# Stanford CS193p

## Developing Applications for iOS
## Fall 2013-14

# Today

- Multithreading
  Posting blocks on queues (which are then executed on other threads).
- UIScrollView
  A "window" on an arbitrarily large content area that can be moved and zoomed.
- Demo
  Imaginarium
- UITableView
  (Time Permitting)
  Data source-driven vertical list of views.

# Multithreading

- Queues
  - Multithreading is mostly about "queues" in iOS.
  - Blocks are lined up in a queue (method calls can also be enqueued).
  - Then those blocks are pulled off the queue and executed on an associated thread.
- Main Queue
  - There is a very special queue called the "main queue."
  - All UI activity MUST occur on this queue and this queue only.
  - And, conversely, non-UI activity that is at all time consuming must NOT occur on that queue.
  - We want our UI to be responsive!
  - Blocks are pulled off and worked on in the main queue only when it is "quiet".
- Other Queues
  - Mostly iOS will create these for us as needed.
  - We'll give a quick overview of how to create your own (but usually not necessary).

# Multithreading

- Executing a block on another queue

```
dispatch_queue_t queue = …;
dispatch_async(queue, ^{ });
```

- Getting the main queue

```
dispatch_queue_t mainQ = dispatch_get_main_queue();
NSOperationQueue *mainQ = [NSOperationQueue mainQueue]; // for object-oriented APIs
```

- Creating a queue (not the main queue)

```
dispatch_queue_t otherQ = dispatch_queue_create("name", NULL); // name a const char *!
```

- Easy mode … invoking a method on the main queue

```
NSObject method …
- (void)performSelectorOnMainThread:(SEL)aMethod
                         withObject:(id)obj
                      waitUntilDone:(BOOL)waitUntilDone;
dispatch_async(dispatch_get_main_queue(), ^{ /* call aMethod */ });
```

# Multithreading

- Example of an iOS API that uses multithreading

```
NSURLRequest *request = [NSURLRequest requestWithURL:[NSURL urlWithString:@“http://...”]];
NSURLConfiguration *configuration = …;
NSURLSession *session = …;
NSURLSessionDownloadTask *task;
task = [session downloadTaskWithRequest:request
                      completionHandler:^(NSURL *localfile, NSURLResponse *response, NSError *error) {
   /* want to do UI things here, can I? */
}];
[task resume];
```

`downloadTaskWithRequest:completionHandler:` will do its work (downloading that URL) NOT in the main thread (i.e. it will not block the UI while it waits on the network).

The `completionHandler` block above might execute on the main thread (or not) depending on how you create the `NSURLSession`.

Let's look at the two options (on or off the main queue) …

# Multithreading

- On the main queue …

```
NSURLSession *session = [NSURLSession sessionWithConfiguration:configuration
                                                      delegate:nil
                                                 delegateQueue:[NSOperationQueue mainQueue]];
NSURLSessionDownloadTask *task;
task = [session downloadTaskWithRequest:request
                      completionHandler:^(NSURL *localfile, NSURLResponse *response, NSErr or *error) {
    /* yes, can do UI things directly because this is called on the main queue */
}];
[task resume];
```

Since the `delegateQueue` is the main queue, our `completionHandler` will be on the main queue.
When the URL is done downloading, the block above will execute on the main queue.
Thus we can do any UI code we want there.
Of course, if you are doing non-UI things here, they'd best be quick (don't block main queue!).

# Multithreading

- Off the main queue …

```
NSURLSession *session = [NSURLSession sessionWithConfiguration:configuration]; // no delegateQueue
NSURLSessionDownloadTask *task;
task = [session downloadTaskWithRequest:request
                      completionHandler:^(NSURL *localfile, NSURLResponse *response, NSError *error) {
    dispatch_async(dispatch_get_main_queue(), ^{ /* do UI things */ });
    or [self performSelectorOnMainThread:@selector(doUIthings) withObject:nil waitUntilDone:NO];
}];
[task resume];
```

In this case, you can't do any UI stuff because the completionHandler is not on the main queue. To do UI stuff, you have to post a block (or call a method) back on the main queue (as shown).

# UIScrollView

# Adding subviews to a normal UIView …

```
subview.frame = ...;
[view addSubview:subview];
```

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```

# Adding subviews to a UIScrollView …

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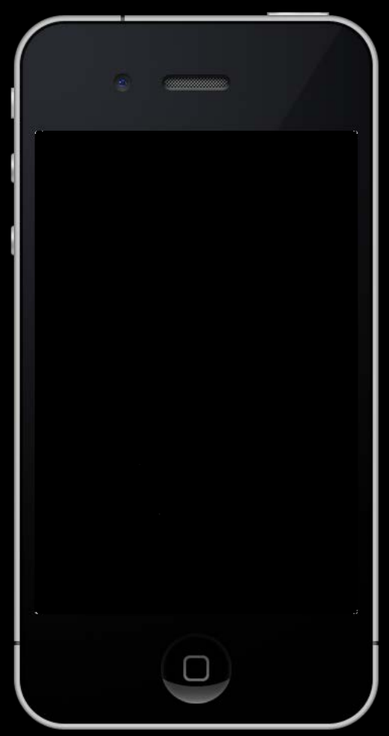
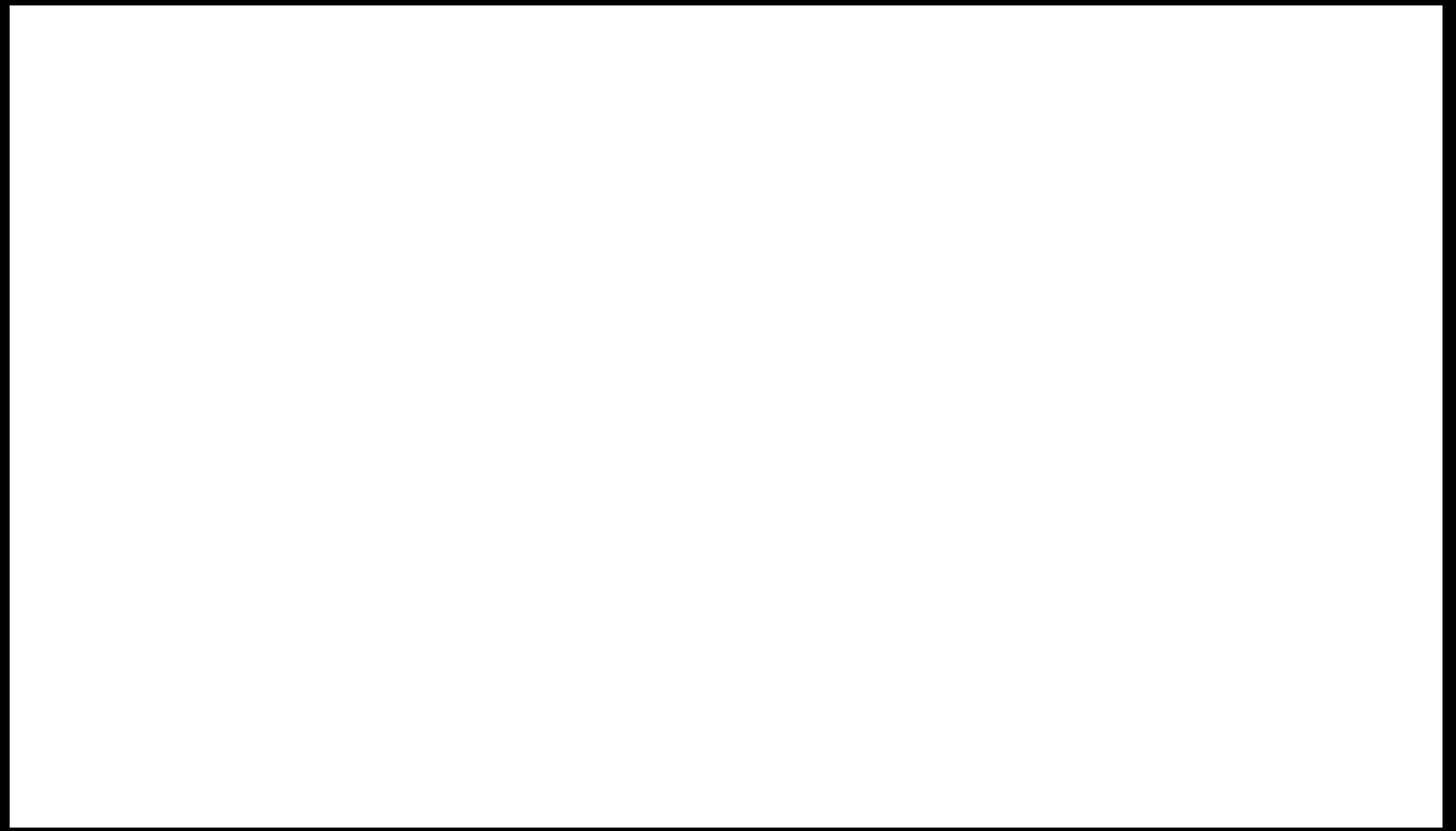
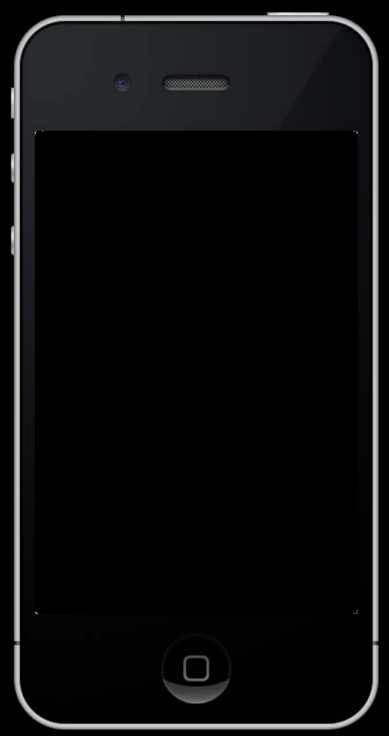
```
scrollView.contentSize = CGSizeMake(3000, 2000);
```

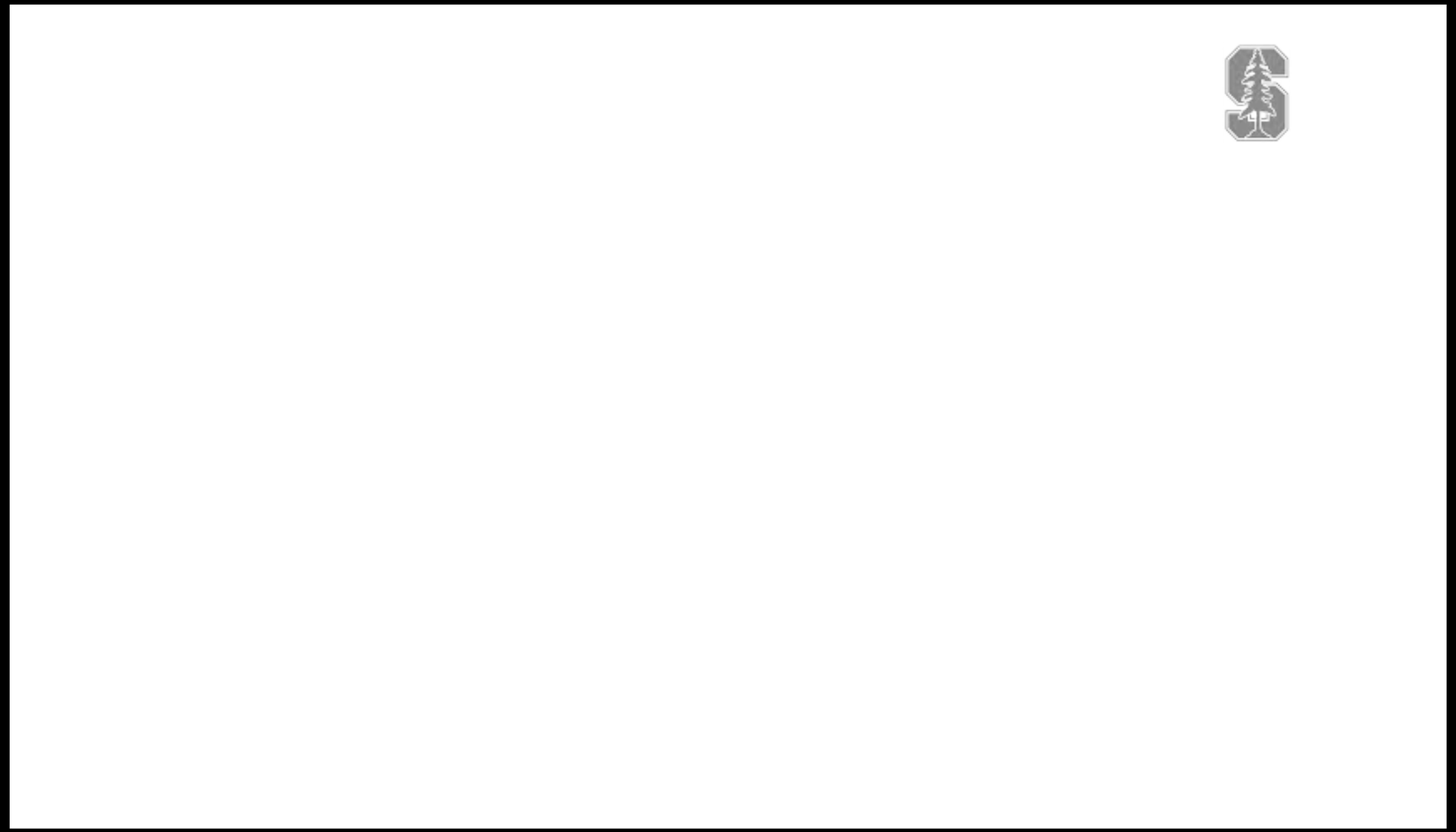




# Adding subviews to a UIScrollView …

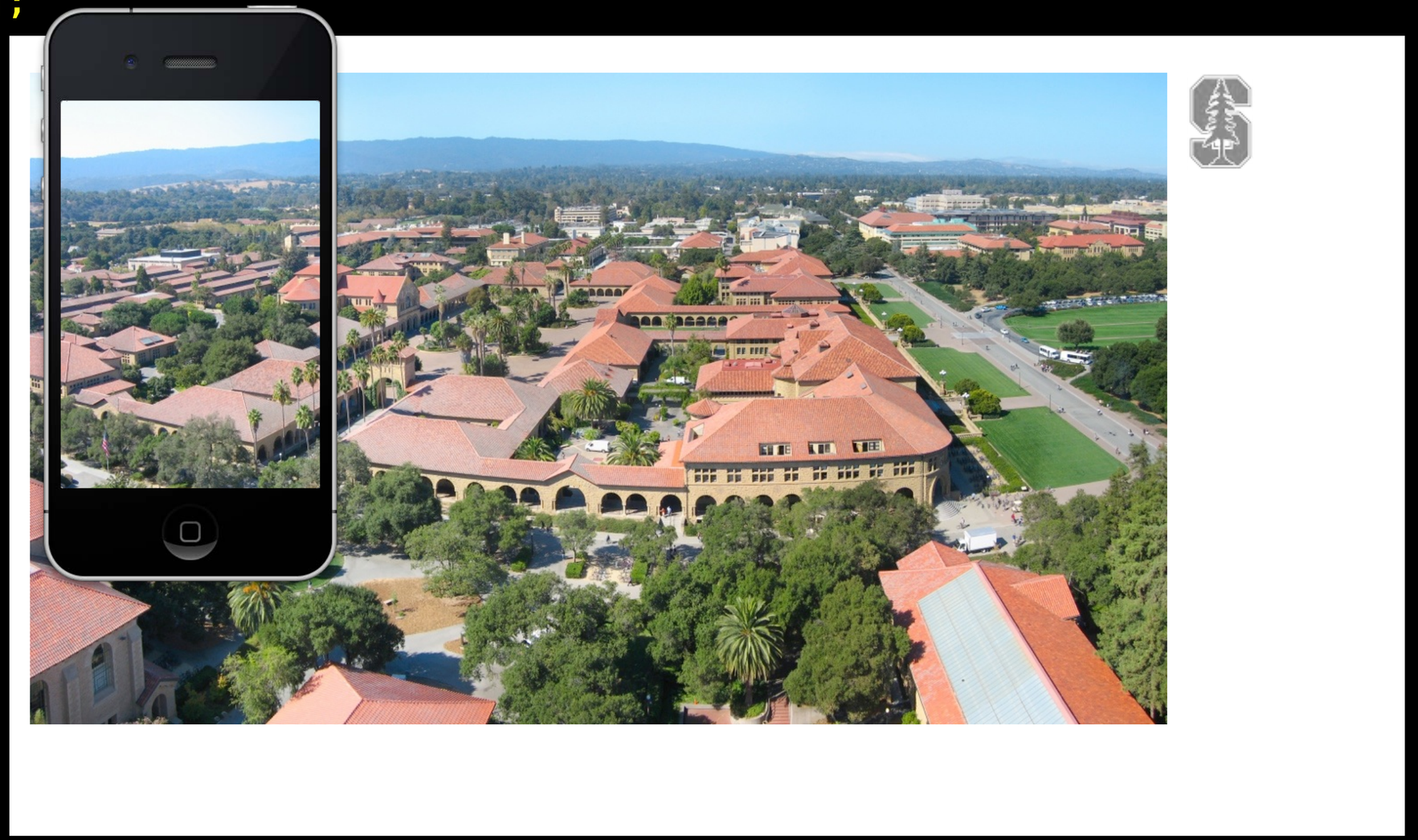
```
scrollView.contentSize = CGSizeMake(3000, 2000);
subview1.frame = CGRectMake(2700, 100, 120, 180);
[view addSubview:subview1];
```



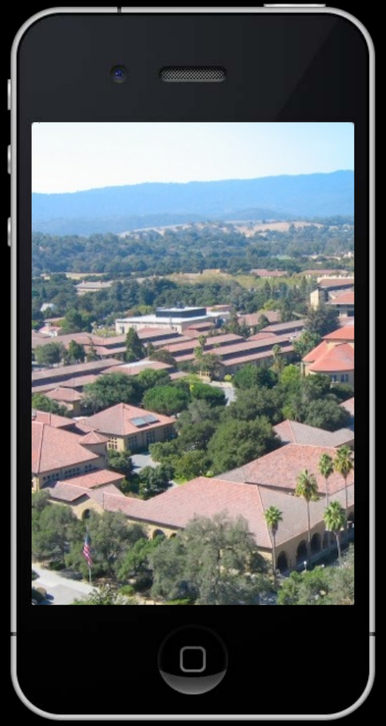


# Adding subviews to a UIScrollView …

```
scrollView.contentSize = CGSizeMake(3000, 2000);
subview2.frame = CGRectMake(50, 100, 2500, 1600);
[view addSubview:subview2];
```



# Adding subviews to a UIScrollView …



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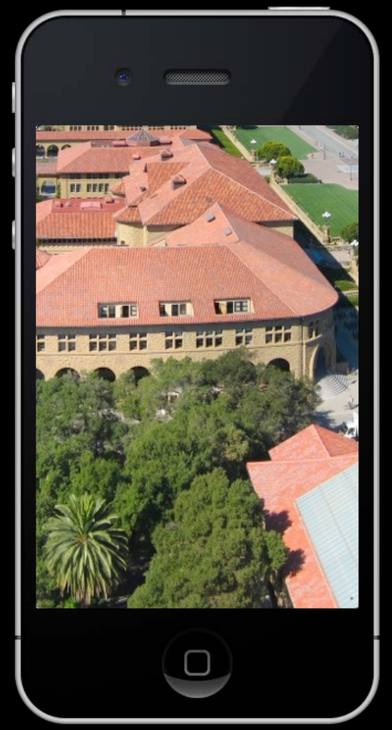
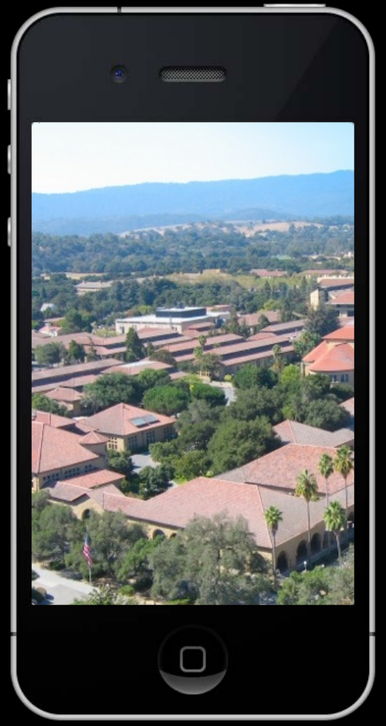
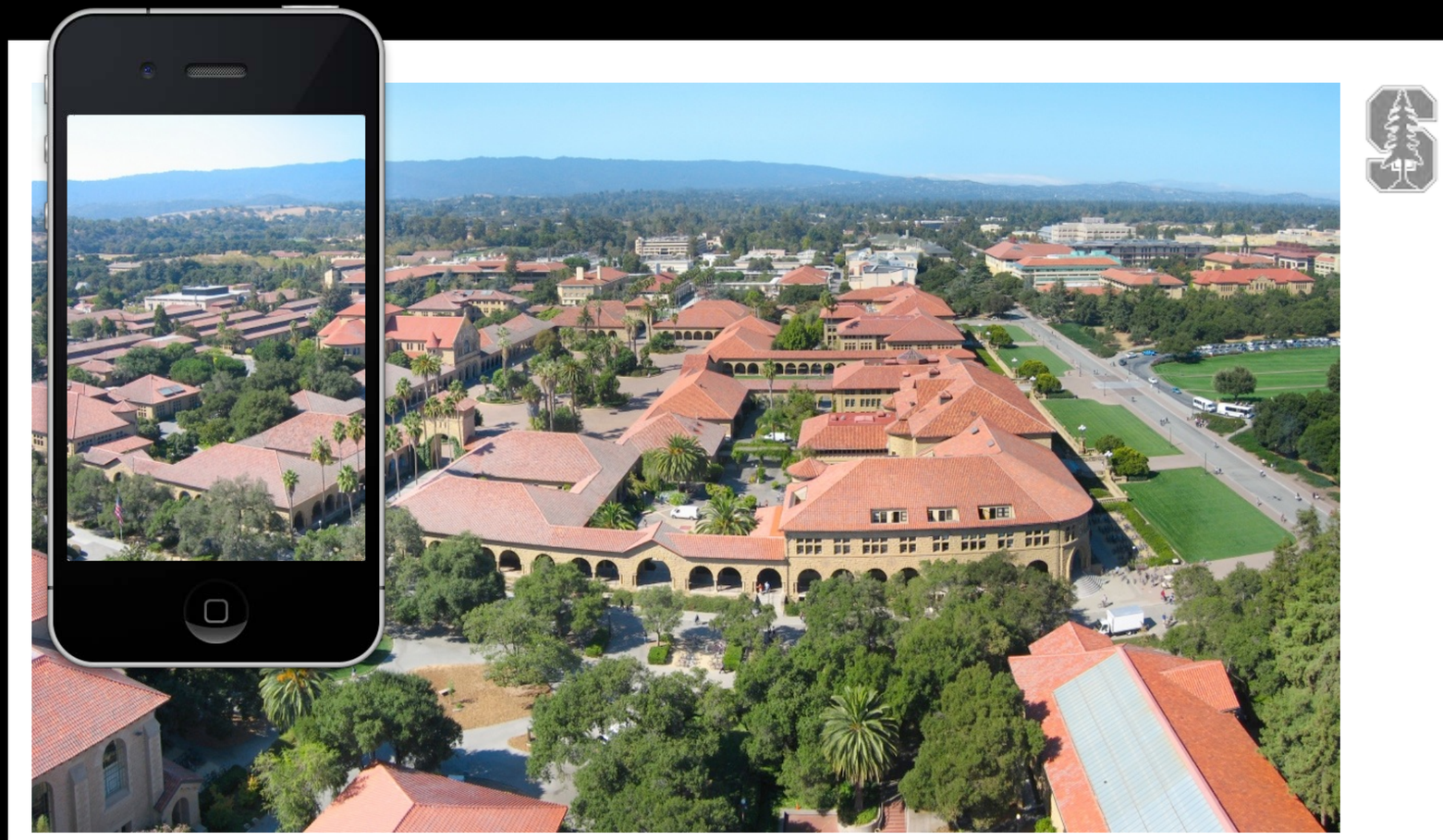


# Adding subviews to a UIScrollView …



# Positioning subviews in a UIScrollView …



# Positioning subviews in a UIScrollView …

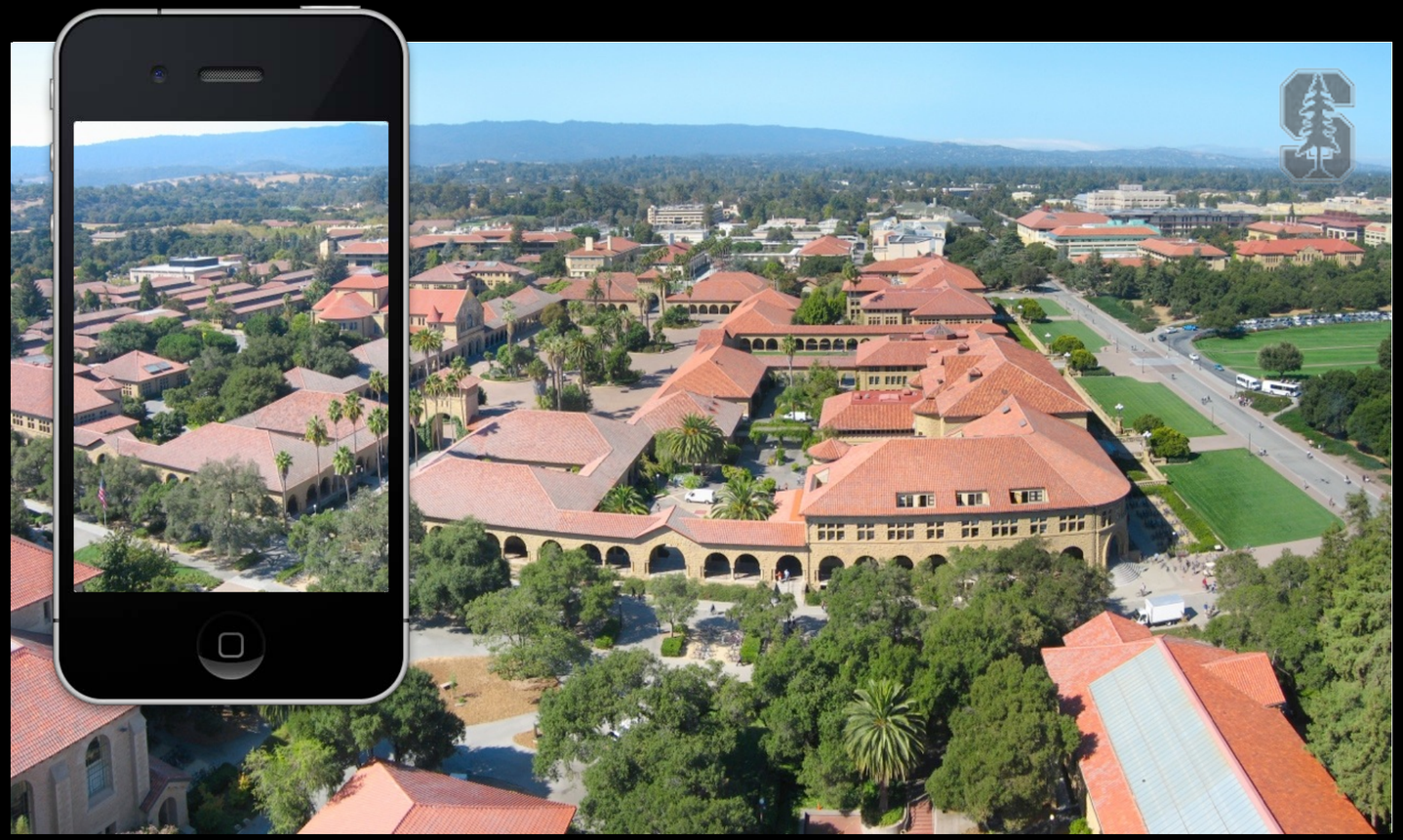
```
subview1.frame = CGRectMake(2250, 50, 120, 180);
```

# Positioning subviews in a UIScrollView …

```
subview2.frame = CGRectMake(0, 0, 2500, 1600);
```

# Positioning subviews in a UIScrollView …

```
subview2.frame = CGRectMake(0, 0, 2500, 1600);
scrollView.contentSize = CGSizeMake(2500, 1600);
```



# Voilà!

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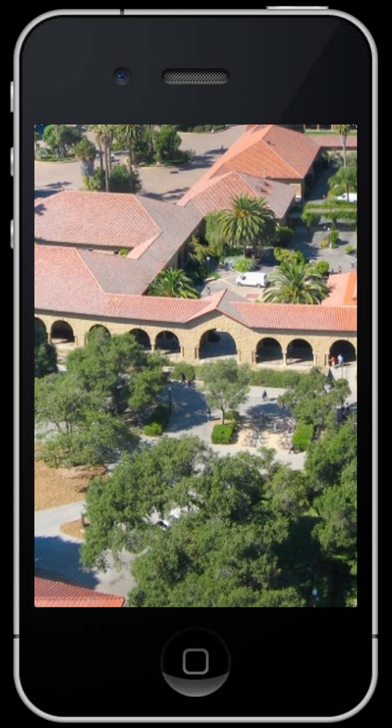


# Voilà!

# Voilà!

# Upper left corner of currently-showing area

```
CGPoint upperLeftOfVisible = scrollView.contentOffset;
```

In content area's coordinates.

# Visible area of a scroll view

`scrollView.bounds`

# Visible area of a scroll view's subview in that view's coordinates

```
CGRect visibleRect = [scrollView convertRect:scrollView.bounds toView:subview];
```

What's the difference?  Might be scaled (due to zooming), for example.

# UIScrollView

- How do you create one?
  - Just like any other UIView. Drag out in a storyboard or use alloc/initWithFrame:.
  - Or select a UIView in your storyboard and choose "Embed In -> Scroll View" from Editor menu.
- Or add your "too big" UIView using addSubview:

```
UIImage *image = [UIImage imageNamed:@"bigimage.jpg"];
UIImageView *iv = [[UIImageView alloc] initWithImage:image]; // frame.size = image.size
[scrollView addSubview:iv];
```

  - Add more subviews if you want.
  - All of the subviews' frames will be in the UIScrollView's content area's coordinate system (that is, (0,0) in the upper left & width and height of contentSize.width & .height).
- Don't forget to set the contentSize
  - Common bug is to do the above 3 lines of code (or embed in Xcode) and forget to say:

```
scrollView.contentSize = imageView.bounds.size
```

# UIScrollView

- Scrolling programmatically
  - `- (void)scrollRectToVisible:(CGRect)aRect animated:(BOOL)animated;`
- Other things you can control in a scroll view

  Whether scrolling is enabled.

  Locking scroll direction to user's first "move".

  The style of the scroll indicators (call `flashScrollIndicators` when your scroll view appears).

  Whether the actual content is "inset" from the content area (`contentInset` property).

# UIScrollView

- Zooming

  All UIView's have a property (transform) which is an affine transform (translate, scale, rotate).

  Scroll view simply modifies this transform when you zoom.

  Zooming is also going to affect the scroll view's contentSize and contentOffset.

- Will not work without minimum/maximum zoom scale being set

```
scrollView.minimumZoomScale = 0.5;   // 0.5 means half its normal size
scrollView.maximumZoomScale = 2.0;   // 2.0 means twice its normal size
```

- Will not work without delegate method to specify view to zoom

```
- (UIView *)viewForZoomingInScrollView:(UIScrollView *)sender;
```

  If your scroll view only has one subview, you return it here. More than one? Up to you.

- Zooming programatically

```
@property (nonatomic) float zoomScale;
- (void)setZoomScale:(float)scale animated:(BOOL)animated;
- (void)zoomToRect:(CGRect)zoomRect animated:(BOOL)animated;
```

```
scrollView.zoomScale = 1.2;
```

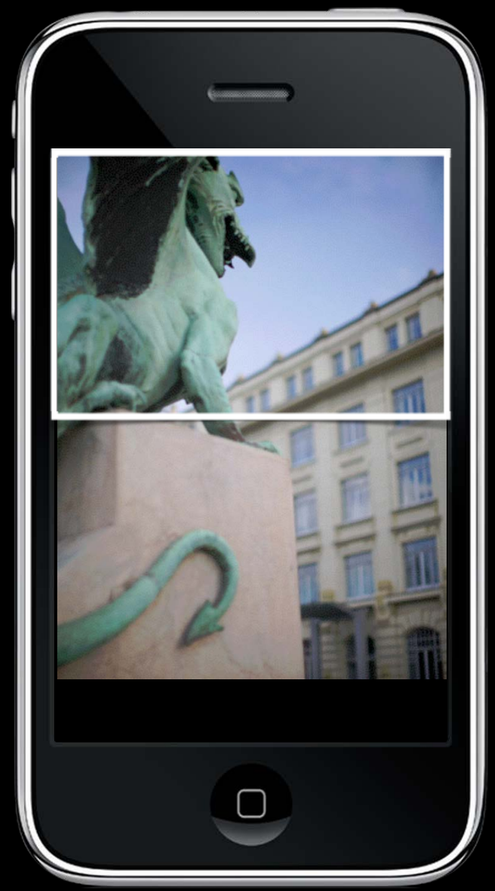
```
scrollView.zoomScale = 1.0;
```

```
scrollView.zoomScale = 1.2;
```

```
- (void)zoomToRect:(CGRect)rect animated:(BOOL)animated;
```

```
- (void)zoomToRect:(CGRect)rect animated:(BOOL)animated;
```

```
- (void)zoomToRect:(CGRect)rect animated:(BOOL)animated;
```



```
- (void)zoomToRect:(CGRect)rect animated:(BOOL)animated;
```

# UIScrollView

- Lots and lots of `delegate` methods!

  The scroll view will keep you up to date with what's going on.

- Example: `delegate` method will notify you when zooming ends

```
- (void)scrollViewDidEndZooming:(UIScrollView *)sender
                       withView:(UIView *)zoomView  // from delegate method above
                        atScale:(CGFloat)scale;
```

  If you redraw your view at the new scale, be sure to reset the transform back to identity.

# Demo

- Imaginarium
  - `UIImageView` inside a `UIScrollView`
  - Multithreaded download from a URL
  - `UIActivityIndicatorView` to show user that a download is in progress

# Coming Up

- Wednesday
  - More `UITableView` (with demo)
  - iPad
- Homework
  - Next Homework will be assigned on Wednesday, due the next Wednesday.
- Friday
  - Stanford Only Review Section
- Next Week
  - Core Data (Object-Oriented Database)