## MEASURES OF VARIABILITY (DISPERSION)

**The Concept**: What is variability (dispersion)?

How spread out are scores around their center?

**Basketball Example:**

Two basketball players with same average shooting percentage

Average shooting % is the same... but there is something different

**Effects of stress on performance**

Scientific Hypothesis: Stress will not affect the average performance of a group of people because it will increase the performance of some of them while decreasing the performance of others. BUT, stress will affect the variability of performance within the group. That is, people's performance will be less alike when they are stressed. DV is 1 to 7 rating of how good a person's performance is on a certain task

Stress group: 6, 2, 1, 7 No-stress group: 4, 3, 5, 4

Mean of stress group vs. Mean of No-stress group

**Range**

**R = Hi - Lo**

**Average deviation** (around the mean)

Formula:

| Stress Group | | |
|---|---|---|
| Score **X** | Deviation **(X - M)** | Abs Value of Dev |
| 6 | +2 | |
| 2 | -2 | |
| 1 | -3 | |
| 7 | +3 | |
| Ex = | E( X - M) = | |

| Stress Group | |
|---|---|
| Score **X** | Abs Value of Dev |
| 6 | |
| 2 | |
| 1 | |
| | |

| Stress Group | |
|---|---|
| 7 | |
| Ex = | |

**Variance:** Average squared deviation (around the mean)

Definitional formula:

$\mathbf{S^2}$ =

Sum of Squares

**SS** =

Stress Group Calculations:

| Stress Group | | |
|---|---|---|
| Score **X** | Deviation **(X - M)** | Squared Deviation **$(X - M)^2$** |
| 6 | +2 | |
| 2 | -2 | |
| 1 | -3 | |

| Stress Group | | |
|---|---|---|
| 7 | +3 | |
| Ex = | E( X - M) = | E( X - M)$^2$ = |

Non Stress Group Calculations:

**Why this formula**?

deviations measure tendency away from the mean

need to square the deviations because

sum to zero

magnifies larger deviations

need to sum all the squared deviations

need to divide by n because...

**Summary: Average Squared Deviation**

**Computational formula for variance**

$S^2$ =

Stress Group Calculations

Non Stress Group Calculations

**Computational formula for SS**

Computational **SS =**

Calculating Variance using SS

$S^2$ =

Stress Group calculations

# Standard Deviation

Formulas

**S** =

Definitional Formula

**S** =

Computational Formula

**S** =

Stress and Non Stress Example Calculations

Rationale: Variance squares the measurement operations of the DV

Example: What is $IQ^2$?

Standard Deviation (S) returns measurements to their original scale

## Interpreting standard deviations

**Standard scores (z-scores)**

We've defined z for the Normal Curve previously

Now we define the same concept for a data set

formula **z =**

Tells how many standard deviations a score is away from...

**rationale:** puts everything on the same scale of sd's

gives the number of sd's a raw score is above or below the mean

allows comparison of scores across populations:

**Example calculations**: Psychology 1010 test

Mean = S =

A student scores 72, what is the z score of a raw score of 72?

**Example: An English test and a math test**

A student gets a 36 in Math and a 72 in English

On which test did he or she do better?

Mean of Math test =

Mean of English test =

Student's z score on Math test

S of Math test =

z(36) =

Student's z score on English test S of English test =

z(72) =

The z scores tell us a great deal about how well the student did on the two tests

**Bell curve**

Bell curves such as the Normal are closely related to S

Rules of Thumb for any Bell Curve

**Example:** Psych 1010 test
Mean = 65 and S = 5

Draw a rough bell curve showing from -3 to +3 S's around the mean

If a student has a raw score of 72, find its z score and draw the score of 72 on your rough sketch of the Bell Curve