A/B TESTING IN R

Analyzing Results

Page Piccinini
Instructor

Experiment results

```
library(tidyverse)

experiment_data <- read_csv("experiment_data.csv")
experiment_data
```

```
# A tibble: 588 x 3
   visit_date condition clicked_adopt_today
        <date>     <chr>                <int>
 1 2018-01-01   control                    0
 2 2018-01-01   control                    1
 3 2018-01-01   control                    0
 4 2018-01-01   control                    0
 5 2018-01-01      test                    0
 6 2018-01-01      test                    0
 7 2018-01-01      test                    1
 8 2018-01-01      test                    0
 9 2018-01-01      test                    0
10 2018-01-01      test                    1
# ... with 578 more rows
```

Experiment results

```
library(tidyverse)

experiment_data <- read_csv("experiment_data.csv")
experiment_data

experiment_data %>%
  group_by(condition) %>%
  summarize(conversion_rate = mean(clicked_adopt_today))
```

```
# A tibble: 2 x 2
  condition conversion_rate
      <chr>           <dbl>
1   control       0.1666667
2      test       0.3843537
```

Plotting results

```
library(tidyverse)

experiment_data <- read_csv("experiment_data.csv")
experiment_data

experiment_data %>%
  group_by(condition) %>%
  summarize(conversion_rate = mean(clicked_adopt_today))
```

Plotting results

```
library(tidyverse)

experiment_data <- read_csv("experiment_data.csv")
experiment_data

experiment_data %>%
  group_by(visit_date, condition) %>%
  summarize(conversion_rate = mean(clicked_adopt_today))
```

Plotting results

```
library(tidyverse)

experiment_data <- read_csv("experiment_data.csv")
experiment_data

experiment_data_sum <- experiment_data %>%
  group_by(visit_date, condition) %>%
  summarize(conversion_rate = mean(clicked_adopt_today))

ggplot(experiment_data_sum,
       aes(x = visit_date,
           y = conversion_rate

           )) +
  geom_point() +
  geom_line()
```

Plotting results

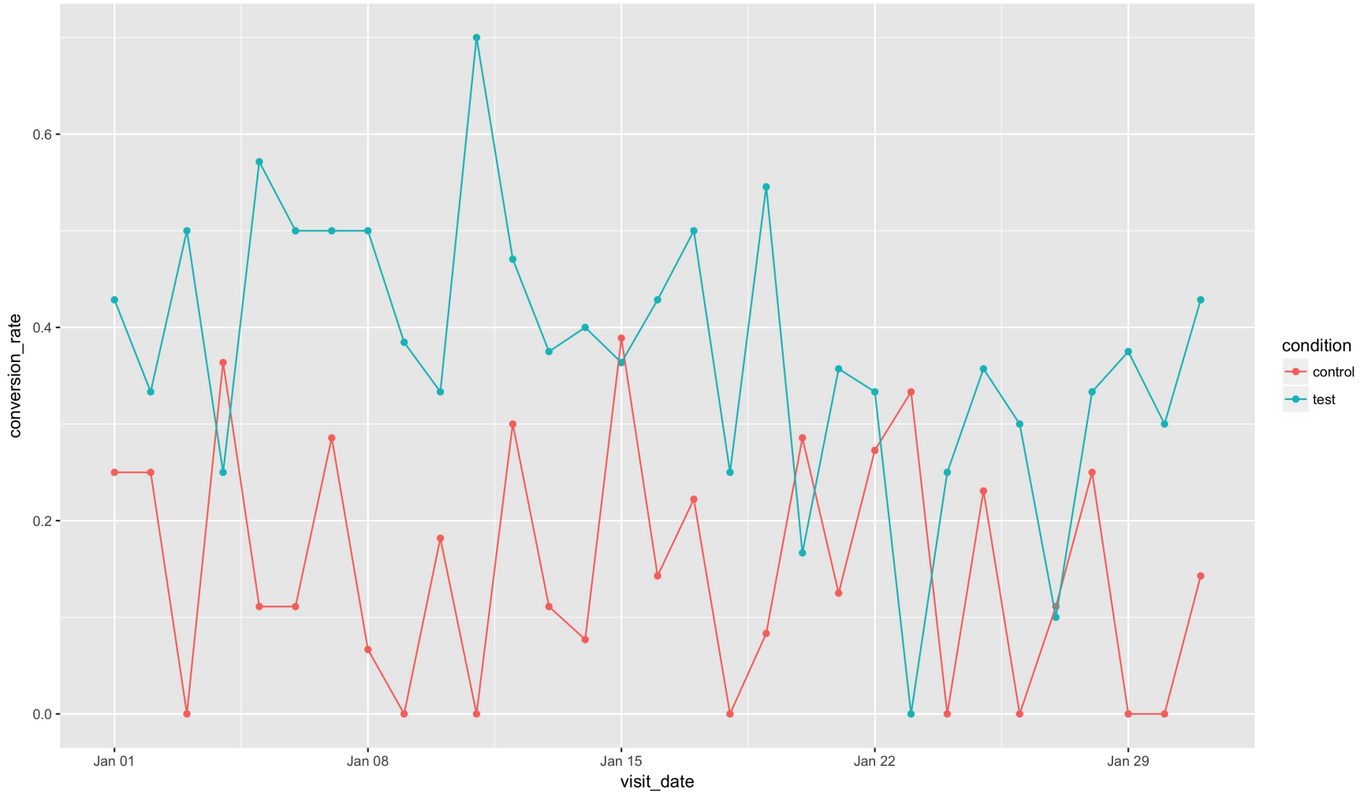
```
library(tidyverse)

experiment_data <- read_csv("experiment_data.csv")
experiment_data

experiment_data_sum <- experiment_data %>%
  group_by(visit_date, condition) %>%
  summarize(conversion_rate = mean(clicked_adopt_today))

ggplot(experiment_data_sum,
       aes(x = visit_date,
           y = conversion_rate,
           color = condition,
           group = condition)) +
  geom_point() +
  geom_line()
```

Plotting results



Analyzing results

```
library(tidyverse)
library(broom)

experiment_data <- read_csv("experiment_data.csv")

glm(                        ~

                                )
```

Analyzing results

```
library(tidyverse)
library(broom)

experiment_data <- read_csv("experiment_data.csv")

glm(clicked_adopt_today ~

                          )
```

Analyzing results

```
library(tidyverse)
library(broom)

experiment_data <- read_csv("experiment_data.csv")

glm(clicked_adopt_today ~ condition,

                          )
```

Analyzing results

```
library(tidyverse)
library(broom)

experiment_data <- read_csv("experiment_data.csv")

glm(clicked_adopt_today ~ condition,
    family = "binomial",
                        )
```

Analyzing results

```
library(tidyverse)
library(broom)

experiment_data <- read_csv("experiment_data.csv")

glm(clicked_adopt_today ~ condition,
    family = "binomial",
    data = experiment_data)
```

Analyzing results

```
library(tidyverse)
library(broom)

experiment_data <- read_csv("experiment_data.csv")

glm(clicked_adopt_today ~ condition,
    family = "binomial",
    data = experiment_data) %>%
  tidy()
```

```
            term  estimate std.error  statistic      p.value
1    (Intercept) -1.609438 0.1564922 -10.284464 8.280185e-25
2 conditiontest  1.138329 0.1971401   5.774212 7.731397e-09
```

A/B TESTING IN R

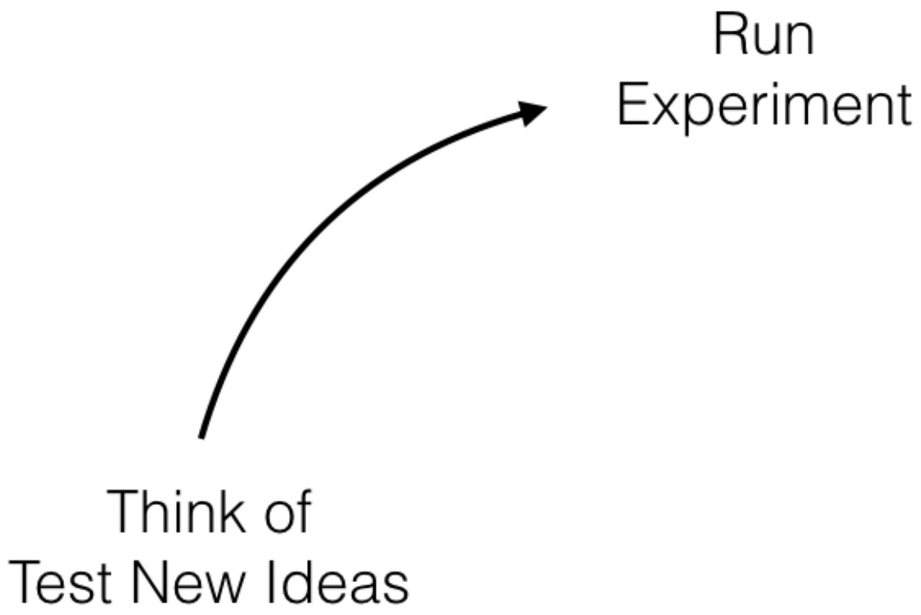
Let's practice!

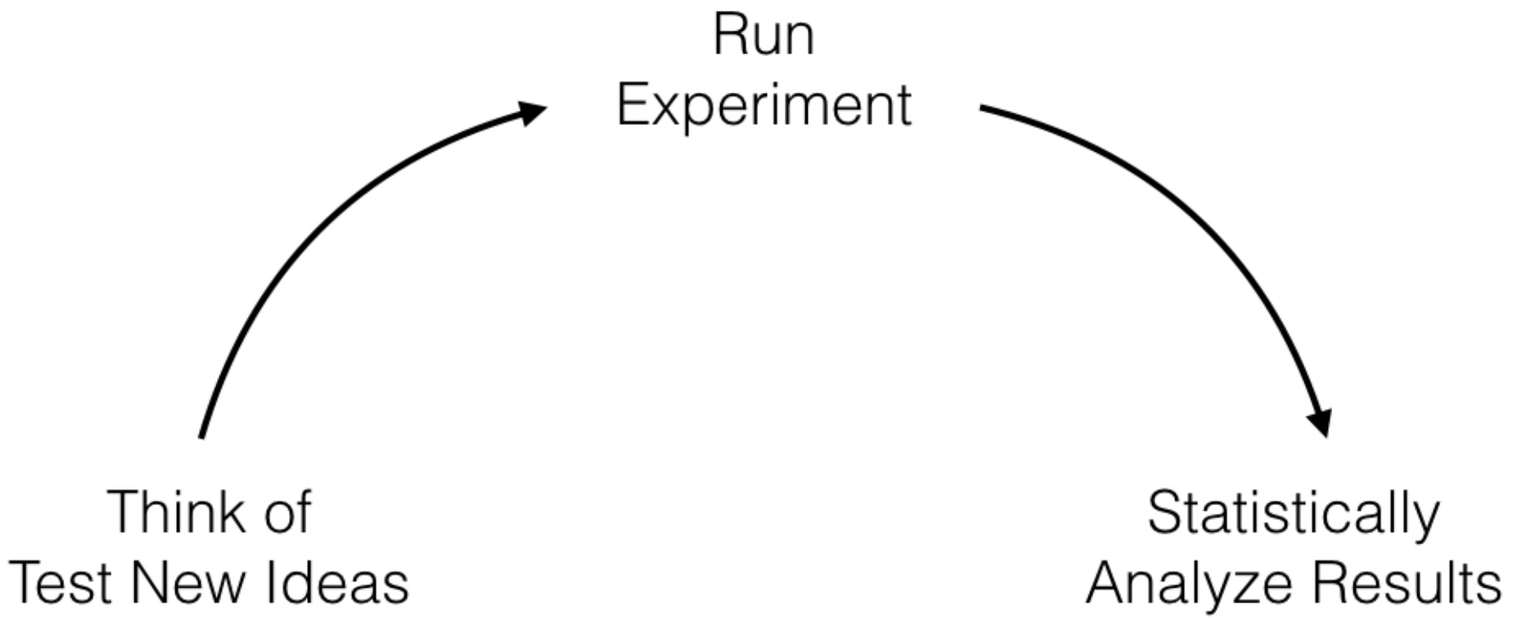
A/B TESTING IN R

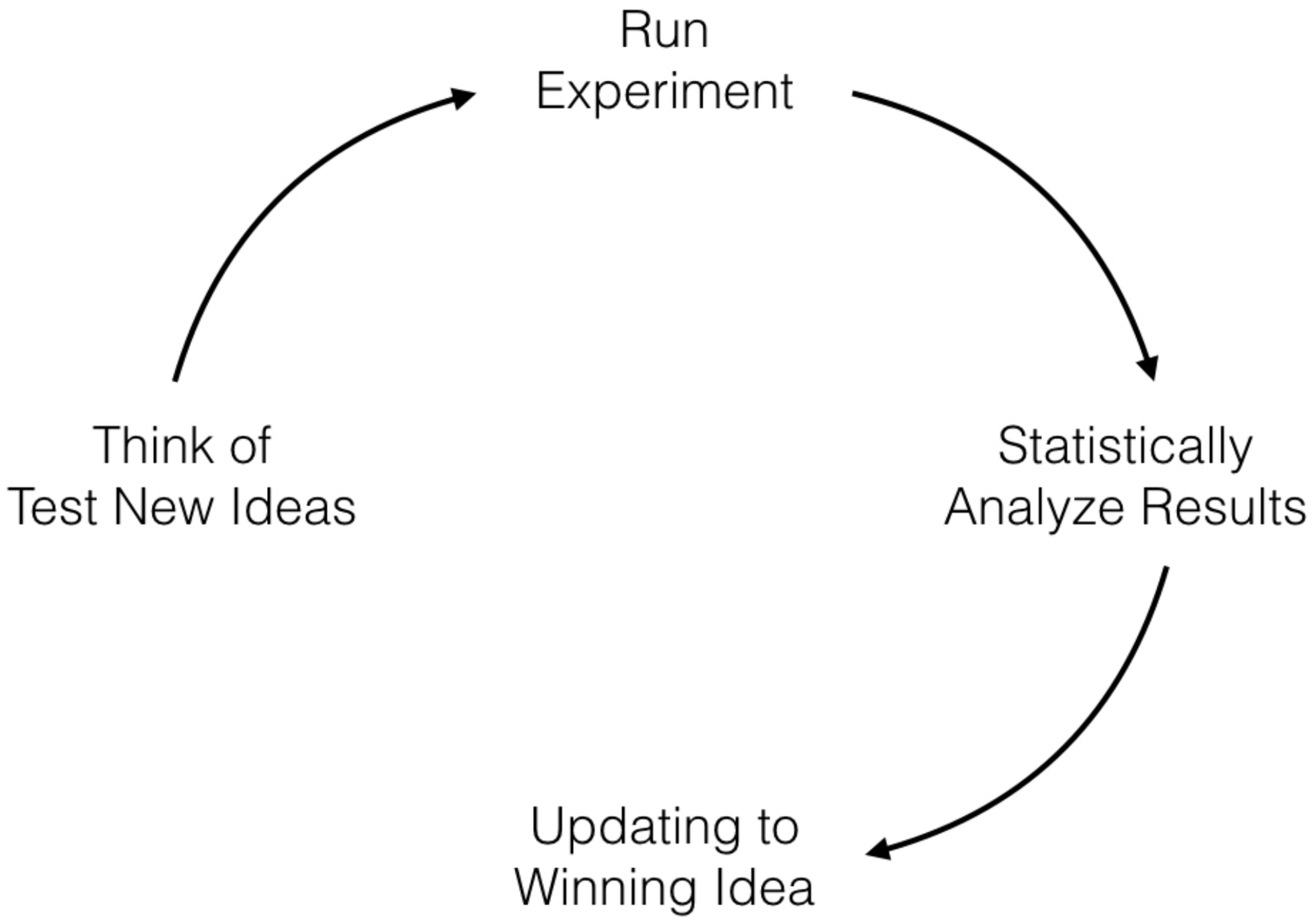
Designing Follow-up Experiments

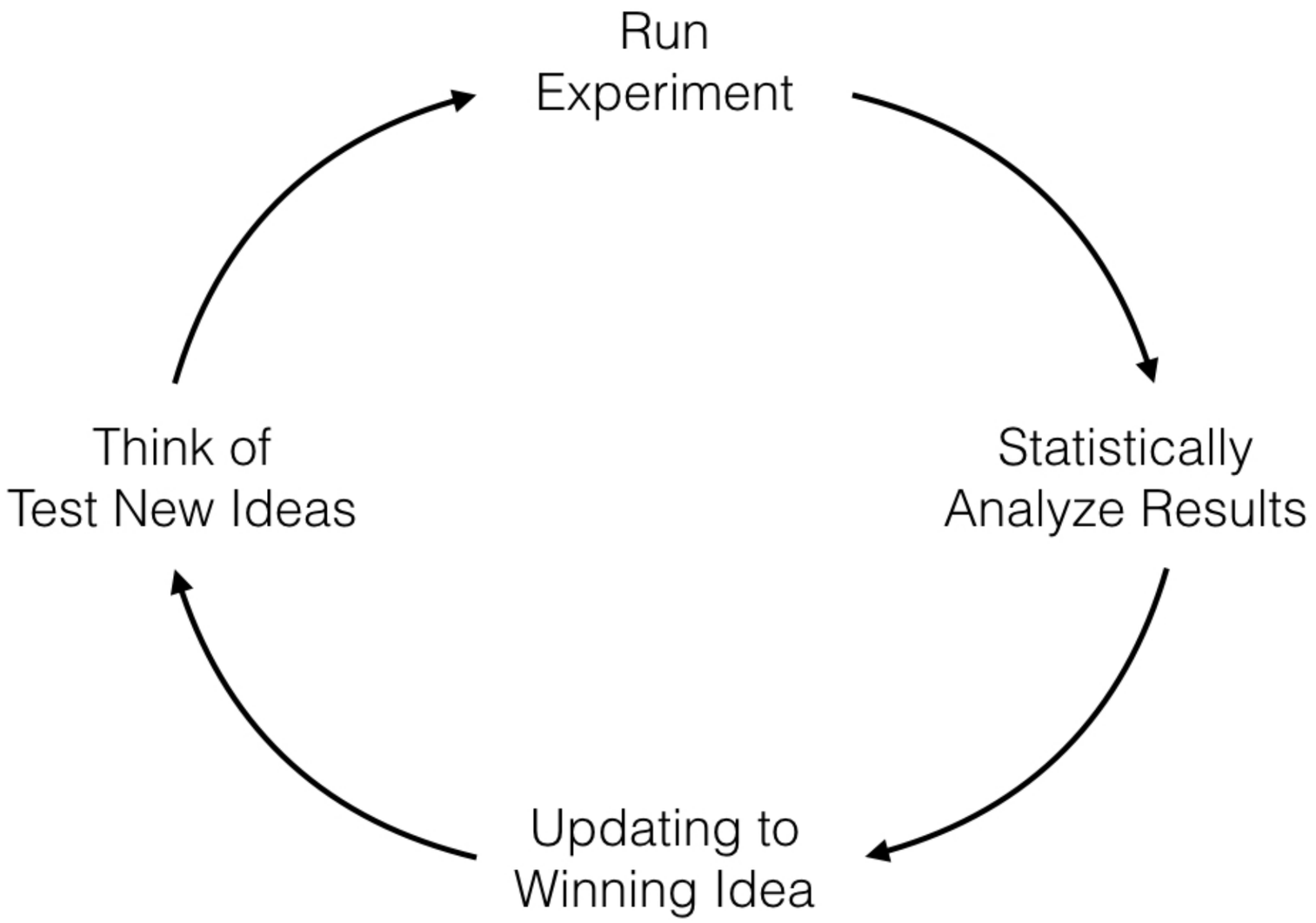
Page Piccinini
Instructor

Think of
Test New Ideas


Run
Experiment
Think of
Test New Ideas


Run
Experiment
Think of
Test New Ideas
Statistically
Analyze Results


Run
Experiment
Statistically
Analyze Results
Updating to
Winning Idea
Think of
Test New Ideas


Run
Experiment
Statistically
Analyze Results
Updating to
Winning Idea
Think of
Test New Ideas

Tips for designing a new experiment

- Build several small follow-up experiments
- Avoid **confounding variables**
- Test small changes

Follow-up experiment #1

1. Use a picture of a **kitten** in a hat instead of an adult cat.

2. Use a picture of **two cats or kittens** in hats instead of one.

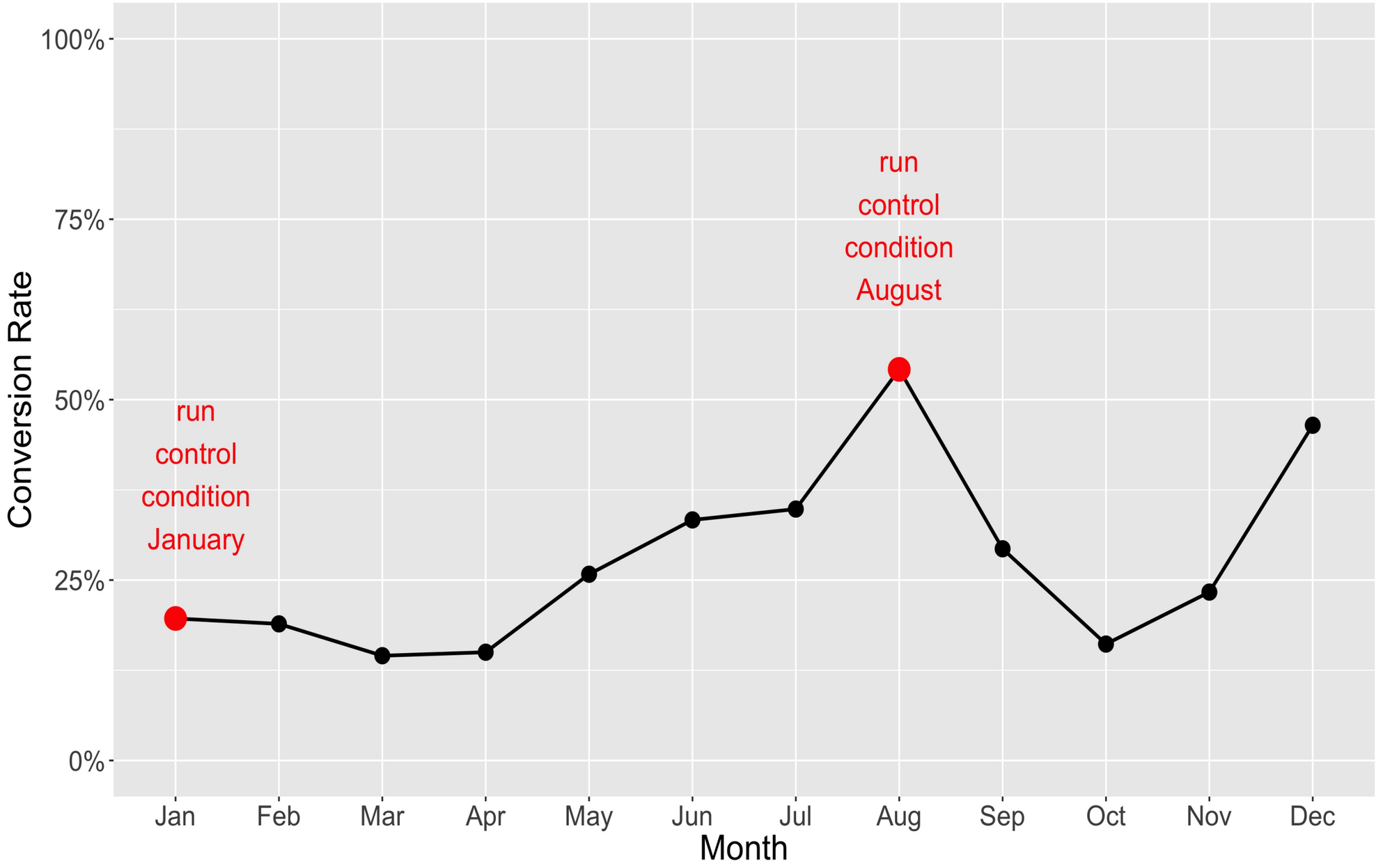
A/B TESTING IN R

Let's practice!

A/B TESTING IN R

Pre-follow-up Experiment Assumptions

Page Piccinini
Instructor


100%
75%
50%
25%
0%
Conversion Rate
run
control
condition
January
run
control
condition
August
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month

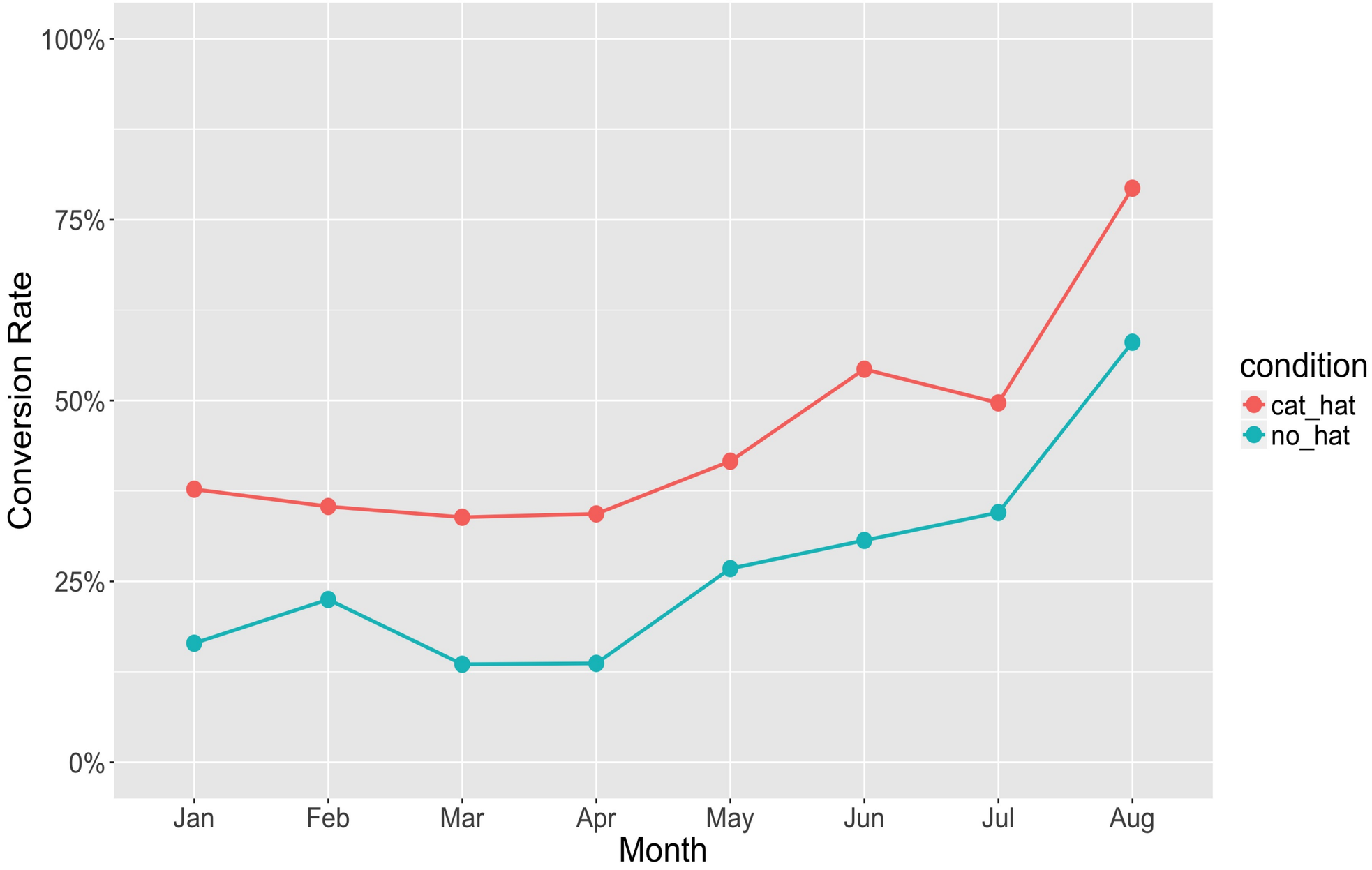
A/B TESTING IN R

Let's practice!

A/B TESTING IN R

Follow-up Experiment Assumptions

Page Piccinini
Instructor


100%
75%
50%
25%
0%
Conversion Rate
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Month
condition
cat_hat
no_hat

Computing conversion rate difference

```
eight_month_checkin_data_sum <- eight_month_checkin_data %>%
  mutate(month_text = month(visit_date, label = TRUE)) %>%
  group_by(month_text, condition) %>%
  summarize(conversion_rate = mean(clicked_adopt_today))
```

```
# A tibble: 16 x 3
   month_text condition conversion_rate
        <ord>     <chr>           <dbl>
 1        Jan   cat_hat       0.3774194
 2        Jan    no_hat       0.1645161
 3        Feb   cat_hat       0.3535714
 4        Feb    no_hat       0.2250000
 5        Mar   cat_hat       0.3387097
 6        Mar    no_hat       0.1354839
 7        Apr   cat_hat       0.3433333
 8        Apr    no_hat       0.1366667
 9        May   cat_hat       0.4161290
10        May    no_hat       0.2677419
11        Jun   cat_hat       0.5433333
12        Jun    no_hat       0.3066667
13        Jul   cat_hat       0.4967742
14        Jul    no_hat       0.3451613
15        Aug   cat_hat       0.7935484
16        Aug    no_hat       0.5806452
```

Computing conversion rate difference

```
eight_month_checkin_data_sum <- eight_month_checkin_data %>%
  mutate(month_text = month(visit_date, label = TRUE)) %>%
  group_by(month_text, condition) %>%
  summarize(conversion_rate = mean(clicked_adopt_today))

eight_month_checkin_data_diff <- eight_month_checkin_data_sum %>%
  spread(condition, conversion_rate)
```

```
# A tibble: 8 x 3
  month_text   cat_hat    no_hat
       <ord>     <dbl>     <dbl>
1       Jan 0.3774194 0.1645161
2       Feb 0.3535714 0.2250000
3       Mar 0.3387097 0.1354839
4       Apr 0.3433333 0.1366667
5       May 0.4161290 0.2677419
6       Jun 0.5433333 0.3066667
7       Jul 0.4967742 0.3451613
8       Aug 0.7935484 0.5806452
```

Computing conversion rate difference

```
eight_month_checkin_data_sum <- eight_month_checkin_data %>%
  mutate(month_text = month(visit_date, label = TRUE)) %>%
  group_by(month_text, condition) %>%
  summarize(conversion_rate = mean(clicked_adopt_today))

eight_month_checkin_data_diff <- eight_month_checkin_data_sum %>%
  spread(condition, conversion_rate) %>%
```

Computing conversion rate difference

```
eight_month_checkin_data_sum <- eight_month_checkin_data %>%
  mutate(month_text = month(visit_date, label = TRUE)) %>%
  group_by(month_text, condition) %>%
  summarize(conversion_rate = mean(clicked_adopt_today))

eight_month_checkin_data_diff <- eight_month_checkin_data_sum %>%
  spread(condition, conversion_rate) %>%
  mutate(condition_diff = cat_hat - no_hat)
```

```
# A tibble: 8 x 4
  month_text   cat_hat    no_hat condition_diff
       <ord>     <dbl>     <dbl>          <dbl>
1        Jan 0.3774194 0.1645161      0.2129032
2        Feb 0.3535714 0.2250000      0.1285714
3        Mar 0.3387097 0.1354839      0.2032258
4        Apr 0.3433333 0.1366667      0.2066667
5        May 0.4161290 0.2677419      0.1483871
6        Jun 0.5433333 0.3066667      0.2366667
7        Jul 0.4967742 0.3451613      0.1516129
8        Aug 0.7935484 0.5806452      0.2129032
```

Computing conversion rate difference

```
eight_month_checkin_data_sum <- eight_month_checkin_data %>%
  mutate(month_text = month(visit_date, label = TRUE)) %>%
  group_by(month_text, condition) %>%
  summarize(conversion_rate = mean(clicked_adopt_today))

eight_month_checkin_data_diff <- eight_month_checkin_data_sum %>%
  spread(condition, conversion_rate) %>%
  mutate(condition_diff = cat_hat - no_hat)
```

```
> mean(eight_month_checkin_data_diff$condition_diff)
[1] 0.1876171
> sd(eight_month_checkin_data_diff$condition_diff)
[1] 0.03893739
```

A/B TESTING IN R

Let's practice!