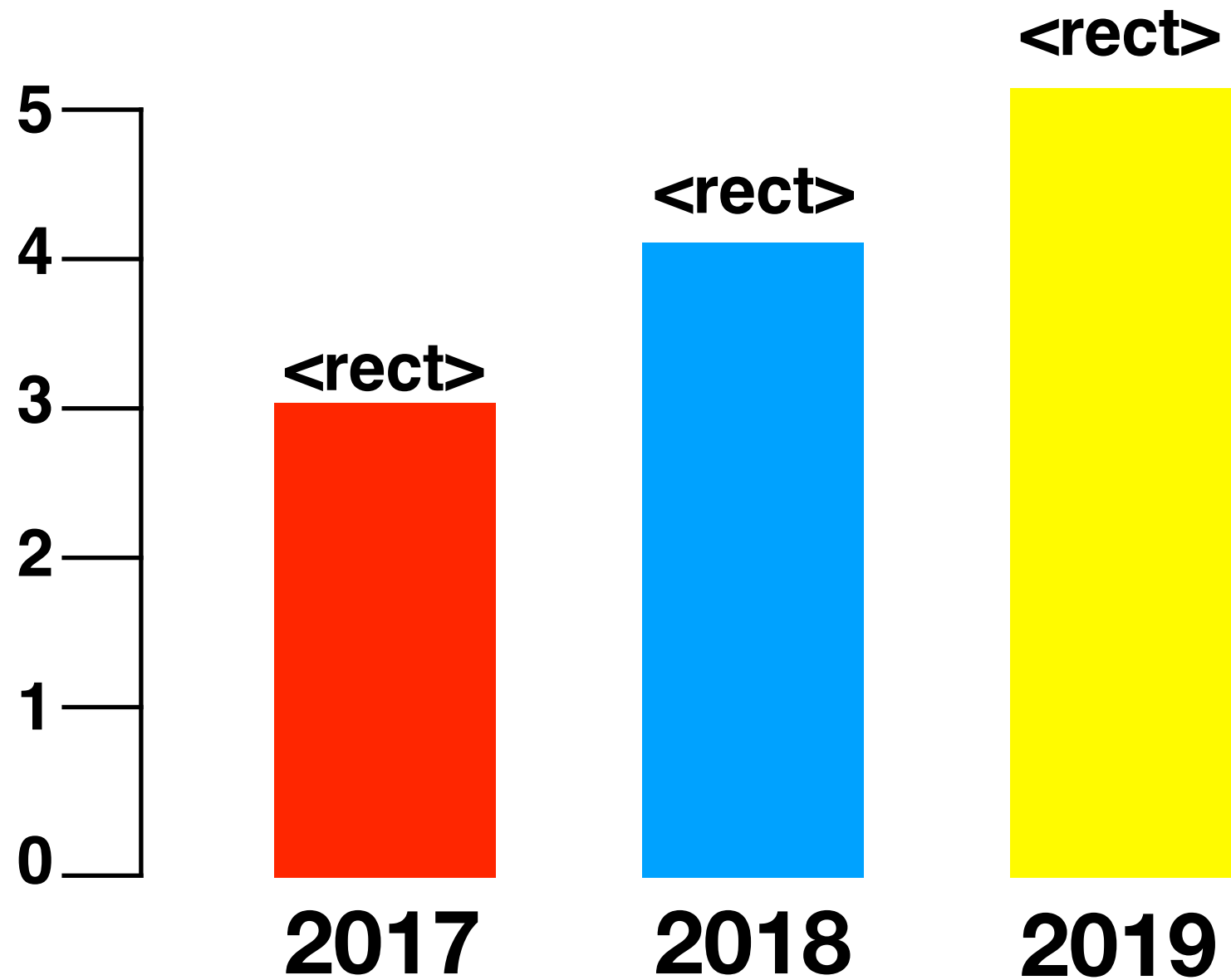
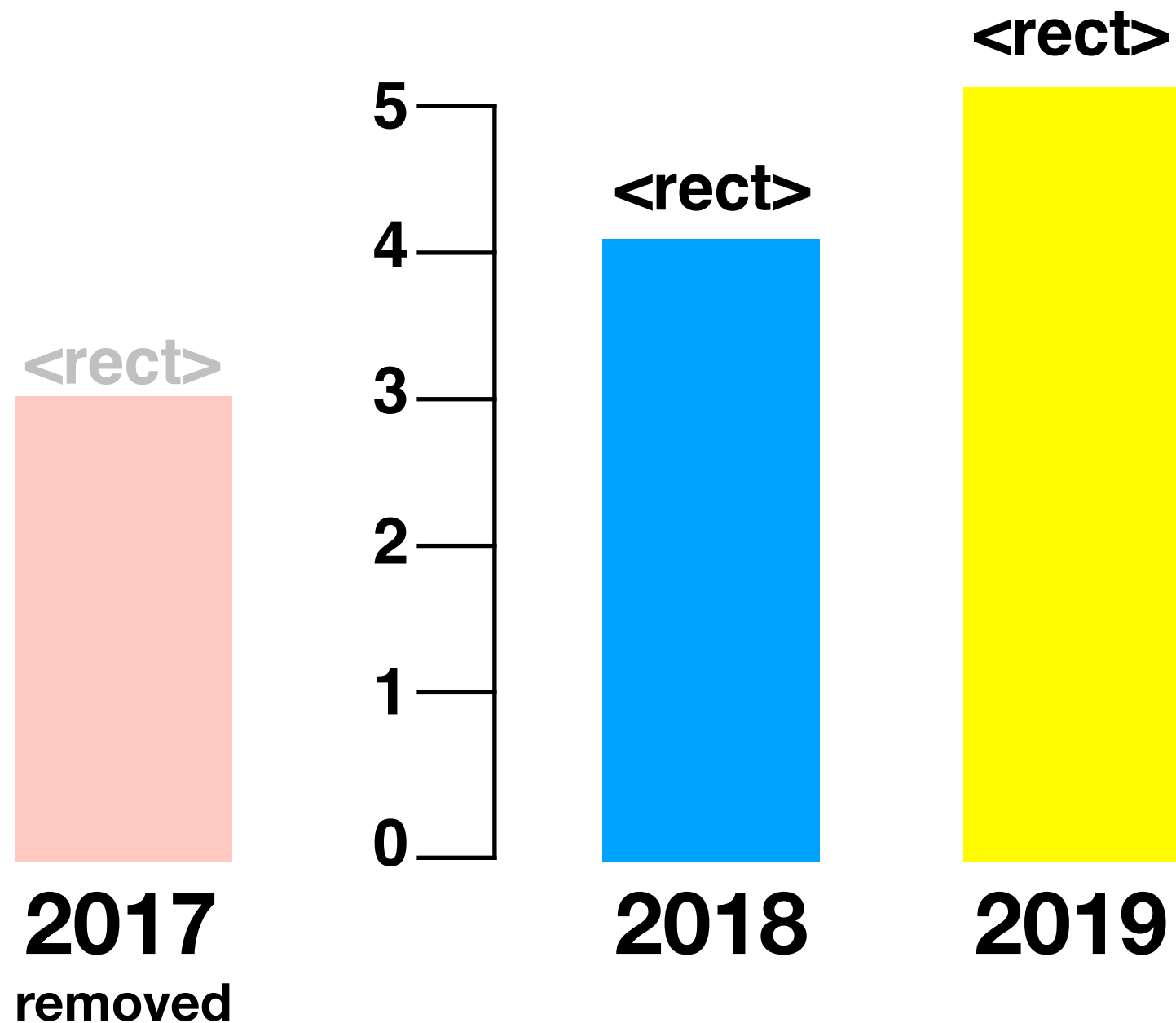


Initial setup

Goal:
remove
2017

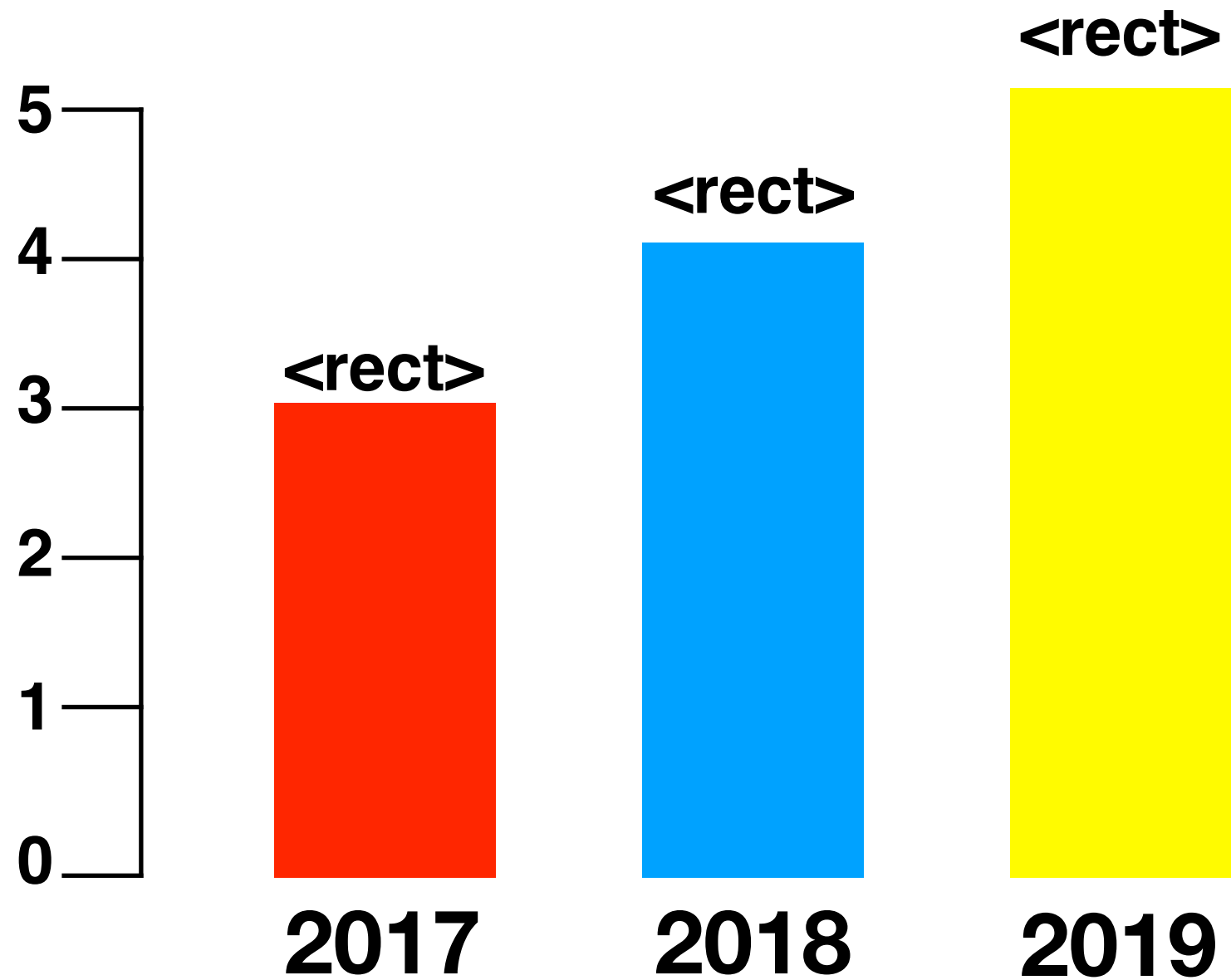


Object constancy maintained

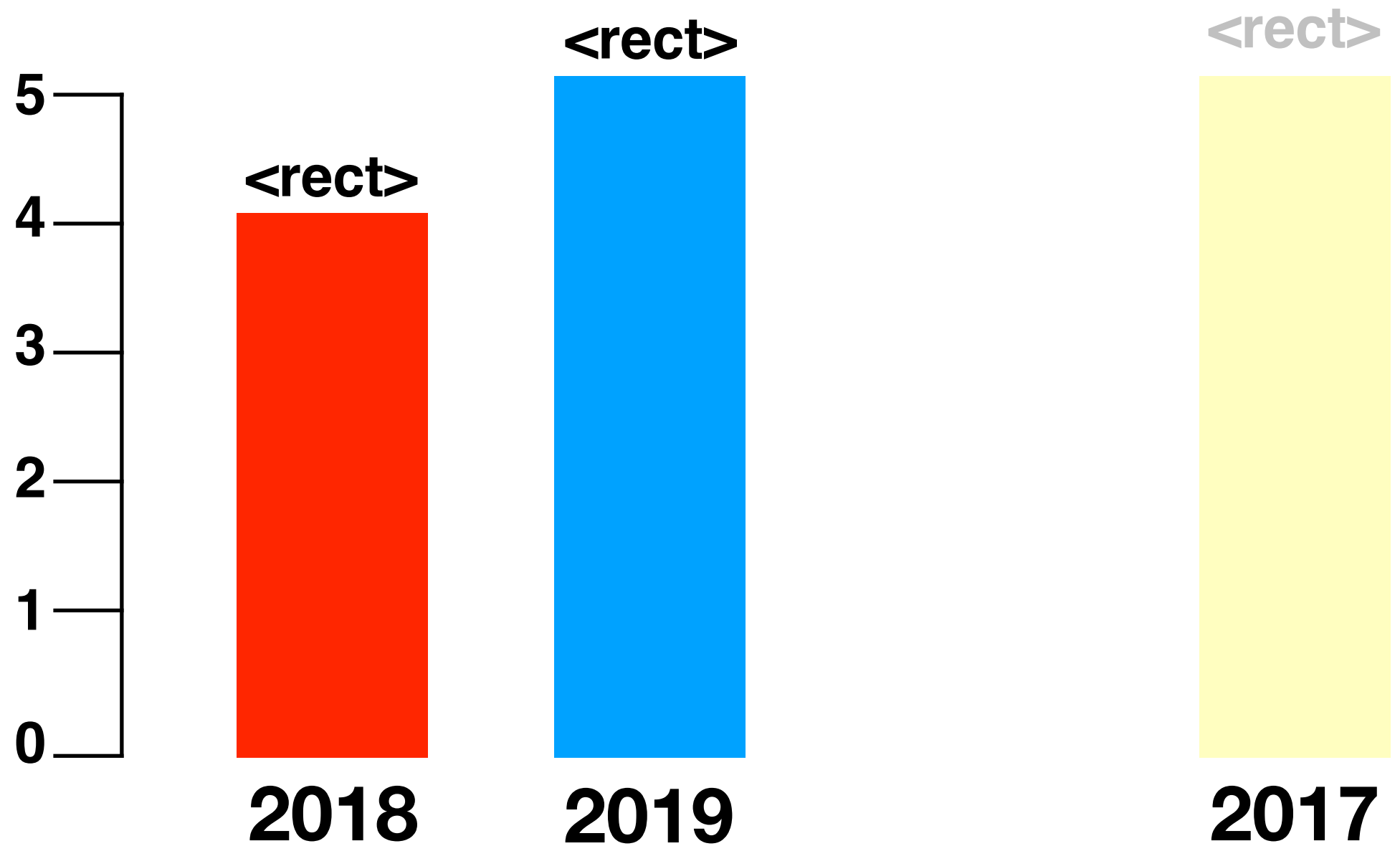


- red (2017) is removed on left side
- other bars (2018, 2019) shift left

Initial setup



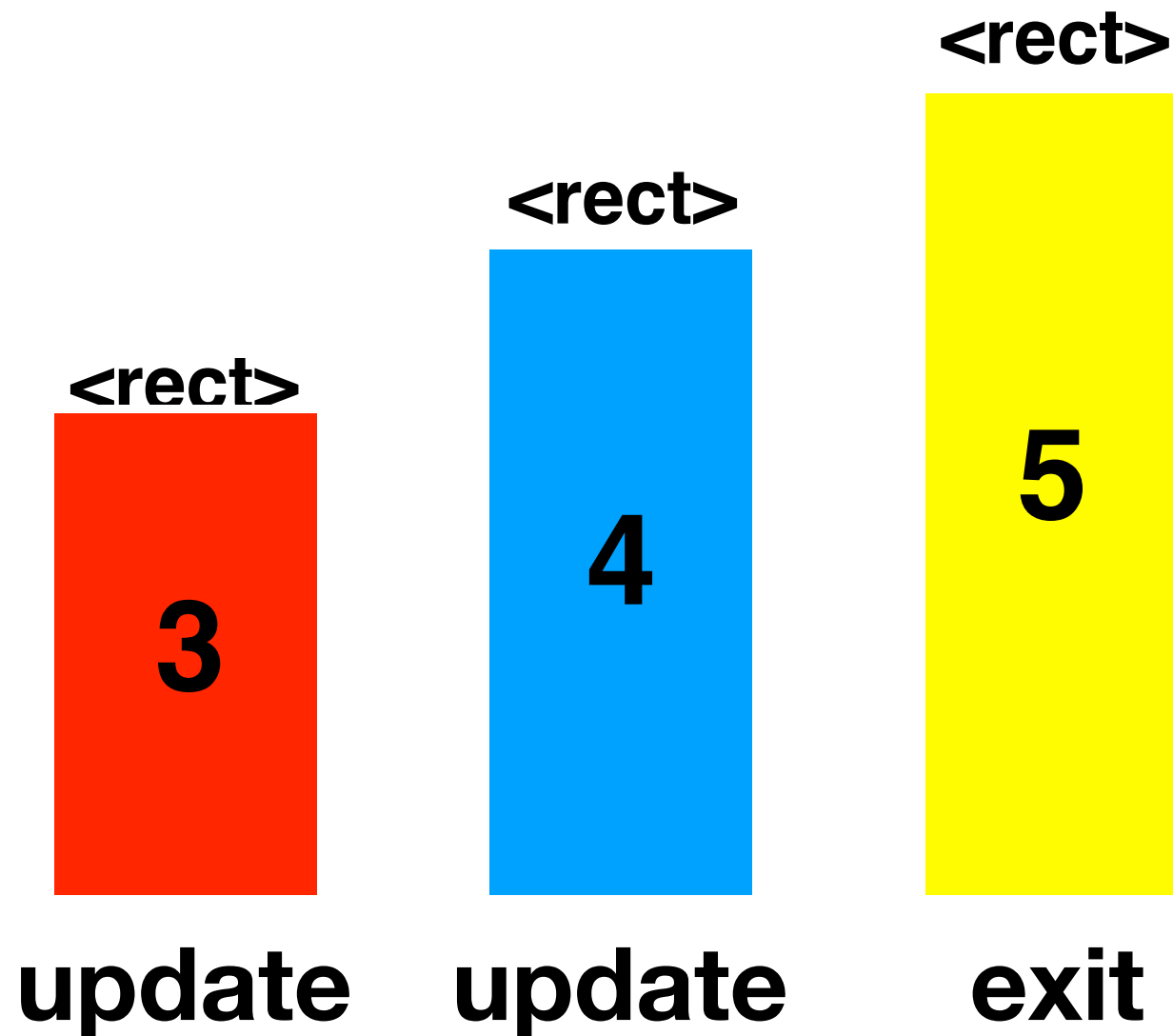
Object constancy not maintained



- yellow (2019) becomes 2017
- red (2017) bar becomes 2018,
- blue (2018) bar becomes 2019

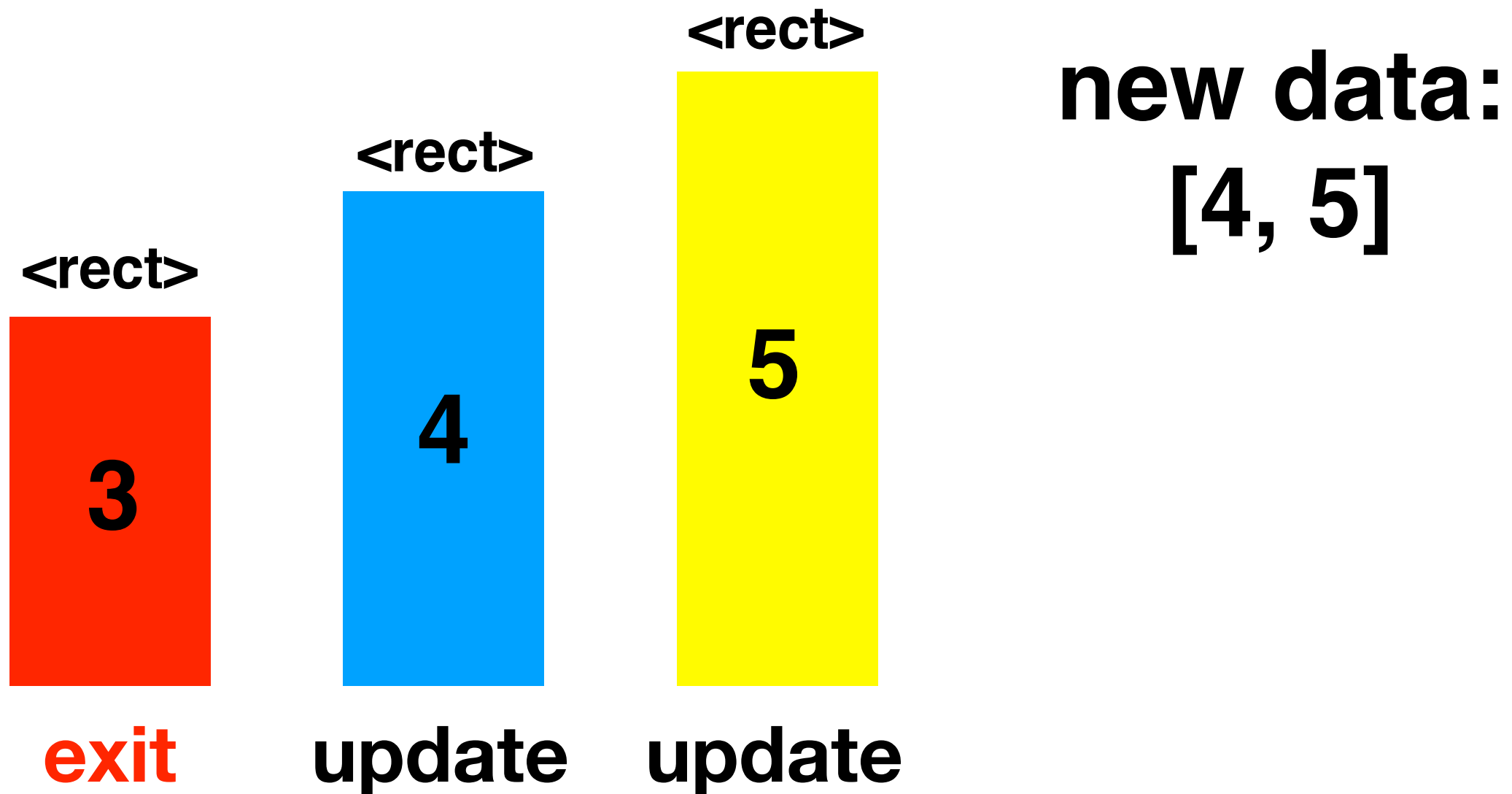
removed

Why isn't object constancy maintained?



**new data:
[4, 5]**

What we *want* to happen



Solution: join data by key

not in order of SVG elements

ex.

```
var bardata = [  
    {key: 2017, value: 3},  
    {key: 2018, value: 4},  
    {key: 2019, value: 5}  
];
```

Bind data by key

key: 2017
value: 3

key: 2018
value: 4

key: 2019
value: 5

```
d3.select("svg")  
  .selectAll("rect")  
  .data([  
    {key: 2018, value: 4},  
    {key: 2019, value: 5}],  
    d => d.key);
```

What selections are returned?

Bind data by key

key: 2017
value: 3

key: 2018
value: 4

key: 2019
value: 5

```
d3.select("svg")  
  .selectAll("rect")  
  .data([  
    {key: 2018, value: 4},  
    {key: 2019, value: 5}],  
    d => d.key);
```

What selections are returned?

key: 2017
value: 3

exit

key: 2018
value: 4

update

key: 2019
value: 5

update

Bind data by key

key: 2017
value: 3

key: 2018
value: 4

key: 2019
value: 5

```
d3.select("svg")  
  .selectAll("rect")  
  .data([  
    {key: 2018, value: 4},  
    {key: 2020, value: 7}],  
    d => d.key);
```

What selections are returned?

Bind data by key

key: 2017
value: 3

key: 2018
value: 4

key: 2019
value: 5

```
d3.select("svg")  
  .selectAll("rect")  
  .data([  
    {key: 2018, value: 4},  
    {key: 2020, value: 7}],  
    d => d.key);
```

What selections are returned?

key: 2017
value: 3

exit

key: 2018
value: 4

update

key: 2019
value: 5

exit

key: 2020
value: 7

enter

How to bind data by key

make data an array of objects:

ex.

```
var bardata = [ {key: 0, value: 300},  
                 {key: 1, value: 100},  
                 {key: 2, value: 150},  
                 {key: 3, value: 220},  
                 {key: 4, value: 70},  
                 {key: 5, value: 270}];
```

Creating array of keys from dataset

```
> var bardata = [23, 34, 123, 29]  
    .map((d, i) => ({key: i, value: d}));
```

```
> bardata
```

```
(4) [ {...}, {...}, {...}, {...} ]  
  0: {key: 0, value: 23}  
  1: {key: 1, value: 34}  
  2: {key: 2, value: 123}  
  3: {key: 3, value: 29}
```

How to bind data by key

- Specify the key when joining data:

selection.data([data[, key]]) 

.data(bardata, d => d.key);

- Replace every "d" with "d.value"

- Use a key when adding data:

*bardata.push({ key: newkey,
value: newvalue });*

Do not use d3.keys()