C tupdi btujd pquj n jtbujpo bmhpsjui n gps qbjsxjtf mjlfmjippe ftujn bujpo pg psejobm gbdups n pefmt

Ijvtfqqf Cmgpo{fuuj[1], Tvhhfsp Dfmmjp[2], Zvoyjbp Eifo[3], Ksjoj Opvtubl j[3]

[1]Vojwfstjuz pg Rbevb. [2]Vojwfstjuz pg Vejof. [3]Mpoepo %dippm pg Gdpopnjdt

%vnnbsz

Uif Djh Hjwf Rfstpobmjuz uftu

Rbjsxjtf Njlfmjippe

$$p\ell(\theta) = \sum_{j<j'} \ell_{jj'}(\theta) = \sum_{j<j'} \sum_{s_j, s_{j'}} n^{jj'}_{s_j s_{j'}} \log \pi^{jj'}_{s_j s_{j'}}$$

$$\pi^{jj'}_{s_j s_{j'}} = \int_{\tau_{s_j-1}}^{\tau_{s_j}} \int_{\tau_{s_{j'}-1}}^{\tau_{s_{j'}}} \varphi_2(y_j, y_{j'}; \rho^{y}_{jj'}) dy_j\, dy_{j'}$$

$O(p^2)$

Ffubjmt po uif Voefsmzjoh sftqpotf wbsjbcmf (VTW) qbsbnfufsjtbujpo

$Y_j = s_j$, $\{0, \dots, c_j - 1\}$

$$Y_j = s_j \qquad \tau^{(j)}_{s_j-1} < y_j < \tau^{(j)}_{s_j},$$

$y = \Lambda u + \delta$, $\Sigma_\delta = I_p - \mathrm{diag}(\Lambda \Sigma_u \Lambda^T)$

$\delta \sim N_p(0, \Sigma_\delta)$

Λ, Σ_u, τ

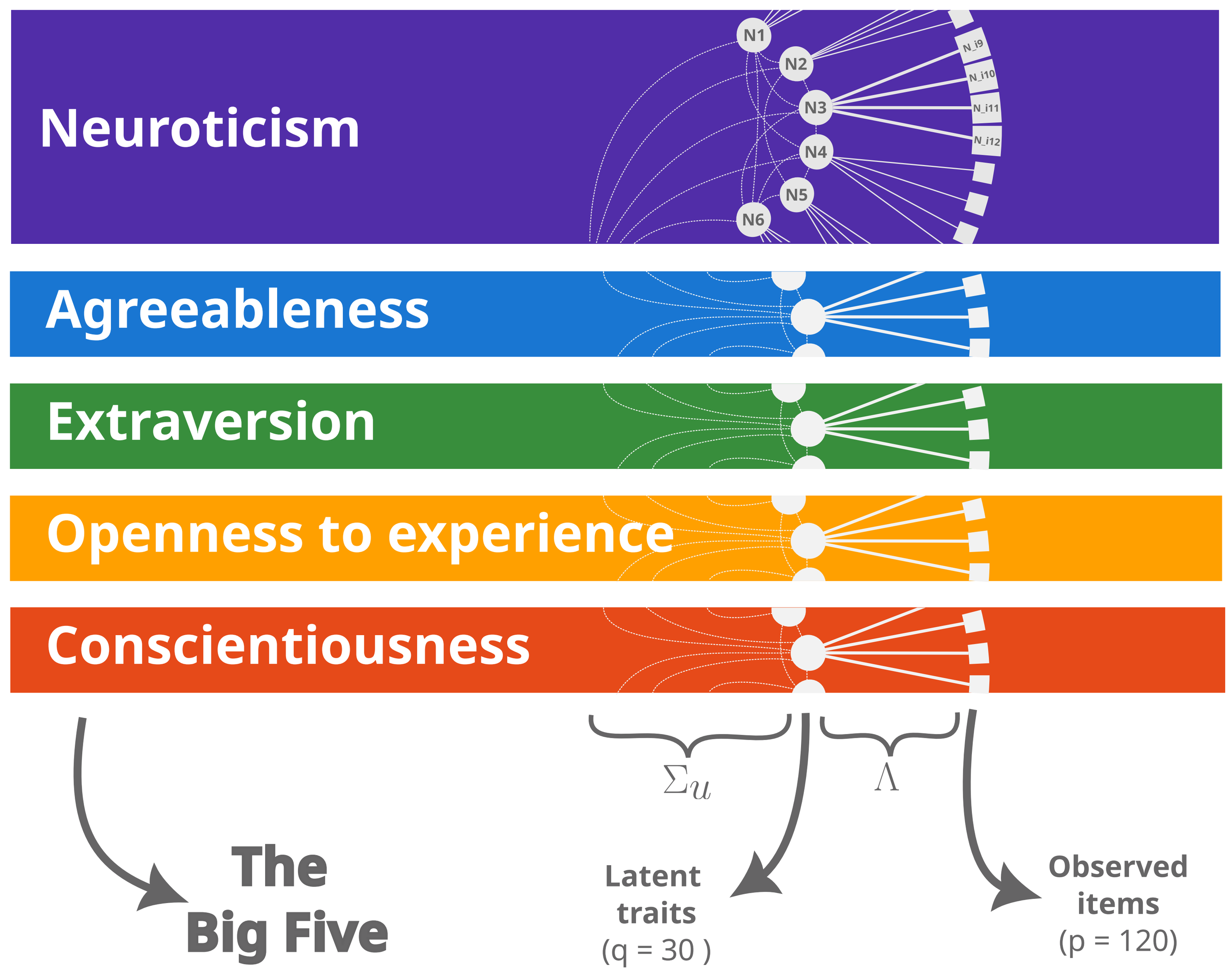
$\tau = (\tau^{(1)T}, \dots, \tau^{(p)T})^T$

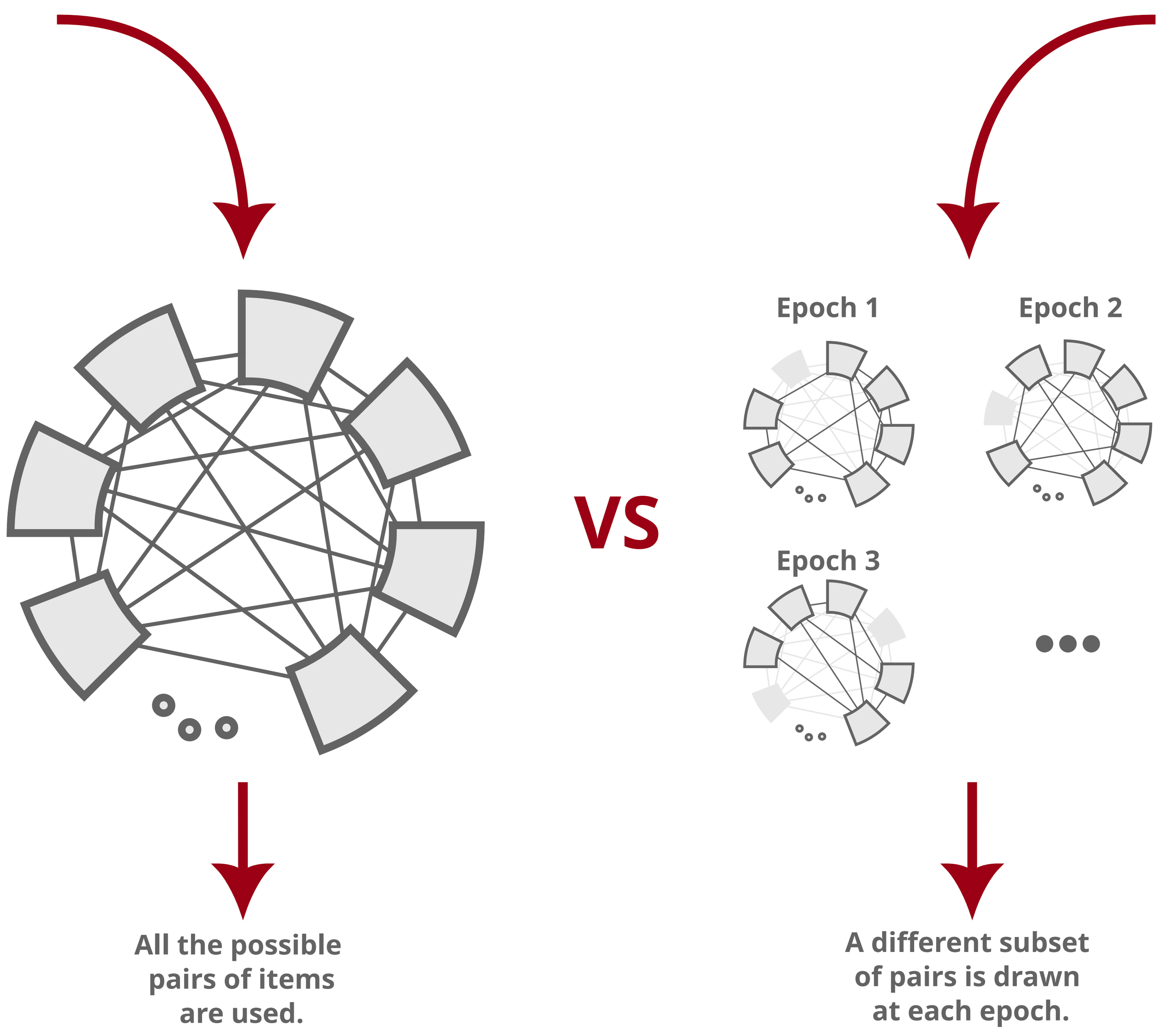
$\tau^{(j)} = (\tau^{(j)}_0, \dots, \tau^{(j)}_{c_j-2})$, $\mathbb{N}^{c_j-1}$

$\theta \in \mathbb{R}^d$

$$\ell(\theta; y) = \sum_{i=1} \log \int_{\tau^{(1)}_{s_1-1}}^{\tau^{(1)}_{s_1}} \cdots \int_{\tau^{(p)}_{sp-1}}^{\tau^{(p)}_{sp}} \varphi_p(y_i; \Sigma_y) dy_i$$

$\varphi_p(x; \Sigma)$





Big Five data results

Non-zero loadings (120)

Latent Correlation Matrix (30 x 30)

Observed items correlations (120 x 120)

Model-implied items correlations (120 x 120)

Ppubujpo

- $Y_i = (Y_{i1}, \dots, Y_{ip})$, $\mathbb{R}^p$, $i = 1, \dots, n$; $y_i = (y_{i1}, \dots, y_{ip})$
- $U_i = (U_{i1}, \dots, U_{iq})$, $\mathbb{R}^q$, $i = 1, \dots, n$; $u_i = (u_{i1}, \dots, u_{iq})$, $u_i \overset{iid}{\sim} N_q(0, \Sigma_u)$
- Σ_u, $\mathbb{R}^q \times \mathbb{R}^q$
- $\Lambda = (\lambda_1^T, \dots, \lambda_p^T)$, $\mathbb{R}^p \times \mathbb{R}^q$, $\lambda_j = (\lambda_{j1}, \dots, \lambda_{jq})$, $j = 1, \dots, p$.

%updibtujd Qquj njtbujpo

$$p\ell(\theta, y) \approx f(\theta; y, w) = \gamma^{-1} \sum_{j<j'} w_{jj'} \ell_{jj'}(\theta).$$

- $w_{jj'}$, $w_{jj'} \overset{iid}{\sim}$
- $f(\theta; y, w) = p\ell(\theta)$, $E_w\{f(\theta; y, w)\} = p\ell(\theta)$

$w^{(t)}$

$f(\theta_{t-1}; y, w^{(t)})$

θ_t

$\theta_t = \theta_{t-1} + \eta_t \nabla f(\theta_{t-1}; y, w^{(t)})$, $\eta_t = \eta t^{-.5+}$, $\sum_{t=1}^\infty \eta_t = \infty$, $\sum_{t=1}^\infty \eta_t^2 < \infty$

$\bar\theta = T^{-1} \sum_t^T \theta_t$

Objo Hjoejoht

Tfgfsfodft