情緒動態特徵剖析

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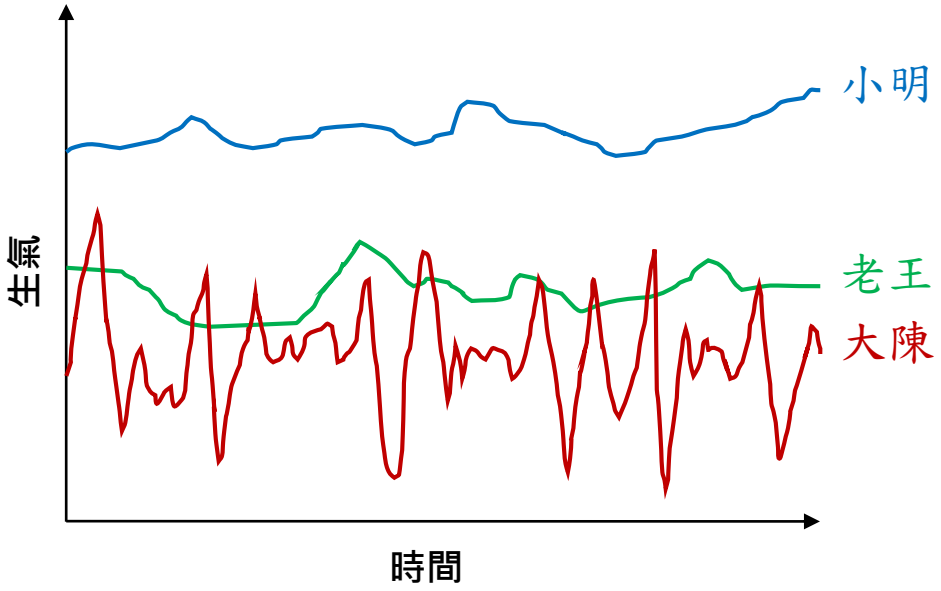
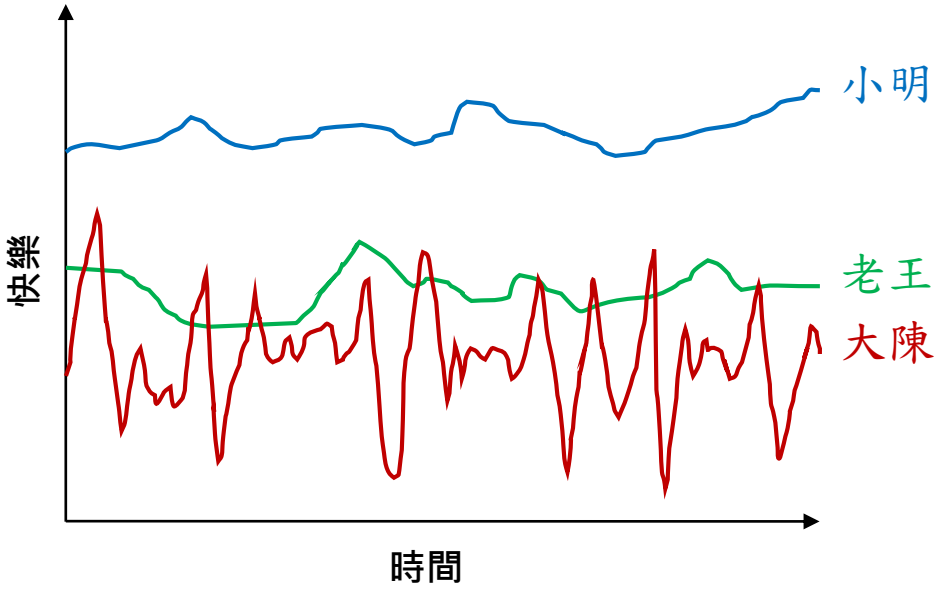
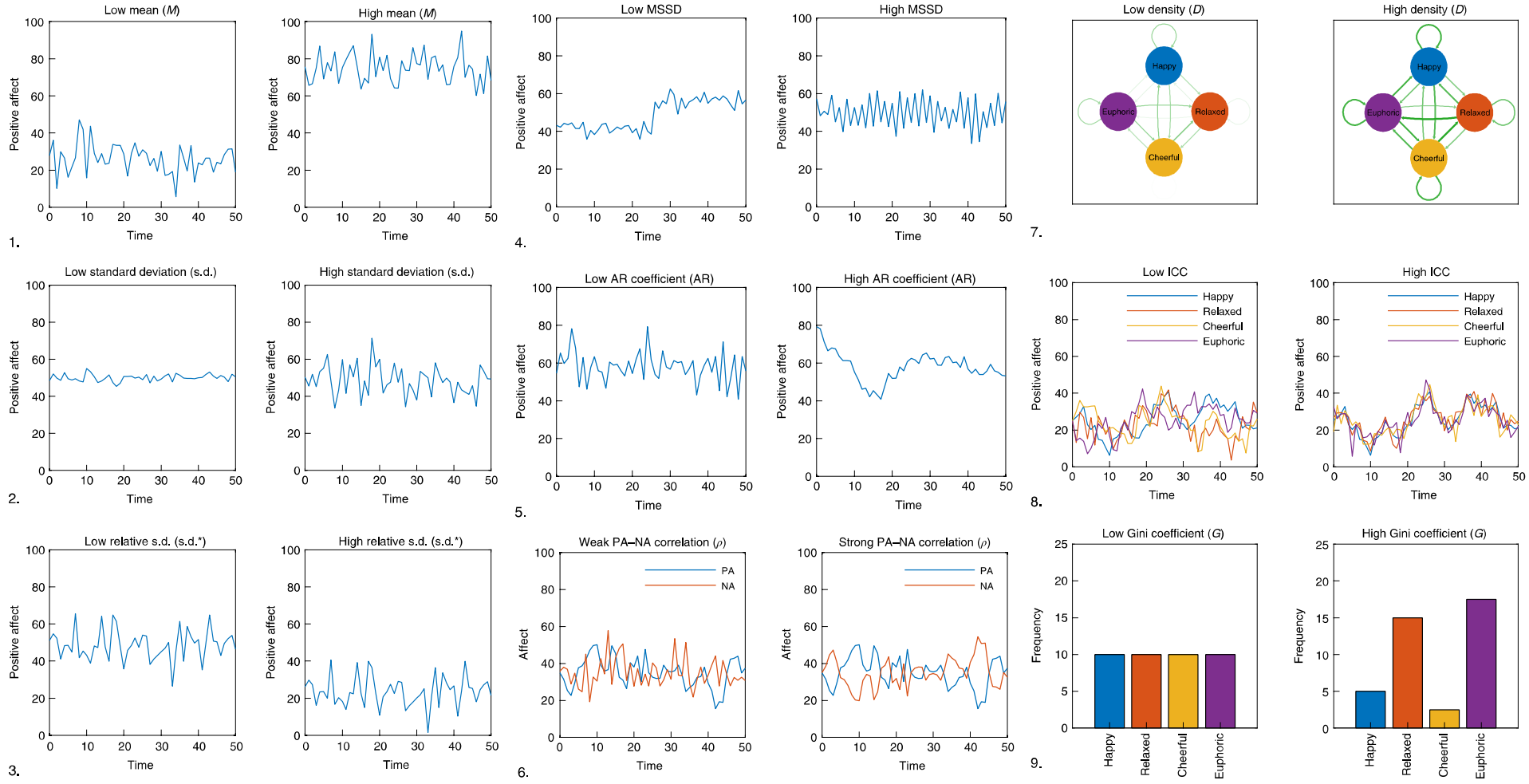
情緒動力的個別差異





情緒動力指標



Dejonckheere et al. (2019, Figure 1). *Nature Human Behaviour*

情緒動力指標

Feature	Definition	Index
Average intensity	How strong an emotion is felt on average, both between emotions within an individual and bet. individuals	Mean score over time
Variability	Intensity varies across time for a single person	Within-person variance or *SD*
Inertia	Tendency of an emotion to carry over from one moment to the next (i.e., resistance to change)	Autocorrelation
Cross-lag	Augmentation: emotion A↑ ↔ emotion B↑ Blunting: emotion A↑ ↔ emotion B↓	Cross-lag cor. between 2 emotions
Granularity	Ability of differentiating between different emotions	▪ # of PCs between emotions of a single person ▪ *Var* unexplained by 1st PC ▪ Cor. or cov. between 2 emotions within a person ▪ ICC between all emotions

Krone et al. (2018). *Emotion*

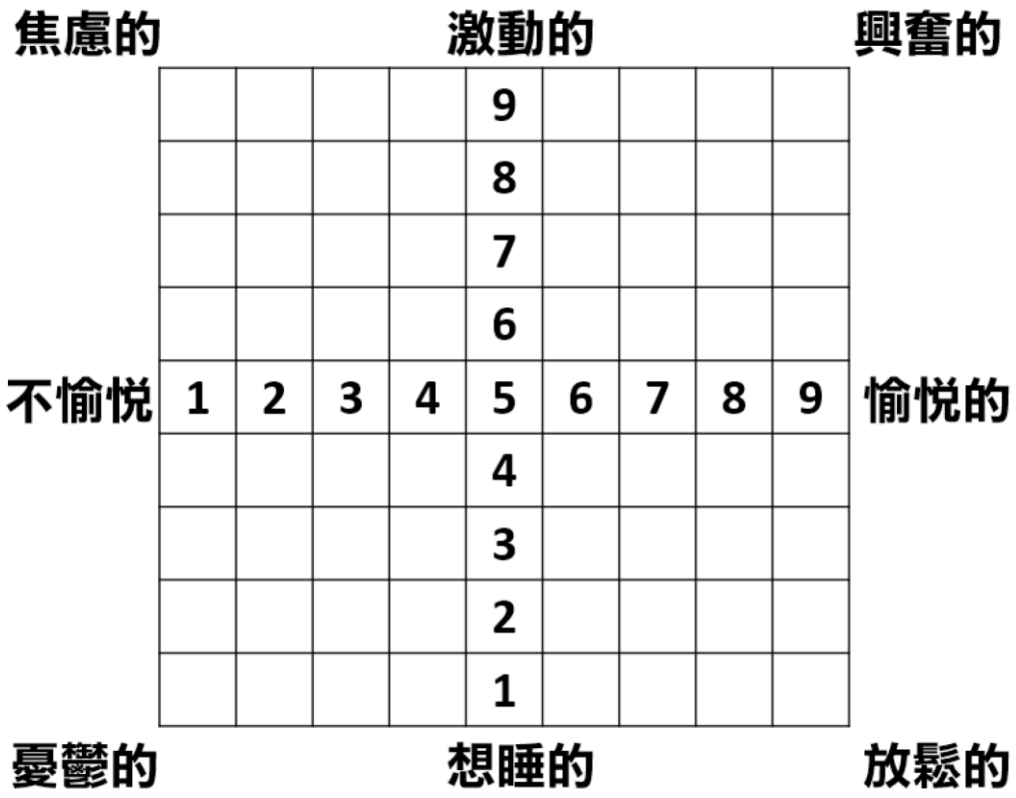
情緒動力指標與心理健康

Features	Relationships
Average intensity ($\boldsymbol{\mu}_{i,\,n}$)	For NA: Neuroticism, depression, … For PA: Emotion regulation, extraversion, agreeableness, conscientiousness
Variability ($\boldsymbol{\Sigma}_{ii,\,n}$)	Stress level, mood disorder (+) Age, emotional well-being (-)
Inertia ($\boldsymbol{\Phi}_{ii,\,n}$)	Rumination (+) Emotional regulation (-)
Cross-lag ($\boldsymbol{\Phi}_{ij,\,n}$)	Increase in major depression patients in terms of higher levels of overall emotion network density
Granularity ($\boldsymbol{\Sigma}_{ij,\,n}$)	Emotion regulation, more effective coping mechanisms (+) Neuroticism, social anxiety disorder, depression (-)

Krone et al. (2018). *Emotion*

資料

104位受試者 (44位女性，年齡介於20至52歲)
連續施測7天，每日填答6次



貝氏統計模式

Observation equation

$$\mathbf{y}_{t,n} = \boldsymbol{\mu}_n + \boldsymbol{\theta}_{t,n} + \boldsymbol{\varepsilon}_{t,n} \quad \boldsymbol{\varepsilon}_{t,n} \sim N(\mathbf{0}, \mathbf{H}_n)$$

Average intensity

Indep.

System equation

$$\boldsymbol{\theta}_{t,n} = \boldsymbol{\Phi}_n \times \boldsymbol{\theta}_{t-1,n} + \boldsymbol{\eta}_{t,n} \quad \boldsymbol{\eta}_{t,n} \sim N(\mathbf{0}, \mathbf{Q}_n)$$

Inertia & Cross-lag

Model-implied covariance

$$\mathrm{vec}(\boldsymbol{\Sigma}_n) = (\mathbf{I} - \boldsymbol{\Phi}'_n \otimes \boldsymbol{\Phi}'_n)^{-1} \mathrm{vec}(\mathbf{Q}_n + \mathbf{H}_n)$$

Variability & Granularity

t: time
n: individual

Krone et al. (2018). *Emotion*

貝氏統計模式

[**H** = diag(**τ**)**Ω**diag(**τ**), where **τ** ~ *Cauchy*(0, 2.5) & **Ω** ~ *LKJ*(2)]
LKJ prior for the corr. matrix of **H**
Half-Cauchy prior for the scale parameter of **H**

$N(5, 2^2)$

$$\mathbf{y}_{t,n} = \boldsymbol{\mu}_n + \boldsymbol{\theta}_{t,n} + \boldsymbol{\varepsilon}_{t,n} \quad \boldsymbol{\varepsilon}_{t,n} \sim N(\mathbf{0}, \mathbf{H}_n)$$

$$\boldsymbol{\theta}_{t,n} = \boldsymbol{\Phi}_n \times \boldsymbol{\theta}_{t-1,n} + \boldsymbol{\eta}_{t,n} \quad \boldsymbol{\eta}_{t,n} \sim N(\mathbf{0}, \mathbf{Q}_n)$$

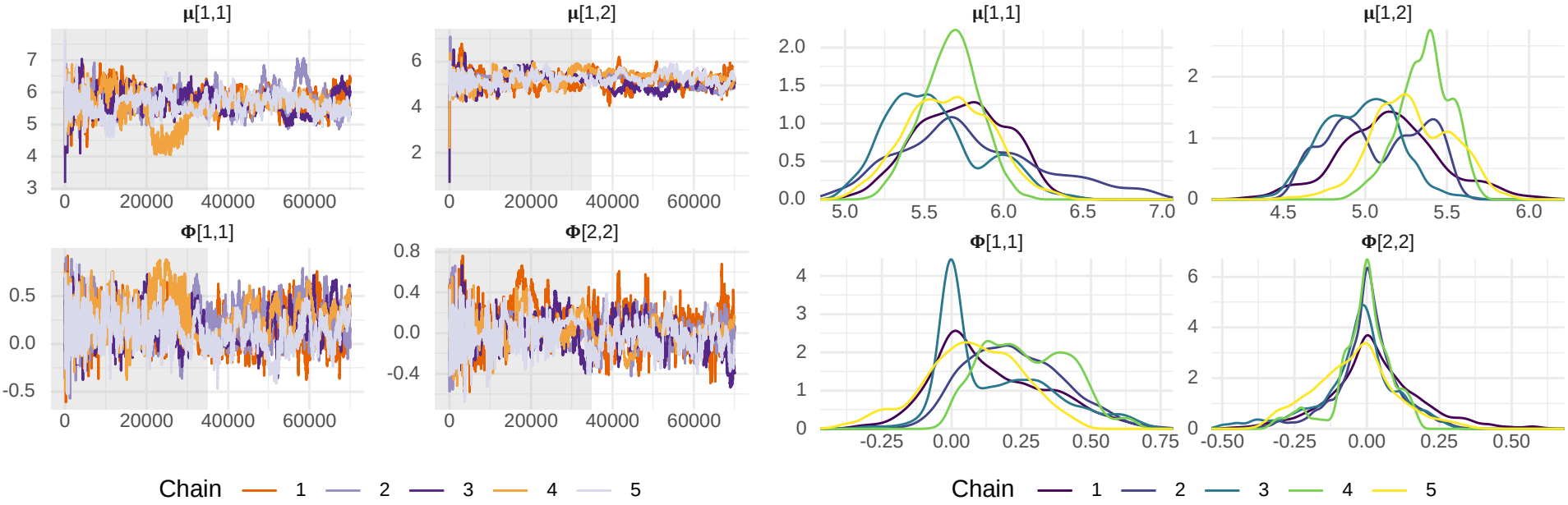
$U(-1, 1)$

diag[*Gamma*(3, 3)]

Krone et al. (2018). *Emotion*

MCMC

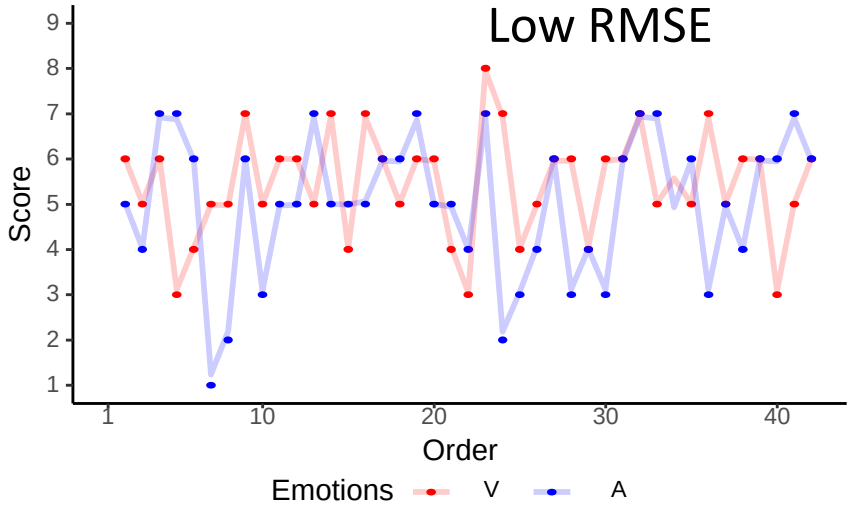
Take subject no. 15 for example



# of chains = 5
Iteration for each chain = 70000 (warm-up / burn-in first 35000 sample)
Thin = 10
Posterior samples = [(70000 − 35000)/10] × 5 = 17500
$\widehat{R}$: 1.00 ~ 1.89 for the 15th participant

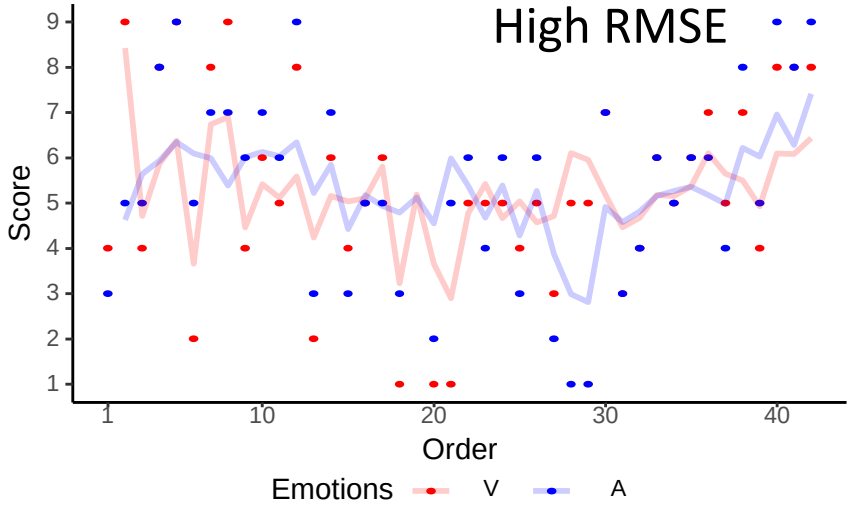
模型適配度

ID = 9
Points = observed scores; line = predictive scores

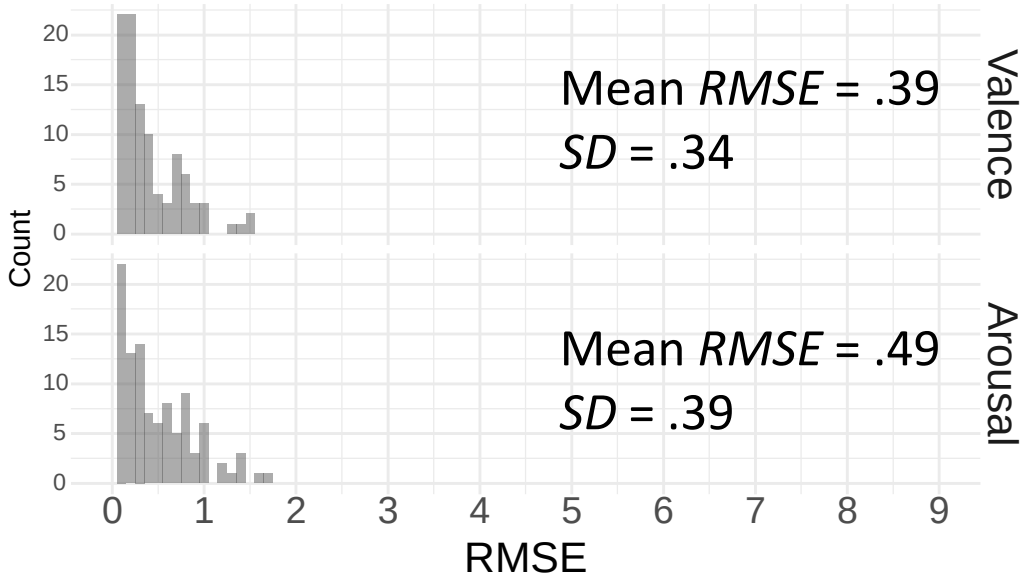


RMSE: V = 0.0434; A = 0.0869

ID = 22
Points = observed scores; line = predictive scores



RMSE: V = 1.3933; A = 1.4302



*V = Valance; A = Arousal

情緒動力指標分析

指標	情緒向度	平均數 (標準差)
平均水準 ($\boldsymbol{\mu}_{i,n}$)	正負向 (V)	5.70 (0.86)
	激發程度 (A)	5.11 (0.91)
不穩定性 ($\boldsymbol{\Sigma}_{ii,n}$)	正負向	2.96 (1.99)
	激發程度	4.10 (2.14)
慣性 ($\boldsymbol{\Phi}_{ii,n}$)	正負向	0.12 (0.19)
	激發程度	0.11 (0.22)
連動性 ($\boldsymbol{\Phi}_{ij,n}$)	正負向$_{t-1}$ → 激發程度$_t$	0.02 (0.21)
	激發程度$_{t-1}$ → 正負向$_t$	0.05 (0.18)
區辨性 ($\boldsymbol{\Sigma}_{ij,n}$)	-	0.21 (0.23)

情緒動力指標分析