

log2 fold change explanation

If we have two numbers, A and B, the fold change from A to B is just B/A

```
a <- 10
b <- 100
fc <- b/a
fc
```

```
## [1] 10
```

In this example, fold change is 10 because B is 10 times A.

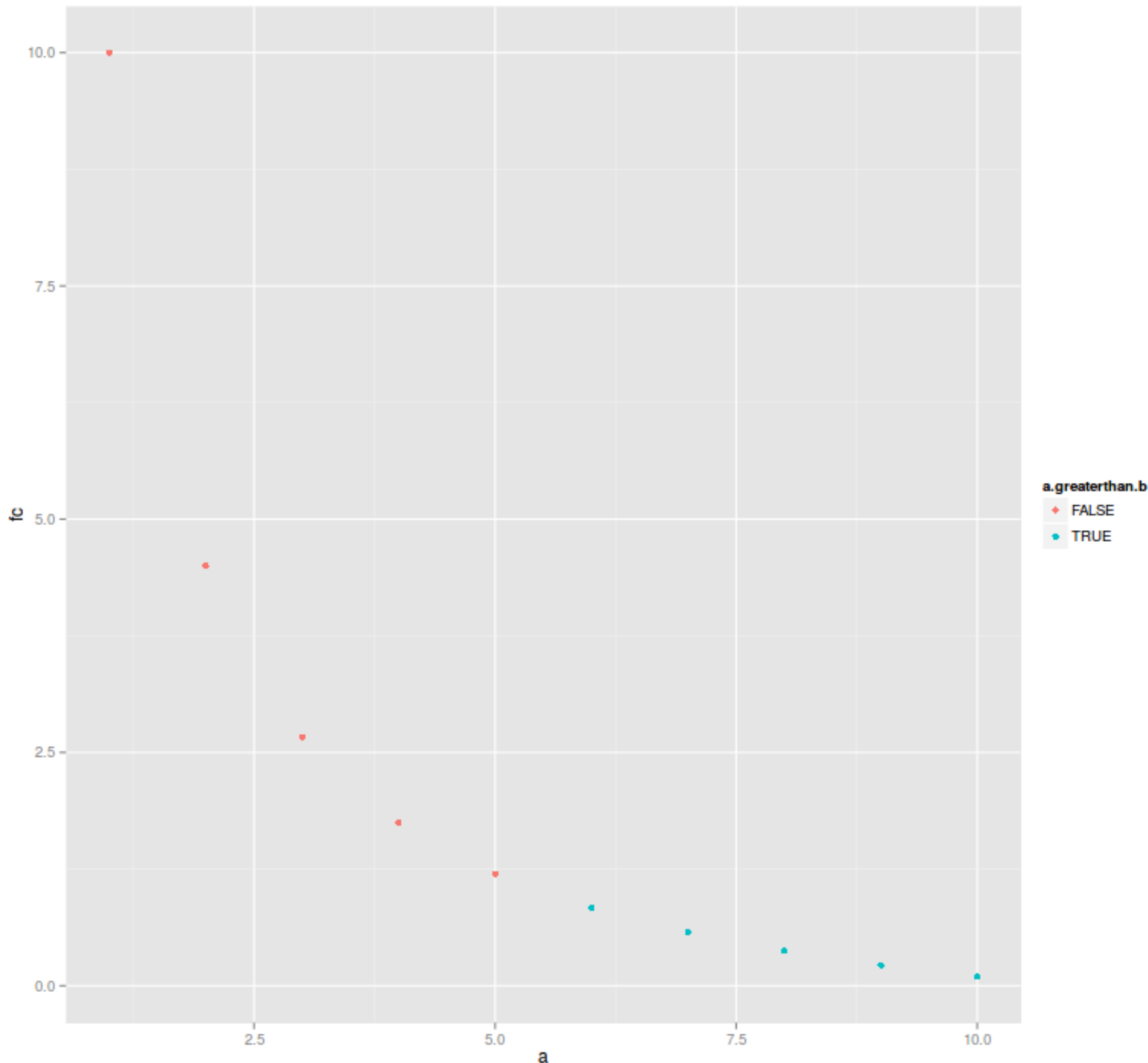
When B is bigger than A, fold change is greater than one. When A is bigger than B, fold change is less than one

```
a <- 1:10
b <- 10:1
fc <- b/a
df <- data.frame(a, b, fc, a.greaterthan.b = a > b)
df
```

##	a	b	fc	a.greaterthan.b
## 1	1	10	10.0000	FALSE
## 2	2	9	4.5000	FALSE
## 3	3	8	2.6667	FALSE
## 4	4	7	1.7500	FALSE
## 5	5	6	1.2000	FALSE
## 6	6	5	0.8333	TRUE
## 7	7	4	0.5714	TRUE
## 8	8	3	0.3750	TRUE
## 9	9	2	0.2222	TRUE
## 10	10	1	0.1000	TRUE

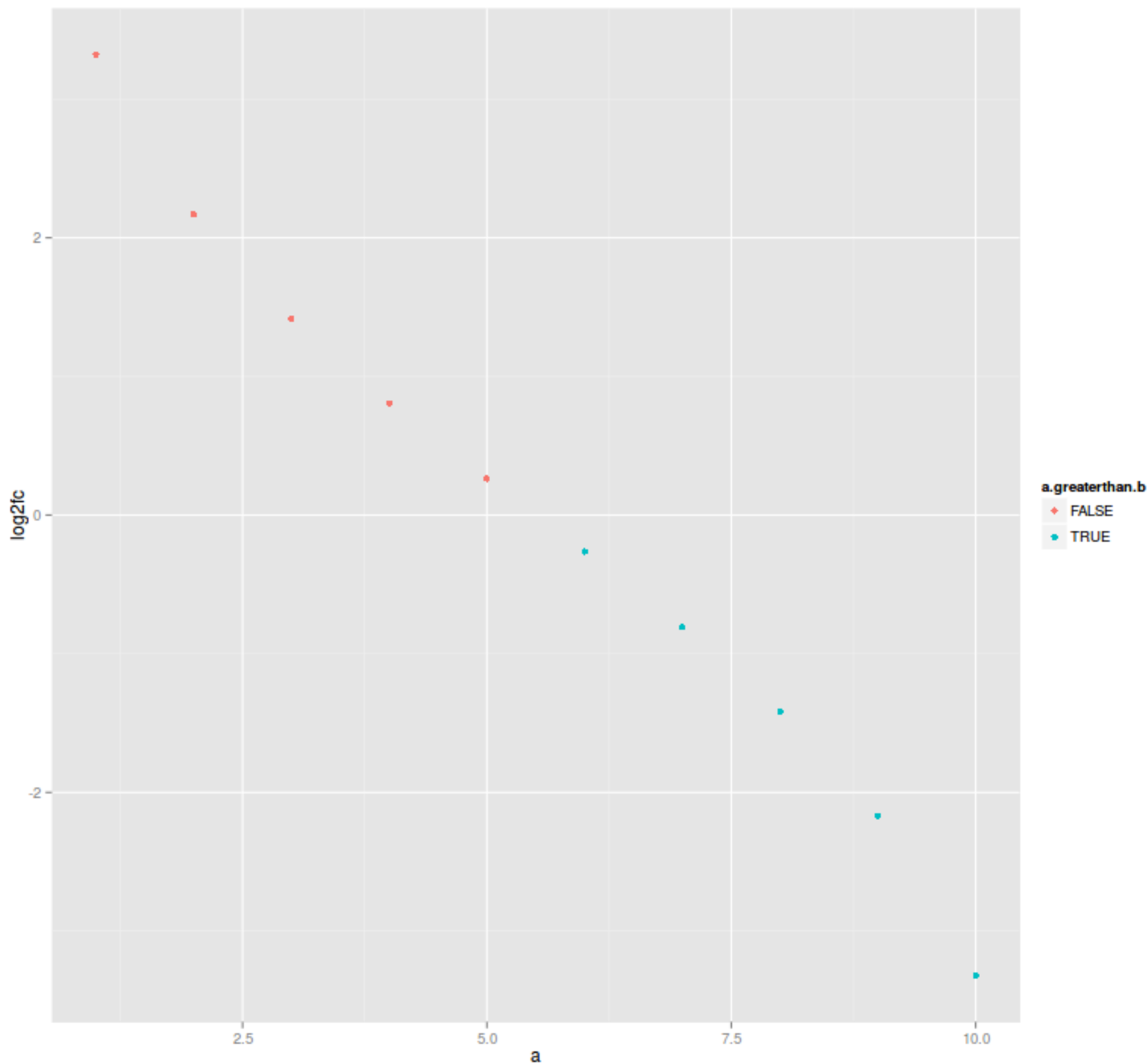
This compresses the information when A is bigger than B, making it hard to see both high and low fold changes on a plot:

```
ggplot(df, aes(a, fc, colour = a.greaterthan.b), size = 8) +
geom_point()
```



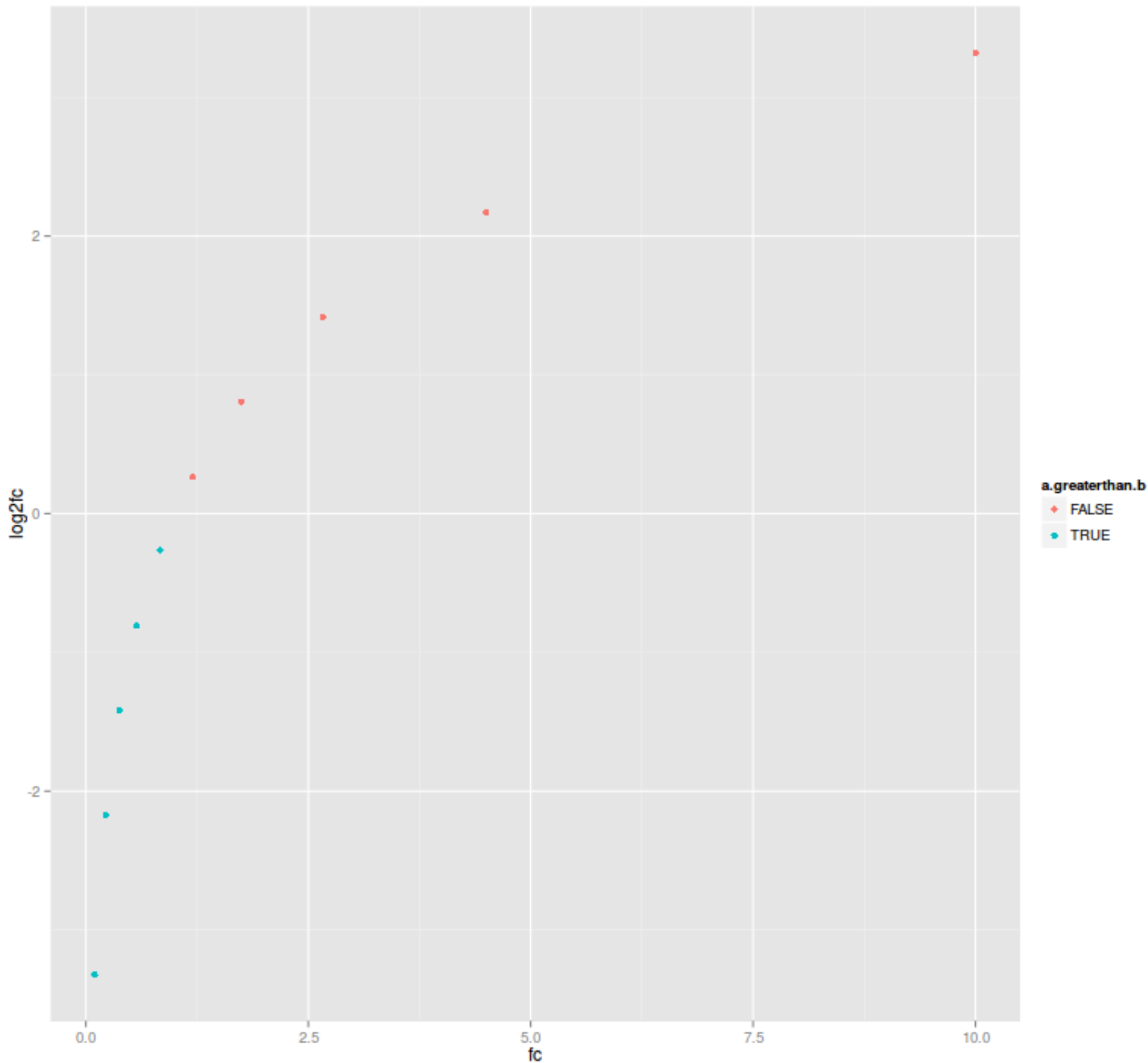
If we use $\log_2(\text{fold change})$, fold changes lower than 1 (when $B > A$) become negative, while those greater than 1 ($A > B$) become positive. Now the values are symmetrical and it's easier to see fold changes in both directions on one plot.

```
log2fc <- log2(fc)
ggplot(df, aes(a, log2fc, colour = a.greaterthan.b), size = 8) +
  geom_point()
```



We can see explicitly that fold changes < 1 become negative and those > 1 become positive:

```
ggplot(df, aes(fc, log2fc, colour = a.greaterthan.b), size = 8) +  
geom_point()
```



It's also useful to know that a log2 fold change (B/A) of 1 means B is twice as large as A, while log2fc of 2 means B is 4x as large as A. Conversely, -1 means A is twice as large as B, and -2 means A is 4x as large as B.