Homework 1 | Bass Model

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DS223: Marketing Analytics

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HyperX Cloud Alpha Wireless Headset

Time's Magazine has published about 200 innovations of 2022 that change how we generally live. As the title mentions, I have picked the HyperX Cloud Alpha Wireless Headset designed for PC gamers. This paper is going to discuss the chosen innovation, its look-alike innovation, the estimated Bass Model parameters, the predictions made of the diffusion, and the estimated potential share globally.

The goal of the Cloud Aloha Wireless headset for PC gamers is to show how energy-efficient a consumer device can be. The headset uses an ultra-low-energy transceiver, audio codec, lasts 300 hours between charges, and has super-cushy ear pads important for extended sessions (Steinberg, 2022).

Innovations rarely exist in isolation. Thus, the HyperX Cloud Alpha Wireless Headset bears resemblances to a category of products known as hearables and headphones/earbuds. The history of these audio devices dates back to the early days of audio technology. Regular headphones and the HyperX Cloud Alpha Wireless Headset share a couple of similarities in their core purposes, while of course having some differences.

1. Delivering high-quality audio is a purpose shared by both innovations. While the HyperX headset is mainly for gaming purposes, traditional headphones have been there for music enthusiasts as well as gamers.
2. Both share a similar design foundation – comfortable ear cushions, adjustable headbands, quality speakers, noise cancellation, etc.
3. While HyperX is initially a wireless headset, many headphones and hearables also offer wireless connectivity, enabling users to connect to their devices via Bluetooth technology.

The look-alike innovation's two chosen datasets are extracted from statista.com, and they are about the global sales volume and usage of wireless headphones. With the help of this data, the following code will make predictions of the diffusion of the innovation.

Bass Model HW

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Reading the datasets

```
sales <- read_excel("sales.xlsx", sheet = "Data")
```

```
## New names:
## * `` -> `...2`
```

```
usage <- read_excel("usage.xlsx", sheet = "Data")
```

```
## New names:
## * `` -> `...2`
## * `` -> `...3`
## * `` -> `...4`
```

## Making some adjustments on the datasets to match the goal.

```
sales <- sales[-c(1, 2), ]
usage <- usage[-c(1, 2), ]
usage <- usage[, -ncol(usage)]

column_names_sales <- c("Year", "Unit_Sales_in_millions")
column_names_usage <- c("Location", "Wireless_earbuds_in_%", "Wireless_headphones_in_%")

colnames(sales) <- column_names_sales
colnames(usage) <- column_names_usage

sales$Year[2] <- "2019"
sales$Year <- as.integer(sales$Year)
sales$Unit_Sales_in_millions <- as.integer(sales$Unit_Sales_in_millions)
usage$`Wireless_earbuds_in_%` <- as.integer(usage$`Wireless_earbuds_in_%`)
usage$`Wireless_headphones_in_%` <- as.integer(usage$`Wireless_headphones_in_%`)
```

Visualizing the sales and usage of regular headphones/earbuds

```
ggplot(sales, aes(x = Year, y = Unit_Sales_in_millions)) + geom_bar(stat = "identity", fill = '#F0BB40')
  labs(x = " ", y = "Unit Sales in millions") +
  ggtitle("Global sales volume for true wireless hearables") +
  scale_x_continuous(breaks = 2018:2021, labels = 2018:2021) + theme_bw()
```

Global sales volume for true wireless hearables
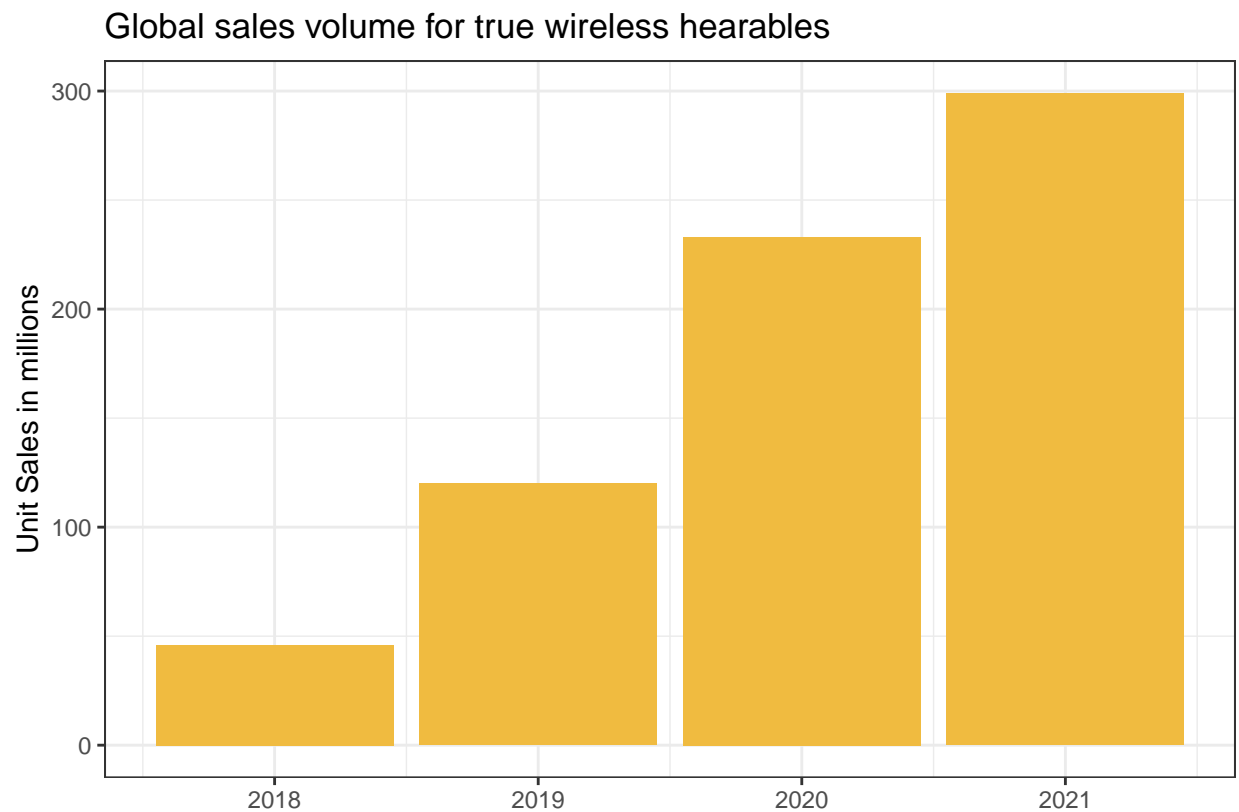

```
ggplot(usage, aes(x = `Wireless_earbuds_in_%`, y = Location)) + geom_bar(stat = "identity", fill = "#AF5
  labs(x = "Wireless earbuds in %", y = " ", title = "Global wireless earbuds usage in 2020") + theme_b
```

Global wireless earbuds usage in 2020

Bar chart titled "Global wireless earbuds usage in 2020" showing Wireless earbuds in % (x-axis 0 to 60) by location category.
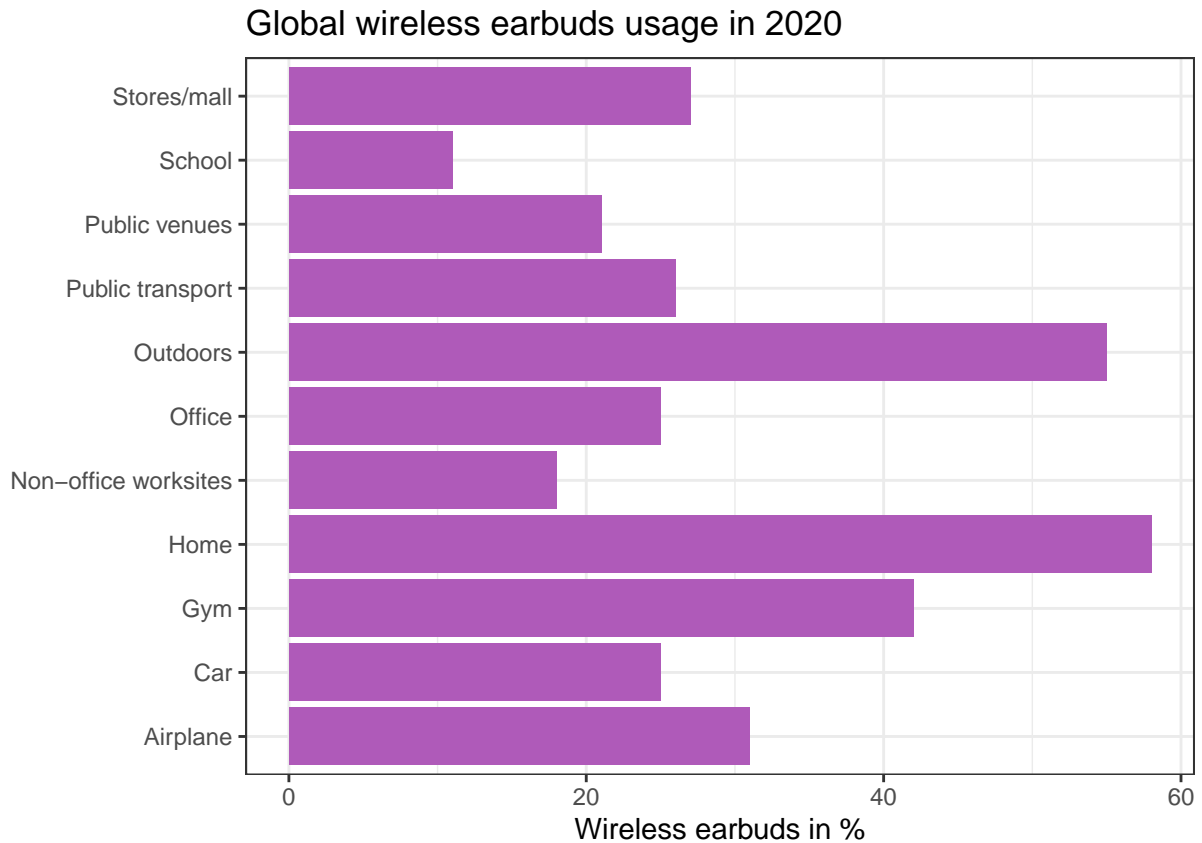
Bass Model parameters for regular headphones/earbuds.

```
bass.f <- function(t,p,q){((p+q)^2/p)*exp(-(p+q)*t)/(1+(q/p)*exp(-(p+q)*t))^2}
bass.F <- function(t,p,q){(1-exp(-(p+q)*t))/(1+(q/p)*exp(-(p+q)*t))}

# innovation rate = p
# imitation rate = q
```

Model summary, parameter estimation

```
salesbass = sales$Unit_Sales_in_millions
t = 1:length(salesbass)
bassM = nls(salesbass ~ m*(((p+q)^2/p)*exp(-(p+q)*t))/(1+(q/p)*exp(-(p+q)*t))^2, start = c(list(m=sum(sa
summary(bassM)
```

```
##
## Formula: salesbass ~ m * (((p + q)^2/p) * exp(-(p + q) * t))/(1 + (q/p) *
##     exp(-(p + q) * t))^2
##
## Parameters:
```

```
##     Estimate Std. Error t value Pr(>|t|)
## m 1.110e+03  2.656e+01   41.77   0.0152 *
## p 1.569e-02  6.272e-04   25.01   0.0254 *
## q 1.046e+00  2.489e-02   42.04   0.0151 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.359 on 1 degrees of freedom
##
## Number of iterations to convergence: 11
## Achieved convergence tolerance: 2.552e-07
```

# Innovation rate (p = 0.01569)

Imitation rate (q = 1.046)

Market potential (m = 1110)

```
df <- data.frame(t = c(1:9))

plot_of_t = ggplot(df, aes(t)) + stat_function(fun = bass.f, args = c(p = 0.01569, q = 1.046)) + ggtitl

sales_plot = ggplot(sales, aes(x = Year, y = Unit_Sales_in_millions)) + geom_bar(stat = "identity") +
  labs(x = " ", y = "Unit Sales in millions") +
  ggtitle("Global sales volume") +
  scale_x_continuous(breaks = 2018:2021, labels = 2018:2021) + theme_bw()

ggarrange(plot_of_t, sales_plot)
```

Plot of f(t)

Global sales volume
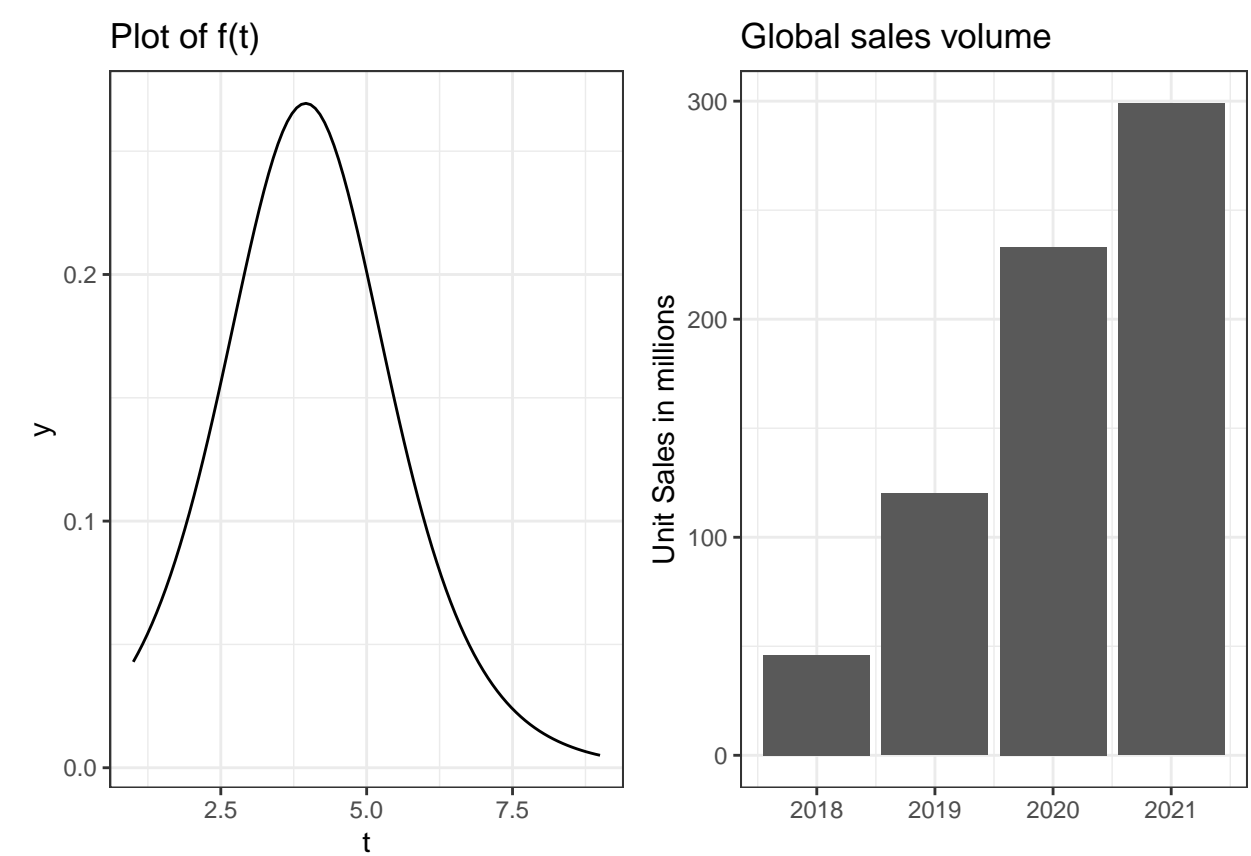
Estimated number of adopters by time

```
sales$predicted_sales = bass.f(1:4, p = 0.01569, q = 1.046)*1110

ggplot(sales, aes(x = Year, y = Unit_Sales_in_millions)) + geom_bar(stat = 'identity', fill = "#F0BB40"
  geom_point(mapping = aes(x=Year, y=predicted_sales), color = 'red') +
  labs( x= ' ', y = 'Sales', title = "Estimated number of adopters by time") + scale_x_continuous(breaks
```

Estimated number of adopters by time
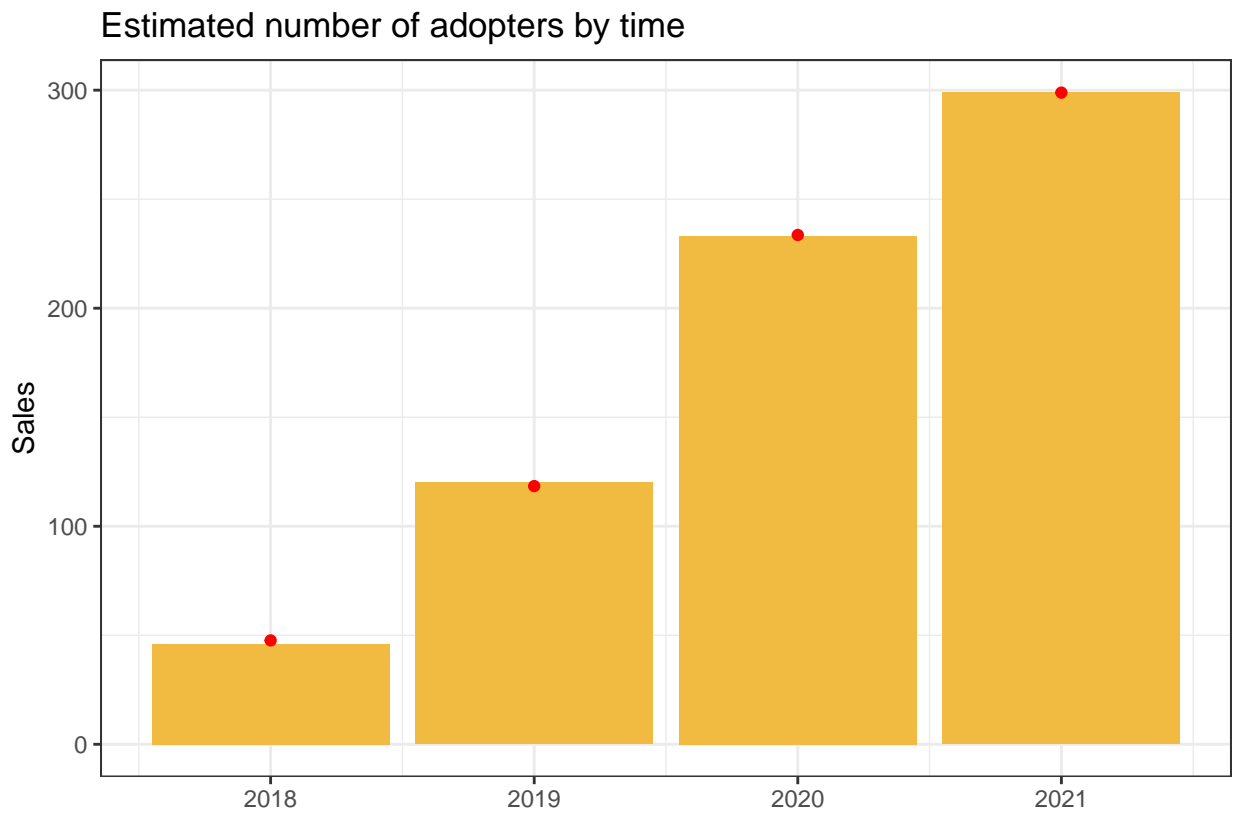
References

1. HyperX Cloud Alpha Wireless Headset: [HyperX Cloud Alpha Wireless Headset: The 200 Best Inventions of 2022 | TIME](#)

2. Unit Sales of true wireless hearables: [True wireless hearables: global sales 2018-2021 | Statista](#)