

Plot and examine chains: 7 regions (no wrap-up; no matrix verb)

JD

March 9, 2021

1 Model without emsp

```
library(dplyr)
library(gdata)
library(ggplot2)
library(ggalt)

cbPalette <- c("#E69F00", "#0072B2", "#D55E00", "#CC79A7")

gp <- read.csv("activations_sentences_gardenpath.csv")

str(gp)

## 'data.frame': 94 obs. of 9 variables:
## $ activation      : num  2.1 3.18 4.88 6.32 6.38 ...
## $ position       : int   1 2 3 4 5 6 7 8 1 2 ...
## $ word           : Factor w/ 36 levels "",".", "a","are",...: 30 19 25 24 30 6 14 2 30 19 ...
## $ sent_nr        : int   1 1 1 1 1 1 1 1 2 2 ...
## $ retrieve_wh     : Factor w/ 1 level "None": 1 1 1 1 1 1 1 1 1 1 ...
## $ reanalysis      : Factor w/ 2 levels "no","yes": 1 1 2 1 1 2 2 1 1 1 ...
## $ agreeing_actions: num   2 2.5 2.67 3 3 ...
## $ matching_fs     : num   6.5 6.25 8.83 9 9 ...
## $ fan_size        : num  1440529 1545912 1426086 1550605 1519423 ...

case1 <- subset(gp, sent_nr == 1 | sent_nr == 2)

str(case1)

## 'data.frame': 18 obs. of 9 variables:
## $ activation      : num  2.1 3.18 4.88 6.32 6.38 ...
## $ position       : int   1 2 3 4 5 6 7 8 1 2 ...
## $ word           : Factor w/ 36 levels "",".", "a","are",...: 30 19 25 24 30 6 14 2 30 19 ...
## $ sent_nr        : int   1 1 1 1 1 1 1 1 2 2 ...
## $ retrieve_wh     : Factor w/ 1 level "None": 1 1 1 1 1 1 1 1 1 1 ...
## $ reanalysis      : Factor w/ 2 levels "no","yes": 1 1 2 1 1 2 2 1 1 1 ...
## $ agreeing_actions: num   2 2.5 2.67 3 3 ...
## $ matching_fs     : num   6.5 6.25 8.83 9 9 ...
## $ fan_size        : num  1440529 1545912 1426086 1550605 1519423 ...

case1$word <- as.character(case1$word)

case1$word[which(case1$position == 5 & case1$sent_nr == 1)] <- "the "
```

```

case1$word[which(case1$position == 7 & case1$sent_nr == 2)] <- "the "
case1$word[which(case1$word == "which")] <- "(which)"
case1$word[which(case1$word == "was")] <- "(was)"

case1$word <- as.factor(as.character(case1$word))
levels(case1$word)

## [1] "."      "(was)"    "(which)"  "barn"     "fell"     "horse"    "past"
## [8] "raced"    "the"      "the "

case1$garden_path <- "no"
case1$garden_path[which(case1$sent == 1)] <- "yes"

# fake missing words with 0 for nice graphs
case1 <- rbind(case1, data.frame(activation = 0, position = 0, word = "(which)",
  sent_nr = 1, retrieve_wh = "None", reanalysis = "no", agreeing_actions = 0,
  matching_fs = 0, fan_size = 0, garden_path = "yes"))
case1 <- rbind(case1, data.frame(activation = 0, position = 0, word = "(was)",
  sent_nr = 1, retrieve_wh = "None", reanalysis = "no", agreeing_actions = 0,
  matching_fs = 0, fan_size = 0, garden_path = "yes"))

# find which word should be circled as causing gp
case1$gp <- NA
case1$gp[which(case1$word == "fell")] <- "yes"

# case1$word <- drop.levels(case1$word)

ordered_levels <- as.numeric(subset(case1, sent_nr == 2)$word)

case1$word <- factor(case1$word, levels(case1$word)[ordered_levels])
levels(case1$word)

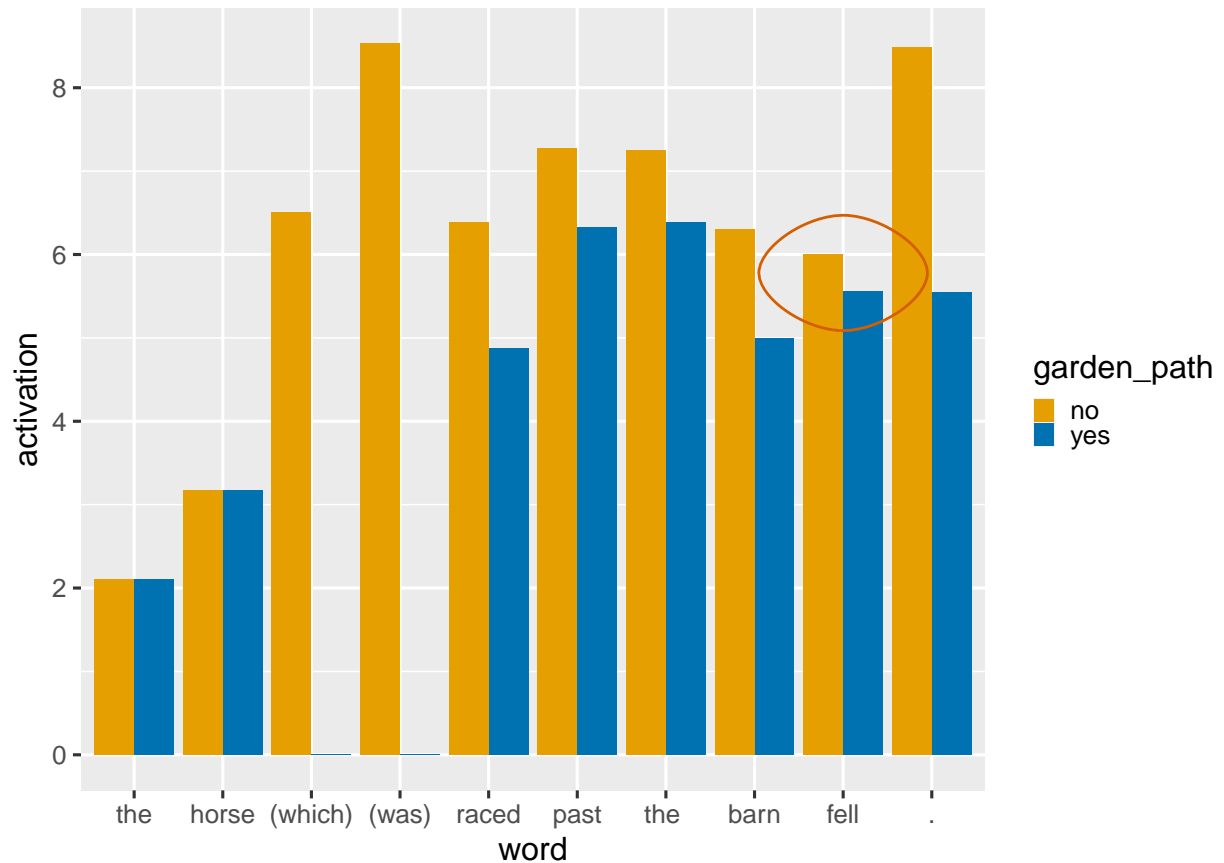
## [1] "the"      "horse"    "(which)"  "(was)"    "raced"    "past"    "the "
## [8] "barn"     "fell"     "."

str(case1)

## 'data.frame': 20 obs. of 11 variables:
## $ activation      : num  2.1 3.18 4.88 6.32 6.38 ...
## $ position        : num  1 2 3 4 5 6 7 8 1 2 ...
## $ word            : Factor w/ 10 levels "the","horse",...: 1 2 5 6 7 8 9 10 1 2 ...
## $ sent_nr         : num  1 1 1 1 1 1 1 1 2 2 ...
## $ retrieve_wh      : Factor w/ 1 level "None": 1 1 1 1 1 1 1 1 1 1 ...
## $ reanalysis       : Factor w/ 2 levels "no","yes": 1 1 2 1 1 2 2 1 1 1 ...
## $ agreeing_actions: num  2 2.5 2.67 3 3 ...
## $ matching_fs      : num  6.5 6.25 8.83 9 9 ...
## $ fan_size         : num  1440529 1545912 1426086 1550605 1519423 ...
## $ garden_path      : chr  "yes" "yes" "yes" "yes" ...
## $ gp              : chr  NA NA NA NA ...

g1 <- ggplot(case1, aes(x = word, y = activation, fill = garden_path, group = garden_path))
g1 <- g1 + geom_bar(stat = "identity", position = "dodge")
g1 <- g1 + geom_encircle(data = subset(case1, gp == "yes"), aes(word, activation),
  inherit.aes = FALSE, s_shape = 0, spread = 0.05, size = 3, color = "#D55E00")
g1 <- g1 + theme_gray(26) + scale_fill_manual(values = cbPalette)

```



```
case2 <- subset(gp, sent_nr == 3 | sent_nr == 4)

str(case2)

## 'data.frame': 21 obs. of 9 variables:
## $ activation      : num  2.31 3.74 7.55 6.67 7.32 ...
## $ position        : int   1 2 3 4 5 6 7 8 9 10 ...
## $ word             : Factor w/ 36 levels "",".", "a","are",...: 34 27 21 30 28 14 23 30 15 2 ...
## $ sent_nr          : int    3 3 3 3 3 3 3 3 3 3 ...
## $ retrieve_wh       : Factor w/ 1 level "None": 1 1 1 1 1 1 1 1 1 1 ...
## $ reanalysis        : Factor w/ 2 levels "no","yes": 1 1 1 1 1 2 1 1 2 1 ...
## $ agreeing_actions : num    2 2.5 3 2 3 ...
## $ matching_fs       : num    7 6.67 9 17.5 9.33 ...
## $ fan_size          : num  1322830 1405593 1405410 764278 1430089 ...

case2$word <- as.character(case2$word)

case2$word[which(case2$position == 8 & case2$sent_nr == 3)] <- "the "
case2$word[which(case2$position == 9 & case2$sent_nr == 4)] <- "the "
case2$word[which(case2$word == ",")] <- "(,)"

case2$word <- as.factor(as.character(case2$word))
levels(case2$word)

## [1] "."      "(,)"    "fell"   "floor"  "mended" "on"     "she"
## [8] "sock"   "the"    "the "   "while"
```

```

case2$garden_path <- "no"
case2$garden_path[which(case2$sent == 3)] <- "yes"

case2 <- rbind(case2, data.frame(activation = 0, position = 0, word = "(,)",
  sent_nr = 3, retrieve_wh = "None", reanalysis = "no", agreeing_actions = 0,
  matching_fs = 0, fan_size = 0, garden_path = "yes"))

case2$gp <- NA
case2$gp[which(case2$word == "fell")] <- "yes"

ordered_levels <- as.numeric(subset(case2, sent_nr == 4)$word)

case2$word <- factor(case2$word, levels(case2$word)[ordered_levels])
levels(case2$word)

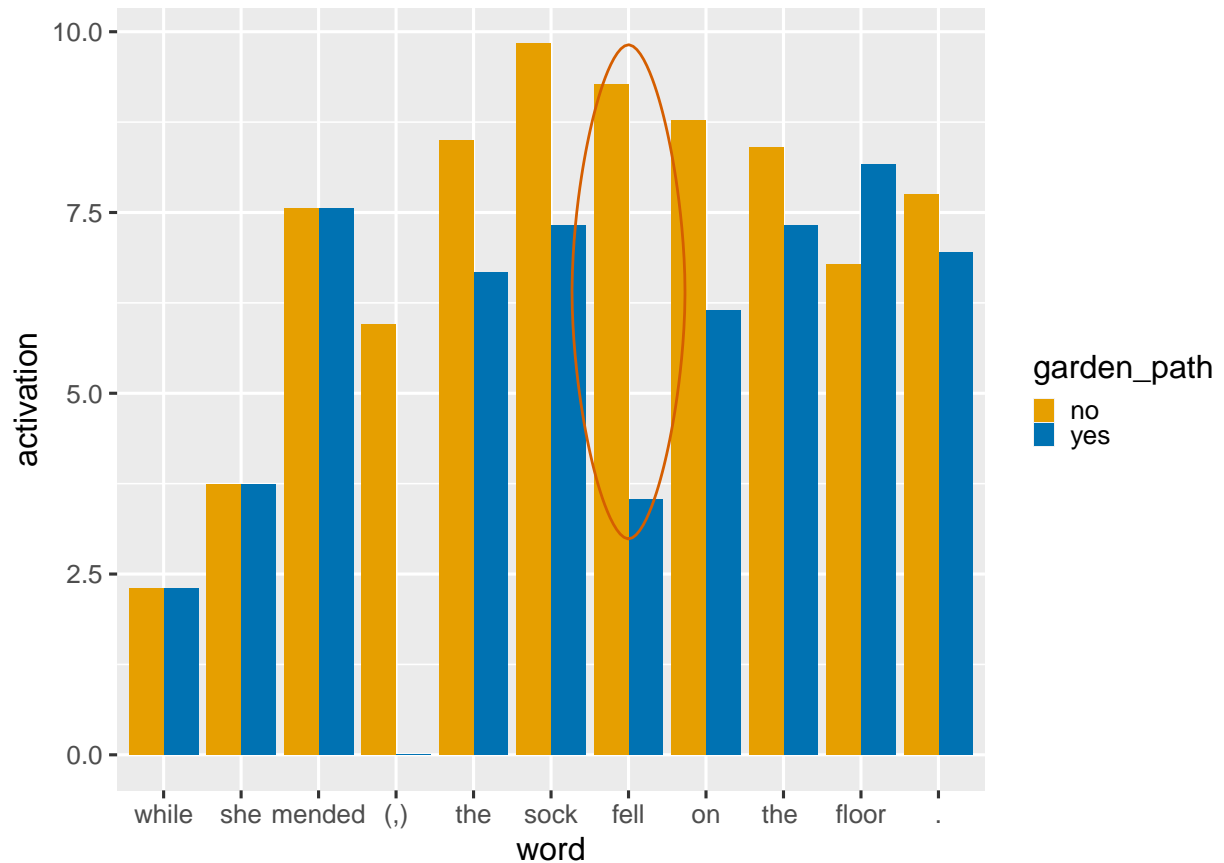
## [1] "while" "she" "mended" "(,)" "the" "sock" "fell"
## [8] "on" "the " "floor" "."

str(case2)

## 'data.frame': 22 obs. of 11 variables:
## $ activation : num 2.31 3.74 7.55 6.67 7.32 ...
## $ position : num 1 2 3 4 5 6 7 8 9 10 ...
## $ word : Factor w/ 11 levels "while","she",...: 1 2 3 5 6 7 8 9 10 11 ...
## $ sent_nr : num 3 3 3 3 3 3 3 3 3 3 ...
## $ retrieve_wh : Factor w/ 1 level "None": 1 1 1 1 1 1 1 1 1 1 ...
## $ reanalysis : Factor w/ 2 levels "no","yes": 1 1 1 1 1 2 1 1 2 1 ...
## $ agreeing_actions: num 2 2.5 3 2 3 ...
## $ matching_fs : num 7 6.67 9 17.5 9.33 ...
## $ fan_size : num 1322830 1405593 1405410 764278 1430089 ...
## $ garden_path : chr "yes" "yes" "yes" "yes" ...
## $ gp : chr NA NA NA NA ...

g1 <- ggplot(case2, aes(x = word, y = activation, fill = garden_path, group = garden_path))
g1 <- g1 + geom_bar(stat = "identity", position = "dodge")
g1 <- g1 + geom_encircle(data = subset(case2, gp == "yes"), aes(word, activation),
  inherit.aes = FALSE, s_shape = 0, spread = 0.02, size = 3, color = "#D55E00")
g1 <- g1 + theme_gray(26) + scale_fill_manual(values = cbPalette)

```



```
case3 <- subset(gp, sent_nr == 5 | sent_nr == 6)

str(case3)

## 'data.frame': 17 obs. of 9 variables:
## $ activation      : num  3.98 4.98 7.6 7.04 4.82 ...
## $ position       : int   1 2 3 4 5 6 7 8 1 2 ...
## $ word           : Factor w/ 36 levels "",".", "a","are",...: 17 12 18 31 10 4 22 2 17 12 ...
## $ sent_nr        : int    5 5 5 5 5 5 5 5 6 6 ...
## $ retrieve_wh     : Factor w/ 1 level "None": 1 1 1 1 1 1 1 1 1 1 ...
## $ reanalysis      : Factor w/ 2 levels "no","yes": 1 1 1 1 1 1 2 1 1 1 ...
## $ agreeing_actions: num    2 2.5 3 3 20 ...
## $ matching_fs     : num   11.67 9.58 9.33 9 7 ...
## $ fan_size        : num   1030551 1244206 1371128 1431177 12391731 ...

case3$word <- as.character(case3$word)

case3$word[which(case3$word == "that")] <- "(that)"

case3$word <- as.factor(as.character(case3$word))
levels(case3$word)

## [1] " ."      "(that)"  "are"     "children" "convinced"
## [6] "he"     "her"     "noisy"   "tired"
```

```
case3$garden_path <- "no"
```

```

case3$garden_path[which(case3$sent == 5)] <- "yes"

case3 <- rbind(case3, data.frame(activation = 0, position = 0, word = "(that)",
  sent_nr = 5, retrieve_wh = "None", reanalysis = "no", agreeing_actions = 0,
  matching_fs = 0, fan_size = 0, garden_path = "yes"))

case3$gp <- NA
case3$gp[which(case3$word == "are")] <- "yes"

ordered_levels <- as.numeric(subset(case3, sent_nr == 6)$word)

case3$word <- factor(case3$word, levels(case3$word)[ordered_levels])
levels(case3$word)

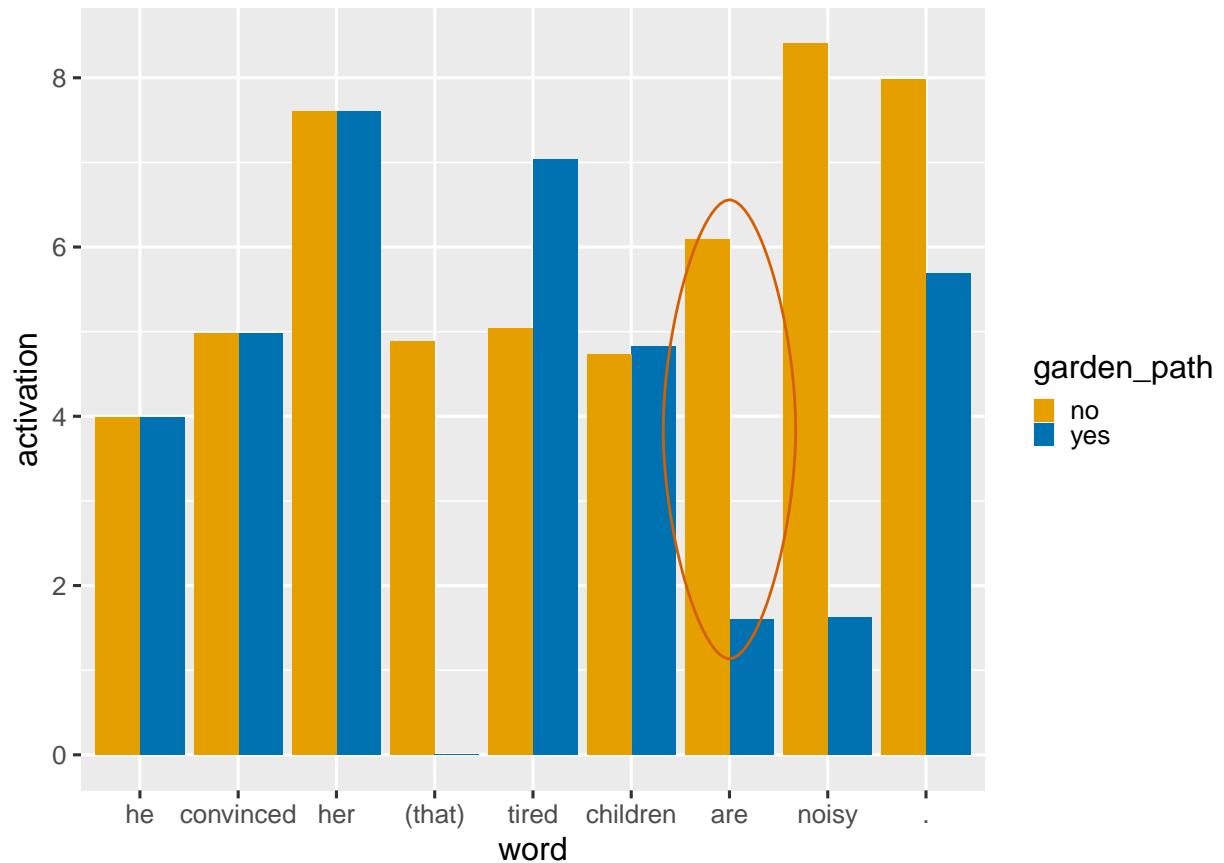
## [1] "he"          "convinced" "her"          "(that)"      "tired"
## [6] "children"    "are"         "noisy"        "."

str(case3)

## 'data.frame': 18 obs. of 11 variables:
## $ activation      : num  3.98 4.98 7.6 7.04 4.82 ...
## $ position        : num  1 2 3 4 5 6 7 8 1 2 ...
## $ word             : Factor w/ 9 levels "he","convinced",...: 1 2 3 5 6 7 8 9 1 2 ...
## $ sent_nr          : num  5 5 5 5 5 5 5 5 6 6 ...
## $ retrieve_wh       : Factor w/ 1 level "None": 1 1 1 1 1 1 1 1 1 1 ...
## $ reanalysis        : Factor w/ 2 levels "no","yes": 1 1 1 1 1 1 2 1 1 1 ...
## $ agreeing_actions : num  2 2.5 3 3 20 ...
## $ matching_fs       : num  11.67 9.58 9.33 9 7 ...
## $ fan_size          : num  1030551 1244206 1371128 1431177 12391731 ...
## $ garden_path       : chr  "yes" "yes" "yes" "yes" ...
## $ gp                : chr  NA NA NA NA ...

g1 <- ggplot(case3, aes(x = word, y = activation, fill = garden_path, group = garden_path))
g1 <- g1 + geom_bar(stat = "identity", position = "dodge")
g1 <- g1 + geom_encircle(data = subset(case3, gp == "yes"), aes(word, activation),
  inherit.aes = FALSE, s_shape = 0, spread = 0.03, size = 3, color = "#D55E00")
g1 <- g1 + theme_gray(26) + scale_fill_manual(values = cbPalette)

```



```
case4 <- subset(gp, sent_nr == 7 | sent_nr == 8)

str(case4)

## 'data.frame': 21 obs. of 9 variables:
## $ activation      : num  4.05 5.06 6.14 8.64 7.43 ...
## $ position        : int   1 2 3 4 5 6 7 8 9 10 ...
## $ word            : Factor w/ 36 levels "",".", "a","are",...: 27 16 30 9 30 13 8 3 5 2 ...
## $ sent_nr         : int    7 7 7 7 7 7 7 7 7 7 ...
## $ retrieve_wh      : Factor w/ 1 level "None": 1 1 1 1 1 1 1 1 1 1 ...
## $ reanalysis       : Factor w/ 2 levels "no","yes": 1 1 1 2 1 1 1 1 2 1 ...
## $ agreeing_actions: num    2 2.5 2 3 3 ...
## $ matching_fs      : num   11.17 9.33 16 10.33 8.78 ...
## $ fan_size         : num  1048230 1252370 822317 1296018 1537815 ...

case4$word <- as.character(case4$word)

case4$word[which(case4$position == 5 & case4$sent_nr == 7)] <- "the "
case4$word[which(case4$position == 6 & case4$sent_nr == 8)] <- "the "
case4$word[which(case4$word == "that")] <- "(that)"

case4$word <- as.factor(as.character(case4$word))
levels(case4$word)

## [1] "." "(that)" "a" "bandage" "bit" "boy" "dog"
## [8] "gave" "she" "the" "the "
```

```

case4$garden_path <- "no"
case4$garden_path[which(case4$sent == 7)] <- "yes"

case4 <- rbind(case4, data.frame(activation = 0, position = 0, word = "(that)",
  sent_nr = 7, retrieve_wh = "None", reanalysis = "no", agreeing_actions = 0,
  matching_fs = 0, fan_size = 0, garden_path = "yes"))

case4$gp <- NA
case4$gp[which(case4$word == "bit")] <- "yes"

ordered_levels <- as.numeric(subset(case4, sent_nr == 8)$word)

case4$word <- factor(case4$word, levels(case4$word)[ordered_levels])
levels(case4$word)

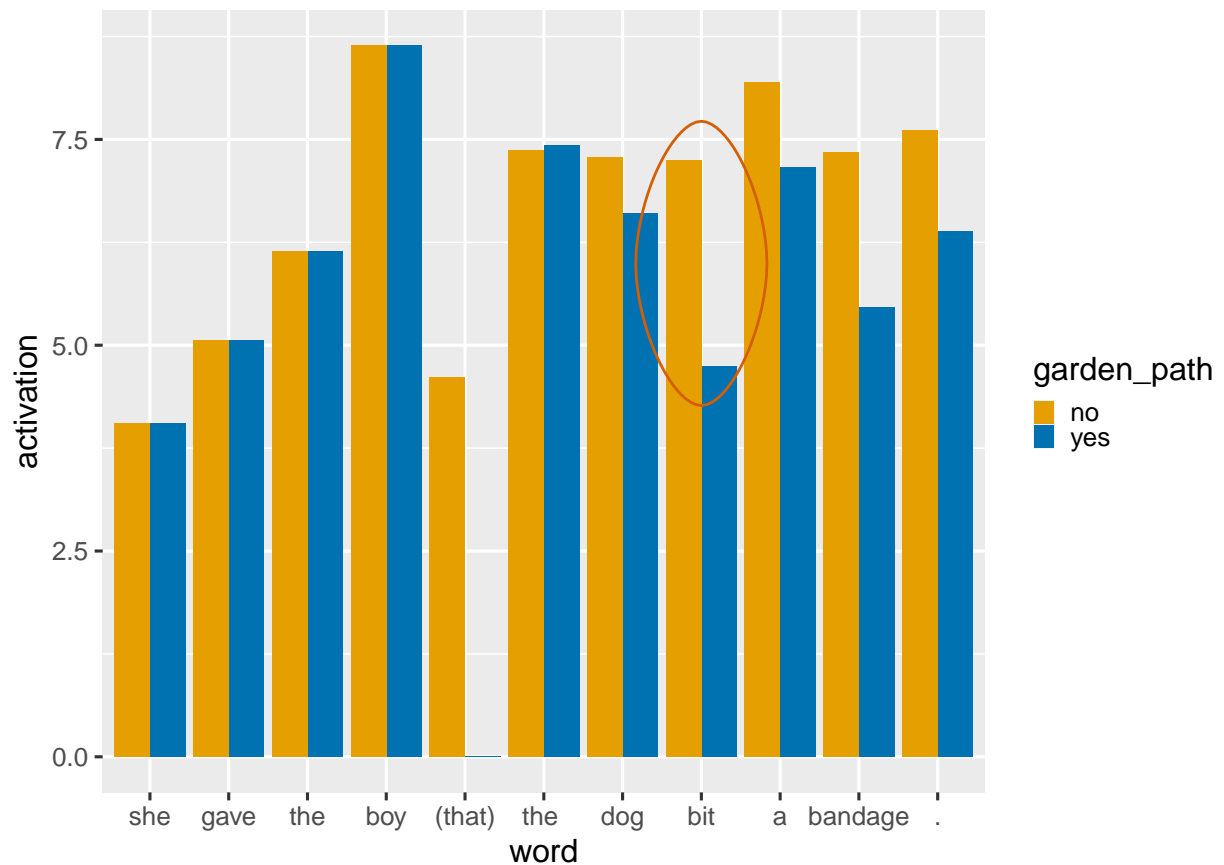
## [1] "she"      "gave"      "the"      "boy"      "(that)"    "the "      "dog"
## [8] "bit"      "a"         "bandage"  "."

str(case4)

## 'data.frame': 22 obs. of 11 variables:
## $ activation      : num  4.05 5.06 6.14 8.64 7.43 ...
## $ position        : num  1 2 3 4 5 6 7 8 9 10 ...
## $ word             : Factor w/ 11 levels "she","gave","the",...: 1 2 3 4 6 7 8 9 10 11 ...
## $ sent_nr          : num  7 7 7 7 7 7 7 7 7 7 ...
## $ retrieve_wh       : Factor w/ 1 level "None": 1 1 1 1 1 1 1 1 1 1 ...
## $ reanalysis        : Factor w/ 2 levels "no","yes": 1 1 1 2 1 1 1 1 2 1 ...
## $ agreeing_actions : num  2 2.5 2 3 3 ...
## $ matching_fs       : num  11.17 9.33 16 10.33 8.78 ...
## $ fan_size          : num  1048230 1252370 822317 1296018 1537815 ...
## $ garden_path       : chr  "yes" "yes" "yes" "yes" ...
## $ gp                : chr  NA NA NA NA ...

g1 <- ggplot(case4, aes(x = word, y = activation, fill = garden_path, group = garden_path))
g1 <- g1 + geom_bar(stat = "identity", position = "dodge")
g1 <- g1 + geom_encircle(data = subset(case4, gp == "yes"), aes(word, activation),
  inherit.aes = FALSE, s_shape = 0, spread = 0.03, size = 3, color = "#D55E00")
g1 <- g1 + theme_gray(26) + scale_fill_manual(values = cbPalette)

```

```
case5 <- subset(gp, sent_nr == 9 | sent_nr == 10)

str(case5)

## 'data.frame': 17 obs. of 9 variables:
## $ activation      : num  2.29 2.4 5.19 5.19 4.62 ...
## $ position       : int   1 2 3 4 5 6 7 8 1 2 ...
## $ word           : Factor w/ 36 levels "\",", ".", "a", "are", ...: 36 18 26 11 35 7 20 2 36 18 ...
## $ sent_nr        : int    9 9 9 9 9 9 9 9 10 10 ...
## $ retrieve_wh     : Factor w/ 1 level "None": 1 1 1 1 1 1 1 1 1 1 ...
## $ reanalysis      : Factor w/ 2 levels "no","yes": 1 1 1 2 1 1 2 1 1 2 ...
## $ agreeing_actions: num    2 2 3 3 2.33 ...
## $ matching_fs     : num    7 7.25 7 7 10.17 ...
## $ fan_size        : num  1322633 1285783 1814393 1817171 1287026 ...

case5$word <- as.character(case5$word)

case5$word[which(case5$word == ",")] <- "(,)"
case5$word <- as.factor(as.character(case5$word))
levels(case5$word)

## [1] "."                "(,)"              "be"               "contributions"
## [5] "her"              "inadequate"       "rich"             "will"
## [9] "without"

case5$garden_path <- "no"
```

```

case5$garden_path[which(case5$sent == 9)] <- "yes"

case5 <- rbind(case5, data.frame(activation = 0, position = 0, word = "(,)",
  sent_nr = 9, retrieve_wh = "None", reanalysis = "no", agreeing_actions = 0,
  matching_fs = 0, fan_size = 0, garden_path = "yes"))

case5$gp <- NA
case5$gp[which(case5$word == "will")] <- "yes"

ordered_levels <- as.numeric(subset(case5, sent_nr == 10)$word)

case5$word <- factor(case5$word, levels(case5$word)[ordered_levels])
levels(case5$word)

## [1] "without"      "her"          "(,)"          "rich"
## [5] "contributions" "will"         "be"           "inadequate"
## [9] "."

str(case5)

## 'data.frame': 18 obs. of 11 variables:
## $ activation      : num  2.29 2.4 5.19 5.19 4.62 ...
## $ position        : num  1 2 3 4 5 6 7 8 1 2 ...
## $ word            : Factor w/ 9 levels "without","her",...: 1 2 4 5 6 7 8 9 1 2 ...
## $ sent_nr         : num  9 9 9 9 9 9 9 9 10 10 ...
## $ retrieve_wh     : Factor w/ 1 level "None": 1 1 1 1 1 1 1 1 1 1 ...
## $ reanalysis      : Factor w/ 2 levels "no","yes": 1 1 1 2 1 1 2 1 1 2 ...
## $ agreeing_actions: num  2 2 3 3 2.33 ...
## $ matching_fs     : num  7 7.25 7 7 10.17 ...
## $ fan_size        : num  1322633 1285783 1814393 1817171 1287026 ...
## $ garden_path     : chr  "yes" "yes" "yes" "yes" ...
## $ gp              : chr  NA NA NA NA ...

g1 <- ggplot(case5, aes(x = word, y = activation, fill = garden_path, group = garden_path))
g1 <- g1 + geom_bar(stat = "identity", position = "dodge")
g1 <- g1 + geom_encircle(data = subset(case5, gp == "yes"), aes(word, activation),
  inherit.aes = FALSE, s_shape = 0, spread = 0.03, size = 3, color = "#D55E00")
g1 <- g1 + theme_gray(26) + scale_fill_manual(values = cbPalette)

```

