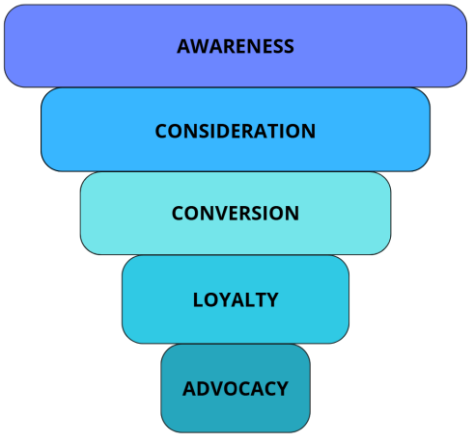
Usage Funnels with SQL

What is a funnel?

In marketing analysis, a **funnel** refers to the customer journey from initial awareness to final conversion (e.g., making a purchase, signing up, or another desired action). It visualizes how potential customers move through different stages, helping businesses identify drop-off points and optimize strategies for better conversion rates.



Why is Funnel Analysis Important?

- Identify where users drop off in the journey.
- Help optimize marketing strategies for better engagement and conversions.
- Inform decision-making on ad spending, content creation, and customer experience improvements.

Funnel Analysis

Throughout this project, we will be working with data from a fictional company called Cushion Co. Using SQL, you can dive into complex funnels and event flow analysis to gain insights into their users' behavior.

Build a Funnel from a single table

Cushion Co. users were asked to answer a five-question survey:

1. How likely are you to recommend Cushion Co. to a friend?
2. Which Cushion Co. location do you shop at?
3. How old are you?
4. What is your gender?
5. What is your annual household income?

We will be using a table called **survey_responses** with the following columns:

- **question_text** - the survey question
- **user_id** - the user identifier

- **response** - the user answer

Let's begin by exploring the **survey_responses** table to understand its structure and contents.

SQL Query

```
SELECT *
FROM survey_responses
LIMIT 10;
```

question_text	user_id	response
2. Which Mattresses and More location do you shop at?	013bd7a1-a2ba-43c1-b980-591d368175da	Fruitville
3. How old are you?	013bd7a1-a2ba-43c1-b980-591d368175da	45-55
1. How likely are you to recommend Mattresses and More to a friend?	013bd7a1-a2ba-43c1-b980-591d368175da	9
5. What is your annual household income?	013bd7a1-a2ba-43c1-b980-591d368175da	80,000 - 100,000
4. What is your gender?	013bd7a1-a2ba-43c1-b980-591d368175da	female
5. What is your annual household income?	0314edb3-92cb-4951-b90a-0cbb1b6f7ca5	80,000 - 100,000
4. What is your gender?	0314edb3-92cb-4951-b90a-0cbb1b6f7ca5	female
2. Which Mattresses and More location do you shop at?	0314edb3-92cb-4951-b90a-0cbb1b6f7ca5	Fruitville
3. How old are you?	0314edb3-92cb-4951-b90a-0cbb1b6f7ca5	35-45
1. How likely are you to recommend Mattresses and More to a friend?	0314edb3-92cb-4951-b90a-0cbb1b6f7ca5	8

Now, let's build our first basic funnel. ***What is the number of responses for each question?***

SQL Query

```
SELECT question_text, COUNT(DISTINCT user_id) AS Users
FROM survey_responses
GROUP BY 1;
```

question_text	Users
1. How likely are you to recommend Cushion Co. to a friend?	500
2. Which Mattresses and More location do you shop at?	475
3. How old are you?	380
4. What is your gender?	361
5. What is your annual household income?	270

Survey Result.

If we calculate the ratio of people completing each step to those who completed the previous step:

Question	Users	Percent Completed this Question
1	500	100%
2	475	95%
3	380	80%

4	361	95%
5	270	75%

Questions 2 and 4 show high completion rates, while Questions 3 and 5 have lower rates. This indicates that age and household income may be more sensitive topics, leading to reluctance in responding.

Compare Funnels For A/B Tests

Cushion Co. has an onboarding workflow for new website users, utilizing modal pop-ups to greet them and highlight key site features such as:

1. Welcome to Cushion Co.
2. Browse our bedding selection
3. Select items to add to your cart
4. View your cart by clicking on the icon
5. Press 'Buy Now!' when you're ready to checkout

The Product team at Cushion Co. has created a new design for the pop-ups that they believe will lead more users to complete the workflow.

They've set up an **A/B test** where:

- 50% of users view the original **control** version of the pop-ups
- 50% of users view the new **variant** version of the pop-ups

Eventually, we want to answer the question:

How is the funnel different between the two groups?

We will be using a table called **onboarding_modals** with the following columns:

- **user_id** - the user identifier
- **modal_text** - the modal step
- **user_action** - the user response (Close Modal or Continue)
- **ab_group** - the version (control or variant)

Let's start by exploring the **onboarding_modals** table.

SQL Query

```
SELECT *
FROM onboarding_modals
LIMIT 10;
```

user_id	modal_text	user_action	ab_group
0015585f-51d0-4654-83fc-acce6544b0cf	1 - Welcome to Cushion Co.	Close Modal	control
0028b8b4-abb3-4711-9ea2-0d1ecb975358	1 - Welcome to Cushion Co.	Close Modal	control
0029802c-22a1-4d22-9a59-244341551ec9	1 - Welcome to Cushion Co.	Continue	variant
0029802c-22a1-4d22-9a59-244341551ec9	2 - Browse our bedding selection	Continue	variant
0029802c-22a1-4d22-9a59-244341551ec9	3 - Select items to add to your cart	Continue	variant
0029802c-22a1-4d22-9a59-244341551ec9	4 - View your cart by clicking on the icon	Continue	variant
0029802c-22a1-4d22-9a59-244341551ec9	5 - Press 'Buy Now!' when you're ready to checkout	Continue	variant
0042ec6f-e343-4486-a009-ecaea4ff31b2	1 - Welcome to Cushion Co.	Continue	variant
0042ec6f-e343-4486-a009-ecaea4ff31b2	2 - Browse our bedding selection	Close Modal	variant
0121762e-7d4e-46b0-94d8-7bc56a5cb88b	1 - Welcome to Cushion Co.	Close Modal	control

Now, using GROUP BY we can count the number of distinct **user_id**'s for each value of **modal_text**. This will tell us the number of users completing each step of the funnel.

SQL Query

```
SELECT modal_text, COUNT(DISTINCT user_id) AS Users
FROM onboarding_modals
GROUP BY 1;
```

modal_text	Users
1 - Welcome to Cushion Co.	1000
2 - Browse our bedding selection	695
3 - Select items to add to your cart	575
4 - View your cart by clicking on the icon	447
5 - Press 'Buy Now!' when you're ready to checkout	379

The previous query combined both the control and variant groups. We can use a **CASE** statement within our **COUNT()** aggregate function to count the **user_ids** whose **ab_group** is equal to '**control**' and '**variant**'.

SQL Query

```
SELECT modal_text,
        COUNT(DISTINCT CASE
            WHEN ab_group = 'control' THEN user_id
            END) AS 'control_clicks',
        COUNT(DISTINCT CASE
            WHEN ab_group = 'variant' THEN user_id
            END) AS 'variant_clicks'
FROM onboarding_modals
GROUP BY 1
ORDER BY 1;
```

modal_text	control_clicks	variant_clicks
1 - Welcome to Cushion Co.	500	500
2 - Browse our bedding selection	301	394
3 - Select items to add to your cart	239	336
4 - View your cart by clicking on the icon	183	264
5 - Press 'Buy Now!' when you're ready to checkout	152	227

A/B Tests Results

After some quick math:

Modal	Control Percent	Variant Percent
1	100%	100%
2	60%	79%
3	80%	85%
4	80%	80%
5	85%	85%

- In Modal 2, the variant achieves a 79% completion rate, surpassing the control's 60%.
- In Modal 3, the variant reaches 85% completion, compared to the control's 80%.
- All other steps maintain the same completion levels.

These results indicate that the variant leads to higher completion rates.

Build a Funnel from Multiple Tables.

Cushion Co. sell essential bedding from their e-commerce store. Their purchase funnel is:

1. The user browses products and adds them to their cart
2. The user proceeds to the checkout page
3. The user enters credit card information and makes a purchase

As a sales analyst, you want to analyze shopping trends in the days leading up to Christmas. You suspect that as the holiday nears, customers are more likely to complete their purchases, transitioning from browsing to buying gifts.

The data for Cushion Co. is spread across several tables:

- **browse (b)** - each row in this table represents an item that a user has added to his shopping cart.
- **checkout (c)** - each row in this table represents an item in a cart that has been checked out.
- **purchase (p)** - each row in this table represents an item that has been purchased.

Let's examine each table.

SQL

```
SELECT *
FROM browse
LIMIT 5;
```

user_id	browse_date	item_id
336f9fdc-aaeb-48a1-a773-e3a935442d45	12/20/2017	3
336f9fdc-aaeb-48a1-a773-e3a935442d45	12/20/2017	22
336f9fdc-aaeb-48a1-a773-e3a935442d45	12/20/2017	25
336f9fdc-aaeb-48a1-a773-e3a935442d45	12/20/2017	24
4596bb1a-7aa9-4ac9-9896-022d871cdcde	12/20/2017	0

```
SELECT *
FROM checkout
LIMIT 5;
```

user_id	checkout_date	item_id
2fdb3958-ffc9-4b84-a49d-5f9f40e9469e	12/20/2017	26
2fdb3958-ffc9-4b84-a49d-5f9f40e9469e	12/20/2017	24
3a3e5fe6-39a7-4068-8009-3b9f649cb1aa	12/20/2017	7
3a3e5fe6-39a7-4068-8009-3b9f649cb1aa	12/20/2017	6
3a3e5fe6-39a7-4068-8009-3b9f649cb1aa	12/20/2017	12

```
SELECT *
FROM purchase
LIMIT 5;
```

user_id	purchase_date	item_id
2fdb3958-ffc9-4b84-a49d-5f9f40e9469e	12/20/2017	26
2fdb3958-ffc9-4b84-a49d-5f9f40e9469e	12/20/2017	24
3a3e5fe6-39a7-4068-8009-3b9f649cb1aa	12/20/2017	7
3a3e5fe6-39a7-4068-8009-3b9f649cb1aa	12/20/2017	6
3a3e5fe6-39a7-4068-8009-3b9f649cb1aa	12/20/2017	12

Now we need to combine the information from the three tables into one table with the following schema:

browser_date	user_id	is_checkout	is_purchase
12/20/2017	6a7617321513	True	False
12/20/2017	022d871cdcde	False	False

Each row will represent a single user:

- If the user has any entries in checkout, then **is_checkout** will be True.

- If the user has any entries in purchase, then **is_purchase** will be True.

If we use an **INNER JOIN** to create this table, we'll lose information from any customer who does not have a row on the checkout or purchase table. Therefore, we'll need to use a series of **LEFT JOIN** commands.

Let's proceed with the LEFT JOIN for three tables, including the following columns to obtain the desired schema.

- DISTINCT **b.browse_date**
- **b.user_id**
- c.user_id IS NOT NULL AS '**is_checkout**'
- p.user_id IS NOT NULL AS '**is_purchase**'

***HINT**
For review, IS NOT NULL will return:

- 1 (True) if a non-empty value is found
- 0 (False) if a NULL value is found

If a **user_id** is not in the **checkout** table (aliased as **c**), then **b.user_id** will be filled in, but **c.user_id** will be NULL because of our LEFT JOIN.

SQL

```
SELECT DISTINCT b.browse_date,
    b.user_id,
    c.user_id IS NOT NULL AS 'is_checkout',
    p.user_id IS NOT NULL AS 'is_purchase'
FROM browse AS 'b'
LEFT JOIN checkout 'c'
  ON c.user_id = b.user_id
LEFT JOIN purchase 'p'
  ON p.user_id = c.user_id
LIMIT 10;
```

browse_date	user_id	is_checkout	is_purchase
12/20/2017	336f9fdc-aaeb-48a1-a773-e3a935442d45	0	0
12/20/2017	4596bb1a-7aa9-4ac9-9896-022d871cdcde	0	0
12/20/2017	2fdb3958-ffc9-4b84-a49d-5f9f40e9469e	1	1
12/20/2017	fc394c75-36f1-4df1-8665-23c32a43591b	0	0
12/20/2017	263e59f2-479b-4736-872c-302ad082b20f	0	0
12/20/2017	58ff3291-84bf-4fc7-96cc-0bc1477adea9	0	0
12/20/2017	d582b899-cace-43dc-84f3-a1df0c30e90c	0	0
12/20/2017	3215212f-7a6f-4d95-937a-ee0ce911db04	0	0
12/20/2017	d0768167-da9c-4209-b3e6-5c6fc446bece	0	0
12/20/2017	182fcdb3-babd-4ade-ae6d-c3d6f30ffcde	0	0

Let's put the whole thing in a **WITH** statement so that we can continue building our query. We will give the temporary table the name **funnels**:

SQL

```
WITH funnels AS (
  SELECT DISTINCT b.browse_date,
    b.user_id,
    c.user_id IS NOT NULL AS 'is_checkout',
    p.user_id IS NOT NULL AS 'is_purchase'
  FROM browse AS 'b'
  LEFT JOIN checkout AS 'c'
   ON c.user_id = b.user_id
  LEFT JOIN purchase AS 'p'
   ON p.user_id = c.user_id)
```

Now, let's add two columns that sum **is_checkout** and **is_purchase** in **funnels**. Alias these columns as '**num_checkout**' and '**num_purchase**'. This will be the number of users in the "**checkout**" and "**purchase**" steps of the funnel.

SQL

```
WITH funnels AS (
  SELECT DISTINCT b.browse_date,
    b.user_id,
    c.user_id IS NOT NULL AS 'is_checkout',
    p.user_id IS NOT NULL AS 'is_purchase'
  FROM browse AS 'b'
  LEFT JOIN checkout AS 'c'
   ON c.user_id = b.user_id
  LEFT JOIN purchase AS 'p'
   ON p.user_id = c.user_id)
SELECT COUNT(*) AS 'num_browse',
    SUM(is_checkout) AS 'num_checkout',
    SUM(is_purchase) AS 'num_purchase'
FROM funnels;
```

num_browse	num_checkout	num_purchase
775	183	163

Finally, let's do add some more calculations to make the results more in depth.

Let's add these two columns:

- Percentage of users from browse to checkout.
- Percentage of users from checkout to purchase.

```
WITH funnels AS (
  SELECT DISTINCT b.browse_date,
    b.user_id,
    c.user_id IS NOT NULL AS 'is_checkout',
    p.user_id IS NOT NULL AS 'is_purchase'
  FROM browse AS 'b'
  LEFT JOIN checkout AS 'c'
    ON c.user_id = b.user_id
  LEFT JOIN purchase AS 'p'
    ON p.user_id = c.user_id)
SELECT COUNT(*) AS 'num_browse',
     SUM(is_checkout) AS 'num_checkout',
     SUM(is_purchase) AS 'num_purchase',
     1.0 * SUM(is_checkout) / COUNT(user_id) AS '% browse to checkout',
     1.0 * SUM(is_purchase) / SUM(is_checkout) AS '% checkout to purchase'
FROM funnels;
```

num_browse	num_checkout	num_purchase	% browse to checkout	% checkout to purchase
775	183	163	0.236129032	0.890710383

The Marketing team and Service Analyst at Cushion Co. should focus their strategies on increasing the number of users who move from browsing items to completing a checkout. Since the conversion rate from checkout to purchase is already high, improving the browse-to-checkout transition can significantly boost overall sales.

***HINT**

By default, mathematical operations between integers will round down to the nearest whole number. To prevent this rounding, it's common practice to multiply the result by **1.0**. This approach ensures the outcome is a decimal value instead of an integer.

We've created a funnel for Cushion Co.'s purchase process. However, the management team suspects that conversion from checkout to purchase changes as the **browse_date** gets closer to Christmas Day.

We can make a few edits to this code to calculate the funnel for each **browse_date** using **GROUP BY**.

SQL

```
WITH funnels AS (
  SELECT DISTINCT b.browse_date,
    b.user_id,
    c.user_id IS NOT NULL AS 'is_checkout',
    p.user_id IS NOT NULL AS 'is_purchase'
  FROM browse AS 'b'
  LEFT JOIN checkout AS 'c'
   ON c.user_id = b.user_id
  LEFT JOIN purchase AS 'p'
   ON p.user_id = c.user_id)
SELECT browse_date,
    COUNT(*) AS 'num_browse',
     SUM(is_checkout) AS 'num_checkout',
     SUM(is_purchase) AS 'num_purchase',
     1.0 * SUM(is_checkout) / COUNT(user_id) AS '% browse to checkout',
     1.0 * SUM(is_purchase) / SUM(is_checkout) AS '% checkout to purchase'
FROM funnels
GROUP BY browse_date
ORDER BY browse_date;
```

browse_date	num_browse	num_checkout	num_purchase	browse_to_checkout	checkout_to_purchase
12/20/2017	100	20	16	0.2	0.8
12/21/2017	150	33	28	0.22	0.848484848
12/22/2017	250	62	55	0.248	0.887096774
12/23/2017	275	68	64	0.247272727	0.941176471

As Christmas approaches, the conversion rates from browsing to checkout and from checkout to purchase increase significantly. Cushion Co. can leverage this trend by implementing targeted promotions and customer loyalty strategies to attract more users during the holiday season—not just for Christmas, but for other key shopping periods as well.