You don't need N dimensions when you have **pandas**

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Pycon X
May 5, 2019 – Florence

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- **pandas** core dev

Disclaimer

[. . . speaker bores audience about personal issues. . .]

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  - (a lot of) additional utilities (IO, datetime. . .)

pandas in one equation

numpy : `list` = **pandas** : `dict`

pandas in one equation

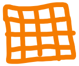
$$\textbf{numpy} : \texttt{list} = \textbf{pandas} : \texttt{dict}$$

$$(\textbf{numpy} : \text{nested } \texttt{list} = \textbf{pandas} : \text{nested } \texttt{dict})$$

Climbing up dimensions

1		
		```
		In :
		np.array(1, ndmin=1)
		Out:
		array([1])
		```
			```
			In :
			pd.Series([1])
			Out:
			0      1
			dtype: int64
			```

Climbing up dimensions

1		`In : np.array(1, ndmin=1) Out: array([1])`	`In : pd.Series([1]) Out: 0    1 dtype: int64`
2		`In : np.array(1, ndmin=2) Out: array([[1]])`	`In : pd.DataFrame([[1]]) Out:    0 0  1`

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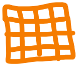
2		`In  :`
		`np.array(1, ndmin=2)`
		`Out:`
		`array([[1]])`
			`In  :`
			`pd.DataFrame([[1]])`
			`Out:`
			`   0`
			`0  1`

3		`In  :`
		`np.array(1, ndmin=3)`
		`Out:`
		`array([[[1]]])`
			`In  :`
			`pd.Panel([[[1]]])`
			`Out:`
			`FutureWarning: Panel is deprecated[...]`

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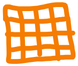
2		In :
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4		In :
		np.array(1, ndmin=4)
		Out:
		array([[[[1]]]])
			In :
			pd.Panel4D([[1]])
			Out:
			AttributeError: [...]

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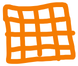
2		`In : np.array(1, ndmin=2) Out: array([[1]])`	`In : pd.DataFrame([[1]]) Out:    0 0  1`
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...	...	...	...
N		`In : np.array(1, ndmin=n) Out: array([...[1]...])`	?!

Are two dimensions enough?

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No

So what, are **pandas** devs crazy?!

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No

The structure of **pandas** data structures

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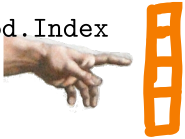
`pd.Index`

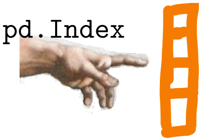


`pd.Series`

`s.loc["a"]`

The structure of **pandas** data structures

pd.Series



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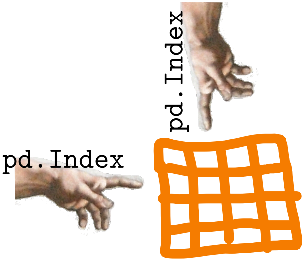
pd.DataFrame



df.loc["a", "b"]

→1.1 pandas for dummies

There are many types of indexes

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- `pd.IntervalIndex` ...

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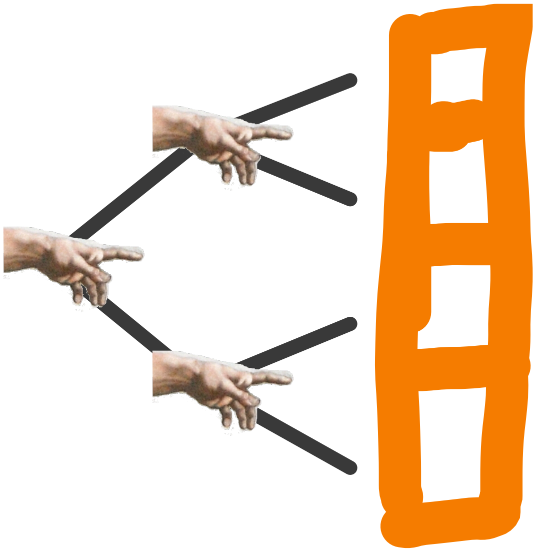
- `pd.Int64Index`, `pd.RangeIndex`, `pd.FloatIndex`
- `pd.DatetimeIndex`, `pd.PeriodIndex`
- `pd.IntervalIndex` . . .
- The star tonight: `pd.MultiIndex`.

What a `MultiIndex` looks like



→1.1 Basic example

What do we gain/loose

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- simpler implementation

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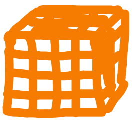
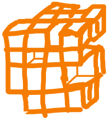
- efficient use of space for unbalanced data


vs.

$\rightarrow$`1.2 - Unbalanced data`

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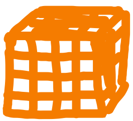
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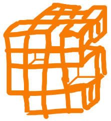

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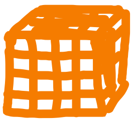
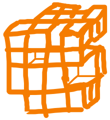


vs.



→`1.2 - Unbalanced data`

Cons

- comparatively inefficient for balanced data
- more complex semantics for `DataFrame`

→`1.2 - Mi DF`

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  $\rightarrow$`1.2 - Unbalanced data`
- Most importantly, we want to "split" dimensions in two groups when doing operations

  $\rightarrow$`1.2 - Reshape`

If you *really* need *n*-dimensional, indexed structures

```
In [4]: xr.DataArray(np.random.randn(2, 3))
Out[4]:
<xarray.DataArray (dim_0: 2, dim_1: 3)>
array([[ 1.643563, -1.469388,  0.357021],
       [-0.6746  , -1.776904, -0.968914]])
Dimensions without coordinates: dim_0, dim_1

In [5]: data = xr.DataArray(np.random.randn(2, 3), coords={'x': ['a', 'b']}, dims=('x',
'y'))

In [6]: data
Out[6]:
<xarray.DataArray (x: 2, y: 3)>
array([[-1.294524,  0.413738,  0.276662],
       [-0.472035, -0.01396 , -0.362543]])
Coordinates:
  * x        (x) <U1 'a' 'b'
Dimensions without coordinates: y
```

“groupby” is lavels aware!

```
df.groupby(level=...)
```

→1.2 Groupby

Thanks

to

- you, for your patience

Thanks

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- the organizers, for their faith in my succinctness

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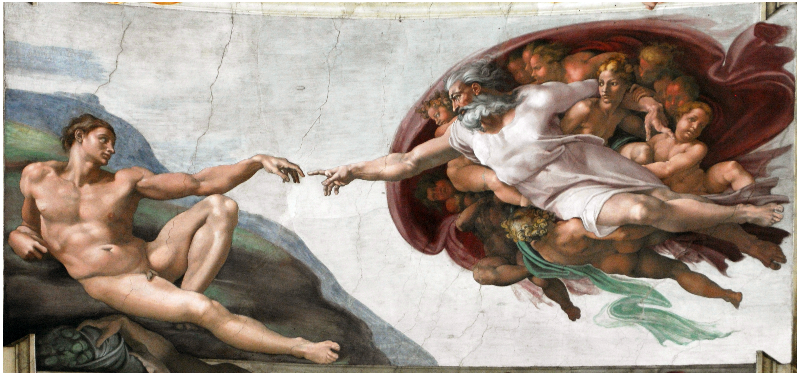
- the organizers, for their faith in my succinctness
- Michelangelo, for his pioneering use of indexes



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