Rethinking Arrays in R

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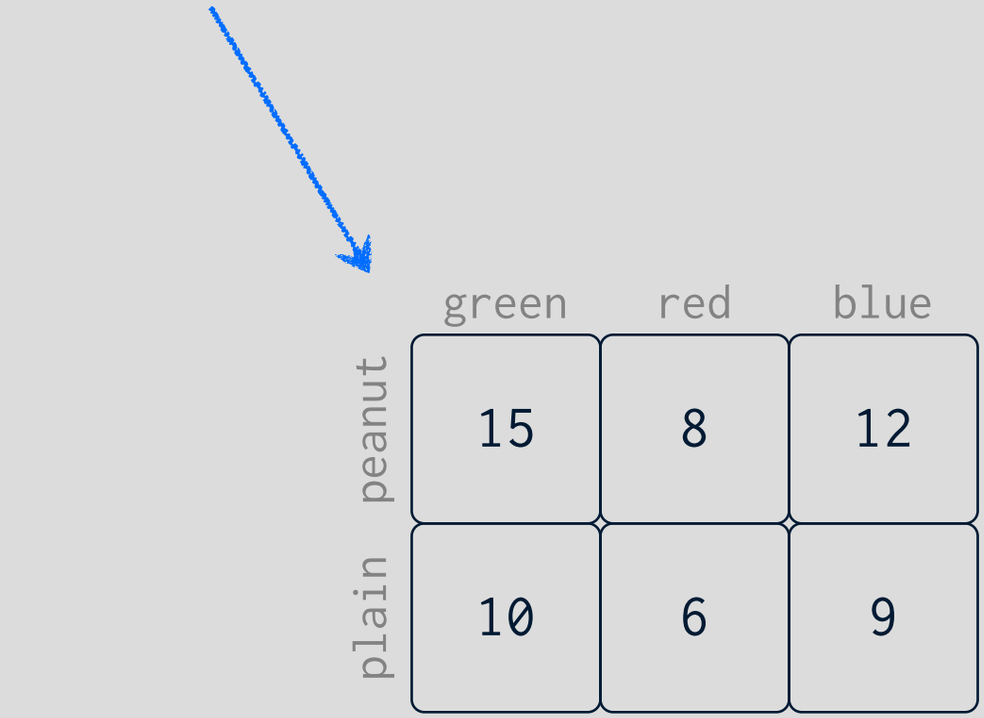
	green	red	blue
peanut	15	8	12
plain	10	6	9

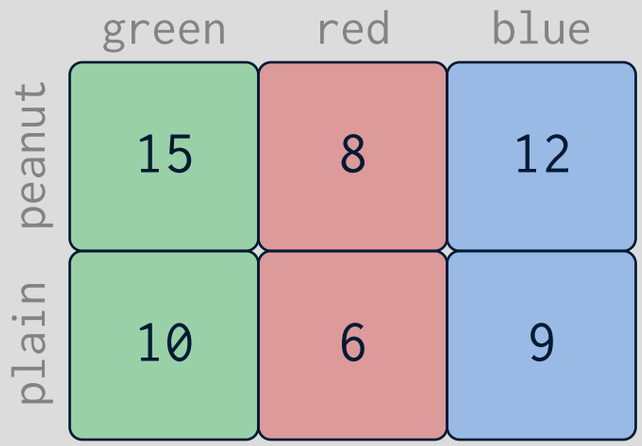
This is a
(2, 3) matrix



This is a
(2, 3) matrix


```
dim_names <- list(
  c("pb", "plain"),
  c("green", "red", “blue”)
)

matrix(
  c(15, 10, 8, 6, 12, 9),
  ncol = 3,
  dimnames = dim_names
)
```

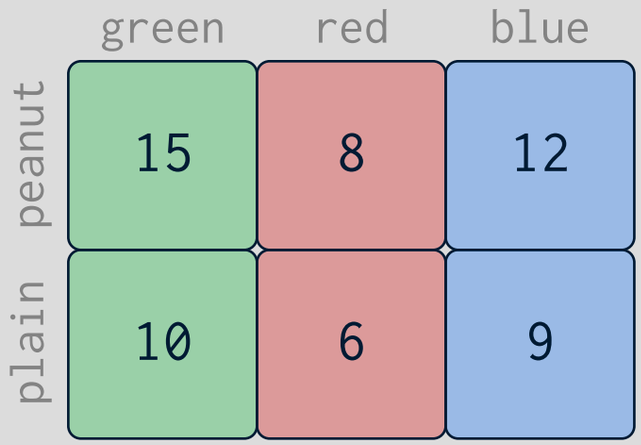

green
red
blue
peanut
15
8
12
plain
10
6
9

	green	red	blue
peanut	15	8	12
plain	10	6	9

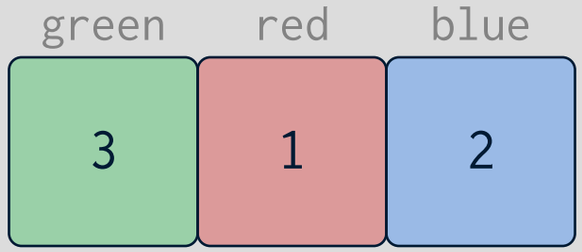
+

green	red	blue
3	1	2

=



+



=

Error:
non-conformable
arrays

	green	red	blue
peanut	15	8	12
plain	10	6	9

+

green	red	blue
3	1	2

=

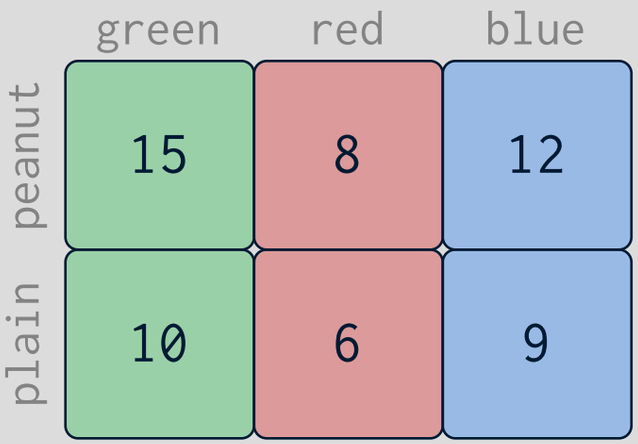
	green	red	blue
peanut	18	9	14
plain	13	7	11

Subsetting

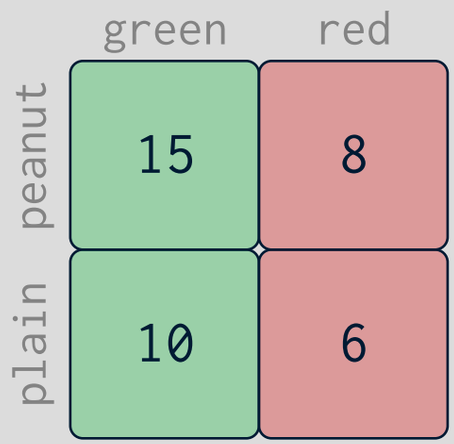
Broadcasting

Manipulation

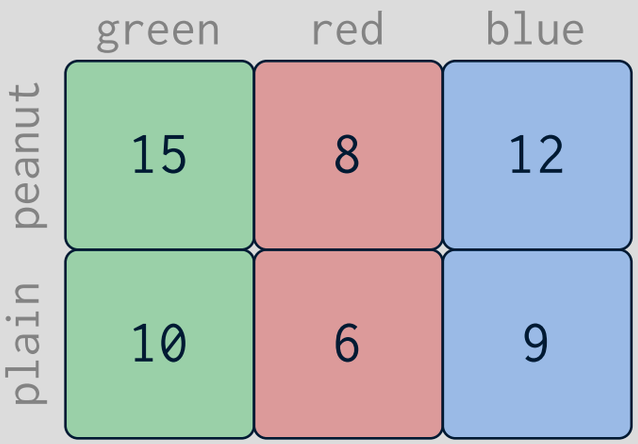
Subsetting


green
red
blue
peanut
plain
15
8
12
10
6
9

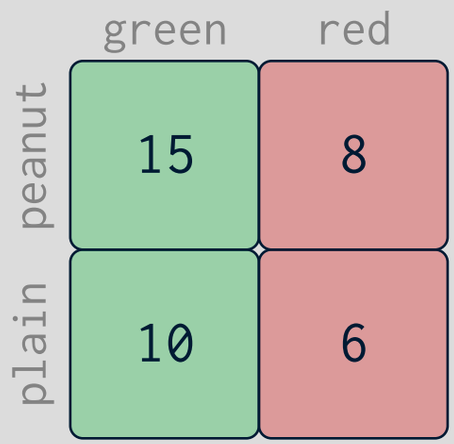
bag


green
red
peanut
plain
15
8
10
6

bag[,1:2]



bag



bag[,1:2]

?

bag[,1]

	green	red	blue
peanut	15	8	12
plain	10	6	9

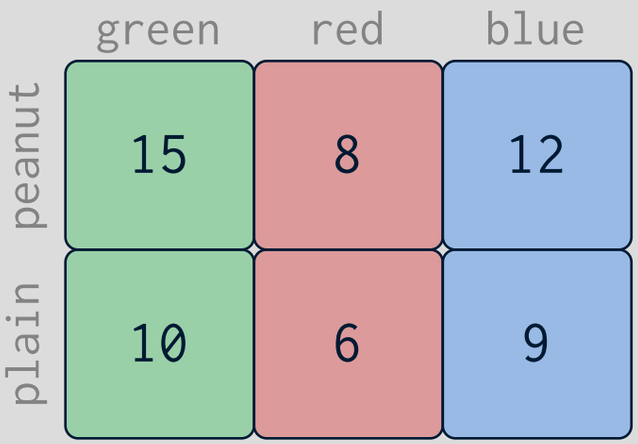
bag

	green	red
peanut	15	8
plain	10	6

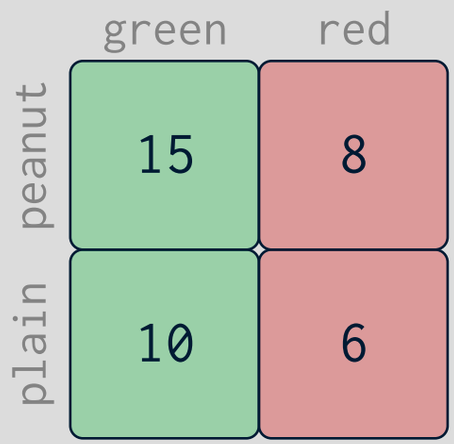
bag[,1:2]

```
peanut  plain
[ 15    10 ]
```

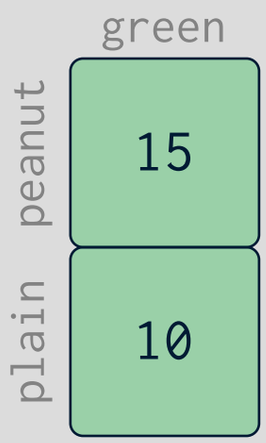
bag[,1]



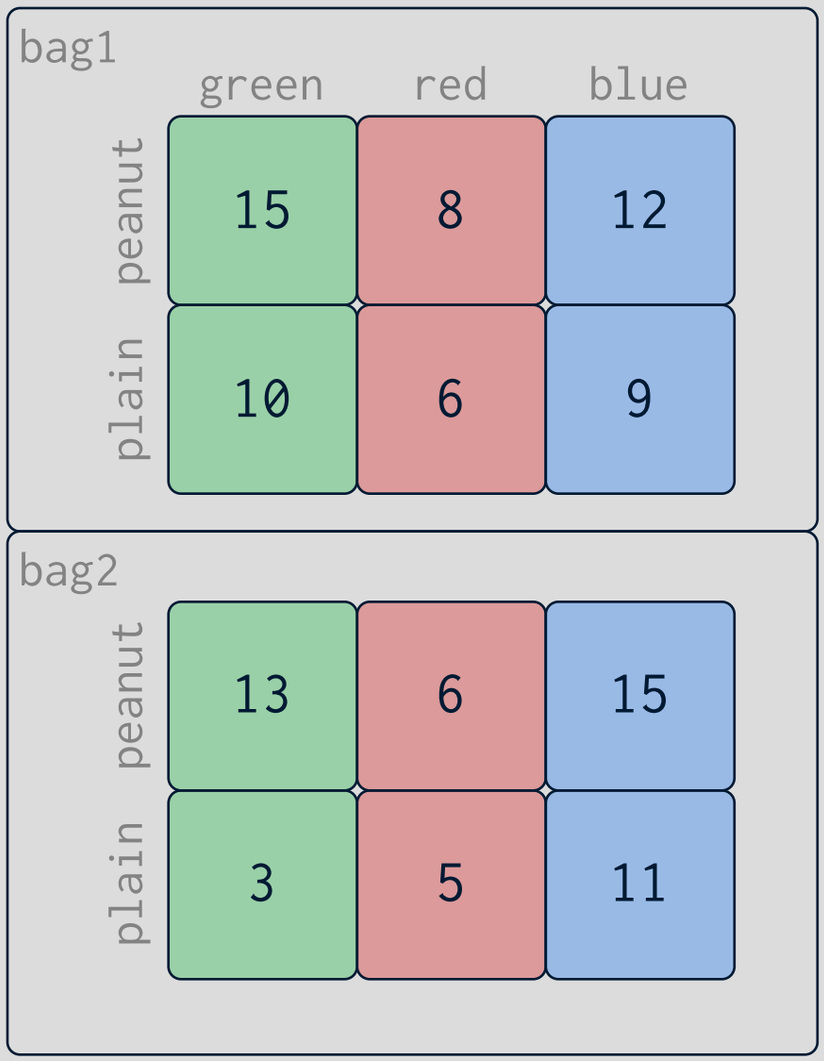
bag



bag[,1:2]

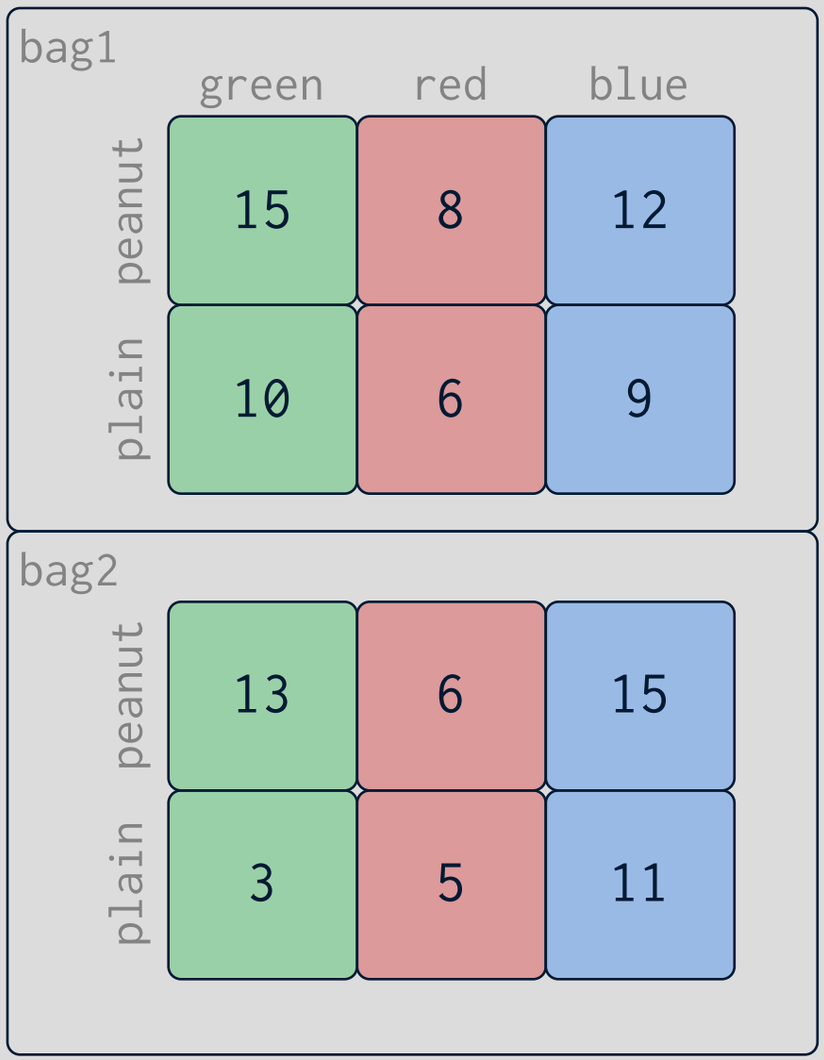


bag[, 1, drop = FALSE]

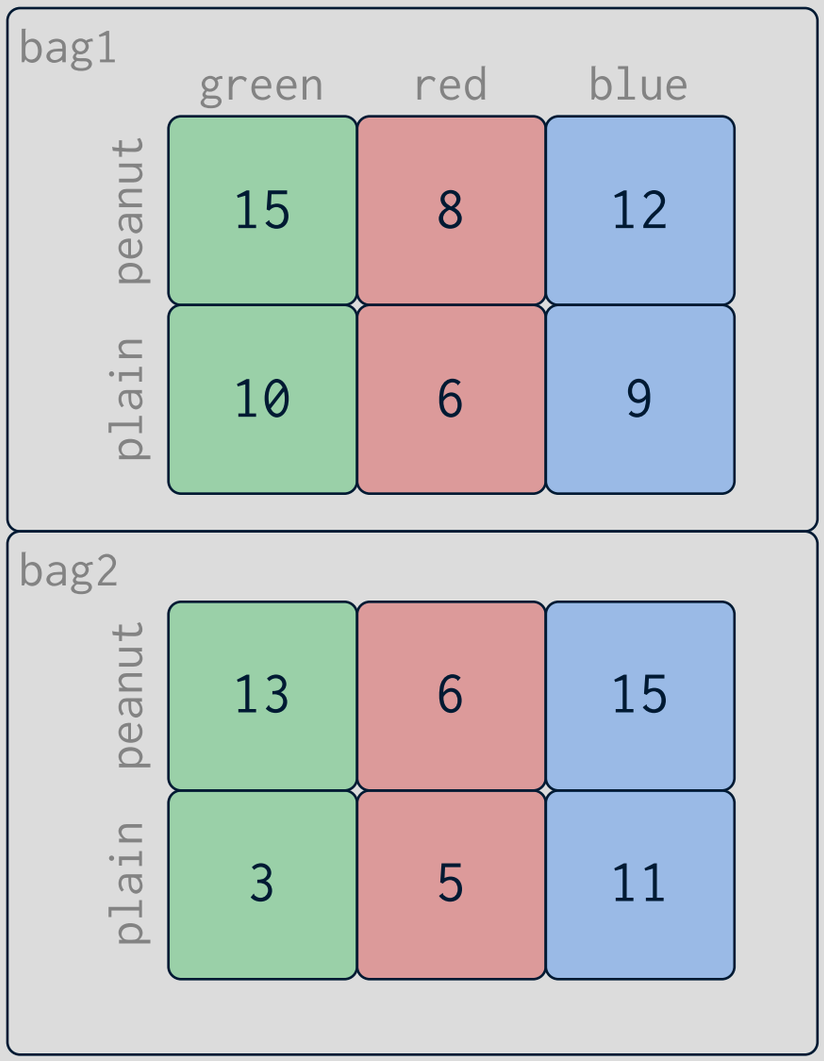

bag1
green
red
blue
peanut
15
8
12
plain
10
6
9
bag2
peanut
13
6
15
plain
3
5
11

bags

This is a
(2, 3, 2) 3D array

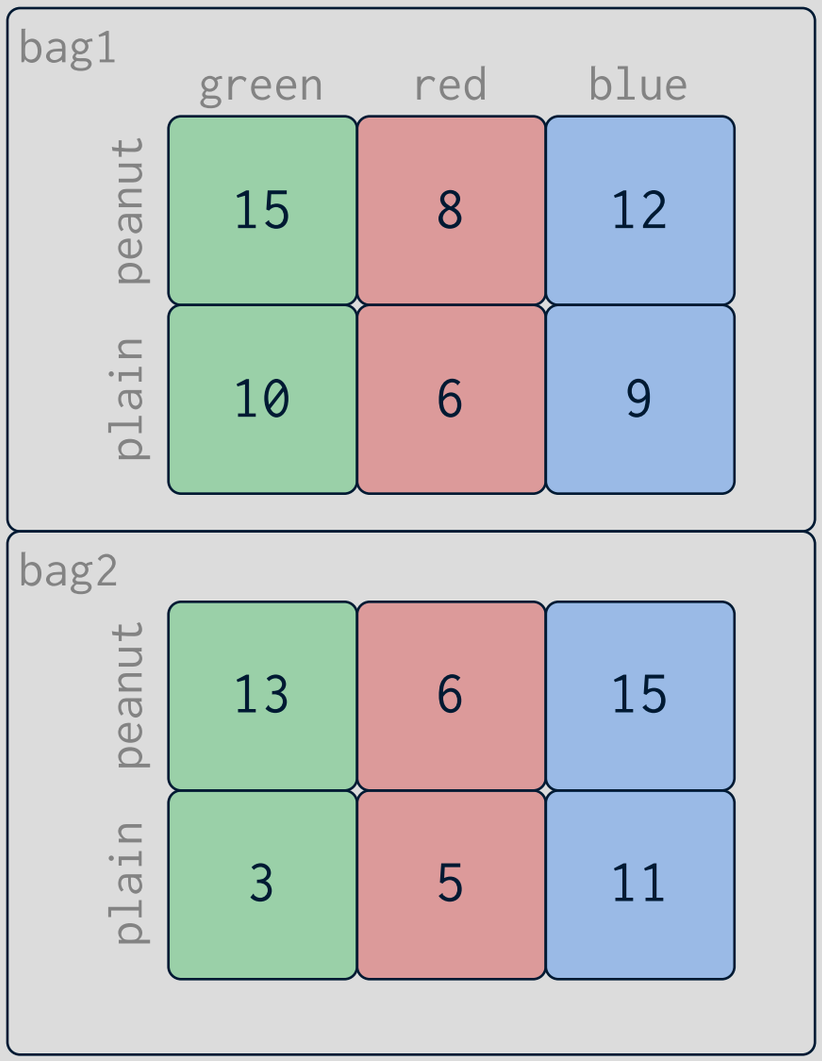


bags



bags

bags[, 1, , drop = FALSE]



bags

`bags[, 1, , drop = FALSE]`

`bag[, 1, drop = FALSE]`

The confusion?

Subsetting is not dimensionality-stable.

rray

rray is designed to provide a stricter array class.

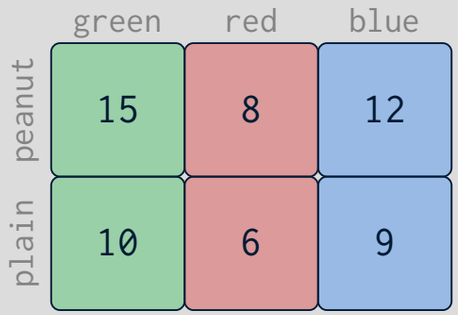
Create an rray

```
library(rray)
```

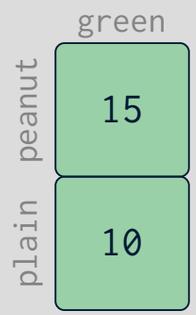
```
bag
#>        green red blue
#> peanut    15   8   12
#> plain     10   6    9
```

```
bag_rray <- as_rray(bag)
```

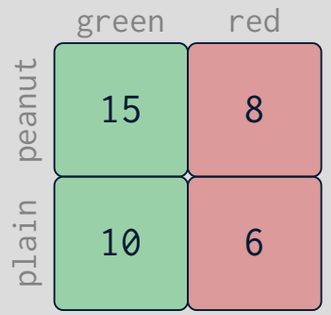
```
bag_rray
#> <rray<dbl>[,3][2]>
#>        green red blue
#> peanut    15   8   12
#> plain     10   6    9
```



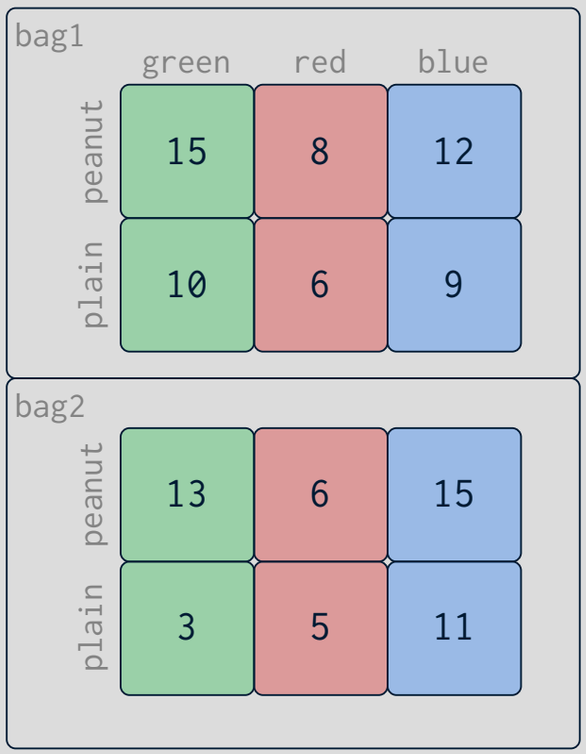
bag_rray



bag_rray[, 1]

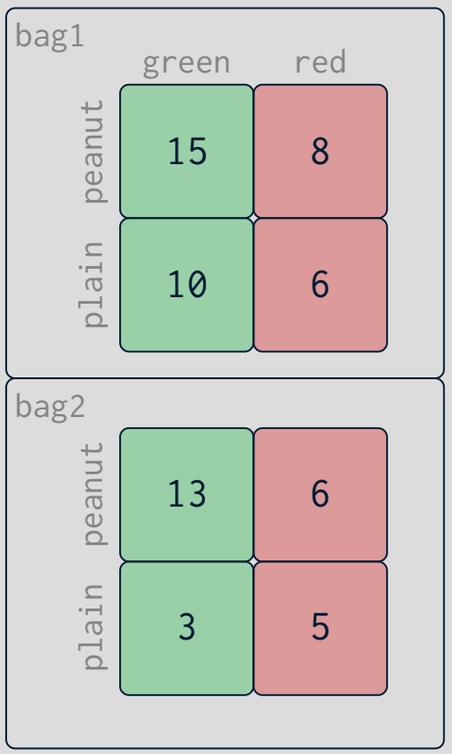


bag_rray[, 1:2]



bags_rray

bags_rray[, 1]



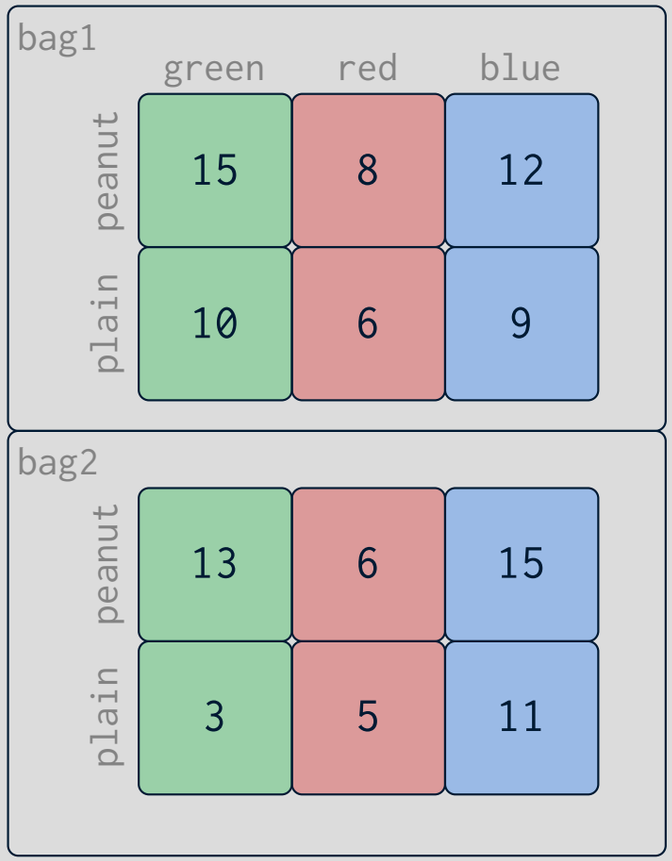
bags_rray[, 1:2]

Broadcasting

Broadcasting has to do with

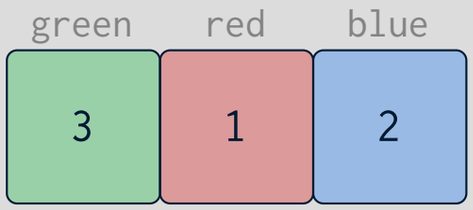
1) increasing dimensionality

2) recycling dimensions



bags (2, 3, 2)

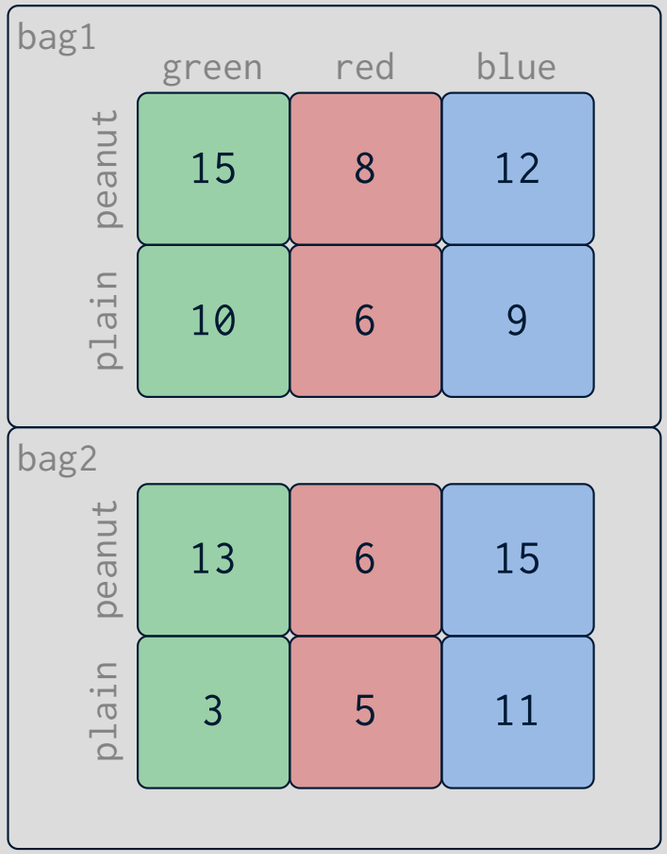
+



extra (1, 3)

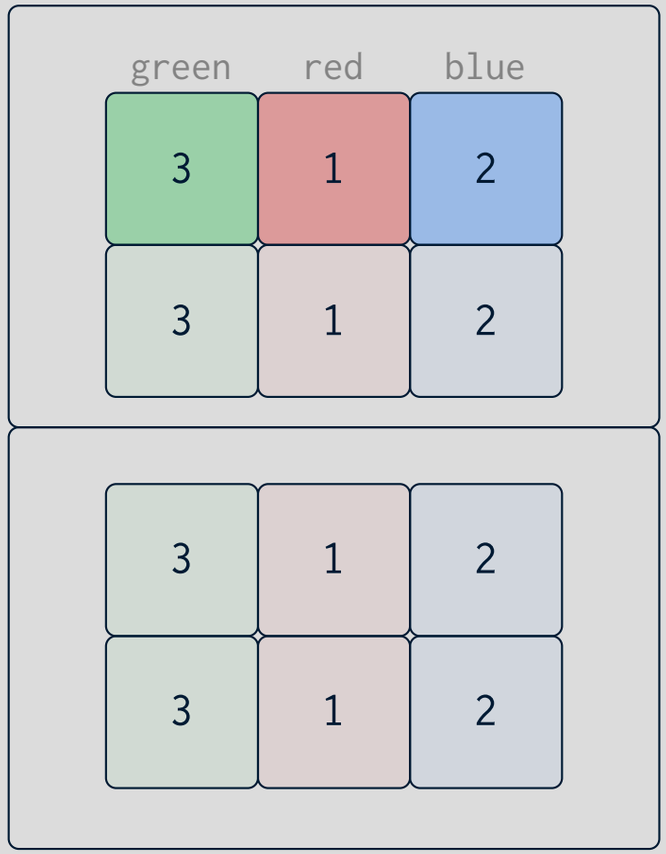
=

Error:
non-conformable
arrays



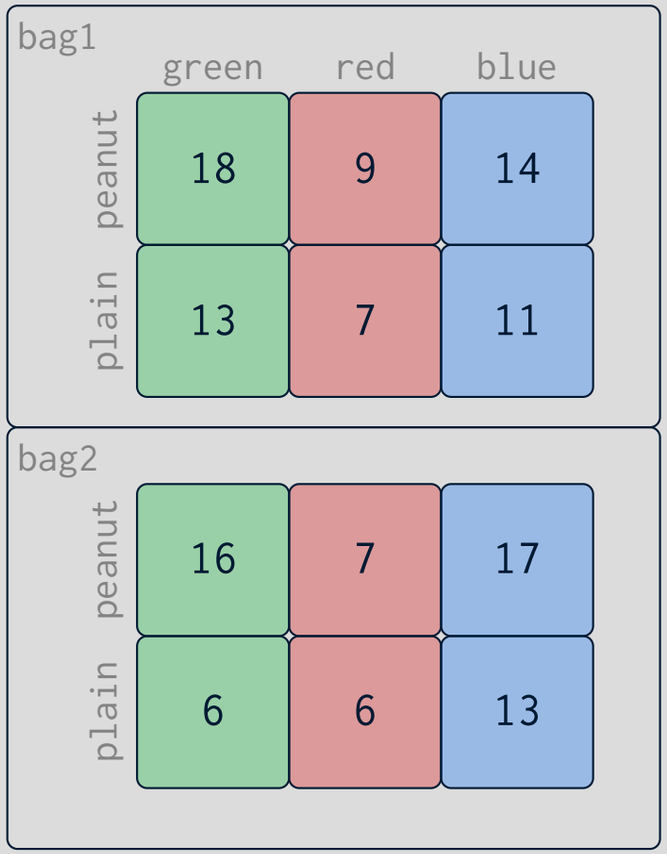
bags (2, 3, 2)

+



extra (2, 3, 2)

=



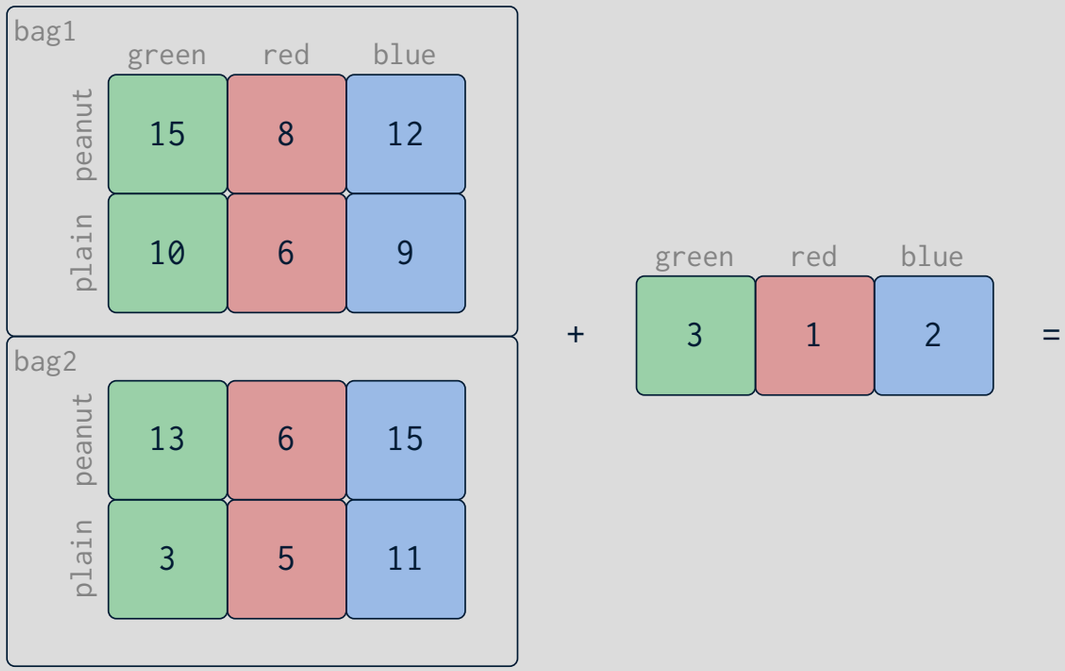
(2, 3, 2)

How is extra reshaped
so that this works?

	# row	# col	# frame
bags	2	3	2
extra	1	3	
	?	?	?

	# row	# col	# frame
bags	2	3	2
extra	1	3	
	?	?	?

	# row	# col	# frame
bags	2	3	2
extra	1	3	1
	?	?	?

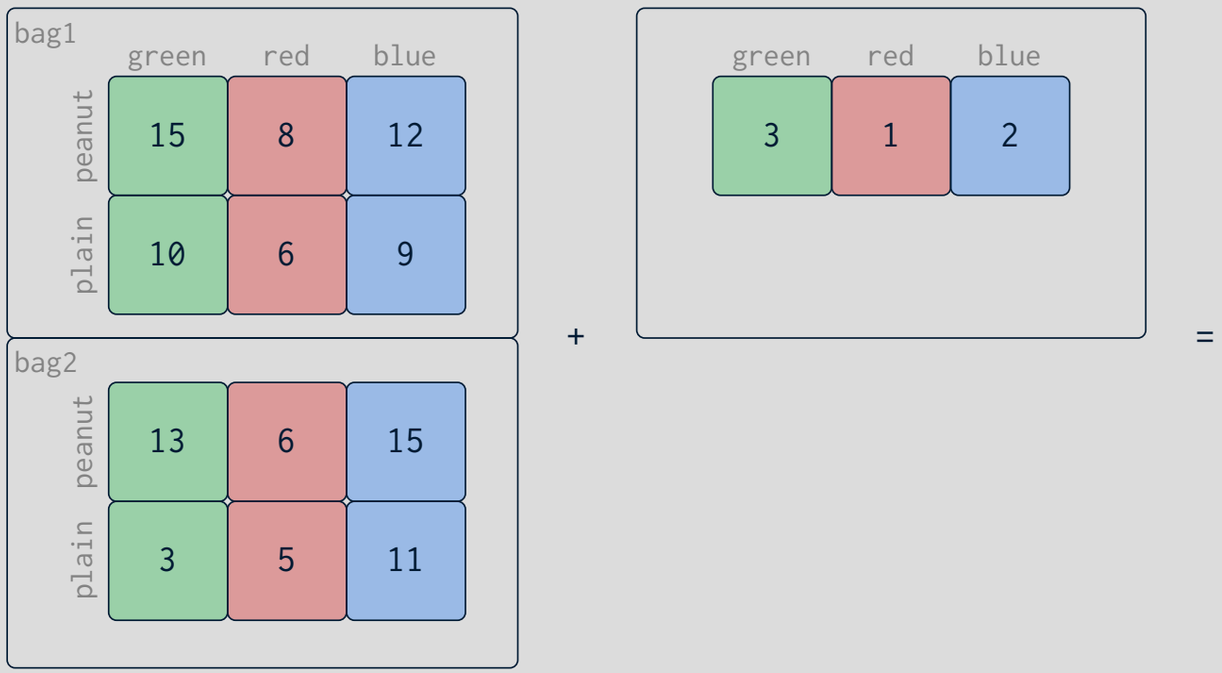


bags (2, 3, 2)

+

=

extra (1, 3)



bags (2, 3, 2)

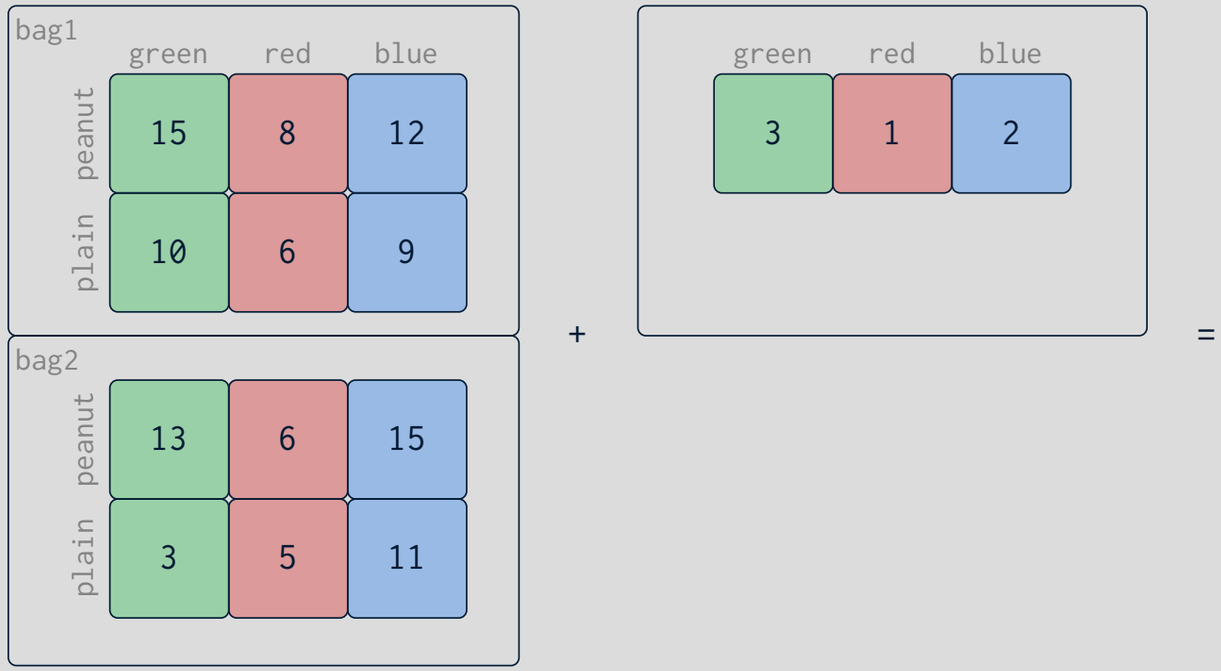
+

=

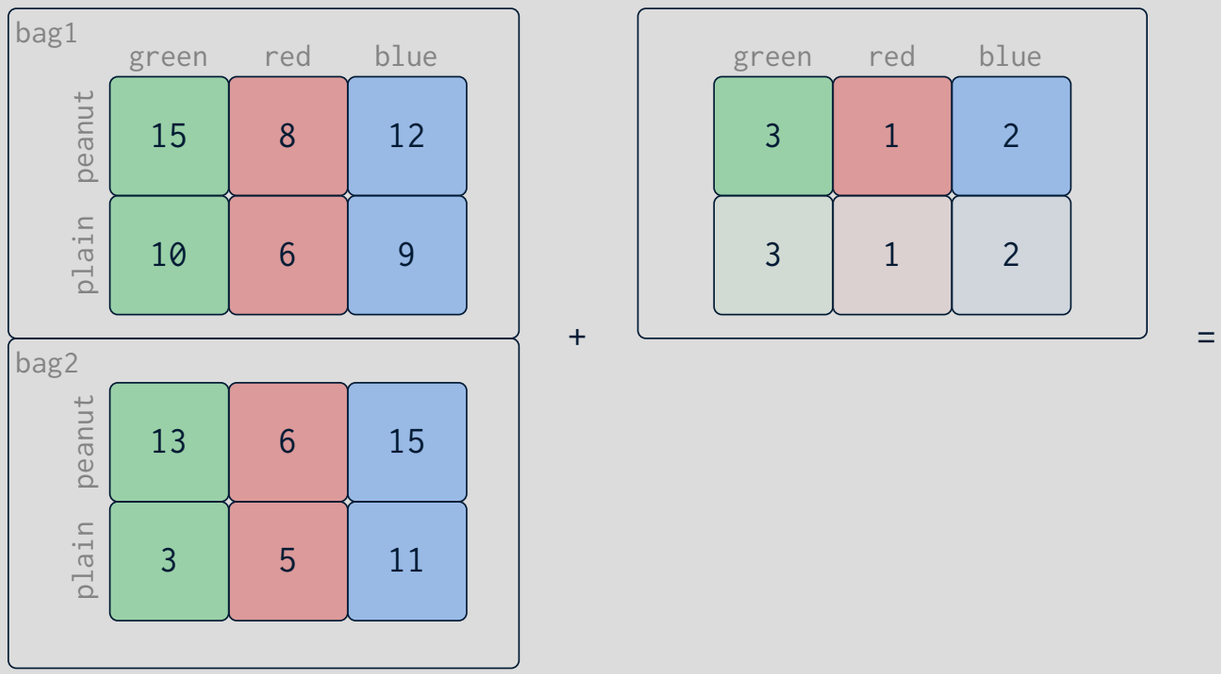
extra (1, 3, 1)

	# row	# col	# frame
bags	2	3	2
extra	1	3	1
	?	?	?

	# row	# col	# frame
bags	2	3	2
extra	~~1~~ 2	3	1
	~~?~~ 2	?	?



bags (2, 3, 2) extra (1, 3, 1)

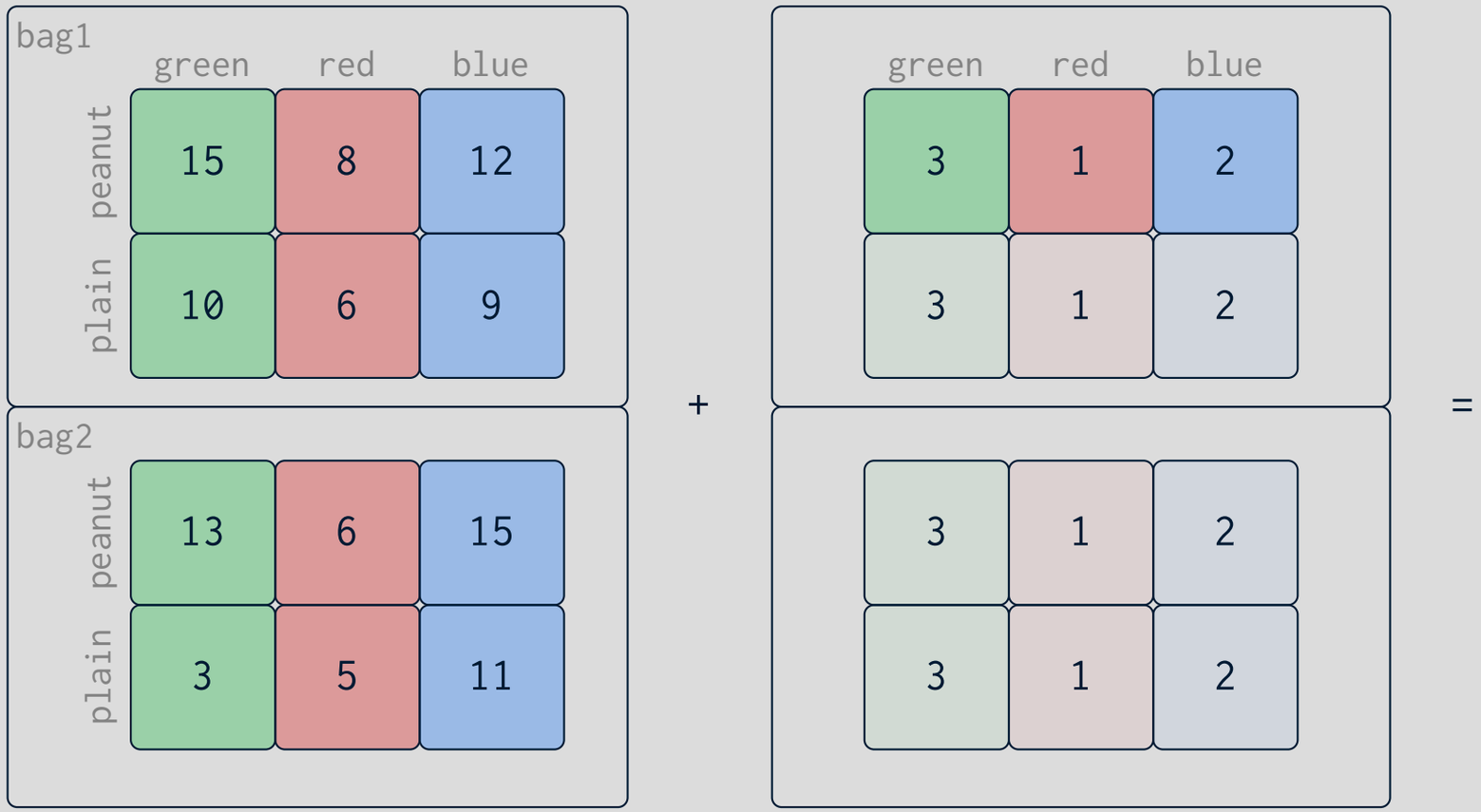


bags (2, 3, 2) extra (2, 3, 1)

	# row	# col	# frame
bags	2	3	2
extra	~~1~~ 2	3	1
	~~?~~ 2	?	?

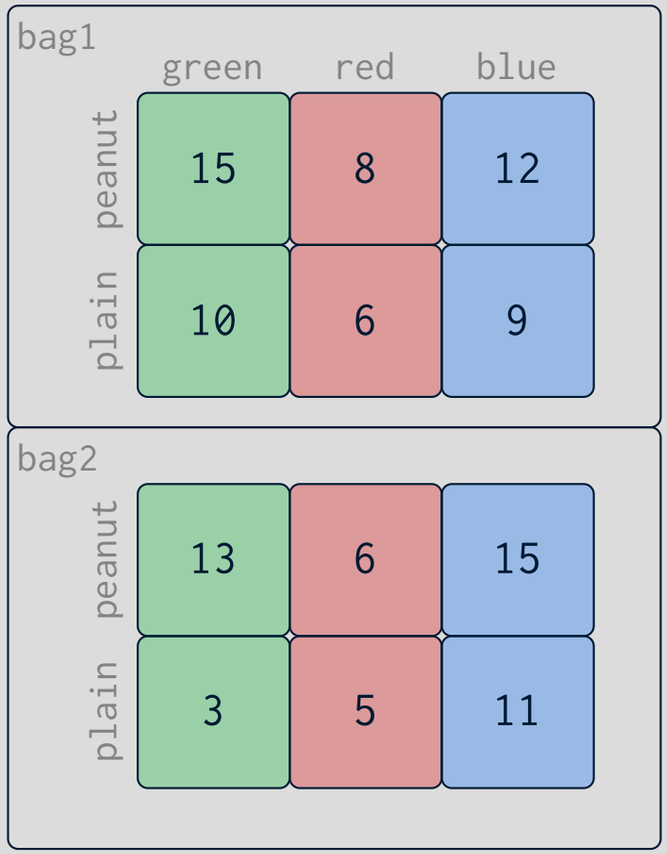
	# row	# col	# frame
bags	2	3	2
extra	~~1~~ 2	3	1
	~~?~~ 2	~~?~~ 3	?

	# row	# col	# frame
bags	2	3	2
extra	~~1~~ 2	3	~~1~~ 2
	~~?~~ 2	~~?~~ 3	~~?~~ 2



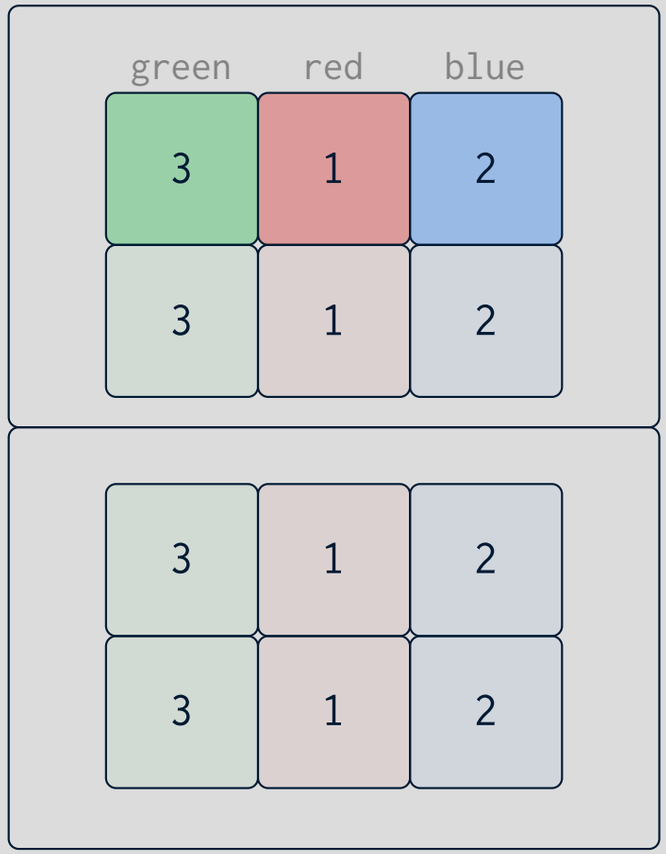
bags (2, 3, 2)

extra (2, 3, 2)



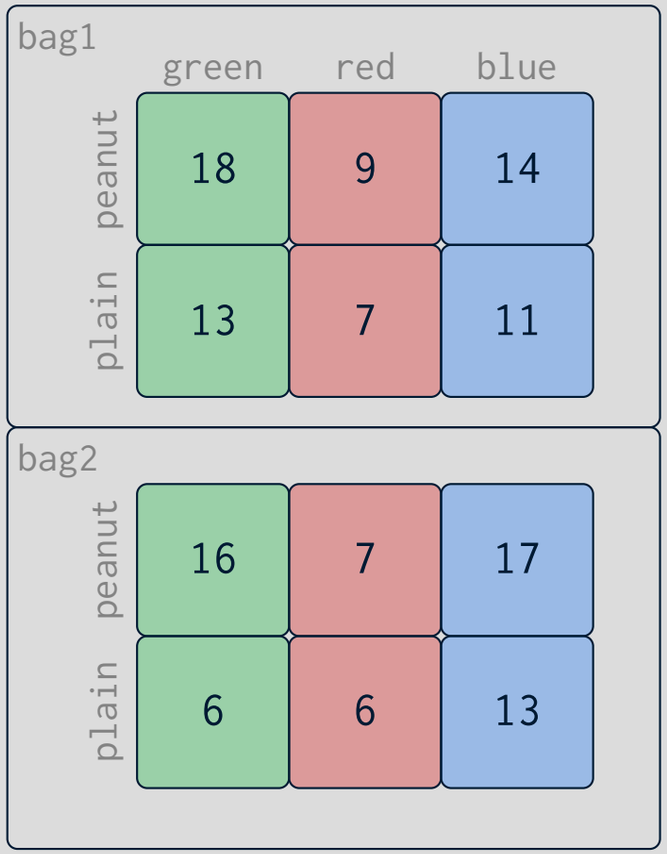
bags (2, 3, 2)

+



extra (2, 3, 2)

=



(2, 3, 2)

Broadcasting rules:

Match dimensionality by appending 1’s

Match dimensions by recycling them

rray broadcasts

```
bag
#>        green red blue
#> peanut    15   8   12
#> plain     10   6    9

extra
#>       green red blue
#> [1,]      3   1    2

bag + extra
#> Error in bag + extra: non-conformable arrays

bag_rray + extra
#> <rray<dbl>[,3][2]>
#>        green red blue
#> peanut    18   9   14
#> plain     13   7   11
```

Manipulation

rray as a toolkit

rray_bind()

rray_duplicate_any()

rray_expand_dims()

rray_broadcast()

rray_flip()

rray_max()

rray_sum()

rray_mean()

rray_reshape()

rray_rotate()

rray_split()

rray_tile()

rray_unique()

...

The best part?

The best part?

They all work with base R.

rray as a toolkit

rray_bind()

rray_duplicate_any()

rray_expand_dims()

rray_broadcast()

rray_flip()

rray_max()

rray_sum()

rray_mean()

rray_reshape()

rray_rotate()

rray_split()

rray_tile()

rray_unique()

...

rray as a toolkit

rray_bind()

rray_duplicate_any()

rray_expand_dims()

rray_broadcast()

rray_flip()

rray_max()

rray_sum()

rray_mean()

rray_reshape()

rray_rotate()

rray_split()

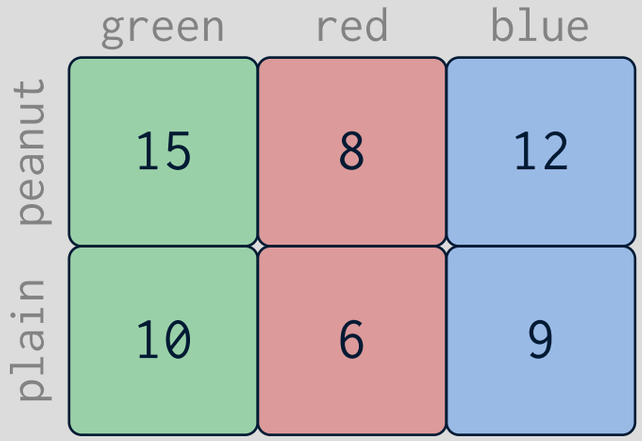
rray_tile()

rray_unique()

...

Compute proportions

1) Overall
2) By filling
3) By color



Overall

bag / sum(bag)

	green	red	blue
peanut	15	8	12
plain	10	6	9

	green	red	blue
peanut	0.25	0.13	0.20
plain	0.17	0.10	0.15

By Filling

sweep(bag, 1, apply(bag, 1, sum), "/")

	green	red	blue
peanut	15	8	12
plain	10	6	9

	green	red	blue
peanut	0.43	0.23	0.34
plain	0.40	0.24	0.36

By Color

sweep(bag, 2, apply(bag, 2, sum), "/")

	green	red	blue
peanut	15	8	12
plain	10	6	9

	green	red	blue
peanut	0.60	0.57	0.57
plain	0.40	0.43	0.43

Overall

	green	red	blue
peanut	15	8	12
plain	10	6	9

```
bag / rray_sum(bag)
```

	green	red	blue
peanut	0.25	0.13	0.20
plain	0.17	0.10	0.15

By Filling

	green	red	blue
peanut	15	8	12
plain	10	6	9

```
bag / rray_sum(bag, axes = 2)
```

	green	red	blue
peanut	0.43	0.23	0.34
plain	0.40	0.24	0.36

By Color

	green	red	blue
peanut	15	8	12
plain	10	6	9

```
bag / rray_sum(bag, axes = 1)
```

	green	red	blue
peanut	0.60	0.57	0.57
plain	0.40	0.43	0.43

In conclusion...

1) Stricter rray class

2) Broadcasting

3) Toolkit

Questions?

GitHub
https://github.com/r-lib/rray

Website
https://rray.r-lib.org

Powered by: xtensor
https://github.com/QuantStack/xtensor