Figure 1 Subfigures

Jasper Flint

2024-09-03

Setup

```r
n_sites <- 5
n_states <- 3
n_timepoints <- 4

ex_kints <- c(2, 1, 5, 4, 3)
ex_protection <- matrix(c(c(0, 0.1, 0.1, 0.1, 0), c(1, 0, 0, 0, 1), c(1, 1, 1, 1, 1)), nrow = n_states,
ex_state_time <- 1 #1 second spent in current state
ex_state_history <- c(0.5, 0.1, 0.3, 0.2, 0.1) %>% set_names(c(1, 2, 1, 2, 3))
ex_times <- seq(0, 1, length.out = 4)

label_size <- 30


#doesn't currently work
plot_exporter <- function(p){
  plot_name <- paste0(deparse(substitute(p)), ".png")
  grDevices::png(file = plot_name, bg = "transparent")
  p
  dev.off()
}
```

Step 1
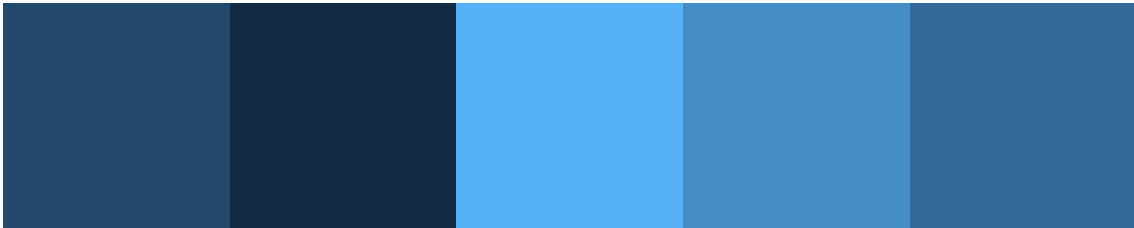
Subfigure 1

Step 2

Subfigure 1

```r
ds_2_1 <- data.frame(y = 1, x = 1:length(ex_kints), z = ex_kints)

p_2_1 <- ggplot(ds_2_1, aes(x = x, y = y, fill = z)) +
  geom_tile() +
  coord_equal() +
  theme_void() +
  ggtitle(TeX(r'($k_{int}s$)')) +
```

```
    theme(legend.position = "none", plot.title = element_text(hjust = 0.5, size = label_size))
```

```
p_2_1
```

$$k_{int}s$$


```
plot_exporter(p_2_1)
```
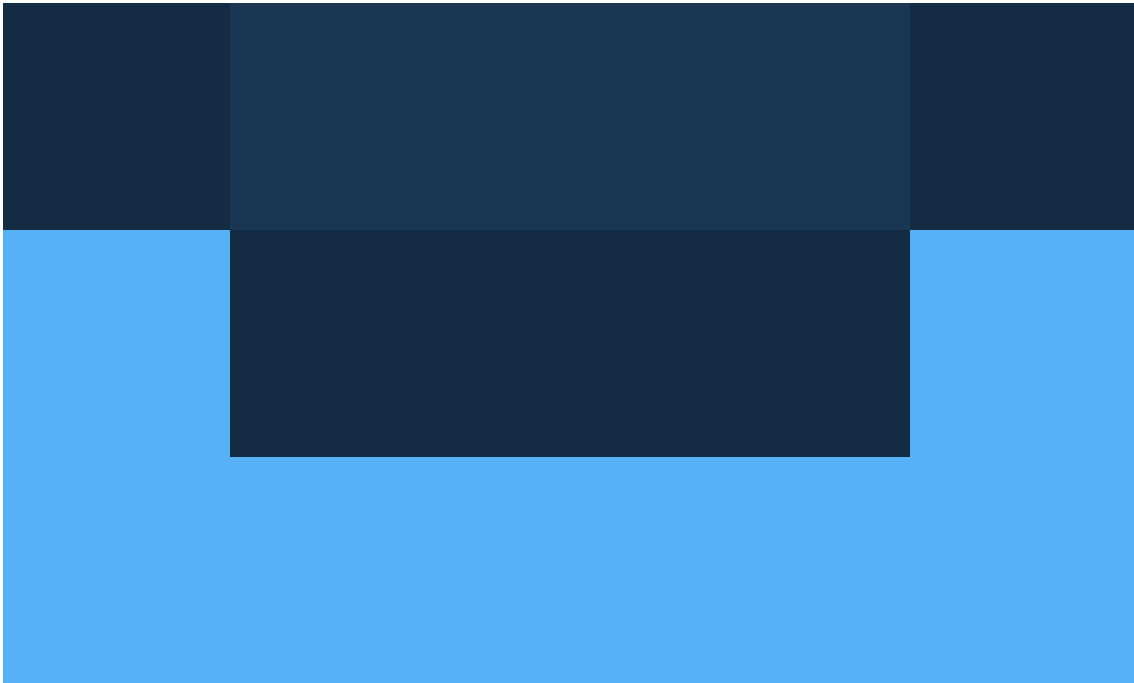
```
## pdf
##   2
```

Subfigure 2

```
ds_2_2 <- data.frame(y = rep(1:n_states, times = n_sites), x = rep(1:n_sites, each = n_states), z = as.
```

```
p_2_2 <- ggplot(ds_2_2, aes(x = x, y = -y, fill = z)) +
  geom_tile() +
  coord_equal() +
  theme_void() +
  theme(legend.position = "none") +
  ggtitle(TeX(r'($Protection\ Information$)')) +
  theme(legend.position = "none", plot.title = element_text(hjust = 0.5, size = label_size))
```

```
p_2_2
```

Protection Information
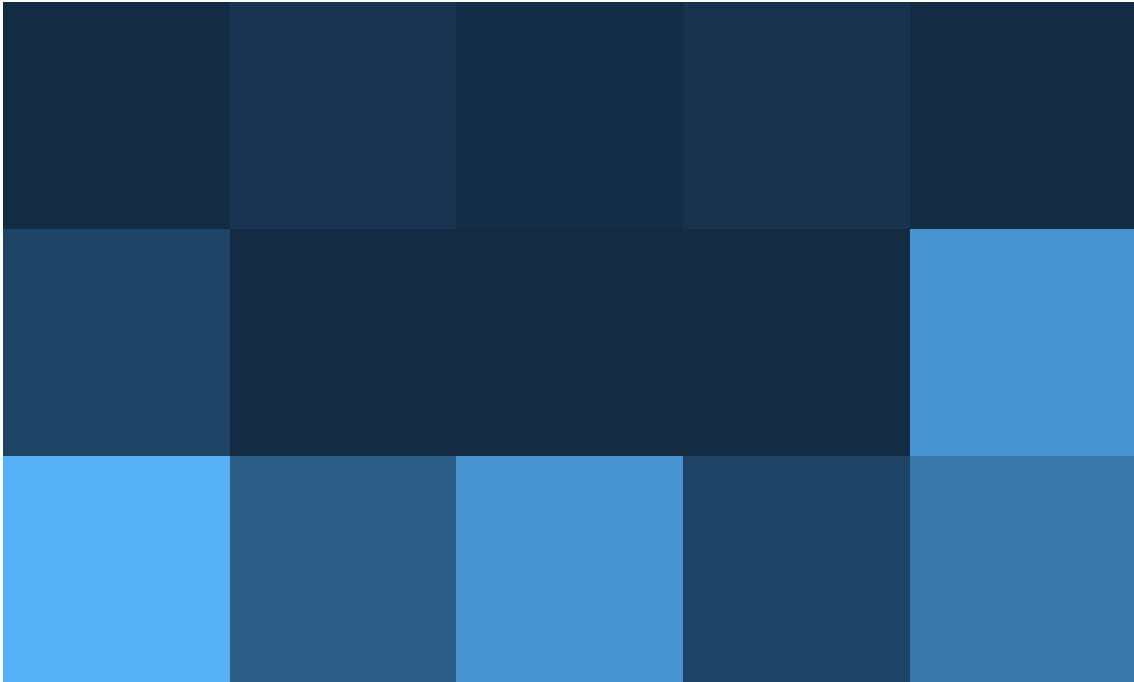

Subfigure 3

```r
ds_2_3 <- ds_2_2 %>%
  mutate(z = z * ex_kints)

p_2_3 <- ggplot(ds_2_3, aes(x = x, y = -y, fill = z)) +
  geom_tile() +
  coord_equal() +
  theme_void() +
  theme(legend.position = "none") +
  ggtitle(TeX(r'($k_{EX}\ Information$)')) +
  theme(legend.position = "none", plot.title = element_text(hjust = 0.5, size = label_size))

p_2_3
```

k$_{EX}$ Information

Step 3

Subfigure 1

```
ds_3_1 <- ds_2_3 %>%
  filter(y == 2) %>% #intermediate state
  mutate(z = 1 - exp(-z*ex_state_time))

p_3_1 <- ggplot(ds_3_1, aes(x = x, y = y, fill = z)) +
  geom_tile() +
  coord_equal() +
  theme_void() +
  theme(legend.position = "none") +
  ggtitle(TeX(r'($Probability\ of\ State\ Exchange$)')) +
  theme(legend.position = "none", plot.title = element_text(hjust = 0.5, size = label_size))

p_3_1
```

Probability of State Exchange

Subfigure 2

```
set.seed(09032024)
ds_3_2 <- ds_3_1 %>%
  mutate(z = as.numeric(z > runif(n_sites)))

p_3_2 <- ggplot(ds_3_2, aes(x = x, y = y, fill = z)) +
  geom_tile() +
  coord_equal() +
  theme_void() +
  theme(legend.position = "none") +
  ggtitle(TeX(r'($State\ Exchange\ Results$)')) +
  theme(legend.position = "none", plot.title = element_text(hjust = 0.5, size = label_size))

p_3_2
```

State Exchange Results

Subfigure 3

```
ds_3_3 <- matrix(c(c(0, 0, 0, 0, 0), c(0, 0, 0, 0, 1), c(1, 0, 0, 0, 1), c(1, 1, 1, 1, 1)), nrow = n_tin
ds_3_3 <- data.frame(y = rep(1:n_timepoints, times = n_sites), x = rep(1:n_sites, each = n_timepoints),

p_3_3 <- ggplot(ds_3_3, aes(x = x, y = -y, fill = z)) +
  geom_tile() +
  coord_equal() +
  theme_void() +
  theme(legend.position = "none") +
  ggtitle(TeX(r'($A\ Protein\'s\ Exchange\ Timecourse$)')) +
  theme(legend.position = "none", plot.title = element_text(hjust = 0.5, size = label_size))

p_3_3
```

A Protein's Exchange Timecourse

Step 4

Subfigure 1

```
ds_4_1 <- matrix(c(c(0, 0, 0, 0, 0), c(0, 1, 0, 0, 1), c(1, 1, 0, 0, 1), c(1, 1, 1, 1, 1)), nrow = n_tir
ds_4_1 <- data.frame(y = rep(1:n_timepoints, times = n_sites), x = rep(1:n_sites, each = n_timepoints),

p_4_1 <- ggplot(ds_4_1, aes(x = x, y = -y, fill = z)) +
  geom_tile() +
  coord_equal() +
  theme_void() +
  theme(legend.position = "none") +
  ggtitle(TeX(r'($Another\ Protein\'s\ Exchange\ Results$)')) +
  theme(legend.position = "none", plot.title = element_text(hjust = 0.5, size = label_size))

p_4_1
```

Subfigure 2

Exchange matrix, E

```
ds_4_2 <- matrix(c(c(0.7, 0.2, 0.1, 0, 0, 0), c(0.3, 0.4, 0.3, 0, 0, 0), c(0.0, 0.2, 0.3, 0.3, 0.2, 0),
ds_4_2 <- data.frame(y = rep(1:n_timepoints, times = n_sites + 1), x = rep(1:(n_sites + 1), each = n_ti

p_4_2 <- ggplot(ds_4_2, aes(x = x, y = -y, fill = z)) +
  geom_tile() +
  coord_equal() +
  theme_void() +
  theme(legend.position = "none") +
  ggtitle(TeX(r'($Exchange\ matrix,\ E$)')) +
  theme(legend.position = "none", plot.title = element_text(hjust = 0.5, size = label_size))

p_4_2
```

Exchange matrix, E