

Homework 9

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Research question

Does the impact of rewards (in the form of likes) on tweet frequency decrease as habit strength increases?

Variables

- `tdiff_pmcs`: Time difference between a tweet and the immediately preceding tweet (person-mean centered and scaled)
- `likes_24hours_pmcs`: Number of likes received in the past 24 hours (person-mean centered and scaled)
- `likes_24hours_pms`: Person-mean number of likes received in the past 24 hours (scaled)
- `avg_day_cs`: Habit strength - Average number of tweets per day (centered and scaled)

Variable Summary

```
datasummary_skim(x %>% select(tdif_pmcs, likes_24hours_pmcs, likes_24hours_pms, avg_day_cs))
```

Model

Let $Y = \text{tdiff_pmcs}$

$\text{likes} = \text{likes_24hours_pmcs}$





$\text{avg_likes} = \text{likes_24hours_pms}$

$\text{habit} = \text{avg_day_cs}$

$$y_{ij} = \beta_{0j} + \beta_{1j}\text{likes}_{ij} + e_{ij}$$

$$\beta_{0j} = \gamma_{00} + \gamma_{01}\text{habit}_j + \gamma_{02}\text{avg_likes} + \mu_{0j}$$

$$\beta_{1j} = \gamma_{10} + \gamma_{11}\text{habit}_j + \mu_{1j}$$

	Unique (#)	Missing (%)	Mean	SD	Min	Median	Max	
<code>tdiff_pmcs</code>	13175	0	0.0	1.0	-4.4	-0.1	3.7	
<code>likes_24hours_pmcs</code>	1577	2	0.0	1.0	-2.7	-0.3	19.0	
<code>likes_24hours_pms</code>	173	0	0.2	1.0	0.0	0.0	7.4	
<code>avg_day_cs</code>	209	0	0.0	1.0	-1.6	-0.2	2.0	

Priors

$$\gamma_{00} \sim N(0, 1)$$

$$\gamma_{01} \sim N(0, 1)$$

$$\gamma_{02} \sim N(0, 1)$$

$$\gamma_{10} \sim N(0, 1)$$

$$\gamma_{11} \sim N(0, 1)$$

$$e_{ij} \sim t_4^+(0, 3)$$

$$\mu_{0j} \sim t_4^+(0, 3)$$

$$\mu_{1j} \sim t_4^+(0, 3)$$

Results

```
m1 <- brm(tdiff_pmcs ~ likes_24hours_pmcs * avg_day_cs + likes_24hours_pms + (1 | subject),
  prior = c(
    prior(normal(0, 1), class = 'Intercept'),
    prior(normal(0, 1), class = 'b'),
    prior(student_t(4, 0, 3), class = 'sd'),
    prior(student_t(4, 0, 3), class = 'sigma')
  ),
  data = x, family = gaussian(link = "identity"),
  cores = numcor, seed = 1,
  file = 'Twitter Main Analysis.rds')

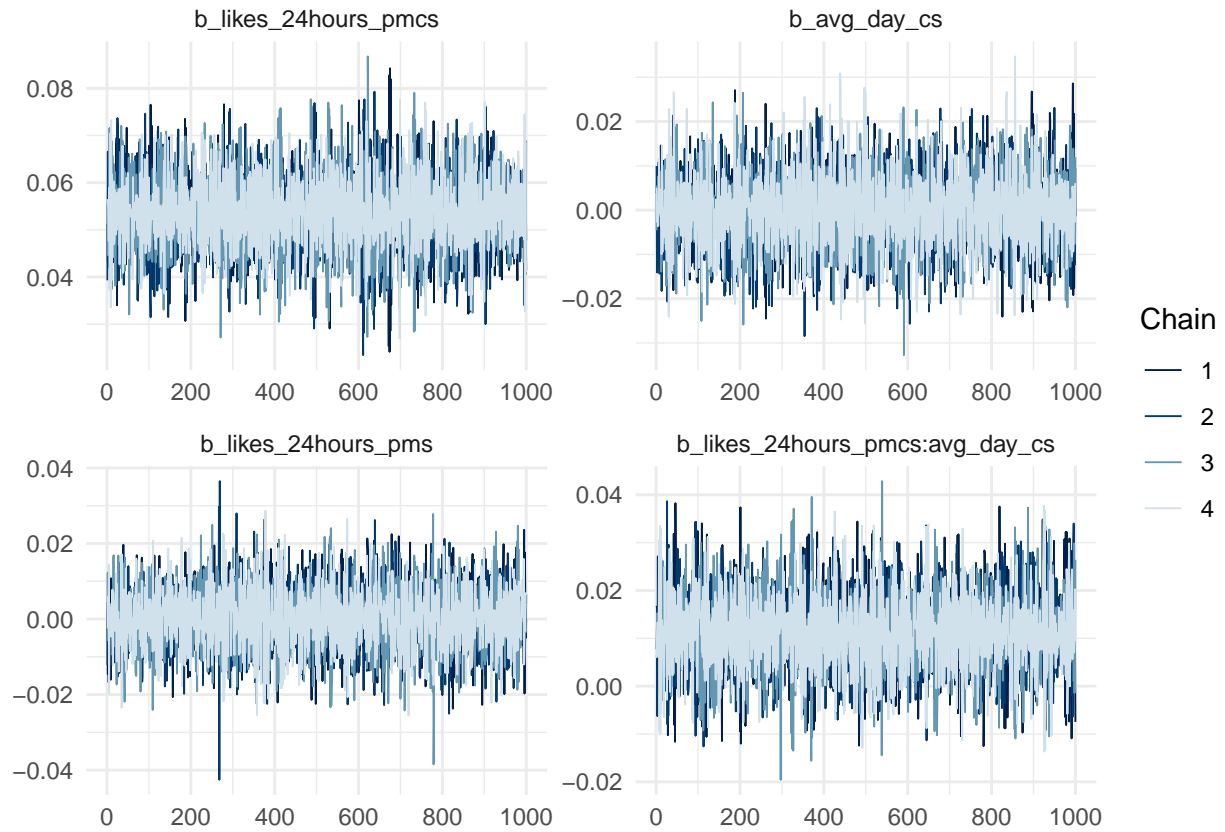
# Uncomment to read bayesian model results from .rds file

# m1 <- readRDS('Twitter Main Analysis.rds')
```

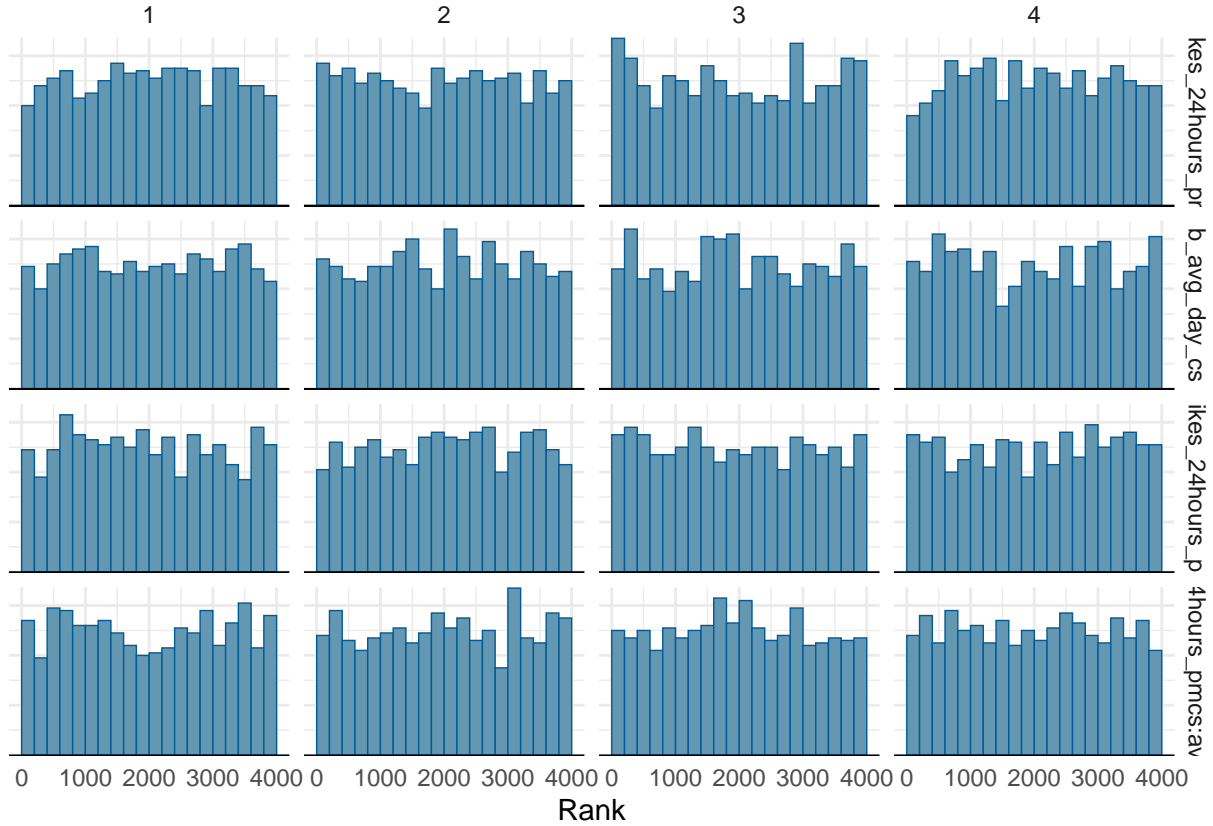
Convergence

The plots below suggest satisfactory convergence.

```
mcmc_trace(m1, pars = c('b_likes_24hours_pmcs', 'b_avg_day_cs', 'b_likes_24hours_pms',
  'b_likes_24hours_pmcs:avg_day_cs'))
```



```
mcmc_rank_hist(m1, pars = c('b_likes_24hours_pmcs', 'b_avg_day_cs', 'b_likes_24hours_pms',
                             'b_likes_24hours_pmcs:avg_day_cs'))
```



Posterior distribution of key parameters

```
sum_m1 <- as_draws_df(m1) %>%
  summarize_draws() %>%
  filter(variable %in% c('b_intercept',
                        'b_likes_24hours_pmcs', 'b_avg_day_cs', 'b_likes_24hours_pms',
                        'b_likes_24hours_pmcs:avg_day_cs'))

sum_m1 %>%
  knitr::kable(digits = 3)
```

variable	mean	median	sd	mad	q5	q95	rhat	ess_bulk	ess_tail
b_likes_24hours_pmcs	0.054	0.054	0.008	0.008	0.040	0.068	1.001	9788.886	2717.732
b_avg_day_cs	0.000	0.000	0.009	0.009	-0.015	0.014	1.000	8989.524	3090.495
b_likes_24hours_pms	0.000	0.000	0.009	0.008	-0.014	0.014	1.000	9325.825	2809.565
b_likes_24hours_pmcs:avg_day_cs	0.011	0.012	0.009	0.008	-0.003	0.026	1.001	11247.509	2816.381

Discussion

Based on the results, we do not see an interaction effect between reward and habit strength in predicting tweet frequency.