# Illustration-Specific Examples

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MED as a compromise between space-filling and quadratic D-Optimal design (examples 2 and 2.1)

MED as a compromise between space-filling and linear D-Optimal design (example 5)

MED for better estimates than space-filling

When BetaT = mu0

# Illustrative Examples: MED as a compromise

Do we have an example where we have:

- MED(s) as a compromise between space-filling design and D-Optimal design?
  - For quadratic D-Optimal design: Example 2 (or, 2.1 might be slightly better)
  - For linear D-Optimal design: Example 5

# Illustrative Examples: when MED performs better than space-filling design

MED is somehow better than the space-filling design?

- in the sense of estimating parameters, we can look at MSE, however, there doesn't seem to be any one single example where it does better at estimating all paramters...
  - for estimating $\beta_0$, the intercept, Examples 2 and 3
  - for estimating $\beta_1$, the coefficient on the linear term, Example 1 and 5
  - for estimating $\beta_2$, coefficient on the quadratic term? Not sure... (they are comparable for example 2, though)
- in the sense of favoring the correct hypothesis?
  - In example 2, MED is better than the space-filling design, when the true model is given by $H_1$.
  - what about when the true model should be linear?
  - what if both competing models are linear? they are comparable in Example 5
  - or quadratic?

# Illustrative Examples: when MED performs better than D-Optimal designs

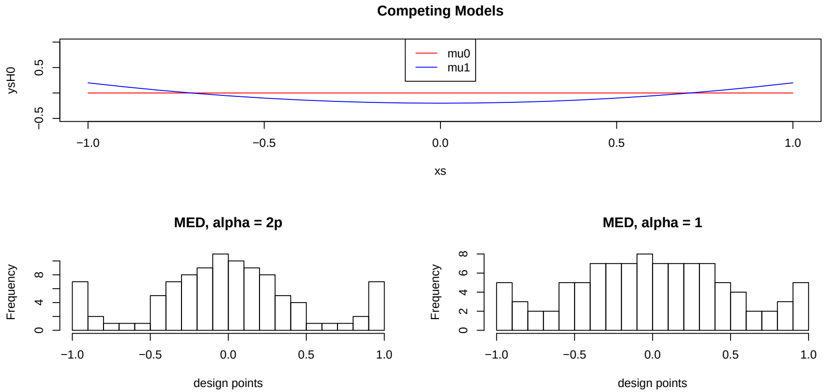
- MED is somehow better than D-Optimal design? (I have the same question)
  - when the model is correctly specified, the D-Optimal design is best at estimating parameters
  - in this case, it becomes important to look at either
    - cases where $\beta_T$ doesn't match a prior mean of either hypothesis
    - cases where the model is misspecified (e.g. quadratic instead of linear)

Another interesting thing is that, it seems that if none of the coefficients are known (and we just set them to be 0), the MED looks like a space-filled D-Optimal linear design, which seems to suggest that it favors testing the simpler model first at all times. (Example 1)

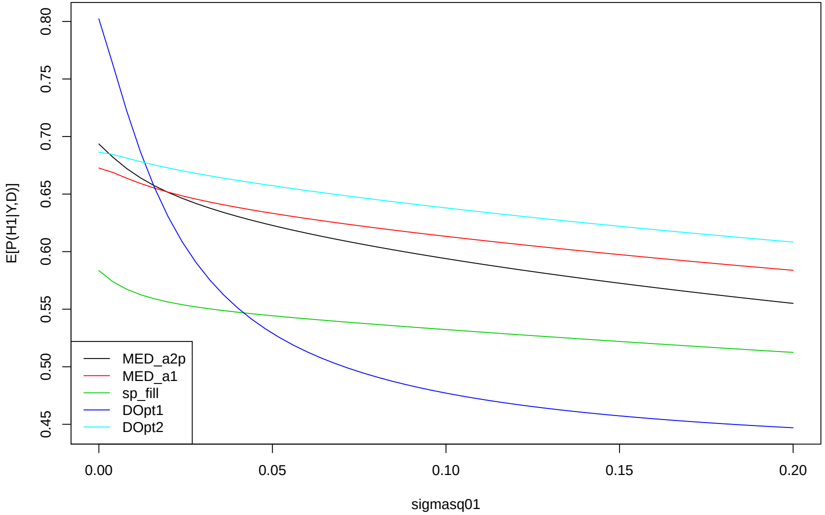
# MED as a compromise between space-filling and quadratic D-Optimal design (examples 2 and 2.1)

# MED as a compromise between space-filling and quadratic D-Optimal design: example 2

- $\mu_0 = (0, 0)^T$
- $\mu_1 = (-0.2, 0, 0.4)^T$

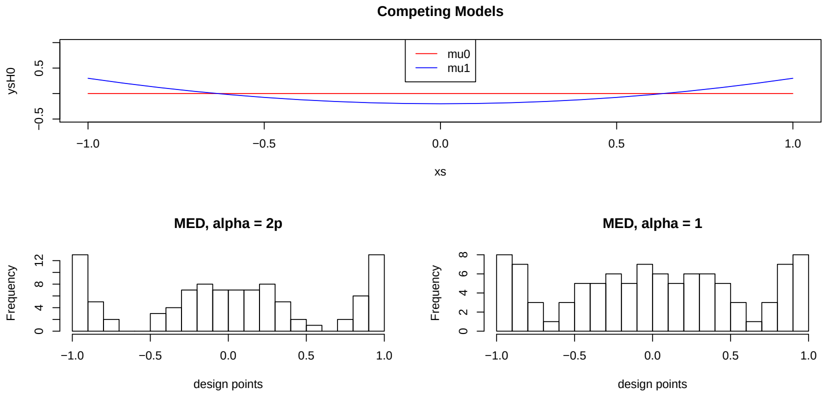


# Example 2 E[P(H1|Y,D, betaT=mu1)]

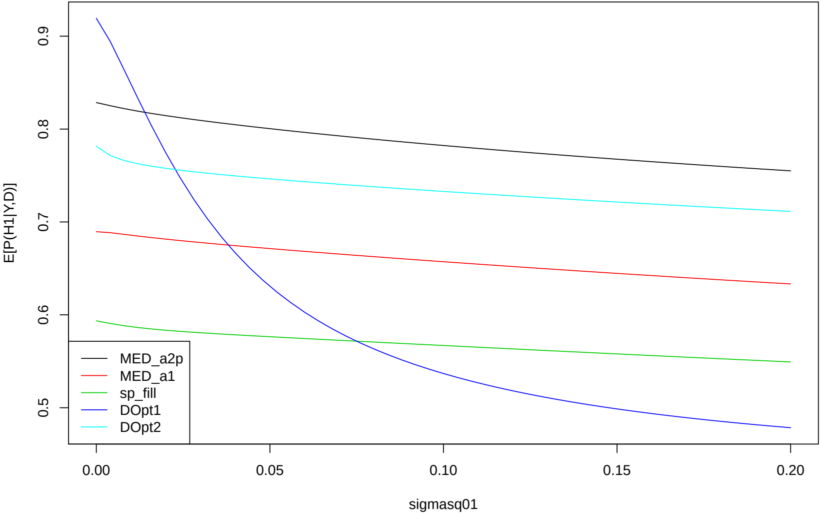


# MED as a (slightly better) compromise (Example 2.1)

- $\mu_0 = (0, 0)^T$
- $\mu_1 = (-0.2, 0, 0.5)^T$



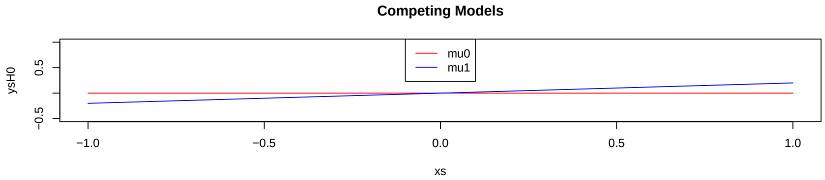
# Example 2.1 E[P(H1|Y,D, betaT=mu1)]

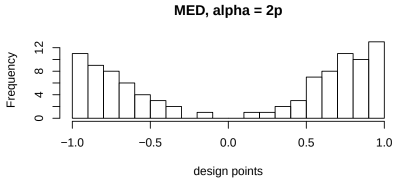


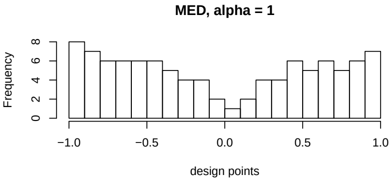
# MED as a compromise between space-filling and linear D-Optimal design (example 5)

# MED as a compromise between space-filling and linear D-Optimal design: example 5

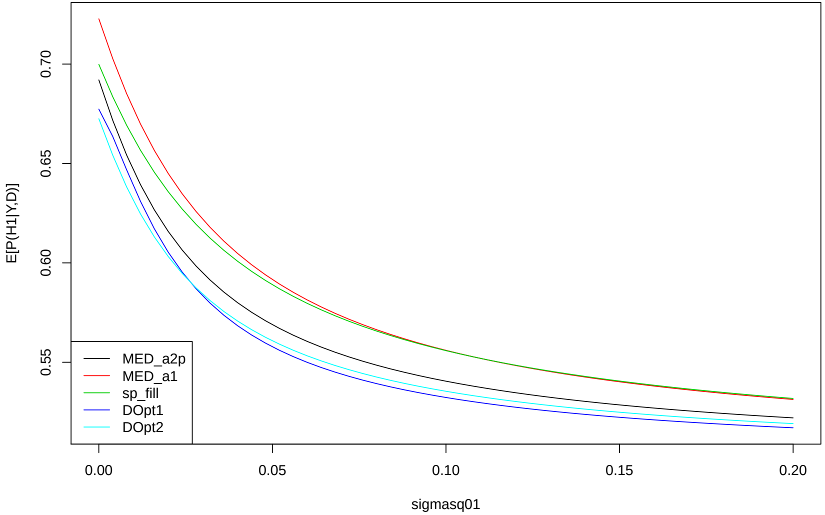
- $\mu_0 = (0, 0)^T$
- $\mu_1 = (0, 0.2)^T$



# Example 5 E[P(H1|Y,D, betaT=mu1)]



## MED for better estimates than space-filling

# Comparisons of MSE(Bn|Y, D)

When comparing MSE evaluations,

- If $\beta_T = mu_1$, we only want to compare MED to space-filling design
- If $\beta_T != mu_1$, we can also compare to the D-Optimal designs.
- See meeting_100419 notes for these comparisons.

## When BetaT = mu0

# When BetaT = mu0

Here, we look at Example 2.1 assuming $H_0$ is the true hypothesis, instead of $H_1$: