Factor Screening

I began by trying a 2^{3-1} fractional factorial design with design generator Tile.Size = Prev.Length:Match.Score, resulting in the principle fraction design. Being a fractional factorial design, it only has half of the 8 conditions in a full 2^3 design. However, each main effect is aliased with a two factor interaction effect.

The high levels for tile size, match score, and preview length are 0.3, 100, 120 and the low levels are 0.1, 80, 100, respectively. After simulating the data and fitting the model, I found the output provided p-values associated with t-tests of the hypothesis

$$H_0 : \beta = 0 \text{ vs } H_A : \beta \neq 0$$

for each regression coefficient in the model. The p-values for each main effect was significant. However, due to confounding from the aliasing, there is no way to conclude if each main effect was really significant, or if it was due to a two factor interaction effect.

Factors_fractional	Pvalues_fractional
Preview Length	<2e-16
Match Score	<2e-16
Tile Size	<2e-16

Thus, I decided to sacrifice some efficiency for accuracy and simulated the other 4 conditions of the full 2^3 model, which resulted in the complementary fraction design. Thus, with all 8 conditions, I analyzed the experiment as a full 2^3 design without any confounding. The output provided p-values associated with t-tests of the hypothesis

$$H_0 : \beta = 0 \text{ vs } H_A : \beta \neq 0$$

for each regression coefficient in the model. The p-value for tile size was $0.787 > 0.01$ so it is not significant at the 1% level. In addition, all 2 factor interaction effects that included tile size are also not significant at a 1% level since their p-values are greater than 0.01 as well. Thus I concluded that tile size does not significantly influence the response variable and I excluded it in future experiments.

Factors_full	Pvalues_full
Preview Length	<2e-16
Match Score	<2e-16
Tile Size	0.787
Prev.Length:Match.Score	<2e-16
Prev.Length:Tile.Size	0.613
Match.Score:Tile.Size	0.709
Prev.Length:Match.Score:Tile.Size	0.342

We can get the effects for the active factors by multiplying their $\hat{\beta}$ estimates by 2.

Preview Length : $2\hat{\beta} = 1.76624$. Thus, as compared to when preview length is 100, when preview length is 120, we expect the average browsing time to increase by 1.76624 minutes

Match Score : $2\hat{\beta} = 1.85906$. Thus, as compared to when match score is 80, when preview length is 100, we

expect the average browsing time to increase by 1.85906. minutes

Main effect Preview Length

Avg Browsing Time) vs Preview Length

Main effect Match Score

Avg Browsing Time) vs Match Score
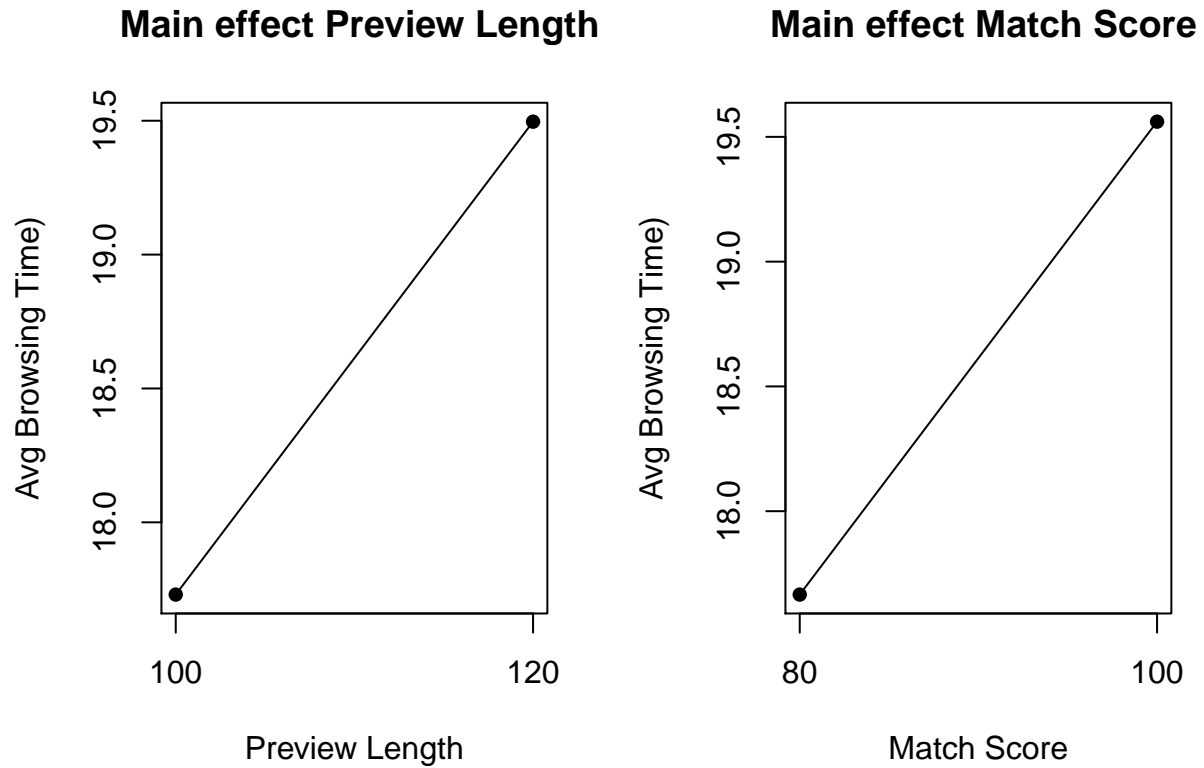
The main effects plots agree with the results from earlier. Browsing time seems to increase as match score increases from 80 to 100 and preview length increases from 100 to 120.

In conclusion, I have found that tile size does not significantly influence the average browsing time, and I will exclude it in further phases. The factors that I have found that significantly influence browsing time are preview length and match score.