The Effect of Soaking Time, Lid Condition, and Water Volume on the Taste of Instant Cup Noodles

STA305 H1S: Design and Analysis of Experiments

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Introduction

- Instant noodle is popular around the world and among university students.

Photo from spot.ph

Photo from thestreet.com

Purpose:

Investigate three factors that may have significant effects on the taste of instant cup noodles:

- ➢ soaking time
- ➢ lid condition
- ➢ water volume

Materials and Methods   --- *Experimental Design and Data*

- Soaking time: 3 minutes and 5 minutes
- Water volume: 50% and 70%
- Lid condition: covered and uncovered

	Lid Condition						
	Without a lid (-1)				With a lid (+1)		
	Water Volume				Water Volume		
Soaking Time	50% water (-1)		70% water (+1)		50% water (-1)		70% water (+1)
3 Mins (-1)							
5 Mins (+1)							

Materials and Methods --- *Experimental Design and Data*

Run	time	lid	water	taste
1	1	-1	-1	5
2	1	1	1	9
3	1	-1	1	6
4	1	-1	-1	4
5	1	1	1	8
6	-1	-1	-1	2
7	-1	-1	1	4
8	1	1	-1	8
9	1	1	-1	8
10	-1	-1	1	3
11	-1	1	1	5
12	-1	1	-1	2
13	-1	1	1	5
14	1	-1	1	6
15	-1	1	-1	5
16	-1	-1	-1	3

Soaking Time	Lid Condition							
	Without a lid (-1)				With a lid (+1)			
	Water Volume				Water Volume			
	50% water (-1)		70% water (+1)		50% water (-1)		70% water (+1)	
3 Mins (-1)	2	3	3	4	2	5	5	5
5 Mins (+1)	4	5	6	6	8	8	8	9
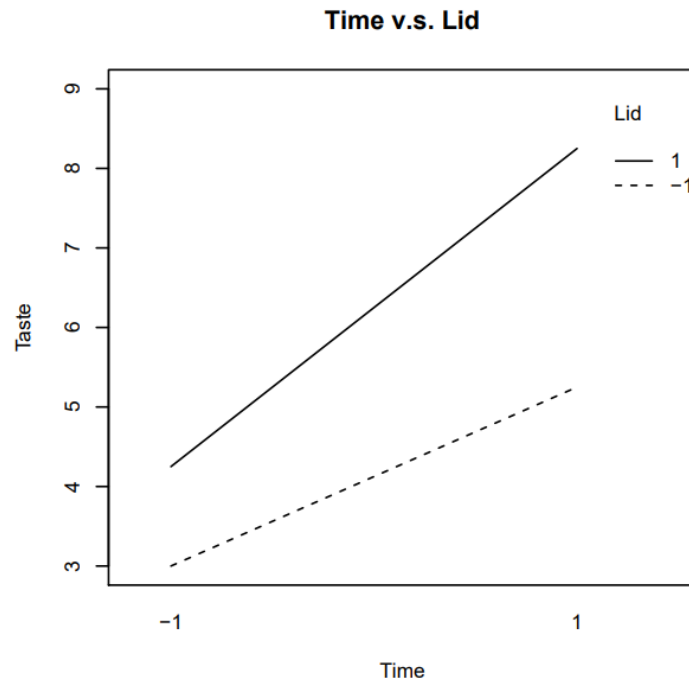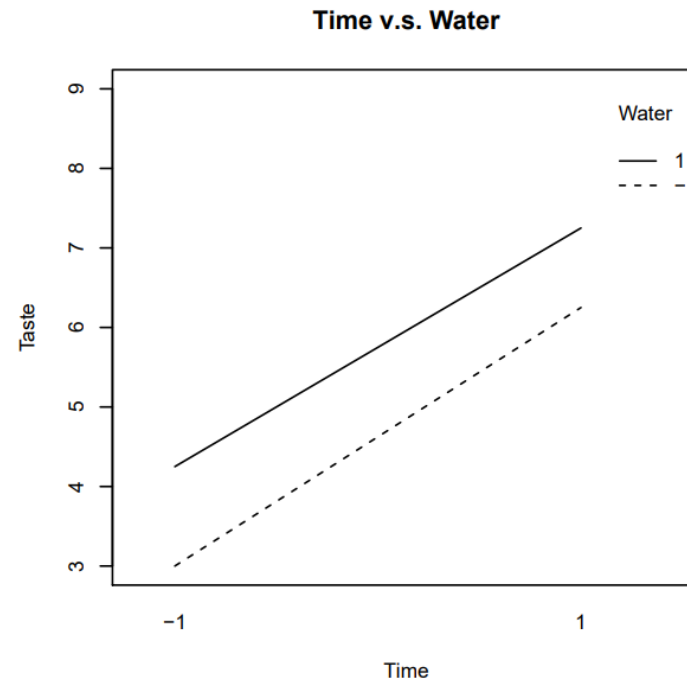
May be crossing   **Nearly parallel**   **Nearly parallel**
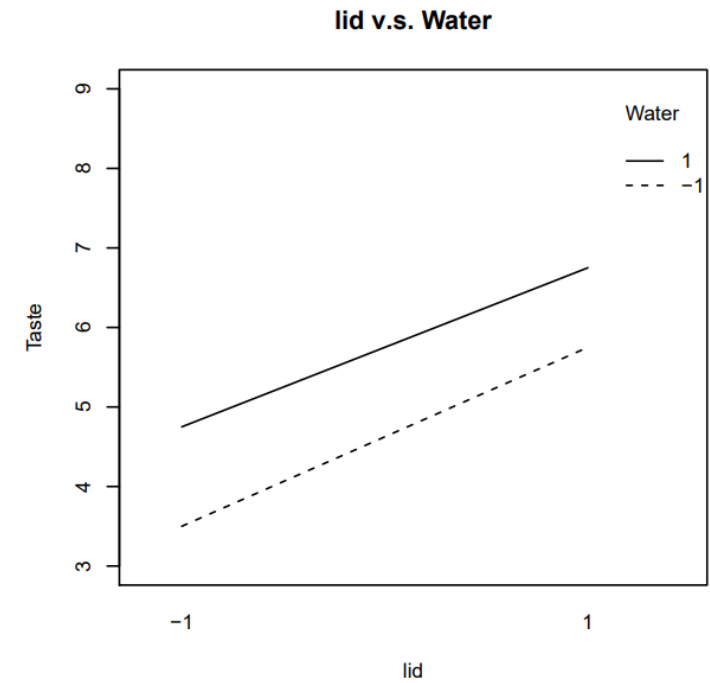
※ **Model**

$$y_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \beta_3 x_{i3} + \beta_4 x_{i1} x_{i2} + \beta_5 x_{i1} x_{i3} + \beta_6 x_{i2} x_{i3} + \beta_7 x_{i1} x_{i2} x_{i3} + \epsilon_i$$

- x_i1, x_i2, x_i3 represent the three factors of soaking time, lid condition, and water volume respectively
- i represents each run
- ϵ_i is the error term

※ **Hypothesis test**

$$H_0 : \beta_k = 0 \quad vs. \quad H_a : \beta_k \neq 0$$

- β_k represents the estimated coefficients for each term, k is in {1,. . . ,7}.

※ Assumptions
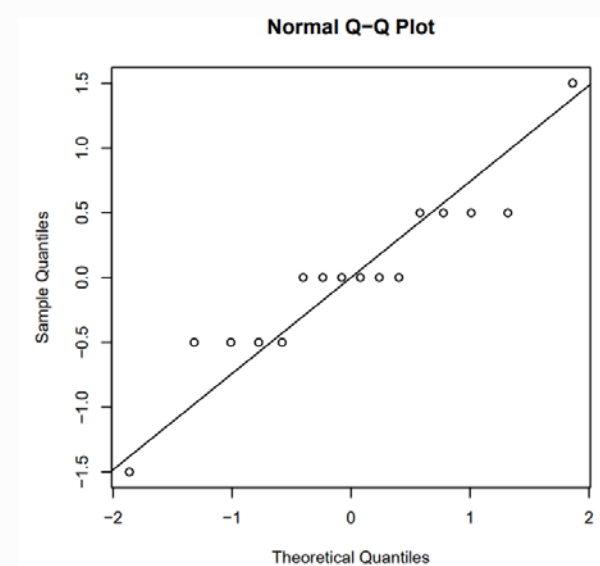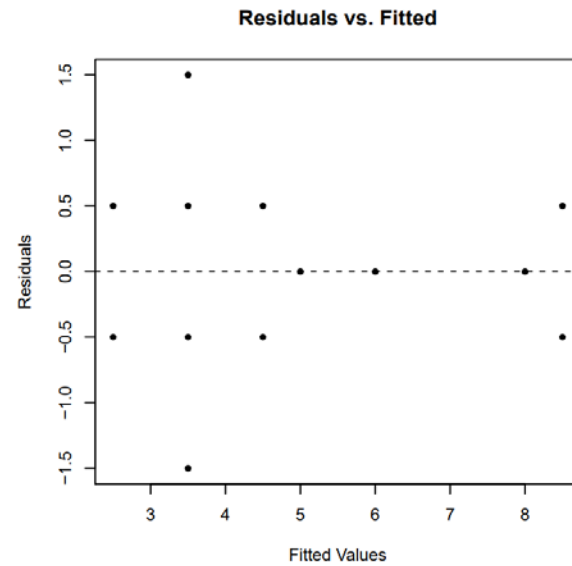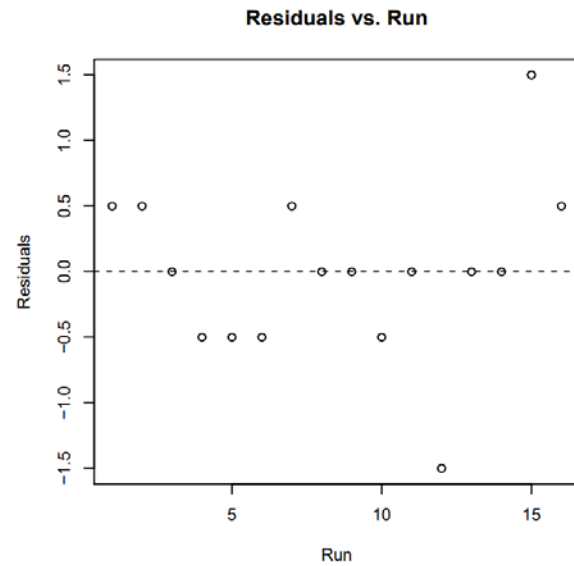
Residual plots

No discernible pattern

Q-Q plot

The point is almost fitted on the line

※ **Interpretations**

	p_value	2.5 %	97.5 %
(Intercept)	0.0000000	9.335698	11.414302
time	0.0001204	2.085698	4.164302
lid	0.0015120	1.085698	3.164302
water	0.0371643	0.085698	2.164302
time:lid	0.0881486	-0.164302	1.914302
time:water	0.7885434	-1.164302	0.914302
lid:water	0.7885434	-1.164302	0.914302
time:lid:water	0.4295161	-1.414302	0.664302

- **Significant factors:** Time, Lid, and Water
- **Interaction terms:** No

	Effects	Variance
(Intercept)	10.375	0.203125
time	3.125	0.203125
lid	2.125	0.203125
water	1.125	0.203125
time:lid	0.875	0.203125
time:water	-0.125	0.203125
lid:water	-0.125	0.203125
time:lid:water	-0.375	0.203125

Half Normal Plot for taste
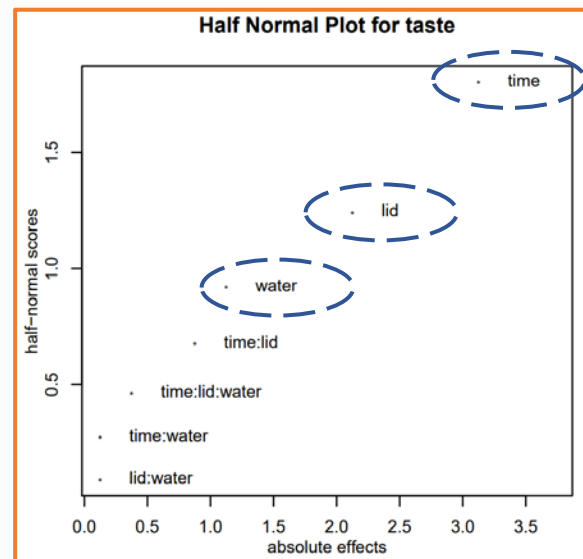
- **Highest effects:** Time > Lid > Water

$$y_{i,taste} = \beta_0 + \beta_1 x_{i,soaking\ time} + \beta_2\ x_{i,lid\ condition} + \beta_3 x_{i,water\ volume} + \epsilon_i$$

	Estimate	Std. Error	t value	Pr(>|t|)	Effects
time	1.5625	0.2310528	6.762522	0.0000201	3.125
lid	1.0625	0.2310528	4.598515	0.0006125	2.125
water	0.5625	0.2310528	2.434508	0.0314722	1.125

< 0.05 ☺

Results and Discussion

Conclusion:

- There is an **association** between the taste of instant noodles with soaking time, lid condition and water volume.
- All factors have **independent** effects on the taste
- Among them, **time** has the greatest impact on the taste of making instant noodles

Time	Lid	Water	Fitted_values
1	1	1	8.375
1	1	-1	7.250
1	-1	1	6.250
-1	1	1	5.250
1	-1	-1	5.125
-1	1	-1	4.125
-1	-1	1	3.125
-1	-1	-1	2.000

➢ Soaking Time: 5 minutes
➢ Lid Condition: Covered
➢ Water Volume: 70%

Discussion:

- The time, place and expectation of eating instant noodles may affect the score
  - → Future experiment could be set at the same time and place and ask people to rate the instant cup noodles without knowing what the combination is.

Thanks For Listening

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