Stacking DataFrames

RESHAPING DATA WITH PANDAS

Maria Eugenia Inzaugarat
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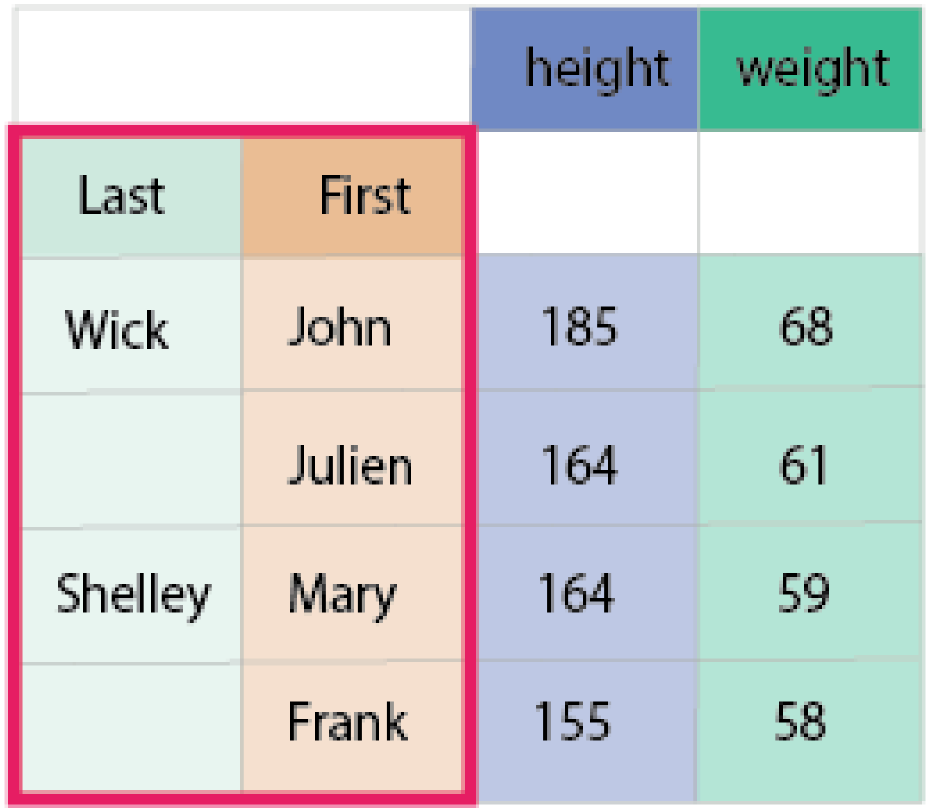
Row multi-indices



		height	weight
Last	First		
Wick	John	185	68
	Julien	164	61
Shelley	Mary	164	59
	Frank	155	58

Setting the index

```
churn
```

```
   credit_score age  country  num_products exited
0           619  43   France             1    Yes
1           608  34  Germany             0     No
2           502  23   France             1    Yes
```

Setting the index

```
churn.set_index(['country', 'age'], inplace=True)
```

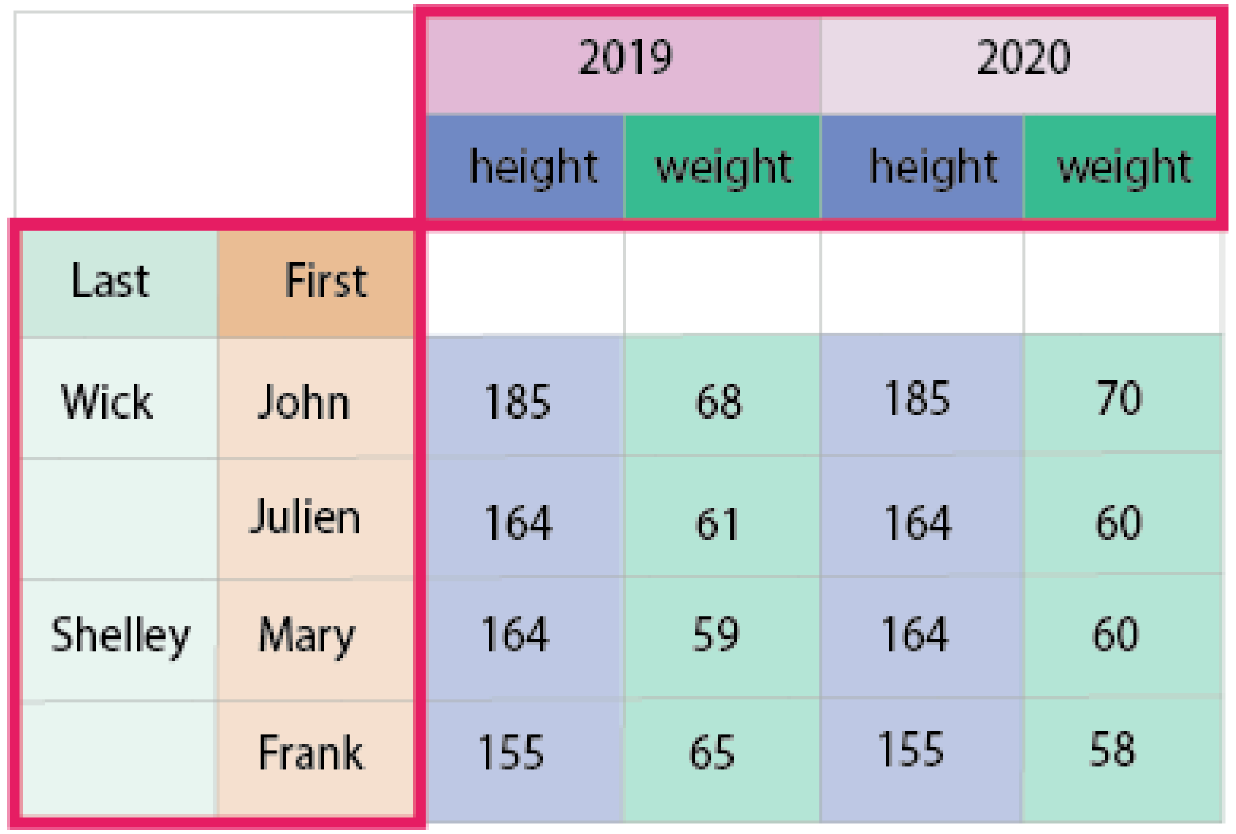
```
             credit_score num_products exited
age  country
 43   France          619            1    Yes
 34  Germany          608            0     No
 23   France          502            1    Yes
```

MultiIndex from array

```python
new_array = [['yes', 'no', 'yes'], ['no', 'yes', 'yes']]
churn.index = pd.MultiIndex.from_arrays(new_array, names=['member', 'credit_card'])
churn
```

```
                    credit_score age  country  num_products exited
member credit_card
   yes          no           619  43   France             1    Yes
    no         yes           608  34  Germany             0     No
   yes         yes           502  23   France             1    Yes
```

MultiIndex DataFrames



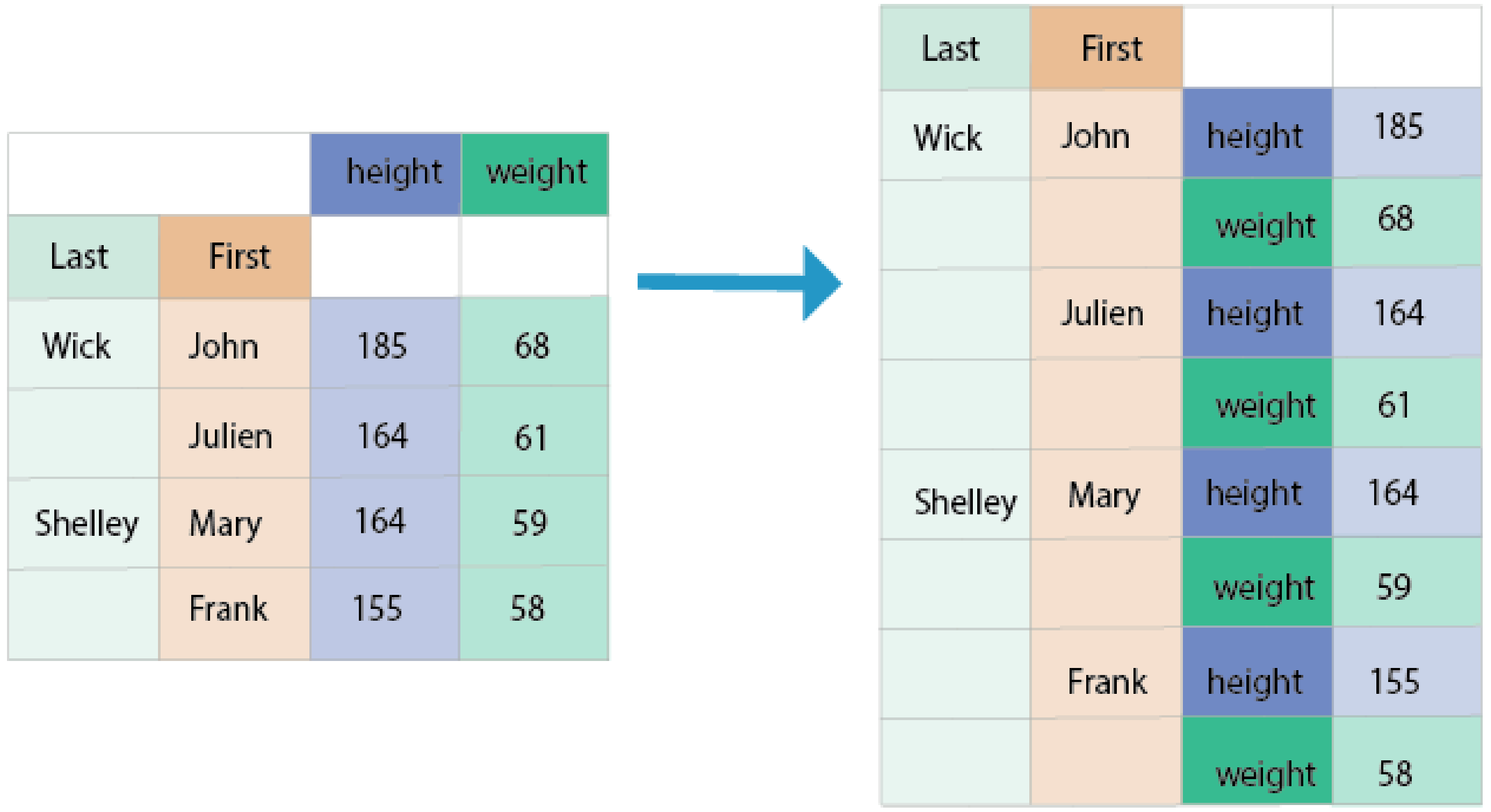
		2019		2020	
		height	weight	height	weight
Last	First				
Wick	John	185	68	185	70
	Julien	164	61	164	60
Shelley	Mary	164	59	164	60
	Frank	155	65	155	58

MultiIndex DataFrames

```
index = pd.MultiIndex.from_arrays([['Wick', 'Wick', 'Shelley', 'Shelley'],
                                   ['John', 'Julien', 'Mary', 'Frank']],
                      names=['last', 'first'])
columns = pd.MultiIndex.from_arrays([['2019', '2019', '2020', '2020'],
                                     ['age', 'weight', 'age', 'weight']],
                        names=['year', 'feature'])
patients = pd.DataFrame(data, index=index, columns=columns)
patients
```

```
             year      2019         2020
          feature  age weight  age weight
   last     first
   Wick      John   25     68   26     72
           Julien   31     72   32     73
Shelley      Mary   41     68   42     69
            Frank   32     75   33     74
```

The .stack() method



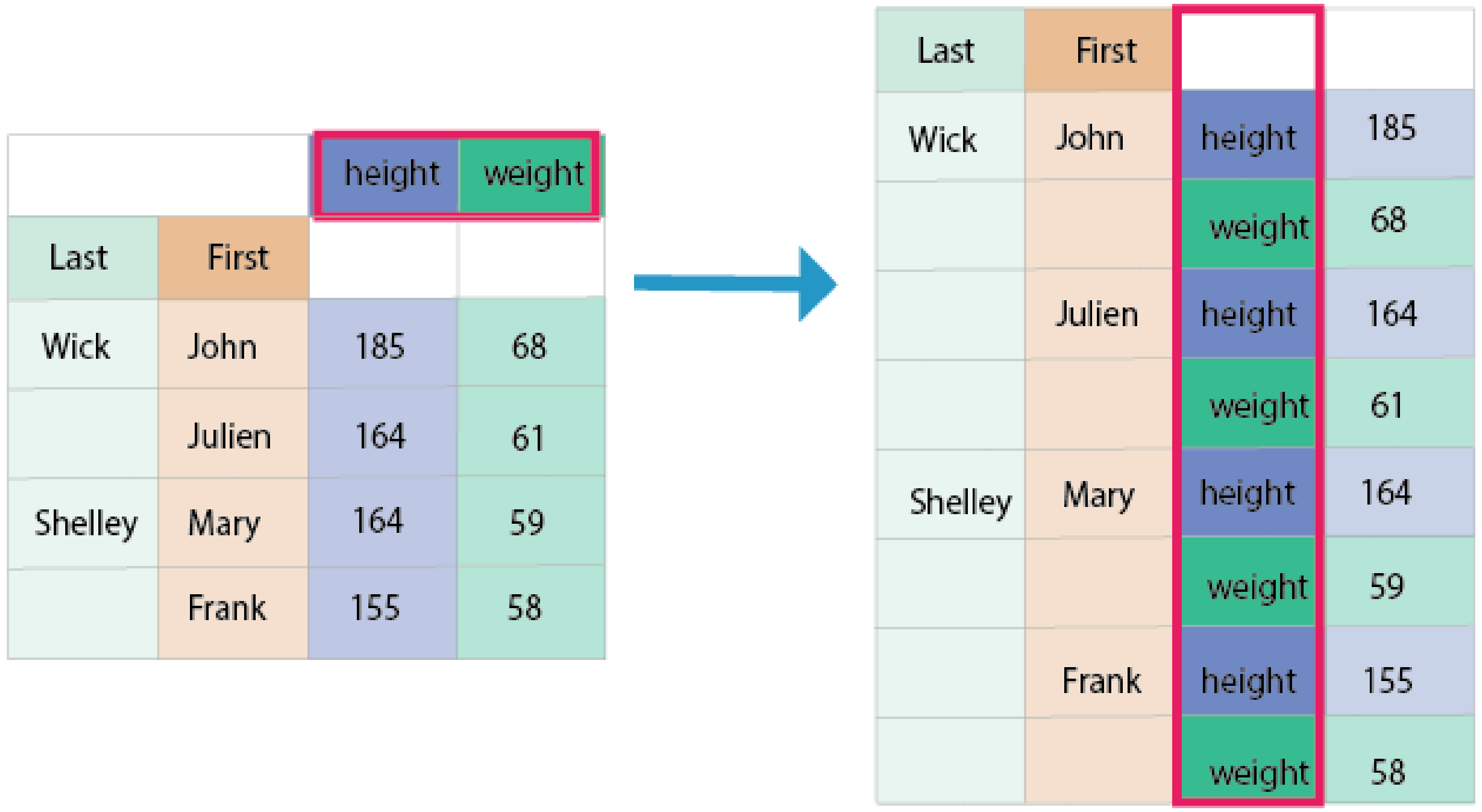
		height	weight
Last	First		
Wick	John	185	68
	Julien	164	61
Shelley	Mary	164	59
	Frank	155	58

Last	First		
Wick	John	height	185
		weight	68
	Julien	height	164
		weight	61
Shelley	Mary	height	164
		weight	59
	Frank	height	155
		weight	58

```
df.stack()
```

The .stack() method

Rearrange a level of the columns to obtain a reshaped DataFrame with a new inner-most level row index



		height	weight
Last	First		
Wick	John	185	68
	Julien	164	61
Shelley	Mary	164	59
	Frank	155	58

Last	First		
Wick	John	height	185
		weight	68
	Julien	height	164
		weight	61
Shelley	Mary	height	164
		weight	59
	Frank	height	155
		weight	58

Stack into a series

```python
churn
```

```
   credit_score age  country  num_products exited
0           619  43   France             1    Yes
1           608  34  Germany             0     No
2           502  23   France             1    Yes
```

```python
churned_stacked = churn.stack()
churned_stacked.head(10)
```

```
member  credit_card
yes     no             credit_score        619
                       age                  43
                       country          France
                       num_products          1
                       churn               Yes
no      yes            credit_score        608
                       age                  34
                       country         Germany
                       num_products          0
                       churn                No
```

Stack into a DataFrame

```
patients
```

```
             year      2019        2020
          feature  age weight  age weight
   last     first
   Wick      John   25     68   26     72
           Julien   31     72   32     73
Shelley      Mary   41     68   42     69
            Frank   32     75   33     74
```

```
patients_stacked = patients.stack()
patients_stacked
```

```
                    year  2019 2020
 last    first  feature
 Wick     John      age    25   26
                 weight    68   72
        Julien      age    31   32
                 weight    72   73
Shelley  Mary       age    41   42
                 weight    68   69
        Frank       age    32   33
                 weight    75   74
```

Stack a level by number

```
patients
```

```
          year       2019         2020
       feature  age weight  age weight
   last  first
   Wick   John   25     68   26     72
        Julien   31     72   32     73
Shelley   Mary   41     68   42     69
         Frank   32     75   33     74
```

```
patients.stack(level=0)
```

```
               feature  age weight
   last  first    year
   Wick   John    2019   25     68
                  2020   26     72
        Julien    2019   31     72
                  2020   32     73
Shelley   Mary    2019   41     68
                  2020   42     69
         Frank    2019   32     75
                  2020   33     74
```

Stack a level by name

```python
patients
```

```
           year     2019         2020
        feature  age weight  age weight
   last   first
   Wick    John   25     68   26     72
         Julien   31     72   32     73
Shelley    Mary   41     68   42     69
          Frank   32     75   33     74
```

```python
patients.stack(level='year')
```

```
            feature  age weight
   last  first   year
   Wick   John   2019   25     68
                 2020   26     72
         Julien  2019   31     72
                 2020   32     73
Shelley   Mary   2019   41     68
                 2020   42     69
          Frank  2019   32     75
                 2020   33     74
```

Let's practice!

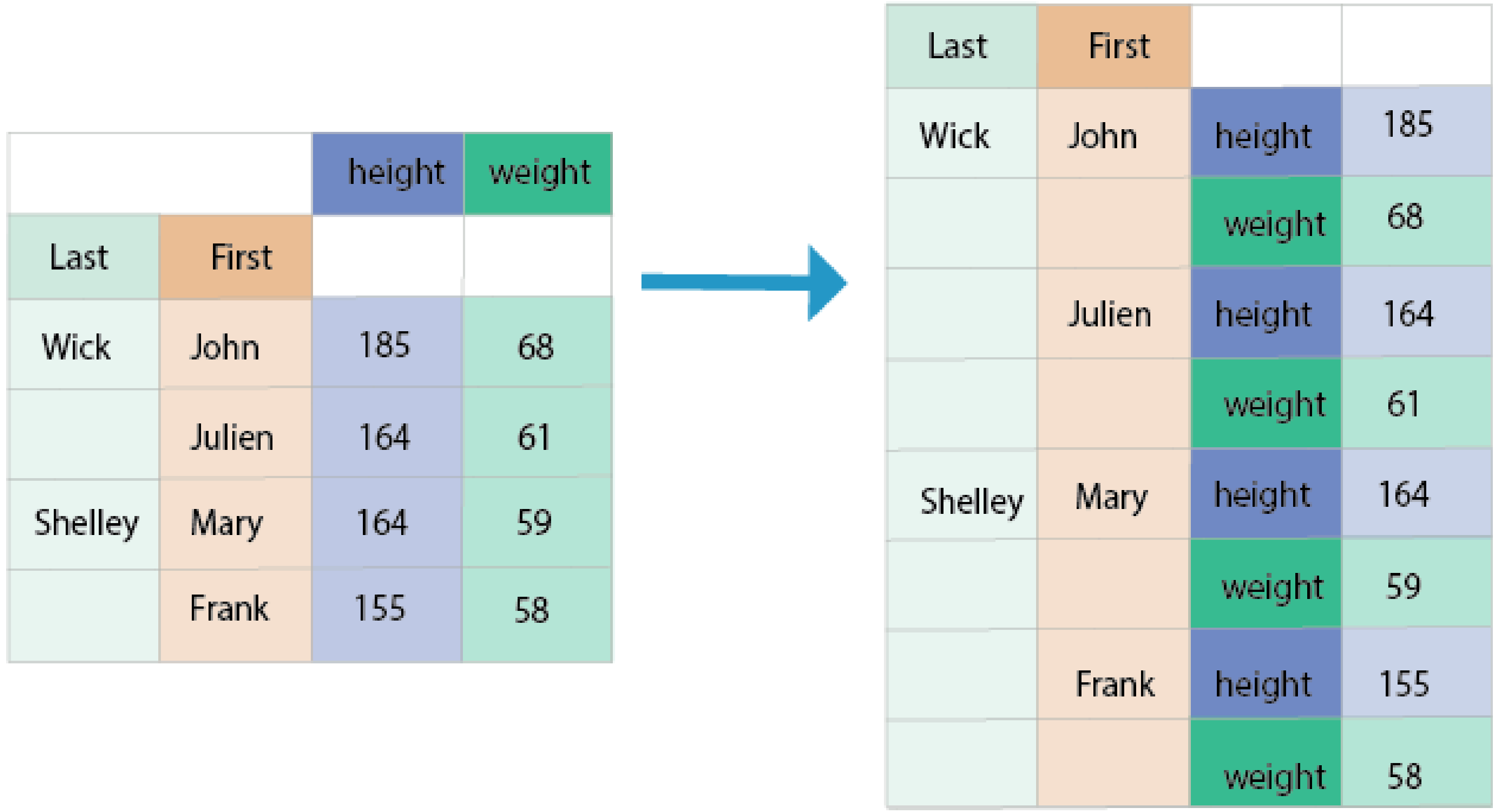
RESHAPING DATA WITH PANDAS

Unstacking DataFrames

RESHAPING DATA WITH PANDAS

Maria Eugenia Inzaugarat
Data Scientist

Review

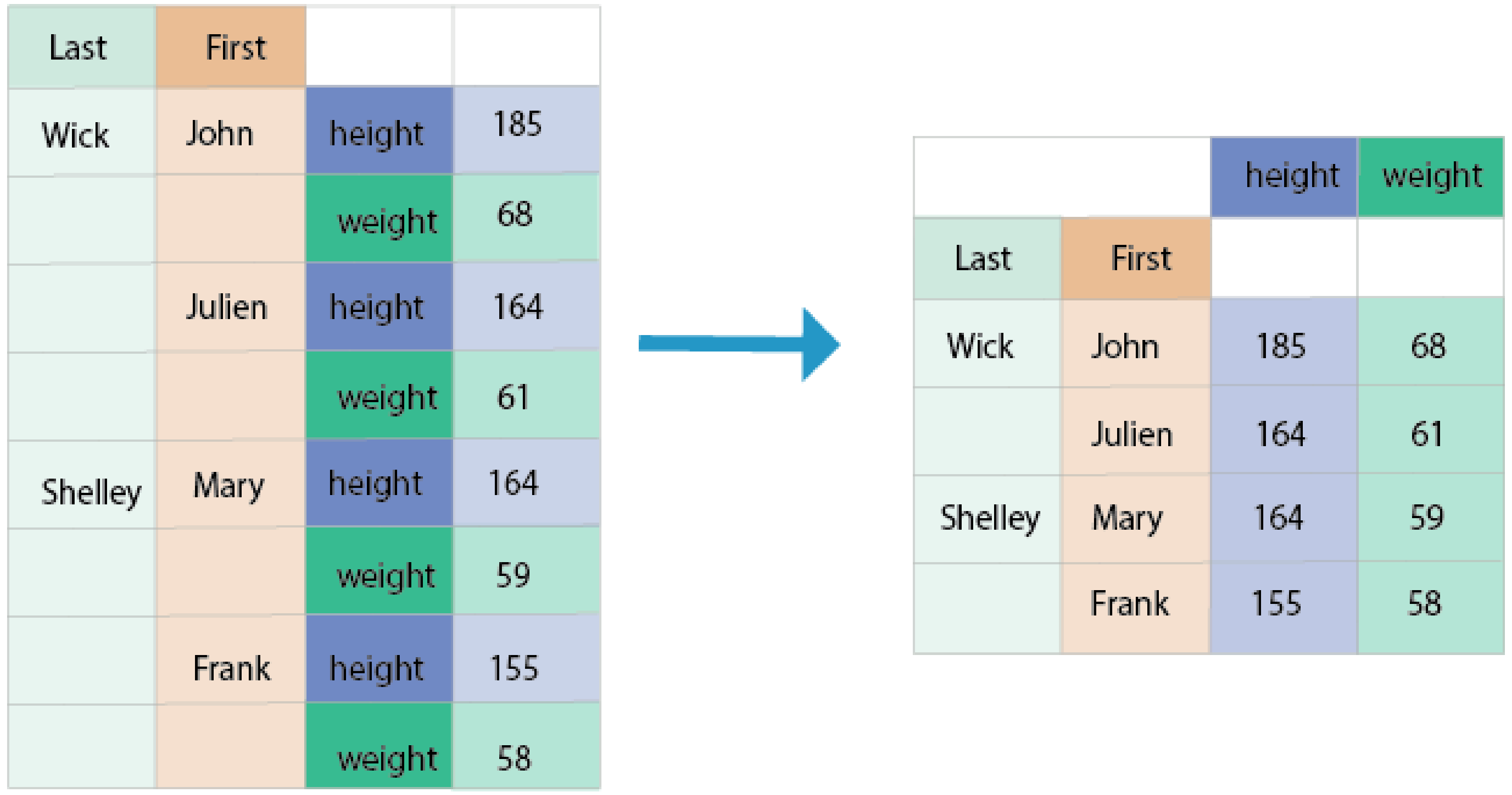


		height	weight
Last	First		
Wick	John	185	68
	Julien	164	61
Shelley	Mary	164	59
	Frank	155	58

Last	First		
Wick	John	height	185
		weight	68
	Julien	height	164
		weight	61
Shelley	Mary	height	164
		weight	59
	Frank	height	155
		weight	58

df.stack()

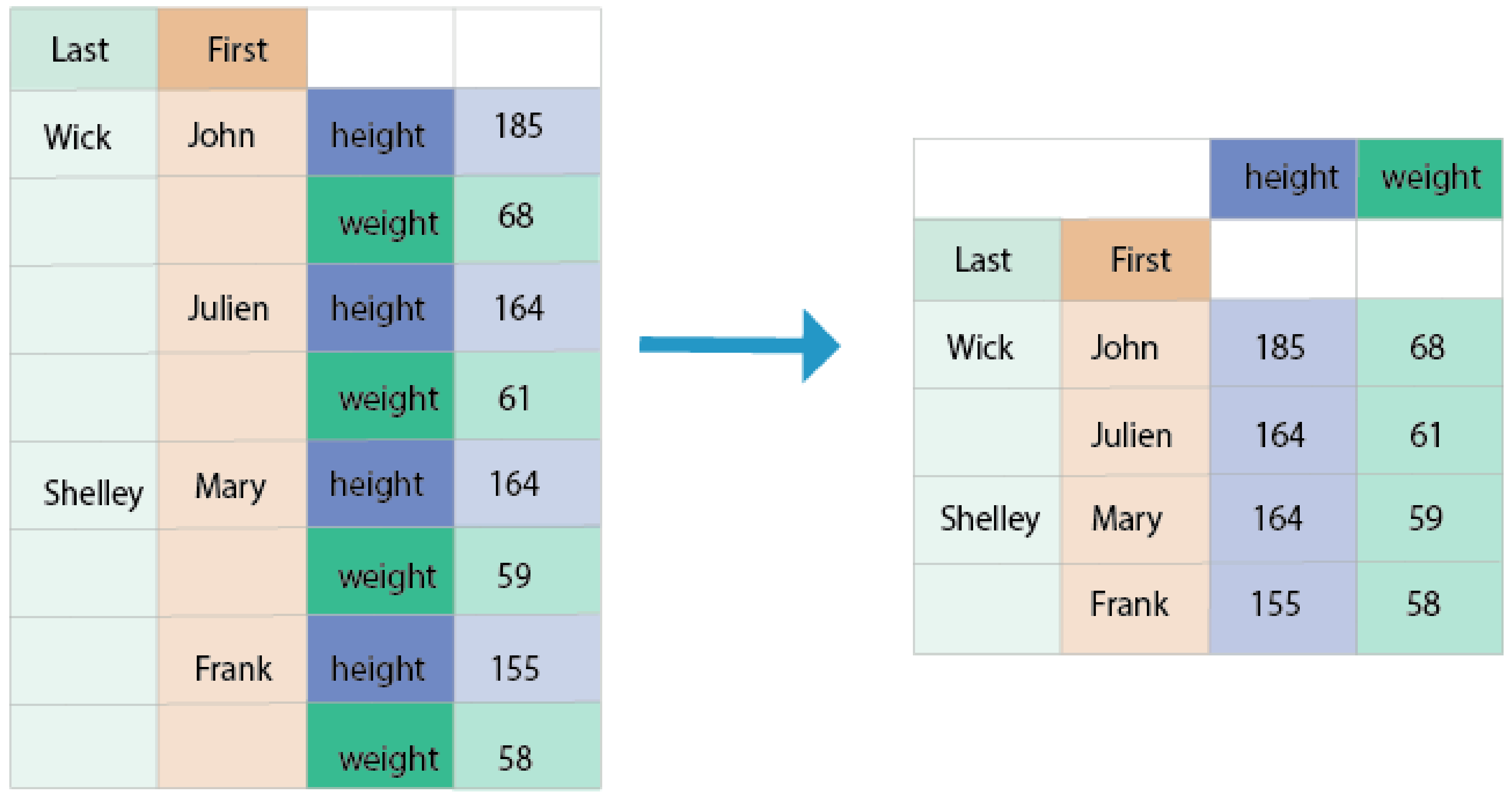
Undoing stacking process



Last	First		
Wick	John	height	185
		weight	68
	Julien	height	164
		weight	61
Shelley	Mary	height	164
		weight	59
	Frank	height	155
		weight	58

		height	weight
Last	First		
Wick	John	185	68
	Julien	164	61
Shelley	Mary	164	59
	Frank	155	58

The .unstack() method



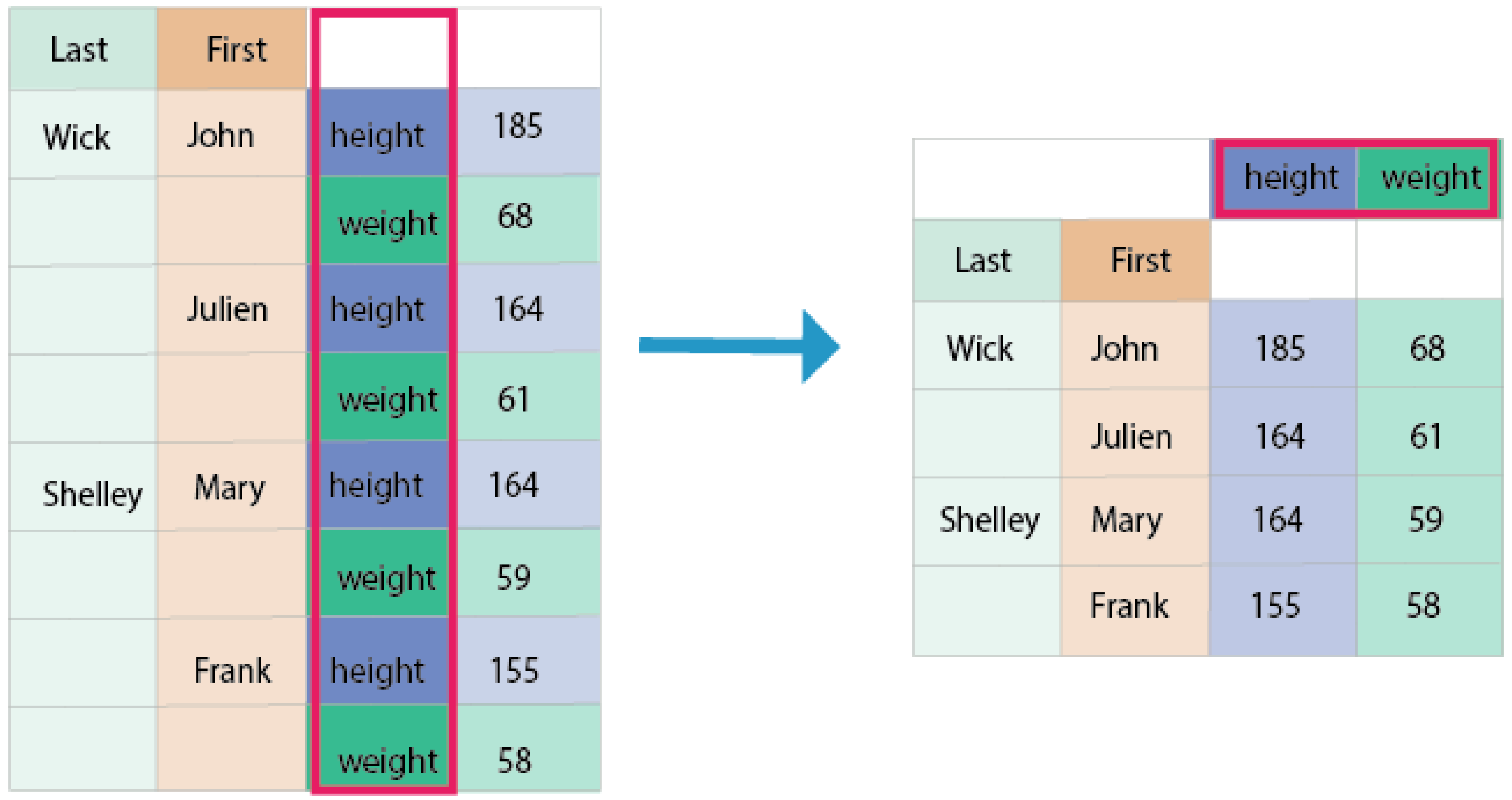
Last	First		
Wick	John	height	185
		weight	68
	Julien	height	164
		weight	61
Shelley	Mary	height	164
		weight	59
	Frank	height	155
		weight	58

		height	weight
Last	First		
Wick	John	185	68
	Julien	164	61
Shelley	Mary	164	59
	Frank	155	58

```
df.unstack()
```

The .unstack() method

Rearrange a level of the row index into the columns to obtain a reshaped DataFrame with a new inner-most level column index.



Last	First		
Wick	John	height	185
		weight	68
	Julien	height	164
		weight	61
Shelley	Mary	height	164
		weight	59
	Frank	height	155
		weight	58

		height	weight
Last	First		
Wick	John	185	68
	Julien	164	61
Shelley	Mary	164	59
	Frank	155	58

Unstack Series

```
churn_stacked
```

```
member  credit_card
yes     no            credit_score         619
                      age                   43
                      country           France
                      num_products           1
                      churn                Yes
no      yes           credit_score         608
                      age                   34
                      country          Germany
                      num_products           0
                      churn                 No
yes     yes           credit_score         502
                      age                   23
                      country           France
                      num_products           1
                      churn                Yes
```

Unstack Series

```
churned_stacked.unstack()
```

```
                    credit_score age  country  num_products exited
member credit_card                                              
    no         yes           608  34  Germany             0     No
   yes          no           619  43   France             1    Yes
               yes           502  23   France             1    Yes
```

Unstacking a DataFrame

```
patients_stacked
```

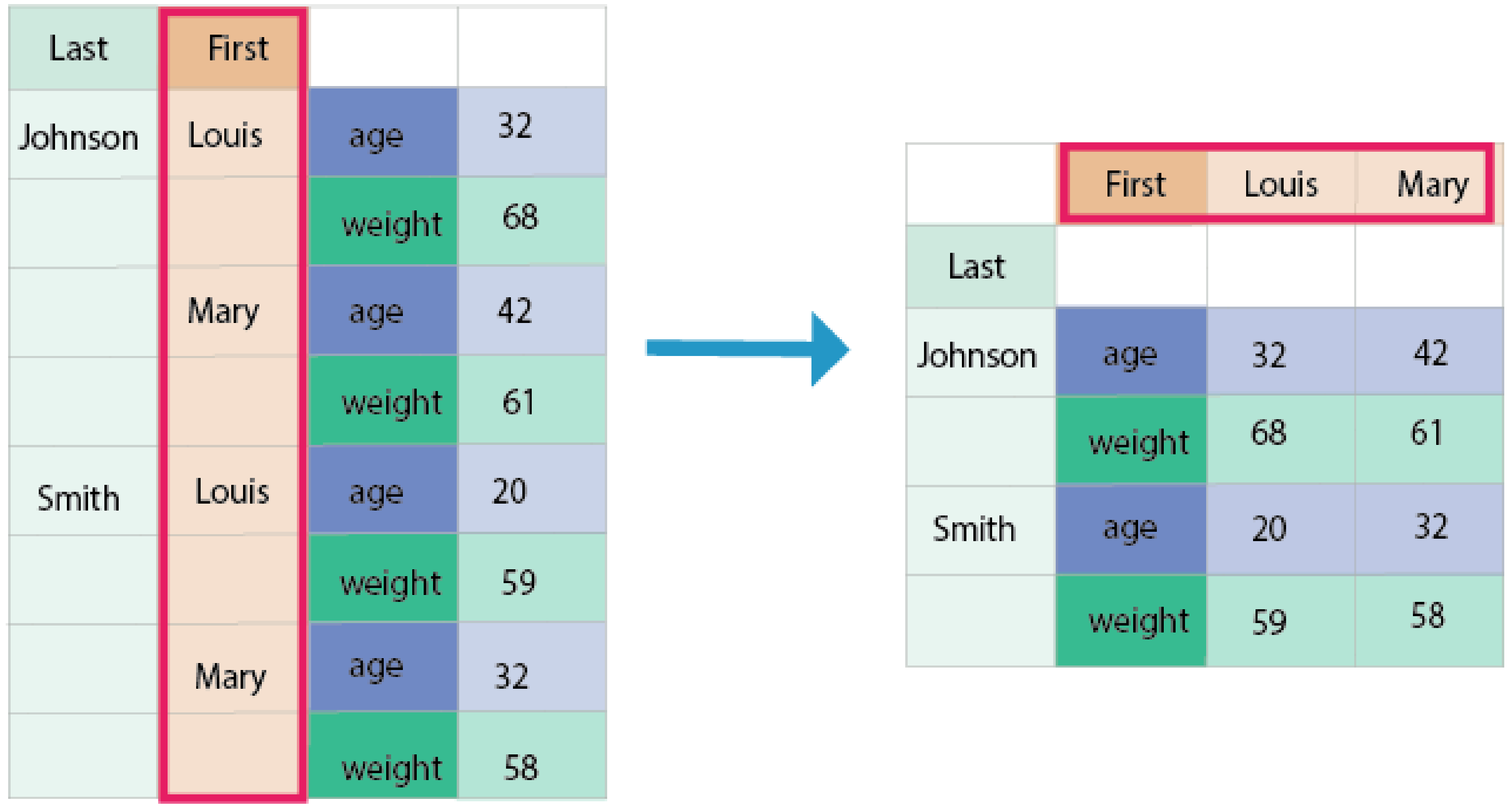
```
                   year  2019 2020
  first   last feature
   Wick   John     age    25   26
                weight    68   72
        Julien     age    31   32
                weight    72   73
Shelley   Mary     age    41   42
                weight    68   69
         Frank     age    32   33
                weight    75   74
```

Unstacking a DataFrame

```
patients_stacked.unstack()
```

```
                       2019        2020
        feature  age weight age weight
   last   first
Shelley   Frank   32     75  33     74
           Mary   41     68  42     69
   Wick    John   25     68  26     72
         Julien   31     72  32     73
```

Unstack a level



Last	First		
Johnson	Louis	age	32
		weight	68
	Mary	age	42
		weight	61
Smith	Louis	age	20
		weight	59
	Mary	age	32
		weight	58

	First	Louis	Mary
Last			
Johnson	age	32	42
	weight	68	61
Smith	age	20	32
	weight	59	58

df.unstack(level=1) or df.unstack(level='First')

Unstack level by number

```
churn_stacked.head(10)
```

```
member  credit_card
yes     no             credit_score         619
                       age                   43
                       country           France
                       num_products           1
                       churn                Yes
no      yes            credit_score         608
                       age                   34
                       country          Germany
                       num_products           0
                       churn                 No
```

```
churn_stacked.unstack(level=0)
```

```
                   member      no    yes
credit_card
         no credit_score      NaN    619
                     age      NaN     43
                 country      NaN France
            num_products      NaN      1
                   churn      NaN    Yes
        yes credit_score      608    502
                     age       34     23
                 country  Germany France
            num_products        0      1
                   churn       No    Yes
```

Unstack level by name

```python
churn_stacked.head(10)
```

```
member  credit_card
yes     no           credit_score          619
                     age                    43
                     country            France
                     num_products            1
                     churn                 Yes
no      yes          credit_score          608
                     age                    34
                     country           Germany
                     num_products            0
                     churn                  No
```

```python
churn_stacked.unstack(level='credit_card')
```

```
             credit_card      no     yes
      member
          no credit_score    NaN     608
                     age     NaN      34
                 country     NaN Germany
            num_products     NaN       0
                   churn     NaN      No
         yes credit_score    619     NaN
                     age      43     NaN
                 country  France     NaN
            num_products       1     NaN
                   churn     Yes     NaN
```

Sort index

```
patients_stacked.unstack().sort_index(ascending=False)
```

```
            year         2019        2020
         feature   age weight age weight
   last    first
   Wick   Julien    31     72  32     73
            John    25     68  26     72
Shelley     Mary    41     68  42     69
           Frank    32     75  33     74
```

Rearranging levels

```
patients_stacked
```

```
                year  2019 2020
  first   last feature
   Wick   John     age    25   26
               weight    68   72
        Julien     age    31   32
               weight    72   73
Shelley   Mary     age    41   42
               weight    68   69
         Frank     age    32   33
               weight    75   74
```

```
patients_stacked.unstack(level=1).stack(level=0)
```

```
first                     Frank   John  Julien   Mary
 last    feature year
Shelley age      2019     32.0    NaN     NaN   41.0
                 2020     33.0    NaN     NaN   42.0
        weight   2019     75.0    NaN     NaN   68.0
                 2020     74.0    NaN     NaN   69.0
Wick    age      2019      NaN   25.0    31.0    NaN
                 2020      NaN   26.0    32.0    NaN
        weight   2019      NaN   68.0    72.0    NaN
                 2020      NaN   72.0    73.0    NaN
```

Let's practice!

RESHAPING DATA WITH PANDAS

Working with multiple levels

RESHAPING DATA WITH PANDAS

Maria Eugenia Inzaugarat
Instructor

datacamp

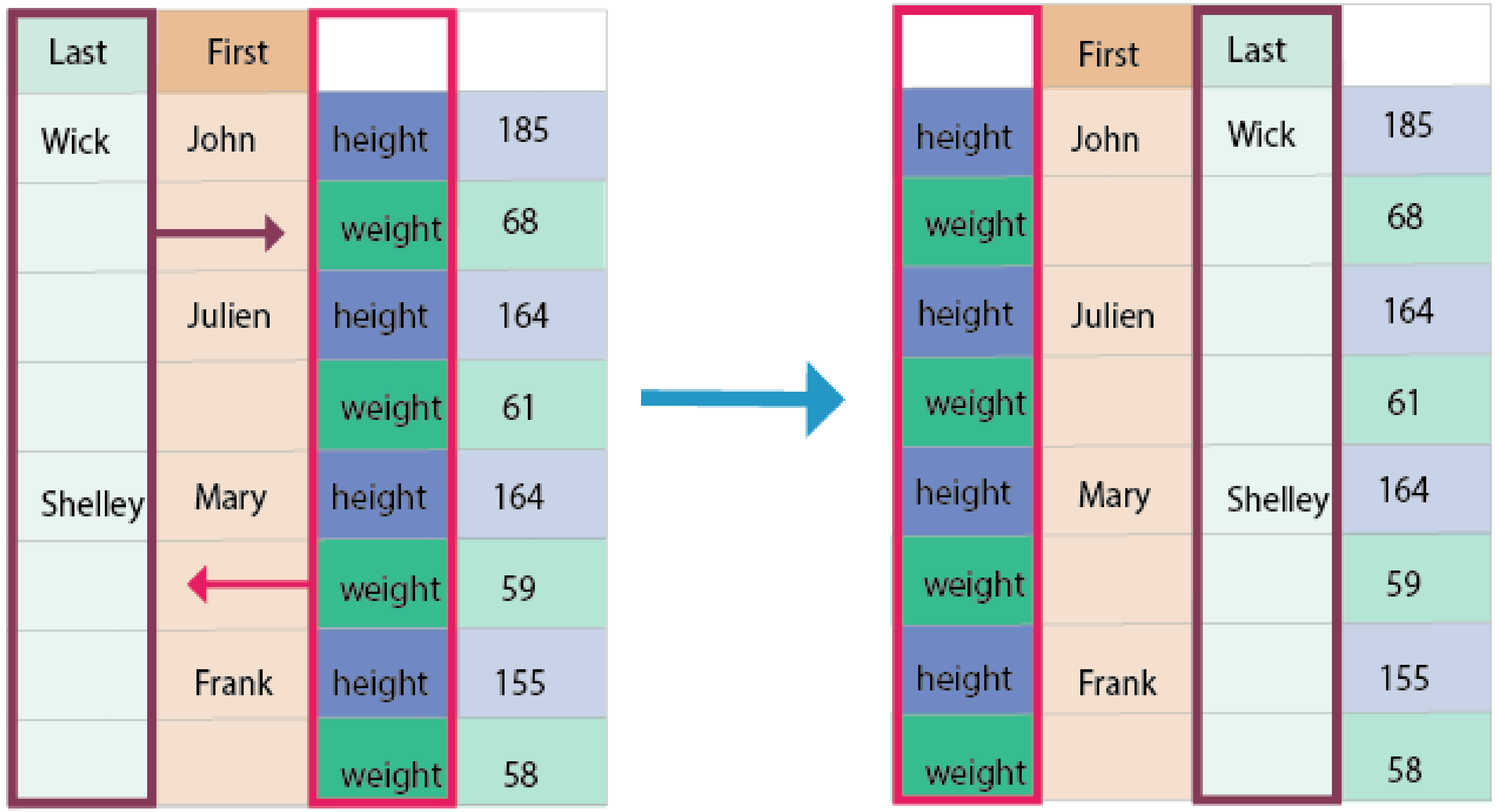
Review

- Stack and unstack DataFrames and Series
- Choose a level to stack or unstack by name or number
- Rearrange levels by combining unstack and stack

Rearranging multiple levels

- Swap levels
- Stack and unstack multiple levels at the same time

Swap levels



```
df.swaplevel( 0, 2 )
```

Swap levels

```
cars
```

```
                           2019  2020
price    Golf        VW      25    26
 sold    Golf        VW      68    72
price  Passat        VW      31    32
 sold  Passat        VW      72    73
price A-class Mercedes       41    42
 sold A-class Mercedes       68    69
price C-class Mercedes       32    33
sold  C-class Mercedes       75    74
```

Swap levels

```
cars
```

```
                           2019  2020
price    Golf         VW     25    26
 sold    Golf         VW     68    72
price  Passat         VW     31    32
 sold  Passat         VW     72    73
price A-class Mercedes     41    42
 sold A-class Mercedes     68    69
price C-class Mercedes     32    33
sold  C-class Mercedes     75    74
```

```
cars.swaplevel(0, 2)
```

```
                          2019  2020
VW       Golf    price      25    26
                 sold       68    72
         Passat  price      31    32
                 sold       72    73
Mercedes A-class price      41    42
                 sold       68    69
         C-class price      32    33
                 sold       75    74
```

Swap levels and unstack

```
cars
```

```
                            2019  2020
price    Golf         VW      25    26
 sold    Golf         VW      68    72
price  Passat         VW      31    32
 sold  Passat         VW      72    73
price A-class Mercedes      41    42
 sold A-class Mercedes      68    69
price C-class Mercedes      32    33
sold  C-class Mercedes      75    74
```

```
cars.swaplevel(0, 2).unstack()
```

```
                          2019        2020
                    price sold price sold
Mercedes A-class       41   68    42   69
         C-class       32   75    33   74
      VW    Golf       25   68    26   72
          Passat       31   72    32   73
```

Swap levels and unstack

```
cars
```

```
                        2019  2020
price    Golf        VW   25    26
 sold    Golf        VW   68    72
price  Passat        VW   31    32
 sold  Passat        VW   72    73
price A-class Mercedes    41    42
 sold A-class Mercedes    68    69
price C-class Mercedes    32    33
sold  C-class Mercedes    75    74
```

```
cars.unstack()
```

```
              Mercedes    VW Mercedes    VW
                  2019  2019     2020  2020
price A-class     41.0   NaN     42.0   NaN
      C-class     32.0   NaN     33.0   NaN
         Golf      NaN  25.0      NaN  26.0
       Passat      NaN  31.0      NaN  32.0
sold  A-class     68.0   NaN     69.0   NaN
      C-class     75.0   NaN     74.0   NaN
         Golf      NaN  68.0      NaN  72.0
       Passat      NaN  72.0      NaN  73.0
```

Swap levels and unstack

```
cars
```

```
                            2019  2020
price    Golf        VW       25    26
 sold    Golf        VW       68    72
price  Passat        VW       31    32
 sold  Passat        VW       72    73
price A-class Mercedes        41    42
 sold A-class Mercedes        68    69
price C-class Mercedes        32    33
sold  C-class Mercedes        75    74
```

```
cars.unstack().swaplevel(0, 1, axis=1)
```

```
                      2019          2020
              Mercedes    VW Mercedes    VW
price A-class     41.0   NaN     42.0   NaN
      C-class     32.0   NaN     33.0   NaN
         Golf      NaN  25.0      NaN  26.0
       Passat      NaN  31.0      NaN  32.0
sold  A-class     68.0   NaN     69.0   NaN
      C-class     75.0   NaN     74.0   NaN
         Golf      NaN  68.0      NaN  72.0
       Passat      NaN  72.0      NaN  73.0
```

Swap levels and stack

```
cars
```

```
                          2019  2020
price    Golf        VW     25    26
 sold    Golf        VW     68    72
price  Passat        VW     31    32
 sold  Passat        VW     72    73
price A-class Mercedes      41    42
 sold A-class Mercedes      68    69
price C-class Mercedes      32    33
sold  C-class Mercedes      75    74
```

```
cars.stack()
```

```
price     Golf         VW   2019    25
                            2020    26
 sold     Golf         VW   2019    68
                            2020    72
price   Passat         VW   2019    31
                            2020    32
 sold   Passat         VW   2019    72
                            2020    73
price   A-class  Mercedes   2019    41
                            2020    42
 sold   A-class  Mercedes   2019    68
                            2020    69
```

Swap levels and stack

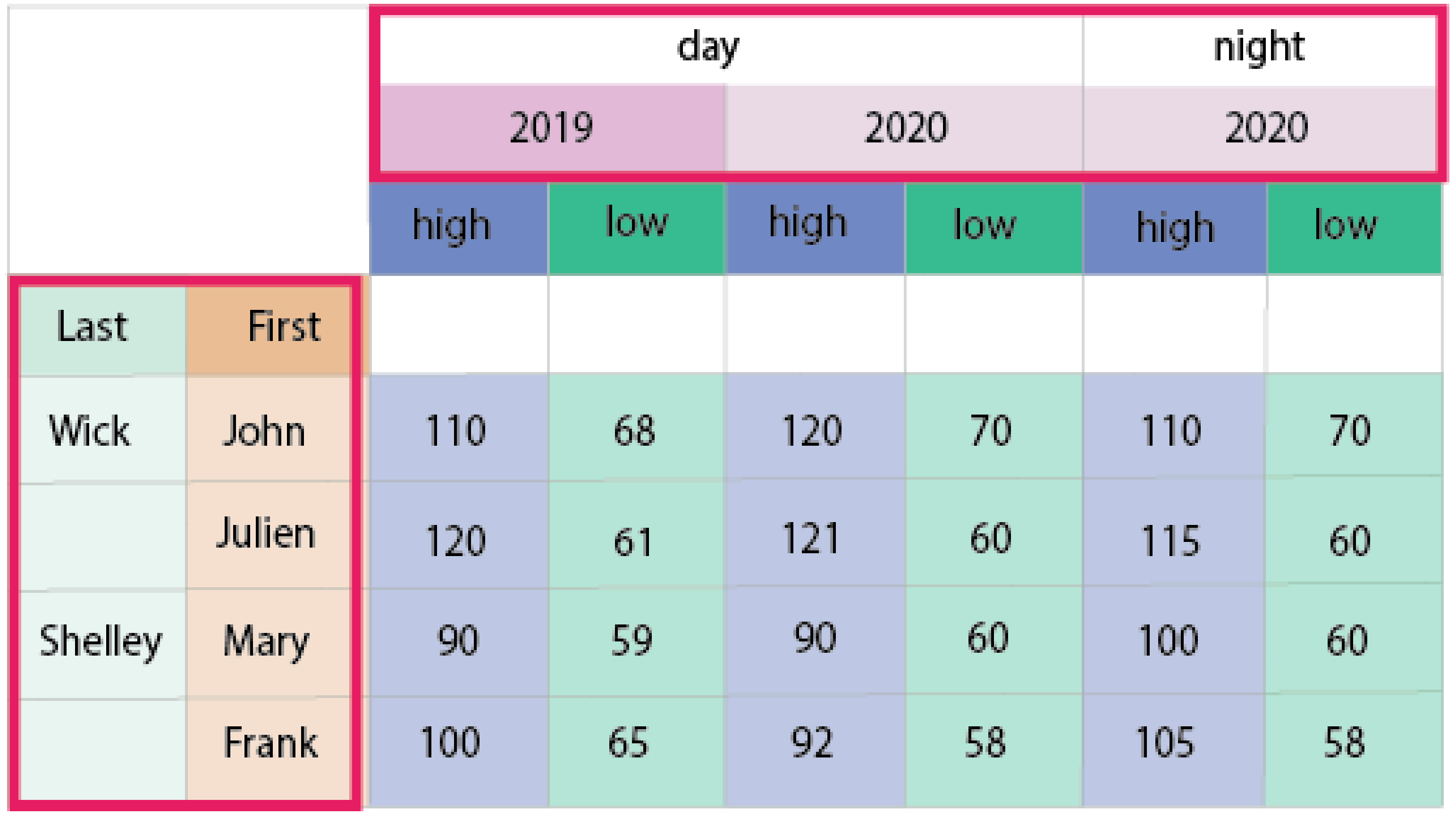
```
cars
```

```
                        2019  2020
price    Golf        VW   25    26
 sold    Golf        VW   68    72
price  Passat        VW   31    32
 sold  Passat        VW   72    73
price A-class Mercedes    41    42
 sold A-class Mercedes    68    69
price C-class Mercedes    32    33
sold  C-class Mercedes    75    74
```

```
cars.stack().swaplevel(0, 2)
```

```
     VW      Golf   price  2019    25
                           2020    26
                     sold  2019    68
                           2020    72
           Passat   price  2019    31
                           2020    32
                     sold  2019    72
                           2020    73
Mercedes  A-class   price  2019    41
                           2020    42
                     sold  2019    68
                           2020    69
```

Multiple levels



		day				night	
		2019		2020		2020	
		high	low	high	low	high	low
Last	First						
Wick	John	110	68	120	70	110	70
	Julien	120	61	121	60	115	60
Shelley	Mary	90	59	90	60	100	60
	Frank	100	65	92	58	105	58

Unstacking multiple levels

```
cars
```

```
year                         2019  2020
  brand      model  feature
      VW      Golf    price    25    26
                       sold    68    72
            Passat    price    31    32
                       sold    72    73
Mercedes   A-class    price    41    42
                       sold    68    69
           C-class    price    32    33
                       sold    75    74
```

Unstacking levels by number

```
cars.unstack(level=[0, 1])
```

```
               year           2019                               2020
brand              VW         Mercedes          VW           Mercedes
model     Golf Passat  A-class C-class Golf Passat  A-class C-class
feature
price       25     31       41      32   26     32       42      33
sold        68     72       68      75   72     73       69      74
```

Unstacking levels by name

```
cars.unstack(level=['brand', 'model'])
```

```
                year            2019                            2020
brand             VW        Mercedes            VW          Mercedes
model    Golf Passat  A-class C-class Golf Passat  A-class C-class
feature
price     25     31        41      32   26     32       42      33
sold      68     72        68      75   72     73       69      74
```

Stacking multiple levels

```
cars_unstacked
```

```
   year                          2019                          2020
  brand             VW        Mercedes             VW        Mercedes
  model   Golf Passat  A-class C-class Golf Passat  A-class C-class
feature
  price   25      31        41       32   26      32        42       33
   sold   68      72        68       75   72      73        69       74
```

Stacking by name or number

```
cars_unstacked.stack(level=[0, 1])
```

```
                 model  A-class  C-class  Golf  Passat
feature year     brand
  price 2019 Mercedes     41.0     32.0   NaN     NaN
                   VW      NaN      NaN  25.0    31.0
        2020 Mercedes     42.0     33.0   NaN     NaN
                   VW      NaN      NaN  26.0    32.0
   sold 2019 Mercedes     68.0     75.0   NaN     NaN
                   VW      NaN      NaN  68.0    72.0
        2020 Mercedes     69.0     74.0   NaN     NaN
                   VW      NaN      NaN  72.0    73.0
```

```
cars_unstacked.stack(level=['year', 'brand'])
```

```
                 model  A-class  C-class  Golf  Passat
feature year     brand
  price 2019 Mercedes     41.0     32.0   NaN     NaN
                   VW      NaN      NaN  25.0    31.0
        2020 Mercedes     42.0     33.0   NaN     NaN
                   VW      NaN      NaN  26.0    32.0
   sold 2019 Mercedes     68.0     75.0   NaN     NaN
                   VW      NaN      NaN  68.0    72.0
        2020 Mercedes     69.0     74.0   NaN     NaN
                   VW      NaN      NaN  72.0    73.0
```

Let's practice!

RESHAPING DATA WITH PANDAS

Handling missing data

RESHAPING DATA WITH PANDAS

Maria Eugenia Inzaugarat
Data Scientist

Review

- Stack and unstack DataFrames:
  - All columns index levels
  - A row index level
  - Choose which levels to stack or unstack

Unstacking leads to missing values

Subgroups do not have the same set of labels

```
animals
```

```
                                jump  run  fly
class    order         name
Mammalia carnivora     dog        No  Yes   No
         Diprotodontia Kangaroo  Yes   No   No
Aves     hervibora     bird       No   No  Yes
```

Unstacking leads to missing values

Subgroups do not have the same set of labels

```
animals
```

```
                                jump  run  fly
class    order         name
   Mammalia carnivora     dog        No  Yes   No <--
         Diprotodontia Kangaroo  Yes   No   No
Aves     hervibora     bird       No   No  Yes
```

Unstacking leads to missing values

Subgroups do not have the same set of labels

```
animals.unstack(level='class')
```

```
                                jump               run              fly
       clas               Aves Mammalia Aves Mammalia Aves Mammalia
       order        name
  Diprotodontia Kangaroo  NaN       Yes  NaN       No  NaN       No
      carnivora      Dog  NaN        No  NaN      Yes  NaN       No
Charadriiformes   Avocet   No       NaN   No      NaN  Yes      NaN
```

Unstacking leads to missing values

Subgroups do not have the same set of labels

```
animals.unstack(level='class')
```

```
                                  jump              run             fly
        clas                 Aves Mammalia Aves Mammalia Aves Mammalia
        order        name
  Diprotodontia Kangaroo   NaN       Yes  NaN        No  NaN        No
  -----------------------------
      carnivora       Dog  NaN <--   No   NaN       Yes  NaN        No
  -----------------------------
Charadriiformes    Avocet   No       NaN   No       NaN  Yes       NaN
```

Handling NaN with unstack

```
animals.unstack(level='class', fill_value=    )
```

Handling NaN with unstack

```
animals.unstack(level='class', fill_value='No')
```

Handling NaN with unstack

```
animals.unstack(level='class', fill_value='No').sort_index(level=['order', 'name'], ascending=[True, False])
```

```
                          jump               run             fly
       clas             Aves Mammalia Aves Mammalia Aves Mammalia
       order      name
  Diprotodontia Kangaroo   No      Yes   No       No   No       No
      carnivora      Dog   No       No   No      Yes   No       No
Charadriiformes   Avocet   No       No   No       No  Yes       No
```

Stack and missing values

Combinations of index and column values missing from the original DataFrame

```
flowers
```

```
     petals Stigma
     number   size
rose     40    NaN
Lily      8      5
```

Stack and missing values

Combinations of index and column values missing from the original DataFrame

```
flowers.stack()
```

```
            Stigma  petals
rose number    NaN    40.0
Lily number    NaN     8.0
       size      5     NaN
```

Stack and missing values

Combinations of index and column values missing from the original DataFrame

```
flowers.stack(dropna=True)
```

```
             Stigma  petals
rose number     NaN    40.0
Lily number     NaN     8.0
       size       5     NaN
```

Stack and missing values

Combinations of index and column values missing from the original DataFrame

```
flowers.stack(dropna=False)
```

```
            Stigma  petals
rose number    NaN    40.0
        size    NaN      NaN <--
Lily number    NaN     8.0
       size      5     NaN
```

Handling NaN with stack

```
flowers.stack(dropna=False).fillna(0)
```

```
            Stigma  petals
rose number      0    40.0
       size      0       0
Lily number      0     8.0
       size      5       0
```

Let's practice!

RESHAPING DATA WITH PANDAS