

Modelling Latent Constructs

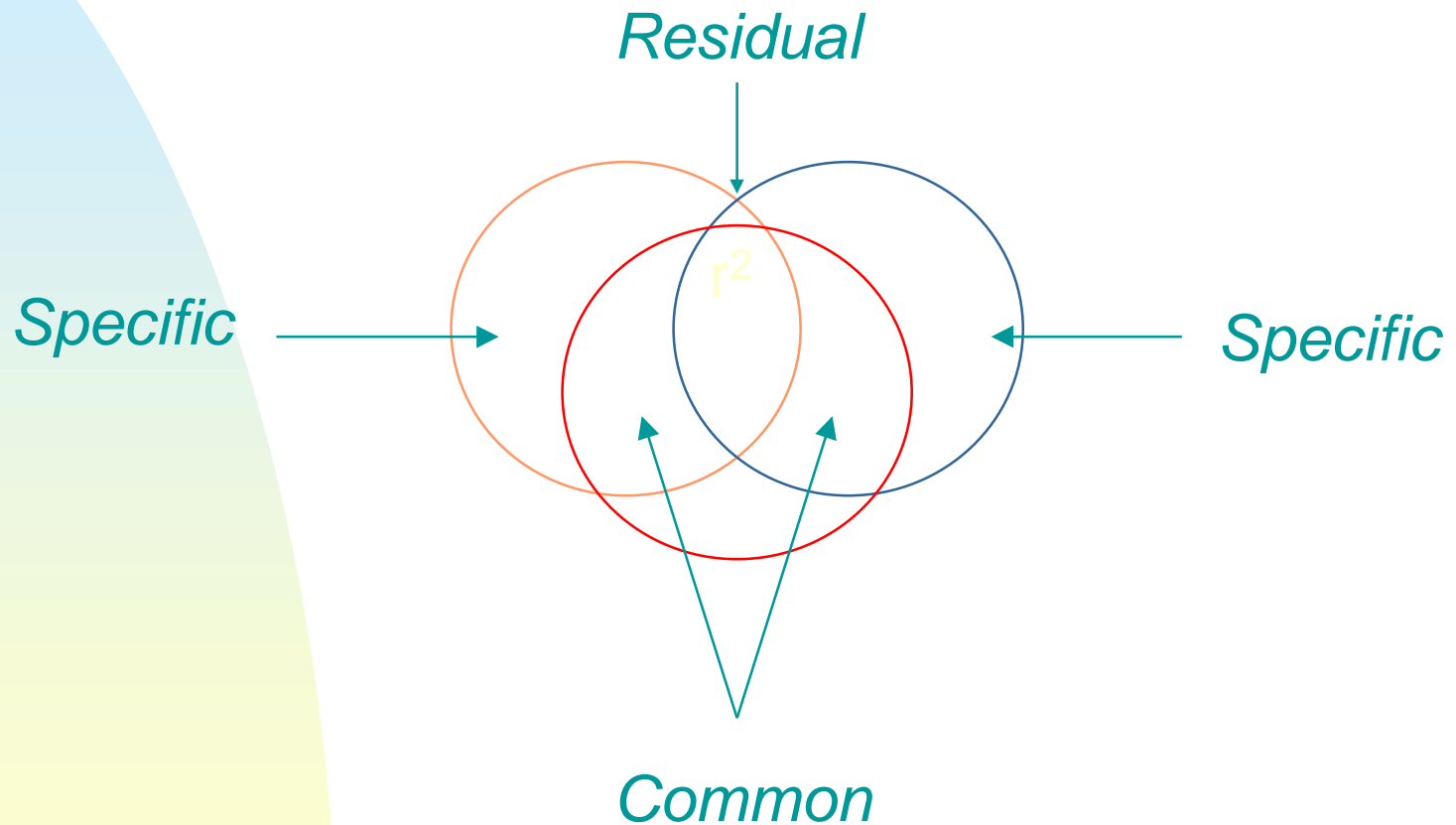
Exploratory Factor Analysis

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Some History

- Spearman ‘Two Factor Theory’
- Hottelling Principal Components
- Thurstone Multiple Groups
- Joreskog ‘Confirmatory’
- McDonald Nonlinear Factor Analysis

The Two Factor Theory



The Models

$$\Sigma = \Lambda\Phi\Lambda + \varepsilon$$

$$\Sigma = \Lambda\Phi\Lambda$$

Decisions

- **Assumptions**
- **Extraction**
- **How many factors?**
- **Rotation**

Assumptions

- Pearson-Bravais Assumptions
- Latent Trait Structure
- Variables are adequately sampled

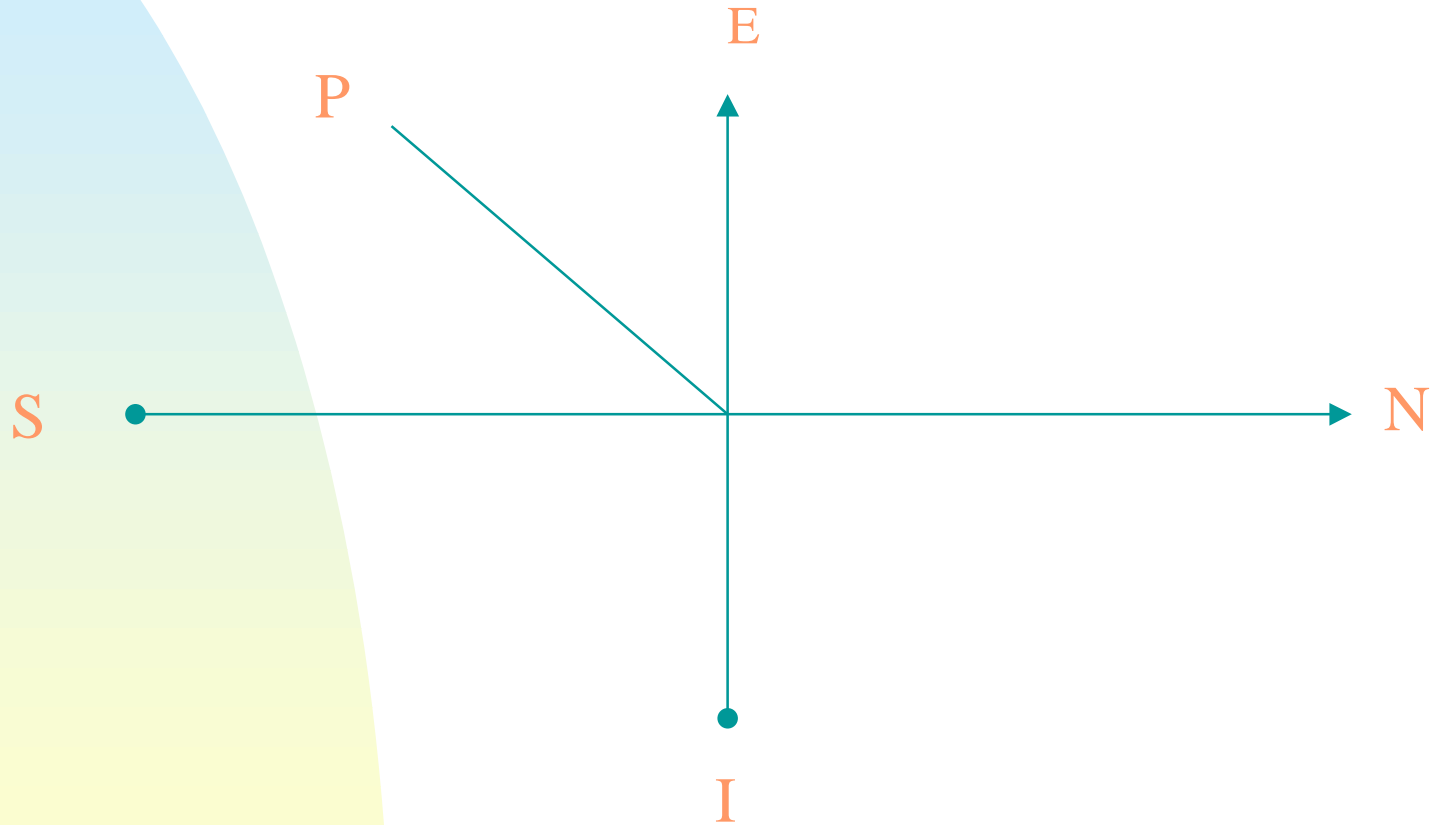
Extraction

- Principal Components
- Principal Factors
- ML, GLS, LS, Alpha, etc.
- Non-Metric

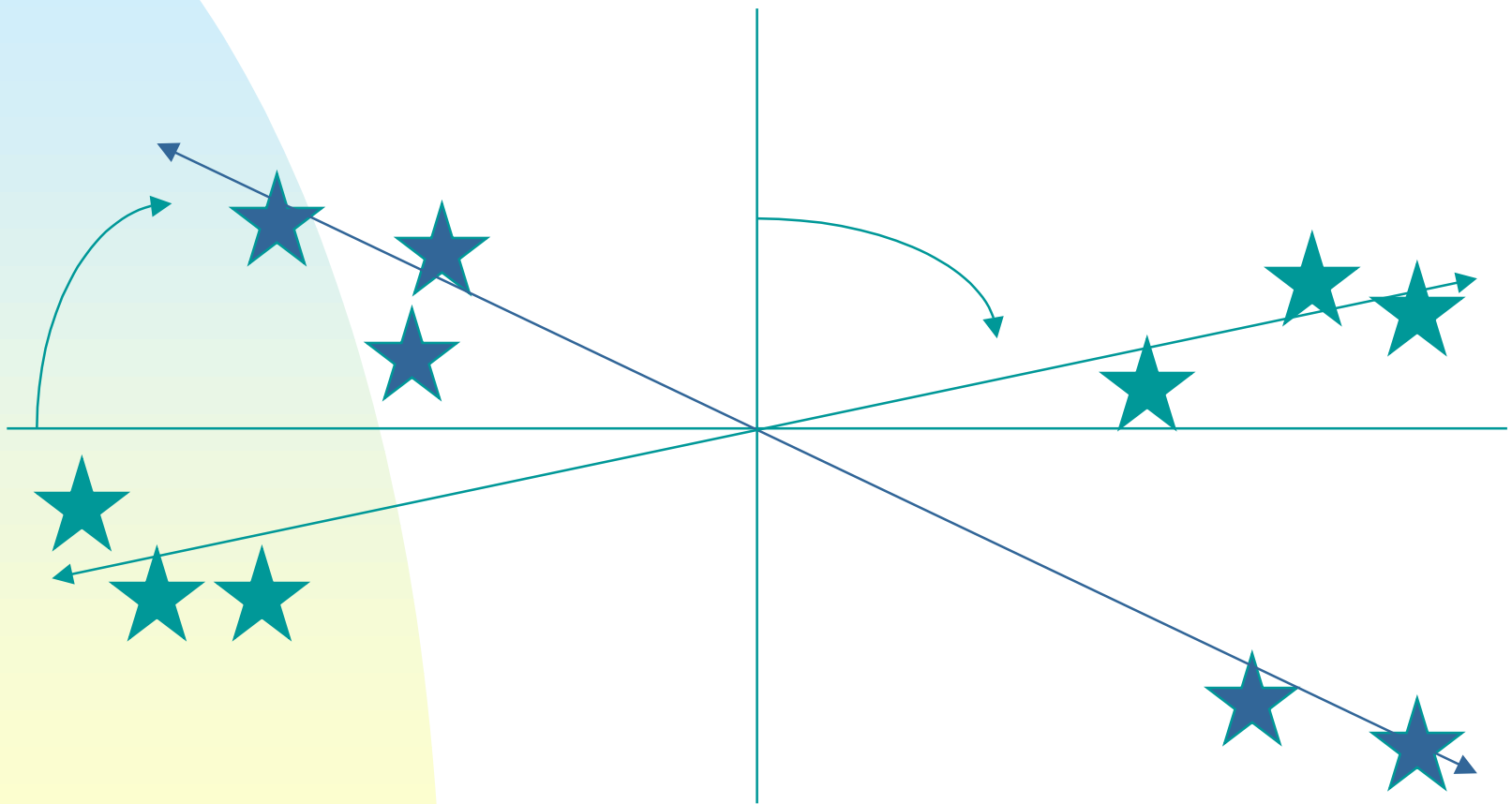
How Many Factors?

- Eigen values > 1 .
- Scree Plot
- Statistical Criteria
- Interpretability
- A priori expectation

Orthogonal Factors (Eysenck)



Oblique Solution



Challenges

- Indeterminacy
- Invariance
- Artefact

Restricted Analysis (Procrustes)

- Target Rotation
- Centroid Cluster Projection
- Multiple Groups Analysis
- 'Confirmatory' Models

The Basic Model

$$\begin{array}{cccccc} 1 & 1 & 1 & 0 & 0 & 0 \\ 1 & 1 & 1 & 0 & 0 & 0 \\ 1 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 \end{array} = \begin{array}{c} 1 \ 0 \\ 1 \ 0 \\ 1 \ 0 \\ 0 \ 1 \\ 0 \ 1 \\ 0 \ 1 \end{array} \times \begin{array}{c} 1 \ 0 \\ 0 \ 1 \end{array} \times \begin{array}{cccccc} 1 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 1 \end{array}$$

 Σ $=$ Λ Φ Λ'