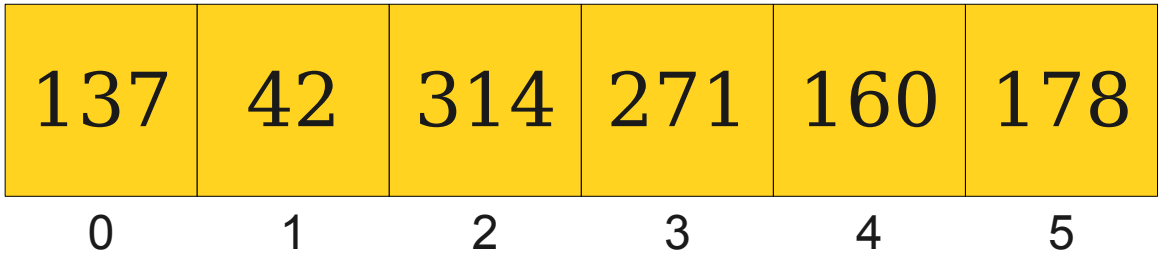
Multidimensional Arrays

Assignment 5 Demo

Announcements

- Assignment 4 due right now.
- Assignment 5 (**Array Algorithms**) out today, due **Monday, March 4** at 3:15PM.
  - Play around with arrays, sound processing, and image processing!
  - Send secret messages to your friends!
  - Compose music!
  - Fix broken family photos!
- YEAH hours (assignment review hours) next Monday from 7PM – 9PM in Herrin T175.

Arrays



- An array stores a **sequence** of multiple objects.
  - Can access objects by index using [].
- All stored objects have the same type.
  - You get to choose the type!
- Can store *any* type, even primitive types.
- Size is fixed; cannot grow once created.

Basic Array Operations

- To create a new array, specify the type of the array and the size in the call to **`new`**:

```
Type[] arr = new Type[size]
```

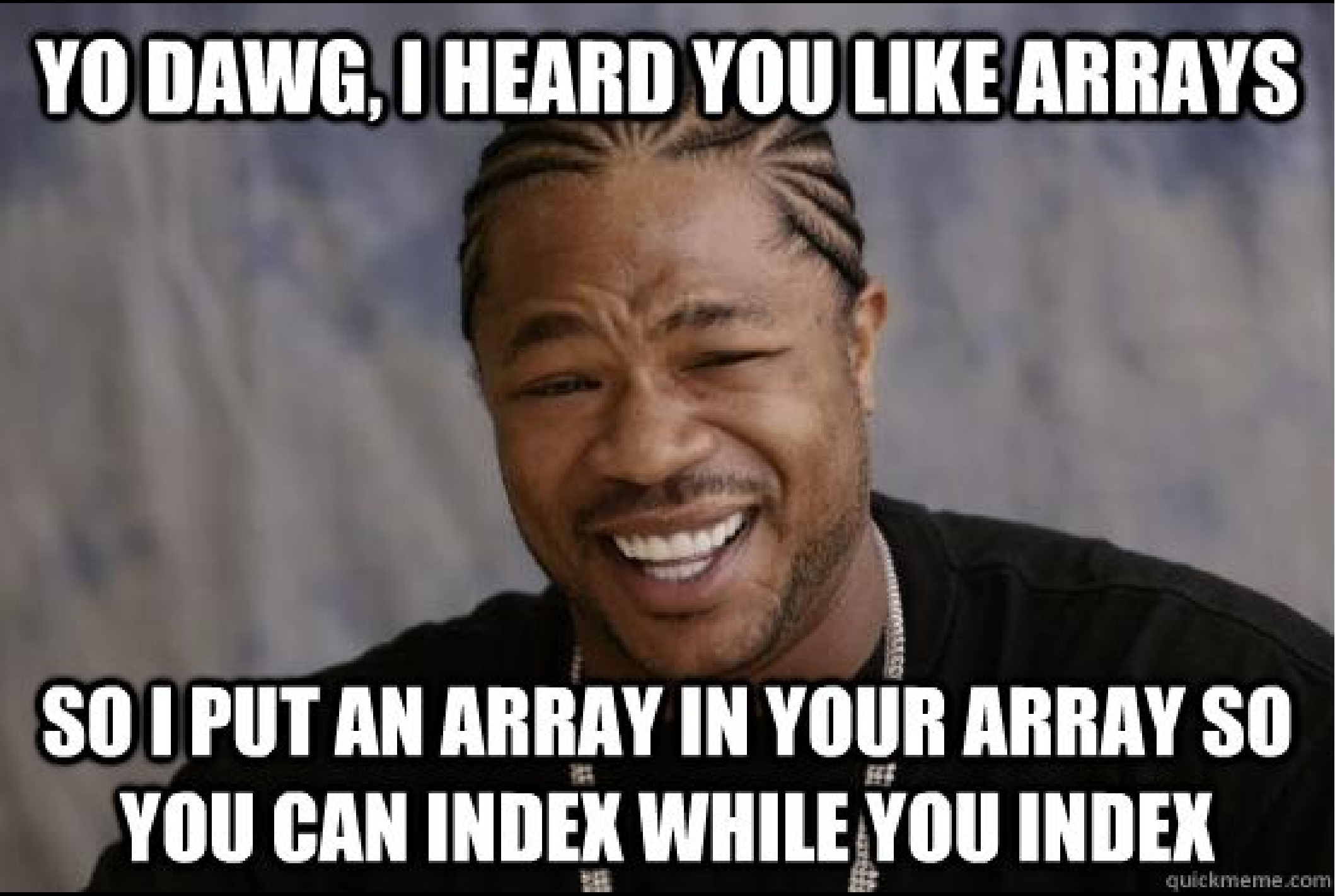
- To access an element of the array, use the square brackets to choose the index:

```
arr[index]
```

- To read the length of an array, you can read the **`length`** field:

```
arr.length
```

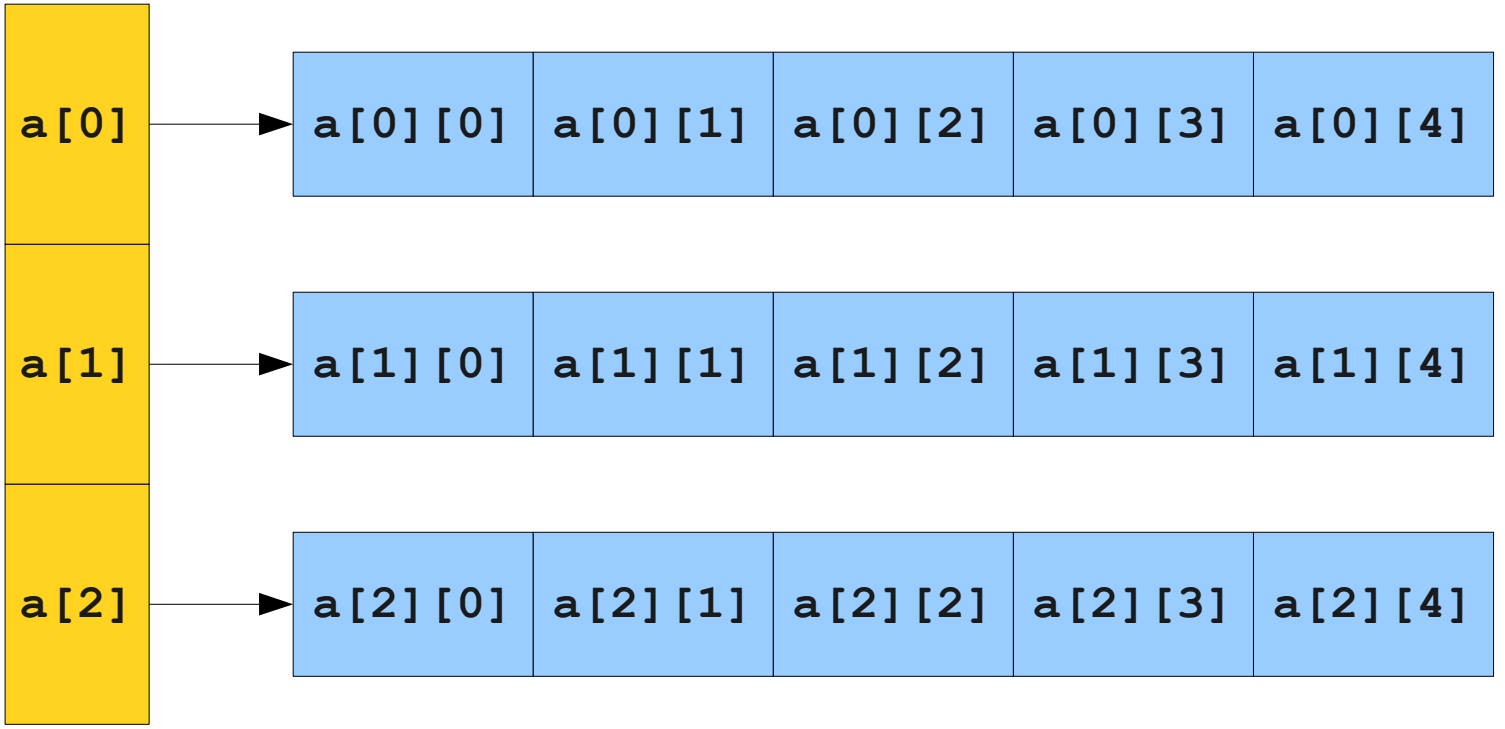

YO DAWG, I HEARD YOU LIKE ARRAYS
quickmeme.com


YO DAWG, I HEARD YOU LIKE ARRAYS
SO I PUT AN ARRAY IN YOUR ARRAY SO YOU CAN INDEX WHILE YOU INDEX
quickmeme.com

Multidimensional Arrays

- You can create **multidimensional arrays** to represent multidimensional data.

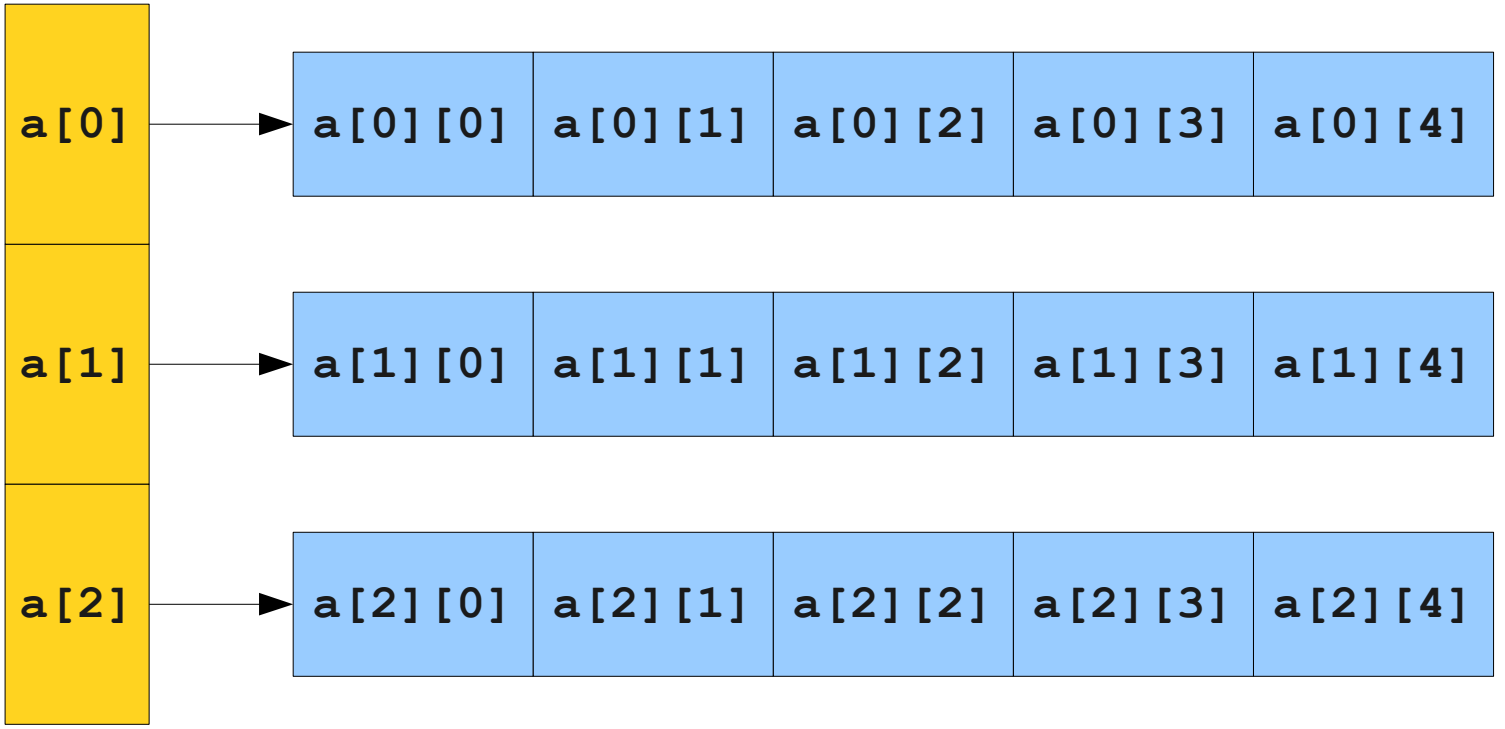
```
int[][] a = new int[3][5];
```



Multidimensional Arrays

- You can create **multidimensional arrays** to represent multidimensional data.

```
Type[][] a = new Type[rows][cols];
```



Interpreting Multidimensional Arrays

- There are two main ways of intuiting a multidimensional array.
- **As a 2D Grid:**
  - Looking up ***arr*`[`*row*`][`*col*`]` selects the element in the array at position (***row***, ***col***).
- **As an array of arrays:**
  - Looking up ***arr*`[`*row*`]` gives back a one-dimensional consisting of the columns in row ***row***.

Loops and Multidimensional Arrays

- The canonical way to loop over a multidimensional array is with a double **`for`** loop:

```
Type[][] arr = /* … */
for (int row = 0; row < arr.length; row++) {
  for (int col = 0; col < arr[row].length; col++) {
     /* … access arr[row][col] … */
  }
}
```

Loops and Multidimensional Arrays

```
int[][] arr = new int[4][5];
for (int row = 0; row < arr.length; row++) {
  for (int col = 0; col < arr[row].length; col++) {
     arr[row][col] = row + col;
  }
}
```

	0	1	2	3	4
0	0	0	0	0	0
1	0	0	0	0	0
2	0	0	0	0	0
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```

	0	1	2	3	4
0	0	1	2	3	4
1	1	2	3	4	5
2	0	0	0	0	0
3	0	0	0	0	0

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	0	1	2	3	4
0	0	1	2	3	4
1	1	2	3	4	5
2	0	0	0	0	0
3	0	0	0	0	0

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}
```
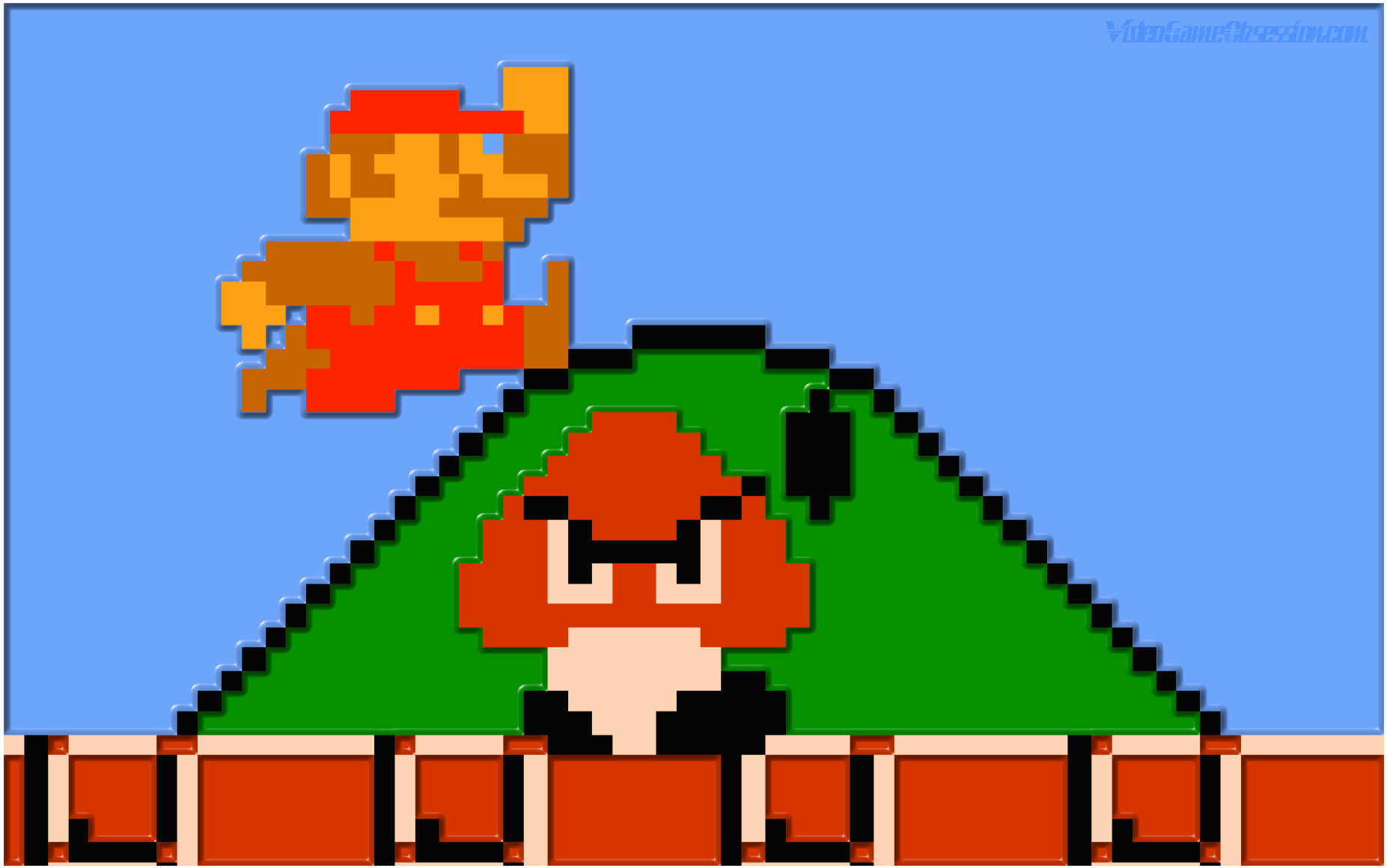

	0	1	2	3	4
0	0	1	2	3	4
1	1	2	3	4	5
2	2	3	4	5	6
3	3	4	5	6	7

Working with Images

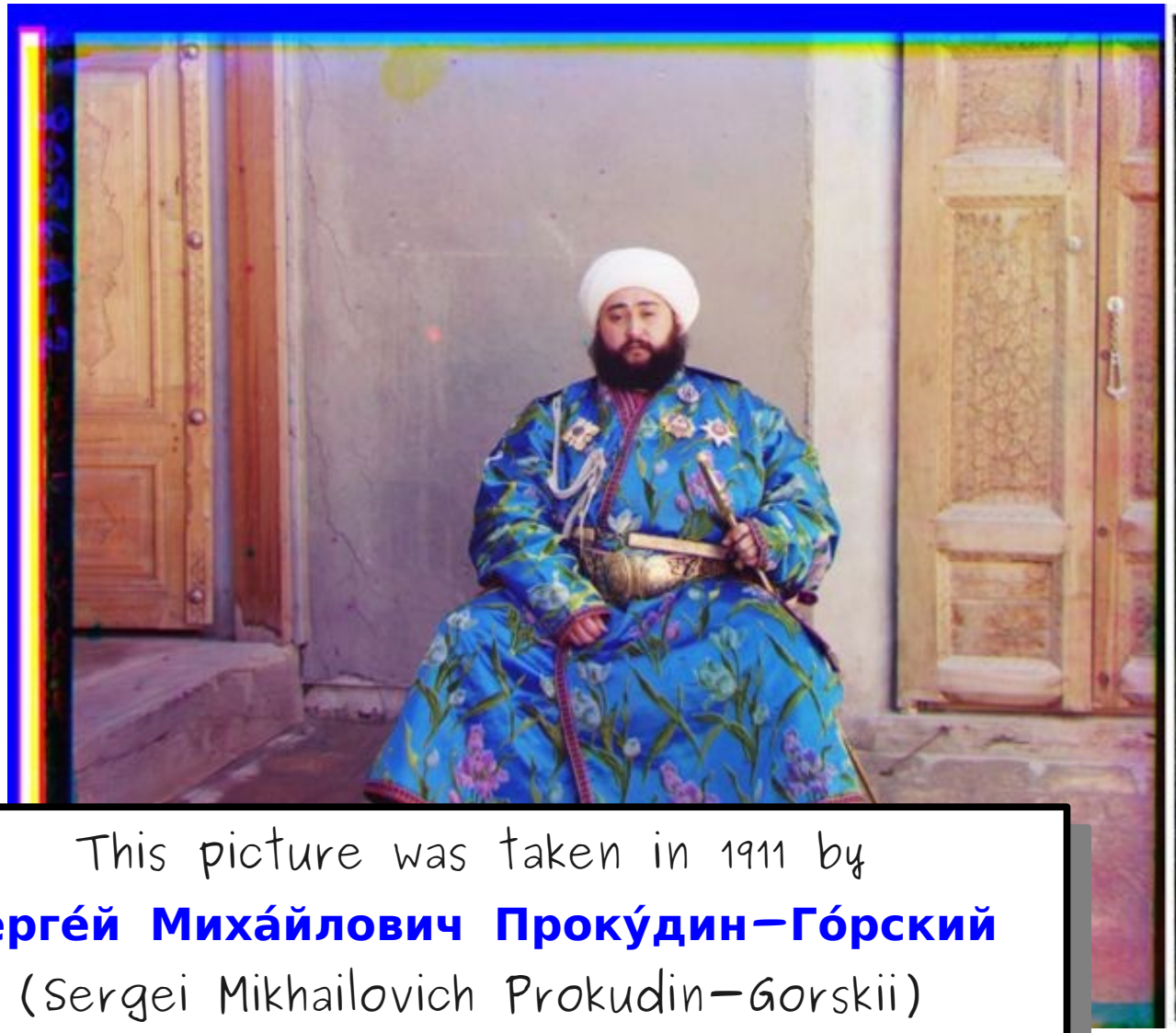


http://www.videogameobsession.com/videogame/wallpapers/VGO-NES-SuperMario_03-vgo.png

Representations of Color

- The human eye has three different types of color receptors that pick up colors (close to) red, green, and blue.
- Computers usually represent color as **RGB triplets**:
  - Describe the intensity of the red, green, and blue components of the color.
  - Values typically range from 0 to 255, inclusive.

Early Color Photographs



This picture was taken in 1911 by

Серге́й Миха́йлович Проку́дин-Го́рский

(Sergei Mikhailovich Prokudin-Gorskii)

http://en.m.wikipedia.org/wiki/File:Rgb-compose-Alim_Khan.jpg

Creating `GImage`s

- It is possible to directly create a GImage by specifying the RGB values of each pixel in the image.
- To do so:
  - Create an `int[][]` two-dimensional array to hold the pixel values.
  - Use `GImage.createRGBPixel` to convert the RGB triplets to `int`.
  - Construct a `new GImage` from the array.

Manipulating Images

- You can extract an array of pixels from a **`GImage`** by calling

***`image`*`.getPixelArray()`**

- You can then create a new image by changing the pixel values.

A Note: `static` Methods

- The methods

  `GImage.createRGBPixel`

  `GImage.getRed`

  `GImage.getGreen`

  `GImage.getBlue`

  are called **static methods**.

- Static methods are invoked on a *class* rather than an *object*. They cannot access instance variables.
- Useful when the method represents a general operation that does not change an object.