

## A Decision Model for Psychophysics (Cont.)

1. How to Test the Decision Model
2. Relating  $d'$  to DL

1

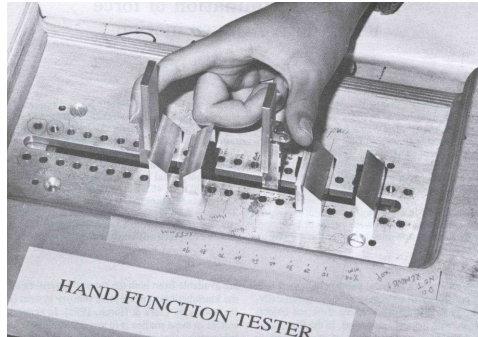
© Hong Z. Tan & Zygmunt Pizlo

## How to Test the Decision Model? — the Idea

- Pang, Tan and Durlach (1991)
- A study of manual force discrimination
- **Q: Is ROC a straight line with slope of 1?**
- Approach: Measure isosensitivity curve by using  $P(S_1)=1/10, 3/10, 5/10, 7/10$  and  $9/10$ .

2

© Hong Z. Tan & Zygmunt Pizlo

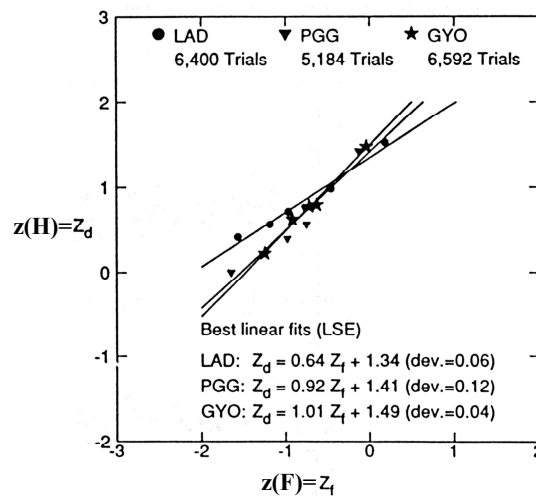


- Apparatus: A Linear Force Grasper
- Stimuli:  $S_1 = 5 \text{ N}$ ,  $S_2 = 5.5 \text{ N}$
- Responses: “smaller” or “larger” force

3

© Hong Z. Tan & Zygmunt Pizlo

## How to Test the Decision Model? — the Results



4

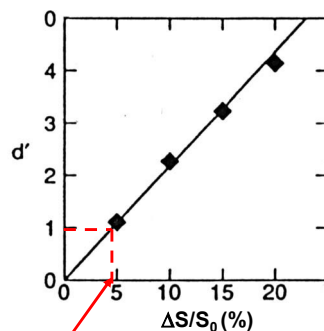
© Hong Z. Tan & Zygmunt Pizlo

## Difference Threshold $DL$ , Sensitivity Index $d'$ , Just Noticeable Difference $JND$ , and their Relationship

5

© Hong Z. Tan & Zygmunt Pizlo

### JND



JND

- Just-Noticeable-Difference
- JND  $\leftrightarrow$  DL (discrimination)
- It is defined as
 
$$JND = \frac{1}{\bar{\delta}}$$
- $\bar{\delta}$  is the average of  $d' / (\Delta S / S_0)$  over several values of  $\Delta S$  for a given  $S_0$
- ( $S_1 = S_0$ ,  $S_2 = S_0 + \Delta S$ )

6

© Hong Z. Tan & Zygmunt Pizlo

## Estimating DL from $d'$

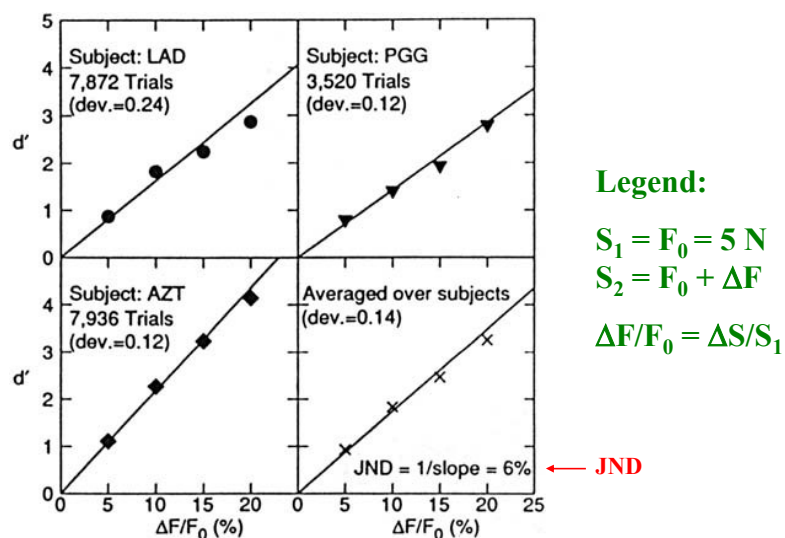
- From a 1-I experiment, we get  $d'$
- In theory, DL can simply be computed as  $DL = \Delta S / d'$
- However, estimating DL from one pair of  $(\Delta S, d')$  values is not reliable
- In practice, draw  $d'$  vs.  $\Delta S$  for many pairs of  $(\Delta S, d')$ , then compute DL as the inverse of the  $d' = \Delta S / DL$  slope.
- DL is the same as JND in a discrimination exp.
  - ◆ Be very careful with units (pixel, gram, vs. %)
  - ◆ Be aware of the reference signal level  $S_0$

7

© Hong Z. Tan & Zygmunt Pizlo

## Real Data

*From Pang, Tan & Durlach (1991)*



8

© Hong Z. Tan & Zygmunt Pizlo

## Reading

- Pang, Tan and Durlach, “Manual discrimination of force using active finger motion,” *Perception & Psychophysics*, 49(6), 531–540, 1991.