A Decision Model for Psychophysics (*Cont.*)

1. Review
2. ROC curves

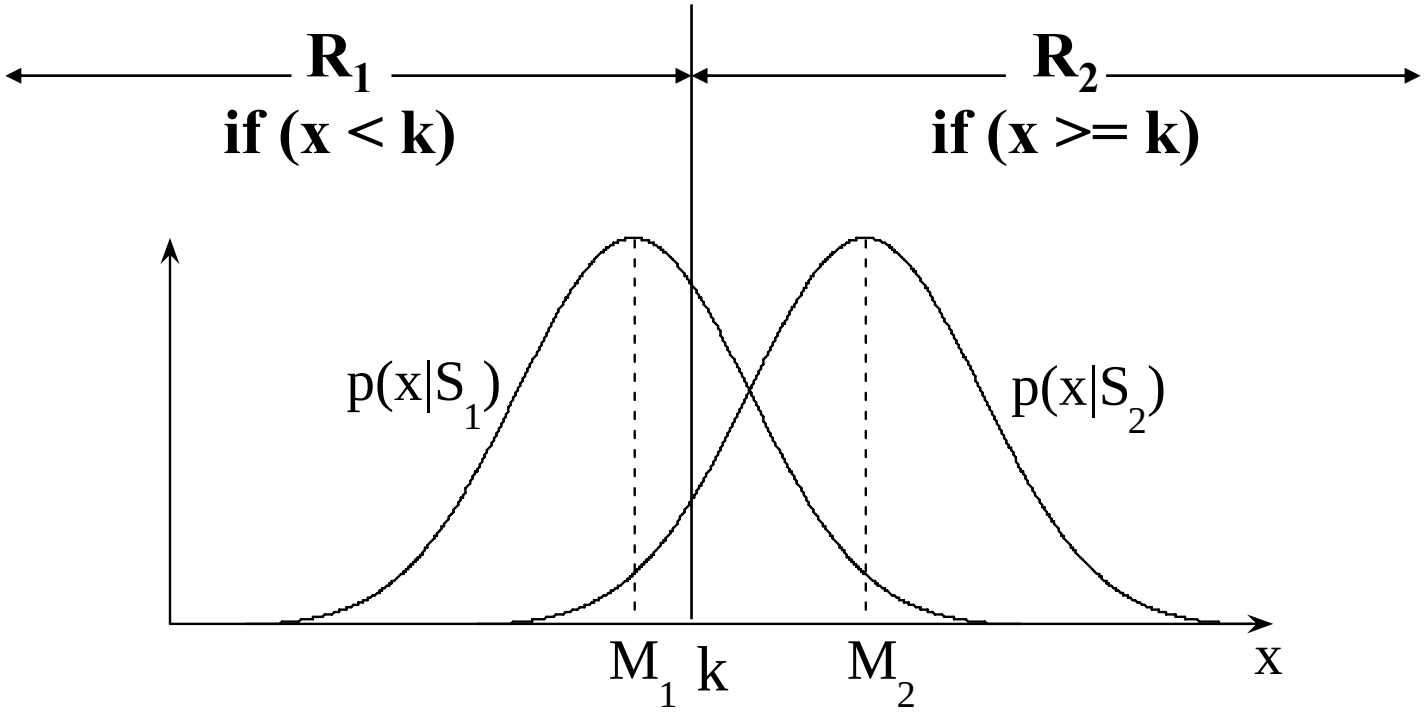
Review of 1-I Experiment

- Procedures
- Decision model
- Data analysis

Procedures

- Pick the stimuli S_1 and S_2
- Pick the responses R_1 and R_2
- Determine probabilities $P(S_1)$ and $P(S_2)$
- Determine total number of trials
- Run yourself first – are the d′ and c values reasonable?
- Should feedback be provided?
- Now run other subjects

Decision Model



$$p(x|S_1)=\frac{1}{\sqrt{2\pi}\sigma}e^{-\frac{\left(x-M_1\right)^2}{2\sigma^2}}$$

$$p(x|S_2)=\frac{1}{\sqrt{2\pi}\sigma}e^{-\frac{\left(x-M_2\right)^2}{2\sigma^2}}$$

$$d'=\frac{M_2-M_1}{\sigma}$$

$$c=\frac{1}{\sigma}\left(k-\frac{M_1+M_2}{2}\right)$$

Data Analysis

	R_1	R_2	
S_1	$f(R_1/S_1)$	$f(R_2/S_1)$=F	} {z(H), z(F)}
S_2	$f(R_1/S_2)$	$f(R_2/S_2)$=H	

$$d' = z(H) - z(F) \qquad c = -\frac{z(H)+z(F)}{2}$$

Detection or Discrimination?

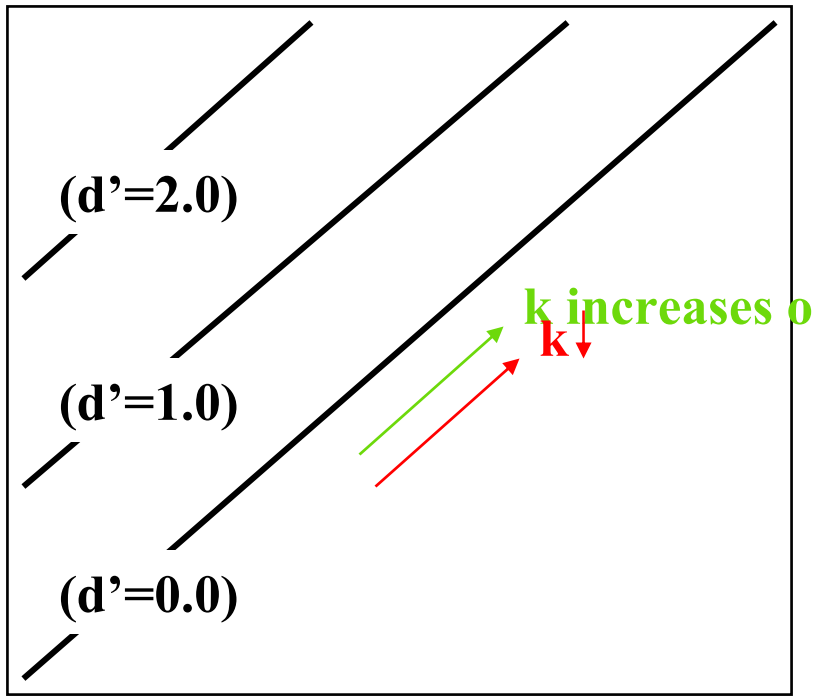
- The 1-I experiments can be used for either detection or discrimination experiments
- What's the main difference between a detection and discrimination experiment?

ROC for d′

- ROC: Receiver Operating Characteristic (Isosensitivity Curve)
- Question: Given the same pair of S_1 and S_2 (d′ is fixed), how would performance (H, F) vary with *k*?
- ROC plotted as z(H) vs. z(F) has a particularly simple form:

  $z(H) = z(F) + d'$

ROC: z(H) = z(F) + d′



z(H)

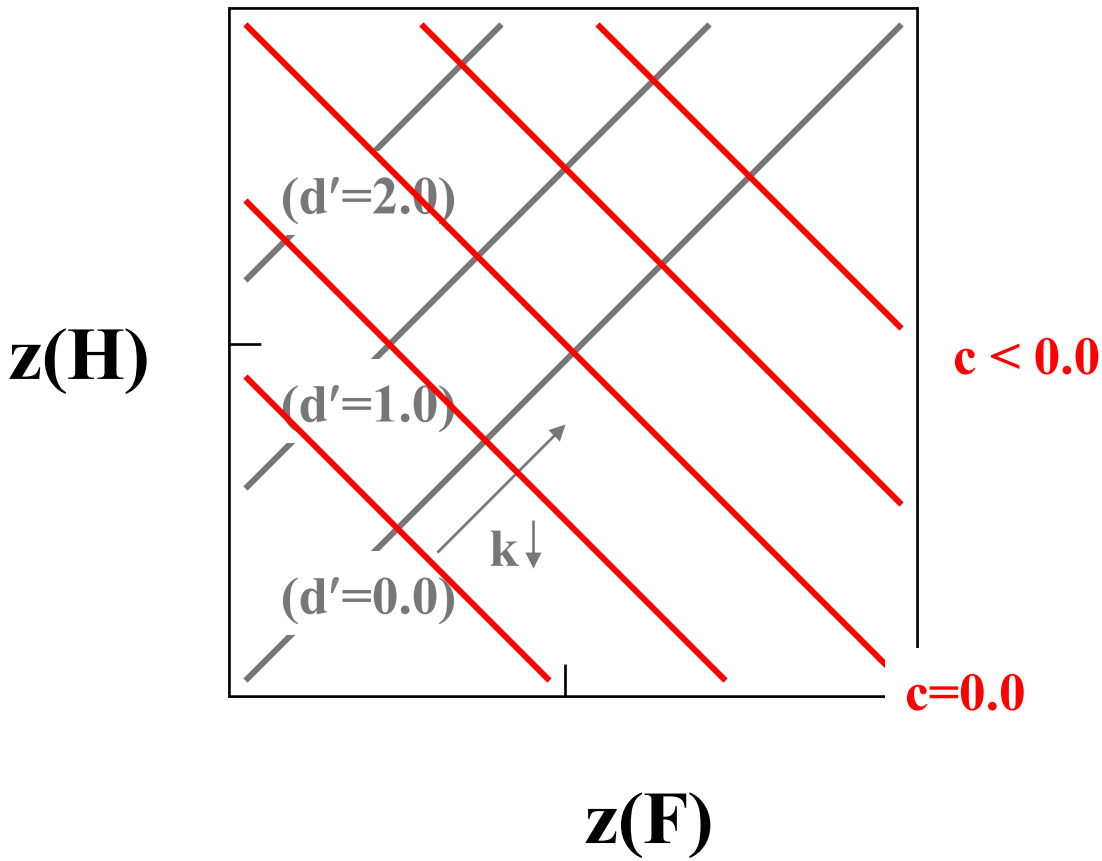
z(F)

ROC for c

- Isobias Curve
- Question: Given the same criterion (c is fixed), how would performance (H, F) vary with S_1 and/or S_2?
- ROC plotted as z(H) vs. z(F) has a particularly simple form:

  $z(H) = -z(F) - 2c$

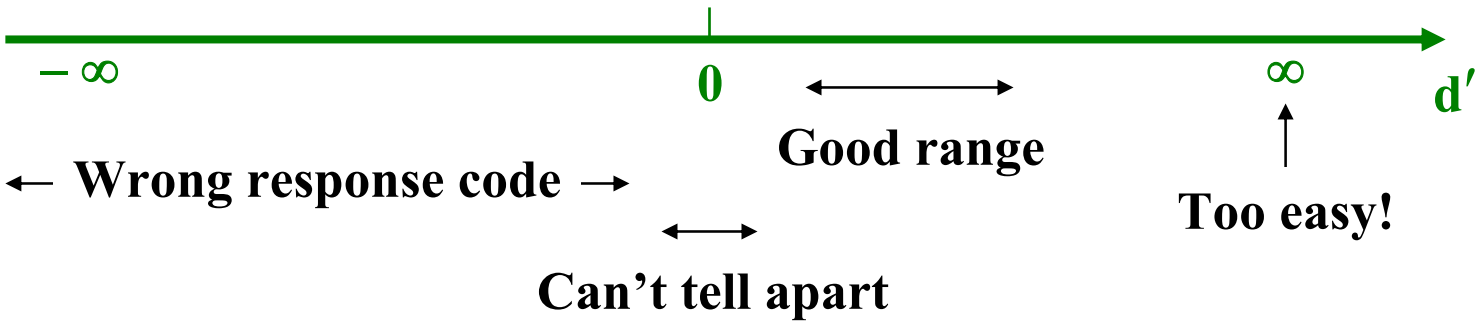
ROC: z(H) = – z(F) – 2c



How to Design a 1-I Exp.?

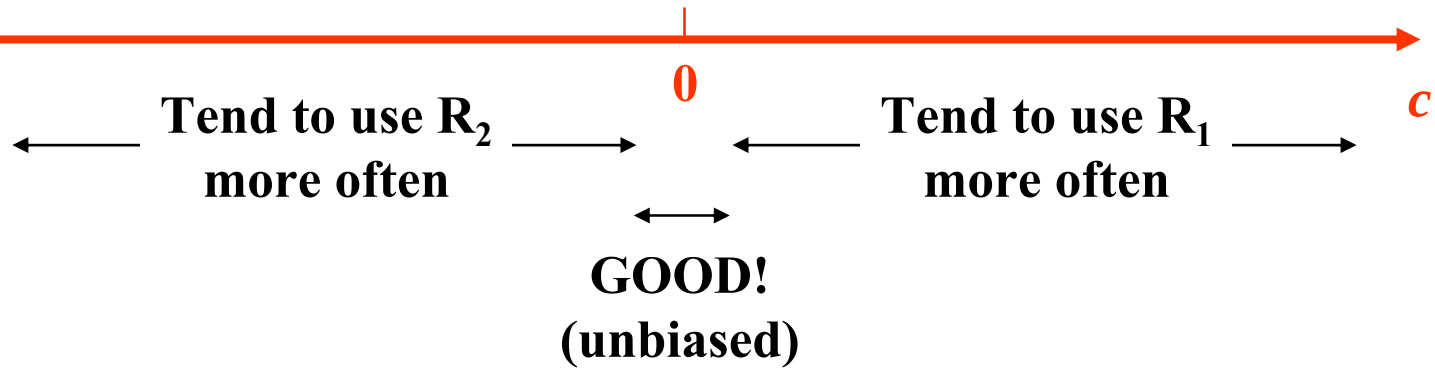
- How to choose S_1 and S_2?
- How to choose probabilities of presenting S_1 or S_2 on each trial?
- The issue of Stimulus-Response compatibility (S-R compatibility)
- How many trials?
- How many subjects?
- How to detect "bad" subjects?

More on Sensitivity Index d′



- Possible values: 0 – 4.65 (H=.99, F=.01)
- Avoid d′=0.0 and d′= ∞
- My preference: 0.5 – 2.5
- My preference: keep c<10%×d′

More on Response Bias *c*



- If *c* is large, investigate why (unless it is part of the experimental design).

Your Results

- Do you understand how the experimental data are organized, and how the different results are calculated?
- Do you think the results are as expected?