结构方程模型中的二阶构念

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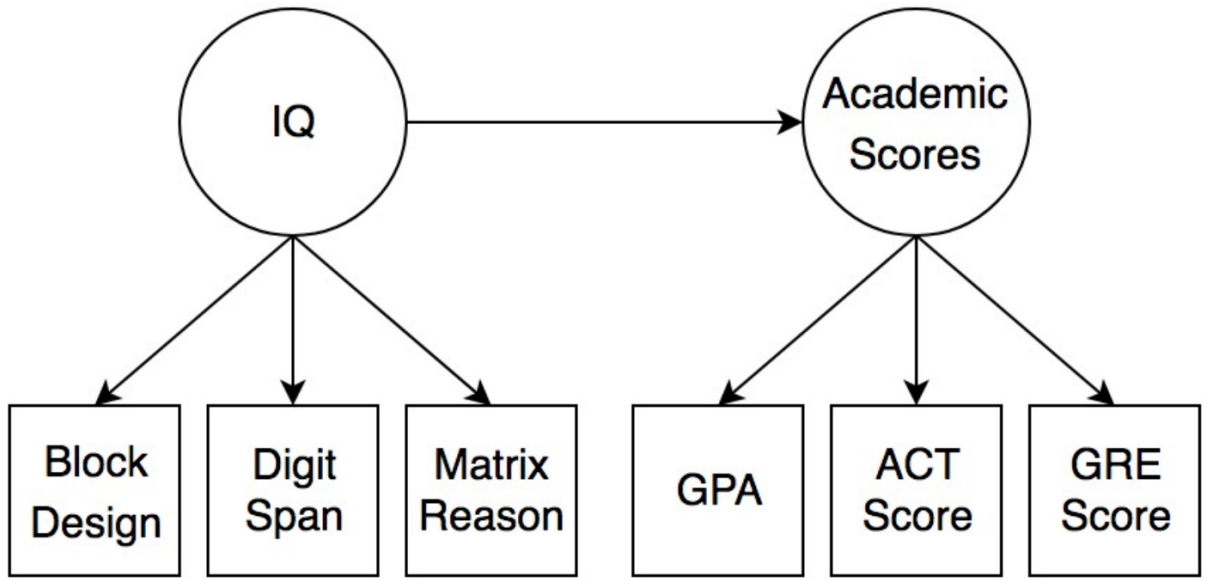
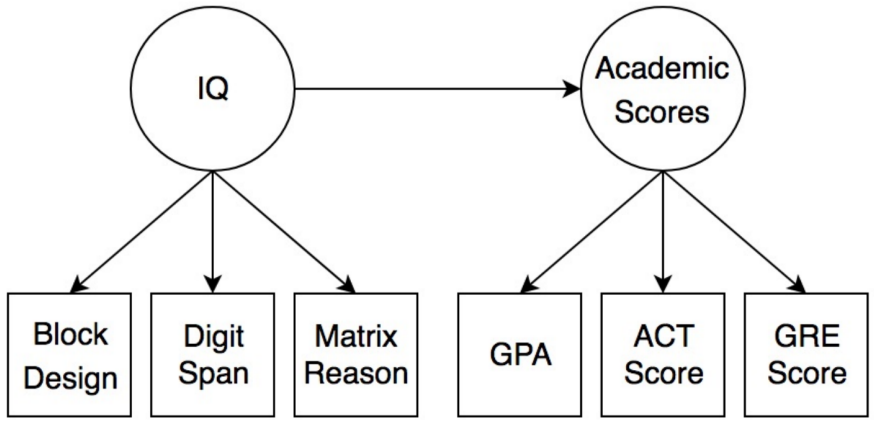
一、基本概念

结构方程模型

- 主要用于探索变量之间的关系
- 包含两种类型的变量：
  - 显变量（manifest variables），图中的方形， 成绩(试卷)
  - 潜变量（latent variables），图中的圆形，智商(脑袋)
- 由以下两种模型构成
  - measurement model (relationship latent variables and indicators)
  - structural equations (regressions among latent/observed variables)

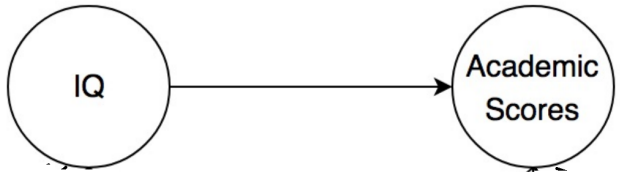


结构方程模型



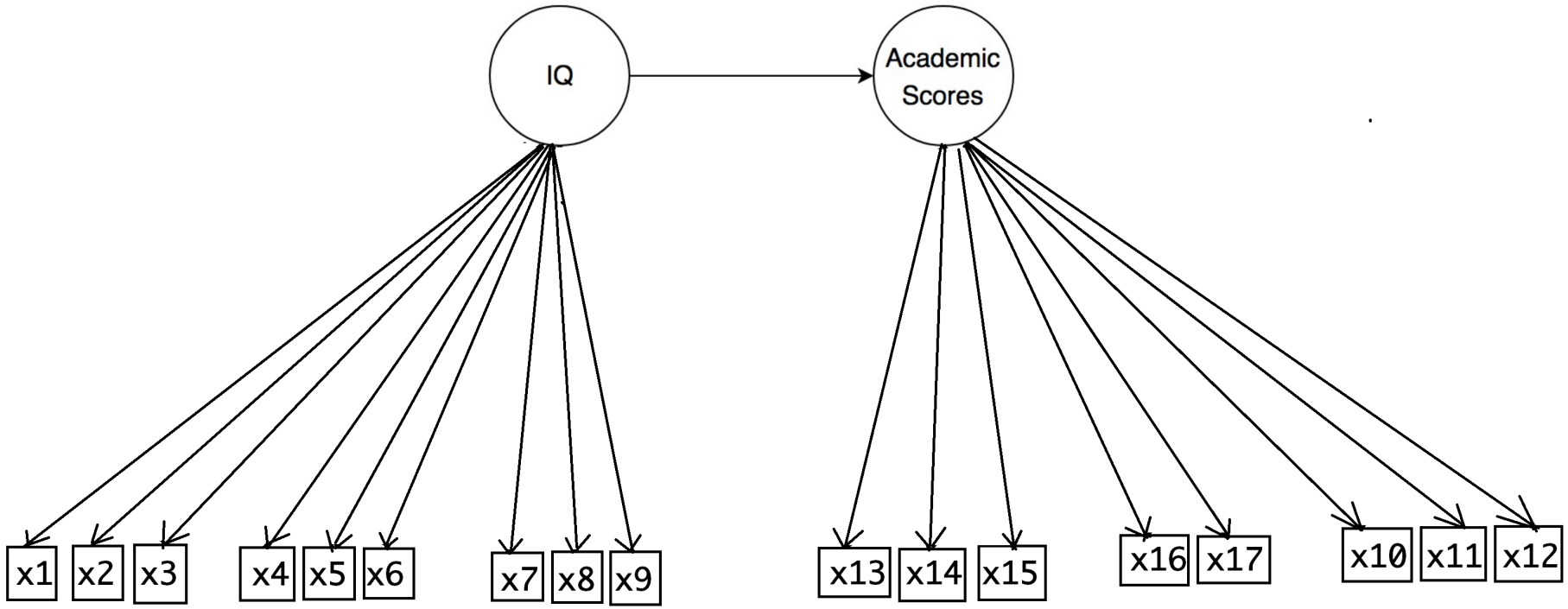

```
library(lavaan)

model <- '

  # measurement model
    IQ        =~ Block + Digit + Matrix
    Academic  =~ GPA + ACT + GRE

  # regressions model
    Academic   ~  IQ

'

fit <- cfa(model, data = d)
```

现实情形

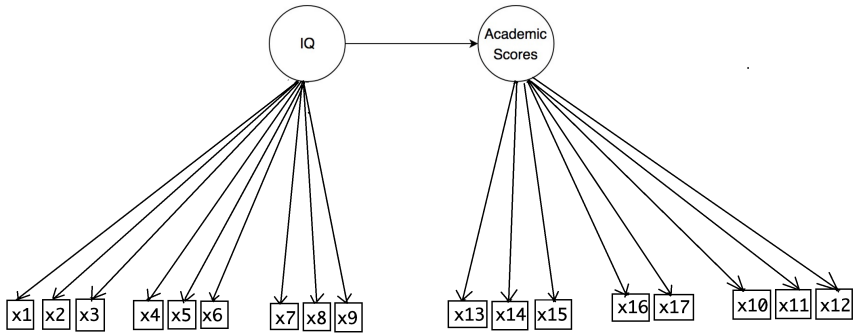

IQ
Academic
Scores


x1
x2
x3
x4
x5
x6
x7
x8
x9
x13
x14
x15
x16
x17
x10
x11
x12

方案1

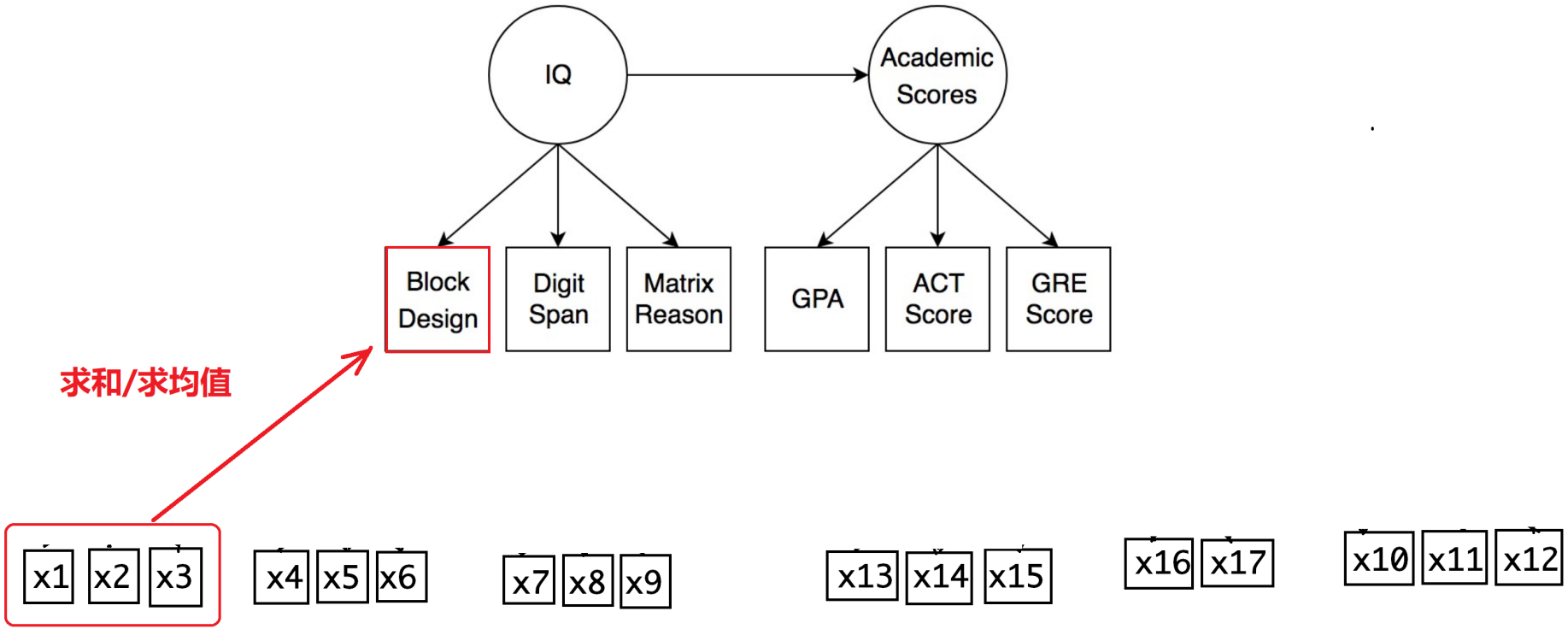

IQ
Academic Scores
x1
x2
x3
x4
x5
x6
x7
x8
x9
x13
x14
x15
x16
x17
x10
x11
x12

方案1

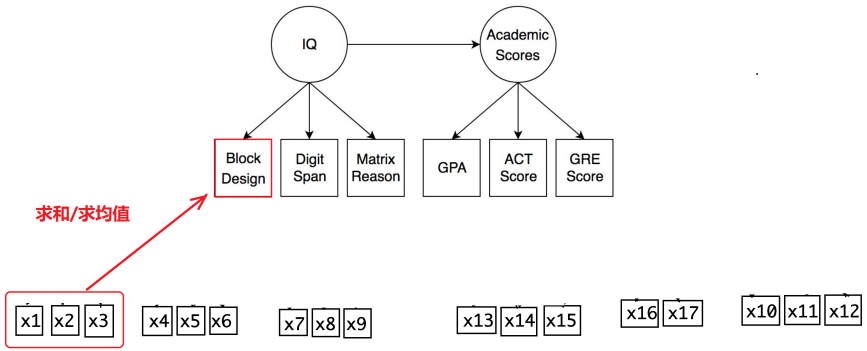



```
library(lavaan)

model <- '

  # measurement model
    IQ        =~ x1 + x2 + x3 + x4 + x5 + x6 + x7 +x8
    Academic  =~ x10 + x11 + x12 + x13 + x14 + x15 + x

  # regressions model
    Academic   ~  IQ

'


fit <- cfa(model, data = d)
```

方案2


IQ
Academic Scores
Block Design
Digit Span
Matrix Reason
GPA
ACT Score
GRE Score
求和/求均值
x1
x2
x3
x4
x5
x6
x7
x8
x9
x13
x14
x15
x16
x17
x10
x11
x12

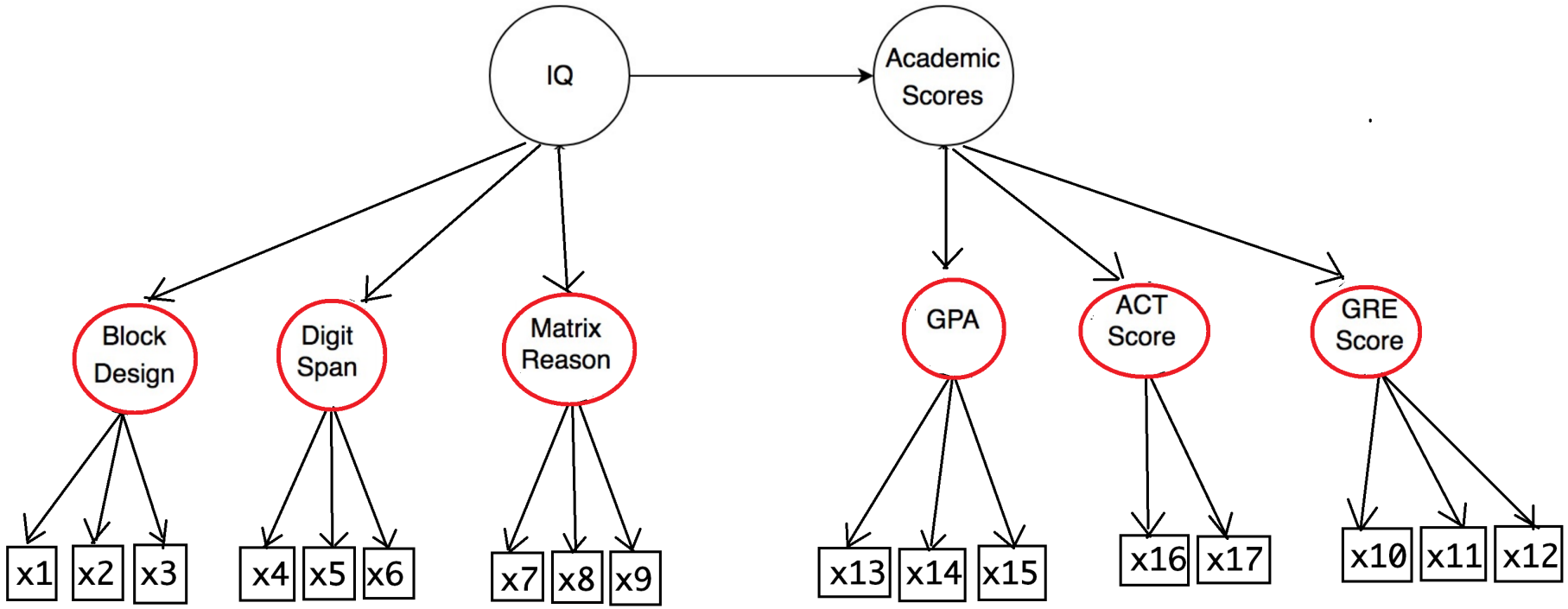
方案2



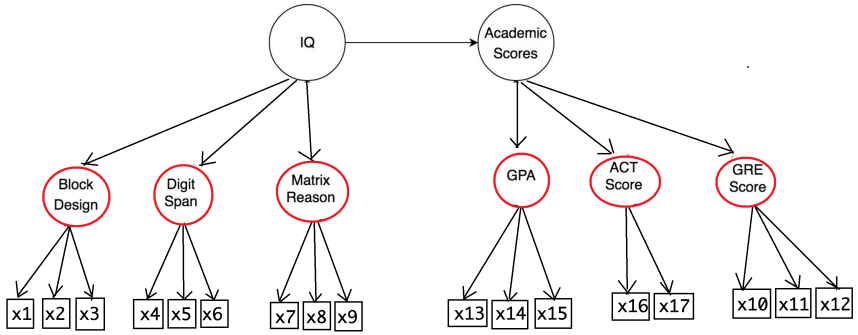

```
d_new <- d %>%
  mutate(
   Block    = x1 + x2 + x3
   Digit    = x4 + x5 + x6
   Matrix   = x7 + x8 + x9
   GPA      = x13 + x14 + x15
   ACT      = x16 + x17
   GRE      = x10 + x11 + x12
  )
```

```
library(lavaan)

model <- '

  # measurement model
    IQ        =~ Block + Digit + Matrix
    Academic  =~ GPA + ACT + GRE

  # regressions model
    Academic   ~  IQ

'

fit <- cfa(model, data = d_new)
```

方案3：二阶构念


IQ
Academic Scores
Block Design
Digit Span
Matrix Reason
GPA
ACT Score
GRE Score
x1
x2
x3
x4
x5
x6
x7
x8
x9
x13
x14
x15
x16
x17
x10
x11
x12

二阶构念




```
library(lavaan)

model <- '

 # first-order
   Block      =~ x1 + x2 + x3
   Digit      =~ x4 + x5 + x6
   Matrix     =~ x7 + x8 + x9
   GPA        =~ x13 + x14 + x15
   ACT        =~ x16 + x17
   GRE        =~ x10 + x11 + x12

 # second-order
   IQ         =~ Block + Digit + Matrix
   Academic   =~ GPA + ACT + GRE


 # regressions model
   Academic    ~  IQ

'

fit <- cfa(model, data = d)
```

文章

Zhang, H. and H. Xu, A structural model of liminal experience in tourism. Tourism Management, 2019.

回顾

旅游体验场景

Physical dimension

Ambient
AM1. Lights at night
AM2. Color
AM3. Odor
AM4. Music

Space
SP1. Ancient town
SP2. Stone bridge and path
SP3. Water
SP4. Snow mountain
SP5. Open space
SP6. Vegetation

Signs, symbols, and artifacts
SI1. Signage and flags
SI2. Decoration in store
SI3. Pilot identifier
SI4. Decorations of the street
SI5. Architectural style
SI6. Artifacts

Social
SO1. Casual behavior
SO2. Trust each other
SO3. Equal contacts
SO4. Casual communication
SO5. Communicate without worries

Socially-symbolic
SY1. Legends of love in ancient times
SY2. Modern love story
SY3. Doodle love
SY4. Concentric lock

Natural
NA1. Being away
NA2. Fascination
NA3. Compatibility

情感唤起

EM1. Romantic
EM2. Love
EM3. Lustful
EM4. Excitement
EM5. Desired

艳遇体验

LE1. Wonderful
LE2. Romantic
LE3. Dubious relationship
LE4. Legendary
LE5. Unique
LE6. Meet by chance
LE7. Mistery
LE8. Encounter
LE9. Meet different people
LE10. A chance acquaintanc
LE11. Relaxed
LE12. Self-indulgence
LE13. Exceeding the bounds
LE14. Freedom
LE15. Unconstraint
LE16. Sense of loss
LE17. Anxiety
LE18. A hint of sadness

感觉寻求

Experience seeking
ES1. I am interested in almost everything that is new
ES2. I always like to do things that no one else has done before

Boredom susceptibility
BS1. I will feel very uncomfortable if I stay in the same place for too long
BS2. I get restless if I do the same thing for a long time

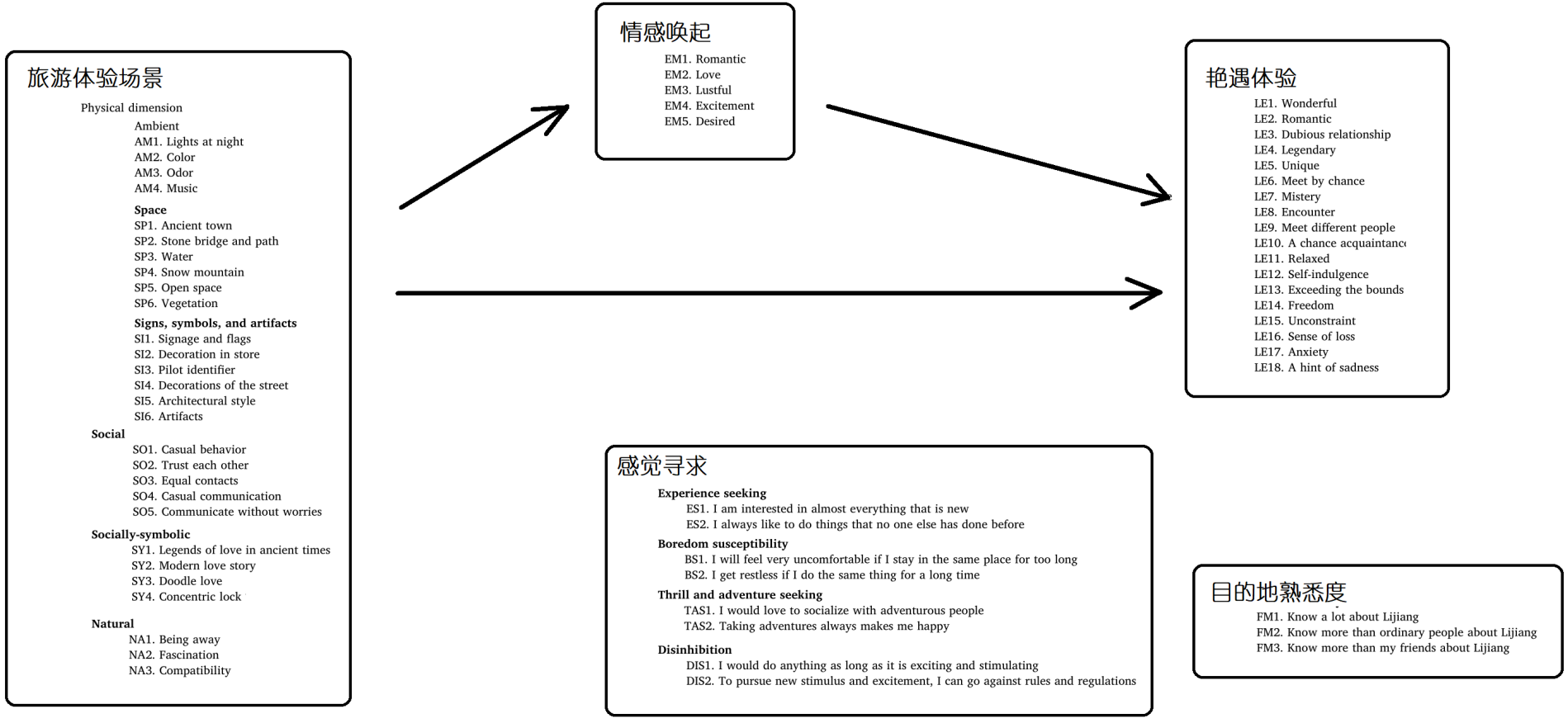
Thrill and adventure seeking
TAS1. I would love to socialize with adventurous people
TAS2. Taking adventures always makes me happy

Disinhibition
DIS1. I would do anything as long as it is exciting and stimulating
DIS2. To pursue new stimulus and excitement, I can go against rules and regulations

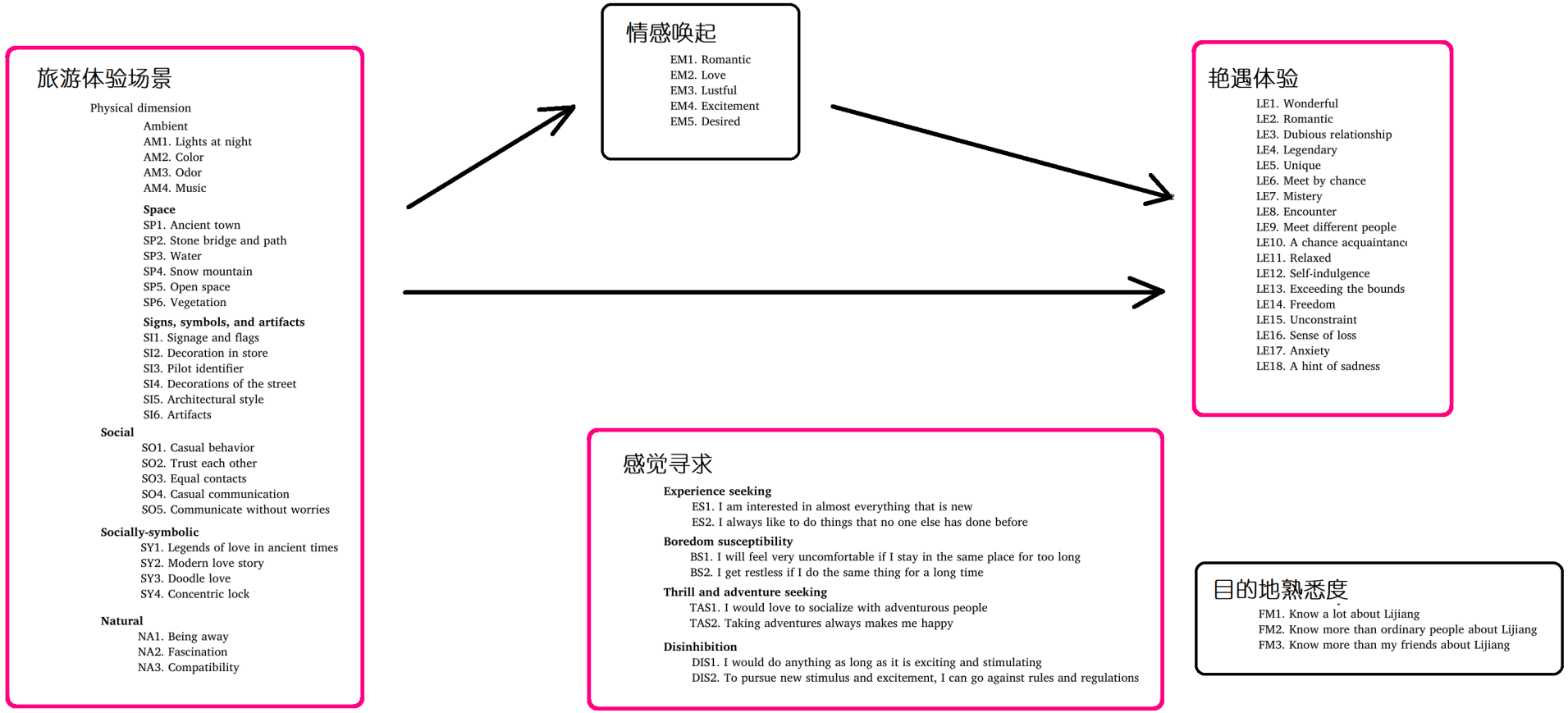
目的地熟悉度

FM1. Know a lot about Lijiang
FM2. Know more than ordinary people about Lijiang
FM3. Know more than my friends about Lijiang

结构方程模型，这是作者的期望



结构方程模型，但降维是第一关



旅游体验场景

Physical dimension

- Ambient
  - AM1. Lights at night
  - AM2. Color
  - AM3. Odor
  - AM4. Music
- **Space**
  - SP1. Ancient town
  - SP2. Stone bridge and path
  - SP3. Water
  - SP4. Snow mountain
  - SP5. Open space
  - SP6. Vegetation
- **Signs, symbols, and artifacts**
  - SI1. Signage and flags
  - SI2. Decoration in store
  - SI3. Pilot identifier
  - SI4. Decorations of the street
  - SI5. Architectural style
  - SI6. Artifacts

Social

- SO1. Casual behavior
- SO2. Trust each other
- SO3. Equal contacts
- SO4. Casual communication
- SO5. Communicate without worries

Socially-symbolic

- SY1. Legends of love in ancient times
- SY2. Modern love story
- SY3. Doodle love
- SY4. Concentric lock

Natural

- NA1. Being away
- NA2. Fascination
- NA3. Compatibility

旅游体验场景

物理维度	Ambient	AM1. Lights at night AM2. Color AM3. Odor AM4. Music
	Space	SP1. Ancient town SP2. Stone bridge and path SP3. Water SP4. Snow mountain SP5. Open space SP6. Vegetation
	Signs,	SI1. Signage and flags SI2. Decoration in store SI3. Pilot identifier SI4. Decorations of the street SI5. Architectural style SI6. Artifacts
社会维度		SO1. Casual behavior SO2. Trust each other SO3. Equal contacts SO4. Casual communication SO5. Communicate without worries
社会符号		SY1. Legends of love in ancient times SY2. Modern love story SY3. Doodle love SY4. Concentric lock
自然维度		NA1. Being away NA2. Fascination NA3. Compatibility

旅游体验场景

物理维度	Ambient	AM1. Lights at night AM2. Color AM3. Odor AM4. Music
	Space	SP1. Ancient town SP2. Stone bridge and path SP3. Water SP4. Snow mountain SP5. Open space SP6. Vegetation
	Signs,	SI1. Signage and flags SI2. Decoration in store SI3. Pilot identifier SI4. Decorations of the street SI5. Architectural style SI6. Artifacts
社会维度		SO1. Casual behavior SO2. Trust each other SO3. Equal contacts SO4. Casual communication SO5. Communicate without worries
社会符号		SY1. Legends of love in ancient times SY2. Modern love story SY3. Doodle love SY4. Concentric lock
自然维度		NA1. Being away NA2. Fascination NA3. Compatibility

```
library(lavaan)

model <- '
 # first order construct
   Ambient  =~ Ambient1 + Ambient2 + Ambient3 + Ambient4
   Space    =~ Space1 + Space2 + Space3 + Space4 + Space5 + Space6
   Signs    =~ Signs1 + Signs2 + Signs3 + Signs4 + Signs5 + Signs6

   Social_tourscape    =~ Social1 + Social2 + Social3 + Social4 + Social5
   Symbolic_tourscape  =~ Symbol1 + Symbol2 + Symbol3
   Natural_tourscape   =~ Nature1 + Nature2 + Nature3

 # second order construct
   Physical_tourscape  =~ Ambient + Space + Signs
'

fit_cfa2 <- cfa(model, data = rawdf)
```

Table 2

Table 2
CFA results of tourscape.

Variables/items	Loading	CR	AVE
Physical tourscape		0.884	0.718
Ambient	0.862		
Space	0.876		
Sign	0.802		
Social tourscape		**0.835**	**0.507**
SO1. Casual behavior	0.529		
SO2. Trust each other	0.802		
SO3. Equal contacts	0.774		
SO4. Casual communication	0.730		
SO5. Communicate without worries	0.693		
Socially symbolic tourscape		**0.768**	**0.531**
SY1. Legends of love in ancient times	0.719		
SY2. Modern love story	0.853		
SY3. Doodle love	0.589		
Natural tourscape		**0.805**	**0.580**
NA1. Being away	0.690		
NA2. Fascination	0.830		
NA3. Compatibility	0.758		

完整代码

https://github.com/perlatex/replicate_paper_yanyu_in_tourism

感谢 R 和 Stan 语言之美!

本幻灯片由 R 包 **xaringan** 和 **flipbookr** 生成