Starting at the beginning

- Data preparation
  - Mx expects 1 line per case/family
  - Almost limitless number of families and variables
  - Space delimited is best
  - Can use a missing code ie -9 or can use the default ‘.’
Important structural stuff
(As I was going to St Ives ...)

- Script is composed of one or more jobs
  (can handle many 'nested' jobs in one script or 2 non nested jobs)
- Each job is composed of one or more groups
  - Each group is 'opened' with a title
  - Each group is 'closed' with an end statement
  - You must tell Mx how many groups will be in the job
A bit about groups

3 types of groups
  • Calculation
  • Data
    • If analysing raw data Mx expects a Means Model and a Covariance Model
  • Constraint
Matrices: the building blocks

- Many types
- Denoted by a single letter
  - Elements defined by letter and 3 numbers
    - A 1 2 1 = A matrix group 1 row 2 column 1
- All constants and estimated parameters must be placed in a matrix & Mx must be told what type of matrix it is
- Letters can be reused in subsequent groups
Short cuts

- Anything after `!` is read as a comment
- Can redefine frequently used/changed parameters
  - `#define nvar=2`
- Can read in another file within the script
  - `#include starting_values.txt`
- Can run loops – via the repeat command
- Use an end of line signal (`;` or `/`) except in the Labels command
Setting up the script – calculation group

- 1st line is the title
- 2nd specifies group type
- Matrix definition
  - Begin Matrices – End Matrices
  - If a matrix is not specified free it will be considered fixed
- Algebra
  - Begin Algebra – End Algebra
- Starting values for free/estimated parameters or specified values for constants
- End
Setting up the script – data group

- 1\textsuperscript{st} line is the title
- 2\textsuperscript{nd} specifies group type and number of variables
- 3\textsuperscript{rd} line gives data location
  - Rectangular file = continuous data
  - Ordinal file = ordinal data (Mx will expect a thresholds model not a means model)
- List the variables
- Select if …
- Select variables
  - Order is important! Select all vs for twin1 then twin2 then sib1 ect
- Specify which vs are covariates (definition variables)
Setting up the script – data group

- **Matrix definition**
  - Call matrices from previous groups and/or define new matrices
- **Algebra & starting values**
- **Means Model**
  - can include covariates ie age, sex …
- **Covariance Model**
  - Expected to be nsib*nvar by nsib*nvar
- **End**
Variance/covariance matrices

**MZ**

<table>
<thead>
<tr>
<th></th>
<th>t1</th>
<th>t2</th>
</tr>
</thead>
<tbody>
<tr>
<td>t1</td>
<td>$a^2+c^2+e^2$</td>
<td>$a^2+c^2$</td>
</tr>
<tr>
<td>t2</td>
<td>$a^2+c^2$</td>
<td>$a^2+c^2+e^2$</td>
</tr>
</tbody>
</table>

**DZ**

<table>
<thead>
<tr>
<th></th>
<th>t1</th>
<th>t2</th>
</tr>
</thead>
<tbody>
<tr>
<td>t1</td>
<td>$a^2+c^2+e^2$</td>
<td>0.5$a^2+c^2$</td>
</tr>
<tr>
<td>t2</td>
<td>0.5$a^2+c^2$</td>
<td>$a^2+c^2+e^2$</td>
</tr>
</tbody>
</table>
So what do you get

- Mx starts by reading back the script

```
** Mx start up successful **

**MX-PC 1.54** Job started on 03/08/05 at 16:45:51
! SCRIPT NAME : example_ace.mx (dp)
! GOAL : To calculate variance components
! DATA : continuous
! INPUT : raw data
! UNI/BI/MULTI : uni
! DATA-GROUPS : M2M D2M M2F D2F DOSMF DOSFM
! MEANS MODEL : grand mean, sex effect

The following Mx script lines were read for group 1

#DEFINE NVAR 1
! Mx reads 1. This corresponds to one phenotype to be analysed

#DEFINE NDEF 1 !Number of covariates (age and sex in this script)
#DEFINE NSIB 2 !Tells Mx the size of the largest sibship
G1: calculation group
DATA CALC NGROUPS=3
```
So what do you get

- Data summary

<table>
<thead>
<tr>
<th></th>
<th>SEX2</th>
<th>SEX1</th>
<th>TWIN1</th>
<th>TWIN2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Code</strong></td>
<td>-2.0000</td>
<td>-1.0000</td>
<td>1.0000</td>
<td>2.0000</td>
</tr>
<tr>
<td><strong>Number</strong></td>
<td>100.0000</td>
<td>100.0000</td>
<td>100.0000</td>
<td>100.0000</td>
</tr>
<tr>
<td><strong>Mean</strong></td>
<td>0.5000</td>
<td>0.5000</td>
<td>0.4696</td>
<td>0.5929</td>
</tr>
<tr>
<td><strong>Variance</strong></td>
<td>0.2500</td>
<td>0.2500</td>
<td>10.0539</td>
<td>7.6557</td>
</tr>
<tr>
<td><strong>Minimum</strong></td>
<td>0.0000</td>
<td>0.0000</td>
<td>-8.6900</td>
<td>-6.5100</td>
</tr>
<tr>
<td><strong>Maximum</strong></td>
<td>1.0000</td>
<td>1.0000</td>
<td>5.9600</td>
<td>7.1800</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>SEX2</th>
<th>SEX1</th>
<th>TWIN1</th>
<th>TWIN2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Code</strong></td>
<td>-2.0000</td>
<td>-1.0000</td>
<td>1.0000</td>
<td>2.0000</td>
</tr>
<tr>
<td><strong>Number</strong></td>
<td>150.0000</td>
<td>150.0000</td>
<td>150.0000</td>
<td>150.0000</td>
</tr>
<tr>
<td><strong>Mean</strong></td>
<td>0.5267</td>
<td>0.4933</td>
<td>0.2276</td>
<td>-0.0323</td>
</tr>
<tr>
<td><strong>Variance</strong></td>
<td>0.2493</td>
<td>0.2500</td>
<td>9.0769</td>
<td>8.6139</td>
</tr>
<tr>
<td><strong>Minimum</strong></td>
<td>0.0000</td>
<td>0.0000</td>
<td>-10.1800</td>
<td>-5.9100</td>
</tr>
<tr>
<td><strong>Maximum</strong></td>
<td>1.0000</td>
<td>1.0000</td>
<td>7.4500</td>
<td>7.6300</td>
</tr>
</tbody>
</table>
So what do you get

- Parameter specifications

<table>
<thead>
<tr>
<th>MATRIX</th>
<th>Description</th>
<th>Order</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>This is a computed FULL matrix of order</td>
<td>1 by 1</td>
</tr>
<tr>
<td>C</td>
<td>This is a computed FULL matrix of order</td>
<td>1 by 1</td>
</tr>
<tr>
<td>E</td>
<td>This is a computed FULL matrix of order</td>
<td>1 by 1</td>
</tr>
<tr>
<td>G</td>
<td>This is a FULL matrix of order</td>
<td>1 by 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 4 5</td>
</tr>
<tr>
<td>H</td>
<td>This is a FULL matrix of order</td>
<td>1 by 1</td>
</tr>
<tr>
<td>P</td>
<td>This is a FULL matrix of order</td>
<td>1 by 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 6</td>
</tr>
</tbody>
</table>
So what do you get

- Estimates

```
MX PARAMETER ESTIMATES

GROUP NUMBER: 1

G1: calculation group

MATRIX A
This is a computed FULL matrix of order 1 by 1
[=X*X']

1 1 4.9765

1 1 2.2310

MATRIX E
This is a computed FULL matrix of order 1 by 1
[=Z*Z']

1 1 1.6885
```
So what do you get

- **Warnings & Fit information**

  *** WARNING! ***
  Minimization may not be successful. See above
  CODE GREEN - it probably was OK

  Your model has 6 estimated parameters and 500 Observed statistics

  $-2 \times \text{log-likelihood of data} \gggg 2355.338$
  Degrees of freedom $\gggg 494$

  This problem used 0.0\% of my workspace

<table>
<thead>
<tr>
<th>Task</th>
<th>Time elapsed (DD:HH:MM:SS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading script &amp; data</td>
<td>0: 0: 0: 1.61</td>
</tr>
<tr>
<td>Execution</td>
<td>0: 0: 0: -1.10</td>
</tr>
<tr>
<td>TOTAL</td>
<td>0: 0: 0: 0.51</td>
</tr>
</tbody>
</table>
Testing for significance

- Drop the parameter(s) from the model or equate parameters using the multiple job option
  - Specify the matrix elements you wish to drop/equate
    - Drop A 1 1 1
    - EQ A 1 1 1 B 1 1 1
    - Compare the fit of the two models
Variance/covariance matrices

**MZ**

<table>
<thead>
<tr>
<th>t1</th>
<th>t2</th>
</tr>
</thead>
<tbody>
<tr>
<td>t1</td>
<td>(a^2+c^2+e^2)</td>
</tr>
<tr>
<td>t2</td>
<td>(a^2+c^2)</td>
</tr>
</tbody>
</table>

**DZ**

<table>
<thead>
<tr>
<th>t1</th>
<th>t2</th>
</tr>
</thead>
<tbody>
<tr>
<td>t1</td>
<td>(a^2+c^2+e^2)</td>
</tr>
<tr>
<td>t2</td>
<td>(0.5a^2+c^2)</td>
</tr>
</tbody>
</table>
Exercise 1

- Save the full ACE model
  - save name.mxs
- Drop C
- Retrieve the full model
  - get name.mxs
- Drop A
- Drop C
- Record standardised VC and fit function
Questions

- Can you drop A?
- Can you drop C?
- Can you drop E from a model?

- How would you test to see if the means were equal for twin1 and twin2?
- How would you test to see if there was a significant effect of sex on the means?
Exercise 2: Adding a constraint group

What will this do?

```plaintext
G4: Constraint Group for G1
Constraint
Begin Matrices;
A Computed nvar nvar = A1
C Computed nvar nvar = C1
E Computed nvar nvar = E1
I Unit 1 nvar
End matrices;
Begin algebra;
P=A+C+E;
End algebra;
Constrain \(d2v(P)=I\);
End
```
Exercise 2: Adding siblings
General Advice/Problem solving

- Scripting styles differ
- Check the parameter numbers
- Check the sample description
- Learn to love the manual
- Comments are your friends
Time for coffee