

# LeftyLemursAnalysis

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Loading library

```
library(tidyverse)
```

```
## -- Attaching packages ----- tidyverse 1.3.1 --
```

```
## v ggplot2 3.3.6    v purrr  0.3.4
## v tibble  3.1.7    v dplyr  1.0.9
## v tidyr   1.2.0    v stringr 1.4.0
## v readr   2.1.2    v forcats 0.5.1
```

```
## -- Conflicts ----- tidyverse_conflicts() --
```

```
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
```

```
library(readr)
library(dplyr)
library(ggplot2)
```

Here's what I did to clean the data:

Importing dataset

```
L_PreClean <- read.csv("~/Documents/GitHub/Lefty_Lemurs/LeftyLemurs_Original.csv")
```

```
summary(L_PreClean)
```

```
## Troop.....A..B..C..D.... Focal.Lemur      Species
## Length:694                  Length:694      Length:694
## Class :character            Class :character  Class :character
## Mode  :character            Mode  :character  Mode  :character
##
##
##
##      Sex          Month      Day          Year
## Length:694      Min.   :6.000  Min.   : 1.00  Min.   :2022
## Class :character 1st Qu.:6.000  1st Qu.: 8.00  1st Qu.:2022
## Mode  :character Median :6.000  Median :22.00  Median :2022
##                  Mean  :6.411  Mean   :18.29  Mean   :2022
```

```
##           3rd Qu.:7.000   3rd Qu.:28.00   3rd Qu.:2022
##           Max.      :7.000   Max.      :30.00   Max.      :2022
## Time..H.M.S.      Category
## Length:694        Length:694
## Class :character   Class :character
## Mode  :character   Mode  :character
##
##
##
## Focal.sample.note.....
## Length:694
## Class :character
## Mode  :character
##
##
##
```

rename long column names to simpler ones

```
L_PreClean <- rename(L_PreClean, Troop = Troop.....A..B..C..D..., Time = Time..H.M.S., Note = I
```

remove commas in the category column

```
L_PreClean$Category <- str_replace(L_PreClean$Category, ",", "")
```

Why on earth did it make it into a value instead of a new data frame??? I guess it doesn't matter because it still works...

Sometimes I wrote behaviors in all caps, and sometimes I didn't. I'm just going to put all of them in all caps because it's easier.

```
L_PreClean$Category = toupper(L_PreClean$Category)
```

I have some data where I didn't actually record the limb used. Why did I do that? I'm going to delete the rows where I forgot to list the limb.

Only keep rows in categories that don't contain RH, LH, RF, and/or LF

```
L_HFdata <-
  L_PreClean %>%
  filter(str_detect(Category, "RH|RF|LH|LF"))
```

Squeaky clean

Now I want to create a separate data frame that only contains behaviors from my ethogram:

```
# do not run
# lefty_justEthogram <-
# L %>% select(Category) %>%
# filter(str_detect(Category, "BP|QP|L|AG|SG|F|E|CL|HC|R|G|"))
```

Why didn't it work

*This did not work* Would it be possible to split the “Category” column into 2 columns? 1 that says “Task” and another that says “Limb”?

“Limb” would have LH/RH/LF/RH and “Task” would have the other stuff

I think if I duplicate the column and rename it and then eliminate the limbs from “Task” and keep only the limbs in “Limbs” it might work.

Then I can rename the tasks to “Eating/Grooming/Locomotion/etc.

Duplicating “Category” and calling the new one “Limb”

```
# do not run: L_HFdata$Limb <- L_PreClean$Category
# do not run: L_PreClean2 <- L_PreClean %>% relocate (Limb, .before = Note)
```

*This did not work*

Replacing limb with nothing

```
# do not run: lefty_split <- L_PreClean2$Category <- str_replace(L_PreClean$Limb, "BP|QP|L|AG|SG|F|E|CL
# do not run: lefty_fullsplit <- L_PreClean2$Limb <- str_replace(L_PreClean$Category, "LF|LH|RF|RH|", "
```

Categories kept limbs because they include an R (like rest) or L (like locomotion) I think limb section stayed the same? I think it kept all the columns that contained the limbs, which was all of them ofc. I might be running the wrong code.

Okay I’m going to use find and replace in Excel to fix it because R doesn’t know how to do anything apparently and I literally want to cry rn

Wait wtf why does it say 30,000+ rows columns

**okay I’ve spent 4 hours trying to get it to work and tbh this is a waste of time so I’m just going to export the behavior data as a CSV and finish cleaning it in Google Sheets**

Writing as CSV bc my attempts at making limb column completely failed after working on it for 2 days

```
# write_csv(L_PreClean, "Lefty_Lemurs.csv")
```

---

**Here’s what I did in Google Sheets with the CSV file** (I really wanted to do it in R but I could not figure it out and wasted hours and hours)

- Deleted rows that didn’t contain behaviors from my ethogram
- Copied “Category” into 2 columns
- In old Category column, deleted limb data
- In new “Limb” data, kept only limb data (not behavior)
- Deleted rows that had question marks in data
- Deleted data where category was “Other”
- Deleted data that had rows with both hands
- Merged “F” and “E” into one category “E”
- Looked through notes to change category when it was just “G”. Most got changed to L, some got changed to R, a few got deleted

- Added new column for H/F to say whether limb was hand or foot
- Added new column for side to say whether limb was left or right

New categories - E (eating/foraging) - R (resting) (lemur is still) - L (locomotion) (active motion like leaping, climbing, or jumping) - CL (cross legs) - HC (hand clasp) - BP (bipedal walking) - QP (quadrupedal walking) - LA (land) - SG (self grooming) - AG (allo-grooming)

**Upload clean data** (it was a nightmare of cleaning this data in R and Excel and took many terrible hours, of which I do not wish to relive)

```
L <- read.csv("~/Documents/GitHub/LeftyLemurs/LeftyLemurs_Clean.csv")
```

## Analysis

~Hex codes for colors (to use in graphs)~ Red: #C84E00 Orange: #E89923 Yellow: #FFD960 Light Green: #A1B70D Turquoise: #339898 Teal: #1D6363 Medium Blue: #005587 Light Blue: #0577B1 Purple: #993399

```
head(L)
```

##	Troop	Focal	Species	Age	Sex	Month	Day	Year	Time	Category	Limb	H.F	Side
## 1	P	Carolina	Emon	12	F	6	30	2022	8:25:26		E	RH	H
## 2	P	Carolina	Emon	12	F	6	30	2022	8:28:29		E	RH	H
## 3	P	Carolina	Emon	12	F	6	30	2022	8:23:54		E	LH	H
## 4	P	Carolina	Emon	12	F	6	30	2022	8:25:47		E	LH	H
## 5	P	Carolina	Emon	12	F	6	30	2022	8:27:13		E	LH	H
## 6	P	Carolina	Emon	12	F	6	30	2022	8:43:36		E	LH	H
##									Note				
## 1									Grasp silverberry with right hand and eat				
## 2									Grasp and eat silverberry with right hand on top				
## 3									Grab silverberry with left hand and eat				
## 4									Grasp silverberry with left hand and eat				
## 5									Grasp silverberry plant with left hand and eat				
## 6									Forage and eat evergreen leaves with left hand				

Let's look at how many total instances of each limb use there was

```
table(L$Limb)
```

```
##
##  LF  LH  RF  RH
##  32 225 47 318
```

Omg

Left Hand: 225 Right Hand: 318 Left Foot: 32 Right Foot: 47

It looks like lemurs used their right hands a lot more than they used their left hands...

```
ggplot (L, aes(x= reorder (Limb, Limb, table ))) +
  geom_bar(color = "black", fill = "#012169") +
  theme_classic() +
  xlab("Limb") +
  ylab("Total Times Using Each Limb") +
  ggtitle("Total Limb Use Across Lemurs") +
  coord_flip()
```

LeftyLemurs\_files/figure-latex/unnamed-chunk-15-1.pdf

Yep, there definitely appears to be a hand/foot preference

```
ggplot (L, aes(x= reorder (Limb, Limb, table ))) +  
  geom_bar(color = "black", fill = "#C84E00") +  
  theme_classic() +  
  xlab("Limb") +  
  ylab("Total Times Using Each Limb") +  
  ggtitle("Total Limb Use Across Lemur Species") +  
  coord_flip() +  
  facet_wrap (~ Species, scales = "free")
```

LeftyLemurs\_files/figure-latex/unnamed-chunk-16-1.pdf

```
ggplot (L, aes(x= Side)) +  
  geom_bar(color = "black", fill = "#C84E00") +  
  theme_classic() +  
  xlab("Left or Right Side") +  
  ylab("# of Times Using Each Limb") +  
  ggtitle("Limb Use Between Lemur Species") +  
  facet_wrap (~ Species, scales = "free")
```

LeftyLemurs\_files/figure-latex/unnamed-chunk-17-1.pdf

```
ggplot (L, aes(x= reorder (Side, Side, table ))) +  
  geom_bar(color = "black", fill = "#C84E00") +  
  theme_classic() +  
  xlab("Left or Right") +  
  ylab("Total Times Using Each Limb") +  
  ggtitle("Limb Use Between Lemur Species") +  
  coord_flip() +  
  facet_wrap (~ Species, scales = "free")
```

LeftyLemurs\_files/figure-latex/unnamed-chunk-18-1.pdf

Same thing but on the same scale (I got more data from sifakas as u can see)

```
ggplot (L, aes(x= Side)) +  
  geom_bar(color = "black", fill = "#C84E00") +  
  theme_classic() +  
  xlab("Left or Right Side") +  
  ylab("# of Times Using Each Limb") +  
  ggtitle("Limb Use Between Lemur Species") +  
  facet_wrap (~ Species,)
```

LeftyLemurs\_files/figure-latex/unnamed-chunk-19-1.pdf

Sifakas have higher left hand use than the other 2 species. Sifakas overall seem more ambidextrous. However, this could be due to them foraging more (maybe all lemurs forage more with their left hands or something idk). Therefore I should separate it out by eating behaviors.

What about by sex

```
ggplot (L, aes(x = reorder (Limb, Limb, table ))) +  
  geom_bar(color = "black", fill = "#1D6363") +  
  theme_classic() +  
  xlab("Limb") +  
  ylab("Total Times Using Each Limb") +  
  ggtitle("Total Limb Use Between Sexes: Lemurs Are Not Lefties") +  
  coord_flip() +  
  facet_wrap (~ Sex, scales = "free")
```

LeftyLemurs\_files/figure-latex/unnamed-chunk-20-1.pdf

This is the same thing but just divided by left and right side (left hand and left foot, etc. are in the same category)

```
ggplot (L, aes(x= reorder (Side, Side, table ))) +  
  geom_bar(color = "black", fill = "#1D6363") +  
  theme_classic() +  
  xlab("Left or Right") +  
  ylab("Total Times Using Each Limb") +  
  ggtitle("Total Limb Use Between Sexes: Lemurs Are Not Lefties") +  
  coord_flip() +  
  facet_wrap (~ Sex, scales = "free")
```

LeftyLemurs\_files/figure-latex/unnamed-chunk-21-1.pdf

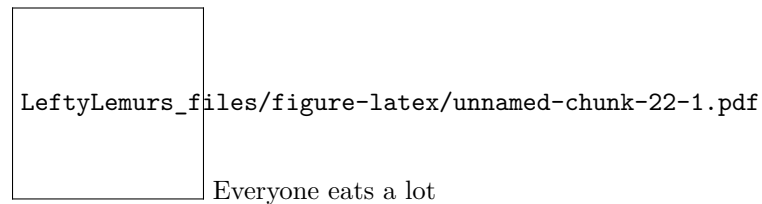
Definitely more right hand than left HAND use for both males and females. Not sure about

foot use, but I didn't get much foot use data to begin with. Is there a way to exclude foot use?

Males might be a little less lateralized than females? Left hand use is also (slightly) higher in males like I thought it would be!

---

```
ggplot (L, aes(x= reorder (Category, Category, table ))) +  
  geom_bar(color = "black", fill = "#0577B1") +  
  theme_classic() +  
  xlab("Type of Behavior") +  
  ylab("Total Times Using Each Limb") +  
  ggtitle("Behavior Across Sexes") +  
  coord_flip() +  
  facet_wrap (~ Sex, scales = "free")
```



---

Some calculations

```
summary(L)
```

```
##      Troop          Focal          Species          Age  
## Length:622      Length:622      Length:622      Min.   : 5  
## Class :character Class :character Class :character 1st Qu.:10  
## Mode  :character Mode  :character Mode  :character Median :12  
##                                           Mean  :12  
##                                           3rd Qu.:14  
##                                           Max.   :29  
##      Sex          Month          Day          Year  
## Length:622      Min.   :6.000      Min.   : 1.00      Min.   :2022  
## Class :character 1st Qu.:6.000      1st Qu.: 8.00      1st Qu.:2022  
## Mode  :character Median :6.000      Median :22.00      Median :2022  
##                                           Mean  :6.436      Mean   :18.04      Mean   :2022  
##                                           3rd Qu.:7.000      3rd Qu.:28.00      3rd Qu.:2022  
##                                           Max.   :7.000      Max.   :30.00      Max.   :2022  
##      Time          Category          Limb          H.F  
## Length:622      Length:622      Length:622      Length:622  
## Class :character Class :character Class :character Class :character  
## Mode  :character Mode  :character Mode  :character Mode  :character  
##  
##  
##      Side          Note  
## Length:622      Length:622
```

```
## Class :character    Class :character
## Mode  :character    Mode  :character
##
##
##
```

```
library(psych)
```

```
##
## Attaching package: 'psych'
```

```
## The following objects are masked from 'package:ggplot2':
##
##    %+%, alpha
```

```
describeBy(L[c(4,1:12)], group = "Category")
```

```
##
## Descriptive statistics by group
## Category: BP
##
```

	vars	n	mean	sd	median	trimmed	mad	min	max	range	skew
## Age	1	48	8.71	4.93	10.0	8.00	0.00	5	29	24	2.74
## Troop*	2	48	1.17	0.48	1.0	1.05	0.00	1	3	2	2.78
## Focal*	3	48	2.54	1.43	2.5	2.55	2.22	1	4	3	-0.04
## Species*	4	48	1.96	0.20	2.0	2.00	0.00	1	2	1	-4.44
## Age.1	5	48	8.71	4.93	10.0	8.00	0.00	5	29	24	2.74
## Sex*	6	48	1.58	0.50	2.0	1.60	0.00	1	2	1	-0.33
## Month	7	48	6.56	0.50	7.0	6.58	0.00	6	7	1	-0.24
## Day	8	48	12.92	10.58	14.0	12.85	14.83	1	27	26	0.01
## Year	9	48	2022.00	0.00	2022.0	2022.00	0.00	2022	2022	0	NaN
## Time*	10	48	24.50	14.00	24.5	24.50	17.79	1	48	47	0.00
## Category*	11	48	1.00	0.00	1.0	1.00	0.00	1	1	0	NaN
## Limb*	12	48	1.56	0.50	2.0	1.57	0.00	1	2	1	-0.24
## H.F*	13	48	1.00	0.00	1.0	1.00	0.00	1	1	0	NaN

```
##
```

	kurtosis	se
## Age	9.10	0.71
## Troop*	6.93	0.07
## Focal*	-1.93	0.21
## Species*	18.13	0.03
## Age.1	9.10	0.71
## Sex*	-1.93	0.07
## Month	-1.98	0.07
## Day	-1.86	1.53
## Year	NaN	0.00
## Time*	-1.28	2.02
## Category*	NaN	0.00
## Limb*	-1.98	0.07
## H.F*	NaN	0.00

```
## -----
## Category: CL
##
```

	vars	n	mean	sd	median	trimmed	mad	min	max	range	skew
## Age	1	16	15.25	3.61	17.0	15.86	0.00	5	17	12	-1.74



```
## Troop*      2 16      1.81 0.40      2.0      1.86 0.00      1      2      1 -1.45
## Focal*      3 16      2.88 0.72      3.0      2.93 0.00      1      4      3 -0.85
## Species*    4 16      1.19 0.40      1.0      1.14 0.00      1      2      1  1.45
## Age.1       5 16     15.25 3.61     17.0     15.86 0.00      5     17     12 -1.74
## Sex*        6 16      1.25 0.45      1.0      1.21 0.00      1      2      1  1.05
## Month       7 16      6.25 0.45      6.0      6.21 0.00      6      7      1  1.05
## Day         8 16     18.81 9.52     21.0     19.29 6.67      1     30     29 -0.76
## Year        9 16    2022.00 0.00    2022.0    2022.00 0.00    2022    2022      0   NaN
## Time*      10 16      8.50 4.76      8.5      8.50 5.93      1     16     15  0.00
## Category*   11 16      1.00 0.00      1.0      1.00 0.00      1      1      0   NaN
## Limb*      12 16      1.94 0.25      2.0      2.00 0.00      1      2      1 -3.28
## H.F*       13 16      1.00 0.00      1.0      1.00 0.00      1      1      0   NaN
```

```
##          kurtosis  se
## Age          1.68 0.90
## Troop*       0.13 0.10
## Focal*       0.92 0.18
## Species*     0.13 0.10
## Age.1        1.68 0.90
## Sex*        -0.95 0.11
## Month        -0.95 0.11
## Day          -0.85 2.38
## Year          NaN 0.00
## Time*       -1.43 1.19
## Category*     NaN 0.00
## Limb*        9.36 0.06
## H.F*         NaN 0.00
```

```
## -----
## Category: E
```

```
##          vars    n    mean    sd median trimmed    mad  min  max range  skew
## Age           1 312    12.27  7.01    12.0    11.10    2.97    5   29    24    1.23
## Troop*        2 312     3.87  1.75     4.0     3.96    1.48    1    6     5   -0.57
## Focal*        3 312     7.41  3.47     8.0     7.62    4.45    1   12    11   -0.43
## Species*      4 312     1.88  0.85     2.0     1.85    1.48    1    3     2    0.23
## Age.1         5 312    12.27  7.01    12.0    11.10    2.97    5   29    24    1.23
## Sex*          6 312     1.71  0.45     2.0     1.76    0.00    1    2     1   -0.93
## Month         7 312     6.36  0.48     6.0     6.33    0.00    6    7     1    0.57
## Day           8 312    19.35 10.46    24.0    20.17    8.90    1   30    29   -0.52
## Year          9 312    2022.00 0.00    2022.0    2022.00    0.00  2022    2022     0   NaN
## Time*        10 312    154.60 89.04   153.5    154.50   113.42    1  309   308    0.01
## Category*     11 312     1.00  0.00     1.0     1.00    0.00    1    1     0   NaN
## Limb*        12 312     2.60  0.50     3.0     2.63    0.00    1    3     2   -0.54
## H.F*         13 312     1.99  0.08     2.0     2.00    0.00    1    2     1  -12.31
```

```
##          kurtosis  se
## Age          0.98 0.40
## Troop*       -1.07 0.10
## Focal*       -0.88 0.20
## Species*     -1.57 0.05
## Age.1        0.98 0.40
## Sex*        -1.14 0.03
## Month        -1.68 0.03
## Day          -1.36 0.59
## Year          NaN 0.00
## Time*       -1.20 5.04
## Category*     NaN 0.00
```

```

## Limb*          -1.35 0.03
## H.F*          150.02 0.00
## -----
## Category: HC
##      vars n      mean      sd median trimmed  mad  min  max range  skew
## Age      1 4      11.50 3.00     10.0   11.50 0.00    10   16     6  0.75
## Troop*    2 4       1.25 0.50      1.0    1.25 0.00     1    2     1  0.75
## Focal*    3 4       1.75 0.50      2.0    1.75 0.00     1    2     1 -0.75
## Species*  4 4       1.75 0.50      2.0    1.75 0.00     1    2     1 -0.75
## Age.1     5 4      11.50 3.00     10.0   11.50 0.00    10   16     6  0.75
## Sex*      6 4       1.00 0.00      1.0    1.00 0.00     1    1     0  NaN
## Month     7 4       6.75 0.50      7.0    6.75 0.00     6    7     1 -0.75
## Day       8 4      10.25 8.50      6.0   10.25 0.00     6   23    17  0.75
## Year      9 4     2022.00 0.00    2022.0 2022.00 0.00   2022 2022     0  NaN
## Time*    10 4       2.50 1.29      2.5    2.50 1.48     1    4     3  0.00
## Category* 11 4       1.00 0.00      1.0    1.00 0.00     1    1     0  NaN
## Limb*    12 4       1.25 0.50      1.0    1.25 0.00     1    2     1  0.75
## H.F*     13 4       1.00 0.00      1.0    1.00 0.00     1    1     0  NaN
##      kurtosis  se
## Age      -1.69 1.50
## Troop*   -1.69 0.25
## Focal*   -1.69 0.25
## Species* -1.69 0.25
## Age.1    -1.69 1.50
## Sex*      NaN 0.00
## Month    -1.69 0.25
## Day      -1.69 4.25
## Year      NaN 0.00
## Time*    -2.08 0.65
## Category* NaN 0.00
## Limb*    -1.69 0.25
## H.F*      NaN 0.00
## -----
## Category: L
##      vars n      mean      sd median trimmed  mad  min  max range  skew
## Age      1 76      11.78 6.11     12.0   10.98 5.93     5   29    24  1.15
## Troop*    2 76       4.12 1.42      5.0    4.24 1.48     1    6     5 -0.84
## Focal*    3 76       5.14 3.36      5.0    4.97 4.45     1   12    11  0.15
## Species*  4 76       1.59 0.82      1.0    1.50 0.00     1    3     2  0.86
## Age.1     5 76      11.78 6.11     12.0   10.98 5.93     5   29    24  1.15
## Sex*      6 76       1.53 0.50      2.0    1.53 0.00     1    2     1 -0.10
## Month     7 76       6.17 0.38      6.0    6.10 0.00     6    7     1  1.71
## Day       8 76      23.16 6.95     27.0   23.98 4.45     6   30    24 -0.91
## Year      9 76     2022.00 0.00    2022.0 2022.00 0.00   2022 2022     0  NaN
## Time*    10 76      38.49 22.06     38.5   38.50 28.17     1   75    74  0.00
## Category* 11 76       1.00 0.00      1.0    1.00 0.00     1    1     0  NaN
## Limb*    12 76       2.51 0.53      3.0    2.53 0.00     1    3     2 -0.32
## H.F*     13 76       1.99 0.11      2.0    2.00 0.00     1    2     1 -8.38
##      kurtosis  se
## Age       1.64 0.70
## Troop*    -0.39 0.16
## Focal*    -1.32 0.39
## Species*  -0.99 0.09
## Age.1     1.64 0.70

```

```

## Sex*          -2.02 0.06
## Month         0.95 0.04
## Day          -0.44 0.80
## Year           NaN 0.00
## Time*        -1.25 2.53
## Category*     NaN 0.00
## Limb*        -1.33 0.06
## H.F*         69.08 0.01
## -----
## Category: LA
## vars n      mean    sd median trimmed  mad   min   max range  skew
## Age       1 8    15.12 2.23   16.0   15.12 0.00   10   17     7 -1.42
## Troop*    2 8     2.62 0.92    3.0    2.62 0.74    1    4     3 -0.32
## Focal*    3 8     2.25 1.58    1.5    2.25 0.74    1    5     4  0.59
## Species*  4 8     1.62 0.74    1.5    1.62 0.74    1    3     2  0.54
## Age.1     5 8    15.12 2.23   16.0   15.12 0.00   10   17     7 -1.42
## Sex*      6 8     1.25 0.46    1.0    1.25 0.00    1    2     1  0.95
## Month     7 8     6.62 0.52    7.0    6.62 0.00    6    7     1 -0.42
## Day       8 8    14.25 9.33    8.0   14.25 1.48    6   27    21  0.47
## Year      9 8   2022.00 0.00 2022.0 2022.00 0.00 2022 2022     0   NaN
## Time*    10 8     4.50 2.45    4.5    4.50 2.97    1    8     7  0.00
## Category* 11 8     1.00 0.00    1.0    1.00 0.00    1    1     0   NaN
## Limb*    12 8     1.62 0.74    1.5    1.62 0.74    1    3     2  0.54
## H.F*     13 8     1.50 0.53    1.5    1.50 0.74    1    2     1  0.00
## kurtosis    se
## Age         0.56 0.79
## Troop*     -1.06 0.32
## Focal*     -1.47 0.56
## Species*   -1.27 0.26
## Age.1       0.56 0.79
## Sex*       -1.21 0.16
## Month      -2.03 0.18
## Day        -1.89 3.30
## Year        NaN 0.00
## Time*     -1.65 0.87
## Category*   NaN 0.00
## Limb*     -1.27 0.26
## H.F*      -2.23 0.19
## -----
## Category: QP
## vars n      mean    sd median trimmed  mad   min   max range  skew
## Age       1 19   16.37 3.30    16   15.76 1.48   14   29    15  2.83
## Troop*    2 19    1.68 0.75     2    1.65 1.48    1    3     2  0.52
## Focal*    3 19    3.84 1.95     4    3.88 2.97    1    6     5 -0.26
## Species*  4 19    1.63 0.50     2    1.65 0.00    1    2     1 -0.50
## Age.1     5 19   16.37 3.30    16   15.76 1.48   14   29    15  2.83
## Sex*      6 19    1.42 0.51     1    1.41 0.00    1    2     1  0.29
## Month     7 19    6.11 0.32     6    6.06 0.00    6    7     1  2.37
## Day       8 19   23.89 6.53    27   24.71 2.97    5   29    24 -1.93
## Year      9 19   2022.00 0.00   2022 2022.00 0.00 2022 2022     0   NaN
## Time*    10 19   10.00 5.63    10   10.00 7.41    1   19    18  0.00
## Category* 11 19    1.00 0.00     1    1.00 0.00    1    1     0   NaN
## Limb*    12 19    2.47 0.77     3    2.53 0.00    1    3     2 -0.95
## H.F*     13 19    1.84 0.37     2    1.88 0.00    1    2     1 -1.73

```

```

##          kurtosis   se
## Age          8.34 0.76
## Troop*       -1.16 0.17
## Focal*       -1.52 0.45
## Species*     -1.84 0.11
## Age.1        8.34 0.76
## Sex*         -2.01 0.12
## Month        3.84 0.07
## Day          2.60 1.50
## Year         NaN 0.00
## Time*       -1.39 1.29
## Category*    NaN 0.00
## Limb*        -0.74 0.18
## H.F*         1.06 0.09
## -----
## Category: R
##      vars   n    mean    sd median trimmed  mad  min  max range  skew
## Age         1 127  11.50  5.25    10  10.72  2.97    5  29   24   2.09
## Troop*      2 127   2.70  1.16     3   2.65  0.00    1   5    4  -0.05
## Focal*      3 127   5.31  2.48     6   5.31  4.45    1   9    8   0.00
## Species*    4 127   2.67  0.69     3   2.83  0.00    1   3    2  -1.76
## Age.1       5 127  11.50  5.25    10  10.72  2.97    5  29   24   2.09
## Sex*        6 127   1.81  0.39     2   1.88  0.00    1   2    1  -1.57
## Month       7 127   6.81  0.39     7   6.88  0.00    6   7    1  -1.57
## Day         8 127  12.51  8.69    12  11.87  5.93    1  30   29   0.63
## Year        9 127 2022.00  0.00   2022 2022.00  0.00 2022 2022    0   NaN
## Time*      10 127   64.00 36.81    64   64.00 47.44    1 127  126   0.00
## Category*   11 127   1.00  0.00     1   1.00  0.00    1   1    0   NaN
## Limb*      12 127   2.17  0.98     3   2.21  0.00    1   3    2  -0.35
## H.F*       13 127   1.99  0.09     2   2.00  0.00    1   2    1 -11.00
##          kurtosis   se
## Age          5.16 0.47
## Troop*       -0.50 0.10
## Focal*       -1.40 0.22
## Species*      1.41 0.06
## Age.1        5.16 0.47
## Sex*          0.47 0.03
## Month        0.47 0.03
## Day         -0.37 0.77
## Year         NaN 0.00
## Time*       -1.23 3.27
## Category*    NaN 0.00
## Limb*       -1.89 0.09
## H.F*       120.05 0.01
## -----
## Category: SG
##      vars   n    mean    sd median trimmed  mad  min  max range  skew
## Age         1 12  11.67  5.21   15.0   11.9 1.48    5  16   11  -0.41
## Troop*      2 12   2.00  0.95    2.0    1.9 1.48    1   4    3   0.58
## Focal*      3 12   3.42  1.56    3.5    3.5 2.22    1   5    4  -0.12
## Species*    4 12   2.25  0.75    2.0    2.3 1.48    1   3    2  -0.36
## Age.1       5 12  11.67  5.21   15.0   11.9 1.48    5  16   11  -0.41
## Sex*        6 12   1.58  0.51    2.0    1.6 0.00    1   2    1  -0.30
## Month       7 12   6.08  0.29    6.0    6.0 0.00    6   7    1   2.65

```

```
## Day      8 12    25.25 3.93    27.0    26.0 0.00    14    29    15 -1.85
## Year      9 12  2022.00 0.00  2022.0    2022.0 0.00  2022  2022     0   NaN
## Time*    10 12     6.50 3.61     6.5     6.5 4.45     1    12    11  0.00
## Category* 11 12     1.00 0.00     1.0     1.0 0.00     1     1     0   NaN
## Limb*     12 12     1.67 0.78     1.5     1.6 0.74     1     3     2  0.55
## H.F*      13 12     1.67 0.49     2.0     1.7 0.00     1     2     1 -0.62
##          kurtosis  se
## Age      -1.86 1.50
## Troop*   -0.78 0.28
## Focal*   -1.86 0.45
## Species* -1.33 0.22
## Age.1    -1.86 1.50
## Sex*     -2.06 0.15
## Month     5.48 0.08
## Day       2.67 1.14
## Year      NaN 0.00
## Time*    -1.50 1.04
## Category*  NaN 0.00
## Limb*    -1.29 0.22
## H.F*     -1.74 0.14
```

```
# what does the 4 mean??
```

Making a DF with just hand grasp data

```
# take out feet use data
```

```
l_hands <-
  L %>%
  select(H.F) %>%
  filter(str_detect(H.F, "H"))
```

```
# add the other stuff back
```

```
l_hands <- inner_join(l_hands, L, by = "H.F")
```

```
l_hands <- unique(l_hands)
```

```
# actually I also don't want to look at all the categories bc some were added just for fun and are prob
```

```
l_handstuff <-
  l_hands %>%
  select(Category) %>%
  filter(str_detect(Category, "E|L|R|SG"))
```

```
# WHY WON'T IT TAKE OUT LA
```

```
# add the other stuff back why did it even go away
```

```
l_handstuff <- inner_join(l_handstuff, l_hands, by = "Category")
```

```
# I can remove the H.F row because all of it is hand
```

```
l_handstuff <- l_handstuff %>% select(-H.F)
```

```

# removing Limb row bc side says the same thing

l_handstuff <- l_handstuff %>% select(-Limb)

# removing mystery duplicates

l_handstuff <- unique(l_handstuff)

l_noLA <-
l_handstuff %>%
  filter(Category == "E" | Category == "L" | Category == "R" | Category == "SG" | Category != "LA")

#wow I forgot you can do that

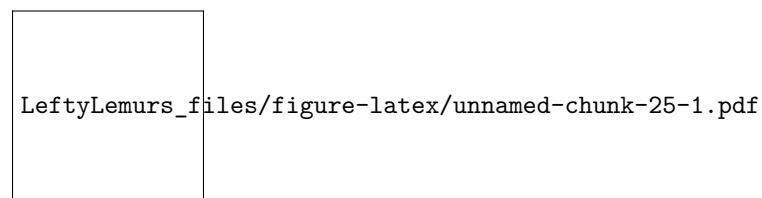
```

Compare hand use by species

```

ggplot (l_noLA, aes(x= Side)) +
  geom_bar(color = "black", fill = "#C84E00") +
  theme_classic() +
  xlab("Left or Right Side") +
  ylab("# of Times Using Each Limb") +
  ggtitle("Hand Use Between Lemur Species") +
  facet_wrap (~ Species, scales = "free")

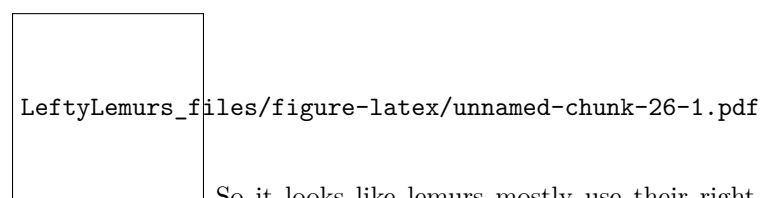
```



```

ggplot (l_noLA, aes(x= Side)) +
  geom_bar(color = "black", fill = "#C84E00") +
  theme_classic() +
  xlab("Left or Right Side") +
  ylab("Type of Behavior") +
  ggtitle("Hand Use Between Behaviors") +
  facet_wrap (~ Category, scales = "free")

```



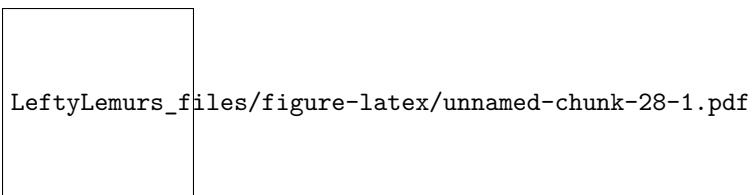
So it looks like lemurs mostly use their right hand for everything except for grooming!  
Interesting

Now I'm going to filter out the grooming data so it's all grasping

```
l_grasps <-
l_noLA %>%
  filter(Category == "E" | Category == "L" | Category == "R")
```

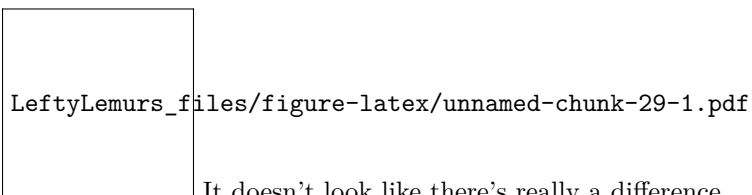
Compare grasping hand by species

```
ggplot(l_grasps, aes(x= Side)) +
  geom_bar(color = "black", fill = "#C84E00") +
  theme_classic() +
  xlab("Left or Right Side") +
  ylab("# of Times Using Each Limb") +
  ggtitle("Hand Use for Grasping Between Lemur Species") +
  facet_wrap(~ Species, scales = "free")
```



What about by sex?

```
ggplot(l_grasps, aes(x= Side)) +
  geom_bar(color = "black", fill = "#C84E00") +
  theme_classic() +
  xlab("Left or Right Side") +
  ylab("# of Times Using Each Limb") +
  ggtitle("Hand Use for Grasping Between Sexes") +
  facet_wrap(~ Sex, scales = "free")
```



It doesn't look like there's really a difference

What about just food grasps?

```
l_foodGrasps <-
l_grasps %>%
  filter(Category == "E")
```

Compare grasping hand by species

```
ggplot(l_foodGrasps, aes(x= Side)) +
  geom_bar(color = "black", fill = "#C84E00") +
  theme_classic() +
  xlab("Left or Right Side") +
  ylab("# of Times Using Each Limb") +
  ggtitle("Hand Use for Food Grasping Between Lemur Species") +
  facet_wrap(~ Species, scales = "free")
```

LeftyLemurs\_files/figure-latex/unnamed-chunk-31-1.pdf

It really looks like sifakas are more ambidextrous when it comes to food grasping!

What about by individual?

```
ggplot (l_foodGrasps, aes(x= Side)) +  
  geom_bar(color = "black", fill = "#C84E00") +  
  theme_classic() +  
  xlab("Left or Right Side") +  
  ylab("# of Times Using Each Limb") +  
  ggtitle("Hand Use for Food Grasping Between Individuals") +  
  facet_wrap (~ Focal, scales = "free")
```

LeftyLemurs\_files/figure-latex/unnamed-chunk-32-1.pdf

It kind of looks like Sophia and Thrax are lefties!!! And Licinius is close... The other lemurs look like righties!

Look at them all on the same scale

```
ggplot (l_foodGrasps, aes(x= Side)) +  
  geom_bar(color = "black", fill = "#C84E00") +  
  theme_classic() +  
  xlab("Left or Right Side") +  
  ylab("# of Times Using Each Limb") +  
  ggtitle("Hand Use for Food Grasping Between Individuals") +  
  facet_wrap (~ Focal)
```

LeftyLemurs\_files/figure-latex/unnamed-chunk-33-1.pdf

Okay there isn't much data for Sophia so it could just be "noise" for her... But Thrax has a lot of data

But is all of this actually statistically significant Don't know

```
ggplot (l_noLA, aes(x= Category)) +  
  geom_bar(color = "black", fill = "#C84E00") +  
  theme_classic() +  
  xlab("Activity") +  
  ylab("Occurrences") +  
  ggtitle("Hand Use for Activities by Species") +  
  facet_wrap (~ Species)
```



LeftyLemurs\_files/figure-latex/unnamed-chunk-34-1.pdf

This just does occurrences. How can I get the Y-axis to be % of L compared to R?  
Idk

```
ggplot (l_foodGrasps, aes(x= Side)) +  
  geom_bar(color = "black", fill = "#C84E00") +  
  theme_classic() +  
  xlab("Activity") +  
  ylab("Occurrences") +  
  ggtitle("Hand Used for Food Grasping Between Species") +  
  facet_wrap (~ Species)
```

LeftyLemurs\_files/figure-latex/unnamed-chunk-35-1.pdf

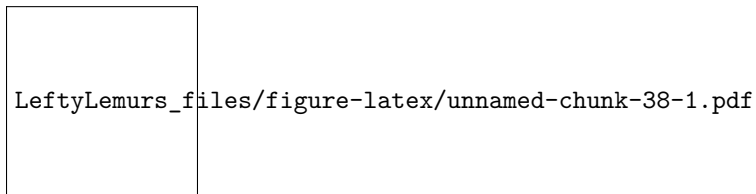
```
ggplot (l_foodGrasps, aes(x= Side)) +  
  geom_bar(color = "black", fill = "#C84E00") +  
  theme_classic() +  
  xlab("Left or Right Side") +  
  ylab("# of Times Using Each Limb") +  
  ggtitle("Hand Use for Grasping Between Individuals") +  
  facet_wrap (~ Focal, scales = "free" )
```

LeftyLemurs\_files/figure-latex/unnamed-chunk-36-1.pdf

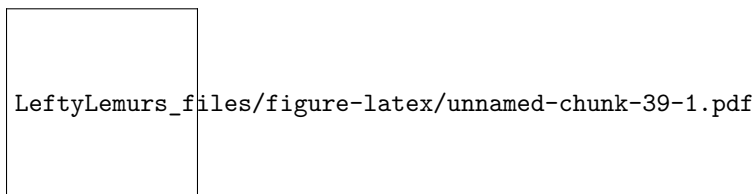
```
ggplot (l_foodGrasps, aes(x= Side)) +  
  geom_bar(color = "black", fill = "#C84E00") +  
  theme_classic() +  
  xlab("Side") +  
  ylab("Occurrences") +  
  ggtitle("Hand Used for Food Grasping Between Species") +  
  facet_wrap (~ Species)
```

LeftyLemurs\_files/figure-latex/unnamed-chunk-37-1.pdf

```
ggplot (L, aes(x= Focal)) +
  geom_bar(color = "black", fill = "#C84E00") +
  theme_classic() +
  xlab("Focal") +
  ylab("Occurrences") +
  ggtitle("# of Times Using Each Limb") +
  facet_wrap (~ Side)
```



```
ggplot (l_foodGrasps, aes(x= Side)) +
  geom_bar(color = "black", fill = "#C84E00") +
  theme_classic() +
  xlab("Side") +
  ylab("Occurrences") +
  ggtitle("Hand Used for Food Grasping Between Sex") +
  facet_wrap (~ Sex, scales = "free")
```



Trying some statistical tests

```
L %>%
  group_by(Side) %>%
  summarise (n = n()) %>%
  mutate(proportion = n / sum(n))
```

```
## # A tibble: 2 x 3
##   Side      n proportion
##   <chr> <int>     <dbl>
## 1 L      257     0.413
## 2 R      365     0.587
```

```
l_handstuff %>%
  group_by(Side) %>%
  summarise (n = n()) %>%
  mutate(proportion = n / sum(n))
```

```
## # A tibble: 2 x 3
##   Side      n proportion
##   <chr> <int>     <dbl>
## 1 L      218     0.417
## 2 R      305     0.583
```

```
binom.test(218, 305, p = .75, alternative = "two.sided")
```

```
##
## Exact binomial test
##
## data: 218 and 305
## number of successes = 218, number of trials = 305, p-value = 0.1648
## alternative hypothesis: true probability of success is not equal to 0.75
## 95 percent confidence interval:
## 0.6605189 0.7647621
## sample estimates:
## probability of success
## 0.7147541
```

Trying to do chi-squared test and contingency coefficients (did not work)

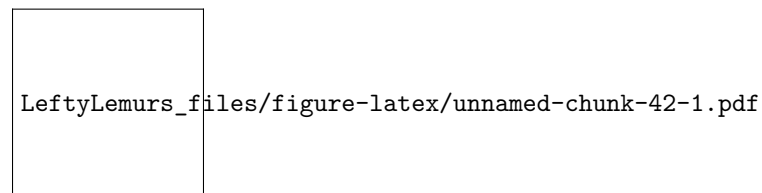
```
# tbl_handGrasps <- as.data.frame(l_noLA) %>%
# group_by(Side, Sex) %>%
# summarize(qty = sum(Freq)) %>%
# ungroup() %>%
# spread(key = Sex, value = qty)

# mat_handGrasps <- as.matrix(tbl_handGrasps[-1])
# rownames(mat_handGrasps) <- levels(tbl_handGrasps$Side)

# chisq.test(mat_handGrasps)
```

It says it can't because it doesn't understand "Freq"

```
ggplot(l_grasps, aes(x= Side)) +
  geom_bar(color = "black", fill = "#C84E00") +
  theme_classic() +
  xlab("Left or Right Side") +
  ylab("# of Times Using Each Limb") +
  ggtitle("Hand Use for Grasping Between Sexes") +
  facet_wrap(~ Sex, scales = "free")
```



```
ggplot(L, aes(x= Limb)) +
  geom_bar(color = "black", fill = "#C84E00") +
  theme_classic() +
  xlab("Limb") +
  ylab("# of Times Using Each Limb") +
  ggtitle("Limb Use Between Individuals") +
  facet_wrap(~ Focal)
```

LeftyLemurs\_files/figure-latex/unnamed-chunk-43-1.pdf

Not a lot of foot use. It might not be very useful to include these data

Just look at bipedal locomotion

```
l_feet <-  
L %>%  
  filter(Category == "BP")  
  
ggplot(l_feet, aes(x= Limb)) +  
  geom_bar(color = "black", fill = "#C84E00") +  
  theme_classic() +  
  xlab("Limb") +  
  ylab("# of Times Using Each Limb") +  
  ggtitle("Foot Use Between Individuals") +  
  facet_wrap (~ Focal)
```

LeftyLemurs\_files/figure-latex/unnamed-chunk-44-1.pdf

I don't really see any overall patterns here. It looks like Furia leads with her right foot more than left and Thrax leads a little more with his left foot than right.

Does age impact hand use?

```
ggplot(L, aes(x = Category, y = Age, color = Side)) +  
  geom_jitter() +  
  theme_classic() +  
  xlab("Type of Behavior") +  
  ylab("Age of Lemur") +  
  ggtitle("Does Age Affect Limb Use?") +  
  scale_color_manual(values = c("#1D6363", "#E89923"))
```

LeftyLemurs\_files/figure-latex/unnamed-chunk-45-1.pdf

Yeah I don't think it does lol

Trying to make the graph I yearn for

```
ggplot(l_noLA, aes(x= Category, fill = Side)) +  
  geom_bar(color = "black") +  
  theme_classic() +  
  xlab("Type of Behavior") +  
  ylab("# of Times Using Each Limb") +  
  ggtitle("Limb Use Between Lemur Species") +
```

```
facet_wrap (~ Species, scales = "free") +
scale_fill_manual(values = c("#1D6363", "#E89923"))
```

LeftyLemurs\_files/figure-latex/unnamed-chunk-46-1.pdf

It's still not exactly what I want. I want the Y-axis to be % of grasps being with left hand, not total times used. Splitting by color makes it really hard to read, but Idk how else to do it :P

```
ggplot (l_noLA, aes(x= Side, fill = interaction(Category, Side))) +
  geom_bar(color = "black") +
  theme_classic() +
  xlab("Left or Right Side") +
  ylab("# of Times Using Each Limb") +
  ggtitle("Limb Use Between Lemur Species") +
  facet_wrap (~ Species, scales = "free")
```

LeftyLemurs\_files/figure-latex/unnamed-chunk-47-1.pdf

Wow that it was too complicated. Why did I dare make this monstrosity?

Okay, the landing and foot use data is fun and all, but the hand grasps it what I actually need to look at. I'm going to make that into a .CSV and analyze the data in JMP

```
# write_csv (l_grasps, "HandGrasps.csv")
```

```
summary(l_grasps)
```

```
##      Category      Troop      Focal      Species
## Length:511      Length:511      Length:511      Length:511
## Class :character Class :character Class :character Class :character
## Mode  :character Mode  :character Mode  :character Mode  :character
##
##
##      Age      Sex      Month      Day
## Min.   : 5.00      Length:511      Min.   :6.000      Min.   : 1.00
## 1st Qu.:10.00      Class :character      1st Qu.:6.000      1st Qu.: 8.00
## Median :12.00      Mode  :character      Median :6.000      Median :22.00
## Mean   :12.05                                Mean   :6.446      Mean   :18.19
## 3rd Qu.:14.00                                3rd Qu.:7.000      3rd Qu.:28.00
## Max.   :29.00                                Max.   :7.000      Max.   :30.00
##      Year      Time      Side      Note
## Min.   :2022      Length:511      Length:511      Length:511
## 1st Qu.:2022      Class :character      Class :character      Class :character
## Median :2022      Mode  :character      Mode  :character      Mode  :character
## Mean   :2022
## 3rd Qu.:2022
## Max.   :2022
```