Problem set 3

The R script `sim.R` defines a function `sim()` that simulates a model observer in a 2AFC depth discrimination task with binocular disparity and touch cues. The first line of the function's definition is

```
sim <- function( depth1, depth2 )
```

To simulate showing depth stimuli to the model observer `sim()`, you can pass input arguments that specify the depths you want to show. The argument `depth1` specifies the depths in the first stimulus interval, and `depth2` specifies the depths in the second stimulus interval. Depths are measured in cm. Each argument must be an atomic vector with two elements, e.g., c(1.2, 1.25). The first element specifies the depth from binocular disparity, and the second element specifies the depth from touch. If you do not want to have a disparity or touch depth cue, set the corresponding element to `NA`. For example, to get the model observer's response on a trial where interval 1 has a disparity cue indicating a depth of 1.5 cm, and interval 2 has a touch cue indicating 2.0 cm, you would call:

```
r <- sim( depth1 = c( 1.5, NA ), depth2 = c( NA, 2.0 ) )
```

`sim()` returns a value of 1 or 2, to indicate which interval it judges as having greater depth. As with human observers, there is a random component in `sim()`'s decision rule, so if you call `sim()` with the same input arguments twice, you do not necessarily get the same answer each time.

Does `sim()` combine disparity and touch cues optimally? Measure a psychometric function where `sim()` judges whether stimuli at a range of depths in interval 1 have more or less depth than a 10 cm reference stimulus in interval 2. Do this for disparity stimuli, touch stimuli, and combined disparity-and-touch stimuli. Fit normal cdf's to these three psychometric functions and use the fitted σ parameters to test for optimal cue combination. (Review `find_sigma.R` from lecture 7 to see how to estimate σ from a psychometric function. Recall that equation (3) in Ernst and Banks (2002) shows how the σ parameters for individual and combined depth cues are related when cue combination is optimal.)

In a real experiment, you would of course use statistical tests. You don't need to use statistical tests for this problem set. I've written `sim()` so that the answers are clear enough without statistical tests.

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