Controlled Experiment of Fitts' Law

HCI class, 2020

Fitts' Law experiment

- Goal: examine the validity of Fitts' Law
- Pointing device
  - Mouse
  - Touch screen
- Task ：
  - Pointing and dragging

Experiment platform (http://39.97.170.246/fitts/)

Reference:

Gillan, Douglas J., Kritina Holden, Susan Adam, Marianne Rudisill, and Laura Magee. "How does Fitts' law fit pointing and dragging?." In *Proceedings of the SIGCHI conference on Human factors in computing systems*, pp. 227-234. ACM, 1990.

Result Analysis

- Examine the impacts of A (distance), W (size) and pointing devices on movement time (ANOVA)
- Examine the predictively of Fitts' Law (Regression Analysis)

Writing a report

- Propose your research question
- Explain the rationality of the experiment design
- Provide enough details of your experiment so other can replicate your experiment
- Interpret the result in a scientific way

HCl experiment report

- Goal
- Participant
- Apparatus
- Task
- Procedure
- Result and Analysis
- Discussion (optional)

Participants

- How do we choose the participants?
- Number
- Gender
- Age
- Familiarity with the task
- Other important details…

Apparatus

- Hardware
  - Display (Size and Resolution)
  - Input Devices (mouse, keyboard and etc.)
- Software
- Environment
  - Lighting and temperature
  - Physical setting
- Using photo and sketch

Experiment Design

- Design Goal
  - Representative
  - Discriminate
- Factorial experiment
  - Independent Variable
  - Dependent Variable
- Within-subjects vs. Between-subjects
- Counterbalance

Procedure of Experiment

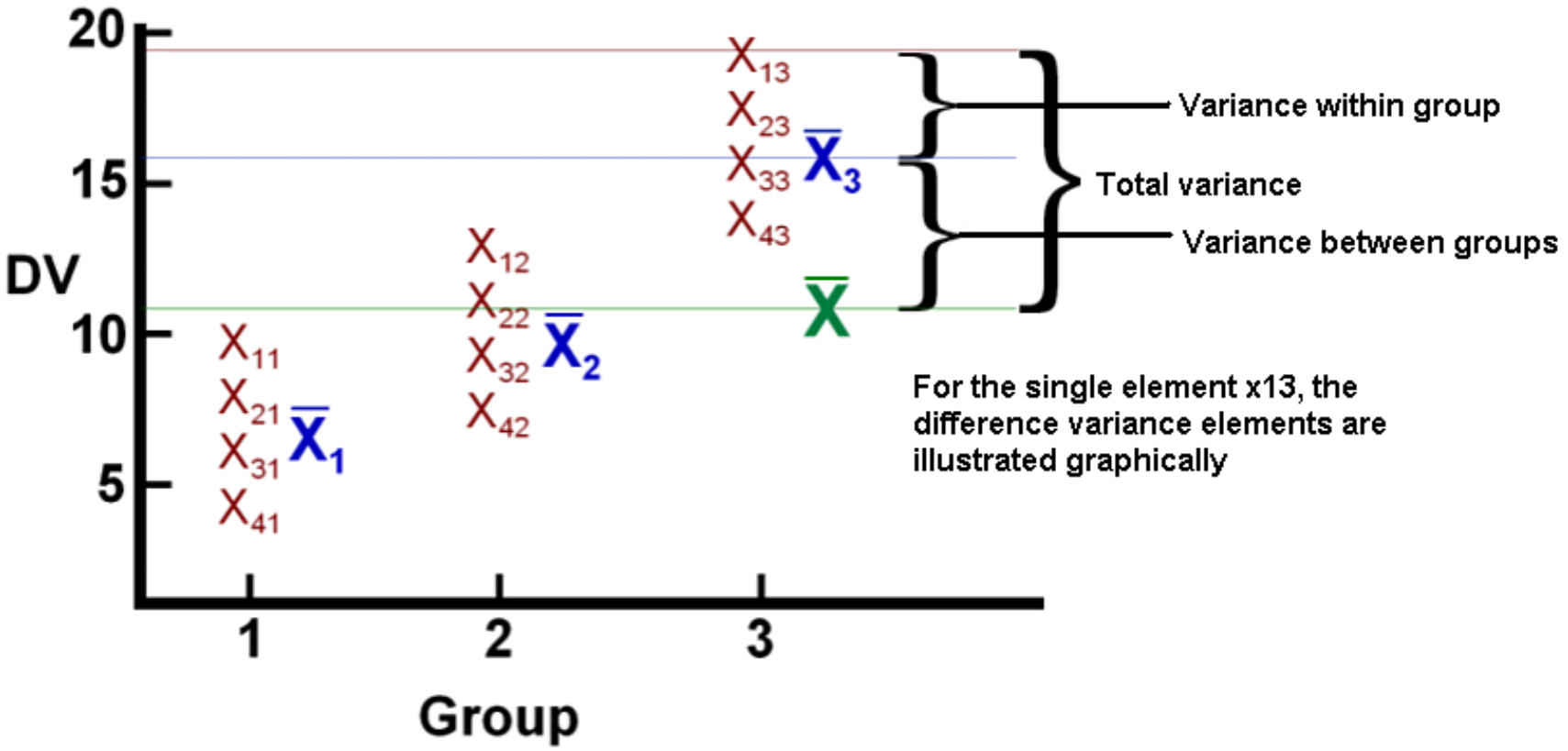
- Steps
- Instruction
- Demonstration
- familiar with tasks
- Questionnaire (optional）
- Fatigue and rest

Data Analysis

Observation	Line1	Line2
1	0.61	-1.01
2	0.15	-0.36
3	-0.24	-0.34
4	-0.65	-0.54
5	-0.58	-0.13
6	-0.48	-0.78
7	-0.35	-0.90
8	-0.07	-0.22
9	-0.45	-0.72
10	-0.25	-0.88

n	10	10
Mean	-0.231	-0.588
StDev	0.380	0.312
Variance	0.144	0.097

Analysis of Variance



$$F_{(K-1,N-K)} = \frac{\text{Variance between groups}}{Variance\ within\ group}$$

F-Value & statistical significance

Null hypothesis (*Ho*): all sample means arising from different factors are equal

Alternative hypothesis (*Hα*): the sample means are not all equal

$$F_{\alpha, n_1-1, n_2-1} \qquad F_{\alpha, n_1-1, n_2-1}$$

Critical Values for F Distributions

v2	α	v1 = 1	2	3	4	5	6	7	8	9	10	15	20
1	0.1	39.86	49.50	53.59	55.83	57.24	58.20	58.91	59.44	59.86	60.19	61.22	61.74
1	0.05	161.45	199.50	215.71	224.58	230.16	233.99	236.77	238.88	240.54	241.88	245.95	248.02
1	0.01	4052.2	4999.3	5403.5	5624.3	5764.0	5859.0	5928.3	5981.0	6022.4	6055.9	6157.0	6208.7
1	0.001	405311.6	499725.3	540256.5	562667.8	576496.1	586032.9	593185.4	597953.8	602245.3	605583.2	616073.6	620842.0
2	0.1	8.53	9.00	9.16	9.24	9.29	9.33	9.35	9.37	9.38	9.39	9.42	9.44
2	0.05	18.51	19.00	19.16	19.25	19.30	19.33	19.35	19.37	19.38	19.40	19.43	19.45
2	0.01	98.50	99.00	99.16	99.25	99.30	99.33	99.36	99.38	99.39	99.40	99.43	99.45
2	0.001	998.38	998.84	999.31	999.31	999.31	999.31	999.31	999.31	999.31	999.31	999.31	999.31
3	0.1	5.54	5.46	5.39	5.34	5.31	5.28	5.27	5.25	5.24	5.23	5.20	5.18
3	0.05	10.13	9.55	9.28	9.12	9.01	8.94	8.89	8.85	8.81	8.79	8.70	8.66
3	0.01	34.12	30.82	29.46	28.71	28.24	27.91	27.67	27.49	27.34	27.23	26.87	26.69
3	0.001	167.06	148.49	141.10	137.08	134.58	132.83	131.61	130.62	129.86	129.22	127.36	126.43
4	0.1	4.54	4.32	4.19	4.11	4.05	4.01	3.98	3.95	3.94	3.92	3.87	3.84
4	0.05	7.71	6.94	6.59	6.39	6.26	6.16	6.09	6.04	6.00	5.96	5.86	5.80
4	0.01	21.20	18.00	16.69	15.98	15.52	15.21	14.98	14.80	14.66	14.55	14.20	14.02
4	0.001	74.13	61.25	56.17	53.43	51.72	50.52	49.65	49.00	48.47	48.05	46.76	46.10

Excel； Matlab； JMP…