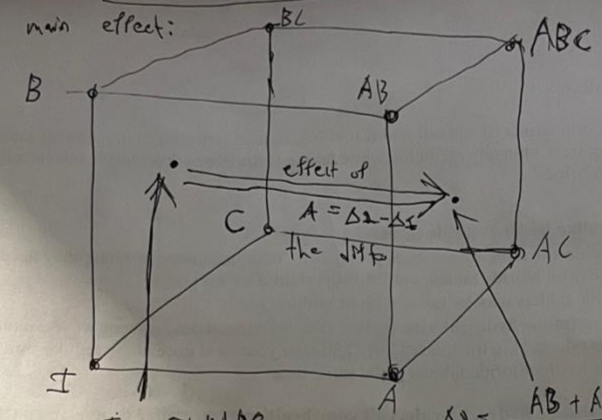
Reflection 7 Notes

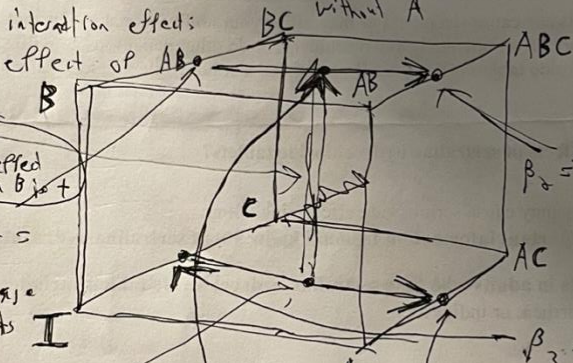
For a main effect:
i.e. effect of A?



$$\Delta 1 = \frac{I + C + B + BC}{4}$$ = average of all measurements without A

$$\Delta 2 = \frac{AB + A + AC + ABC}{4}$$ = average of all measurements with A

For an interaction effect:
i.e. effect of AB



$\Sigma_2 - \Sigma_1 =$ changes in effect of A when B is +

$$\beta_1 = \frac{B\,\cancel{C} + B}{2} =$$ the average measurements for when A is − and B is +

$$\beta_2 = \frac{ABC + AB}{2}$$ = average measurement when A is + and B is +

$$\beta_3 = \frac{I + C}{2}$$ = average measurement when A is − and B is −

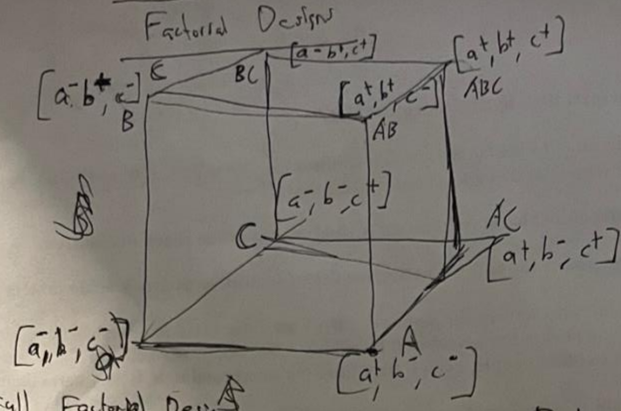
$$\beta_4 = \frac{AC + A}{2}$$ = the average measurement when A is + and B is −

$$\Sigma_1 = \frac{\beta_1 + \beta_2}{2}$$ = the effect of A when B is + ~~or has an influence on A~~

$$\Sigma_2 = \frac{\beta_3 + \beta_4}{2}$$ = the normal effect of A (when B is −)

Reflection 7 Notes

Factorial Designs



Full Factorial Design

A	B	C	Observation	Point
−	−	−	I	$a^- b^- c^-$
+	−	−	A	$a^+ b^- c^-$
−	+	−	B	$a^- b^+ c^-$
−	−	+	C	$a^- b^- c^+$
+	+	−	AB	$a^+ b^+ c^-$
+	−	+	AC	$a^+ b^- c^+$
−	+	+	BC	$a^- b^+ c^+$
+	+	+	ABC	$a^+ b^+ c^+$

Balanced:

* For EACH SINGULAR attribute, is + and − the same count
  ex. [I, A, B, C] is Not balanced, A, B, and C only have 1 positive
  ex. [I, C, AB, ABC] is balanced:
  a has 2 + and 2 −
  b has 2 + and 2 −
  c has 2 + and 2 −

Orthogonal

* For each PAIR of attributes, (+ +) or (− −) and (+ −) or (− +) appear the same # of times ⟹ if you were to draw a shape of attribute levels, the # of measurements would be even and on the same side

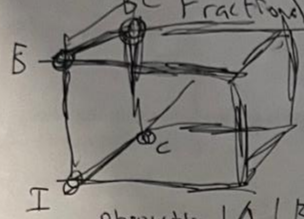
ex. [I, C, B, BC] is orthogonal

A	B	C	Observation
−	−	−	I
−	+	−	B
−	−	+	C
−	+	+	BC

AB have 2 (− −) and 2 (+ −)
BC have (+ +), (− −), and 2 (+ −)
AC have 2 (− −) and 2 (+ −)

Reflection 7 Notes

Fractional Factorial Designs



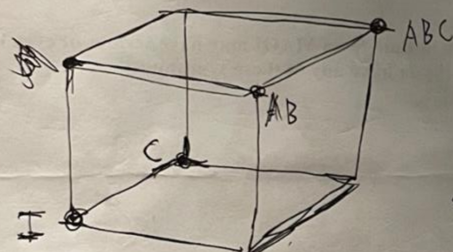
- Not balanced
- Orthogonal

ex.

observation	A	B	C
I	−	−	−
B	−	+	−
C	−	−	+
BC	−	+	+

- Confounding table:

observation	confounding observation
I	ABC
B	AC
C	AB
BC	A

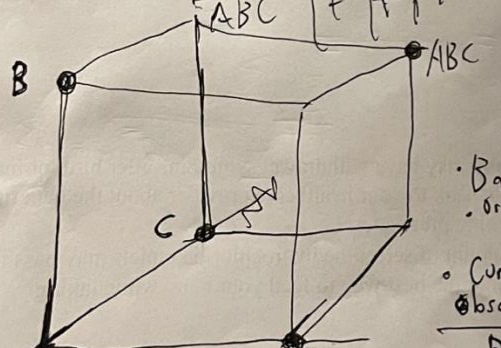


- Balanced
- Not orthogonal

observation	A	B	C
I	−	−	−
C	−	−	+
AB	+	+	−
ABC	+	+	+

- Confounding table:
  a is confounded with b ⇒
  a = b

observation	confounding observation
I	AB
A	B
B	A
C	ABC
AB	I
AC	BC
BC	AC
ABC	C

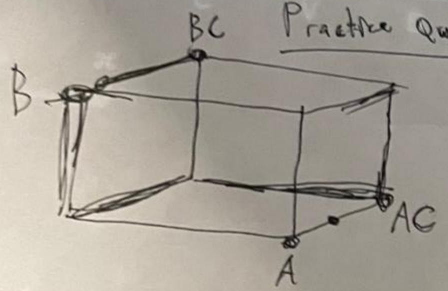


- Balanced
- orthogonal

observation	A	B	C
A	+	−	−
B	−	+	−
C	−	−	+
ABC	+	+	+

- Confounding table!

observation	confounding observation
B	AC
ABC	~~ABC~~ I
C	AB
A	BC



Practice Question 1

a. The design is balanced, each observation has 2 + and 2 −

The design is NOT orthogonal → a and b are opposites 4 times

b. $a = \frac{A+AC}{2} - \frac{B+BC}{2}$

$b = \frac{B+BC}{2} - \frac{A+AC}{2} = -a$

$c = \frac{BC+AC}{2} - \frac{A+B}{2}$

c. a is confounded with b, as $a = -b$, and the design is not orthogonal ⇒ main effects are confounded

Reflection 7 Notes

What type of design to use in conjoint analysis?

Start

↓

Full factorial design too big? —no→ use full factorial

↓ yes

are interaction effects important? —no→ use an orthogonal design

↓ no

use a randomized design