34**			
.85	**34**			
.87	**35**			

Datos:



.52	**21**	.87	**35**
.42	**17**	.9	**36**
.52	**21**	.97	**39**
.45	**18**	.9	**36**
.55	**22**	.87	**35**
.77	**31**		
.77	**31**		
.85	**34**		
.85	**34**		
.87	**35**		

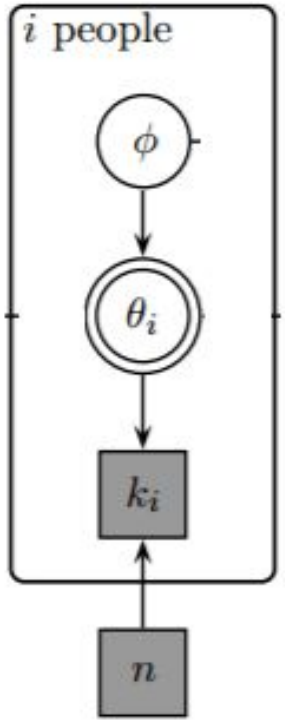
Datos:



.52	21	.87	35
.42	17	.9	36
.52	21	.97	39
.45	18	.9	36
.55	22	.87	35
.77	31		
.77	31		
.85	34		
.85	34		
.87	35		

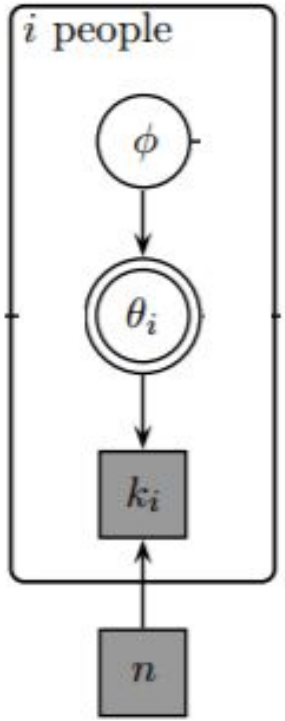
La calificación como reflejo de... ¿Qué?

¿Del conocimiento?

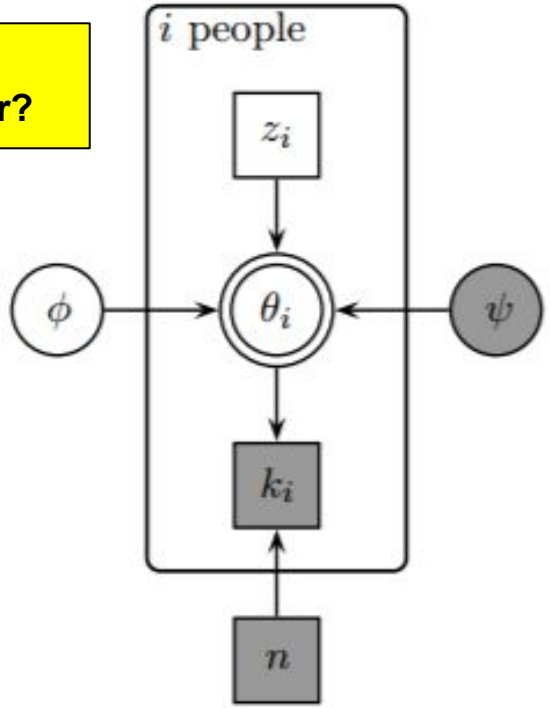


La calificación como reflejo de... ¿Qué?

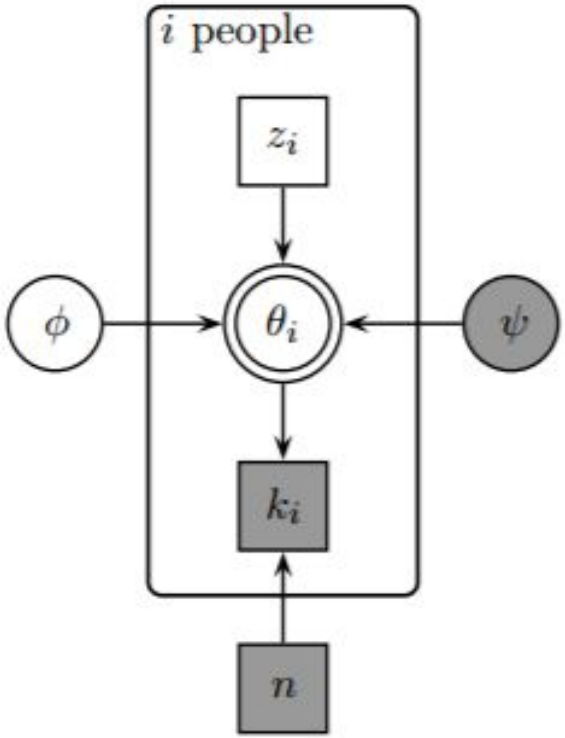
¿Del conocimiento?



ó…
¿Del azar?



¿De tin marín...?



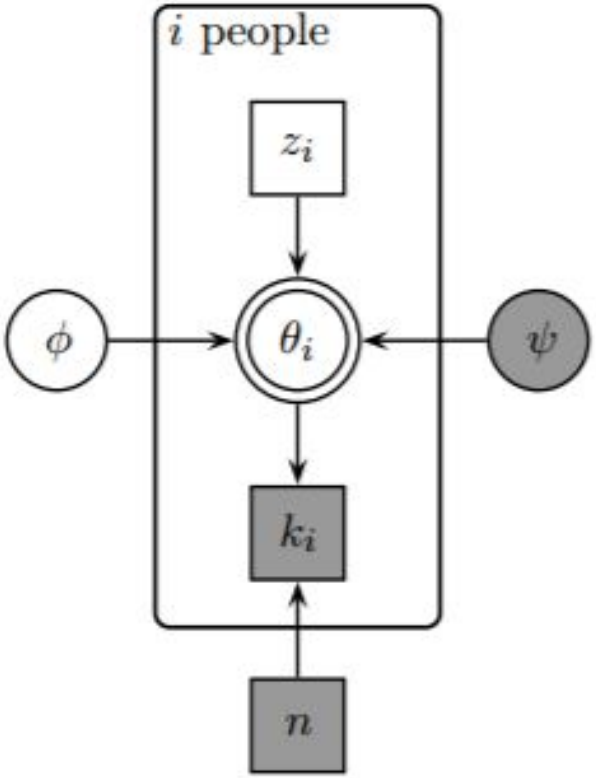
$$z_i \sim \text{Bernoulli}(0.5)$$

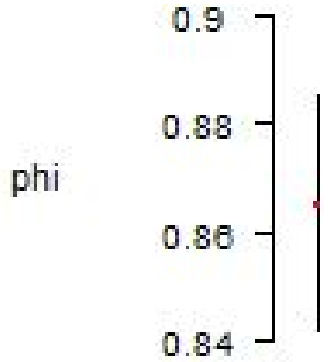
$$\phi \sim \text{Uniform}(0.5, 1)$$

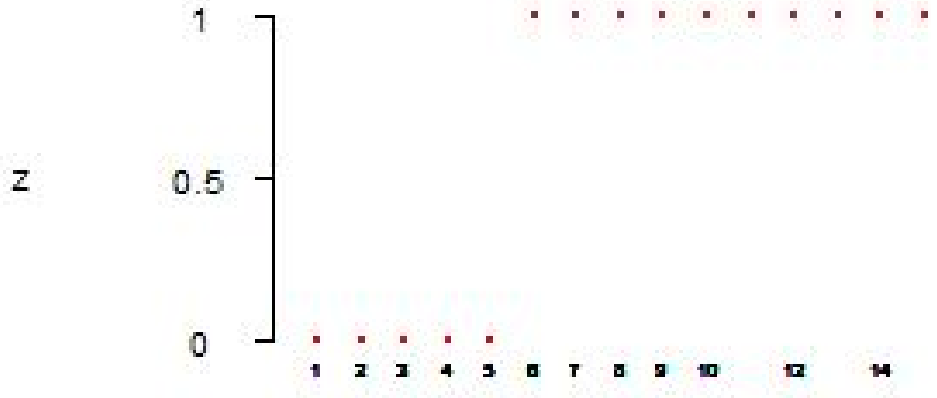
$$\psi \leftarrow 0.5$$

$$\theta_i \leftarrow \begin{cases} \phi \text{ if } z_i = 1 \\ \psi \text{ if } z_i = 0 \end{cases}$$

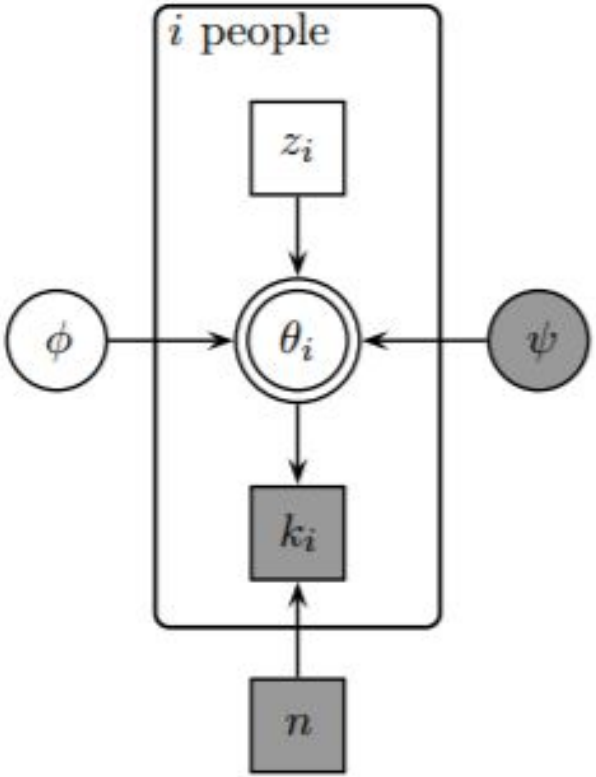
$$k_i \sim \text{Binomial}(\theta_i, n)$$


i people
z_i
ϕ
θ_i
ψ
k_i
n

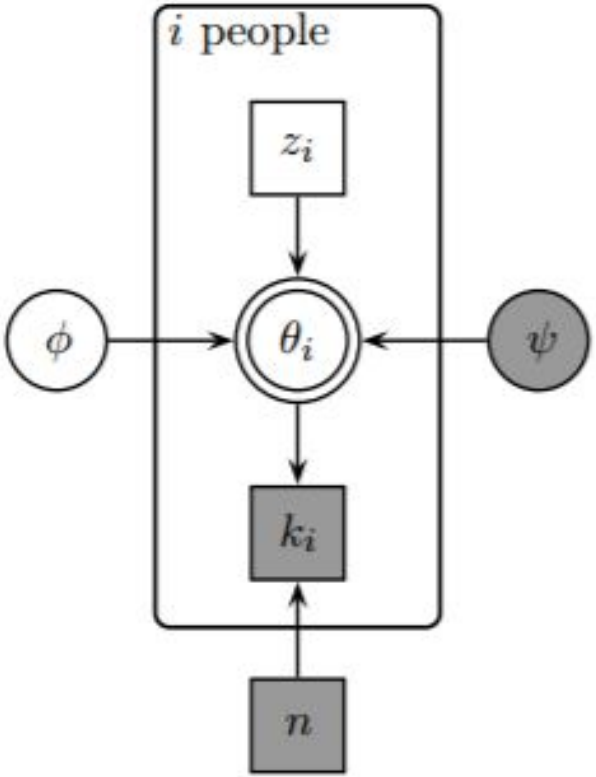

phi
0.9
0.88
0.86
0.84

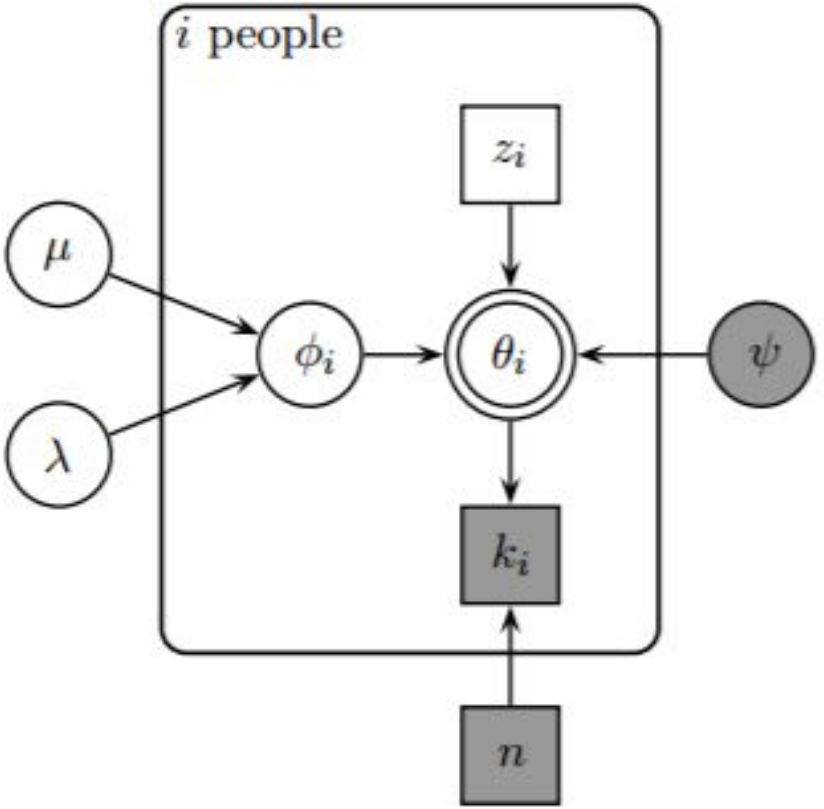

z
1
0.5
0
1
2
3
4
5
6
7
8
9
10
12
14

Pero.. ¿Por qué Phi permanecería constante entre participantes?



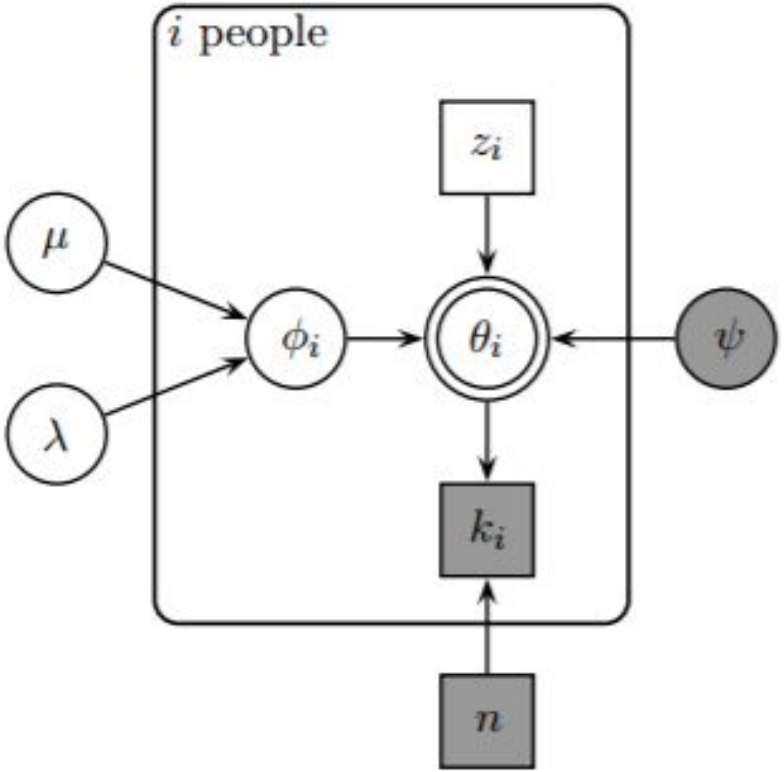
Pero.. ¿Por qué Phi permanecería constante entre participantes?





Tiene màs sentido pensar en un...

¡Modelo Jerárquico de mezclas latentes!



$$z_i \sim \text{Bernoulli}(0.5)$$

$$\mu \sim \text{Uniform}(0.5, 1)$$

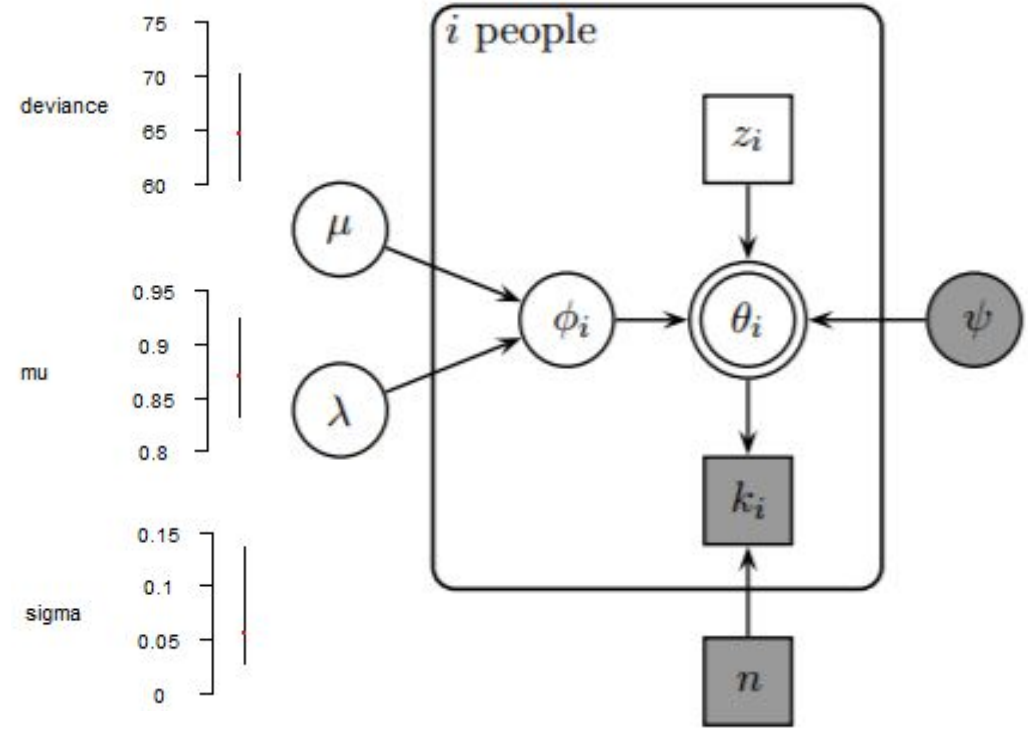
$$\lambda \sim \text{Gamma}(0.001, 0.001)$$

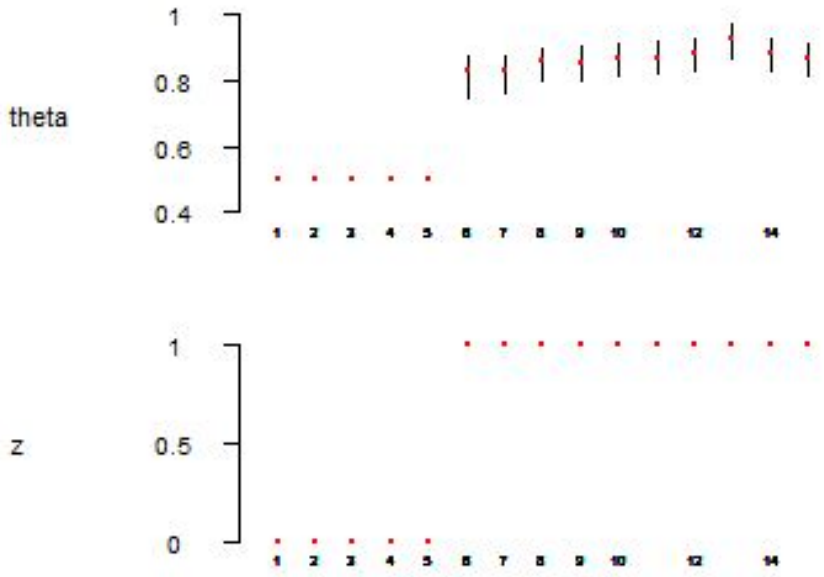
$$\phi_i \sim \text{Gaussian}(\mu, \lambda)_{\mathcal{I}(0,1)}$$

$$\psi \leftarrow 0.5$$

$$\theta_i \leftarrow \begin{cases} \phi_i \text{ if } z_i = 1 \\ \psi \text{ if } z_i = 0 \end{cases}$$

$$k_i \sim \text{Binomial}(\theta_i, n)$$


deviance
75
70
65
60
mu
0.95
0.9
0.85
0.8
sigma
0.15
0.1
0.05
0
i people
z_i
μ
ϕ_i
θ_i
ψ
λ
k_i
n

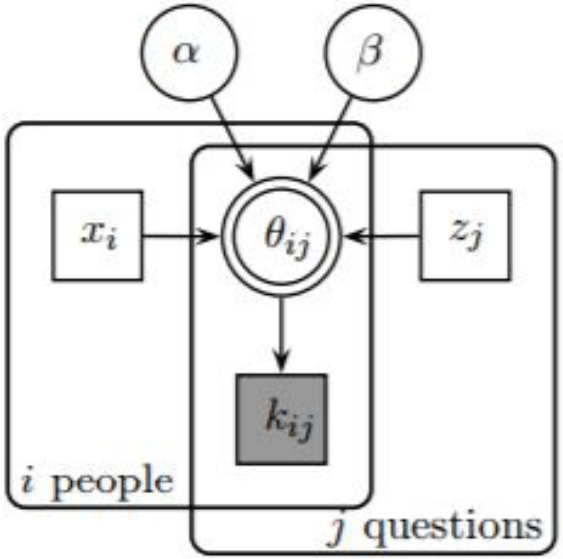

theta
1
0.8
0.6
0.4
z
1
0.5
0
1 2 3 4 5 6 7 8 9 10 12 14

Ejemplo 2:

The two-country quiz

Table 6.3 Correct and incorrect answers for 8 people on 8 questions.

	Question							
	A	B	C	D	E	F	G	H
Person 1	1	0	0	1	1	0	0	1
Person 2	1	0	0	1	1	0	0	1
Person 3	0	1	1	0	0	1	0	0
Person 4	0	1	1	0	0	1	1	0
Person 5	1	0	0	1	1	0	0	1
Person 6	0	0	0	1	1	0	0	1
Person 7	0	1	0	0	0	1	1	0
Person 8	0	1	1	1	0	1	1	0



$$\alpha \sim \text{Uniform}(0, 1)$$

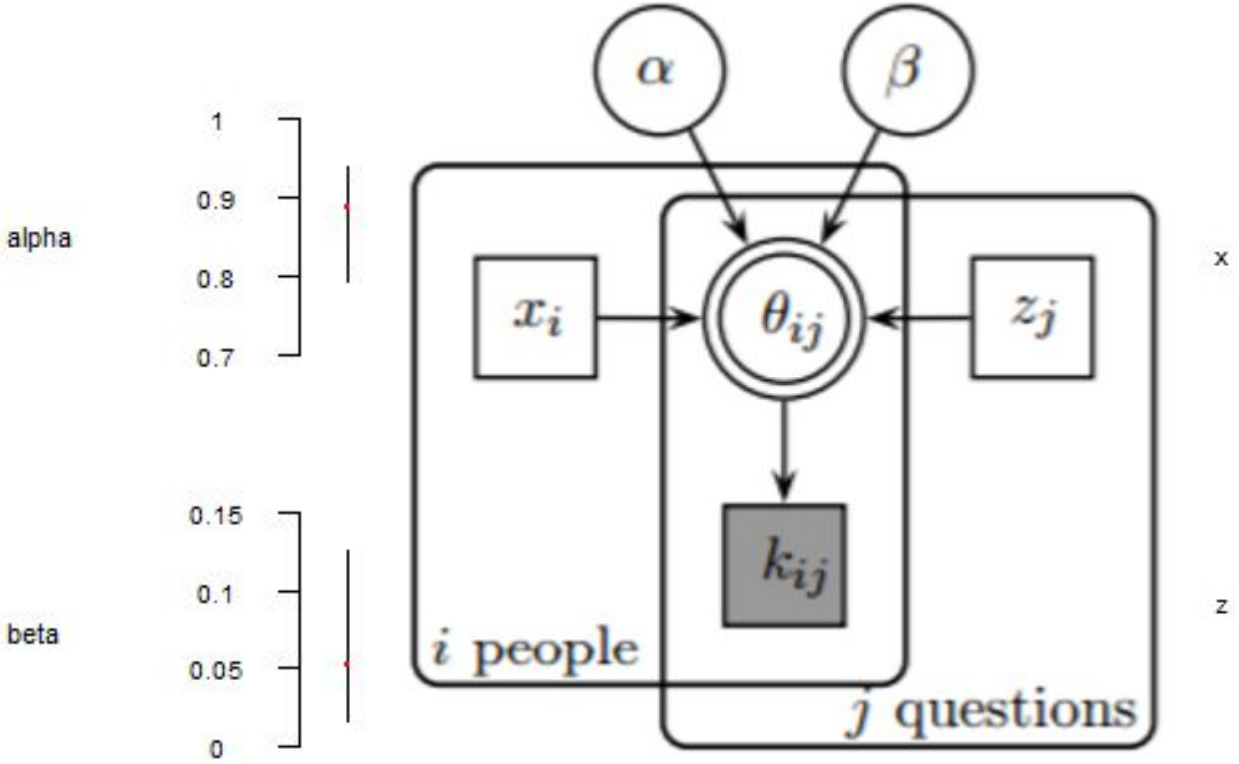
$$\beta \sim \text{Uniform}(0, \alpha)$$

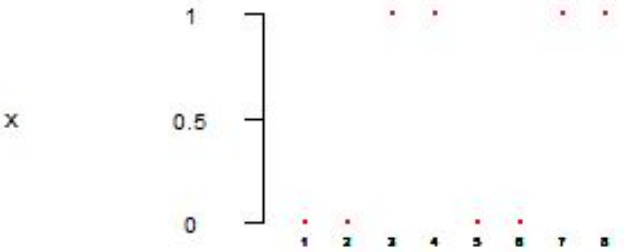
$$x_i \sim \text{Bernoulli}(0.5)$$

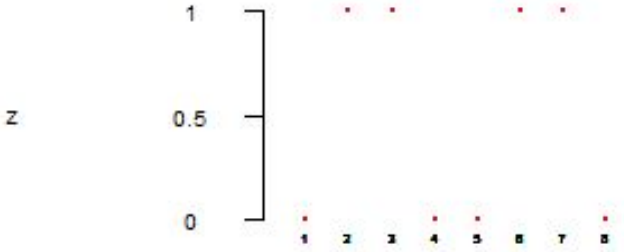
$$z_j \sim \text{Bernoulli}(0.5)$$

$$\theta_{ij} \leftarrow \begin{cases} \alpha & \text{if } x_i = z_j \\ \beta & \text{if } x_i \neq z_j \end{cases}$$

$$k_{ij} \sim \text{Bernoulli}(\theta_{ij})$$


alpha
1
0.9
0.8
0.7
beta
0.15
0.1
0.05
0
α
β
x_i
θ_{ij}
z_j
k_{ij}
i people
j questions


x
1
0.5
0
1 2 3 4 5 6 7 8


z
1
0.5
0
1 2 3 4 5 6 7 8