



Week 4 - A/B Testing

📅 Dates	@2019년 10월 17일
▼ Type	📌 Assignment
☰ Topic	

This figure represents the difference in units sold between round 1 and round 2 for the same group. To solve this problem, you'll need to subtract the difference between the round 1 test and control groups units sold and the round 2 test and control groups units sold.

AB Testing

- Evaluate the consequences of different marketing actions like advertising or sales promotion
- Why it's important to find out causality and effect of Marketing?
 - 낭비되는 마케팅 채널을 찾아내서 효율성을 높임
 - 관계부서에 투입을 요구할 때 '마케팅을 하지 않았을 때'와 '마케팅을 했을 때'의 차이를 증명할 수 있음

Rules for establishing causality

- Change in marketing mix produces change in sales
 - Increasing Advertising dollars → Increased Sales
- No sales increase when there is no change in the marketing mix
 - No Increase in Advertising dollars → Same sales
- Time Sequence
 - Increased advertising dollars today leads to higher sales tomorrow
- No other external factor

- When advertising was Increased, one of the competitors left the market. So sales Increased because of lesser competition not because of increased advertising.

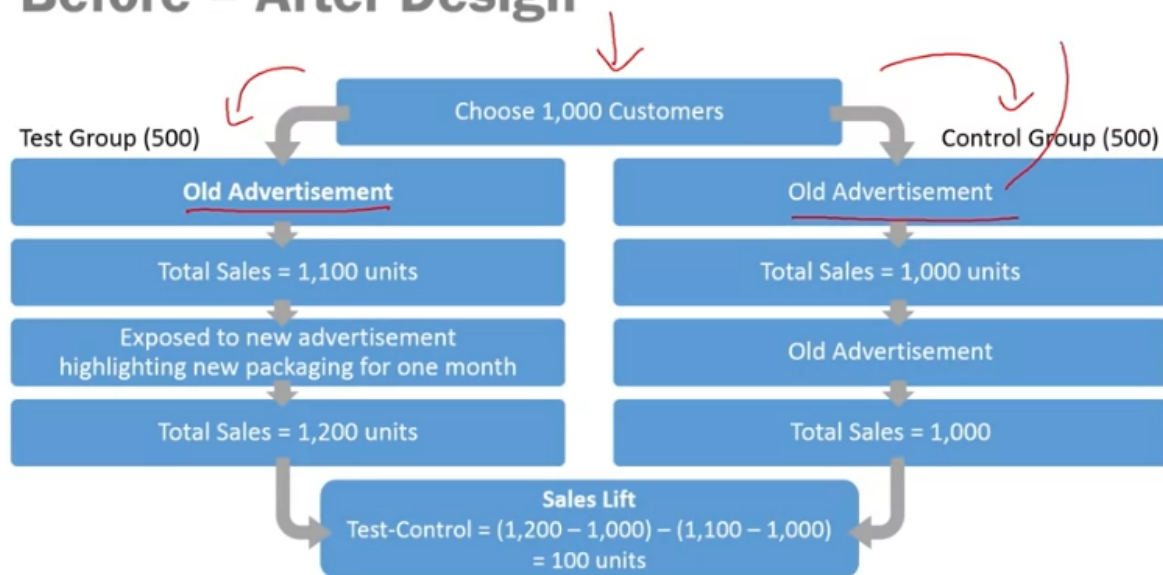
Experiment for measuring casuality

- Test group: subjects with new marketing
- Control group: subjects that does not see any new marketing
- The consequence difference between test group and control group is the proof for marketing effect

Designing Before - After Experiments

- How to assign customers to to test and control group?
 - randomization : the assigning is made by chance
 - Note that if we have 1,000 or more customers, randomization is achieved.
 - Choose subjects with similar environment.
 - 겨울재킷에 대한 마케팅 효과를 판단할 때 추운 지역과 더운 지역의 고객을 함께 넣고 랜덤추출할 수는 없다.
- Difference between “before-after experiment” and “A/B Test”
 - “Before-after experiment” control the preexisting differences between test and control groups.
 - 아래 예시에서 마케팅 Control group과 Test group의 매출 차이는 200이 아니라 100이다 (Test group의 증가분 100 - Control group의 증가분 0) → 이렇게 이전 차이를 고려한 difference를 “Sales Lift”라고 부름
 - AB 테스트는 실험군과 대조군이 원래부터 가지고 있었던 차이를 고려하지 않고 결과를 확인함.

Before – After Design



Designing Full Factorial Web Experiments

- Advantages of web experiments
 - Cheap and Quick
 - Allows to change multiple conditions
- Full factorial Design
 - Changing multiple factors and find what condition leads to the greatest lift

Analyzing an Experiment: Etch A Sketch

- Ohio Art, which owns the program “Etch A Sketch” did TV Advertising Experiment
 - Test group: Cincinnati
 - Control group: Other states in U.S
- Experiment results
 - Test Product: Etch A Sketch
 - Control Product: Doodle
 - Reason for establishing control product
 - Measuring external factors (Etch a Sketch는 판매량이 늘어나는 시기가 존재하기 때문에 판매량 상승이 시기의 영향일 수도 있음. 같은 시기 비슷한 물

품의 판매량을 확인하여 시기의 영향을 파악한다)

- Doodle sales become the baseline (removing seasonal effect)

	Number of Weeks	Etch A Sketch			Doodle		
		Cincinnati Units	Control* Units	Cincinnati Shares (%)	Cincinnati Units	Control Units	Cincinnati Share
Pre Test 5 Dec 2005 – 26 Nov 2006	12	162	1526	9.6	1517	6742	18.4
Test 27 Nov 2006 – 16 Dec 2006	3	240	1598	13.1	816	3780	17.7
Lift				136.1			96.7

- Measuring net lift for the promotion
 - Etch A Sketch sales lift in Cincinnati: $13.1 / 9.6 = 136.1$
 - Doodle sales lift in Cincinnati: $17.7 / 18.4 = 96.7$
 - Doodle sales was declined during the test
 - Net lift (순수상승률) : Test Product lift - Control Product lift (136.1 - 96.7)
- Calculating promotion spending

Retail Price	10
Retail Margin (소매업체가 가져가는 돈)	36%
Manufacturer Selling Price	$10 * (1 - 0.36) = 6.4$
Manufacturer Contribution Margin % → 공헌이익 (원가에 의해 소비되지 않는 비율)	58%
Manufacturer Contribution Margin \$ (Margin for the Ohio Art)	$6.4 * 0.58 = 3.71$

National Budget (Amount spent for Marketing)	5,000,000
Unit Break Even (Amount needed to compensate national budget)	$5 \text{ million} / 3.71 = 1,346,983$
Base Units (Sales without promotion)	3,100,000
Base Units Test Period (Sales during promotion)	1,085,000
Break Even Lift % of Base	$1.3 \text{ million} / 1.08 \text{ million} = 124(\%)$

- Break Even Lift % of Base (124%) > Net lift from TV Ads (39.4%)
- TV advertising campaign for Etch A Sketch isn't efficient

Practice Quiz on Calculating Break Even and Lift

1.

In an advertising experiment using before-after design, 1000 customers are randomly assigned to 3 groups. All groups are exposed to the existing advertisement for round 1 of the experiment. In round 2 of the experiment, groups 2 and 3 see the new ad while group 1 (the control) is still shown the old ad.

	Control Group1	Test Group2	Test Group3
Round 1 sales —old ad	295	310	300
Round 2 sales - Group1, old ad, Gropu2 and 3, new ad	310	450	325

answer) $325 - 300 = 25$

틀림!! $\pi\pi\pi$

Feedback: This figure represents the difference in units sold between round 1 and round 2 for the same group. To solve this problem, you'll need to subtract the difference between the round 1 test and control groups units sold and the round 2 test and control groups units sold.

new answer)

- how to get lift?
 1. calculate the share of test group 3 with old ad
→ $300 / 905 = 0.3315$
 2. calculate the share of test group 3 with new ad
→ $325 / 1085 = 0.2995$
 3. calculate $(2 / 1) * 100$
→ 90.3469

답은 10인데 도대체 왜 10인지 도저히 몰라

2. Correct

What is the manufacturer contribution margin (\$)?

Retail price	\$100
Retail margin	30%
Manufacturer contribution margin	42%

answer) $\$100 * (1-0.3) * 0.42 = 29.4$

3. Correct

A "Mom & Pop" startup wants to increase brand awareness of their delicious hot sauce. How many bottle of hot sauce do they need to sell to break even on the ad campaign?

Ad budget	\$25,000
Retail price	\$4.50 / bottle
Retail margin	45%
Manufacturer contribution margin	30%

answer)

- manufacturer contribution margin in dollars : $4.5 * 0.55 * 0.3 = 0.7425(\$)$
- Unit Break Even: $25,000 / 0.7425 = 33,670.033$

→ Isn't the unit break even 33,671?

4. Correct

Calculate net lift given the following information:

		Test Product			Control Product		
	Number of weeks	Mumbai Units	Control* Units	Mumbai Share (%)	Mumbai Units	Control * Units	Mumbai Share
Pre-test	12	5310	22334	?	2033	5777	?
Test	3	9231	29589	?	2512	6820	?
Lift				?			?
Net lift				?			

*Control cities include: New Delhi, Calcutta, Bangalore, Chennai.

Answer)

- Lift for Test product: $\text{Test} / \text{Pretest} = \{9231 / (29589 + 9231)\} / \{5310 / (5310 + 22334)\} = (9231 / 38820) / (5310 / 27644)$
 $= 0.2378 / 0.1921 = 1.2378...$
Lift = 123.79
- Lift for Control Product
 $(2512 / 9332) / (2033 / 7810) = 0.2692 / 0.2603 = 1.0342$
Lift = 103.42
- Net Lift : (Lift for Test Product) - (Lift for Control Product)
= About 20.37

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Experimental Design example 2 - Betty Spaghetti

- Dealing with situations when marketers don't have sales before the experiment
(New products usually don't have previous sales → unable to run true before-after experiment)
- content of experiment
 - Test group : Arizona
 - Control group: California
 - Test period: June 17th - July 17th
 - Test results (number of each cell shows unit sales per week)

	Arizona		California	
	Color Crazy	Go Go Glam	Color Crazy	Go Go Glam
Total/Store/Week 17 Jun – 17 Jul 2007	1.8	2.2	0.3	1.2
Lift	267%	$= \frac{1.8 + 2.2}{0.3 + 1.2}$		

- Lift of sales provided to Betty Spaghetti by TV ads

$$: (1.8 + 2.2) / (0.3 + 1.2) = 267\%$$
- Calculating break even lift

Ad Budget	\$ 3,000,000
Retail Selling Price	\$ 15
Retail Margin (%)	36%
Manufacturer Suggested Price	$15 * (1 - 0.36) = 9.6$
Manufacturer Contribution Margin (%)	58%
Manufacturer Contribution Margin \$	$0.6 * 0.58 = 5.568$
Break Even Units	$3,000,000 / 5.568 = 538,793$

- Would the 267% sales lift can meet Break Even units 538,793?
- The experiment was conducted between June and July. If the TV ads turned out to be effective, Betty Spaghetti will run the commercial during December, the

peak season.

- You need to predict the sales lift of entire states based on sales lift in Arizona
 - Predict sales of the whole chains (Test stores in Arizona → All stores in Arizona → national chain sales in entire country)
 - Consider the season effect (Holiday season have positive impacts on toy sales)



- Calculating Projected Lift (Projecting test results from Arizona to national level)
 - Basic numbers in control states

Control Stores ratio in California (주 가게 몇 %를 통제 집단으로 설정했는지)	10%
Total California Units sold	1420
California % of National Sales	12 %
National Retailer Sales	$1420 * (100/12) = 11,833$
Retailer Share versus entire vendor (전체 판매량의 몇 %가 소매점에서 판매되는가)	25 %
National Units	$11,833 * (100/25) = 47,333$
Test period shares (% compared to Annual Sales)	5.5 %
Annual Sales without experiment	$47,333 * (100/5.5) = 860,606$
Holiday sales percent of Annual sales	45 %
Holiday Units(Sales) without Ads	$860,606 * 0.45 = 38,273$

Holiday Units After Ads	$38,273 * 2.67$ (sales lift from ads) = 1,034,018
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- Expected sales with holiday season ads (1,034,018) is higher than Break Even Units (538,793)
 - TV commercials during holiday season is suggested
- Challenges of TV commercials
 - Situation changes (time gap) but the company can't pull back the investment (sunk cost)
 - Betty Spaghetti campaign ran during holiday season but the company recorded a loss because the Disney launched Hanna Montana during holiday season.
 - This fixed cost problem can be solved in digital marketing

Marketing in Digital World - example of Nanoblocks

- Ohio Art launched a nano block with a gold box on Amazon during March 2012
 - Pre-test period: January, February
 - Test period: March
 - Post-test period: May
- Nanoblocks sales lift were better than control groups even after the test
 - The more sales the product record, the more people are interested in the product
- Advantages of Online Marketing are....
 - Experiments have long-term effect in Online store
 - **The experiment pays dividends forward - post period doing the experiment also.**

- Ohio Art can take out the money whenever the experiment seems not working (avoid sunk cost problem)
- Richer data (get sales of control groups easily)
- Ohio Art work more campaigns in Social Media and gain good results

Practice Quiz 3

1. Given the data below, calculate break even units. (Correct)

Ad budget		2,000,000.00
Retail selling price		15
Retail margin %		40%
Manufacturer suggested price		?
Manufacturer contribution margin %		56%
Manufacturer contribution margin \$?
Break even units		?

- manufacturer suggested price: $15 * 0.6 = 9$
- manufacturer contribution margin \$: $9 * 0.56 = 5.04$
- Break even units: $2,000,000 / 5.04 = 396,825$

2. Snacker Crackers is studying the impact of a print ad campaign for their Thinminies product line.

Without the campaign, their sales in November were 100,000 boxes. With the campaign, sales in December rose to 120,000 boxes. Historically, November represents 15% of their annual sales and December represents

10%.

What is the lift for their print ad campaign? (Correct)

- $(120,000 / 100,000) (10/15) = 1.2 + 0.66$?????
- my answer 180%... I don't know how to solve this problem

(해설) After calculating the difference between the results with and without social media, to calculate the net lift, one must also take into account seasonal sales patterns.

3. Calculate December unit sales of a new toy based on the following data from a product launch test in June. (Correct)

Test market units sold	250
Control % of national sales	20%
Retailer share of product sales	35%
Test % of annual sales	7%
December % of annual sales	40%

- $250 * (100/20) * (100/35) * (100/7) * 0.4 = 20,408$

Week 4 Final Quiz

4. In an advertising experiment using before-after design, 3000 customers are randomly assigned to 3 groups. All continued to be exposed to the existing advertisement in round 1. In round 2, a new advertisement is shown to groups 2 and 3. ❌

	Control Group 1	Test Group 2	Group 3
Round1 — old ad	650	695	680
Round2 — Group1, old ad, Groups2 and 3, new ad	630	660	740

What is the sales lift (in units) for the ad shown to group 3?

- $\text{share after new ads} / \text{share before old ads} = \{740/(2030)\} / \{680/2025\} = 0.3645 / 0.3358 = 1.08$

Hint) While this does calculate the difference between the new celebrity and the existing advertisement for different groups, it doesn't take into consideration any underlying differences between the two groups. See the "Designing Before - After Experiments" video to review.

5. What is the manufacturer contribution margin (\$)?

$$\text{retail price} * (1 - \text{retail margin}) * (\text{manufacturer contribution margin}) = 40 * 0.65 * 0.4 = 10.4$$

6. A sporting goods manufacturer is considering increasing advertising for its running shoes by \$3 million.

manufacturer selling price: \$ 30, contribution margin: 60%

How many additional pairs of shoes must be sold to break even on the increase in advertising spending?

- manufacturer contribution margin \$: $30 * 0.6 = \$18$
- Break even units: $3,000,000 / 18 = 166,666. xxx$

7. Calculate net lift given the following information:

	Number of weeks	Test Product			Control Product		
		Rio de Janeiro Units	Control* Units	Rio de Janeiro Share (%)	Rio de Janeiro Units	Control* Units	Rio de Janeiro Share
Pre-test	10	5431	33,567	?	4021	23,419	?
Test	4	2,220	4765	?	695	3300	?
Lift				?			?
Net lift				?			

*Control cities include: Buenos Aires, Bogota, Santiago, Lima, Sao Paulo

- Pre-test Share
 - of Test product : $5431/(5431+33,567) = 0.1392$
 - of Control product: $4021/(4021+23,419) = 0.1465$
- Test Share
 - of Test product: $2,220/(2,220+4,765) = 0.3178$
 - of Control product: $695/(695+3300) = 0.1740$
- Lift
 - of Test Product: $0.3178 / 0.1392 = 228.30 \%$
 - of Control product: $0.1740 / 0.1465 = 118.77 \%$
- Net lift
 - : $228.30 - 118.77 = 109.53$

8. Given the data below, calculate break even units. 

Ad budget		10,000.00
Retail selling price		5.5
Retail margin %		40%
Manufacturer suggested price		?
Manufacturer contribution margin %		42%
Manufacturer contribution margin \$?
Break even units		?

- Manufacturer suggested price: $5.5 * 0.6 = 3.3$
- Manufacturer contribution margin \$: $3.3 * 0.42 = 1.386$
- Break even units: $10,000 / 1.386 = 7215.xxx$

9. Snacker Crackers is studying the impact of an advertising campaign for their multigrain product line. Without the ad campaign, their sales in October were 80,000 boxes. With the ad campaign, sales fell to 70,000

boxes in November. Historically, October represents 15% of their annual sales and November represents 5% ❌

What is the lift for their advertising campaign?

$$(7/15) / (0.05/0.2) = 1.86 \text{ (186 \%)}$$

- not on the answer selections.....T.T

Hint) Think about the difference between lift and net lift. See the "Projecting Lift" video to review.

10. **Burpease has developed a new oral medication to relieve upset stomach symptoms. Their test market was run during August and September in New York.** ○

Test market units sold	1000
Test % of the population	10%
Retailer % of national sales	30%
August/Sept % of annual sales	15%
Fourth quarter % of sales	35%

What are the projected unit sales for the 4th quarter, assuming securing 100% distribution nationally?

$$1000 * (100/10) * (100/30) * (100/15) * 0.35 = 77,777.777$$