

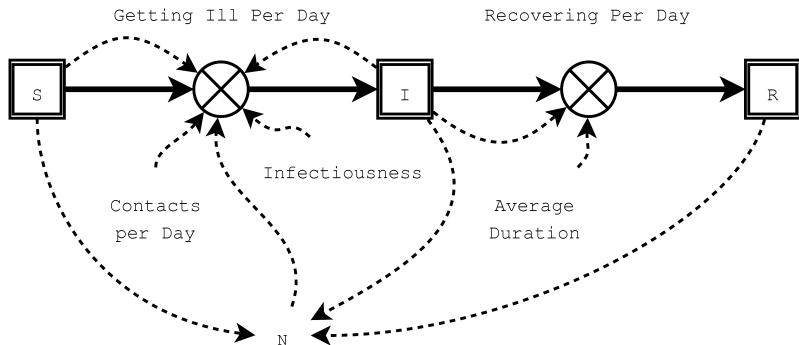
System Dynamics for Cheapskates

Bill Harris

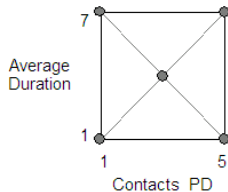
Facilitated Systems

Evaluation 2006

An SIR “Model”



Define the Experiments



Scenario	Contacts_PD	Average_Duration
Base	3.0	4.0
Safe	1.0	1.0
Scary	5.0	7.0
Short & nasty	5.0	1.0
Long & mild	1.0	7.0

```
Simulation { # Base
Contacts_PD = 3.0;
Average_Duration = 4.0;
PrintStep(1,0.0,200.0,1.0);
PrintStep(Getting_III_PD,0.0,200.0,1.0);
}
```

```
Simulation { # Safe
Contacts_PD = 1.0;
Average_Duration = 1.0;
PrintStep(1,0.0,200.0,1.0);
PrintStep(Getting_III_PD,0.0,200.0,1.0);
}
```

⋮

The Simulation File: `sir.test01.in`

```
Integrate (Lsodes,1.0e-6,1.0e-6,0);  
OutputFile ("sir.test01.out");  
StartTime (0.0);
```

```
Initial_S = 9999.0;  
Infectiousness = 0.25;
```

```
Simulation { # Base  
Contacts_PD = 3.0;  
Average_Duration = 4.0;  
PrintStep (I,0.0,200.0,1.0);  
PrintStep (Getting_Ill_PD,0.0,200.0,1.0);  
}
```

```
Simulation { # Safe  
Contacts_PD = 1.0;  
Average_Duration = 1.0;  
PrintStep (I,0.0,200.0,1.0);  
PrintStep (Getting_Ill_PD,0.0,200.0,1.0);  
}
```

```
Simulation { # Scary  
Contacts_PD = 5.0;  
Average_Duration = 7.0;  
PrintStep (I,0.0,200.0,1.0);  
PrintStep (Getting_Ill_PD,0.0,200.0,1.0);  
}
```

```
Simulation { # Short and nasty  
Contacts_PD = 5.0;  
Average_Duration = 1.0;  
PrintStep (I,0.0,200.0,1.0);  
PrintStep (Getting_Ill_PD,0.0,200.0,1.0);  
}
```

```
Simulation { # Long and mild  
Contacts_PD = 1.0;  
Average_Duration = 7.0;  
PrintStep (I,0.0,200.0,1.0);  
PrintStep (Getting_Ill_PD,0.0,200.0,1.0);  
}
```

Run the Model

```
$ time makemcsims sir.model
```

Mod – Model Generator Program v5.0.0

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MCSim comes with ABSOLUTELY NO WARRANTY;
This is free software, and you are welco...
under certain conditions; see the GNU Ge...

* Created model file 'model.c'
Linking mcsimstd.sir ...
* Created: standalone mcsimstd.sir for m...

rm: cannot remove 'model.c': No such fil...

```
real    0m39.554s
user    0m22.416s
sys     0m6.950s
```

```
$ time ./mcsimstd.sir sir.test01.in
```

MCSim v5.0.0

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* Using 'sir.model' model in file "model...

Reading experiment 1.
Reading experiment 2.

Doing analysis – 2 normal experiments

```
1
2
Wrote output file "sir.test01.out"
```

```
real    0m0.259s
user    0m0.070s
sys     0m0.130s
```

Simple Graphs With J

```
datalength =: 201
dataset    =: 5 NB. Count from 1
variableno =: 1
NB. Count from 1, ignoring Time

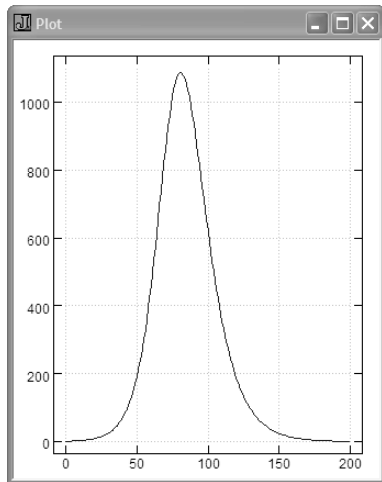
NB. Leave the following code alone.
NB. Type pd commands to add labels and titles .

require 'convert csv plot'

datasetindex=:3+(dataset-1)*datalength+5
headerindex  =: datasetindex - 1
datapick=:>@:,&((datasetindex+i.datalength)&{)
data =: 0 & ". @: detab"1

d=: readcsv fselect ''

plot (0&{"1;variableno&{"1) data @: datapick d
```



A Model Example
Thoughts on Process
The Software
More Value
Summary

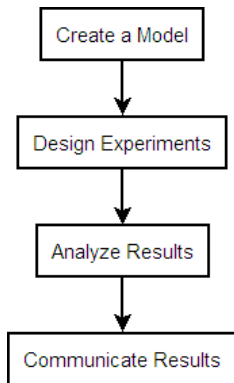
A Model Diagram
Design Experiments
Analyze Results
Communicate Results

Questions and Answers



A Better Process Model

- Matched process and system
- Modular software
- More powerful analysis
- Fewer numerical analysis concerns



A Better Business Model



OSS



- Models in text
- Linux, OS X, Windows
- Zero cost
- Open source

Questions and Answers



gcc, Command Shell

Windows: `http://cygwin.com/`

- Base
- gcc, gcc-core, gcc-g++
- binutils, make
- gsl, gsl-apps, gsl-devel, gsl-doc
- man, texinfo





Mac OS X: `http://fink.sourceforge.net/`

Linux: `apt-get ...`

MCSim

- 1 <http://freedomatic.free.fr/>
- 2 GPL
- 3 MCSim-v5.1.beta.tar.gz or later
- 4 MCSim User's Manual (3. Installation)

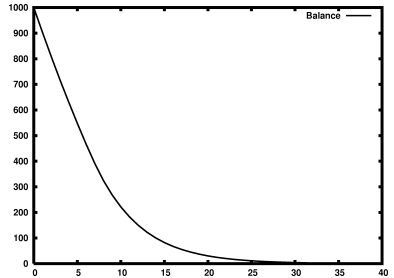
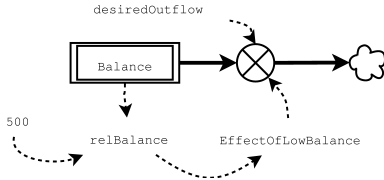
For Further Reading

-  F. Bois and D. Maszle.
MCSim: A Monte Carlo Simulation Program.
-  D. Dörner.
The Logic of Failure.
Perseus Publishing, 1996.
-  J. Sterman.
Business Dynamics.
McGraw-Hill/Irwin, 2000.
-  Facilitated Systems.
System Dynamics with MCSim:
A Facilitated Systems Quick Reference

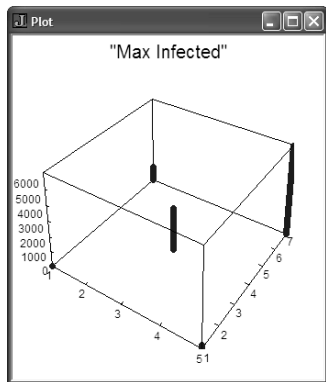
Questions and Answers



Nonlinearities



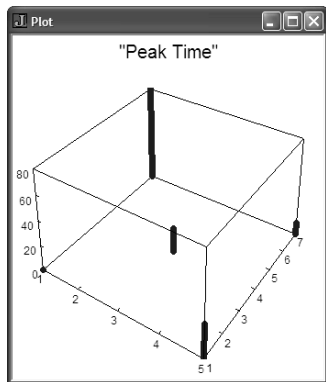
Stick Plot



- Peak infection in 5 experiments

```
cpd =: 3 1 5 5 1  
ad =: 4 1 7 1 7  
'stick;title "Max Infected"; pensize 7' plot cpd;ad;(max"1) 1& {"1 D
```

Stick Plot



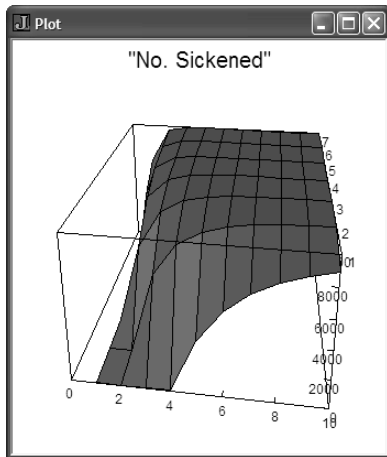
- Time of peak infection in 5 experiments

```
cpd =: 3 1 5 5 1
```

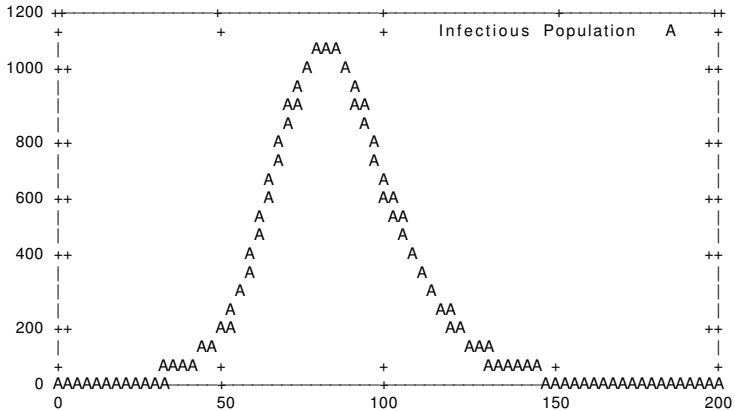
```
ad =: 4 1 7 1 7
```

```
'stick; pensize 7; title "Peak Time"' plot cpd;ad;({."1(<<1){d}{~}(i."1 0)(max"1))1&{"1 d=.D
```

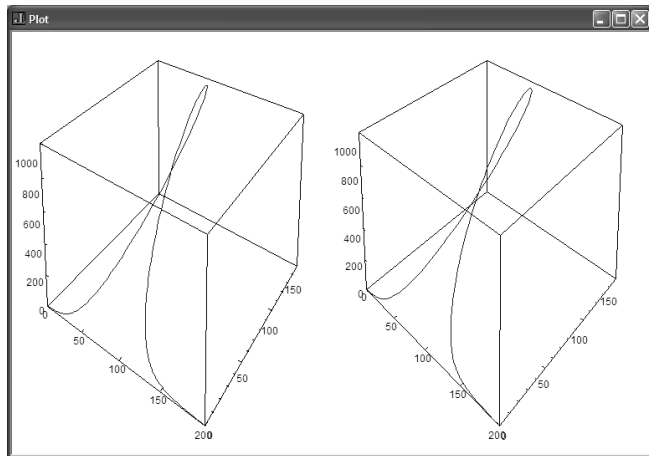
Surface Plot



Text Plot



Stereograms



Questions and Answers



Summary

- MCSim can help you.
- You can do it.

Thank you for attending!

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