

Reproducible Research Demo

OHSU Center for Health Systems Effectiveness

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Last update by Stephanie Renfro (renfst@ohsu.edu) on 2015-07-22 11:47:02 using R version 3.1.2 (2014-10-31).

Purpose

This work was inspired by the following email from Farmer Ben.

From: Ben Chan
Sent: Thursday, June 11, 2015 4:04 PM
To: Stephanie Renfro
Subject: What to feed chicks

Hello,

I'm receiving 20 baby chicks next month. Can you help me decide what to feed them?

I'm choosing between the following four diets:

1. Grower diet
2. Layer diet
3. Breeder diet
4. High cluckage diet

Thanks,
Ben

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Preliminaries

Start clock to calculate total runtime.

```
start_program <- proc.time()
```

Load needed packages:

- *data.table* - for faster processing
- *knitr* - for better table display (“kable” function)
- *ggplot2* - for pretty plots

```
packages <- c("data.table", "knitr", "ggplot2")
sapply(packages, require, character.only=TRUE, quietly=TRUE)
```

```
## data.table      knitr      ggplot2
##      TRUE      TRUE      TRUE
```

Define the CHSE color palette function.

```
colorPalette <- function () {
  c(rgb( 1,  67, 134, maxColorValue=255),
    rgb(119, 120, 123, maxColorValue=255),
    rgb(139, 184, 234, maxColorValue=255),
    rgb(188, 190, 192, maxColorValue=255),
    rgb( 94, 122, 162, maxColorValue=255),
    rgb(223, 122,  28, maxColorValue=255))
}
```

Prepare Data

This demo uses [data from an experiment on the effect of diet on early growth of chicks](#), `ChickWeight`, which comes pre-loaded in any R session.

Let’s take a look at the first few rows:

```
head(ChickWeight)
```

```
##   weight Time Chick Diet
## 1     42   0     1     1
## 2     51   2     1     1
## 3     59   4     1     1
## 4     64   6     1     1
## 5     76   8     1     1
## 6     93  10     1     1
```

Let’s also print a summary of the data.

Note, by specifying the option “echo = FALSE”, the resulting output will display, but not the code that generated it.

```
##      weight      Time      Chick      Diet
## Min.   : 35.0   Min.   : 0.00   13      : 12   1:220
## 1st Qu.: 63.0   1st Qu.: 4.00    9       : 12   2:120
## Median :103.0   Median :10.00   20      : 12   3:120
## Mean   :121.8   Mean    :10.72   10      : 12   4:118
## 3rd Qu.:163.8   3rd Qu.:16.00   17      : 12
## Max.   :373.0   Max.    :21.00   19      : 12
##                                     (Other):506
```

Convert to data.table for faster processing.

```
ChickWeight <- data.table(ChickWeight)
```

Create a table showing mean weight at times 0, 10, and 21 days, for each of the four diet types.

```
mean_ChickWeight <- ChickWeight[Time %in% c(0,10,21),
                                list(mean_weight = round(mean(weight), digits=1)),
                                by = list(Diet,Time)]

kable(mean_ChickWeight)
```

Diet	Time	mean_weight
1	0	41.4
1	10	93.1
1	21	177.8
2	0	40.7
2	10	108.5
2	21	214.7
3	0	40.8
3	10	117.1
3	21	270.3
4	0	41.0
4	10	126.0
4	21	238.6

Create a character variable for diet. Use this variable for plotting small multiples.

```
ChickWeight[, dietChr := sprintf("Diet %d", Diet)]
```

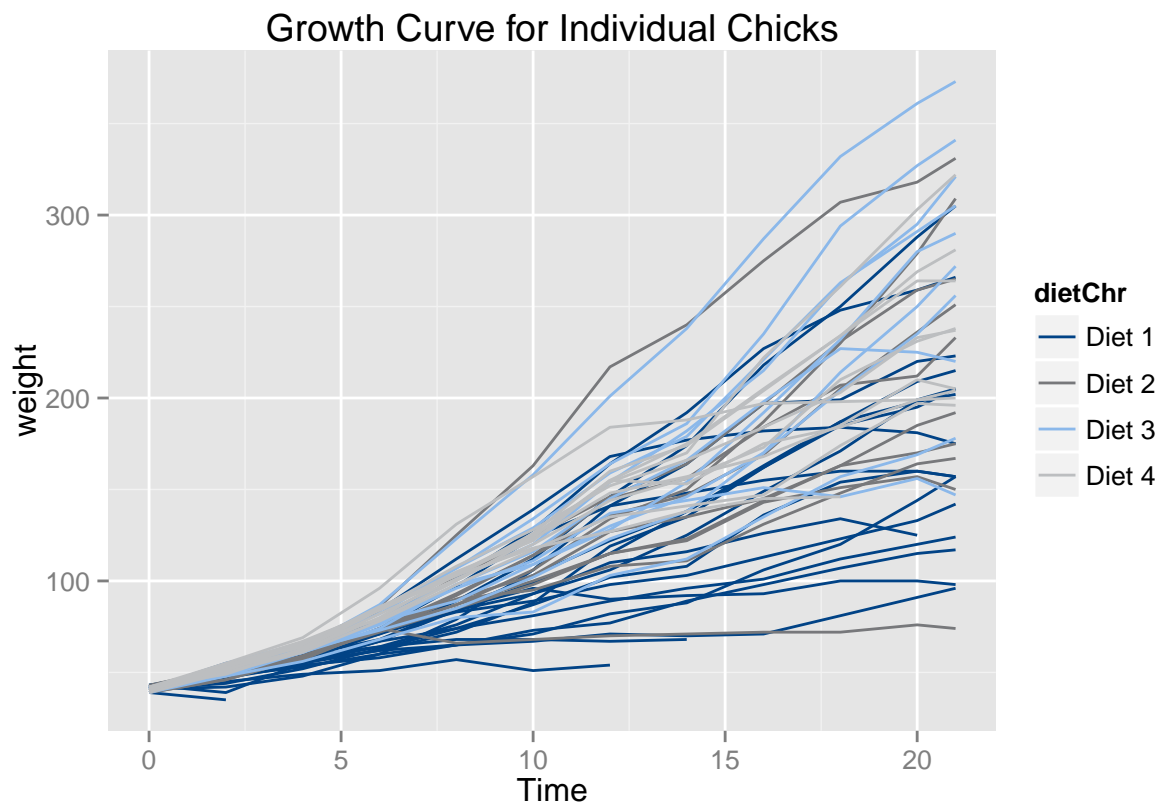
```
##      weight Time Chick Diet dietChr
## 1:      42    0     1    1 Diet 1
## 2:      51    2     1    1 Diet 1
## 3:      59    4     1    1 Diet 1
## 4:      64    6     1    1 Diet 1
## 5:      76    8     1    1 Diet 1
## ---
## 574:    175   14    50    4 Diet 4
## 575:    205   16    50    4 Diet 4
## 576:    234   18    50    4 Diet 4
## 577:    264   20    50    4 Diet 4
## 578:    264   21    50    4 Diet 4
```

Growth for Individual Chicks

The following plot illustrates the growth curve for individual chicks from 0 to 21 days.

Colors represent the four diets.

```
ggplot() +  
  geom_line(data=ChickWeight, aes(x=Time, y=weight, color=dietChr, group=Chick)) +  
  scale_color_manual(values=colorPalette()) +  
  ggtitle("Growth Curve for Individual Chicks")
```

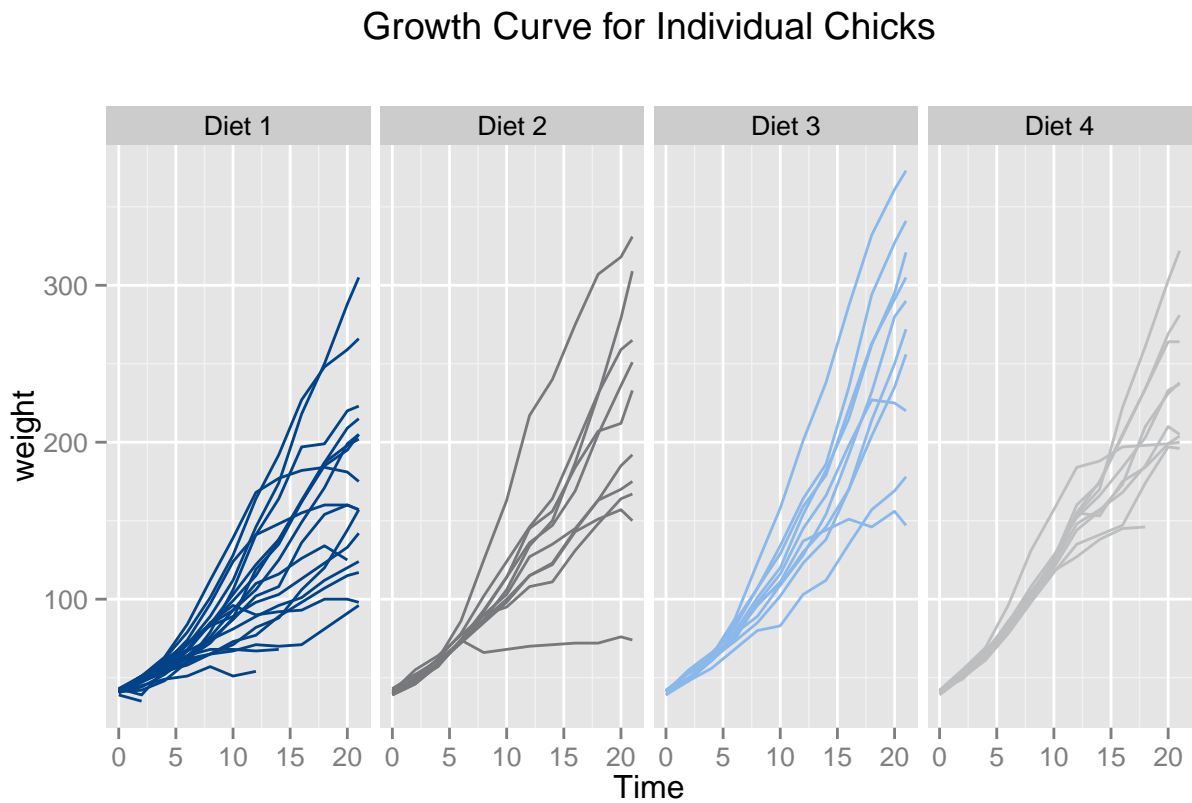


From this plot, it is difficult to distinguish between the performance of the four diets.

Individual growth curves

Plot individual chick growth curves using small multiples.

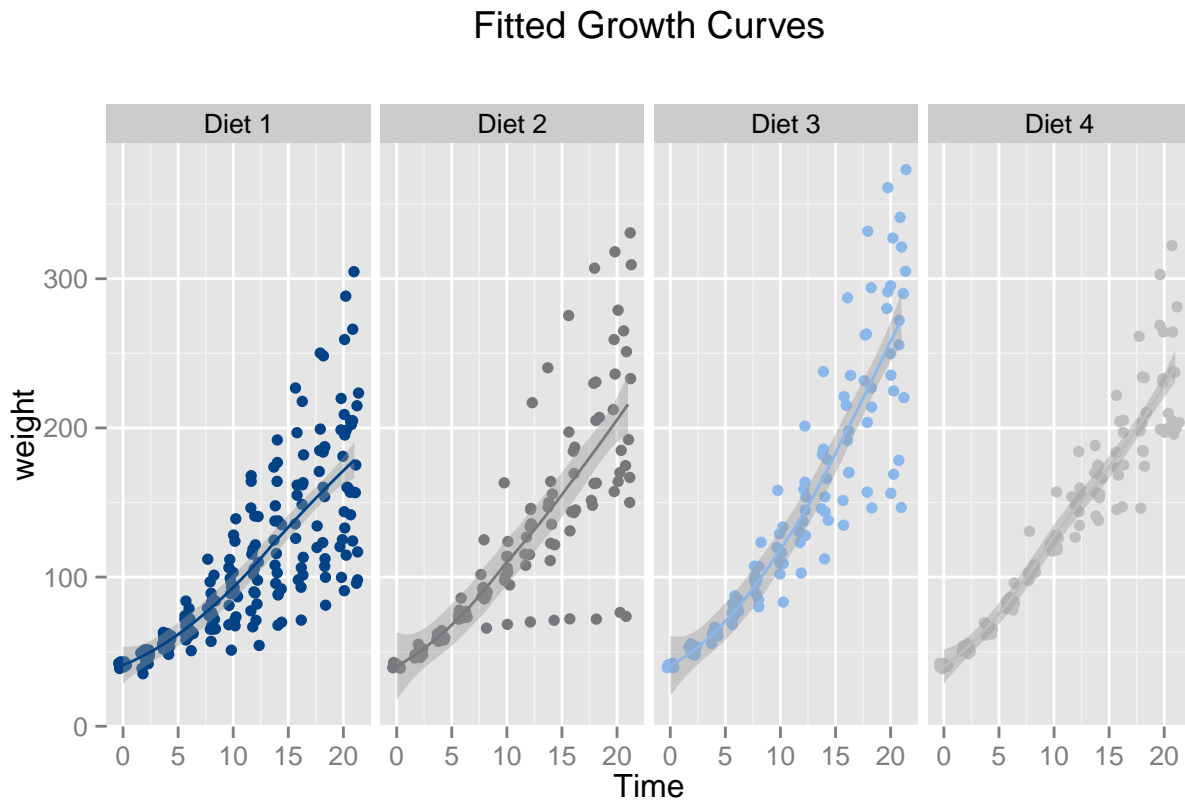
```
ggplot() +  
  geom_line(data=ChickWeight, aes(x=Time, y=weight, color=dietChr, group=Chick)) +  
  facet_wrap(~ dietChr, nrow=1) +  
  scale_color_manual(values=colorPalette()) +  
  theme(legend.position="none") +  
  ggtitle(bquote(atop("Growth Curve for Individual Chicks")))
```



Fitted growth curves

Plot fitted growth curves using small multiples. Data points are jittered around time value.

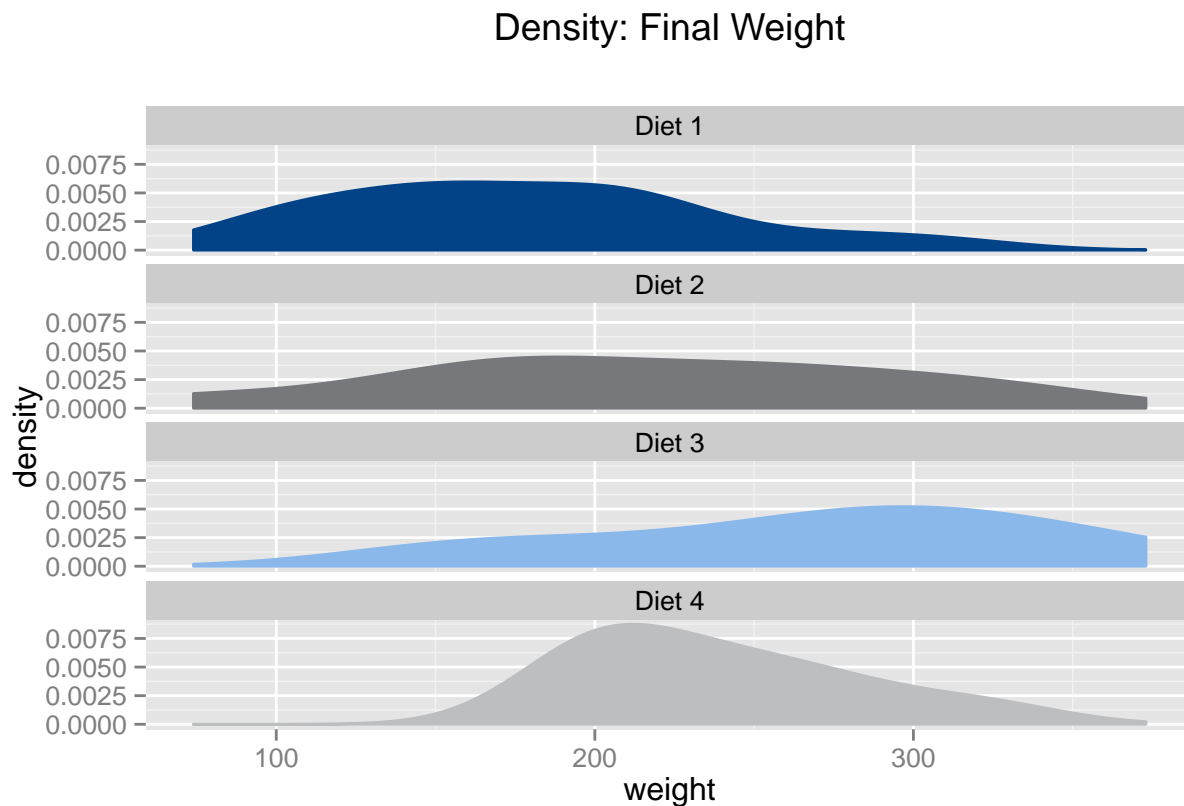
```
ggplot() +  
  geom_jitter(data=ChickWeight, aes(x=Time, y=weight, colour=dietChr)) +  
  geom_smooth(data=ChickWeight, aes(x=Time, y=weight, colour=dietChr)) +  
  facet_wrap(~ dietChr, nrow=1) +  
  scale_color_manual(values=colorPalette()) +  
  theme(legend.position="none") +  
  ggtitle(bquote(atop("Fitted Growth Curves")))
```



Final weight density

Plot densities by diet for chicks' final weights (day 21) using small multiples.

```
ggplot(ChickWeight[Time==21], aes(x=weight, colour=dietChr, fill=dietChr)) +  
  geom_density() +  
  facet_wrap(~ dietChr, nrow=4) +  
  scale_color_manual(values=colorPalette()) +  
  scale_fill_manual(values=colorPalette()) +  
  theme(legend.position="none") +  
  ggtitle(bquote(atop("Density: Final Weight")))
```



Wrap Up

Calculate total runtime and clear memory.

```
time_program <- proc.time()-start_program  
print(paste("Total runtime:", format(time_program[3]/60,digits=3), "minutes"))
```

```
## [1] "Total runtime: 0.0805 minutes"
```

```
rm(list=ls())  
invisible(gc())
```