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Temporal Selection Gradients

```
library(MASS) # MASS clashes with dplyr... so always load first
library(pander) # pander clashes with dplyr... so always load first

##
## Attaching package: 'pander'
##
## The following object is masked from 'package:knitr':
##
##     pandoc
```

```

set.alignment('right', row.names = 'left')
library(MCMCglmm)

## Loading required package: Matrix
## Loading required package: coda
## Loading required package: lattice
## Loading required package: ape

library(arm)

## Loading required package: lme4
## Loading required package: Rcpp
##
## arm (Version 1.7-07, built: 2014-8-27)
##
## Working directory is /home/ryan/projects/2014-female-selection
##
##
## Attaching package: 'arm'
##
## The following object is masked from 'package:ape':
##
##     balance
##
## The following object is masked from 'package:coda':
##
##     traceplot

library(dplyr)

##
## Attaching package: 'dplyr'
##
## The following object is masked from 'package:MASS':
##
##     select
##
## The following objects are masked from 'package:stats':
##
##     filter, lag
##
## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union

library(ggplot2)
library(grid)

# Load Data
load("data/analyses_data/fit_raneff_data.RData")
fit_raneff_data$Year <- as.character(fit_raneff_data$Year)

```

Does ‘Year’ significantly improve models of selection?

The significance of interaction terms between Year and the behavioral traits on fitness.

```
# GLMMs to test whether selection fluctuates across years.
library(lme4)
# Models with interactions between year and the behavioral traits
fit_raneff_data_blup <- filter(fit_raneff_data, type == "blup")

fit_raneff_data_blup %>%
  group_by(Grid, Year, add = FALSE) %>%
  summarise(n(), var(ars_all))

## Source: local data frame [16 x 4]
## Groups: Grid
##
##   Grid Year n() var(ars_all)
## 1    KL 2003  4      0.0000
## 2    KL 2004  8      0.7857
## 3    KL 2005 19      1.6550
## 4    KL 2006 24      0.4275
## 5    KL 2007 21      1.1000
## 6    KL 2008 29      0.5369
## 7    KL 2009 24      0.7373
## 8    KL 2010 22      1.2121
## 9    SU 2003 14      1.3022
## 10   SU 2004 18      0.8007
## 11   SU 2005 31      1.9828
## 12   SU 2006 24      0.3025
## 13   SU 2007 19      1.0526
## 14   SU 2008 16      0.0000
## 15   SU 2009 11      0.8727
## 16   SU 2010 12      2.4470

# grid_years with no variation in fitness need to be removed
fit_raneff_data_blup <- filter(fit_raneff_data_blup,
  !(grid_year %in% c("KL2003", "SU2008")))

# Need to also remove Grid Years with very low sample sizes.
fit_raneff_data_blup %>%
  group_by(Grid, Year, add = FALSE) %>%
  summarise(n(), var(ars_all))

## Source: local data frame [14 x 4]
## Groups: Grid
##
##   Grid Year n() var(ars_all)
## 1    KL 2004  8      0.7857
## 2    KL 2005 19      1.6550
## 3    KL 2006 24      0.4275
## 4    KL 2007 21      1.1000
```

```

## 5    KL 2008  29      0.5369
## 6    KL 2009  24      0.7373
## 7    KL 2010  22      1.2121
## 8    SU 2003  14      1.3022
## 9    SU 2004  18      0.8007
## 10   SU 2005  31      1.9828
## 11   SU 2006  24      0.3025
## 12   SU 2007  19      1.0526
## 13   SU 2009  11      0.8727
## 14   SU 2010  12      2.4470

fit_raneff_data_blup <- filter(fit_raneff_data_blup,
  !(grid_year %in% c("KL2004")))

fit_raneff_data_blup$OID <- 1:nrow(fit_raneff_data_blup)
fit_raneff_data_blup <- droplevels(fit_raneff_data_blup)

ars_year <- glmer(ars_all ~ Year + Grid + activity_s + activity_s:Year +
  aggression_s + aggression_s:Year + docility_s + docility_s:Year +
  (1|ID) + (1|OID), data = fit_raneff_data_blup, family = poisson,
  control=glmerControl(optimizer="bobyqa"))

## Warning: maxfun < 10 * length(par)^2 is not recommended.

save(ars_year, file = "data/analyses_data/ars_year.RData")

load("data/analyses_data/ars_year.RData")
# Test fit of models. Does the addition of year:traits improve the fit?
library(car)

##
## Attaching package: 'car'
##
## The following object is masked from 'package:arm':
##
##      logit

library(lme4)
aod <- Anova(ars_year, type = 2)
aod <- data.frame(aod)
aod$Chisq <- round(aod$Chisq ,digits = 2)

# Function to convert small p-values into 'P < X'
p.format <- function(x){
  out <- signif(x, digits = 2)
  out[x < 0.005] <- "< 0.005"
  out[x < 0.001] <- "< 0.001"
  out[x < 0.0001] <- "< 0.0001"
  return(out)
}

```

```
# Format p values
aod[,3] <- p.format(aod[,3])
row.names(aod) <- c("Year", "Grid", "Activity", "Aggression", "Docility",
  "Year x Activity", "Year x Aggression", "Year x Docility")
pandoc.table(aod, caption =
  "The effect of year on selection for female behavioral traits through annual
  reproductive success. Significance was calculated with Wald chisq tests from
  a type II analysis of deviance. GLMMs were fitted with identity as a random
  effect and assumed a Poisson error distribution.")
```

	Chisq	Df	Pr..Chisq.
Year	38.1	7	< 0.0001
Grid	1.07	1	0.3
Activity	0.34	1	0.56
Aggression	0.34	1	0.56
Docility	0.98	1	0.32
Year x Activity	22.92	7	< 0.005
Year x Aggression	22.84	7	< 0.005
Year x Docility	10.33	7	0.17

Table 1: The effect of year on selection for female behavioral traits through annual reproductive success. Significance was calculated with Wald chisq tests from a type II analysis of deviance. GLMMs were fitted with identity as a random effect and assumed a Poisson error distribution.

Accounting for random effect uncertainty

Calculate selection gradients

Calculate selection coefficients for each of the 1000 samples of the posterior distribution of random effects.

```
# Function to get posterior distribution of selection gradients
x <- fit_raneff_data %>% filter(type == "raneff" & Year == 2003 & itt == 1)
seCoefMCMC <- function(x){
  mod <- lm(rel_ars ~ aggression + activity + docility, data = x)
  mod_sd <- lm(rel_ars ~ aggression_sy + activity_sy + docility_sy, data = x)
  res <- c(as.list(coef(mod)[-1]), as.list(coef(mod_sd)[-1]))
  res$Year <- x$Year[1]
  res$itt <- x$itt[1]
  return(data.frame(res, stringsAsFactors = FALSE))
}

start_time <- Sys.time()
sel_grads_mcmc_post <- fit_raneff_data %>%
```

```

    filter(type == "raneff") %>%
    group_by(itt, Year, add = FALSE) %>%
    do(seCoefMCMC())
print(paste("Approx. run time: ", format(Sys.time() - start_time)))

## [1] "Approx. run time: 57.5 secs"

save(sel_grads_mcmc_post,
     file = "data/analyses_data/sel_grads_mcmc_post.RData")

load("data/analyses_data/sel_grads_mcmc_post.RData")
x <- sel_grads_mcmc_post %>% filter(Year == "2003")
getCred <- function(x, sig = 0.05){
  require(MCMCglmm)
  mcmc_data <- x %>% ungroup() %>% select(aggression, activity, docility, aggression_sy, activity_sy)
  pm <- posterior.mode(mcmc_data)
  int <- HPDinterval(mcmc_data, prob = 1 - sig)
  tbl_df(data.frame(
    Year = x$Year[1],
    variable = c("Aggression", "Activity", "Docility", "Aggression",
                 "Activity", "Docility"),
    standardization = c("None", "None", "None", "SD", "SD", "SD"),
    post_mode = pm,
    lower = int[, "lower"],
    upper = int[, "upper"],
    stringsAsFactors = FALSE
  ))
}

getCred(sel_grads_mcmc_post %>% filter(Year == "2004"))

## Source: local data frame [6 x 6]
##
##      Year  variable standardization post_mode  lower  upper
## aggression 2004 Aggression          None -0.30391 -0.76486 0.14086
## activity   2004 Activity           None  0.03346 -0.31909 0.66905
## docility    2004 Docility           None  0.05488 -0.06433 0.11222
## aggression_sy 2004 Aggression          SD -0.24452 -0.80615 0.07615
## activity_sy  2004 Activity           SD  0.01654 -0.35851 0.62341
## docility_sy   2004 Docility           SD  0.20932 -0.25839 0.51523

sel_grads_mcmc <- sel_grads_mcmc_post %>%
  group_by(Year, add = FALSE) %>%
  do(getCred(x = ., sig = 0.05))

sel_grads_mcmc$upper_sig_star <- ""
sel_grads_mcmc$lower_sig_star <- ""
sel_grads_mcmc$upper_sig_star[sel_grads_mcmc$post_mode > 0 &
  sel_grads_mcmc$lower > 0] <- "*"
sel_grads_mcmc$lower_sig_star[sel_grads_mcmc$post_mode < 0 &

```

```

sel_grads_mcmc$upper < 0] <- "*"

save(sel_grads_mcmc, sel_grads_mcmc_post, getCred,
     file = "data/analyses_data/sel_grads_mcmc.RData")

load("data/analyses_data/sel_grads_mcmc.RData")

N <- fit_ranef_data %>%
  filter(type == "blup") %>%
  group_by(Year, add = FALSE) %>%
  summarise(n(), doc_mean = mean(docility, na.rm = TRUE))

# Format for table
sgt <- sel_grads_mcmc
sgt$sig_star <- ""
sgt$sig_star[sgt$post_mode > 0 & sgt$lower > 0] <- "*"
sgt$sig_star[sgt$post_mode < 0 & sgt$upper < 0] <- "*"
sgt$post_mode <- format(round(sgt$post_mode, digits = 2), digits = 1,
  nsmall = 2)
sgt$lower <- format(round(sgt$lower, digits = 2), digits = 1,
  nsmall = 2)
sgt$upper <- format(round(sgt$upper, digits = 2), digits = 1,
  nsmall = 2)
sgt$coef <- paste(sgt$post_mode, " (", sgt$lower, " to ", sgt$upper, ")",
  sgt$sig_star, sep = '')

sgt_agg <- filter(sgt, variable == "Aggression", standardization == "None")
sgt_act <- filter(sgt, variable == "Activity", standardization == "None")
sgt_doc <- filter(sgt, variable == "Docility", standardization == "None")

sgt_agg_sd <- filter(sgt, variable == "Aggression", standardization == "SD")
sgt_act_sd <- filter(sgt, variable == "Activity", standardization == "SD")
sgt_doc_sd <- filter(sgt, variable == "Docility", standardization == "SD")

doc_post_mode <- sel_grads_mcmc %>% filter(standardization == "None" & variable == "Docility")
doc_post_mode$post_mode_m <- doc_post_mode$post_mode * N$doc_mean
doc_post_mode$post_mode_m <- format(round(doc_post_mode$post_mode_m, digits = 2), digits = 1, nsmall
pandoc.table(
  data.frame(Year = N$Year, N = N[,2], Aggression = sgt_agg$coef,
    Acitivity = sgt_act$coef, Docility = sgt_doc$coef
  ),
  caption = "Non-standardized selection gradients (accounting for behavioural uncertainty)."
)

```

Year	N	Aggression	Acitivity
2003	18	0.03 (-0.92 to 0.84)	0.45 (-0.17 to 1.32)
2004	26	-0.30 (-0.76 to 0.14)	0.03 (-0.32 to 0.67)

Year	N	Aggression	Acitivity
2005	50	-0.18 (-0.45 to 0.10)	0.13 (-0.16 to 0.40)
2006	48	0.39 (-0.04 to 0.79)	0.08 (-0.39 to 0.45)
2007	40	0.00 (-0.35 to 0.36)	0.11 (-0.22 to 0.42)
2008	45	0.44 (-0.12 to 0.95)	-0.26 (-0.75 to 0.40)
2009	35	0.12 (-0.33 to 0.58)	-0.58 (-0.93 to -0.02)*
2010	34	0.06 (-0.30 to 0.35)	0.03 (-0.26 to 0.30)

Table 2: Non-standardized selection gradients (accounting for behavioural uncertainty). (continued below)

Docility
-0.08 (-0.26 to 0.06)
0.05 (-0.06 to 0.11)
0.03 (-0.02 to 0.07)
-0.04 (-0.12 to 0.00)
0.00 (-0.05 to 0.05)
-0.02 (-0.08 to 0.05)
-0.06 (-0.11 to -0.01)*
-0.05 (-0.08 to -0.02)*

```
pandoc.table(
  data.frame(Year = N$Year, N = N[,2], Aggression = sgt_agg_sd$coef,
    Acitivity = sgt_act_sd$coef, Docility = sgt_doc_sd$coef
  ),
  caption = "SD-standardized selection gradients (accounting for behavioural uncertainty)."
```

Year	N	Aggression	Acitivity
2003	18	0.03 (-0.76 to 0.71)	0.79 (-0.24 to 1.38)
2004	26	-0.24 (-0.81 to 0.08)	0.02 (-0.36 to 0.62)
2005	50	-0.19 (-0.47 to 0.07)	0.16 (-0.12 to 0.41)
2006	48	0.39 (-0.04 to 0.72)	0.08 (-0.37 to 0.44)
2007	40	-0.01 (-0.32 to 0.34)	0.09 (-0.23 to 0.42)
2008	45	0.46 (-0.06 to 0.95)	-0.18 (-0.72 to 0.40)
2009	35	0.16 (-0.29 to 0.59)	-0.55 (-0.92 to 0.01)
2010	34	-0.04 (-0.27 to 0.32)	0.04 (-0.25 to 0.30)

Year	N	Aggression	Acitivity
------	---	------------	-----------

Table 4: SD-standardized selection gradients (accounting for behavioural uncertainty). (continued below)

Docility
-0.38 (-1.12 to 0.31)
0.21 (-0.26 to 0.52)
0.10 (-0.09 to 0.34)
-0.25 (-0.58 to -0.03)*
0.01 (-0.23 to 0.23)
-0.08 (-0.37 to 0.25)
-0.30 (-0.53 to -0.05)*
-0.23 (-0.35 to -0.10)*

```
pandoc.table(
  data.frame(Year = N$Year, N = N[,2], mean_trait = N$doc_mean, Docility = doc_post_mode$post_mode_
),
  caption = "Mean standardized selection gradients (accounting for behavioural uncertainty)."
```

Year	N	mean_trait	Docility
2003	18	17.29	-1.46
2004	26	17.31	0.95
2005	50	17.25	0.55
2006	48	16.77	-0.70
2007	40	16.77	0.05
2008	45	16.9	-0.27
2009	35	16.79	-0.97
2010	34	17.19	-0.87

Table 6: Mean standardized selection gradients (accounting for behavioural uncertainty).

Plots

```
load("data/analyses_data/sel_grads_mcmc_post.RData")
library(ggplot2)
library(dplyr)

sel_grads_mcmc <- sel_grads_mcmc_post %>%
  group_by(Year, add = FALSE) %>% do(getCred(x = ., sig = 0.05))

sel_grads_mcmc$upper_sig_star <- ""
sel_grads_mcmc$lower_sig_star <- ""
sel_grads_mcmc$upper_sig_star[sel_grads_mcmc$post_mode > 0 &
  sel_grads_mcmc$lower > 0] <- "*"
sel_grads_mcmc$lower_sig_star[sel_grads_mcmc$post_mode < 0 &
  sel_grads_mcmc$upper < 0] <- "*"

p <- ggplot(data = filter(sel_grads_mcmc, standardization == "SD"),
  aes(x = Year, y = post_mode, group = variable))
p <- p + geom_hline(yintercept = 0, size = 0.25) # Line at y = 0
p <- p + geom_errorbar(aes(ymin = upper, ymax = lower),
  position = position_dodge(width = 0.5), width = 0.4, size = 0.4)
# Houle data percentiles
p <- p + geom_hline(yintercept = c(0.2975, -0.2975), linetype = 2, size = 0.4)
p <- p + geom_point(aes(shape = variable, fill = variable),
  position = position_dodge(width = 0.5), size = 3)
p <- p + scale_shape_manual(name = "B", values = c(24, 21, 22))
p <- p + scale_fill_manual(name = "B", values = c("white", "black", "white"))
p <- p + scale_color_manual(name = "B", values = c("black", "black", "black"))
p <- p + xlab("Year")
p <- p + ylab("Posterior Mode ± 0.95 Credible Interval")
p <- p + theme_bw(base_size = 10)
p <- p + theme(legend.position = c(0.92, 0.86),
  legend.background = element_blank(), legend.key.size = unit(0.4, "cm"))
p <- p + theme(legend.title = element_text(family = "Helvetica",
  face = "plain", size = 18))
p <- p + theme(legend.key = element_blank())
p <- p + theme(strip.background = element_blank())
p <- p + theme(panel.grid.minor = element_blank(),
  panel.grid.major = element_blank())
p <- p + theme(panel.border = element_blank())
p <- p + theme(axis.line = element_line(color = "black"))
p <- p + geom_text(aes(x = Year, y = upper, group = variable,
  label = upper_sig_star), vjust = -0.3,
  position = position_dodge(width = 0.5), size = 5)
p <- p + geom_text(aes(x = Year, y = lower, group = variable,
  label = lower_sig_star), vjust = 1.3,
  position = position_dodge(width = 0.5), size = 5)
p_sel_grad_MCMC <- p + ylim(c(-1.1, 1.4))

pdf(file = "figure/04_sg_mcmc_SD_print.pdf", width = 4.33, height = 3)
p_sel_grad_MCMC
```

```
## ymax not defined: adjusting position using y instead
## ymax not defined: adjusting position using y instead
## ymax not defined: adjusting position using y instead
```

```
## Warning: Removed 4 rows containing missing values (geom_path).
## Warning: Removed 1 rows containing missing values (geom_text).
```

```
dev.off()
```

```
## pdf
## 2
```

```
p_sel_grad_MCMC
```

```
## ymax not defined: adjusting position using y instead
## ymax not defined: adjusting position using y instead
## ymax not defined: adjusting position using y instead
```

```
## Warning: Removed 4 rows containing missing values (geom_path).
## Warning: Removed 1 rows containing missing values (geom_text).
```

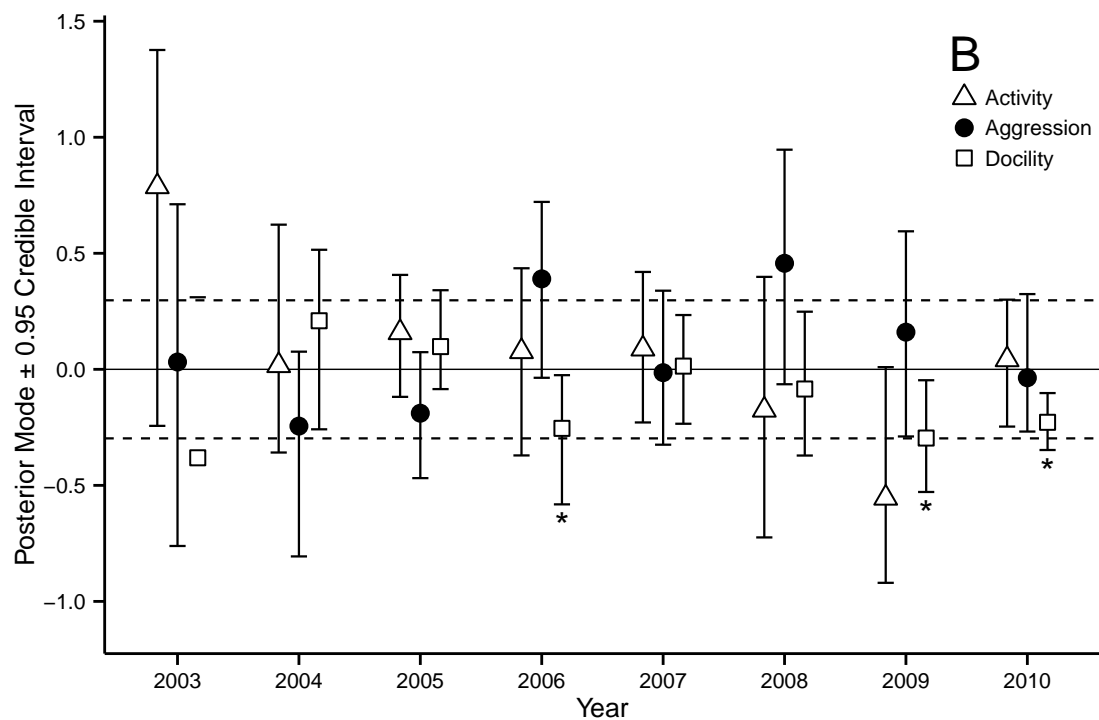


Figure 1: SD Standardized Selection Gradients

```

load("data/analyses_data/sel_grads_mcmc_post.RData")
library(ggplot2)
library(dplyr)

sel_grads_mcmc <- sel_grads_mcmc_post %>%
  group_by(Year, add = FALSE) %>% do(getCred(x = ., sig = 0.05))

sel_grads_mcmc$upper_sig_star <- ""
sel_grads_mcmc$lower_sig_star <- ""
sel_grads_mcmc$upper_sig_star[sel_grads_mcmc$post_mode > 0 &
  sel_grads_mcmc$lower > 0] <- "*"
sel_grads_mcmc$lower_sig_star[sel_grads_mcmc$post_mode < 0 &
  sel_grads_mcmc$upper < 0] <- "*"

p <- ggplot(data = filter(sel_grads_mcmc, standardization == "None"),
  aes(x = Year, y = post_mode, group = variable)
)
p <- p + geom_hline(yintercept = 0, size = 0.25) # Line at y = 0
p <- p + geom_errorbar(aes(ymax = upper, ymin = lower),
  position = position_dodge(width = 0.5), width = 0.4, size = 0.4)
# Houle data percentiles
p <- p + geom_hline(yintercept = c(0.2975, -0.2975), linetype = 2, size = 0.4)
p <- p + geom_point(aes(shape = variable, fill = variable),
  position = position_dodge(width = 0.5), size = 3)
p <- p + scale_shape_manual(name = "B", values = c(24, 21, 22))
p <- p + scale_fill_manual(name = "B", values = c("white", "black", "white"))
p <- p + scale_color_manual(name = "B", values = c("black", "black", "black"))
p <- p + xlab("Year")
p <- p + ylab("Posterior Mode ± 0.95 Credible Interval")
p <- p + theme_bw(base_size = 10)
p <- p + theme(legend.position = c(0.92, 0.86),
  legend.background = element_blank(), legend.key.size = unit(0.4, "cm"))
p <- p + theme(legend.title = element_text(family = "Helvetica",
  face = "plain", size = 18))
p <- p + theme(legend.key = element_blank())
p <- p + theme(strip.background = element_blank())
p <- p + theme(panel.grid.minor = element_blank(),
  panel.grid.major = element_blank())
p <- p + theme(panel.border = element_blank())
p <- p + theme(axis.line = element_line(color = "black"))
p <- p + geom_text(aes(x = Year, y = upper, group = variable,
  label = upper_sig_star), vjust = -0.3,
  position = position_dodge(width = 0.5), size = 5)
p <- p + geom_text(aes(x = Year, y = lower, group = variable,
  label = lower_sig_star), vjust = 1.3,
  position = position_dodge(width = 0.5), size = 5)
p_sel_grad_MCMC <- p + ylim(c(-1.1, 1.4))

pdf(file = "figure/04_sg_mcmc_NS_print.pdf", width = 4.33, height = 3)
p_sel_grad_MCMC

## ymax not defined: adjusting position using y instead

```

```
## ymax not defined: adjusting position using y instead
## ymax not defined: adjusting position using y instead
```

```
dev.off()
```

```
## pdf
## 2
```

```
p_sel_grad_MCMC
```

```
## ymax not defined: adjusting position using y instead
## ymax not defined: adjusting position using y instead
## ymax not defined: adjusting position using y instead
```

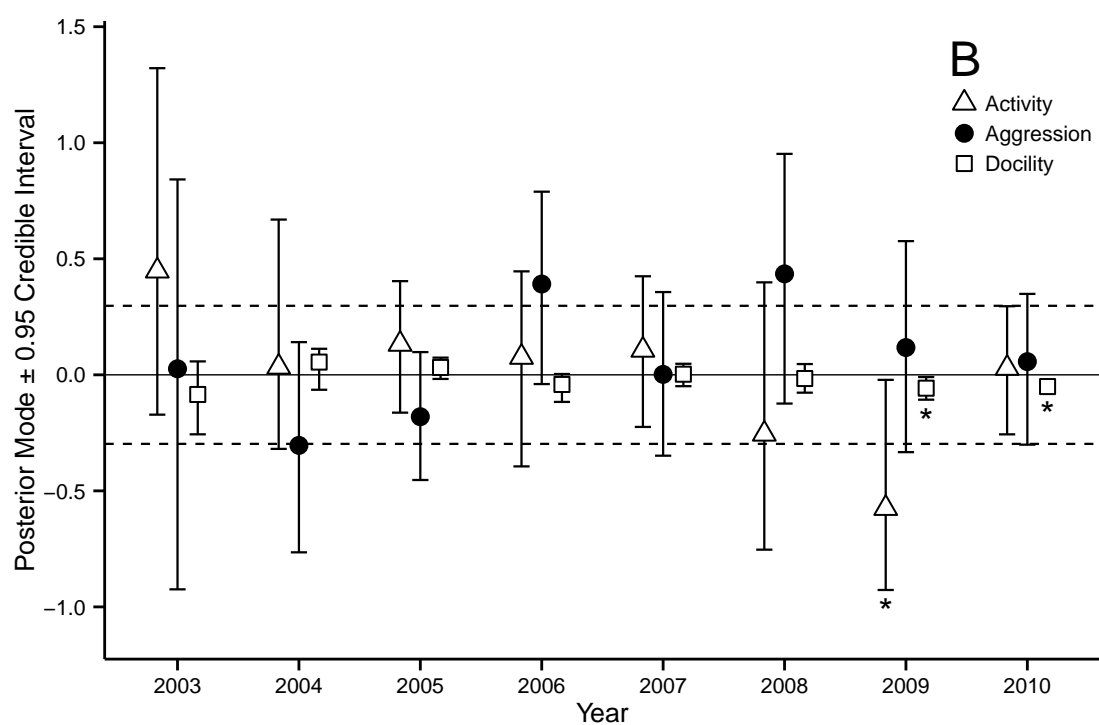


Figure 2: Non-standardized Selection Gradients

Correlations

```
sel_grads_mcmc_flat <- data.frame(
  Aggression = filter(sel_grads_mcmc, standardization == "SD",
    variable == "Aggression")$post_mode,
  Agg_upper = filter(sel_grads_mcmc, standardization == "SD",
    variable == "Aggression")$upper,
```

```

Agg_lower = filter(sel_grads_mcmc, standardization == "SD",
  variable == "Aggression")$lower,
Activity   = filter(sel_grads_mcmc, standardization == "SD",
  variable == "Activity")$post_mode,
Act_upper  = filter(sel_grads_mcmc, standardization == "SD",
  variable == "Activity")$upper,
Act_lower  = filter(sel_grads_mcmc, standardization == "SD",
  variable == "Activity")$lower,
Docility   = filter(sel_grads_mcmc, standardization == "SD",
  variable == "Docility")$post_mode,
Doc_upper  = filter(sel_grads_mcmc, standardization == "SD",
  variable == "Docility")$upper,
Doc_lower  = filter(sel_grads_mcmc, standardization == "SD",
  variable == "Docility")$lower
)

cor.behav <- function(x, y){
  ct <- cor.test(x, y)
  out <- data.frame(est = ct$estimate, lower = ct$conf.int[1],
    upper = ct$conf.int[2], stringsAsFactors = FALSE)
  out <- round(out, digits = 2)
  out$print <- paste(out$est, " (", out$lower, ", ", out$upper, ")", sep = "")
}

cor_agg_act <- cor.behav(sel_grads_mcmc_flat$Aggression,
  sel_grads_mcmc_flat$Activity)
cor_agg_doc <- cor.behav(sel_grads_mcmc_flat$Aggression,
  sel_grads_mcmc_flat$Docility)
cor_doc_act <- cor.behav(sel_grads_mcmc_flat$Docility,
  sel_grads_mcmc_flat$Activity)

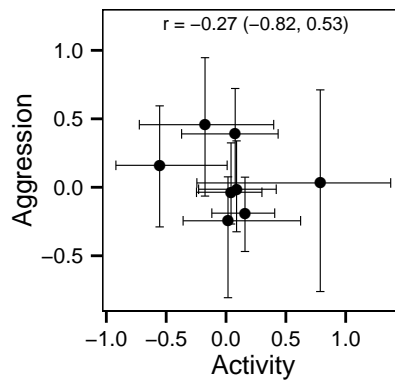
```

Aggression and Activity

```

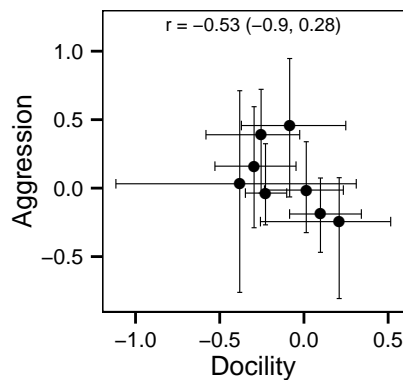
p <- ggplot(data = sel_grads_mcmc_flat, aes(x = Activity, y = Aggression))
p <- p + geom_point()
p <- p + ylab("Aggression")
p <- p + xlab("Activity")
p <- p + theme_bw(base_size = 10)
p <- p + theme(panel.grid.major = element_blank(),
  panel.grid.minor = element_blank(), panel.background = element_blank(),
  strip.background = element_blank(), strip.text = element_blank(),
  panel.border = element_rect(linetype = "solid", colour = "black"))
p <- p + geom_errorbarh(aes(xmin = Act_lower, xmax = Act_upper),
  height = 0.07, size = 0.2)
p <- p + geom_errorbar(aes(ymin = Agg_lower, ymax = Agg_upper),
  width = 0.07, size = 0.2)
p <- p + annotate(geom = "text", size = 2.5, x = 0.25, y = 1.2,
  label = paste("r = ", cor_agg_act, sep = ' '))
p <- p + theme(plot.margin = unit(c(0.1, 0.1, 0.1, 0.1), "cm"))

```



Aggression and Docility

```
p <- ggplot(data = sel_grads_mcmc_flat, aes(y = Aggression, x = Docility))
p <- p + geom_point()
p <- p + ylab("Aggression")
p <- p + xlab("Docility")
p <- p + theme_bw(base_size = 10)
p <- p + theme(panel.grid.major = element_blank(),
  panel.grid.minor = element_blank(), panel.background = element_blank(),
  strip.background = element_blank(), strip.text = element_blank(),
  panel.border = element_rect(linetype = "solid", colour = "black"))
p <- p + geom_errorbarh(aes(xmin = Doc_lower, xmax = Doc_upper),
  height = 0.07, size = 0.2)
p <- p + geom_errorbar(aes(ymin = Agg_lower, ymax = Agg_upper),
  width = 0.03, size = 0.2)
p <- p + annotate(geom = "text", size = 2.5, x = -0.3, y = 1.2,
  label = paste("r = ", cor_agg_doc, sep = ' '))
p <- p + theme(plot.margin = unit(c(0.1, 0.1, 0.1, 0.1), "cm"))
```



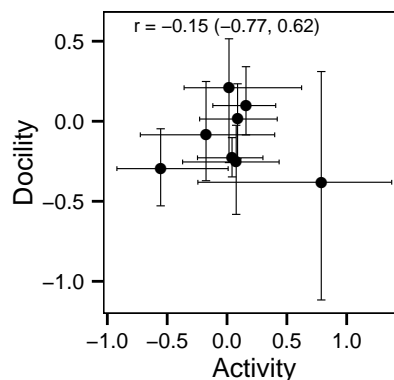
Activity and Docility

```
p <- ggplot(data = sel_grads_mcmc_flat, aes(x = Activity, y = Docility))
p <- p + geom_point()
```

```

p <- p + xlab("Activity")
p <- p + ylab("Docility")
p <- p + theme_bw(base_size = 10)
p <- p + theme(panel.grid.major = element_blank(),
  panel.grid.minor = element_blank(), panel.background = element_blank(),
  strip.background = element_blank(), strip.text = element_blank(),
  panel.border = element_rect(linetype = "solid", colour = "black"))
p <- p + geom_errorbar(aes(ymin = Doc_lower, ymax = Doc_upper),
  width = 0.07, size = 0.2)
p <- p + geom_errorbarh(aes(xmin = Act_lower, xmax = Act_upper),
  height = 0.03, size = 0.2)
p <- p + annotate(geom = "text", size = 2.5, x = 0, y = 0.6,
  label = paste("r = ", cor_doc_act, sep = ' '))
p + theme(plot.margin = unit(c(0.1, 0.1, 0.1, 0.1), "cm"))

```



Summary Stats

```

library(dplyr)
sign_change <- function(x){
  # sign changes calculated as the number of changes in direction between
  # successive years relative to n-1
  s <- sign(x)
  sum(s[1:(length(s)-1)] != s[-1])/(length(s)-1)
}
se <- function(lower, upper){
  (upper - lower) / 3.92
}

sum_stats_mcmc <- sel_grads_mcmc %>%
  filter(standardization == "SD") %>%
  group_by(variable, add = FALSE) %>%
  summarise(
    mean_abs_b = mean(abs(post_mode)),
    abs_mean_b = abs(mean(post_mode)),
    sd_b = sd(post_mode),
    mean_se_b = mean(se(lower, upper)),
    freq_sign = sign_change(post_mode),

```



```

    mean_cv = mean(se(lower, upper) / abs(post_mode))
  )
sum_stats_mcmc[ ,2:6] <- round(sum_stats_mcmc[ ,2:6], 2)
pandoc.table(sum_stats_mcmc)

```

variable	mean_abs_b	abs_mean_b	sd_b	mean_se_b
Activity	0.24	0.05	0.37	0.23
Aggression	0.19	0.07	0.25	0.22
Docility	0.2	0.12	0.21	0.16

Table 7: Table continues below

freq_sign	mean_cv
0.29	3.307
0.71	4.002
0.57	1.845

Ignoring random effect uncertainty

Calculate selection gradients from BLUPs, estimate SE using jackknifing.

Calculate selection gradients

```

# Calculate standardized selection gradients
seCoeffLmer <- function(x){
  model <- lm(rel_ars ~ aggression + activity + docility, data = x)
  model_sy <- lm(rel_ars ~ aggression_sy + activity_sy + docility_sy, data = x)
  mod_coefs <- c(coef(model)[-1], coef(model_sy)[-1])
  sim_coefs <- data.frame(coef(sim(model))[, -1], coef(sim(model_sy))[, -1]) ## Simulated coefficients
  names(sim_coefs) <- names(mod_coefs)
  sim_CI <- apply(sim_coefs, 2, quantile, prob = c(0.025, 0.975)) #0.95 conf. int.

  docil_mean_coef <- mod_coefs["docility"] * mean(x$docility, na.rm = TRUE)
  out <- data.frame(
    standardization = c("None", "None", "None", "SD", "SD", "SD", "Mean"),
    Year = as.numeric(rep(as.character(x$Year[1]), 7)),
    variable = c("Aggression", "Activity", "Docility", "Aggression",
      "Activity", "Docility", "Docility"),
    coefficients = c(mod_coefs, docil_mean_coef),
    lower = c(sim_CI[1, ], 0),
    upper = c(sim_CI[2, ], 0)
  )
  return(out)
}

```

```

}

sel_grads_blup <- fit_raneff_data %>%
  filter(type == "blup") %>%
  group_by(Year, add = FALSE) %>%
  do(seCoeffLmer())
sel_grads_blup$variable <- as.character(sel_grads_blup$variable)
sel_grads_blup$Year <- as.character(sel_grads_blup$Year)
sel_grads_blup <- tbl_df(sel_grads_blup)
save(sel_grads_blup, file = "data/analyses_data/sel_grads_blup.RData")

load("data/analyses_data/sel_grads_blup.RData")
# Format for table
sgt <- sel_grads_blup
sgt$sig_star <- ""
sgt$sig_star[sgt$coefficients > 0 & sgt$lower > 0] <- "*"
sgt$sig_star[sgt$coefficients < 0 & sgt$upper < 0] <- "*"
sgt$coefficients <- format(round(sgt$coefficients, digits = 2),
  digits = 1, nsmall = 2)
sgt$lower <- format(round(sgt$lower, digits = 2),
  digits = 1, nsmall = 2)
sgt$upper <- format(round(sgt$upper, digits = 2),
  digits = 1, nsmall = 2)
sgt$prb <- NA
sgt$coef <- paste(sgt$coefficients,
  " (", sgt$lower, " to ", sgt$upper, ")", sgt$sig_star, sep = '')

sgt_agg <- filter(sgt, standardization == "None" & variable == "Aggression")
sgt_act <- filter(sgt, standardization == "None" & variable == "Activity")
sgt_doc <- filter(sgt, standardization == "None" & variable == "Docility")

sgt_agg_sd <- filter(sgt, standardization == "SD" & variable == "Aggression")
sgt_act_sd <- filter(sgt, standardization == "SD" & variable == "Activity")
sgt_doc_sd <- filter(sgt, standardization == "SD" & variable == "Docility")

sgt_doc_ms <- filter(sgt, standardization == "Mean" & variable == "Docility")

N <- fit_raneff_data %>%
  filter(type == "blup") %>%
  group_by(Year, add = FALSE) %>%
  summarise(n = n(), t_kprod = sum(kprod), t_ars = sum(ars_all), mean_docil = mean(docility, na.rm =

pandoc.table(
  data.frame(
    Year = N$Year,
    Aggression = sgt_agg$coef,
    Activity = sgt_act$coef,
    Docility = sgt_doc$coef
  ),
  caption = "Traditional selection gradients (ignoring behavioural uncertainty). Not standardized."
)

```

Year	Aggression	Activity
2003	-0.26 (-1.66 to 0.61)	0.90 (-0.25 to 1.76)
2004	-0.75 (-1.36 to -0.05)*	0.57 (-0.18 to 1.35)
2005	-0.56 (-1.02 to -0.06)*	0.46 (-0.08 to 0.98)
2006	0.98 (0.20 to 1.86)*	-0.33 (-1.11 to 0.48)
2007	-0.09 (-0.92 to 0.49)	0.19 (-0.53 to 0.88)
2008	1.11 (-0.36 to 2.30)	-0.60 (-1.46 to 0.94)
2009	0.75 (-0.09 to 1.39)	-1.38 (-2.11 to -0.60)*
2010	-0.03 (-0.74 to 0.67)	0.12 (-0.54 to 0.77)

Table 9: Traditional selection gradients (ignoring behavioural uncertainty). Not standardized. (continued below)

Docility
-0.11 (-0.36 to 0.10)
0.07 (-0.13 to 0.24)
0.05 (-0.04 to 0.16)
-0.10 (-0.22 to 0.04)
0.01 (-0.11 to 0.13)
-0.04 (-0.21 to 0.13)
-0.12 (-0.23 to 0.00)*
-0.05 (-0.12 to 0.04)

```

pandoc.table(
  data.frame(
    Year = N$Year,
    Aggression = sgt_agg_sd$coef,
    Activity = sgt_act_sd$coef,
    Docility = sgt_doc_sd$coef
  ),
  caption = "Traditional selection gradients (ignoring behavioural uncertainty). SD-standardized."
)

```

Year	Aggression	Activity
2003	-0.17 (-1.25 to 0.57)	0.86 (-0.20 to 1.96)
2004	-0.62 (-1.17 to 0.22)	0.49 (-0.37 to 1.29)
2005	-0.41 (-0.71 to -0.04)*	0.34 (-0.10 to 0.76)
2006	0.66 (0.13 to 1.19)*	-0.23 (-0.96 to 0.35)

Year	Aggression	Activity
2007	-0.07 (-0.57 to 0.48)	0.15 (-0.44 to 0.63)
2008	0.78 (0.20 to 1.54)*	-0.44 (-1.64 to 0.39)
2009	0.56 (0.05 to 1.20)*	-1.01 (-1.84 to -0.47)*
2010	-0.02 (-0.43 to 0.56)	0.10 (-0.34 to 0.50)

Table 11: Traditional selection gradients (ignoring behavioural uncertainty). SD-standardized. (continued below)

Docility
-0.40 (-1.22 to 0.61)
0.26 (-0.29 to 1.01)
0.19 (-0.11 to 0.54)
-0.41 (-0.92 to 0.17)
0.03 (-0.47 to 0.52)
-0.17 (-0.81 to 0.45)
-0.56 (-1.07 to -0.06)*
-0.21 (-0.47 to 0.16)

```

pandoc.table(
  data.frame(
    Year = N$Year,
    Docility = sgt_doc_ms$coefficients,
    mean = N$mean_docil
  ),
  caption = "Traditional selection gradients (ignoring behavioural uncertainty). Mean-standardized."
)

```

Year	Docility	mean
2003	-1.86	17.29
2004	1.25	17.31
2005	0.88	17.25
2006	-1.72	16.77
2007	0.12	16.77
2008	-0.63	16.9
2009	-2.04	16.79
2010	-0.79	17.19

Year	Docility	mean
------	----------	------

Table 13: Traditional selection gradients (ignoring behavioural uncertainty). Mean-standardized.

Plot

Female Linear Selection Gradients ARS

Linear selection gradients \pm 95% credible intervals for female behavioral traits on annual reproductive success.

```
load("data/analyses_data/sel_grads_blup.RData")
sel_grads_blup$post_mode <- sel_grads_blup$coefficients
sel_grads_blup$upper_sig_star <- ""
sel_grads_blup$lower_sig_star <- ""
sel_grads_blup$upper_sig_star[sel_grads_blup$coefficients > 0 &
  sel_grads_blup$lower > 0] <- "*"
sel_grads_blup$lower_sig_star[sel_grads_blup$coefficients < 0 &
  sel_grads_blup$upper < 0] <- "*"
sel_grads_blup$upper_sig_01_star <- ""
sel_grads_blup$lower_sig_01_star <- ""
sel_grads_blup$upper_sig_01_star[sel_grads_blup$coefficients > 0
  & sel_grads_blup$lower_1 > 0] <- "."
sel_grads_blup$lower_sig_01_star[sel_grads_blup$coefficients < 0
  & sel_grads_blup$upper_1 < 0] <- "."
sel_grads_blup$upper_sig_01_star[sel_grads_blup$coefficients > 0
  & sel_grads_blup$lower > 0] <- ""
sel_grads_blup$lower_sig_01_star[sel_grads_blup$coefficients < 0
  & sel_grads_blup$upper < 0] <- ""

pdf(file = "figure/04_sg_blup_SD_print.pdf", width = 4.33, height = 3)
p <- p_sel_grad_MCMC %>% filter(sel_grads_blup, standardization == "SD")
p <- p + ylab("Coefficient  $\pm$  0.95 Confidence Interval")
p <- p + geom_text(aes(x = Year, y = upper, group = variable,
  label = upper_sig_01_star), vjust = -0.3,
  position = position_dodge(width = 0.5), size = 7)
p <- p + geom_text(aes(x = Year, y = lower, group = variable,
  label = lower_sig_01_star), vjust = 0.5,
  position = position_dodge(width = 0.5), size = 7)
p <- p + geom_text(aes(x = Year, y = upper, group = variable,
  label = upper_sig_star), vjust = -0.3,
  position = position_dodge(width = 0.5), size = 5)
p <- p + geom_text(aes(x = Year, y = lower, group = variable,
  label = lower_sig_star), vjust = 1.3,
  position = position_dodge(width = 0.5), size = 5)
p <- p + ylim(c(-2, 2))
```

Scale for 'y' is already present. Adding another scale for 'y', which will replace the existing scale.

```

p <- p + scale_shape_manual(name = "A", values = c(24, 21, 22))

## Scale for 'shape' is already present. Adding another scale for 'shape', which will replace the existing s

p <- p + scale_fill_manual(name = "A", values = c("white", "black", "white"))

## Scale for 'fill' is already present. Adding another scale for 'fill', which will replace the existing s

p <- p + scale_color_manual(name = "A", values = c("black", "black", "black"))

## Scale for 'colour' is already present. Adding another scale for 'colour', which will replace the existi

p

## ymax not defined: adjusting position using y instead
## ymax not defined: adjusting position using y instead
## ymax not defined: adjusting position using y instead
## ymax not defined: adjusting position using y instead
## ymax not defined: adjusting position using y instead
## ymax not defined: adjusting position using y instead
## ymax not defined: adjusting position using y instead

dev.off()

## pdf
## 2

p

## ymax not defined: adjusting position using y instead
## ymax not defined: adjusting position using y instead
## ymax not defined: adjusting position using y instead
## ymax not defined: adjusting position using y instead
## ymax not defined: adjusting position using y instead
## ymax not defined: adjusting position using y instead
## ymax not defined: adjusting position using y instead

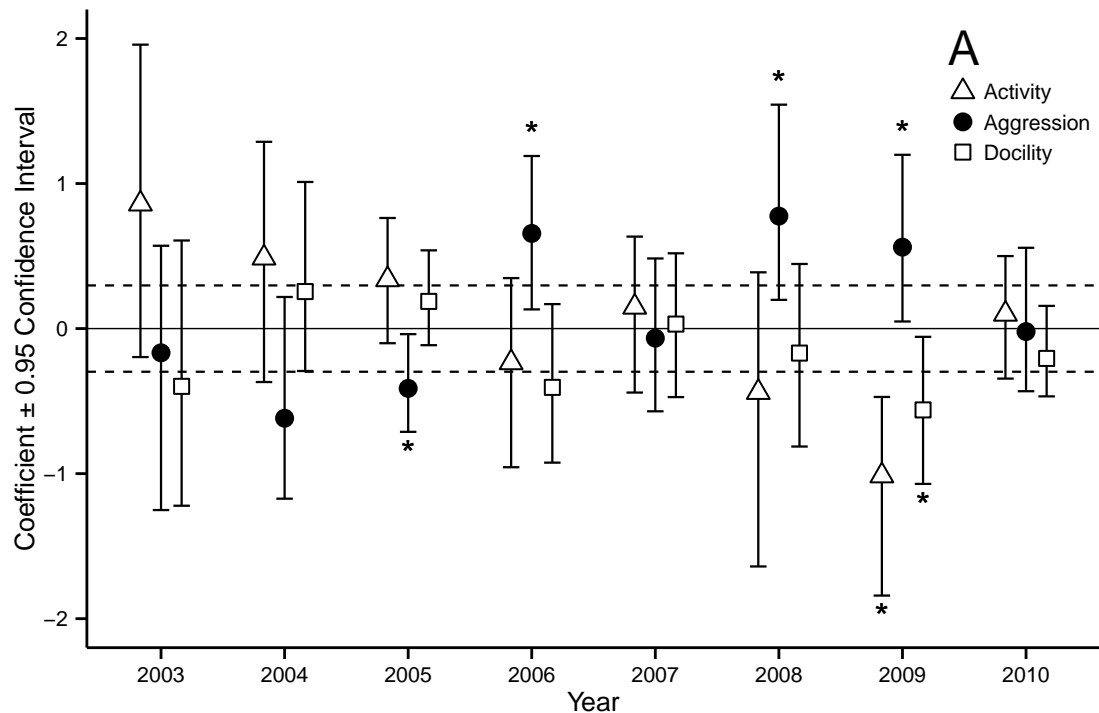
```

Correlations

```

load("data/analyses_data/sel_grads_blup.RData")
sel_grads_blup_flat <- data.frame(
  Aggression = filter(sel_grads_blup, standardization == "SD" &
    variable == "Aggression")$coefficients,
  Agg_upper = filter(sel_grads_blup, standardization == "SD" &
    variable == "Aggression")$upper,
  Agg_lower = filter(sel_grads_blup, standardization == "SD" &
    variable == "Aggression")$lower,

```



```

Activity = filter(sel_grads_blup, standardization == "SD" &
  variable == "Activity")$coefficients,
Act_upper = filter(sel_grads_blup, standardization == "SD" &
  variable == "Activity")$upper,
Act_lower = filter(sel_grads_blup, standardization == "SD" &
  variable == "Activity")$lower,
Docility = filter(sel_grads_blup, standardization == "SD" &
  variable == "Docility")$coefficients,
Doc_upper = filter(sel_grads_blup, standardization == "SD" &
  variable == "Docility")$upper,
Doc_lower = filter(sel_grads_blup, standardization == "SD" &
  variable == "Docility")$lower
)

cor.behav <- function(x, y){
  ct <- cor.test(x, y)
  out <- data.frame(est = ct$estimate, lower = ct$conf.int[1],
    upper = ct$conf.int[2], stringsAsFactors = FALSE)
  out <- round(out, digits = 2)
  out$print <- paste(out$est, " (", out$lower, ", ", out$upper, ")", sep = "")
}

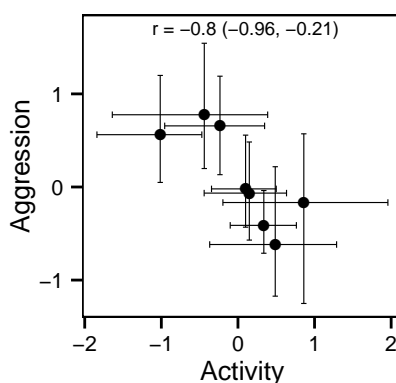
cor_blup_agg_act <- cor.behav(sel_grads_blup_flat$Aggression,
  sel_grads_blup_flat$Activity)
cor_blup_agg_doc <- cor.behav(sel_grads_blup_flat$Aggression,
  sel_grads_blup_flat$Docility)

```

```
cor_blup_doc_act <- cor.behav(sel_grads_blup_flat$Docility,
  sel_grads_blup_flat$Activity)
```

Aggression and Activity

```
p <- ggplot(data = sel_grads_blup_flat, aes(x = Activity, y = Aggression))
p <- p + geom_point()
p <- p + ylab("Aggression")
p <- p + xlab("Activity")
p <- p + theme_bw(base_size = 10)
p <- p + theme(panel.grid.major = element_blank(),
  panel.grid.minor = element_blank(), panel.background = element_blank(),
  strip.background = element_blank(), strip.text = element_blank(),
  panel.border = element_rect(linetype = "solid", colour = "black"))
p <- p + geom_errorbarh(aes(xmin = Act_lower, xmax = Act_upper),
  height = 0.07, size = 0.2)
p <- p + geom_errorbar(aes(ymin = Agg_lower, ymax = Agg_upper),
  width = 0.07, size = 0.2)
p <- p + annotate(geom = "text", size = 2.5, x = 0.1, y = 1.7,
  label = paste("r = ", cor_blup_agg_act, sep = ' '))
p + theme(plot.margin = unit(c(0.1, 0.1, 0.1, 0.1), "cm"))
```



Aggression and Docility

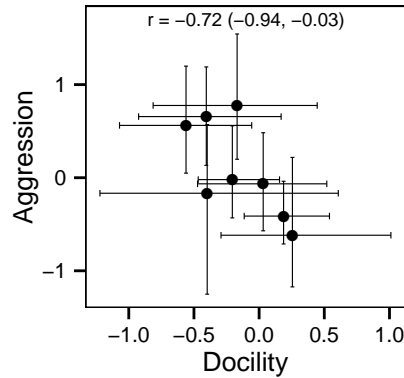
```
p <- ggplot(data = sel_grads_blup_flat, aes(y = Aggression, x = Docility))
p <- p + geom_point()
p <- p + ylab("Aggression")
p <- p + xlab("Docility")
p <- p + theme_bw(base_size = 10)
p <- p + theme(panel.grid.major = element_blank(),
  panel.grid.minor = element_blank(), panel.background = element_blank(),
  strip.background = element_blank(), strip.text = element_blank(),
  panel.border = element_rect(linetype = "solid", colour = "black"))
p <- p + geom_errorbarh(aes(xmin = Doc_lower, xmax = Doc_upper),
  height = 0.07, size = 0.2)
p <- p + geom_errorbar(aes(ymin = Agg_lower, ymax = Agg_upper),
```



```

width = 0.03, size = 0.2)
p <- p + annotate(geom = "text", size = 2.5, x = -0.1, y = 1.7,
  label = paste("r = ", cor_blup_agg_doc, sep = ''))
p + theme(plot.margin = unit(c(0.1, 0.1, 0.1, 0.1), "cm"))

```



Activity and Docility

```

p <- ggplot(data = sel_grads_blup_flat, aes(x = Activity, y = Docility))
p <- p + geom_point()
p <- p + xlab("Activity")
p <- p + ylab("Docility")
p <- p + theme_bw(base_size = 10)
p <- p + theme(panel.grid.major = element_blank(),
  panel.grid.minor = element_blank(), panel.background = element_blank(),
  strip.background = element_blank(), strip.text = element_blank(),
  panel.border = element_rect(linetype = "solid", colour = "black"))
p <- p + geom_errorbar(aes(ymin = Doc_lower, ymax = Doc_upper),
  width = 0.07, size = 0.2)
p <- p + geom_errorbarh(aes(xmin = Act_lower, xmax = Act_upper),
  height = 0.03, size = 0.2)
p <- p + annotate(geom = "text", size = 2.5, x = 0, y = 1.2,
  label = paste("r = ", cor_blup_doc_act, sep = ''))
p + theme(plot.margin = unit(c(0.1, 0.1, 0.1, 0.1), "cm"))

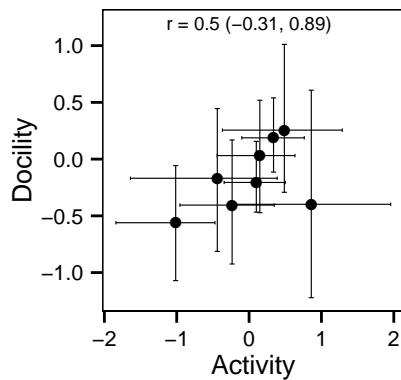
```

Summary Statistics

```

library(dplyr)
sign_change <- function(x){
  # sign changes calculated as the number of changes in direction between
  # successive years relative to n-1
  s <- sign(x)
  sum(s[1:(length(s)-1)] != s[-1])/(length(s)-1)
}
se <- function(lower, upper){
  (upper - lower) / 3.92
}

```



```
}
```

```
sum_stats_blup <- sel_grads_blup %>%
  filter(standardization == "SD") %>%
  group_by(variable, add = FALSE) %>%
  summarise(
    mean_abs_b = mean(abs(coefficients)),
    abs_mean_b = abs(mean(coefficients)),
    sd_b = sd(coefficients),
    mean_se_b = mean(se(lower, upper)),
    freq_sign = sign_change(coefficients),
    mean_cv = mean(se(lower, upper) / abs(coefficients))
  )
sum_stats_blup[, 2:6] <- round(sum_stats_blup[, 2:6], 2)
pandoc.table(sum_stats_blup)
```

variable	mean_abs_b	abs_mean_b	sd_b	mean_se_b
Activity	0.45	0.03	0.58	0.36
Aggression	0.41	0.09	0.52	0.3
Docility	0.28	0.16	0.3	0.28

Table 14: Table continues below

freq_sign	mean_cv
0.57	1.138
0.57	2.701
0.57	1.912

Compare Analytical Frameworks

Table

```
load("data/analyses_data/sel_grads_blup.RData")
load("data/analyses_data/sel_grads_mcmc.RData")

sg_blups <- sel_grads_blup %>% filter(standardization == "SD")
sg_mcmc <- sel_grads_mcmc %>% filter(standardization == "SD")

compare_grads <- left_join(select(sg_blups, Year, variable,
  blup_coef = coefficients, blup_upper = upper, blup_lower = lower),
  select(sg_mcmc, Year, variable, mcmc_pm = post_mode,
    mcmc_upper = upper, mcmc_lower = lower), by = c("variable", "Year"))
```

```

ct <- cor.test(x,y)
est <- format(ct$estimate, digits = 2)
ci <- format(ct$conf.int, digits = 2)
ct <- format(ct, digits = 2)
paste(est, " (", ci[1], ", ", ci[2], ")", sep = '')
}

c_table <- compare_grads %>%
  group_by(variable) %>%
  summarise(cor = cor(blup_coef, mcmc_pm),
    abs_diff = mean(abs(blup_coef - mcmc_pm)),
    mean_mcmc = mean(abs(mcmc_pm)), mean_blup = mean(abs(blup_coef)),
    prop_diff = mean_blup / mean_mcmc, cor_test = ct_print(blup_coef, mcmc_pm),
    lmerGreater = sum(abs(blup_coef) > abs(mcmc_pm))
  )
pandoc.table(c_table)

```

variable	cor	abs_diff	mean_mcmc	mean_blup
Activity	0.8931	0.2345	0.2374	0.4527
Aggression	0.9599	0.2312	0.1904	0.4096
Docility	0.9489	0.08657	0.1957	0.2766

Table 16: Table continues below

prop_diff	cor_test	lmerGreater
1.907	0.89 (0.51, 0.98)	8
2.152	0.96 (0.79, 0.99)	7
1.413	0.95 (0.74, 0.99)	7

Aggression plot

```

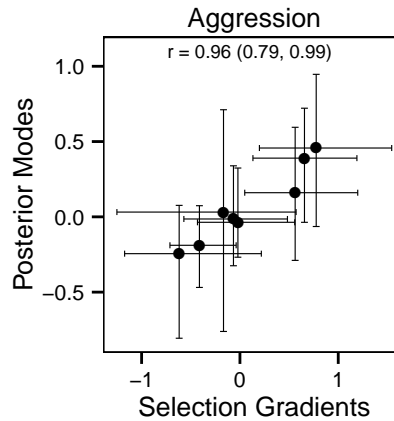
p <- ggplot(filter(compare_grads, variable == "Aggression"),
  aes(x = blup_coef, y = mcmc_pm))
p <- p + geom_point()
p <- p + geom_errorbarh(aes(xmin = blup_lower, xmax = blup_upper),
  height = 0.04, size = 0.2)
p <- p + geom_errorbar(aes(ymin = mcmc_lower, ymax = mcmc_upper),
  width = 0.07, size = 0.2)
p <- p + theme_bw(base_size = 10)
p <- p + theme(plot.title = element_text(size = 10),
  panel.grid.major = element_blank(), panel.grid.minor = element_blank(),
  panel.background = element_blank(), strip.background = element_blank(),
  strip.text = element_blank(),
  panel.border = element_rect(linetype = "solid", colour = "black"))

```

```

p <- p + annotate(geom = "text", size = 2.5, x = 0.1, y = 1.1,
  label = paste("r = ", filter(c_table, variable == "Aggression") %>%
    select(cor_test), sep = ' '))
p <- p + ylab("Posterior Modes")
p <- p + xlab("Selection Gradients")
p <- p + ggtitle("Aggression")
p + theme(plot.margin = unit(c(0.1, 0.1, 0.1, 0.1), "cm"))

```



Activity Plot

```

p <- ggplot(filter(compare_grads, variable == "Activity"),
  aes(x = blup_coef, y = mcmc_pm))
p <- p + geom_point()
p <- p + geom_errorbarh(aes(xmin = blup_lower, xmax = blup_upper),
  height = 0.04, size = 0.2)
p <- p + geom_errorbar(aes(ymin = mcmc_lower, ymax = mcmc_upper),
  width = 0.07, size = 0.2)
p <- p + theme_bw(base_size = 10)
p <- p + theme(plot.title = element_text(size = 10),
  panel.grid.major = element_blank(), panel.grid.minor = element_blank(),
  panel.background = element_blank(), strip.background = element_blank(),
  strip.text = element_blank(),
  panel.border = element_rect(linetype = "solid", colour = "black"))
p <- p + annotate(geom = "text", size = 2.5, x = 0, y = 1.5,
  label = paste("r = ", filter(c_table, variable == "Activity") %>%
    select(cor_test), sep = ' '))
p <- p + ylab("Posterior Modes")
p <- p + xlab("Selection Gradients")
p <- p + ggtitle("Activity")
p + theme(plot.margin = unit(c(0.1, 0.1, 0.1, 0.1), "cm"))

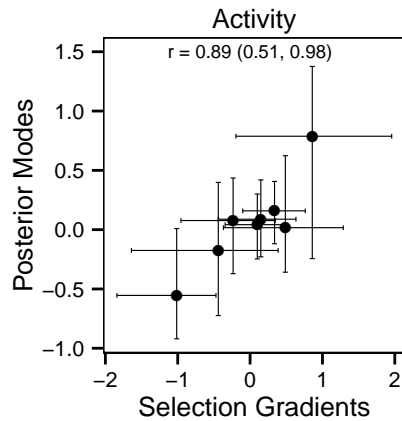
```

Docility Plot

```

p <- ggplot(filter(compare_grads, variable == "Docility"),
  aes(x = blup_coef, y = mcmc_pm))

```



```
p <- p + geom_point()
p <- p + geom_errorbarh(aes(xmin = blup_lower, xmax = blup_upper),
  height = 0.04, size = 0.2)
p <- p + geom_errorbar(aes(ymin = mcmc_lower, ymax = mcmc_upper),
  width = 0.07, size = 0.2)
p <- p + theme_bw(base_size = 10)
p <- p + theme(plot.title = element_text(size = 10),
  panel.grid.major = element_blank(), panel.grid.minor = element_blank(),
  panel.background = element_blank(), strip.background = element_blank(),
  strip.text = element_blank(),
  panel.border = element_rect(linetype = "solid", colour = "black"))
p <- p + ylab("Posterior Modes")
p <- p + xlab("Selection Gradients")
p <- p + annotate(geom = "text", size = 2.5, x = 0, y = 0.7,
  label = paste("r = ", filter(c_table, variable == "Docility") %>%
    select(cor_test), sep = ' '))
p <- p + ggtitle("Docility")
p + theme(plot.margin = unit(c(0.1, 0.1, 0.1, 0.1), "cm"))
```

