Analyzing Popular App Categories on Google Play Project

In this project, our Goal is to figure out what types of apps tend to be popular on the google play store.We work for a company that makes free apps and earn money through ads. By understanding which app Categories are in high demand. We can help our developers create apps that attrack more users and generate more revenue. We will Analyze date from Google play store to identify patterns and preferences among users. This way,we can make smarter decisions about the kind of apps we develops.

In [1]:
```
import pandas as pd
import matplotlib.pyplot as plt
```

In [2]:
```
#reading the database in pandas dataframe object
android_df = pd.read_csv("googleplaystore.csv")
```

In [3]:
```
#Explore the data using pandas method
android_df.head()
```

Out[3]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating	Genres	Last Updated	Current Ver	Andr
0	Photo Editor & Candy Camera & Grid & ScrapBook	ART_AND_DESIGN	4.1	159	19M	10,000+	Free	0	Everyone	Art & Design	January 7, 2018	1.0.0	4. and
1	Coloring book moana	ART_AND_DESIGN	3.9	967	14M	500,000+	Free	0	Everyone	Art & Design;Pretend Play	January 15, 2018	2.0.0	4. and
2	U Launcher Lite – FREE Live Cool Themes, Hide ...	ART_AND_DESIGN	4.7	87510	8.7M	5,000,000+	Free	0	Everyone	Art & Design	August 1, 2018	1.2.4	4. and
3	Sketch - Draw & Paint	ART_AND_DESIGN	4.5	215644	25M	50,000,000+	Free	0	Teen	Art & Design	June 8, 2018	Varies with device	4.2 a
4	Pixel Draw - Number Art Coloring Book	ART_AND_DESIGN	4.3	967	2.8M	100,000+	Free	0	Everyone	Art & Design;Creativity	June 20, 2018	1.1	4.4 a

In [4]:
```
android_df["Category"].value_counts()
```

Out[4]:
```
FAMILY                 1972
GAME                   1144
TOOLS                   843
MEDICAL                 463
BUSINESS                460
PRODUCTIVITY            424
PERSONALIZATION         392
COMMUNICATION           387
SPORTS                  384
LIFESTYLE               382
FINANCE                 366
HEALTH_AND_FITNESS      341
PHOTOGRAPHY             335
SOCIAL                  295
NEWS_AND_MAGAZINES      283
SHOPPING                260
TRAVEL_AND_LOCAL        258
DATING                  234
BOOKS_AND_REFERENCE     231
VIDEO_PLAYERS           175
EDUCATION               156
ENTERTAINMENT           149
MAPS_AND_NAVIGATION     137
FOOD_AND_DRINK          127
HOUSE_AND_HOME           88
LIBRARIES_AND_DEMO       85
AUTO_AND_VEHICLES        85
WEATHER                  82
ART_AND_DESIGN           65
EVENTS                   64
PARENTING                60
COMICS                   60
BEAUTY                   53
1.9                       1
Name: Category, dtype: int64
```

In [5]:
```
android_df[android_df["Category"] == "1.9"]
```

Out[5]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating	Genres	Last Updated	Current Ver	Android Ver
10472	Life Made WI-Fi Touchscreen Photo Frame	1.9	19.0	3.0M	1,000+	Free	0	Everyone	NaN	February 11, 2018	1.0.19	4.0 and up	NaN

In [6]:
```
android_df[android_df["Category"] == "1.9"].values
```

Out[6]:
```
array([['Life Made WI-Fi Touchscreen Photo Frame', '1.9', 19.0, '3.0M',
        '1,000+', 'Free', '0', 'Everyone', nan, 'February 11, 2018',
        '1.0.19', '4.0 and up', nan]], dtype=object)
```

In [7]:
```
clean_1st=['Life Made WI-Fi Touchscreen Photo Frame','LIFESTYLE','1.9', 19.0, '3.0M',
        '1,000+', 'Free', '0', 'Everyone','LIFESTYLE' , 'February 11, 2018',
        '1.0.19', '4.0 and up']
clean_1st
```

Out[7]:
```
['Life Made WI-Fi Touchscreen Photo Frame',
 'LIFESTYLE',
 '1.9',
 19.0,
 '3.0M',
 '1,000+',
 'Free',
 '0',
 'Everyone',
 'LIFESTYLE',
 'February 11, 2018',
 '1.0.19',
 '4.0 and up']
```

In [8]:
```
android_df[android_df["Category"]=="1.9"]=clean_1st
```

In [9]:
```
android_category=android_df["Category"].value_counts()
android_category
```

Out[9]:
```
FAMILY                 1972
GAME                   1144
TOOLS                   843
MEDICAL                 463
BUSINESS                460
PRODUCTIVITY            424
PERSONALIZATION         392
COMMUNICATION           387
SPORTS                  384
LIFESTYLE               383
FINANCE                 366
HEALTH_AND_FITNESS      341
PHOTOGRAPHY             335
SOCIAL                  295
NEWS_AND_MAGAZINES      283
SHOPPING                260
TRAVEL_AND_LOCAL        258
DATING                  234
BOOKS_AND_REFERENCE     231
VIDEO_PLAYERS           175
EDUCATION               156
ENTERTAINMENT           149
MAPS_AND_NAVIGATION     137
FOOD_AND_DRINK          127
HOUSE_AND_HOME           88
AUTO_AND_VEHICLES        85
LIBRARIES_AND_DEMO       85
WEATHER                  82
ART_AND_DESIGN           65
EVENTS                   64
PARENTING                60
COMICS                   60
BEAUTY                   53
Name: Category, dtype: int64
```

In [12]:
```
app_count = android_df["App"].value_counts()
app_count
```

Out[12]:
```
ROBLOX                                                9
CBS Sports App - Scores, News, Stats & Watch Live     8
ESPN                                                  7
Duolingo: Learn Languages Free                        7
Candy Crush Saga                                      7
                                                     ..
Meet U - Get Friends for Snapchat, Kik & Instagram    1
U-Report                                              1
U of I Community Credit Union                         1
Waiting For U Launcher Theme                          1
iHoroscope - 2018 Daily Horoscope & Astrology         1
Name: App, Length: 9660, dtype: int64
```

In [13]:
```
app_count[app_count > 2]
```

Out[13]:
```
ROBLOX                                               9
CBS Sports App - Scores, News, Stats & Watch Live    8
ESPN                                                 7
Duolingo: Learn Languages Free                       7
Candy Crush Saga                                     7
                                                    ..
Viki: Asian TV Dramas & Movies                       3
Twitter                                              3
Camera360: Selfie Photo Editor with Funny Sticker    3
Facetune - For Free                                  3
Wunderlist: To-Do List & Tasks                       3
Name: App, Length: 237, dtype: int64
```

In [17]:
```
"Whatsapp" in app_count[app_count > 1].index
```

Out[17]:
```
False
```

In [18]:
```
"Instagram" in app_count[app_count > 1].index
```

Out[18]:
```
True
```

In [21]:
```
android_df[android_df["App"] == "Instagram"]
```

Out[21]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating	Genres	Last Updated	Current Ver	Android Ver
2545	Instagram	SOCIAL	4.5	66577313	Varies with device	1,000,000,000+	Free	0	Teen	Social	July 31, 2018	Varies with device	Varies with device
2604	Instagram	SOCIAL	4.5	66577446	Varies with device	1,000,000,000+	Free	0	Teen	Social	July 31, 2018	Varies with device	Varies with device
2611	Instagram	SOCIAL	4.5	66577313	Varies with device	1,000,000,000+	Free	0	Teen	Social	July 31, 2018	Varies with device	Varies with device
3909	Instagram	SOCIAL	4.5	66509917	Varies with device	1,000,000,000+	Free	0	Teen	Social	July 31, 2018	Varies with device	Varies with device

In [43]:
```
# check for duplicate rows based on "App" column marking all duplicates as True
duplicate_apps_df=android_df[android_df.duplicated(subset=["App"],keep=False)]

#keep=false means show all duplicates
duplicate_apps_df[duplicate_apps_df["App"]=="Instagram"]
```

Out[43]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating	Genres	Last Updated	Current Ver	Android Ver
2545	Instagram	SOCIAL	4.5	66577313	Varies with device	1,000,000,000+	Free	0	Teen	Social	July 31, 2018	Varies with device	Varies with device
2604	Instagram	SOCIAL	4.5	66577446	Varies with device	1,000,000,000+	Free	0	Teen	Social	July 31, 2018	Varies with device	Varies with device
2611	Instagram	SOCIAL	4.5	66577313	Varies with device	1,000,000,000+	Free	0	Teen	Social	July 31, 2018	Varies with device	Varies with device
3909	Instagram	SOCIAL	4.5	66509917	Varies with device	1,000,000,000+	Free	0	Teen	Social	July 31, 2018	Varies with device	Varies with device

In [47]:
```
#number of duplicate app
num_duplicate_apps=duplicate_apps_df["App"].nunique()
num_duplicate_apps
```

Out[47]:
```
798
```

In [48]:
```
duplicate_apps_df.shape
```

Out[48]:
```
(1979, 13)
```

In [49]:
```
android_df.shape
```

Out[49]:
```
(10841, 13)
```

In [50]:
```
10841-1181
```

Out[50]:
```
9660
```

PART TWO

In [53]:
```
#Group by "App" and get the maximum number of reviews for each app
#reviews_max=android_df.groupby("App")["Reviews"].max()
#reviews_max["Instagram"]
reviews_max = android_df.groupby("App")["Reviews"].max()
reviews_max["Instagram"]
```

Out[53]:
```
'66577446'
```

In [55]:
```
reviews_max
```

Out[55]:
```
App
"i DT" Fútbol. Todos Somos Técnicos.                    27
+Download 4 Instagram Twitter                        40467
- Free Comics - Comic Apps                             115
.R                                                     259
/u/app                                                 573
                                                     ...
뽕티비 - 개인방송, 인터넷방송, BJ방송                              414
💎 I'm rich                                              718
💘 WhatsLov: Smileys of love, stickers and GIF         22098
📏 Smart Ruler ↔ cm/inch measuring for homework!         19
🔥 Football Wallpapers 4K | Full HD Backgrounds 😍     11661
Name: Reviews, Length: 9660, dtype: object
```

In [56]:
```
#create an empty list to store clean data
android_clean = []
#create an empty list to keep track of  already added app
already_added = []
#iterate through each row in the dataframe
for index, row in android_df.iterrows():
    name = row['App']
    n_reviews = row['Reviews']

    #check if the current app has the maximum number of reviews and has not been added before
    if (reviews_max[name] == n_reviews) and (name not in already_added):
        android_clean.append(row) #add the app tothe clean list
        already_added.append(name) #add the app name to the list of already added apps
```

In [57]:
```
android_clean = pd.DataFrame(android_clean)
```

In [58]:
```
android_clean.shape
```

Out[58]:
```
(9660, 13)
```

REMOVING NON_ENGLISH APPS

PART ONE

If you explore the data sets enough,you will notice the names of some of the apps suggest they are not directed towards an English-Speaking audience.Below we see a couple of examples from both data sets.

In [62]:
```
chr(106)
```

Out[62]:
```
'j'
```

In [63]:
```
ord("A")
```

Out[63]:
```
65
```

In [64]:
```
def is_english(app_name):
    lst = []
    for i in app_name:
        if ord(i) > 127:
            lst.append(False)
        else:
            lst.append(True)
    check = set(lst)
    if False in check:
        return False
    else:
        return True
```

In [65]:
```
is_english("Instagram😍")
```

Out[65]:
```
False
```

In [66]:
```
is_english("Instagram")
```

Out[66]:
```
True
```

PART TWO

In [67]:
```
def is_english(app_name):
    lst = []
    for i in app_name:
        if ord(i) > 127:
            lst.append(False)
        else:
            lst.append(True)
    non_ascii = 0
    for j in lst:
        if j == False:
            non_ascii += 1
    if non_ascii > 3:
        return False
    else:
        return True
```

In [68]:
```
android_clean["App"].apply(is_english)
```

Out[68]:
```
0        True
2        True
3        True
4        True
5        True
         ...
10836    True
10837    True
10838    True
10839    True
10840    True
Name: App, Length: 9660, dtype: bool
```

In [69]:
```
android_english = android_clean[android_clean["App"].apply(is_english)]
android_english
```

Out[69]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating	Genres	Last Updated
0	Photo Editor & Candy Camera & Grid & ScrapBook	ART_AND_DESIGN	4.1	159	19M	10,000+	Free	0	Everyone	Art & Design	January 7, 2018
2	U Launcher Lite – FREE Live Cool Themes, Hide ...	ART_AND_DESIGN	4.7	87510	8.7M	5,000,000+	Free	0	Everyone	Art & Design	August 1, 2018
3	Sketch - Draw & Paint	ART_AND_DESIGN	4.5	215644	25M	50,000,000+	Free	0	Teen	Art & Design	June 8, 2018
4	Pixel Draw - Number Art Coloring Book	ART_AND_DESIGN	4.3	967	2.8M	100,000+	Free	0	Everyone	Art & Design;Creativity	June 20, 2018
5	Paper flowers instructions	ART_AND_DESIGN	4.4	167	5.6M	50,000+	Free	0	Everyone	Art & Design	March 26, 2017
...	...	...	...	...	...	...	...	...	...	...	...
10836	Sya9a Maroc - FR	FAMILY	4.5	38	53M	5,000+	Free	0	Everyone	Education	July 25, 2017
10837	Fr. Mike Schmitz Audio Teachings	FAMILY	5.0	4	3.6M	100+	Free	0	Everyone	Education	July 6, 2018
10838	Parkinson Exercices FR	MEDICAL	NaN	3	9.5M	1,000+	Free	0	Everyone	Medical	January 20, 2017
10839	The SCP Foundation DB fr nn5n	BOOKS_AND_REFERENCE	4.5	114	Varies with device	1,000+	Free	0	Mature 17+	Books & Reference	January 19, 2015
10840	iHoroscope - 2018 Daily Horoscope & Astrology	LIFESTYLE	4.5	398307	19M	10,000,000+	Free	0	Everyone	Lifestyle	July 25, 2018

9615 rows × 13 columns

In [70]:
```
android_english.shape
```

Out[70]:
```
(9615, 13)
```

In [71]:
```
android_english.head()
```

Out[71]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating	Genres	Last Updated	Current Ver	Andr
0	Photo Editor & Candy Camera & Grid & ScrapBook	ART_AND_DESIGN	4.1	159	19M	10,000+	Free	0	Everyone	Art & Design	January 7, 2018	1.0.0	4 anc
2	U Launcher Lite – FREE Live Cool Themes, Hide ...	ART_AND_DESIGN	4.7	87510	8.7M	5,000,000+	Free	0	Everyone	Art & Design	August 1, 2018	1.2.4	4 anc
3	Sketch - Draw & Paint	ART_AND_DESIGN	4.5	215644	25M	50,000,000+	Free	0	Teen	Art & Design	June 8, 2018	Varies with device	4.2
4	Pixel Draw - Number Art Coloring Book	ART_AND_DESIGN	4.3	967	2.8M	100,000+	Free	0	Everyone	Art & Design;Creativity	June 20, 2018	1.1	4.4
5	Paper flowers instructions	ART_AND_DESIGN	4.4	167	5.6M	50,000+	Free	0	Everyone	Art & Design	March 26, 2017	1.0	2.3

ISOLATING THE FREE APP

As we mentioned in the introduction,we only build apps that are free to downloaded and install, and our main source of revenue consist of in_app ads.Our data set contains both free and non_free apps and we will neeed to isolate only the free apps for our analysis. Below,we isolate for both our data sets.

In [72]:
```
android_english["Price"].unique()
```

Out[72]:
```
array(['0', '$4.99', '$3.99', '$6.99', '$1.49', '$2.99', '$7.99', '$5.99',
       '$3.49', '$1.99', '$9.99', '$7.49', '$0.99', '$9.00', '$5.49',
       '$10.00', '$11.99', '$79.99', '$16.99', '$14.99', '$1.00',
       '$29.99', '$12.99', '$2.49', '$24.99', '$10.99', '$1.50', '$19.99',
       '$15.99', '$33.99', '$74.99', '$39.99', '$3.95', '$4.49', '$1.70',
       '$8.99', '$2.00', '$3.88', '$25.99', '$399.99', '$17.99',
       '$400.00', '$3.02', '$1.76', '$4.84', '$4.77', '$1.61', '$2.50',
       '$1.59', '$6.49', '$1.29', '$5.00', '$13.99', '$299.99', '$379.99',
       '$37.99', '$18.99', '$389.99', '$19.90', '$8.49', '$1.75',
       '$14.00', '$4.85', '$46.99', '$109.99', '$154.99', '$3.08',
       '$2.59', '$4.80', '$1.96', '$19.40', '$3.90', '$4.59', '$15.46',
       '$3.04', '$4.29', '$2.60', '$3.28', '$4.60', '$28.99', '$2.95',
       '$2.90', '$1.97', '$200.00', '$89.99', '$2.56', '$30.99', '$3.61',
       '$394.99', '$1.26', '$1.20', '$1.04'], dtype=object)
```

In [73]:
```
android_final = android_english[android_english["Price"]=="0"]
```

In [74]:
```
android_final.shape
```

Out[74]:
```
(8863, 13)
```

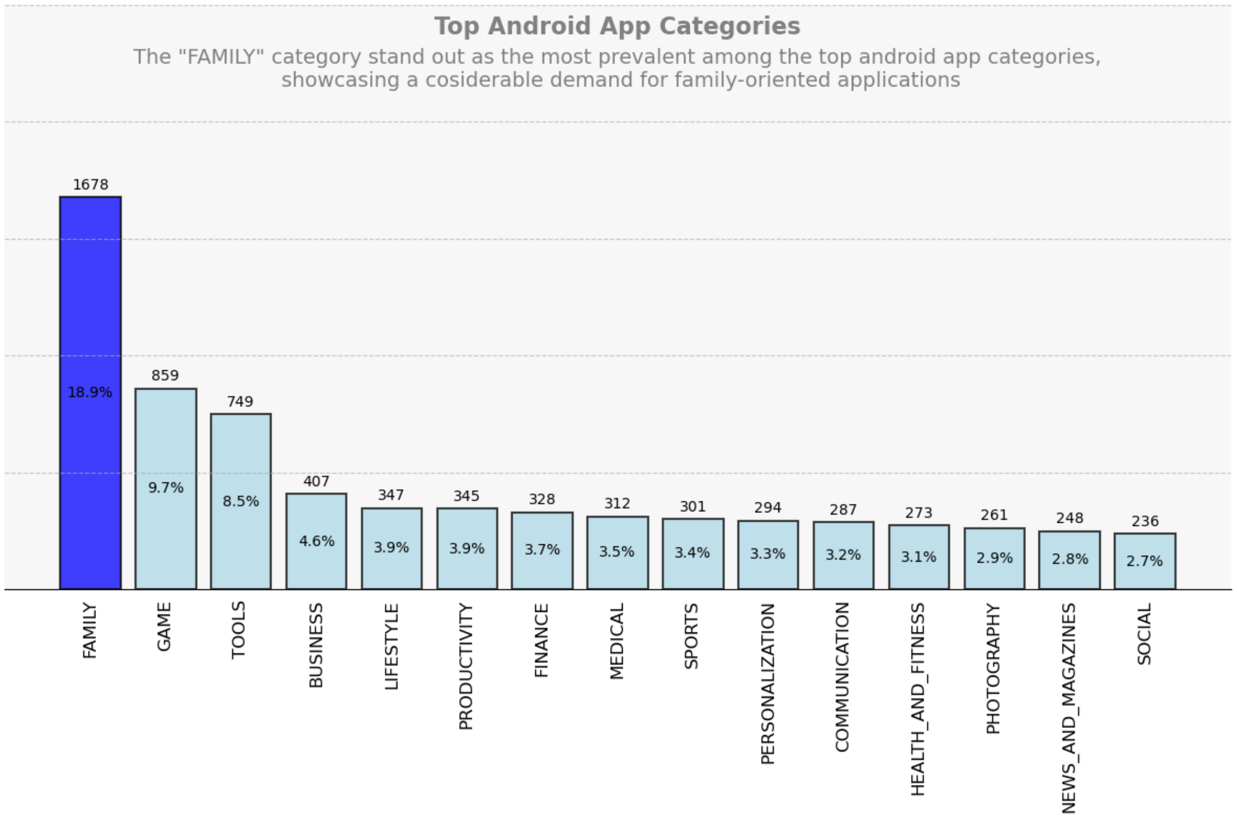
Most Common Apps by Genre

Analysis

```
In [75]: android_final["Category"].value_counts(normalize=True)*100
```

```
Out[75]: FAMILY                 18.932641
         GAME                    9.691978
         TOOLS                   8.450863
         BUSINESS                4.592125
         LIFESTYLE               3.915153
         PRODUCTIVITY            3.892587
         FINANCE                 3.700779
         MEDICAL                 3.520253
         SPORTS                  3.396141
         PERSONALIZATION         3.317161
         COMMUNICATION           3.238181
         HEALTH_AND_FITNESS      3.080221
         PHOTOGRAPHY             2.944827
         NEWS_AND_MAGAZINES      2.798150
         SOCIAL                  2.662755
         TRAVEL_AND_LOCAL        2.335552
         SHOPPING                2.245289
         BOOKS_AND_REFERENCE     2.143744
         DATING                  1.861672
         VIDEO_PLAYERS           1.793975
         MAPS_AND_NAVIGATION     1.399075
         FOOD_AND_DRINK          1.241115
         EDUCATION               1.173418
         ENTERTAINMENT           0.959043
         LIBRARIES_AND_DEMO      0.936477
         AUTO_AND_VEHICLES       0.925195
         HOUSE_AND_HOME          0.823649
         WEATHER                 0.801083
         EVENTS                  0.710820
         PARENTING               0.654406
         ART_AND_DESIGN          0.643123
         COMICS                  0.620557
         BEAUTY                  0.597992
         Name: Category, dtype: float64
```

In [77]:
```
#Data
categories = android_final["Category"].value_counts().index[:15]
counts = android_final["Category"].value_counts().values[:15]
percentage = round(android_final["Category"].value_counts(normalize = True)*100,1)[:15]

#create stylish bar chart
plt.figure(figsize=(12, 8))
bars = plt.bar(categories,counts,color="lightblue", alpha=0.75, edgecolor="black", linewidth=1.5)
plt.xticks(rotation=90, fontsize=12)
plt.yticks(fontsize=12)
plt.grid(axis="y", linestyle= '--', alpha=0.7)
plt.grid(axis="x", linestyle= '')
plt.xticks(fontsize=12) #customized tick tables
plt.yticks(range(0,3000,500),[],fontsize=12) # customized tick table and customized y_tick table
plt.tick_params(bottom=0, left=0)

#find the category with the highest count
max_count_category = categories[counts.argmax()]

#highlight the bar for the category with the highest count
max_count_index = list(categories).index(max_count_category)
bars[max_count_index].set_color('blue')
bars[max_count_index].set_edgecolor('black')

#adding data labels and percentage inside each bar
for bar, perc in zip(bars,percentage):
    height = bar.get_height()
    plt.text(bar.get_x() + bar.get_width()/2, height + 20, '%d' % int(height), ha= 'center', va='bottom',fon
    plt.text(bar.get_x() + bar.get_width()/2, height/2, f'{perc}%', ha= 'center', va='center',fontsize=10,co

#adding a background color
ax = plt.gca()
ax.set_facecolor('#f7f7f7')

#adding chart title inside the chart
plt.text(0.5,0.95,'Top Android App Categories',horizontalalignment='center',fontsize=16,transform=plt.gca().
         color='gray',fontweight='bold')

#adding conclusion inside the chart
plt.text(0.5,0.86,'The "FAMILY" category stand out as the most prevalent among the top android app categorie
         color='gray')

#remove spines
for i in ["top","right","left",]:
    plt.gca().spines[i].set_visible(False)

plt.tight_layout() #adjust layout to prevent clipping
plt.show()
```



In [78]:
```python
android_final[android_final["Category"]=="FAMILY"]
```

Out[78]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating	Genres	Last Updated	Current Ver	Andı
2017	Jewels Crush- Match 3 Puzzle	FAMILY	4.4	14774	19M	1,000,000+	Free	0	Everyone	Casual;Brain Games	July 23, 2018	1.9.3901	4 anc
2018	Coloring & Learn	FAMILY	4.4	12753	51M	5,000,000+	Free	0	Everyone	Educational;Creativity	July 17, 2018	1.49	4 anc
2019	Mahjong	FAMILY	4.5	33983	22M	5,000,000+	Free	0	Everyone	Puzzle;Brain Games	August 2, 2018	1.24.3181	4 anc
2020	Super ABC! Learning games for kids! Preschool ...	FAMILY	4.6	20267	46M	1,000,000+	Free	0	Everyone	Educational;Education	July 16, 2018	1.1.6.7	4.1
2021	Toy Pop Cubes	FAMILY	4.5	5761	21M	1,000,000+	Free	0	Everyone	Casual;Brain Games	July 4, 2018	1.8.3181	4 anc
...	...	...	...	...	...	...	...	...	...	...	...	...	
10821	Poop FR	FAMILY	NaN	6	2.5M	50+	Free	0	Everyone	Entertainment	May 29, 2018	1.0	4 anc
10827	Fr Agnel Ambarnath	FAMILY	4.2	117	13M	5,000+	Free	0	Everyone	Education	June 13, 2018	2.0.20	4 anc
10834	FR Calculator	FAMILY	4.0	7	2.6M	500+	Free	0	Everyone	Education	June 18, 2017	1.0.0	4.1
10836	Sya9a Maroc - FR	FAMILY	4.5	38	53M	5,000+	Free	0	Everyone	Education	July 25, 2017	1.48	4.1
10837	Fr. Mike Schmitz Audio Teachings	FAMILY	5.0	4	3.6M	100+	Free	0	Everyone	Education	July 6, 2018	1.0	4.1

1678 rows × 13 columns

Most Popular App by genre on Google Play Store

For the google play market, we actually have data baout the number of install, so we should be able to get a clearer picture genre popularity. However the install number don't seem precise enough--we can see the most values are open ended (100,+1000,+5000

In [79]:
```
android_final["Installs"].value_counts(normalize = True)*100
```

Out[79]:
```
1,000,000+        15.739592
100,000+          11.553650
10,000,000+       10.515627
10,000+           10.199707
1,000+             8.405732
100+               6.916394
5,000,000+         6.837414
500,000+           5.573733
50,000+            4.772650
5,000+             4.513145
10+                3.542818
500+               3.249464
50,000,000+        2.290421
100,000,000+       2.121178
50+                1.918086
5+                 0.789800
1+                 0.507729
500,000,000+       0.270789
1,000,000,000+     0.225657
0+                 0.045131
0                  0.011283
Name: Installs, dtype: float64
```

In [80]:
```
ndroid_final["Installs_int"] = android_final["Installs"].str.replace(",","").str.replace("+","").astype(int)
```

```
C:\Users\hassa\AppData\Local\Temp\ipykernel_12576\3840374705.py:1: FutureWarning: The default value of rege
x will change from True to False in a future version. In addition, single character regular expressions wil
l *not* be treated as literal strings when regex=True.
  android_final["Installs_int"] = android_final["Installs"].str.replace(",","").str.replace("+","").astype
(int)
C:\Users\hassa\AppData\Local\Temp\ipykernel_12576\3840374705.py:1: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html
#returning-a-view-versus-a-copy (https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#retu
rning-a-view-versus-a-copy)
  android_final["Installs_int"] = android_final["Installs"].str.replace(",","").str.replace("+","").astype
(int)
```

In [81]:
```
install_frq = android_final["Installs_int"].value_counts().sort_index()
install_frq = install_frq[install_frq.index > 500]
install_frq
```

Out[81]:
```
1000           745
5000           400
10000          904
50000          423
100000        1024
500000         494
1000000       1395
5000000        606
10000000       932
50000000       203
100000000      188
500000000       24
1000000000      20
Name: Installs_int, dtype: int64
```

```
In [82]: install_frq_per = round(android_final["Installs_int"].value_counts(normalize = True)*100,2).sort_index()
         install_frq_per = install_frq_per[install_frq_per.index > 500]
         install_frq_per
```

```
Out[82]: 1000           8.41
         5000           4.51
         10000         10.20
         50000          4.77
         100000        11.55
         500000         5.57
         1000000       15.74
         5000000        6.84
         10000000      10.52
         50000000       2.29
         100000000      2.12
         500000000      0.27
         1000000000     0.23
         Name: Installs_int, dtype: float64
```

```
In [83]: #alphanumeric_units
         def alphanumeric_units(value):
             if value >= 1e9:
                 return f'{value / 1e9:.0f}B'
             elif value >= 1e6:
                 return f'{value / 1e6:.0f}M'
             elif value >= 1e3:
                 return f'{value / 1e3:.0f}K'
             else:
                 return f'{value:.0f}'
```

```
In [84]: alphanumeric_units(1000000000)
```

```
Out[84]: '1B'
```

```
In [85]: install_frq.index
```

```
Out[85]: Int64Index([      1000,       5000,      10000,      50000,     100000,
                        500000,    1000000,    5000000,   10000000,   50000000,
                     100000000,  500000000, 1000000000],
                   dtype='int64')
```

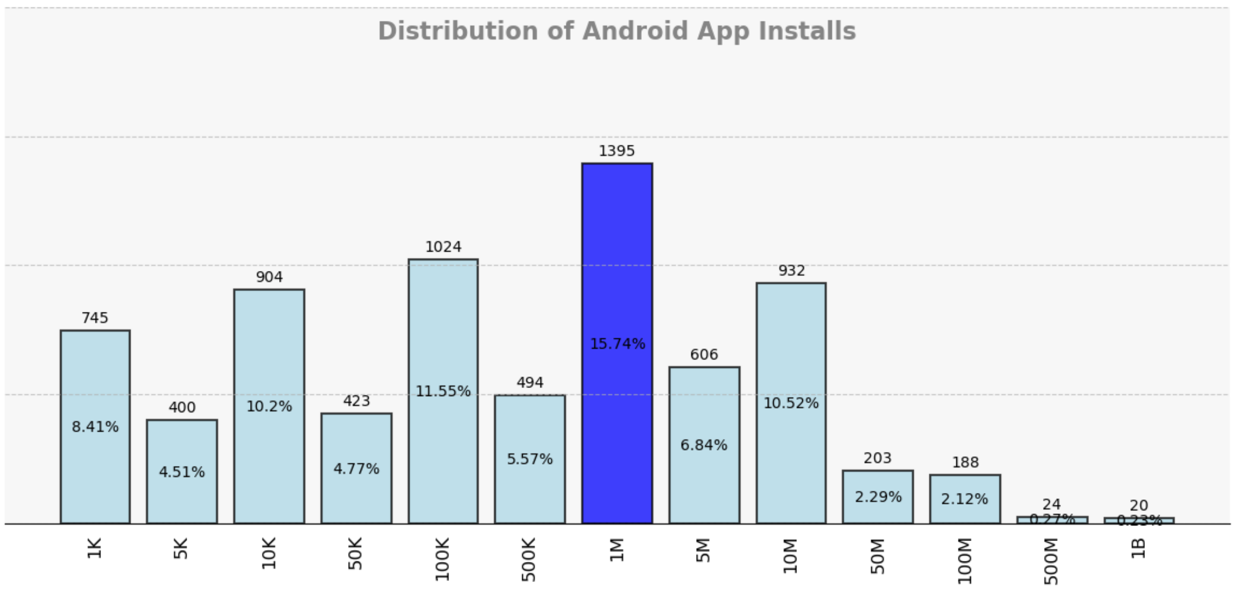
```
In [86]: install_frq.index = install_frq.index.map(alphanumeric_units)
         install_frq.index
```

```
Out[86]: Index(['1K', '5K', '10K', '50K', '100K', '500K', '1M', '5M', '10M', '50M',
                '100M', '500M', '1B'],
               dtype='object')
```

```
In [87]: install_frq
```

```
Out[87]: 1K       745
         5K       400
         10K      904
         50K      423
         100K    1024
         500K     494
         1M      1395
         5M       606
         10M      932
         50M      203
         100M     188
         500M      24
         1B        20
         Name: Installs_int, dtype: int64
```

```
In [89]: # Data
categories = install_frq.index
counts = install_frq.values
percentage = install_frq_per.values

#create stylish bar chart
plt.figure(figsize=(12,7))
bars = plt.bar(categories,counts,color='lightblue',alpha=0.75, edgecolor='black', linewidth=1.5)
plt.xticks(rotation=90,fontsize=12)
plt.yticks(fontsize=12)
plt.grid(axis='y',linestyle='--',alpha=0.7)
plt.grid(axis='x',linestyle='')
plt.xticks(fontsize=12) #customized tick table
plt.yticks(range(0,2500,500),[],fontsize=12) #customized tick label and customized y tick range
plt.tick_params(bottom=0,left=0)

#find the category with the highest count
max_count_category = categories[counts.argmax()]

#highlight the bar for the category with the highest count
max_count_index = list( categories).index(max_count_category)
bars[max_count_index].set_color('blue')
bars[max_count_index].set_edgecolor('black')

#adding data labels and percentage inside each bar
for bar,perc in zip(bars,percentage):
    height = bar.get_height()
    plt.text(bar.get_x() + bar.get_width()/2, height + 20, '%d' % int(height), ha='center',va='bottom',fonts
    plt.text(bar.get_x() + bar.get_width()/2, height/2, f'{perc}%' ,ha='center',va='center',fontsize=10,colo

#adding a background color
ax = plt.gca()
ax.set_facecolor('#f7f7f7')

#adding chart title inside the chart
plt.text(0.5,0.94,'Distribution of Android App Installs',horizontalalignment='center', fontsize=16,transform
        color='#858585',fontweight='bold')

#adding conclusion inside the chart
plt.text(0.5,-0.35,'From the data provided it is evident that the majority of Android App installs fall with
        horizontalalignment='center',fontsize=11,transform=plt.gca().transAxes, color = "#858585",fontweight

# remove spines
for i in ["top","right","left"]:
    plt.gca().spines[i].set_visible(False)

plt.tight_layout() #adjust layout to prevent clipping
plt.show()
```



**From the data provided it is evident that the majority of Android App installs fall within the lower range,
with th highest number of installs being in the 1k to 10M range.
Specifically,1M install range stand out with 1395 app, indicating a significant of apps falling into this category
As the number of install increases,the count of app decreases,
with only a few app reaching install counts of 500M and 1B**

In [90]:
```
categories_android = android_final["Category"].unique()
categories_android
```

Out[90]:
```
array(['ART_AND_DESIGN', 'AUTO_AND_VEHICLES', 'BEAUTY',
       'BOOKS_AND_REFERENCE', 'BUSINESS', 'COMICS', 'COMMUNICATION',
       'DATING', 'EDUCATION', 'ENTERTAINMENT', 'EVENTS', 'FINANCE',
       'FOOD_AND_DRINK', 'HEALTH_AND_FITNESS', 'HOUSE_AND_HOME',
       'LIBRARIES_AND_DEMO', 'LIFESTYLE', 'GAME', 'FAMILY', 'MEDICAL',
       'SOCIAL', 'SHOPPING', 'PHOTOGRAPHY', 'SPORTS', 'TRAVEL_AND_LOCAL',
       'TOOLS', 'PERSONALIZATION', 'PRODUCTIVITY', 'PARENTING', 'WEATHER',
       'VIDEO_PLAYERS', 'NEWS_AND_MAGAZINES', 'MAPS_AND_NAVIGATION'],
      dtype=object)
```

In [91]:
```
pd.pivot_table(android_final, values="Installs_int",index="Category",aggfunc="mean")
```

Out[91]:

	Installs_int
Category	
ART_AND_DESIGN	1.986335e+06
AUTO_AND_VEHICLES	6.473178e+05
BEAUTY	5.131519e+05
BOOKS_AND_REFERENCE	8.767812e+06
BUSINESS	1.712290e+06
COMICS	8.176573e+05
COMMUNICATION	3.845612e+07
DATING	8.540288e+05
EDUCATION	1.820673e+06
ENTERTAINMENT	1.164071e+07
EVENTS	2.535422e+05
FAMILY	3.694276e+06
FINANCE	1.387692e+06
FOOD_AND_DRINK	1.924898e+06
GAME	1.556097e+07
HEALTH_AND_FITNESS	4.188822e+06
HOUSE_AND_HOME	1.331541e+06
LIBRARIES_AND_DEMO	6.385037e+05
LIFESTYLE	1.433676e+06
MAPS_AND_NAVIGATION	4.056942e+06
MEDICAL	1.206165e+05
NEWS_AND_MAGAZINES	9.549178e+06
PARENTING	5.426036e+05
PERSONALIZATION	5.201483e+06
PHOTOGRAPHY	1.780563e+07
PRODUCTIVITY	1.678733e+07
SHOPPING	7.036877e+06
SOCIAL	2.325365e+07
SPORTS	3.638640e+06
TOOLS	1.068230e+07
TRAVEL_AND_LOCAL	1.398408e+07
VIDEO_PLAYERS	2.472787e+07
WEATHER	5.074486e+06

In [92]:
```
#display DataFrame without scientific notation
pd.options.display.float_format = '{:.0f}'.format
```

In [93]:
```
categories_installs = pd.pivot_table(android_final, values="Installs_int",index="Category",aggfunc="mean")
categories_installs = categories_installs.sort_values(by="Installs_int", ascending=False)
categories_installs = categories_installs["Installs_int"]
categories_installs
```

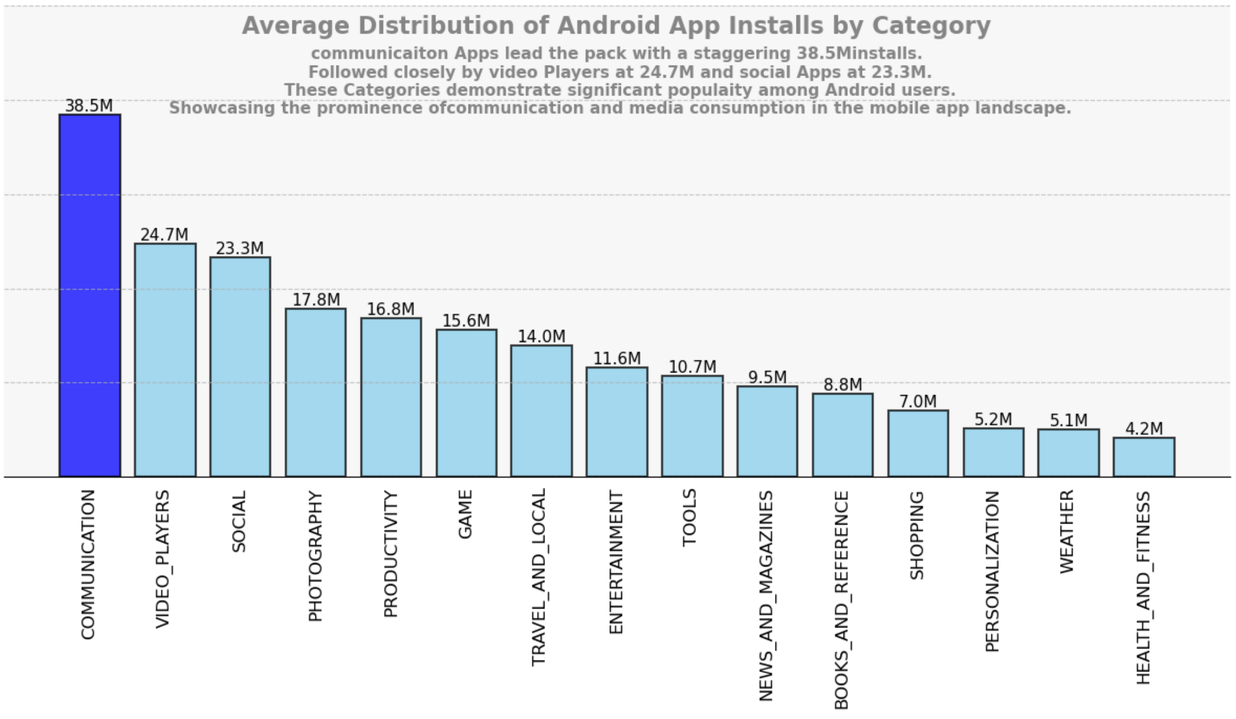
Out[93]:
```
Category
COMMUNICATION         38456119
VIDEO_PLAYERS         24727872
SOCIAL                23253652
PHOTOGRAPHY           17805628
PRODUCTIVITY          16787331
GAME                  15560966
TRAVEL_AND_LOCAL      13984078
ENTERTAINMENT         11640706
TOOLS                 10682301
NEWS_AND_MAGAZINES     9549178
BOOKS_AND_REFERENCE    8767812
SHOPPING               7036877
PERSONALIZATION        5201483
WEATHER                5074486
HEALTH_AND_FITNESS     4188822
MAPS_AND_NAVIGATION    4056942
FAMILY                 3694276
SPORTS                 3638640
ART_AND_DESIGN         1986335
FOOD_AND_DRINK         1924898
EDUCATION              1820673
BUSINESS               1712290
LIFESTYLE              1433676
FINANCE                1387692
HOUSE_AND_HOME         1331541
DATING                  854029
COMICS                  817657
AUTO_AND_VEHICLES       647318
LIBRARIES_AND_DEMO      638504
PARENTING               542604
BEAUTY                  513152
EVENTS                  253542
MEDICAL                 120616
Name: Installs_int, dtype: float64
```

In [94]:
```
#alphanumeric_units
def alphanumeric_units(value):
    if value >= 1e9:
        return f'{value / 1e9:.1f}B'
    elif value >= 1e6:
        return f'{value / 1e6:.1f}M'
    elif value >= 1e3:
        return f'{value / 1e3:.1f}K'
    else:
        return f'{value:.1f}'
```

In [95]:
```
categories_installs_units = categories_installs.map(alphanumeric_units)
categories_installs_units
```

Out[95]:
```
Category
COMMUNICATION           38.5M
VIDEO_PLAYERS           24.7M
SOCIAL                  23.3M
PHOTOGRAPHY             17.8M
PRODUCTIVITY            16.8M
GAME                    15.6M
TRAVEL_AND_LOCAL        14.0M
ENTERTAINMENT           11.6M
TOOLS                   10.7M
NEWS_AND_MAGAZINES       9.5M
BOOKS_AND_REFERENCE      8.8M
SHOPPING                 7.0M
PERSONALIZATION          5.2M
WEATHER                  5.1M
HEALTH_AND_FITNESS       4.2M
MAPS_AND_NAVIGATION      4.1M
FAMILY                   3.7M
SPORTS                   3.6M
ART_AND_DESIGN           2.0M
FOOD_AND_DRINK           1.9M
EDUCATION                1.8M
BUSINESS                 1.7M
LIFESTYLE                1.4M
FINANCE                  1.4M
HOUSE_AND_HOME           1.3M
DATING                 854.0K
COMICS                 817.7K
AUTO_AND_VEHICLES      647.3K
LIBRARIES_AND_DEMO     638.5K
PARENTING              542.6K
BEAUTY                 513.2K
EVENTS                 253.5K
MEDICAL                120.6K
Name: Installs_int, dtype: object
```

In [97]:
```
# Data
categories = categories_installs.index[:15]
counts = categories_installs.values[:15]

# create stylish bar
plt.figure(figsize=(12,7))
bars = plt.bar(categories,counts,color="skyblue",alpha=0.75,edgecolor="black",linewidth=1.5)
plt.xticks(rotation=90,fontsize=12)
plt.yticks(fontsize=12)
plt.grid(axis='y',linestyle='--',alpha=0.7)
plt.grid(axis='x',linestyle='')
plt.xticks(fontsize=12) #customized tick table
plt.yticks(range(0,60000000,10000000),[],fontsize=12) #customized tick label and customized y tick range
plt.tick_params(bottom=0,left=0)

#find the category with the highest count
max_count_category = categories[counts.argmax()]

#highlight the bar for the category with the highest count
max_count_index = list( categories).index(max_count_category)
bars[max_count_index].set_color('blue')
bars[max_count_index].set_edgecolor('black')

#adding data labels and percentage inside each bar
for bar,units in zip(bars,categories_installs_units.values):
    height = bar.get_height()
    plt.text(bar.get_x() + bar.get_width()/2, height + 25, units , ha='center',va='bottom',fontsize=11)

#adding a background color
ax = plt.gca()
ax.set_facecolor('#f7f7f7')

#adding chart title inside the chart
plt.text(0.5,0.94,'Average Distribution of Android App Installs by Category',horizontalalignment='center',fo
        color='#858585',fontweight='bold')

#adding conclusion inside the chart
plt.text(0.5,0.77,'communicaiton Apps lead the pack with a staggering 38.5Minstalls.\n Followed closely by v
        horizontalalignment='center',fontsize=11,transform=plt.gca().transAxes, color = "#858585",fontweight

# remove spines
for i in ["top","right","left"]:
    plt.gca().spines[i].set_visible(False)

plt.tight_layout() #adjust layout to prevent clipping
plt.show()
```


Average Distribution of Android App Installs by Category

communicaiton Apps lead the pack with a staggering 38.5Minstalls.
Followed closely by video Players at 24.7M and social Apps at 23.3M.
These Categories demonstrate significant populaity among Android users.
Showcasing the prominence ofcommunication and media consumption in the mobile app landscape.

In [98]:
```
category_group = android_final.groupby("Category")
```

In [99]:
```
communication = category_group.get_group('COMMUNICATION').sort_values(by="Installs_int",ascending=False)
communication.head()
```

Out[99]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating	Genres	Last Updated	Current Ver
336	WhatsApp Messenger	COMMUNICATION	4	69119316	Varies with device	1,000,000,000+	Free	0	Everyone	Communication	August 3, 2018	Varies with device
382	Messenger – Text and Video Chat for Free	COMMUNICATION	4	56646578	Varies with device	1,000,000,000+	Free	0	Everyone	Communication	August 1, 2018	Varies with device
464	Hangouts	COMMUNICATION	4	3419513	Varies with device	1,000,000,000+	Free	0	Everyone	Communication	July 21, 2018	Varies with device
411	Google Chrome: Fast & Secure	COMMUNICATION	4	9643041	Varies with device	1,000,000,000+	Free	0	Everyone	Communication	August 1, 2018	Varies with device
391	Skype - free IM & video calls	COMMUNICATION	4	10484169	Varies with device	1,000,000,000+	Free	0	Everyone	Communication	August 3, 2018	Varies with device

In [100]:
```
#alphanumeric_units
def alphanumeric_units(value):
    if value >= 1e9:
        return f'{value / 1e9:.0f}B'
    elif value >= 1e6:
        return f'{value / 1e6:.0f}M'
    elif value >= 1e3:
        return f'{value / 1e3:.0f}K'
    else:
        return f'{value:.1f}'
```

In [101]:
```
categories_installs.index[:15]
```

Out[101]:
```
Index(['COMMUNICATION', 'VIDEO_PLAYERS', 'SOCIAL', 'PHOTOGRAPHY',
       'PRODUCTIVITY', 'GAME', 'TRAVEL_AND_LOCAL', 'ENTERTAINMENT', 'TOOLS',
       'NEWS_AND_MAGAZINES', 'BOOKS_AND_REFERENCE', 'SHOPPING',
       'PERSONALIZATION', 'WEATHER', 'HEALTH_AND_FITNESS'],
      dtype='object', name='Category')
```

In [102]:
```
df=communication[['App','Installs_int']].head(15)
df['App','Installs_int_unit']= df['Installs_int'].map(alphanumeric_units)
df
```

Out[102]:

	App	Installs_int	(App, Installs_int_unit)
336	WhatsApp Messenger	1000000000	1B
382	Messenger – Text and Video Chat for Free	1000000000	1B
464	Hangouts	1000000000	1B
411	Google Chrome: Fast & Secure	1000000000	1B
391	Skype - free IM & video calls	1000000000	1B
451	Gmail	1000000000	1B
403	LINE: Free Calls & Messages	500000000	500M
4676	Viber Messenger	500000000	500M
420	UC Browser - Fast Download Private & Secure	500000000	500M
371	Google Duo - High Quality Video Calls	500000000	500M
383	imo free video calls and chat	500000000	500M
393	Who	100000000	100M
4633	UC Browser Mini -Tiny Fast Private & Secure	100000000	100M
4602	Truecaller: Caller ID, SMS spam blocking & Dialer	100000000	100M
4592	Telegram	100000000	100M

In [103]:
```
df = category_group.get_group('VIDEO_PLAYERS').sort_values(by="Installs_int",ascending=False)
df = df[['App','Installs_int']].head(15)
df['App','Installs_int_unit']= df['Installs_int'].map(alphanumeric_units)
df
```

Out[103]:

	App	Installs_int	(App, Installs_int_unit)
3665	YouTube	1000000000	1B
3687	Google Play Movies & TV	1000000000	1B
3711	MX Player	500000000	500M
3675	VLC for Android	100000000	100M
4688	VivaVideo - Video Editor & Photo Movie	100000000	100M
4032	Dubsmash	100000000	100M
10647	Motorola FM Radio	100000000	100M
4696	VideoShow-Video Editor, Video Maker, Beauty Ca...	100000000	100M
3672	Motorola Gallery	100000000	100M
3691	Samsung Video Library	50000000	50M
4038	DU Recorder – Screen Recorder, Video Editor, Live	50000000	50M
3693	LIKE – Magic Video Maker & Community	50000000	50M
3686	Vigo Video	50000000	50M
4049	KineMaster – Pro Video Editor	50000000	50M
5612	Ringdroid	50000000	50M

In [104]:
```
df = category_group.get_group('SOCIAL').sort_values(by="Installs_int",ascending=False)
df = df[['App','Installs_int']].head(15)
df['App','Installs_int_unit']= df['Installs_int'].map(alphanumeric_units)
df
```

Out[104]:

	App	Installs_int	(App, Installs_int_unit)
2544	Facebook	1000000000	1B
2554	Google+	1000000000	1B
2604	Instagram	1000000000	1B
2610	Snapchat	500000000	500M
2546	Facebook Lite	500000000	500M
3945	Tik Tok - including musical.ly	100000000	100M
2592	Tango - Live Video Broadcast	100000000	100M
6373	VK	100000000	100M
2552	Pinterest	100000000	100M
3951	BIGO LIVE - Live Stream	100000000	100M
2621	LinkedIn	100000000	100M
2548	Tumblr	100000000	100M
2588	Badoo - Free Chat & Dating App	100000000	100M
2636	Zello PTT Walkie Talkie	50000000	50M
2595	ooVoo Video Calls, Messaging & Stories	50000000	50M

In [108]:
```
df = category_group.get_group('PHOTOGRAPHY').sort_values(by="Installs_int",ascending=False)
df = df[['App','Installs_int']].head(15)
df['App','Installs_int_unit']= df['Installs_int'].map(alphanumeric_units)
df
```

Out[108]:

	App	Installs_int	(App, Installs_int_unit)
2884	Google Photos	1000000000	1B
4574	S Photo Editor - Collage Maker , Photo Collage	100000000	100M
2949	Camera360: Selfie Photo Editor with Funny Sticker	100000000	100M
2908	Retrica	100000000	100M
8307	LINE Camera - Photo editor	100000000	100M
2921	Photo Editor Pro	100000000	100M
2847	Sweet Selfie - selfie camera, beauty cam, phot...	100000000	100M
2937	BeautyPlus - Easy Photo Editor & Selfie Camera	100000000	100M
2938	PicsArt Photo Studio: Collage Maker & Pic Editor	100000000	100M
5057	AR effect	100000000	100M
2833	YouCam Makeup - Magic Selfie Makeovers	100000000	100M
2942	Z Camera - Photo Editor, Beauty Selfie, Collage	100000000	100M
2943	PhotoGrid: Video & Pic Collage Maker, Photo Ed...	100000000	100M
2944	Candy Camera - selfie, beauty camera, photo ed...	100000000	100M
2945	YouCam Perfect - Selfie Photo Editor	100000000	100M

In [106]:
```
df = category_group.get_group('TOOLS').sort_values(by="Installs_int",ascending=False)
df = df[['App','Installs_int']].head(15)
df['App','Installs_int_unit']= df['Installs_int'].map(alphanumeric_units)
df
```

Out[106]:

	App	Installs_int	(App, Installs_int_unit)
3234	Google	1000000000	1B
3265	Gboard - the Google Keyboard	500000000	500M
3255	SHAREit - Transfer & Share	500000000	500M
4005	Clean Master- Space Cleaner & Antivirus	500000000	500M
3235	Google Translate	500000000	500M
7536	Security Master - Antivirus, VPN, AppLock, Boo...	500000000	500M
8452	Automatic Call Recorder	100000000	100M
3266	Google Korean Input	100000000	100M
7550	Battery Doctor-Battery Life Saver & Battery Co...	100000000	100M
3272	Share Music & Transfer Files - Xender	100000000	100M
4578	Samsung Smart Switch Mobile	100000000	100M
4568	360 Security - Free Antivirus, Booster, Cleaner	100000000	100M
3289	Tiny Flashlight + LED	100000000	100M
4151	Google Now Launcher	100000000	100M
8758	Anti-virus Dr.Web Light	100000000	100M

In [109]:
```
df = category_group.get_group('COMMUNICATION').sort_values(by="Installs_int",ascending=False)
df = df[['App','Installs_int']].head(15)
df['App','Installs_int_unit']= df['Installs_int'].map(alphanumeric_units)
df
```

Out[109]:

	App	Installs_int	(App, Installs_int_unit)
336	WhatsApp Messenger	1000000000	1B
382	Messenger – Text and Video Chat for Free	1000000000	1B
464	Hangouts	1000000000	1B
411	Google Chrome: Fast & Secure	1000000000	1B
391	Skype - free IM & video calls	1000000000	1B
451	Gmail	1000000000	1B
403	LINE: Free Calls & Messages	500000000	500M
4676	Viber Messenger	500000000	500M
420	UC Browser - Fast Download Private & Secure	500000000	500M
371	Google Duo - High Quality Video Calls	500000000	500M
383	imo free video calls and chat	500000000	500M
393	Who	100000000	100M
4633	UC Browser Mini -Tiny Fast Private & Secure	100000000	100M
4602	Truecaller: Caller ID, SMS spam blocking & Dialer	100000000	100M
4592	Telegram	100000000	100M

Analysis of "Communication" Category and Why Communication Dominates in Google Play Store.

Conclusion

According to our analysis, the data highlights the importance of communication apps for consumers as well as the vital role they play in the Android ecosystem. With the growth of remote work and technological improvements, video calling, messaging, and other forms of communication are set to continue being indispensable parts of day-to-day living. In this competitive context, developers should put an emphasis on innovation and user-centric features to fulfill changing demands. In addition, the persistent popularity of communication applications points to an increasing demand for effective collaboration and seamless connectivity, opening the door for greater advancements in this field. To stay relevant and promote long-term growth, app developers must concentrate on improving user experiences, incorporating cutting-edge technologies, and responding to shifting customer behavior. In the ever-changing world of communication app development, developers can position themselves for success by keeping an eye on current trends and providing value-driven solutions

In [ ]:

In [ ]: