Analyse d'un jeu de données réel

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1 Librairies

```
library(plyr)
library(tidyverse)
library(lubridate)
library(naniar)
library(scales)
library(ggsci)
library(GGally)
library(ggthemes)
library(lemon)
library(rvest)
```

`plyr` pour appliquer le paradigme «split-apply-combine».
`tidyverse` contient tidyr, dplyr et ggplot2 pour la manipulation et visualisation des données.
`naniar` pour visualiser les données manquantes.
`lubridate` pour la gestion des formats de date.
`scales` pour modifier les formats d'échelles des graphiques.
`ggsci` pour différents thèmes de graphique.
`ggthemes` donne accès à des thèmes supplémentaires pour `ggplot2`
`lemon` donne accès à des fonction suppémentaires pour changer subtilement des aspects de `ggplot2`
`rvest` pour le web scraping.

2 Données manquantes

2.1 Jeu de données PhD_v1

2.1.1 Import du jeu de données

```
these_v1 <- read_csv("jeux_de_donnees/PhD_v1.csv")
head(these_v1)
```

Auteur;Identifiant auteur;Titre;Directeur de these;Directeur de these (nom prenom);Identifiant directeur;Etablissement de soutenance;Identifiant etablissement;Discipline;Statut;Date de premiere inscription en doctorat;Date de soutenance;Langue de la these;Identifiant de la these;Accessible en ligne;Publication dans theses.fr;Mise a jour dans theses.fr;

Saeed Al marri;;Le credit documentaire et l'onopposabilite des exceptions;Philippe Delebecque;Delebecque Philippe;029561248;Paris 1;027361802;Driot prive;enCours;30-09-2011;;;s69480;non;26-01-2012;26-01-2012;

Andrea Ramazzotti;174423705;Application de la PGD a la resolution de problemes transitoires couples en vue de l'allegement des structures composites.;Jean-Claude Grandidier,Marianne Beringhier;Grandidier Jean-Claude,Beringhier Marianne;071544151,118113429;Chasseneuil-du-Poitou, Ecole nationale superieure de mecanique et d'aerotechnique;028024400;Mecanique des solides, des materiaux, des structures et des surfaces;enCours;01-10-2012;;;s98826;non;22-11-2013;22-11-2013;

OLIVIER BODENREIDER;;Conception d'un outil informatique d'etude des cinetiques observees en toxicologie clinique;Francois Kohler;Kohler Francois;057030758;Nancy 1;;Medecine;soutenue;;01-01-1993;fr;1993NAN19006;non;24-05-2013;17-11-2012;

Emmanuel Porte;;Socio-histoire des politiques publiques en matiere sociale concernant les etudiants.;Gilles Pollet;Pollet Gilles;;Lyon 2;02640334X;Science politique;enCours;01-06-2011;;;s88867;non;12-07-2013;12-01-2016;

Arthur Devriendt;;LES TECHNOLOGIES DE L'INFORMATION ET DE LA COMMUNICATION ET LES NOUVELLES RURALITES.;Gabriel Dupuy;Dupuy Gabriel;;Paris 1;027361802;Geographie;enCours;07-12-2009;;;s89663;non;13-07-2013;12-07-2013;

Elmantsr Briak;;Integration forcee de l'afrique subsaharienne dans le processus de mondialisation "structuration des economies","destructuration des etats".;Edmond Jouve;Jouve Edmond;026941848;Paris 5;026404788;Science politique;enCours;01-12-2002;24-11-2008;;s6336;non;26-09-2011;16-11-2011;

```
dim(these_v1)
```

```
## [1] 446871      1
```

```
rm(these_v1)
```

La commande `rm` permet de supprimer la variable `these_v1`

2.2 Jeu de données PhD_v2

2.2.1 Import et préparation des données

```
these <- as_tibble(read_csv("jeux_de_donnees/PhD_v2.csv"))
these$`Date de soutenance` <- dmy(these$`Date de soutenance`)
these$`Publication dans theses.fr` <- dmy(these$`Publication dans theses.fr`)
these$`Mise a jour dans theses.fr` <- dmy(these$`Mise a jour dans theses.fr`)
these$Statut <- as.factor(these$Statut)
these$`Langue de la these` <- as.factor(these$`Langue de la these`)
these$`Accessible en ligne` <- as.factor(these$`Accessible en ligne`)
these$`Identifiant directeur` <- na_if(these$`Identifiant directeur`,"na")
```

2.2.2 Summary.

```
head(these)
```

Auteur	Identifiant auteur	Titre	Directeur de these	Directeur de these (nom prenom)	Identifiant directeur	Etablissement de soutenance	Identifiant etablissement	Discipline	Statut	Date de premiere inscription en doctorat	D sc
Saeed Al marri	NA	Le credit documentaire et l'onopposabilite des exceptions	Philippe Delebecque	Delebecque Philippe	29561248	Paris 1	27361802	Driot prive	enCours	30-09-11	N
Andrea Ramazzotti	174423705	Application de la PGD a la resolution de problemes transitoires couples en vue de l'allegement des structures composites.	Jean-Claude Grandidier,Marianne Beringhier	Grandidier Jean-Claude,Beringhier Marianne	715,441,511	Chasseneuil-du-Poitou, Ecole nationale superieure de mecanique et d'aerotechnique	28024400	Mecanique des solides, des materiaux, des structures et des surfaces	enCours	01-10-12	N
OLIVIER BODENREIDER	NA	Conception d'un outil informatique d'etude des cinetiques observees en toxicologie clinique	Francois Kohler	Kohler Francois	57030758	Nancy 1	NA	Medecine	soutenue	NA	1 0
Emmanuel Porte	NA	Socio-histoire des politiques publiques en matiere sociale concernant les etudiants.	Gilles Pollet	Pollet Gilles	NA	Lyon 2	02640334X	Science politique	enCours	01-06-11	N
Arthur Devriendt	NA	LES TECHNOLOGIES DE L'INFORMATION ET DE LA COMMUNICATION ET LES NOUVELLES RURALITES.	Gabriel Dupuy	Dupuy Gabriel	NA	Paris 1	27361802	Geographie	enCours	07-12-09	N
Elmantsr Briak	NA	Integration forcee de l'afrique subsaharienne dans le processus de mondialisation "structuration des economies","destructuration des etats".	Edmond Jouve	Jouve Edmond	26941848	Paris 5	26404788	Science politique	enCours	01-12-02	2 2

```
glimpse(these)
```

```
## Rows: 447,644
## Columns: 18
## $ Auteur                                <chr> "Saeed Al marri", "Andrea R…
## $ `Identifiant auteur`                  <chr> NA, "174423705", NA, NA, NA…
## $ Titre                                 <chr> "Le credit documentaire et …
## $ `Directeur de these`                  <chr> "Philippe Delebecque", "Jea…
## $ `Directeur de these (nom prenom)`     <chr> "Delebecque Philippe", "Gra…
## $ `Identifiant directeur`               <chr> "29561248", "715,441,511", …
## $ `Etablissement de soutenance`         <chr> "Paris 1", "Chasseneuil-du-…
## $ `Identifiant etablissement`           <chr> "27361802", "28024400", NA,…
## $ Discipline                            <chr> "Driot prive", "Mecanique d…
## $ Statut                                <fct> enCours, enCours, soutenue,…
## $ `Date de premiere inscription en doctorat` <chr> "30-09-11", "01-10-12", NA,…
## $ `Date de soutenance`                  <date> NA, NA, 1993-01-01, NA, NA…
## $ Year                                  <dbl> NA, NA, 1993, NA, NA, 2008,…
## $ `Langue de la these`                  <fct> NA, NA, fr, NA, NA, NA, NA,…
## $ `Identifiant de la these`             <chr> "s69480", "s98826", "1993NA…
## $ `Accessible en ligne`                 <fct> non, non, non, non, non, no…
## $ `Publication dans theses.fr`          <date> 2012-01-26, 2013-11-22, 20…
## $ `Mise a jour dans theses.fr`          <date> 2012-01-26, 2013-11-22, 20…
```

```
summary(these)
```

```
##     Auteur          Identifiant auteur    Titre          Directeur de these
##  Length:447644      Length:447644      Length:447644      Length:447644
##  Class :character   Class :character   Class :character   Class :character
##  Mode  :character   Mode  :character   Mode  :character   Mode  :character
##
##
##
##
##  Directeur de these (nom prenom) Identifiant directeur
##  Length:447644                   Length:447644
##  Class :character                Class :character
##  Mode  :character                Mode  :character
##
##
##
##
##  Etablissement de soutenance Identifiant etablissement  Discipline
##  Length:447644               Length:447644              Length:447644
##  Class :character            Class :character           Class :character
##  Mode  :character            Mode  :character           Mode  :character
##
##
##
##
##       Statut       Date de premiere inscription en doctorat
##  enCours : 66329   Length:447644
##  soutenue:381315   Class :character
##                    Mode  :character
##
##
##
##
##  Date de soutenance        Year       Langue de la these
##  Min.   :1971-01-01   Min.   :1971    fr     :334404
##  1st Qu.:1994-01-01   1st Qu.:1994    en     : 30942
##  Median :2004-01-01   Median :2004    enfr   : 10576
##  Mean   :2003-06-08   Mean   :2003    fren   :  4793
##  3rd Qu.:2012-06-25   3rd Qu.:2012    it     :   634
##  Max.   :2020-07-07   Max.   :2020    (Other):  2530
##  NA's   :56746        NA's   :56746   NA's   : 63765
##  Identifiant de la these Accessible en ligne Publication dans theses.fr
##  Length:447644           non:347341          Min.   :2006-04-13
##  Class :character        oui:100303          1st Qu.:2013-05-24
##  Mode  :character                            Median :2013-05-24
##                                              Mean   :2014-11-09
##                                              3rd Qu.:2016-07-11
##                                              Max.   :2020-07-08
##
##  Mise a jour dans theses.fr
##  Min.   :2010-10-12
##  1st Qu.:2019-04-08
##  Median :2020-02-26
##  Mean   :2019-06-30
##  3rd Qu.:2020-03-08
##  Max.   :2020-07-08
##  NA's   :177
```

```
these %>%
  summarise(across(everything(), n_distinct)) %>%
  glimpse()
```

```
## Rows: 1
## Columns: 18
## $ Auteur                                <int> 430277
## $ `Identifiant auteur`                  <int> 313775
## $ Titre                                 <int> 446815
## $ `Directeur de these`                  <int> 159019
## $ `Directeur de these (nom prenom)`     <int> 159021
## $ `Identifiant directeur`               <int> 98907
## $ `Etablissement de soutenance`         <int> 568
## $ `Identifiant etablissement`           <int> 573
## $ Discipline                            <int> 24263
## $ Statut                                <int> 2
## $ `Date de premiere inscription en doctorat` <int> 4010
## $ `Date de soutenance`                  <int> 3992
## $ Year                                  <int> 45
## $ `Langue de la these`                  <int> 206
## $ `Identifiant de la these`             <int> 447572
## $ `Accessible en ligne`                 <int> 2
## $ `Publication dans theses.fr`          <int> 2765
## $ `Mise a jour dans theses.fr`          <int> 2634
```

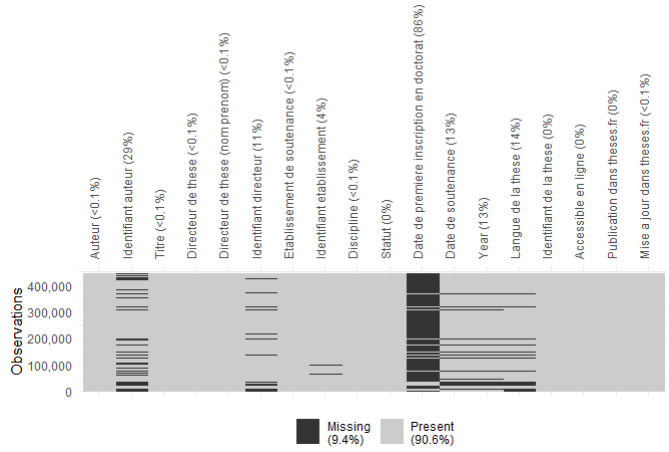
2.3 Visualisation des données manquantes

2.3.1 Préparation des données manquantes

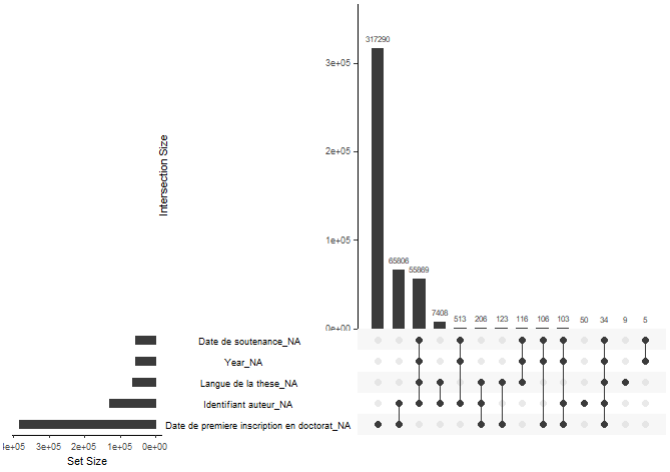
```
these_NA <- these %>% select(Statut, `Date de premiere inscription en doctorat`,
                             `Date de soutenance`, Year, `Langue de la these`)
these_NA_encours <- these_NA %>% filter(Statut == "enCours")
these_NA_soutenue <- these_NA %>% filter(Statut == "soutenue")
```

2.3.2 Visualisation des données manquantes

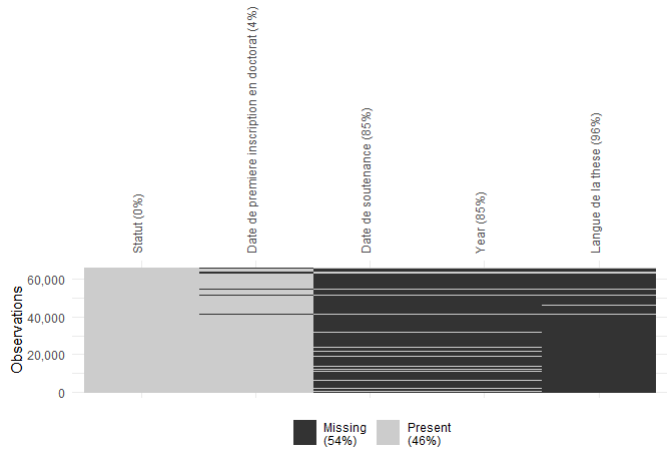
```
# Visualisation donnees manquantes
vis_miss(these, warn_large_data = FALSE) +
  scale_y_continuous(labels = comma) +
  theme(axis.text.x =  element_text(angle = 90))
```



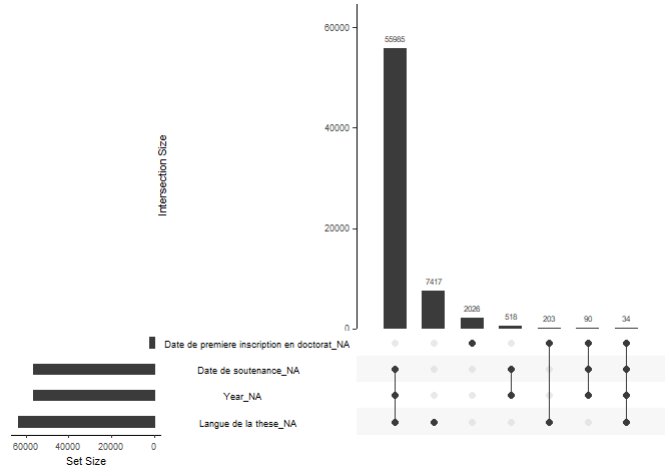

```
gg_miss_upset(these)
```



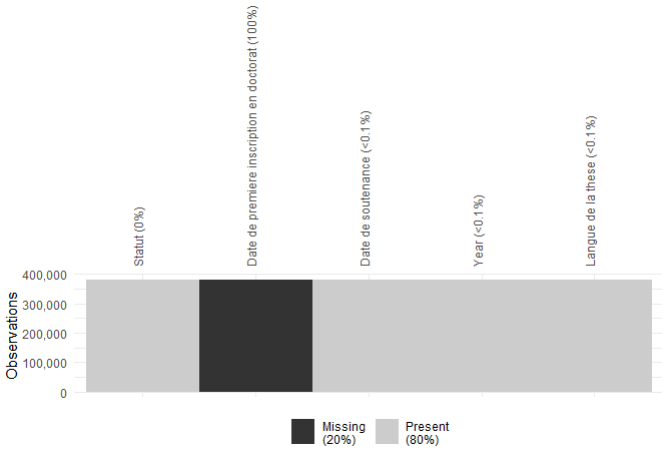

```
# Visualisation statut enCours
vis_miss(these_NA_encours, warn_large_data = FALSE) +
  scale_y_continuous(labels = comma) +
  theme(axis.text.x =  element_text(angle = 90))
```



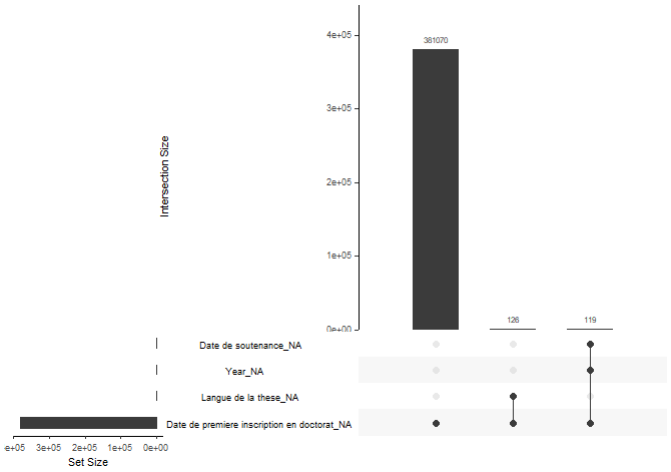

```
gg_miss_upset(these_NA_encours)
```



```
# Visualisation statut soutenue
vis_miss(these_NA_soutenue, warn_large_data = FALSE) +
  scale_y_continuous(labels = comma) +
  theme(axis.text.x =  element_text(angle = 90))
```




```
gg_miss_upset(these_NA_soutenue)
```



3 Problèmes

3.1 Problèmes soutenances

3.1.1 Préparations des données

```
these_soutenance <- these %>% select(Year, `Date de soutenance`)
these_soutenance <- these_soutenance %>%
  mutate(month =  as.factor(month(`Date de soutenance`, label = TRUE)),
         day = as.factor(day(`Date de soutenance`)))
```

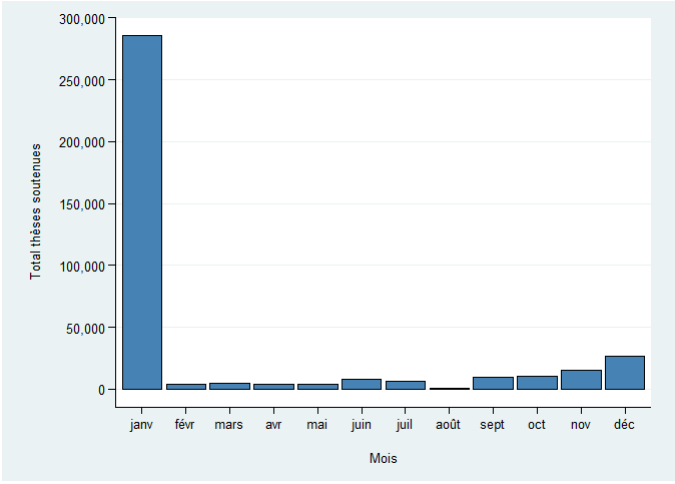
Selection des variables cibles et création de nouvelles colonnes `month` et `day` pour plus de lisibilité dans le code suivant.

3.1.2 Préparation des tables intermédiaires.

```r
# full_join pour la distribution des pourcentages moyens de soutenance par mois avec errorbar
# Sans filtrer le 1 Janvier
these_soutenance_count_year <- these_soutenance %>%
  filter(Year > 2004 & Year < 2019) %>%
  count(Year) %>%
  rename(total_year = n)

these_soutenance_year_month <-  these_soutenance  %>%
  filter(Year > 2004 & Year < 2019) %>%
  count(Year, month) %>%
  rename(total_month = n)

these_soutenance_full <- full_join(these_soutenance_count_year,
                                   these_soutenance_year_month,
                                   by = "Year") %>%
  mutate(freq = total_month / total_year) %>%
  drop_na()

# Avec filtre sur le 1 Janvier
these_soutenance_count_year_no_first <- these_soutenance %>%
  filter(day != "1" & Year > 2004 & Year < 2019) %>%
  count(Year) %>%
  rename(total_year = n)

these_soutenance_year_month_no_first <-  these_soutenance  %>%
  filter(day != "1" & Year > 2004 & Year < 2019) %>%
  count(Year, month) %>%
  rename(total_month = n)

these_soutenance_full_no_first <- full_join(these_soutenance_count_year_no_first,
                                 these_soutenance_year_month_no_first,
                                 by = "Year") %>%
  mutate(freq = total_month / total_year) %>%
  drop_na()

# full_join pour l'evolution des frequences des defenses de theses par annees au premier janvier
these_soutenance_count_year <- these_soutenance %>%
  count(Year) %>%
  rename(total_year = n)

these_soutenance_count_janv <- these_soutenance %>%
  filter(month == "janv" & day == "1") %>%
  group_by(Year) %>%
  count(Year) %>%
  rename(total_janv = n)

these_soutenance_year_janv <- full_join(these_soutenance_count_year,
                                        these_soutenance_count_janv, by = "Year") %>%
  mutate(freq = total_janv / total_year)
```

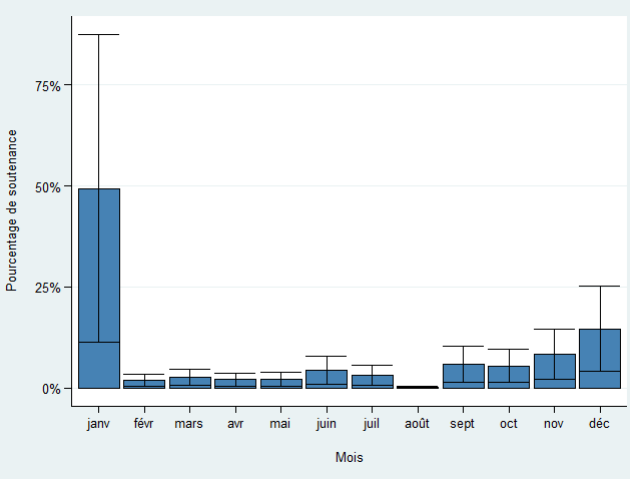
3.1.3 Visualisations

```r
# Distribution du total these par mois
these_soutenance %>%
  filter(Year > 1983 & Year < 2019) %>%
  count(month) %>%
  ggplot(aes(month, n)) +
  geom_col(fill = "steelblue", color = "black") +
  scale_y_continuous(labels = comma,
                     breaks = seq(0, 300000, 50000)) +
  labs(x = "\nMois",
       y = "Total thèses soutenues\n") +
  theme_stata() +
  theme(axis.text.y = element_text(angle = 0))
```

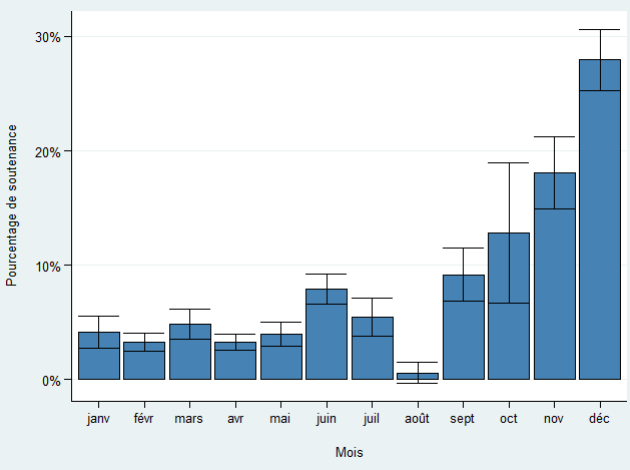



```r
# facet_wrap month~year
these_soutenance %>%
  filter(Year > 2004 & Year < 2019) %>%
  count(Year, month) %>%
  ggplot(aes(month, n)) +
  geom_col(fill = "steelblue", color = "black") +
  facet_wrap( ~ Year) +
  scale_x_discrete(guide = guide_axis(angle = 90)) +
  labs(x = "\nMois",
       y = "Total thèses soutenues\n") +
  theme_stata() +
  theme(axis.text.y = element_text(angle = 0))
```

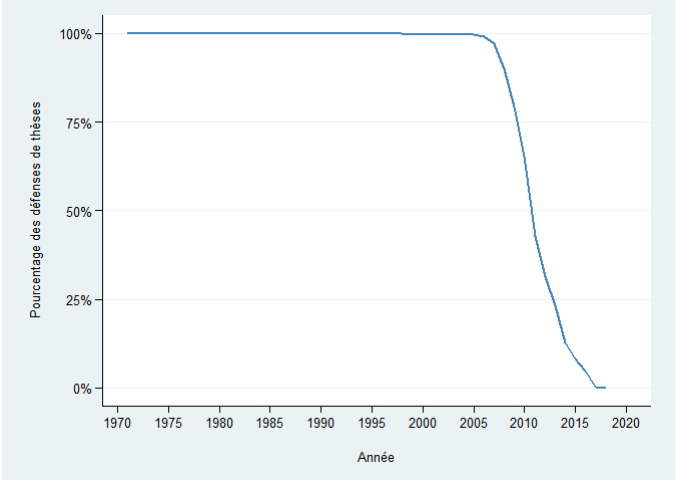

```r
# Distribution des pourcentages moyens de soutenance par mois avec errorbar
# Avec 1 Janvier
these_soutenance_full %>%
  ddply(~month, summarise, mean = mean(freq, na.rm = TRUE), sd = sd(freq, na.rm = TRUE)) %>%
  ggplot(aes(month, mean)) +
  geom_col(fill = "steelblue", color = "black") +
  geom_errorbar(aes(ymin = mean - sd, ymax = mean + sd)) +
  scale_y_continuous(labels = percent_format()) +
  labs(x = "\nMois",
       y = "Pourcentage de soutenance\n") +
  theme_stata() +
  theme(axis.text.y = element_text(angle = 0))
```




```r
# Sans 1 Janvier
these_soutenance_full_no_first %>%
  ddply(~month, summarise, mean = mean(freq, na.rm = TRUE), sd = sd(freq, na.rm = TRUE)) %>%
  ggplot(aes(month, mean)) +
  geom_col(fill = "steelblue", color = "black") +
  geom_errorbar(aes(ymin = mean - sd, ymax = mean + sd)) +
  scale_y_continuous(labels = percent_format()) +
  labs(x = "\nMois",
       y = "Pourcentage de soutenance\n") +
  theme_stata() +
  theme(axis.text.y = element_text(angle = 0))
```




```r
# Evolution des frequences des defenses de theses par annees au premier janvier
these_soutenance_year_janv %>%
  ggplot(aes(Year, freq)) +
  geom_line(color = "steelblue", size = 1) +
  scale_x_continuous(breaks = seq(1970, 2020, 5)) +
  scale_y_continuous(labels = percent_format()) +
  labs(x = "\nAnnée",
       y = "Pourcentage des défenses de thèses\n") +
  theme_stata() +
  theme(axis.text.y = element_text(angle = 0))
```



3.2 Problème homonyme Cecile Martin

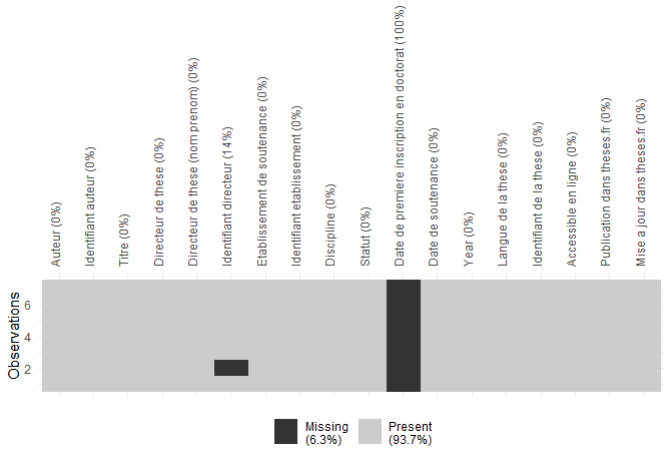
3.2.1 Import et préparation des données

```
these_cecile_martin <- these %>%
  filter(str_detect(Auteur, "Cecile Martin")) %>%
  slice(-c(4,6, 8, 9, 12))

glimpse(these_cecile_martin %>%
  summarise(across(everything(), n_distinct)))
```

```
## Rows: 1
## Columns: 18
## $ Auteur                              <int> 1
## $ `Identifiant auteur`                <int> 4
## $ Titre                               <int> 7
## $ `Directeur de these`                <int> 7
## $ `Directeur de these (nom prenom)`   <int> 7
## $ `Identifiant directeur`             <int> 7
## $ `Etablissement de soutenance`       <int> 7
## $ `Identifiant etablissement`         <int> 7
## $ Discipline                          <int> 7
## $ Statut                              <int> 1
## $ `Date de premiere inscription en doctorat` <int> 1
## $ `Date de soutenance`                <int> 7
## $ Year                                <int> 7
## $ `Langue de la these`                <int> 2
## $ `Identifiant de la these`           <int> 7
## $ `Accessible en ligne`               <int> 2
## $ `Publication dans theses.fr`        <int> 3
## $ `Mise a jour dans theses.fr`        <int> 5
```

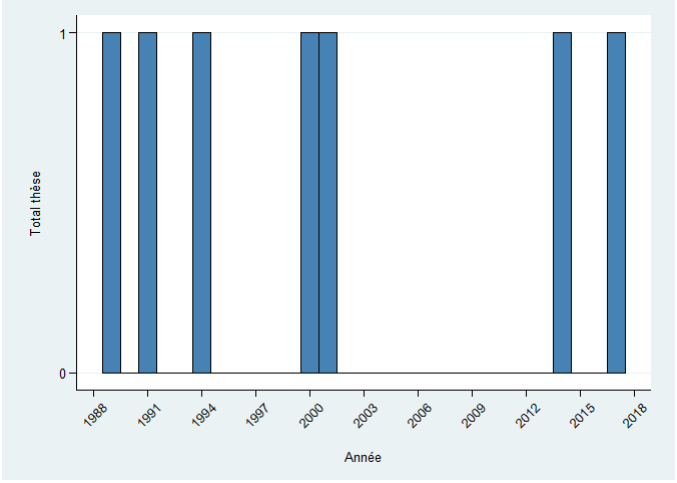
3.2.2 Visualisation des données manquantes

```
these_cecile_martin %>%
  vis_miss() +
  scale_y_continuous(labels = comma) +
  theme(axis.text.x =  element_text(angle = 90))
```

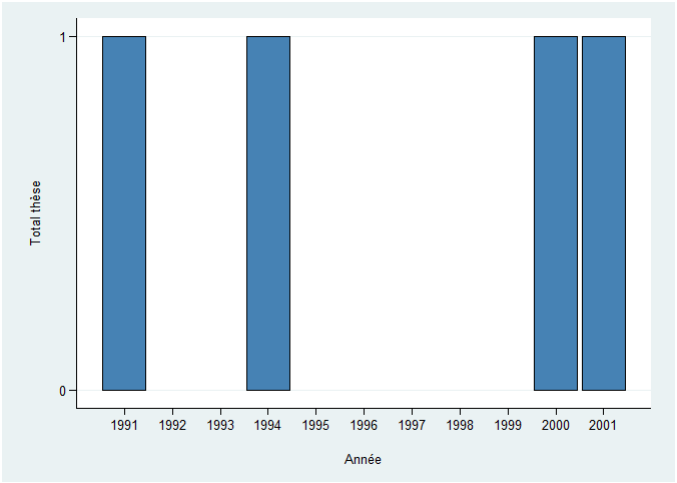


3.2.3 Exploration des données

```
these_cecile_martin %>%
  ggplot(aes(x = Year)) +
  geom_histogram(binwidth = 1, fill = "steelblue", color = "black") +
  scale_x_continuous(breaks = seq(1985, 2020, 3)) +
  scale_y_continuous(breaks = c(0, 1)) +
  labs(x = "\nAnnée",
       y = "Total thèse\n") +
  theme_stata() +
  theme(axis.text.x =  element_text(angle = 45,
                                    vjust = 0.5),
        axis.text.y = element_text(angle = 0))
```




```
# Filtrage sur l'Identifiant auteur "81323557"
these_cecile_martin %>%
  filter(`Identifiant auteur` == "81323557") %>%
  ggplot(aes(x = Year)) +
  geom_bar(binwidth = 1, fill = "steelblue", color = "black") +
  scale_x_continuous(breaks = seq(1990, 2002, 1)) +
  scale_y_continuous(breaks = c(0, 1)) +
  labs(x = "\nAnnée",
       y = "Total thèse\n") +
  theme_stata() +
  theme(axis.text.y = element_text(angle = 0))
```



4 Outliers

4.1 Outliers director

4.1.1 Import et préparation des données

```
these_director <- these[!grepl(",", these$`Directeur de these (nom prenom)`), ]
these_director <- these_director[!grepl("@", these_director$`Directeur de these (nom prenom)`), ]

these_director <- these_director %>%
  filter(Year > 1983 & Year < 2019) %>%
  select(`Directeur de these (nom prenom)`, `Identifiant directeur`) %>%
  group_by(`Directeur de these (nom prenom)`) %>%
  mutate(total_these_diriger = n())

dim(these_director)
```

```
## [1] 308587      3
```

```
n_distinct(these_director$`Directeur de these (nom prenom)`)
```

```
## [1] 66148
```

```
n_distinct(these_director$`Identifiant directeur`)
```

```
## [1] 58680
```

4.1.2 Méthodes de différent moyen de calcul des outliers

```
# Mean and Standard deviation (SD)
## Tmin, Tmax = mean(+-)(k*sd), k = 3
Tmin_msd <-  mean(these_director$total_these_diriger) - ( 3 * sd(these_director$total_these_diriger))
Tmax_msd <-  mean(these_director$total_these_diriger) + ( 3 * sd(these_director$total_these_diriger))
msd <- which(these_director$total_these_diriger < Tmin_msd |
                                 these_director$total_these_diriger > Tmax_msd)
msd_outliers <- these_director[msd,]
min(msd_outliers$total_these_diriger)
```

```
## [1] 131
```

```
max(msd_outliers$total_these_diriger)
```

```
## [1] 711
```

```
# Median and Median Absolute Deviation (MAD)
## MAD = b * median(|xi - median(x)|), b = 1.4826 for normal distribution
## Tmin, Tmax = median(+-)(k*MAD), k = 3
med <- median(these_director$total_these_diriger)
abs_med <- abs(these_director$total_these_diriger - med)
mad <- 1.4826 * median(abs_med)
Tmin_mad <- med - ( 3 * mad)
Tmax_mad <- med + ( 3 * mad)
mad <- which(these_director$total_these_diriger < Tmin_mad |
               these_director$total_these_diriger > Tmax_mad)
mad_outliers <- these_director[mad,]
min(mad_outliers$total_these_diriger)
```

```
## [1] 36
```

```
max(mad_outliers$total_these_diriger)
```

```
## [1] 711
```

```
# Interquartile Range (IQR)
## Tmin = Q1 - (c * IQR) c = 1.5(mild)
## Tmax = Q3 + (c * IQR) c = 1.5(mild)
summary(these_director)
```

```
##  Directeur de these (nom prenom) Identifiant directeur total_these_diriger
##  Length:308587                   Length:308587         Min.   :  1.00
##  Class :character                Class :character      1st Qu.:  4.00
##  Mode  :character                Mode  :character      Median :  9.00
##                                                        Mean   : 16.21
##                                                        3rd Qu.: 18.00
##                                                        Max.   :711.00
```

```
IQR(these_director$total_these_diriger)
```

```
## [1] 14
```

```
Tmin_iqr_mild <- 4 - (1.5 * 14)
Tmax_iqr_mild <- 18 + (1.5 * 14)
iqr_mild <- which(these_director$total_these_diriger < Tmin_iqr_mild |
               these_director$total_these_diriger > Tmax_iqr_mild)
iqr_mild_outliers <- these_director[iqr_mild,]
min(iqr_mild_outliers$total_these_diriger)
```

```
## [1] 40
```

```
max(iqr_mild_outliers$total_these_diriger)
```

```
## [1] 711
```

```
## Tmin = Q1 - (c * IQR) c = 3(extreme)
## Tmax = Q3 + (c * IQR) c = 3(extreme)
Tmin_iqr_ext <- 4 - (3 * 14)
Tmax_iqr_ext <- 18 + (3 * 14)
iqr_ext <- which(these_director$total_these_diriger < Tmin_iqr_ext |
                   these_director$total_these_diriger > Tmax_iqr_ext)
iqr_ext_outliers <- these_director[iqr_ext,]
min(iqr_ext_outliers$total_these_diriger)
```

```
## [1] 61
```

```
max(iqr_ext_outliers$total_these_diriger)
```

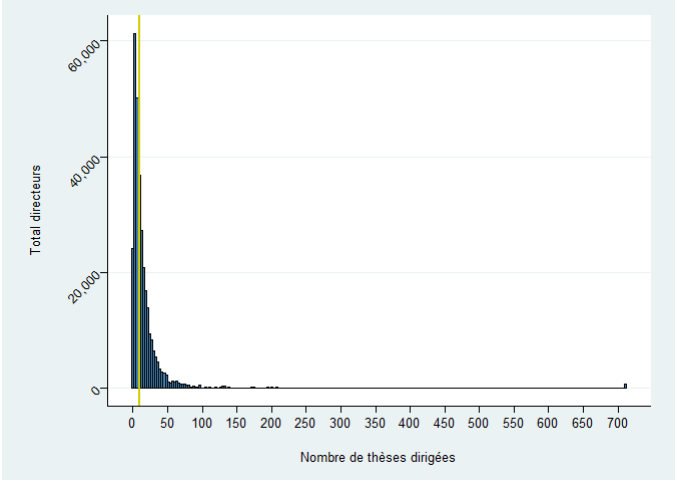
```
## [1] 711
```

4.1.3 Visualisation des données manquantes

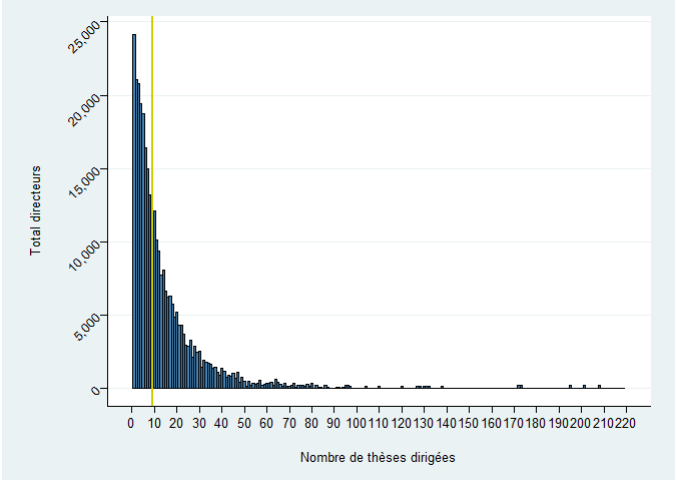
```
these_director %>% vis_miss(warn_large_data = FALSE) +
  scale_y_continuous(labels = comma) +
  theme(axis.text.x =  element_text(angle = 90))
```

4.1.4 Recherches des outliers

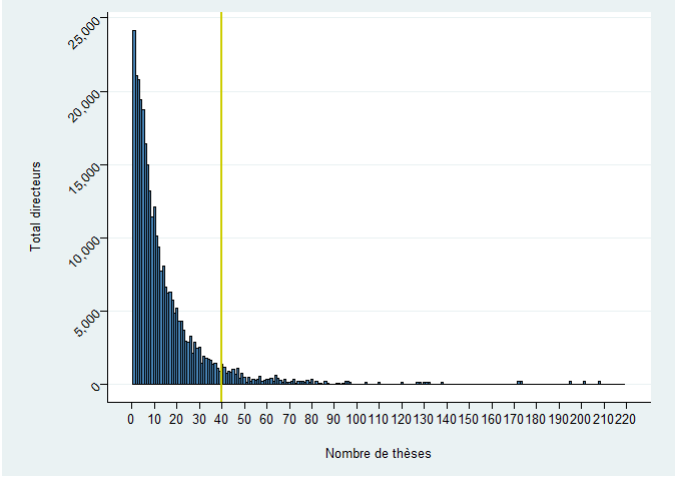
```
these_director %>%
  ggplot(aes(total_these_diriger)) +
  geom_histogram(binwidth = 3, fill = "steelblue", color = "Black") +
  geom_vline(aes(xintercept = median(total_these_diriger)), color = "yellow3", size = 1) +
  scale_y_continuous(labels = comma) +
  labs(x = "\nNombre de thèses dirigées",
       y = "Total directeurs\n") +
  scale_x_continuous(breaks = seq(0, 800, 50)) +
  theme_stata() +
  theme(axis.text.y = element_text(angle = 45))
```



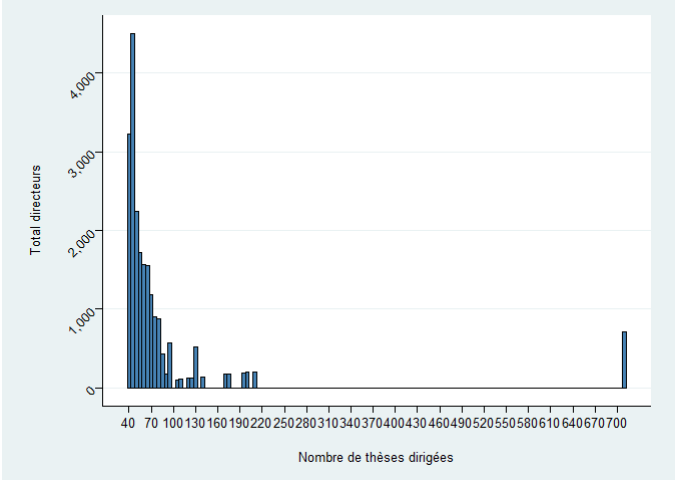

```
these_director %>%
  ggplot(aes(total_these_diriger)) +
  geom_histogram(binwidth = 1, fill = "steelblue", color = "Black") +
  geom_vline(aes(xintercept = median(total_these_diriger)), color = "yellow3", size = 1) +
  scale_x_continuous(limits = c(0, 220), breaks = seq(0, 220, 10)) +
  scale_y_continuous(labels = comma) +
  labs(x = "\nNombre de thèses dirigées",
       y = "Total directeurs\n") +
  theme_stata() +
  theme(axis.text.y = element_text(angle = 45))
```




```
these_director %>%
  ggplot(aes(total_these_diriger)) +
  geom_histogram(binwidth = 1, fill = "steelblue", color = "Black") +
  geom_vline(aes(xintercept = min(iqr_mild_outliers$total_these_diriger)), color = "yellow3", size = 1) +
  scale_x_continuous(limits = c(0, 220), breaks = seq(0, 220, 10)) +
  scale_y_continuous(labels = comma) +
  labs(x = "\nNombre de thèses",
       y = "Total directeurs\n") +
  theme_stata() +
  theme(axis.text.y = element_text(angle = 45))
```




```
these_director %>%
  filter(total_these_diriger >= 40) %>%
  ggplot(aes(total_these_diriger)) +
  geom_histogram(binwidth = 5, fill = "steelblue", color = "Black") +
  scale_x_continuous(breaks = seq(40, 720, 30)) +
  scale_y_continuous(labels = comma) +
  labs(x = "\nNombre de thèses dirigées",
       y = "Total directeurs\n") +
  theme_stata() +
  theme(axis.text.y = element_text(angle = 45))
```



4.1.5 Analyse des outliers

```
# Total theses >= 40 & <= 140
these_director_outliers <- these_director %>% filter(total_these_diriger >= 40 &
                                                       total_these_diriger <= 140)
dim(these_director_outliers)
```

```
## [1] 20068     3
```

```
n_distinct(these_director_outliers$`Directeur de these (nom prenom)`)
```

```
## [1] 367
```

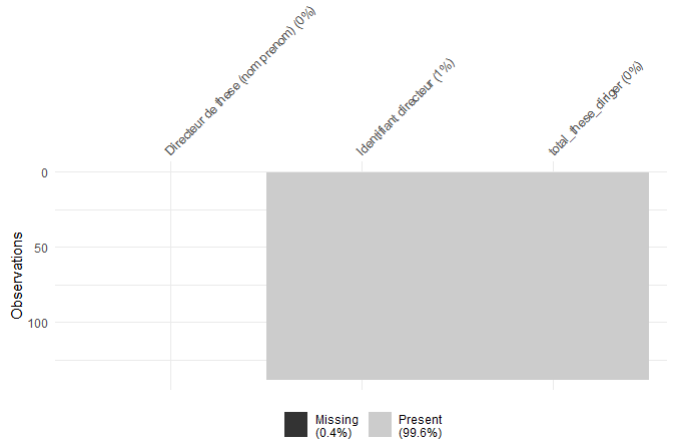
```
n_distinct(these_director_outliers$`Identifiant directeur`)
```

```
## [1] 447
```

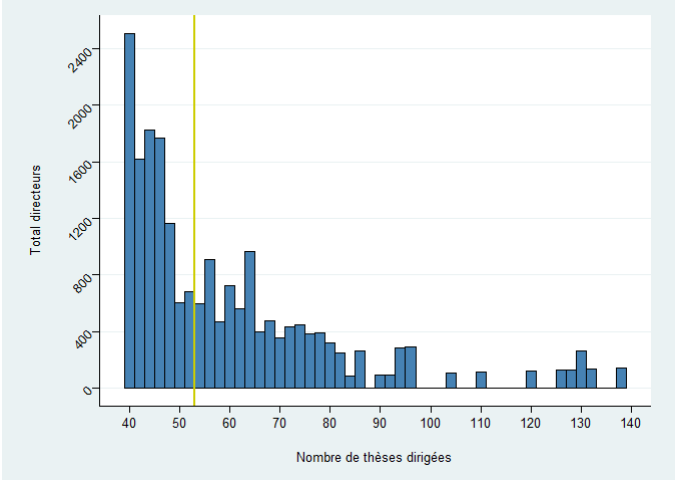
```
glimpse(these_director_outliers)
```

```
## Rows: 20,068
## Columns: 3
## Groups: Directeur de these (nom prenom) [367]
## $ `Directeur de these (nom prenom)` <chr> "Jouve Edmond", "Dekeuwer-Defossez F…
## $ `Identifiant directeur`           <chr> "26941848", "26818094", "26941848", …
## $ total_these_diriger               <int> 46, 44, 46, 41, 59, 44, 75, 75, 43, …
```

```
vis_miss(these_director_outliers)
```




```
ggplot(these_director_outliers, aes(total_these_diriger)) +
  geom_histogram(binwidth = 2, fill = "steelblue", color = "Black") +
  geom_vline(aes(xintercept = median(total_these_diriger)), color = "yellow3", size = 1) +
  labs(x = "\nNombre de thèses dirigées",
       y = "Total directeurs\n") +
  scale_x_continuous(breaks = seq(40, 140, 10)) +
  scale_y_continuous(breaks = seq(0, 2600, 400)) +
  theme_stata() +
  theme(axis.text.y = element_text(angle = 45))
```




```
# total theses >=140 & <= 240
these_director_outliers_middle <- these_director %>% filter(total_these_diriger >= 140 &
                                                            total_these_diriger <= 240)
dim(these_director_outliers_middle)
```

```
## [1] 949   3
```

```
n_distinct(these_director_outliers_middle$`Directeur de these (nom prenom)`)
```

```
## [1] 5
```

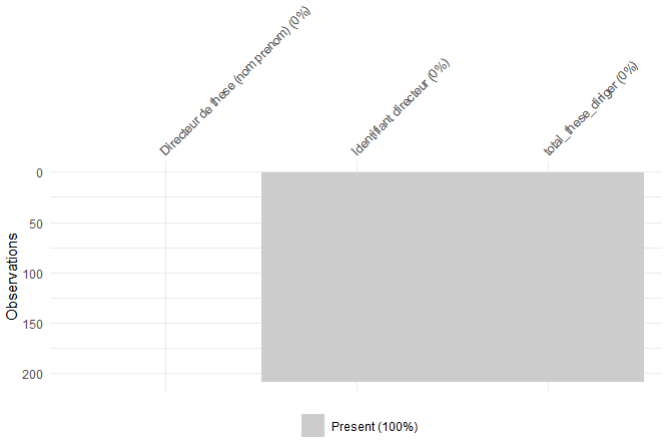
```
n_distinct(these_director_outliers_middle$`Identifiant directeur`)
```

```
## [1] 7
```

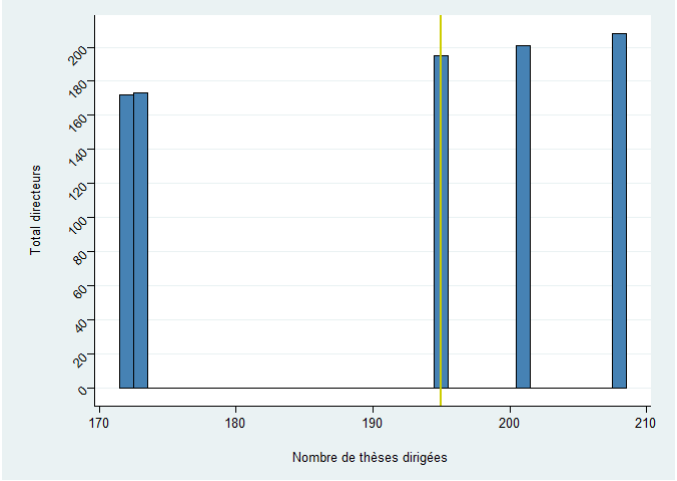
```
glimpse(these_director_outliers_middle)
```

```
## Rows: 949
## Columns: 3
## Groups: Directeur de these (nom prenom) [5]
## $ `Directeur de these (nom prenom)` <chr> "Blanc Francois-Paul", "Blanc Franco…
## $ `Identifiant directeur`           <chr> "26730774", "26730774", "26756625", …
## $ total_these_diriger               <int> 201, 201, 195, 172, 195, 195, 195, 1…
```

```
vis_miss(these_director_outliers_middle)
```




```
ggplot(these_director_outliers_middle, aes(total_these_diriger)) +
  geom_histogram(binwidth = 1, fill = "steelblue", color = "Black") +
  geom_vline(aes(xintercept = median(total_these_diriger)), color = "yellow3", size = 1) +
  labs(x = "\nNombre de thèses dirigées ",
       y = "Total directeurs\n") +
  scale_x_continuous(breaks = seq(170, 210, 10)) +
  scale_y_continuous(breaks = seq(0, 200, 20)) +
  theme_stata() +
  theme(axis.text.y = element_text(angle = 45))
```




```
# Total theses > 700.
these_director_outliers_big <- these_director %>% filter(total_these_diriger > 250)
dim(these_director_outliers_big)
```

```
## [1] 711   3
```

```
n_distinct(these_director_outliers_big$`Directeur de these (nom prenom)`)
```

```
## [1] 1
```

```
unique(these_director_outliers_big$`Directeur de these (nom prenom)`)
```

```
## [1] "Directeur de these inconnu"
```

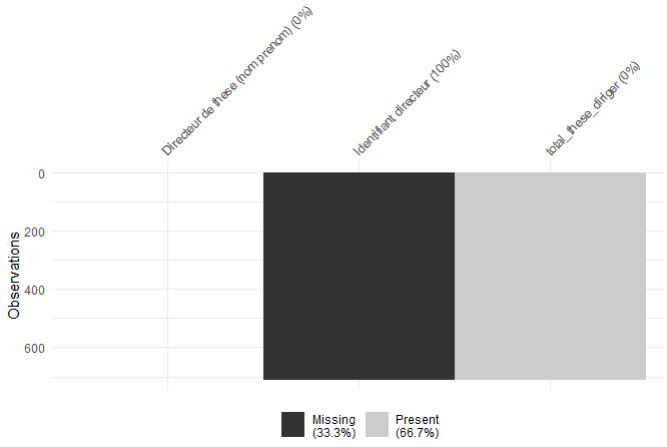
```
n_distinct(these_director_outliers_big$`Identifiant directeur`)
```

```
## [1] 1
```

```
glimpse(these_director_outliers_big)
```

```
## Rows: 711
## Columns: 3
## Groups: Directeur de these (nom prenom) [1]
## $ `Directeur de these (nom prenom)` <chr> "Directeur de these inconnu", "Direc…
## $ `Identifiant directeur`           <chr> NA, NA, NA, NA, NA, NA, NA, NA, NA, …
## $ total_these_diriger               <int> 711, 711, 711, 711, 711, 711, 711, 7…
```

```
vis_miss(these_director_outliers_big)
```



5 Résultats préliminaires

5.1 Langues

5.1.1 Import et préparation des données

```
these_langue <- these
these_langue <- rename(these_langue, Langue = `Langue de la these`)
these_langue <- these_langue %>%
  mutate(Langue = as.factor(case_when(
    is.na(Langue) ~ "NA",
    Langue ==  "fr" ~ "Français",
    Langue == "en" ~ "Anglais",
    Langue == "enfr" | Langue == "fren" ~ "Bilingue",
    TRUE ~ "Autres")))
levels(these_langue$Langue)
```

```
## [1] "Anglais"  "Autres"   "Bilingue" "Français" "NA"
```

```
summary(these_langue)
```

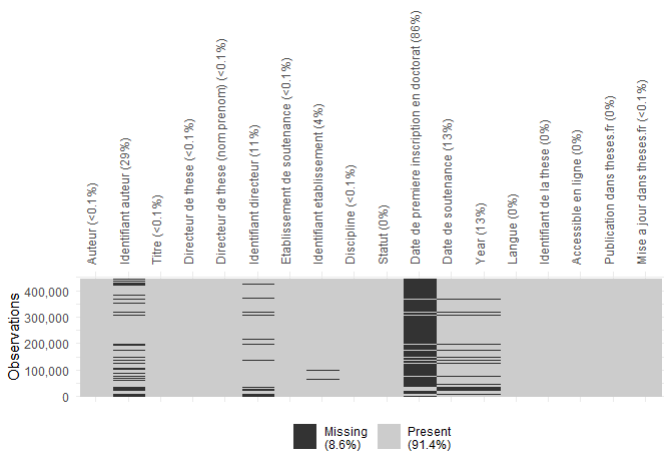
```
##     Auteur          Identifiant auteur    Titre          Directeur de these
##  Length:447644      Length:447644      Length:447644      Length:447644
##  Class :character   Class :character   Class :character   Class :character
##  Mode  :character   Mode  :character   Mode  :character   Mode  :character
##
##
##
##
##  Directeur de these (nom prenom) Identifiant directeur
##  Length:447644                   Length:447644
##  Class :character                Class :character
##  Mode  :character                Mode  :character
##
##
##
##
##  Etablissement de soutenance Identifiant etablissement  Discipline
##  Length:447644               Length:447644              Length:447644
##  Class :character            Class :character           Class :character
##  Mode  :character            Mode  :character           Mode  :character
##
##
##
##
##       Statut       Date de premiere inscription en doctorat
##  enCours : 66329   Length:447644
##  soutenue:381315   Class :character
##                    Mode  :character
##
##
##
##
##  Date de soutenance        Year           Langue       Identifiant de la these
##  Min.   :1971-01-01   Min.   :1971   Anglais : 30942   Length:447644
##  1st Qu.:1994-01-01   1st Qu.:1994   Autres  :  3164   Class :character
##  Median :2004-01-01   Median :2004   Bilingue: 15369   Mode  :character
##  Mean   :2003-06-08   Mean   :2003   Français:334404
##  3rd Qu.:2012-06-25   3rd Qu.:2012   NA      : 63765
##  Max.   :2020-07-07   Max.   :2020
##  NA's   :56746        NA's   :56746
##  Accessible en ligne Publication dans theses.fr Mise a jour dans theses.fr
##  non:347341          Min.   :2006-04-13         Min.   :2010-10-12
##  oui:100303          1st Qu.:2013-05-24         1st Qu.:2019-04-08
##                      Median :2013-05-24         Median :2020-02-26
##                      Mean   :2014-11-09         Mean   :2019-06-30
##                      3rd Qu.:2016-07-11         3rd Qu.:2020-03-08
##                      Max.   :2020-07-08         Max.   :2020-07-08
##                                                 NA's   :177
```

```
these_langue %>%
  summarise(across(everything(), n_distinct)) %>%
  glimpse()
```

```
## Rows: 1
## Columns: 18
## $ Auteur                                  <int> 430277
## $ `Identifiant auteur`                    <int> 313775
## $ Titre                                   <int> 446815
## $ `Directeur de these`                    <int> 159019
## $ `Directeur de these (nom prenom)`       <int> 159021
## $ `Identifiant directeur`                 <int> 98907
## $ `Etablissement de soutenance`           <int> 568
## $ `Identifiant etablissement`             <int> 573
## $ Discipline                              <int> 24263
## $ Statut                                  <int> 2
## $ `Date de premiere inscription en doctorat` <int> 4010
## $ `Date de soutenance`                    <int> 3992
## $ Year                                    <int> 45
## $ Langue                                  <int> 5
## $ `Identifiant de la these`               <int> 447572
## $ `Accessible en ligne`                   <int> 2
## $ `Publication dans theses.fr`            <int> 2765
## $ `Mise a jour dans theses.fr`            <int> 2634
```

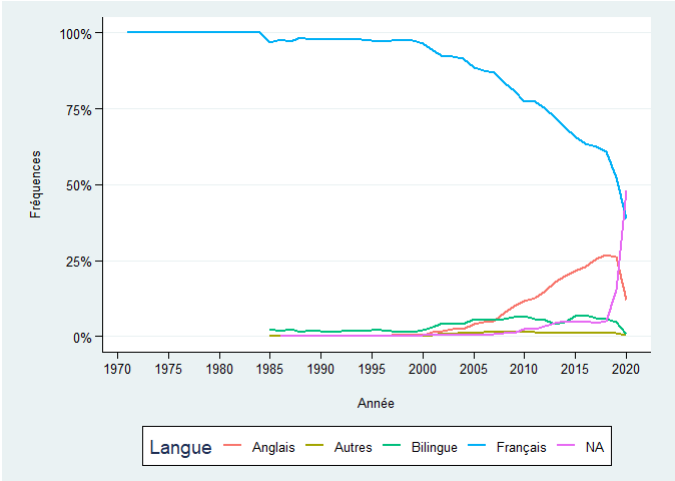
5.1.2 Données manquantes

```
vis_miss(these_langue, warn_large_data = FALSE)+
  scale_y_continuous(labels = comma) +
  theme(axis.text.x =  element_text(angle = 90))
```

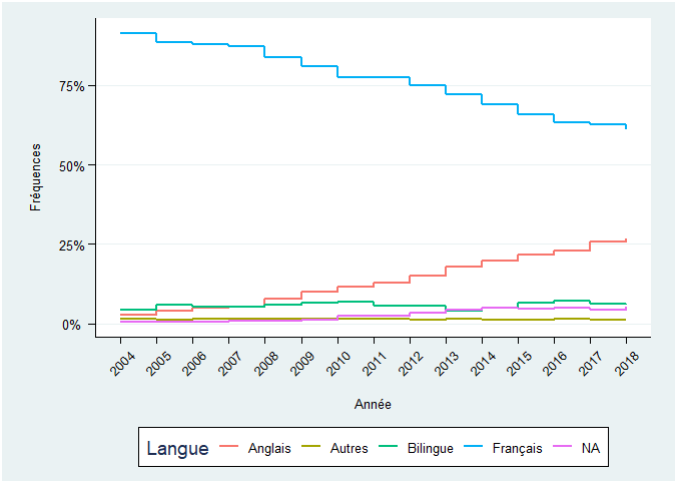


5.1.3 Exploration

```
# Fréquence des langues.
these_langue_count_year <- these_langue %>%
  select(Year) %>%
  count(Year) %>%
  rename(total_year = n)

these_langue_count_langue <- these_langue %>%
  count(Year, Langue) %>%
  rename(langue_count = n)

these_langue_fulljoin <- full_join(these_langue_count_year,
            these_langue_count_langue,
            by = "Year") %>%
  mutate(freq = langue_count / total_year)

# Jeu de données entier
these_langue_fulljoin %>%
ggplot(aes(Year, freq,  color = Langue)) +
  geom_line(size = 1) +
  scale_x_continuous(breaks = seq(1970, 2020, 5)) +
  scale_y_continuous(labels = percent_format()) +
  labs(x = "\nAnnée",
       y = "Fréquences\n") +
  theme_stata() +
  theme(axis.text.y = element_text(angle = 0))
```




```
# Période de 2004 à 2018
these_langue_fulljoin %>%
  filter(Year >= 2004 & Year <= 2018) %>%
  ggplot(aes(Year, freq, color = Langue)) +
  geom_step(size = 1) +
  scale_x_continuous(breaks = seq(2004, 2018, 1)) +
  scale_y_continuous(labels = percent_format()) +
  labs(x = "\nAnnée",
       y = "Fréquences\n") +
  theme_stata() +
  theme(axis.text.x =  element_text(angle = 45,
                                    vjust = 0.5),
        axis.text.y = element_text(angle = 0,
                                   hjust = 0.5))
```



6 SQL

```
business <- read_csv("jeux_de_donnees/business.csv")

glimpse(business)
```

```
## Rows: 4
## Columns: 4
## $ INCORP_DATE <date> 1995-05-01, 2001-01-01, 2002-06-30, 1999-05-01
## $ NAME        <chr> "Chilton Engineering", "Northeast Cooling Inc.", "Superio…
## $ STATE_ID    <chr> "12-345-678", "23-456-789", "34-567-890", "45-678-901"
## $ CUST_ID     <dbl> 10, 11, 12, 13
```

7 Travail en bonus

7.1 Heatmap des données manquantes

7.1.1 Import et préparation des données

```
these_missing_heatmap <- these %>%
  select(Year, `Langue de la these`, `Identifiant etablissement`, `Identifiant directeur`,
         `Identifiant auteur`, `Date de soutenance`, `Date de premiere inscription en doctorat`,
         Statut) %>%
  group_by(Statut) %>%
  miss_var_summary()
these_missing_heatmap$pct_miss <- round(these_missing_heatmap$pct_miss, 1)
```

7.1.2 Visualisations

```
these_missing_heatmap %>%
  ggplot(aes(Statut, variable, fill = pct_miss)) +
  geom_tile(color = "black") +
  geom_text(aes(label = pct_miss), color = "black", size = 4) +
  labs(y = "Variables\n") +
  scale_fill_gradient2(low = "#075AFF",
                       mid = "#FFFFCC",
                       high = "#FF0000") +
  guides(fill = guide_colourbar(barwidth = 0.5,
                                barheight = 20)) +
  coord_fixed()

gg_miss_fct(x = these, fct = Statut)
```

Les deux heatmap représente la même chose mais montre deux moyens de le faire diffèrement.

7.2 Problème Genre/Discipline/Langue

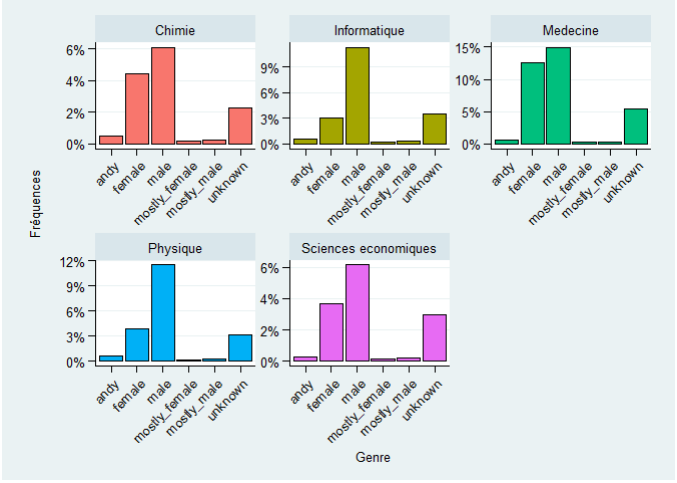
7.2.1 Problème Genre/Discipline import et préparation des données PhD_v2_gender

```
these_gender <- as_tibble(read_csv("jeux_de_donnees/PhD_v2_gender.csv"))
these_gender <- subset(these_gender, select = -c(...1))
these_gender$`Date de premiere inscription en doctorat` <- dmy(these_gender$`Date de premiere inscription en doctorat`)
these_gender$`Date de soutenance` <- dmy(these_gender$`Date de soutenance`)
these_gender$`Publication dans theses.fr` <- dmy(these_gender$`Publication dans theses.fr`)
these_gender$`Mise a jour dans theses.fr` <- dmy(these_gender$`Mise a jour dans theses.fr`)
these_gender$Statut <- as.factor(these_gender$Statut)
these_gender$`Langue de la these` <- as.factor(these_gender$`Langue de la these`)
these_gender$`Accessible en ligne` <- as.factor(these_gender$`Accessible en ligne`)
these_gender$`Identifiant directeur` <- na_if(these_gender$`Identifiant directeur`,"na")
these_gender$gender <- as.factor(these_gender$gender)
these_gender$Gender <- these_gender$gender


these_gender %>%
  subset(select = -c(gender)) %>%
  summarise(across(everything(), n_distinct)) %>%
  glimpse()
```

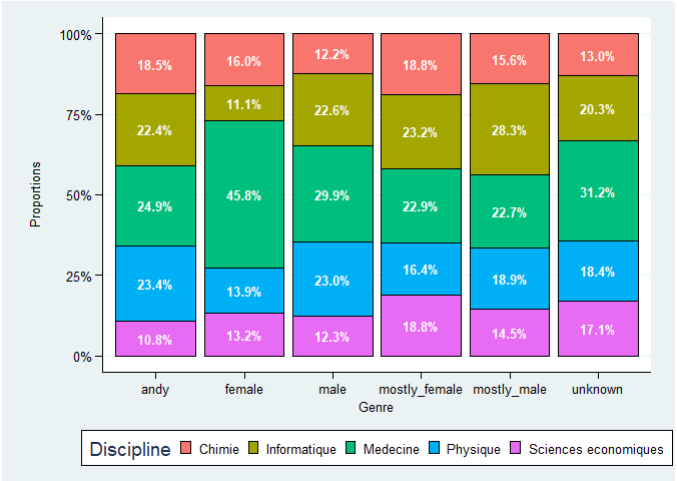
```
## Rows: 1
## Columns: 21
## $ Auteur                              <int> 430277
## $ `Identifiant auteur`                <int> 313775
## $ Titre                               <int> 446815
## $ `Directeur de these`                <int> 159019
## $ `Directeur de these (nom prenom)`   <int> 159021
## $ `Identifiant directeur`             <int> 98907
## $ `Etablissement de soutenance`       <int> 568
## $ `Identifiant etablissement`         <int> 573
## $ Discipline                          <int> 24263
## $ Statut                              <int> 2
## $ `Date de premiere inscription en doctorat` <int> 4010
## $ `Date de soutenance`                <int> 3992
## $ Year                                <int> 45
## $ `Langue de la these`                <int> 206
## $ `Identifiant de la these`           <int> 447572
## $ `Accessible en ligne`               <int> 2
## $ `Publication dans theses.fr`        <int> 2765
## $ `Mise a jour dans theses.fr`        <int> 2634
## $ First_name                          <int> 44920
## $ Last_name                           <int> 237706
## $ Gender                              <int> 6
```

7.2.2 Visualisations

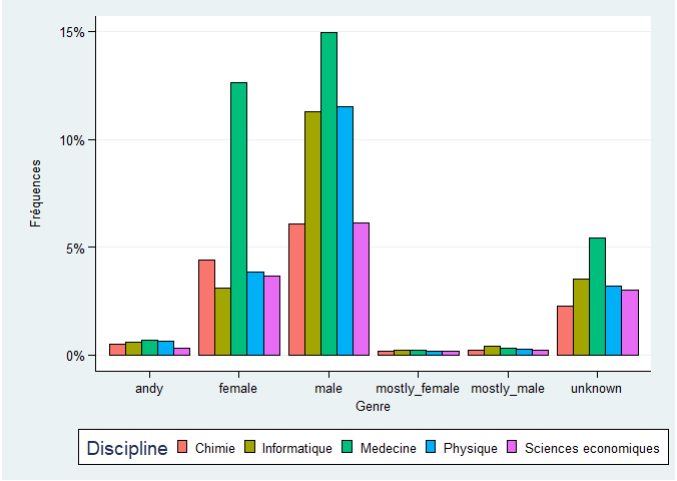
```
# Selection des top 5 disciplines
these_gender_top_5_discipline <- these_gender %>%
  select(Discipline, Gender) %>%
  count(Discipline, sort = TRUE) %>%
  slice(1:5) %>%
  subset(select = -c(n)) %>%
  pull()

these_gender_top_5_discipline <- these_gender %>%
  filter(Discipline %in% these_gender_top_5_discipline)

# Visualisations
these_gender_top_5_discipline %>%
  ggplot(aes(Gender, after_stat(count/sum(count)), fill = Discipline)) +
  geom_bar( position = "dodge", color = "black") +
  facet_wrap( ~ Discipline, scales = "free") +
  scale_y_continuous(labels = percent_format()) +
  labs(x = "Genre",
       y = "Fréquences\n") +
  theme_stata() +
  theme(legend.position = "none",
        axis.text.x = element_text(angle = 45, hjust = 1),
        strip.text.x = element_text(size = 10),
        axis.text.y = element_text(angle = 0))
```




```
these_gender_top_5_discipline %>%
  ggplot(aes(Gender, after_stat(count/sum(count)), fill = Discipline, by = Gender)) +
  geom_bar( position = "fill", color = "black") +
  geom_text(stat = "prop", position = position_fill(.5),
            colour = "white", fontface = "bold", size = 3.5) +
  scale_y_continuous(labels = percent_format()) +
  labs(x = "Genre",
       y = "Proportions\n") +
  theme_stata() +
  theme(legend.position = "bottom",
        legend.key.size = unit(0.3, 'cm'),
        legend.key.height = unit(0.3, 'cm'),
        legend.key.width = unit(0.3, 'cm'),
        legend.title = element_text(size=14),
        legend.text = element_text(size=10),
        axis.text.y = element_text(angle = 0))
```




```
these_gender_top_5_discipline %>%
  ggplot(aes(Gender, after_stat(count/sum(count)), fill = Discipline)) +
  geom_bar(position = "dodge", color = "black") +
  scale_y_continuous(labels = percent_format()) +
  labs(x = "Genre",
       y = "Fréquences\n") +
  theme_stata() +
  theme(legend.position = "bottom",
        legend.key.size = unit(0.3, 'cm'),
        legend.key.height = unit(0.3, 'cm'),
        legend.key.width = unit(0.3, 'cm'),
        legend.title = element_text(size=14),
        legend.text = element_text(size=10),
        axis.text.y = element_text(angle = 0))
```



7.2.3 Problème Genre/Discipline import et préparation des données PhD_v3

```
these_v3 <- as_tibble(read_csv("jeux_de_donnees/PhD_v3.csv"))
these_v3 <- subset(these_v3, select = -c(...1))
these_v3$`Date de premiere inscription en doctorat` <- dmy(these_v3$`Date de premiere inscription en doctorat`)
these_v3$`Date de soutenance` <- dmy(these_v3$`Date de soutenance`)
these_v3$`Publication dans theses.fr` <- dmy(these_v3$`Publication dans theses.fr`)
these_v3$`Mise a jour dans theses.fr` <- dmy(these_v3$`Mise a jour dans theses.fr`)
these_v3$Statut <- as.factor(these_v3$Statut)
these_v3$`Langue de la these` <- as.factor(these_v3$`Langue de la these`)
these_v3$`Accessible en ligne` <- as.factor(these_v3$`Accessible en ligne`)
these_v3$`Identifiant directeur` <- na_if(these_v3$`Identifiant directeur`,"na")
these_v3$Genre <- as.factor(these_v3$Genre)
these_v3 <- rename(these_v3, Discipline_prediction = `Discipline_prÃ©di`)
these_v3$Discipline_prediction <- as.factor(these_v3$Discipline_prediction)
levels(these_v3$Discipline_prediction)[levels(these_v3$Discipline_prediction) == "MathÃ©matiques"] <- "Mathematiques"
levels(these_v3$Discipline_prediction)[levels(these_v3$Discipline_prediction) == "Science de l'ingÃ©nieur" ] <- "Science de l'ingenieur"


these_v3 %>%
  summarise(across(everything(), n_distinct)) %>%
  glimpse()
```

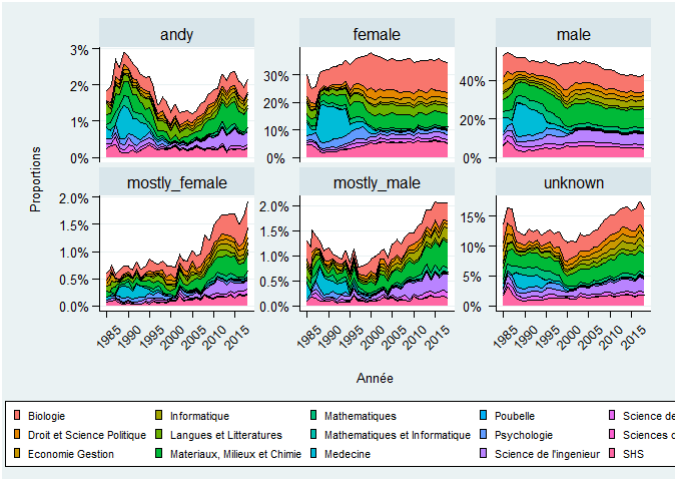
```
## Rows: 1
## Columns: 22
## $ Auteur                          <int> 430272
## $ `Identifiant auteur`            <int> 313772
## $ Titre                           <int> 446812
## $ `Directeur de these`            <int> 159018
## $ `Directeur de these (nom prenom)` <int> 159020
## $ `Identifiant directeur`         <int> 98906
## $ `Etablissement de soutenance`   <int> 568
## $ `Identifiant etablissement`     <int> 573
## $ Discipline                      <int> 24262
## $ Statut                          <int> 2
## $ `Date de premiere inscription en doctorat` <int> 4010
## $ `Date de soutenance`            <int> 3992
## $ Year                            <int> 45
## $ `Langue de la these`            <int> 206
## $ `Identifiant de la these`       <int> 447567
## $ `Accessible en ligne`           <int> 2
## $ `Publication dans theses.fr`    <int> 2765
## $ `Mise a jour dans theses.fr`    <int> 2634
## $ Discipline_prediction           <int> 15
## $ Genre                           <int> 6
## $ etablissement_rec               <int> 111
## $ Langue_rec                      <int> 5
```

7.2.4 Préparation des tables intermédiaires

```
these_v3_count_year <- these_v3 %>%
  filter(Year >= 1985 & Year <= 2018) %>%
  count(Year) %>%
  rename(total_year = n)

these_v3_year_genre_discipline <-  these_v3  %>%
  filter(Year >= 1985 & Year <= 2018) %>%
  count(Year, Genre, Discipline_prediction) %>%
  rename(total = n)

these_genre_discipline_full <- full_join(these_v3_count_year,
                                 these_v3_year_genre_discipline,
                                 by = "Year") %>%
  mutate(freq = total / total_year) %>%
  drop_na()
```

7.2.5 Visualisation

```
these_genre_discipline_full %>%
  ggplot(aes(Year, freq, fill = Discipline_prediction)) +
  geom_area(color = "black") +
  facet_wrap( ~ Genre, scales = "free_y") +
  scale_x_continuous(breaks = seq(1985, 2020, 5)) +
  scale_y_continuous(labels = percent_format()) +
  labs(x = "\nAnnée",
       y = "Proportions\n")  +
  theme_stata() +
  theme(axis.text.x =  element_text(angle = 45,
                                    vjust = 0.5),
        axis.text.y = element_text(angle = 0,
                                   hjust = 0.5),
        legend.key.size = unit(0.2, "cm"),
        legend.text = element_text(size = '8'),
        legend.title = element_blank())
```



7.2.6 Problème Langue/Discipline import et préparation des données PhD_v3

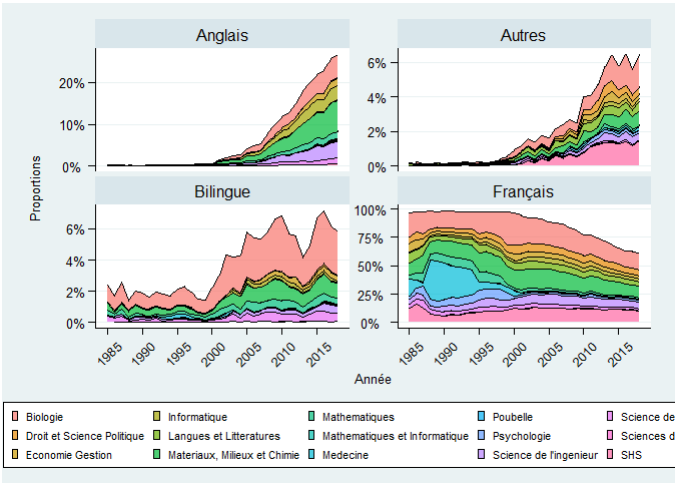
```
these_v3_langue <- these_v3
these_v3_langue <- rename(these_v3_langue, Langue = `Langue de la these`)
these_v3_langue <- these_v3_langue %>%
  mutate(Langue = as.factor(case_when(
    is.na(Langue) ~ "NA",
    Langue ==  "fr" ~ "Français",
    Langue == "en" ~ "Anglais",
    Langue == "enfr" | Langue == "fren" ~ "Bilingue",
    TRUE ~ "Autres")))
```

7.2.7 Préparation des tables intermédiaires

```
these_soutenance_year_langue_discipline <-  these_v3_langue  %>%
  filter(Year >= 1985 & Year <= 2018) %>%
  count(Year, Langue, Discipline_prediction) %>%
  rename(total = n)

these_genre_discipline_full <- full_join(these_v3_count_year,
                                 these_soutenance_year_langue_discipline,
                                 by = "Year") %>%
  mutate(freq = total / total_year)
```

7.2.8 Visualisation

```
these_genre_discipline_full %>%
  ggplot(aes(Year, freq, fill = Discipline_prediction)) +
  geom_area(color = "black", alpha = 0.7) +
  facet_wrap( ~ Langue , scales = "free_y") +
  scale_x_continuous(breaks = seq(1985, 2020, 5)) +
  scale_y_continuous(labels = percent_format()) +
  labs(x = "Année",
       y = "Proportions\n") +
  theme_stata() +
  theme(axis.text.x =  element_text(angle = 45,
                                    vjust = 0.5),
        axis.text.y = element_text(angle = 0,
                                   hjust = 0.5),
        legend.key.size = unit(0.2, "cm"),
        legend.text = element_text(size = '8'),
        legend.title = element_blank())
```



7.3 Webscraping

```r
######################## Déclaration des séquences ###############################################
langue <- c("fr", "en", "es")
numero_page <- seq(0, 500, 10)
numero_page_langue <- seq(0, 300, 10)

######################## Déclaration des tibbles #################################################
thesis_webscraping_info <- tibble()
thesis_webscraping_pdf <- tibble()
thesis_webscraping_langue <- tibble()

######################## Scrap des informations ##################################################
for (page_result in numero_page) {
  link_infos <- paste0("https://theses.fr/fr/?q=&fq=dateSoutenance:[1965-01-01T23:59:59Z%2BTO%2B2022-12-31T23:59:59Z]&checkedfacets
=&start=",
                page_result,"&sort=none&status=&access=&prevision=&filtrepersonne=&zone1=titreRAs&val1=&op1=AND&zone2=auteurs&val2=&
op2=AND&zone3=etabSoutenances&val3=&op3=AND&zone4=dateSoutenance&val4a=&val4b=&type=")
  pages_infos <- read_html(link_infos)

  Titre <- pages_infos %>% html_nodes("h2 a") %>% html_text2() %>% str_to_lower() %>%
    str_to_sentence()

  Auteur <- pages_infos %>% html_nodes("#resultat p") %>% html_text2() %>%
    str_split("\\r", n = 2) %>% map_chr(1) %>% sub(".*? ", "", .)

  Discipline <- pages_infos %>% html_nodes(".domaine h5:nth-child(1)") %>% html_text2()

  Directeur <- pages_infos %>% html_nodes("#resultat p") %>% html_text2() %>%
    str_split("\\r", n = 3) %>%
    map_chr(3) %>% sub(".*? ", "", .) %>% str_replace(" et de \r", ",") %>%
    str_split("\\r") %>% map_chr(1)

  Etablissment <- pages_infos %>% html_nodes("#resultat p") %>% html_text2() %>%
    str_split("\\r", n = 3) %>%
    map_chr(3) %>% sub(".*? ", "", .) %>% str_replace(" et de \r", ",") %>%
    str_split("\\r") %>% map_chr(2) %>% str_remove(" - ")

  Statut <- pages_infos %>% html_nodes("div.statusThese img") %>% html_attr("title")

  Date_soutenance_ymd <- pages_infos %>% html_nodes("br+ h5") %>% html_text2() %>%
    str_remove("En préparation depuis le ") %>% str_sub(13, 22) %>% dmy()

  Date_soutenance_y <-  pages_infos %>% html_nodes("br+ h5") %>% html_text2() %>%
    str_remove_all("En préparation depuis le ") %>% str_remove_all("Soutenue le ") %>%
    str_sub(12, 16) %>% as.Date(as.character(), format = "%Y") %>% year()

  Date_inscription <- pages_infos %>% html_nodes("br+ h5") %>% html_text2() %>%
    str_sub(25, 35) %>% dmy()


  thesis_webscraping_info <- rbind(thesis_webscraping_info, tibble(Auteur, Titre, Discipline, Directeur,
                                     Etablissment, Statut, Date_inscription,
                                     Date_soutenance_ymd, Date_soutenance_y))

}

######################## Scrap des pdf ###########################################################
for (page_pdf in numero_page) {
  link_pdf <- paste0("https://theses.fr/fr/?q=&fq=dateSoutenance:[1965-01-01T23:59:59Z%2BTO%2B2022-12-31T23:59:59Z]&checkedfacets=&
start=",page_pdf,"&sort=none&status=&access=accessible:oui&prevision=&filtrepersonne=&zone1=titreRAs&val1=&op1=AND&zone2=auteurs
&val2=&op2=AND&zone3=etabSoutenances&val3=&op3=AND&zone4=dateSoutenance&val4a=&val4b=&type=")
  pages_pdf <- read_html(link_pdf)

  Link_to_pdf <- pages_pdf %>% html_nodes(".arrondi-10x a") %>% html_attr("href") %>%
    paste0("theses.fr", .)

  Auteur <- pages_pdf %>% html_nodes("#resultat p") %>% html_text2() %>%
    str_split("\\r", n = 2) %>% map_chr(1) %>% sub(".*? ", "", .)

  thesis_webscraping_pdf <- rbind(thesis_webscraping_pdf, tibble(Auteur, Link_to_pdf))

}


######################## Scrap des langues (Pbm duplicate later) #################################
for(Lg in langue){
  for (npl in numero_page_langue) {
    link_langue <- paste0("https://theses.fr/fr/?q=&fq=dateSoutenance:[1965-01-01T23:59:59Z%2BTO%2B2022-12-31T23:59:59Z]&checkedfac
ets=langueThese=",Lg,"&start=",npl,"&status=&access=&prevision=&filtrepersonne=&zone1=titreRAs&val1=&op1=AND&zone2=auteurs&val2
=&op2=AND&zone3=etabSoutenances&val3=&op3=AND&zone4=dateSoutenance&val4a=&val4b=&type=")
    pages_langue <- read_html(link_langue)

    Auteur <- pages_langue %>% html_nodes("#resultat p") %>% html_text2() %>%
      str_split("\\r", n = 2) %>% map_chr(1) %>% sub(".*? ", "", .)

    Langue <- Lg

    thesis_webscraping_langue <- rbind(thesis_webscraping_langue, tibble(Auteur, Langue))

  }
}

######################## Fusion des tibbles ######################################################
thesis_webscraping <- left_join(thesis_webscraping_info, thesis_webscraping_pdf, by = "Auteur")
thesis_webscraping <- left_join(thesis_webscraping, thesis_webscraping_langue, by = "Auteur")


######################## Data wrangling ##########################################################
thesis_webscraping <- thesis_webscraping %>% mutate(Statut = case_when(Statut == " thèse en cours de préparation" ~ "en_cours", Statut =
= "thèse soutenue" ~ "soutenue"))


glimpse(thesis_webscraping)
```

```
## Rows: 0
## Columns: 11
## $ Auteur              <chr>
## $ Titre               <chr>
## $ Discipline          <chr>
## $ Directeur           <chr>
## $ Etablissment        <chr>
## $ Statut              <chr>
## $ Date_inscription    <date>
## $ Date_soutenance_ymd <date>
## $ Date_soutenance_y   <dbl>
## $ Link_to_pdf         <chr>
## $ Langue              <chr>
```

```
summary(thesis_webscraping)
```

```
##    Auteur             Titre            Discipline         Directeur
##  Length:0           Length:0           Length:0           Length:0
##  Class :character   Class :character   Class :character   Class :character
##  Mode  :character   Mode  :character   Mode  :character   Mode  :character
##
##
##
##  Etablissment          Statut         Date_inscription Date_soutenance_ymd
##  Length:0           Length:0           Min.   :NA       Min.   :NA
##  Class :character   Class :character   1st Qu.:NA       1st Qu.:NA
##  Mode  :character   Mode  :character   Median :NA       Median :NA
##                                        Mean   :NaN      Mean   :NaN
##                                        3rd Qu.:NA       3rd Qu.:NA
##                                        Max.   :NA       Max.   :NA
##  Date_soutenance_y Link_to_pdf          Langue
##  Min.   : NA       Length:0           Length:0
##  1st Qu.: NA       Class :character   Class :character
##  Median : NA       Mode  :character   Mode  :character
##  Mean   :NaN
##  3rd Qu.: NA
##  Max.   : NA
```

```
head(thesis_webscraping)
```

Auteur	Titre	Discipline	Directeur	Etablissment	Statut	Date_inscription	Date_soutenance_ymd	Date_soutenance_y	Link_to_pdf	Langue