

Debugging in Swift

how hard can it be

**Why do we struggle
with debugging?**

Output is not helpful

```
(lldb) po objectiveCString  
0x00007fbaa1f24910  
  (ObjectiveC.NSObject = {})
```

Error messages make no sense

```
func randomPointInRectangle(rectangle:CGRect) {  
    return CGPoint(x: randomInt(rectangle.size.width), y:  
        randomInt(rectangle.size.height))  
}
```

! Cannot invoke 'init' with an argument list of type '(x: \$T4, y: \$T9)'

**What?! That tool
exists?**

How debugging should be like

- Get to the content of interest

How debugging should be like

- Get to the content of interest
- Get helpful error messages

How debugging should be like

- Get to the content of interest
- Get helpful error messages
- Display additional information where needed

How debugging should be like

- Get to the content of interest
- Get helpful error messages
- Display additional information where needed
- Know about debugging tools

LLDB

Expression

```
(lldb) po objectiveCString  
0x00007fbaa1f24910  
  (ObjectiveC.NSObject = {})
```

Expression

```
(lldb) expression -0 -- objectiveCString  
0x00007fbaa1f24910  
  (ObjectiveC.NSObject = {})
```

Magic command

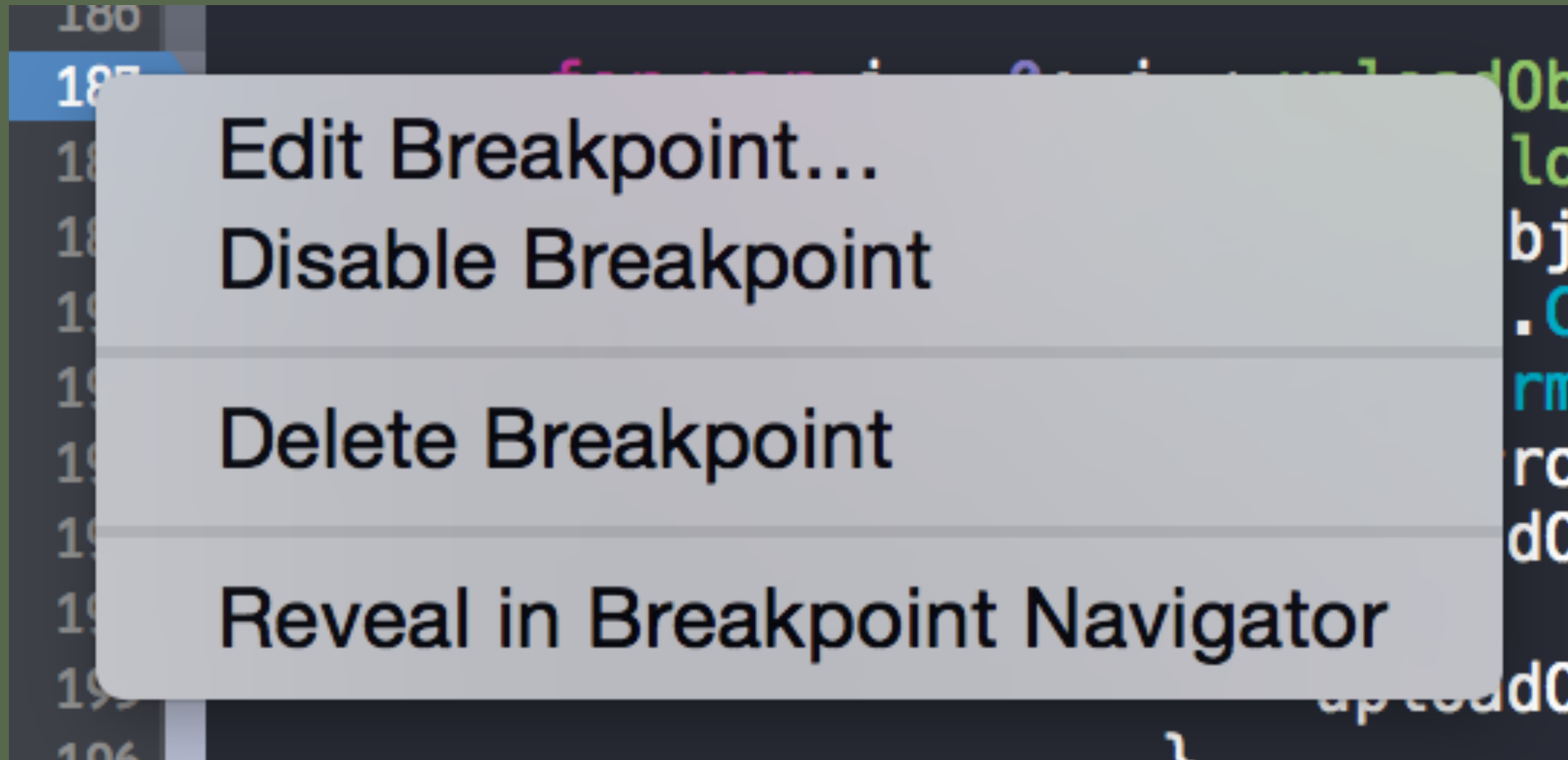
```
(lldb) expression -l objc -0 -- (id) 0x00007fbaa1f24910
```

Magic command

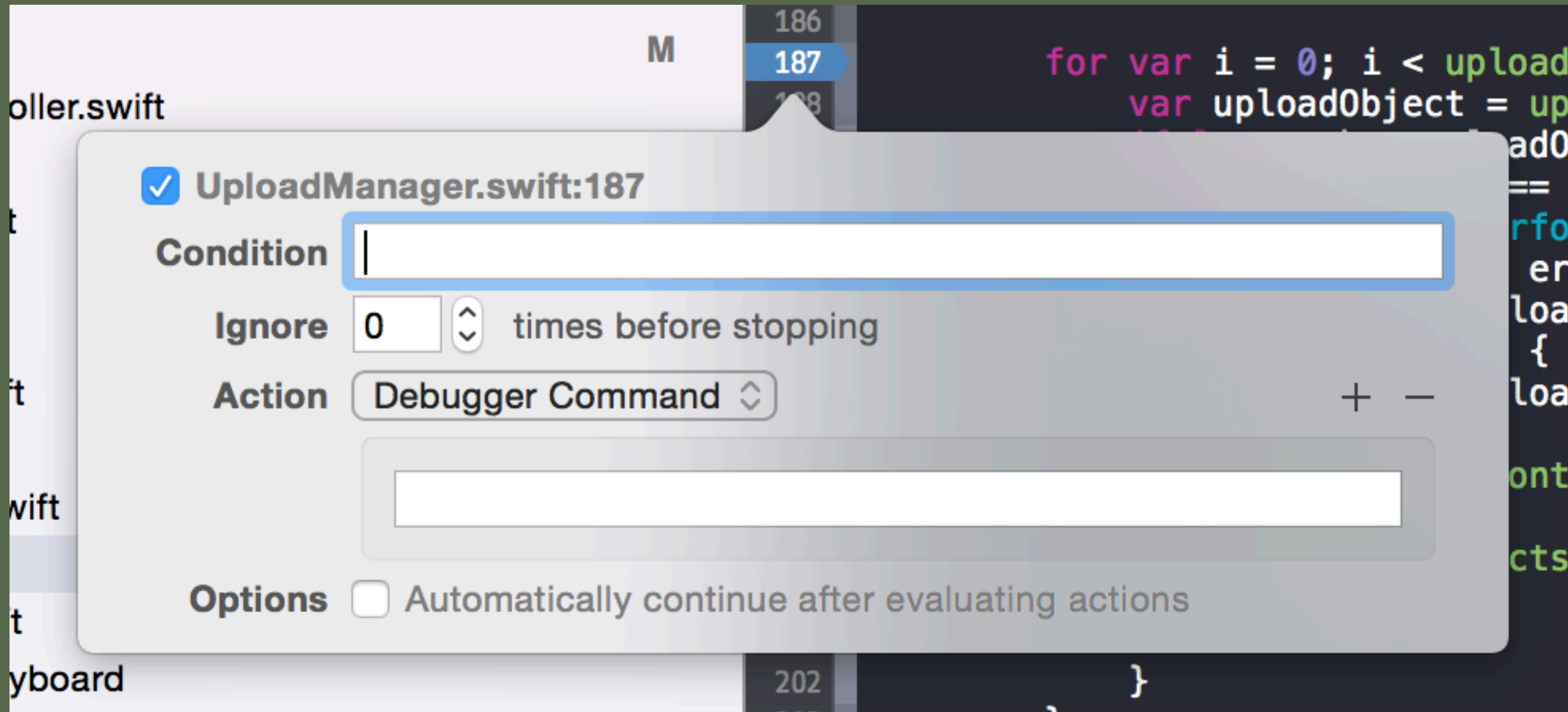
```
(lldb) expression -l objc -0 -- (id) 0x00007fbaa1f24910  
I'm a fancy Objective-C String
```

Breakpoints

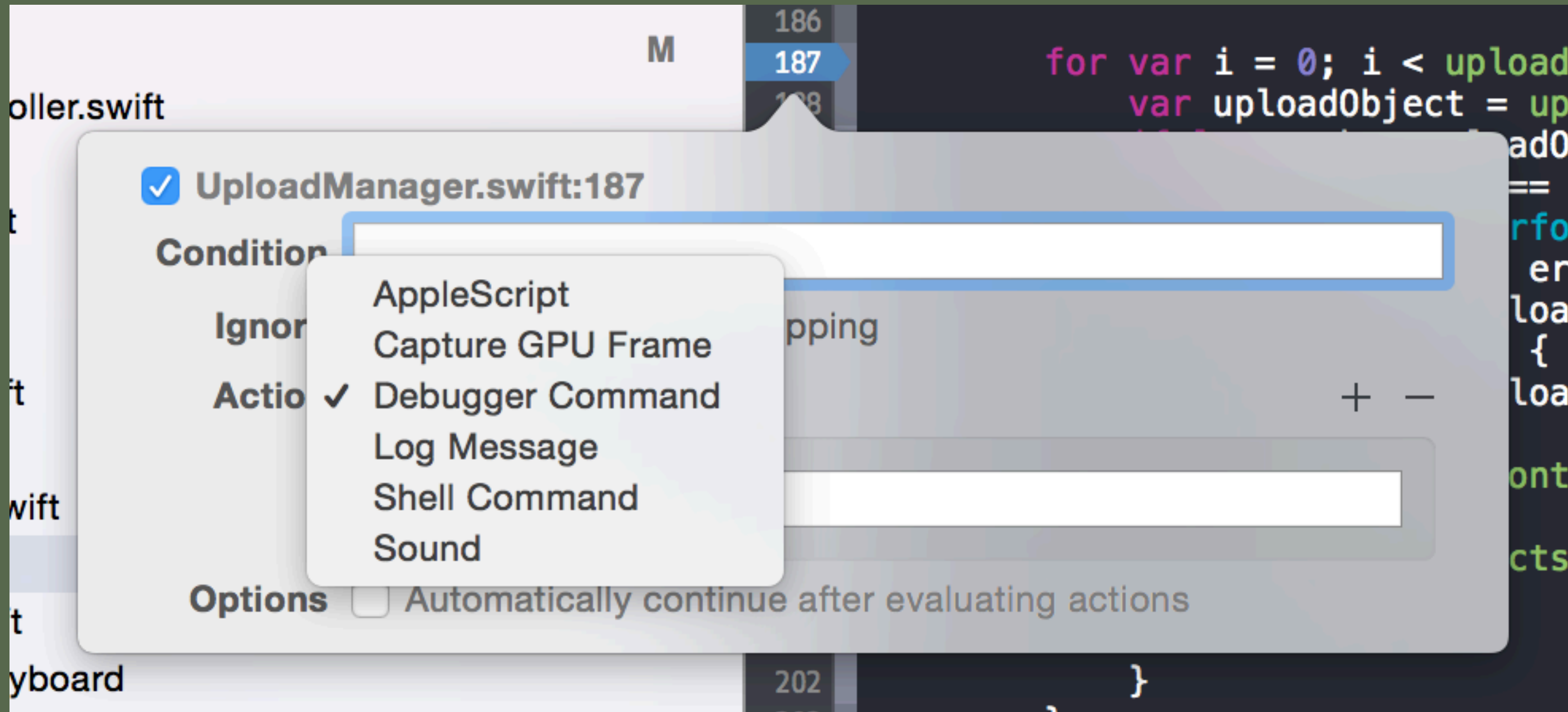
Editing Breakpoints



Editing Breakpoints

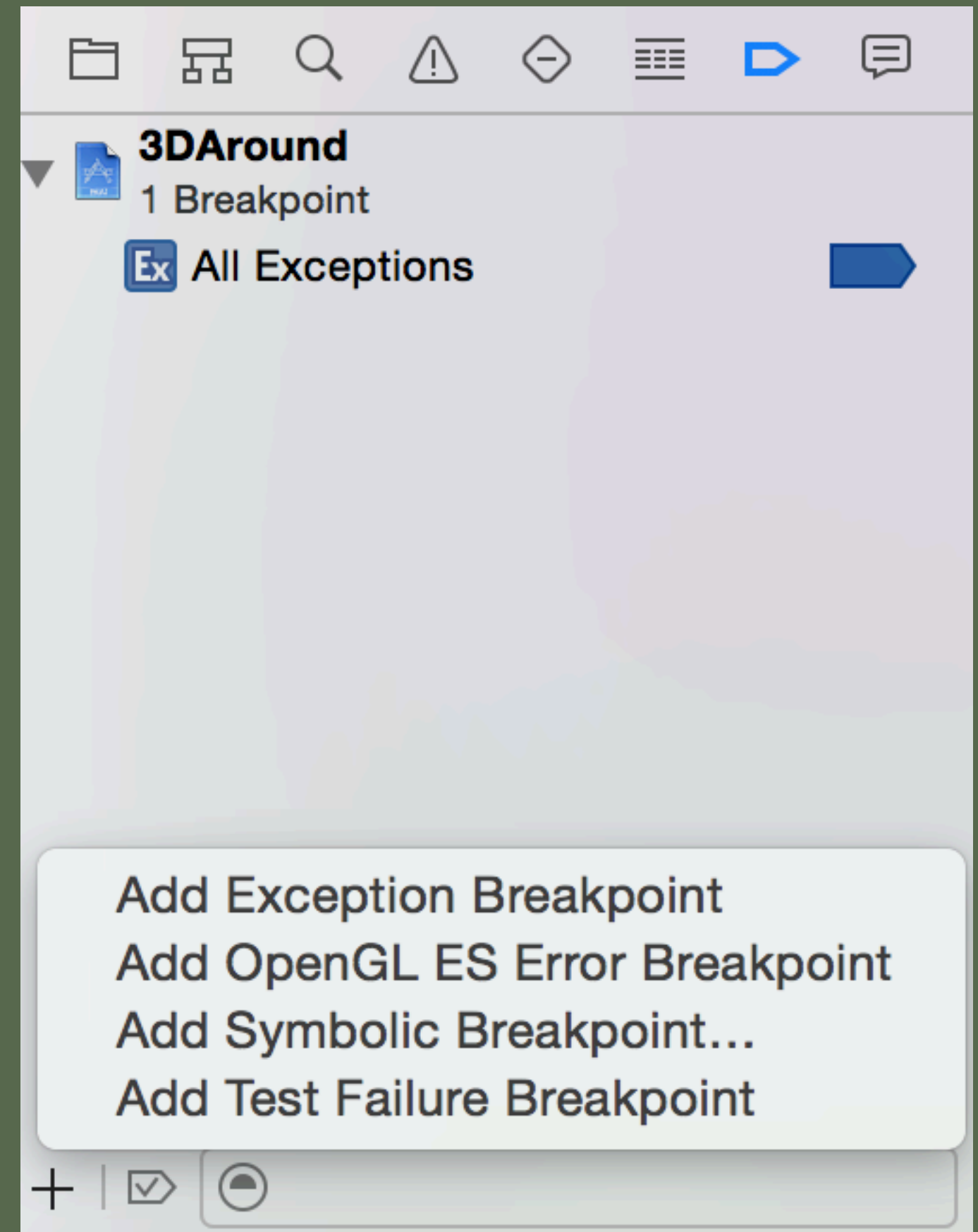


Editing Breakpoints



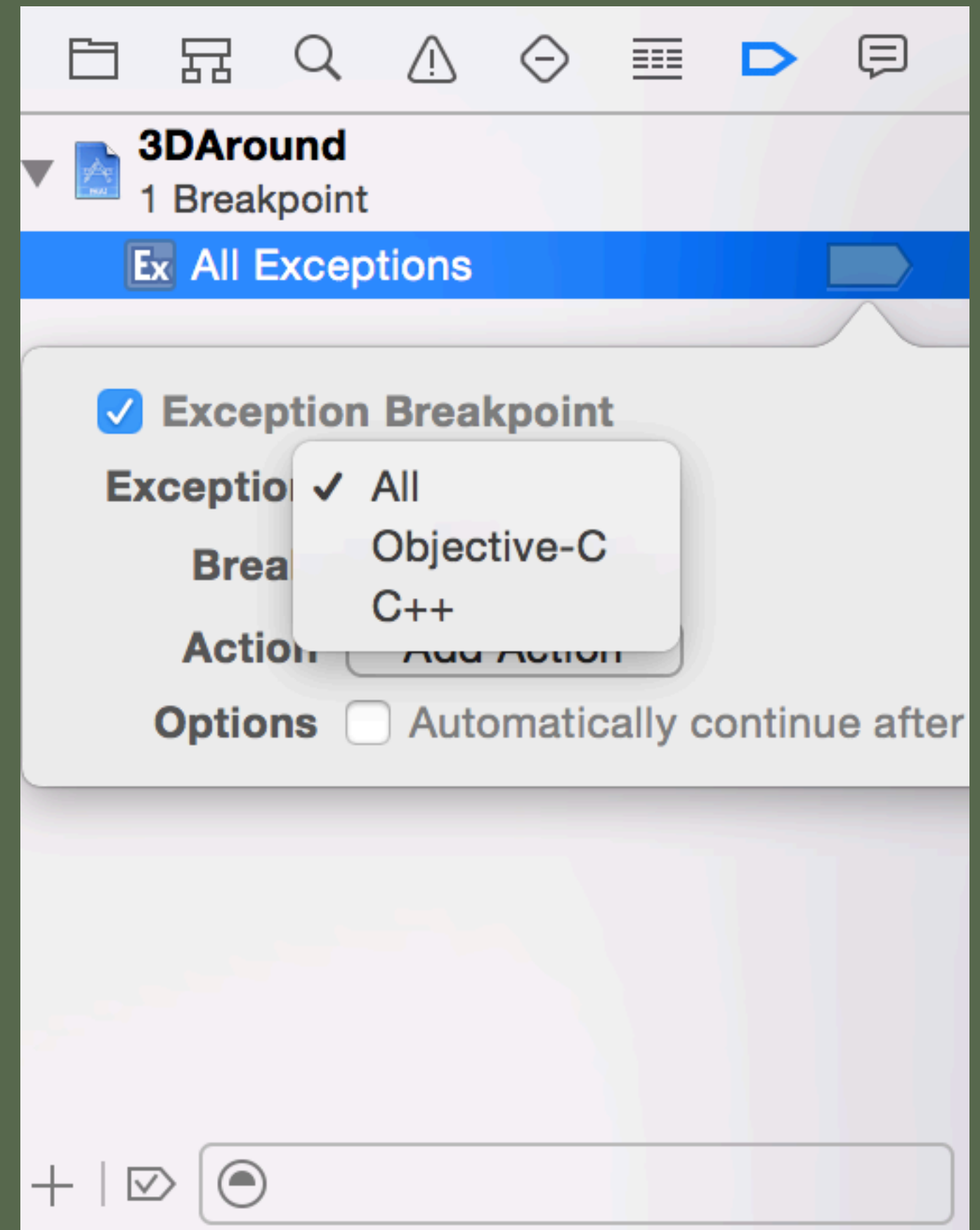
Projectwide Breakpoints

- Catch Objective-C or C++ Exceptions on throw or catch



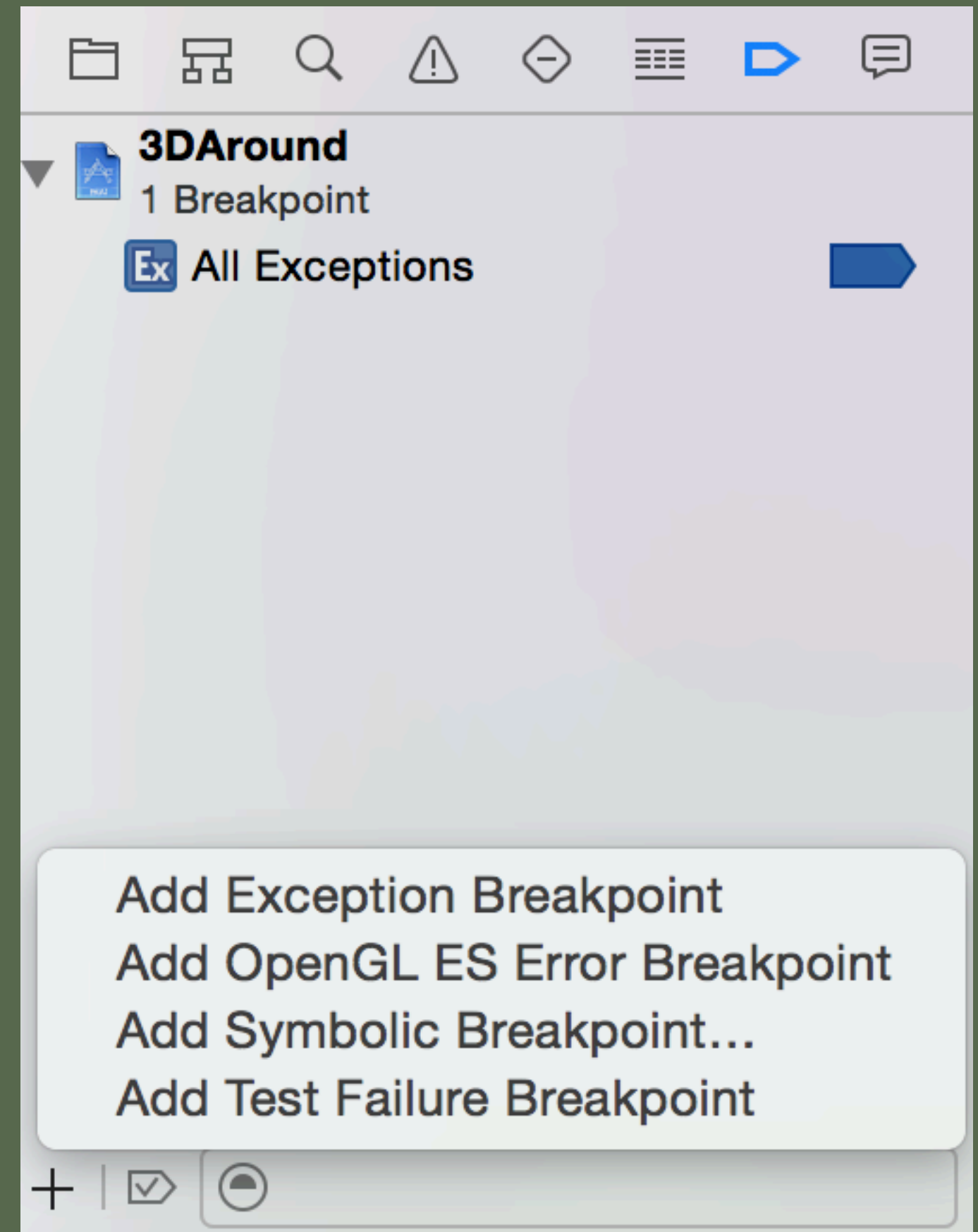
Projectwide Breakpoints

- Catch Objective-C or C++ Exceptions on throw or catch



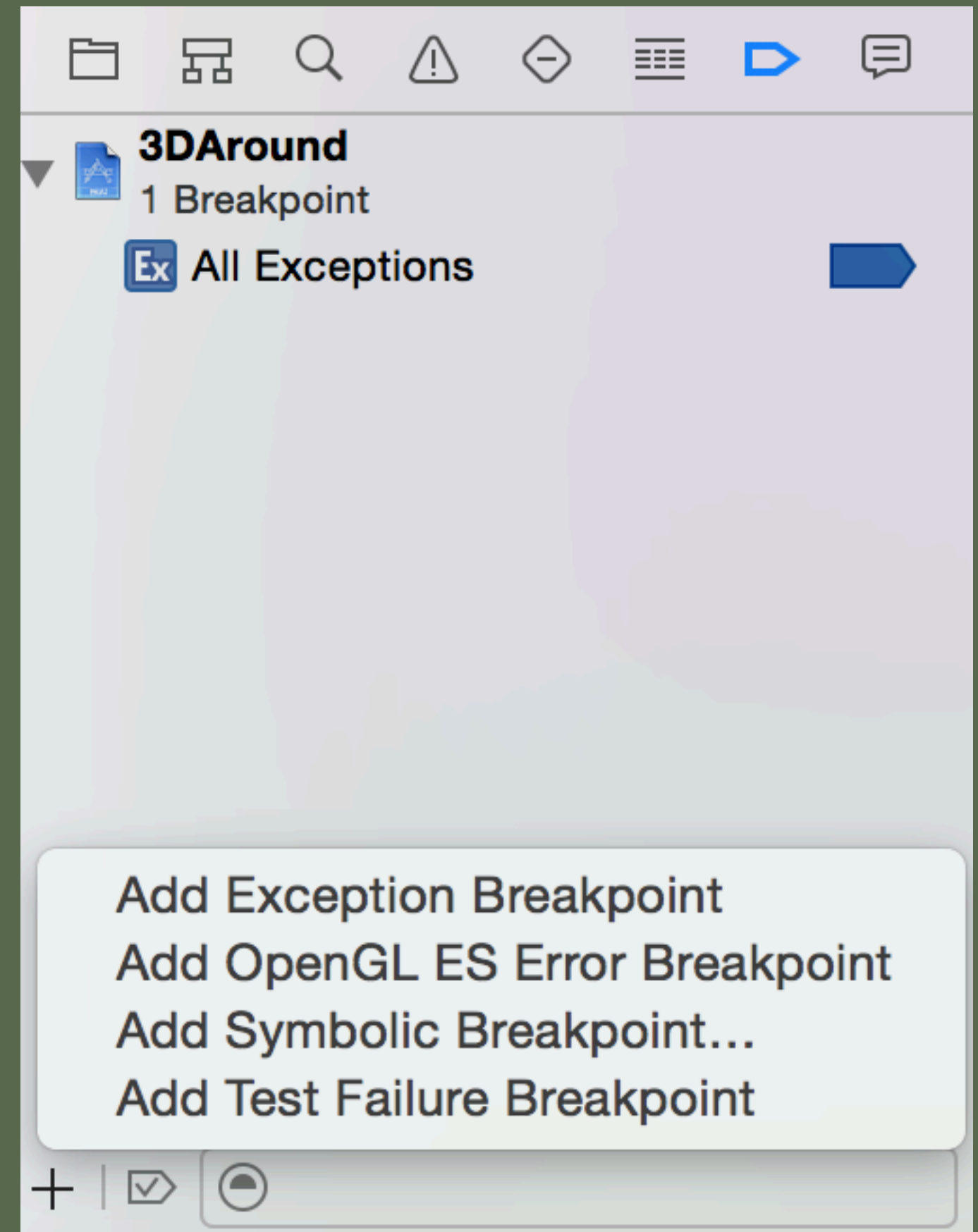
Projectwide Breakpoints

- Catch Objective-C or C++ Exceptions on throw or catch
- Catch OpenGL ES errors



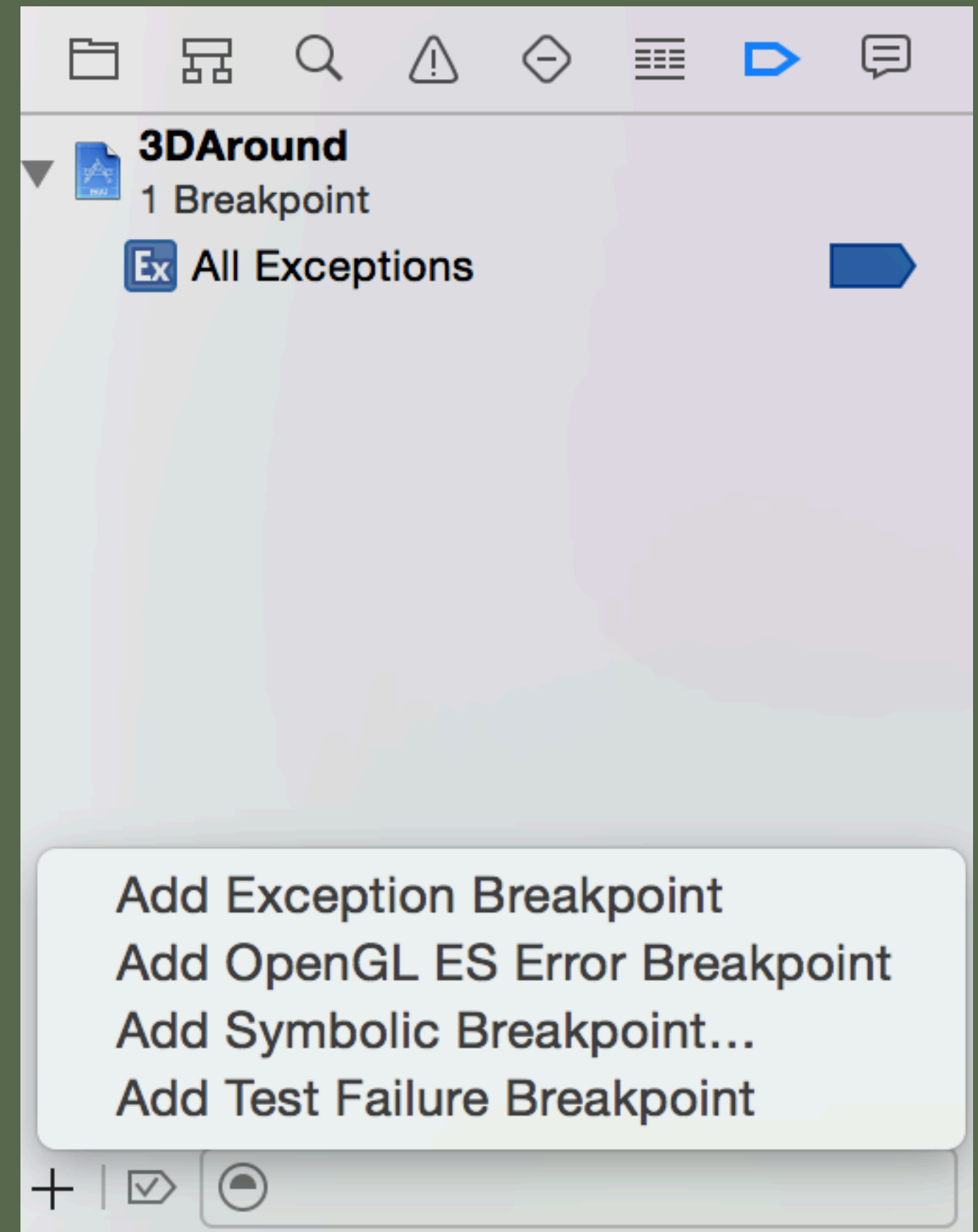
Projectwide Breakpoints

- Catch Objective-C or C++ Exceptions on throw or catch
- Catch OpenGL ES errors
- Stop when executing a specific function or method

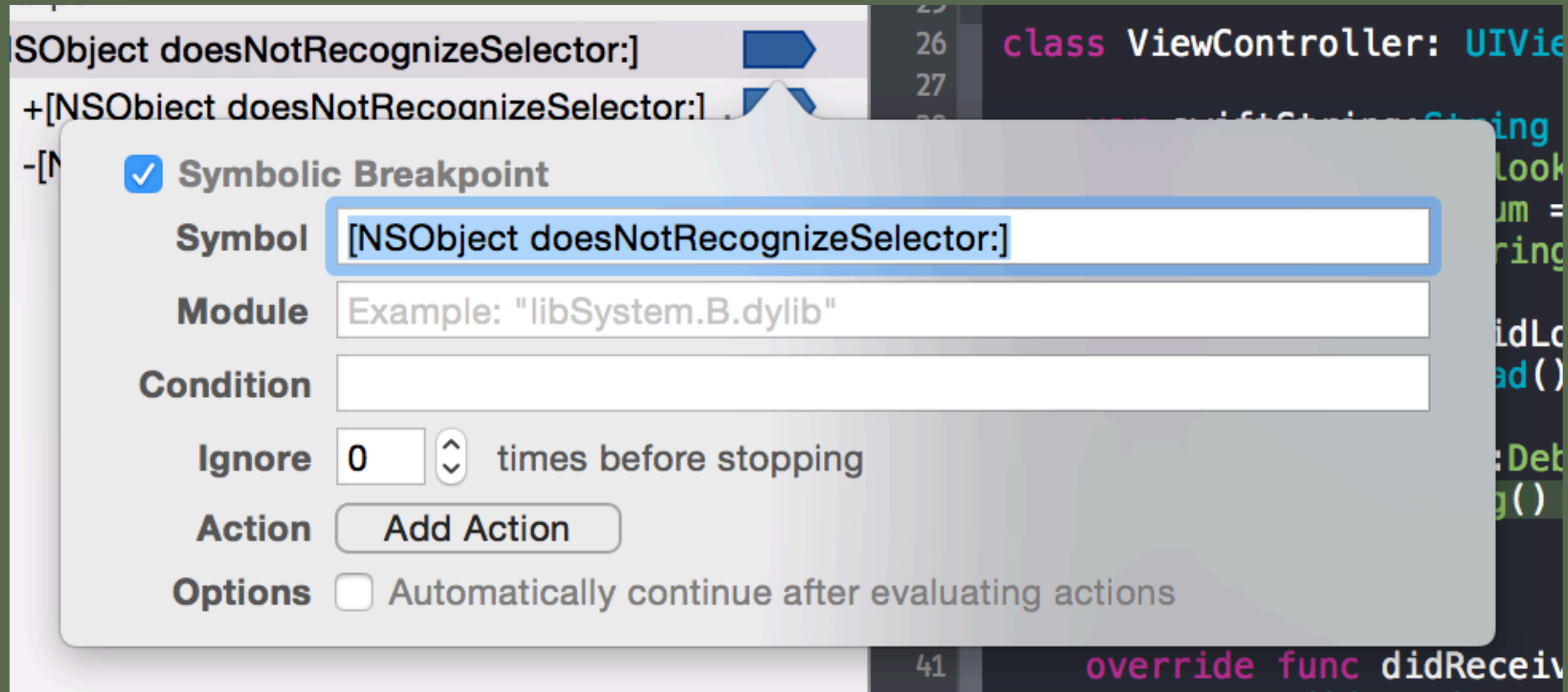


Projectwide Breakpoints

- Catch Objective-C or C++ Exceptions on throw or catch
- Catch OpenGL ES errors
- Stop when executing a specific function or method
- Stop when test Assertions fail



Symbolic Breakpoints



Symbolic Breakpoints

The image shows a screenshot of Xcode's interface. On the left, the 'Workspace' pane displays two breakpoint groups: '2 Breakpoints' and '1 Breakpoint (1 disabled)'. The '2 Breakpoints' group contains four symbolic breakpoints for the selector `+[NSObject(NSObject) doesNotRecognizeSelector:]` and one 'All Exceptions' breakpoint. The '1 Breakpoint (1 disabled)' group contains one 'All Exceptions' breakpoint. On the right, the code editor shows Swift code with a breakpoint set on line 301, `popover!.count()`. A tooltip above the breakpoint reads 'Thread 1: breakpoint 1.4'. The code includes UI setup for a popover, such as setting text, background color, and constraints for a label, and then presenting the popover.

```
286 label.text = NSLocalizedString("viewer.ispublicinfo", comment: "")
287 label.numberOfLines = 0
288 label.backgroundColor = UIColor.clearColor()
289 label.setTranslatesAutoresizingMaskIntoConstraints(false)
290
291 popoverController = UIViewController()
292 popoverController!.view.addSubview(label)
293 popoverController!.view.addConstraints(NSLayoutConstraint.constraintsWithFormat:@"width:0", options: [], metrics: nil, views: popoverController!.view, label)
294 popoverController!.view.addConstraints(NSLayoutConstraint.constraintsWithFormat:@"height:0", options: [], metrics: nil, views: popoverController!.view, label)
295
296 popover = WYPopoverController(contentViewController: popoverController)
297 popover!.contentViewController.view.backgroundColor = UIColor.dacudaGreen
298 let requiredHeight = label.sizeThatFits(CGSizeMake(view.frame.width - 1, 0)).height
299 // popover!.popoverContentSize = CGSizeMake(view.frame.width, requiredHeight)
300 }
301 popover!.count()
302 popover!.presentPopoverFromRect(isPublicInfo.frame, inView: scrollView, permittedAnimation: true)
303 }
304
305 private func showNavigationBarButtons(show: Bool) {
```

Compiler errors

Approach?

```
func randomPointInRectangle(rectangle:CGRect) {  
    return CGPoint(x: randomInt(rectangle.size.width), y:  
        randomInt(rectangle.size.height))  
}
```

! Cannot invoke 'init' with an argument list of type '(x: \$T4, y: \$T9)'

1. Remove variables

```
13 func randomPointInRectangle(rectangle:CGRect) {  
14     // return CGPoint(x: randomInt(rectangle.size.width), y:  
    randomInt(rectangle.size.height))  
! 15     return CGPoint(x:10,y:10);  
16 } ! Cannot invoke 'init' with an argument list of type '(x: IntegerLiteralConvertible, y: IntegerLiteralConvertible)'  
17
```

2. Split instructions

```
13 func randomPointInRectangle(rectangle:CGRect) {
14     // return CGPoint(x: randomInt(rectangle.size.width), y:
15     // randomInt(rectangle.size.height))
16     // return CGPoint(x:10,y:10);
16     let point = CGPoint(x:10,y:10);
! 17     return point;
18 }
19
```

! 'CGPoint' is not convertible to '()'

Add return type

```
13 func randomPointInRectangle(rectangle:CGRect) -> CGPoint {  
14     return CGPoint(x: randomInt(rectangle.size.width), y:  
15         randomInt(rectangle.size.height))  
16 }
```

Launch arguments

Adding arguments in the scheme editor

The screenshot shows the Xcode Scheme Editor for the project '3DAround' on an 'iOS Device'. The left sidebar contains a list of build actions: Build (2 targets), Run (Debug), Test (Debug), Profile (Release), and Analyze (Debug). The 'Run' action is selected. The main area shows the 'Arguments' tab, which is expanded to show 'Arguments Passed On Launch'. Two arguments are listed, both with checked checkboxes: '-com.apple.CoreData.ConcurrencyDebug' and '-com.apple.CoreData.SQLDebug 3'. The second argument is highlighted. Below the list are '+' and '-' icons for adding or removing arguments.

	Info	Arguments	Options
Arguments Passed On Launch			
<input checked="" type="checkbox"/>		-com.apple.CoreData.ConcurrencyDebug	
<input checked="" type="checkbox"/>		-com.apple.CoreData.SQLDebug 3	
+ -			

Concurrency

-com.apple.CoreDataConcurrencyDebug 1

```
CoreDataDebugging > Thread 1 > 0 +[NSManagedObjectContext __Multithreading_Violation_AllThatIsLeftToUsIsHonor__]  
1 CoreData`+[NSManagedObjectContext __Multithreading_Violation_AllThatIsLeftToUsIsHonor__]:  
2 0x1003f4430: pushq %rbp  
3 0x1003f4431: movq %rsp, %rbp  
4 0x1003f4434: ud2  
5 0x1003f4436: nopw %cs: (%rax,%rax)  
6
```

Thread 1: EXC_BAD_INSTRUCTION (code=EXC_I386_INVOP, subcode=0x0)

SQL Statements

-com.apple.CoreData.SQLDebug 3

```
2015-03-01 17:52:43.935 3DAround[2940:1173658] CoreData: sql: SELECT 0, t0.Z_PK, t0.Z_OPT, t0.ZAVATARURLSTRING, t0.ZCOUNTRY, t0.ZCREATED, t0.ZEMAIL, t0.ZFIRSTNAME, t0.ZISSELF, t0.ZLASTNAME, t0.ZNAME, t0.ZUSERID FROM ZUSEROBJECT t0 WHERE t0.ZUSERID = ?
2015-03-01 17:52:43.935 3DAround[2940:1173658] CoreData: details: SQLite bind[0] = "ag5zfmRhY3VkYTNkc3RhZ3IRCxIEVXNlchiAgICAgICAg"
2015-03-01 17:52:43.936 3DAround[2940:1173658] CoreData: annotation: sql connection fetch time: 0.0008s
2015-03-01 17:52:43.936 3DAround[2940:1173658] CoreData: annotation: fetch using NSSQLiteStatement <0x15737840> on entity 'UserObject' with sql text 'SELECT 0, t0.Z_PK, t0.Z_OPT, t0.ZAVATARURLSTRING, t0.ZCOUNTRY, t0.ZCREATED, t0.ZEMAIL, t0.ZFIRSTNAME, t0.ZISSELF, t0.ZLASTNAME, t0.ZNAME, t0.ZUSERID FROM ZUSEROBJECT t0 WHERE t0.ZUSERID = ? ' returned 1 rows with values: (
    "<_DAround.UserObject: 0x1566a4c0> (entity: UserObject; id: 0x157d9e60 <x-coredata://564E3357-D2E2-4267-8365-84406210207C/UserObject/p5> ; data: {\n avatarURLString = nil;\n captureObjects = \<relationship fault: 0x156270a0 'captureObjects'\>";\n country = \&quot;&quot;;\n created = \&quot;2014-11-12 13:19:52 +0000\&quot;;\n email = \&quot;nitz.carola@googlemail.com\&quot;;\n firstName = Carola;\n isSelf = 0;\n lastName = Nitz;\n name = \&quot;Carola Nitz\&quot;;\n userId = ag5zfmRhY3VkYTNkc3RhZ3IRCxIEVXNlchiAgICAgICAg;\n})"
)
2015-03-01 17:52:43.937 3DAround[2940:1173658] CoreData: annotation: total fetch execution time: 0.0023s for 1 rows.
2015-03-01 17:52:44.506 3DAround[2940:1173819] CoreData: sql: BEGIN EXCLUSIVE
2015-03-01 17:52:44.508 3DAround[2940:1173819] CoreData: annotation: getting max pk for entityID = 1
2015-03-01 17:52:44.508 3DAround[2940:1173819] CoreData: annotation: updating max pk for entityID = 1 with old = 253 and new = 254
2015-03-01 17:52:44.508 3DAround[2940:1173819] CoreData: sql: COMMIT
2015-03-01 17:52:44.509 3DAround[2940:1173819] CoreData: sql: SELECT COUNT(*) FROM ZGAIHIT
2015-03-01 17:52:44.509 3DAround[2940:1173819] CoreData: annotation: count request <NSFetchRequest: 0x1561ef30> (entity: GAIHit; predicate: ((null)); sortDescriptors: ((null)); type: NSCountResultType; ) returned 2
2015-03-01 17:52:44.509 3DAround[2940:1173819] CoreData: annotation: total count request execution time: 0.0008s for count of 2.
2015-03-01 17:52:44.512 3DAround[2940:1173819] CoreData: sql: BEGIN EXCLUSIVE
2015-03-01 17:52:44.514 3DAround[2940:1173819] CoreData: sql: INSERT INTO ZGAIHIT(Z_PK, Z_ENT, Z_OPT, ZPARAMETERS, ZTIMESTAMP) VALUES(?, ?, ?, ?, ?)
2015-03-01 17:52:44.514 3DAround[2940:1173819] CoreData: details: SQLite bind[0] = (int64)254
2015-03-01 17:52:44.515 3DAround[2940:1173819] CoreData: details: SQLite bind[1] = (int64)1
2015-03-01 17:52:44.517 3DAround[2940:1173819] CoreData: details: SQLite bind[2] = (int64)1
2015-03-01 17:52:44.517 3DAround[2940:1173819] CoreData: details: SQLite bind[3] = {
```

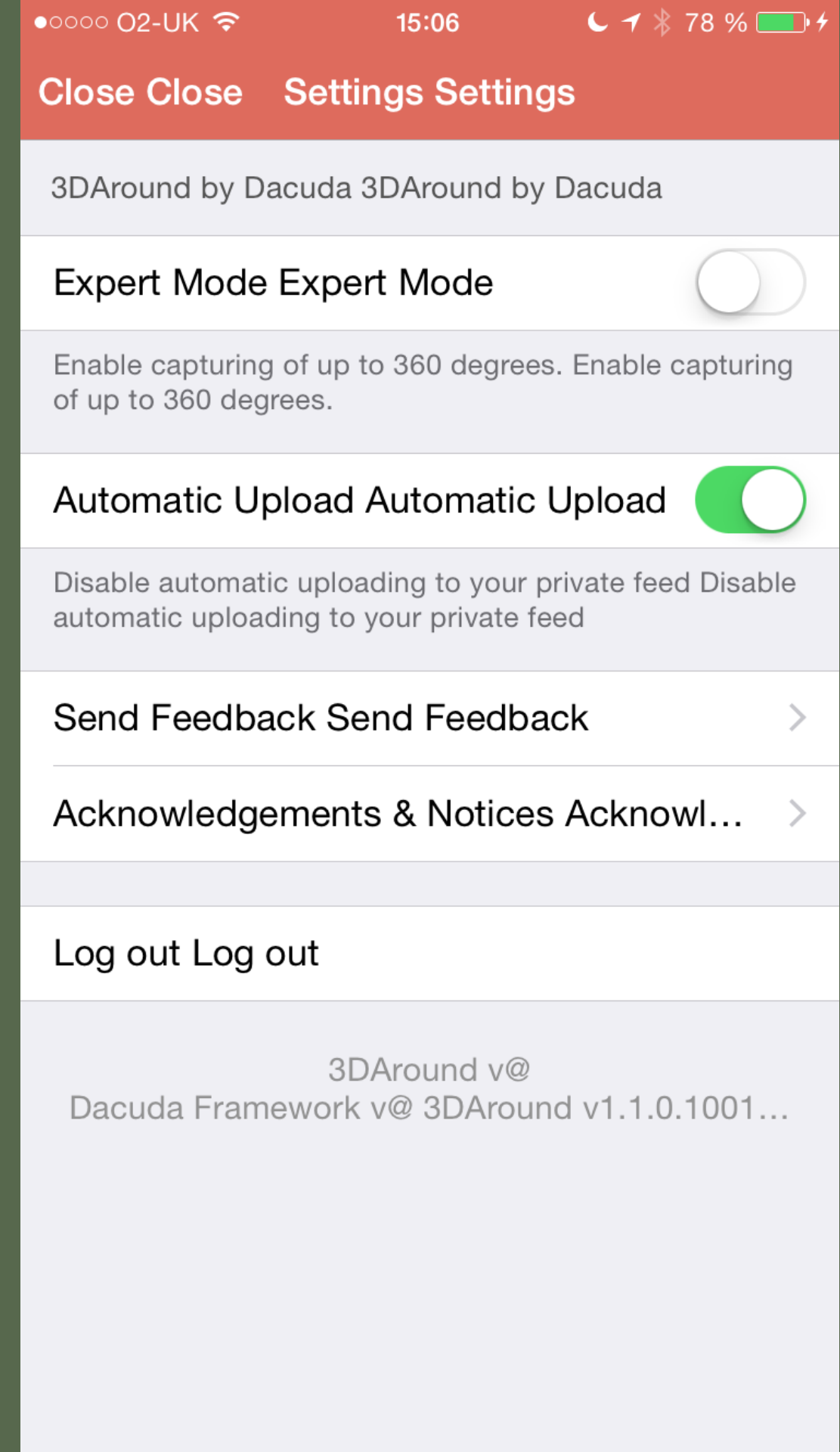
Many more

- com.apple.CoreData.MigrationDebug
- com.apple.CoreData.SQLiteDebugSynchronous [0,1,2]
- com.apple.CoreData.SQLiteIntegrityCheck 1
- com.apple.CoreData.ThreadingDebug [1,2,3]

<http://matthewmorey.com/tools-for-core-data/>

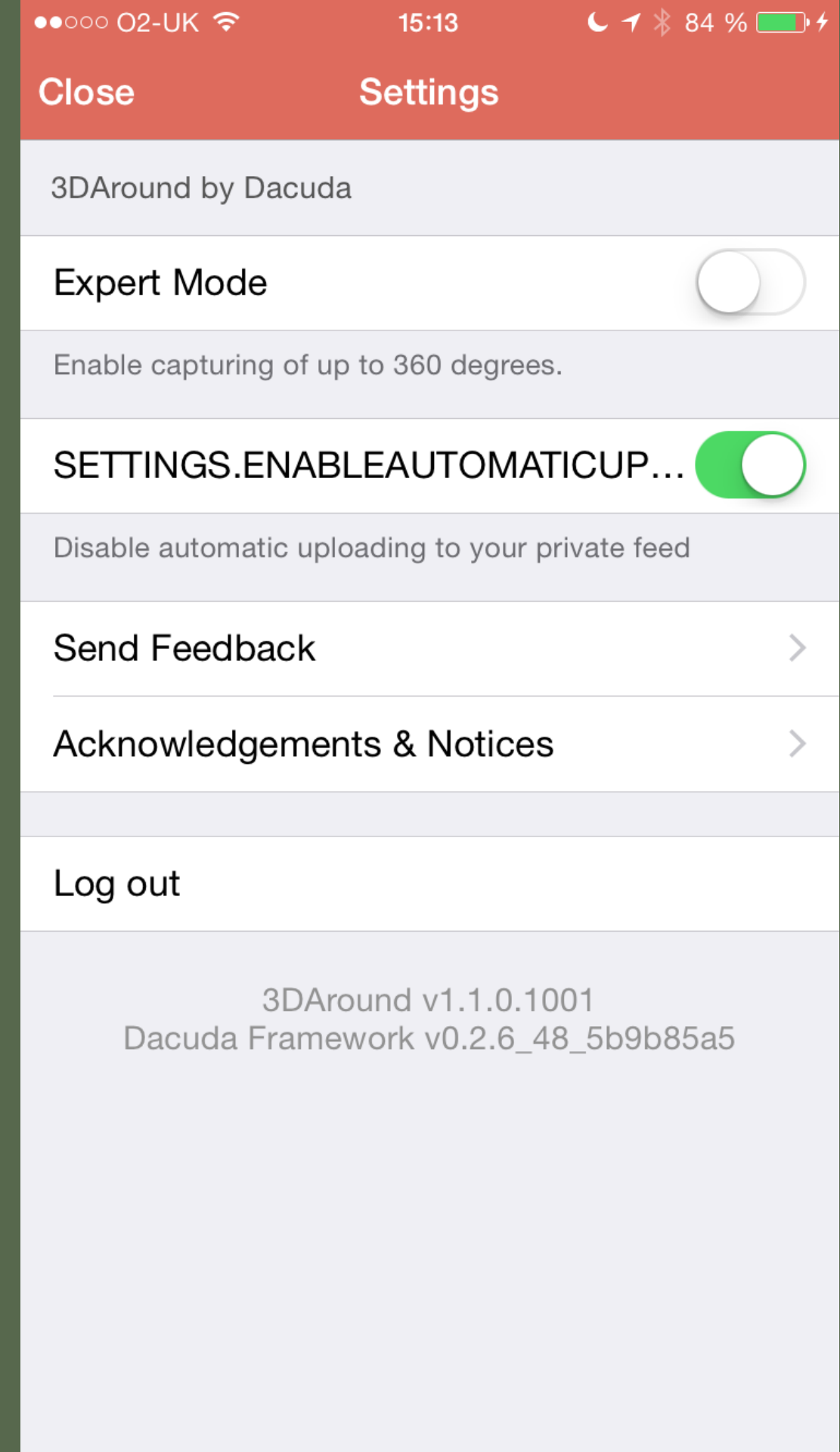
Localization

- -NSDoubleLocalizedString 1



Localization

- -NSDoubleLocalizedString 1
- -NSShowNonLocalizedStrings 1

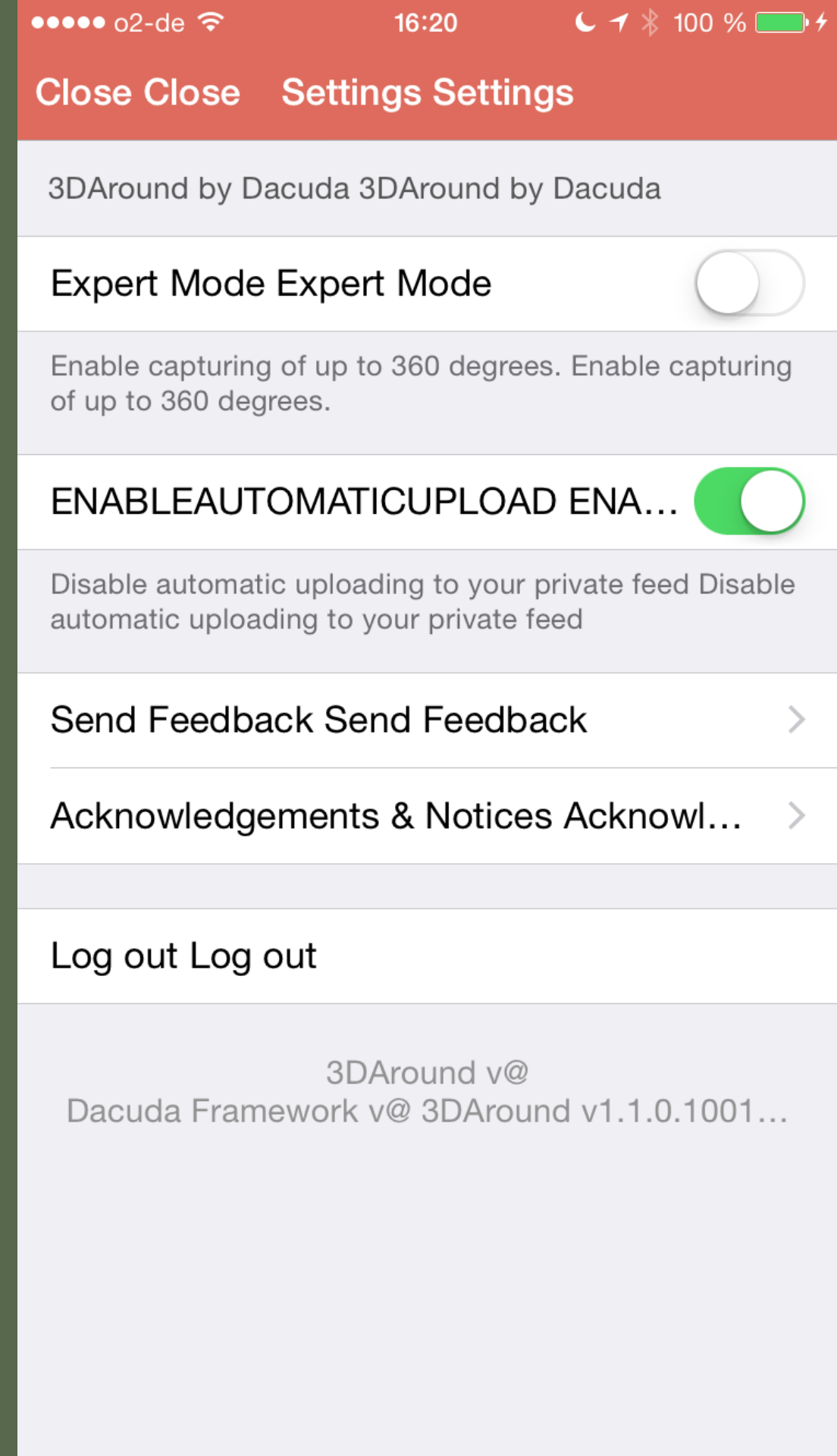


Localization

- -NSDoubleLocalizedString 1
- -NSShowNonLocalizedStrings 1
- -AppleLanguages (es de)

Technical Note TN2239 iOS

Debugging Magic



Debugging tools

Charles



- Debug http/https requests
- Throttle traffic
- Record download statistics

Swift REPL

- Test and interact with your app
- Add new code
- Clean slate `xcrun swift` in the terminal

```
DebuggingInSwift > DebuggingInSwift > timetwo.swift > No Selection
7 //
8
9 import Foundation
10
11 func timestwo(var a : Int) -> Int
12 {
13     return a * 2
14 }
15
16 func timestwo(var a : Double) -> Double
17 {
18     return a * 2.0
19 }
20
21 func timestwo(var a : String) -> String
22 {
23     return a+a
24 }

(lldb) repl
1> :expression
Enter expressions, then terminate with an empty line to evaluate:
1 timestwo(13.0)
2
(Double) $R0 = 26
1> :expression
Enter expressions, then terminate with an empty line to evaluate:
1 timestwo("nanana")
2
(String) $R1 = "nananananana"
1>
```

Activity Tracing

Trace crashes in asynchronous code

```
os_activity_t activity = os_activity_start("activity name", OS_ACTIVITY_FLAG_DEFAULT);  
    // [...]  
    os_activity_set_breadcrumb("event description");  
    // [...]  
    os_trace("Received %d creates, %d updates, %d deletes", created, updated, deleted);  
    // [...]  
os_activity_end(activity);
```

Activity Tracing

```
Problem Details and System Configuration
Process: Query Directory [4150]
Path: /Users/USER/Desktop/Query Directory.app/Contents/MacOS/Query Directory
Identifier: com.apple.Query-Directory
Version: 1.0 (1)
Code Type: X86-64 (Native)
Parent Process: ??? [1]
Responsible: Query Directory [4150]
User ID: 501

Date/Time: 2014-06-05 12:05:17.349 -0700
OS Version: Mac OS X 10.10 (14A238x)
Report Version: 11
Anonymous UUID: B7620343-69DE-AF75-B3A8-988B047E1062

Sleep/Wake UUID: 77D051C9-9C7A-42E2-8485-0C3F9319D6BF

Time Awake Since Boot: 30000 seconds
Time Since Wake: 2600 seconds

Crashed Thread: 4 Dispatch queue: NSOperationQueue 0x608000037b80 :: NSOperation 0x7f9c249098e0

Exception Type: EXC_CRASH (SIGABRT)
Exception Codes: 0x0000000000000000, 0x0000000000000000

Application Specific Information:
abort() called

Breadcrumb Trail (reverse chronological seconds):
0 Query directory using NSOperationQueue (Activity ID: 0x0000035000000007)
4 Query directory using NSOperationQueue
14 Query directory using NSRunLoop

Thread 0:: Dispatch queue: com.apple.main-thread
0 com.apple.vImage 0x00007fff88f105d7 vDilate + 455
1 com.apple.vImage 0x00007fff88efbe66 vImageDilate_Planar8 + 1094
2 libRIP.A.dylib 0x00007fff950a6979 rips_f_BlurRingRoundedDilation + 445
3 libRIP.A.dylib 0x00007fff9509e8e3 rips_f_DrawRing + 1659
4 libRIP.A.dylib 0x00007fff9509e260 rips_f_BltImage + 96
5 libRIP.A.dylib 0x00007fff9508eacd ripc_RenderImage + 221
6 libRIP.A.dylib 0x00007fff9509c187 ripc_EndLayer + 1204
7 com.apple.CoreGraphics 0x00007fff8d936bf4 CGContextEndTransparencyLayer + 53
8 com.apple.AppKit 0x00007fff963829b2 +[_NSAutomaticFocusRing showForView:] + 3699
9 com.apple.AppKit 0x00007fff9633e2e7 -[NSView
```

Activity Tracing

```
Exception Type:      EXC_CRASH (SIGABRT)
Exception Codes:     0x0000000000000000, 0x0000000000000000
```

```
Application Specific Information:
abort() called
```

```
Breadcrumb Trail (reverse chronological seconds):
```

```
0      Query directory using NSOperationQueue (Activity ID: 0x0000035000000007)
4      Query directory using NSOperationQueue
14     Query directory using NSRunLoop
```

```
Thread 0:: Dispatch queue: com.apple.main-thread
```

```
0      com.apple.vImage      0x00007fff88f105d7 vDilate + 455
1      com.apple.vImage      0x00007fff88efbe66 vImageDilate_Planar8 + 109
2      libRIP.A.dylib         0x00007fff950a6979 rips_f_BlurRingRoundedDila
```

<http://www.objc.io/issue-19/activity-tracing.html>

Summary

- expression -l objc -O -- (id) 0x00007fbaa1f24910
- Edit Breakpoints, add symbolic and exception breakpoints
- Tackle incomprehensive compiler errors
- Launch arguments
- Charles, REPL, Activity tracing

Thanks