Macoun'10

Eleganter Code dank Blocks

Frank Illenberger
ProjectWizards

Was sind Blocks?

- Apple-eigene Erweiterung des C-Standards
- explizit entwickelt für Grand Central Dispatch
- anonyme Funktion
  - Argumente
  - interne Variablen
  - fängt externe Variablen ein (Closure, achtung retain-Cycles!)

Was sind Blocks?

- Code wird zu einer Art von Daten
  - Zuweisen zu Variablen
  - herumreichen als Funktionsparameter
- Ähnlich zu C-Funktionszeigern
  - gleicher Aufruf
  - Blocks werden jedoch zur Laufzeit erzeugt (Stack)

Alle Beispiele verwenden Garbage-Collection

iOS → bugreport.apple.com

Was sind Blocks?

```
typedef int (^CounterBlock)();

Counter newCounter(int start, int step) {
    __block int index = start;
    Counter counter = ^{ return (index += step); }
    return [counter copy];
}

int main(void) {
    Counter counter = newCounter(2, 3);
    NSLog("%d-%d-%d", counter(), counter(), counter());
    return 0;
}

/* Output:  2-5-7 */
```

Was sind Blocks?

- Ermöglichen Konstrukte aus dynamischen Sprachen wie Lisp, Python, JavaScript oder Ruby
- Synchrones Umschließen (Wrapping)
- Asynchroner Aufruf (Callback, Delegation)

Synchrones Umschließen
(Wrapping)

Synchrones Umschließen

- Synchron
- Blocks werden nur auf Stack angelegt
- Mitgegebener Code wird mit Logik umschlossen
- Sehr effizient
- Ersatz für Compiler-Makros

Synchrones Umschließen

```
typedef void (^MCNActionBlock)();

@implementation MCNTools

+ (void)timeAction:(NSString*)actionName block:(MCNActionBlock)block {
    NSParameterAssert(actionName);
    NSParameterAssert(block);
    NSDate* startDate = [NSDate date];
    block();
    NSTimeInterval duration = -startDate.timeIntervalSinceNow;
    NSLog(@"%@ took %gs", actionName, duration);
}

@end
```

Enumerieren

Enumerieren

```
NSArray* names = [NSArray arrayWithObjects:@“Leonard“, @“Sheldon“,
                                           @“Howard“,  @“Rajesh“, nil];

[names enumerateObjectsWithOptions: NSEnumerationReverse
                        usingBlock:^(id obj, NSUInteger idx, BOOL *stop) {
  NSString* iString = obj;
  NSLog(@“%@“, iString);
  if([iString isEqualToString:@“Sheldon“])
    *stop = YES;
}];

/* Output: Rajesh Howard Sheldon */
```

Enumerieren

```
NSDictionary* dict = [NSDictionary
dictionaryWithObjectsAndKeys:@“Physicist“, @“Sheldon“,
                             @“Engineer“,  @“Howard“, nil];

[dict enumerateKeysAndObjectsUsingBlock:^(id key, id obj, BOOL *stop) {
  NSLog(@“%@ -> %@“, key, obj);
}];

/* Output: Sheldon -> Physicist
           Howard  -> Engineer */
```

Enumerieren

```
NSMutableIndexSet* set = [NSMutableIndexSet indexSet];
[set addIndex:42];
[set addIndexesInRange:NSMakeRange(5,3)];

[set enumerateIndexesInRange:NSMakeRange(6,50)
                     options:NSEnumerationReverse
                  usingBlock:^(NSUInteger index, BOOL *stop) {
  NSLog(@“%d“,index);
}];

/* Output: 42 7 6*/
```

Enumerieren

- `-[NSSet enumerateObjectsWithOptions:usingBlock]`
- `-[NSAttributedString enumerateAttributesInRange:options:usingBlock:]`
- `NSEnumerationConcurrent`
- Keine Unterstützung von NSMapTable & NSHashTable (Mac)
  - Können in Kategorien implementiert werden

Enumerieren

```
@implementation NSMapTable (MacounAdditions)

- (void)enumerateKeysAndObjectsUsingBlock:(void (^)(id key, id obj,
                                            BOOL *stop)) block {
    NSParameterAssert(block != nil);
    for(NSString* key in self) {
        BOOL shouldStop = NO;
        block(key, [self objectForKey:key], &shouldStop);
        if(shouldStop)
            break;
    }
}

@end
```

Filtern

Filtern

```
@interface Nerd : NSObject
@property (copy) NSString* name;
- (id)initWithName:(NSString*)name;
@end

@implementation Nerd
@synthesize name = name_;

- (id)initWithName:(NSString*)name {
  if((self = [self init])) {
    name_ = [name copy];
  }
  return self;
}
@end
```

Filtern

```
Nerd* leonard = [[Nerd alloc] initWithName:@“Leonard“];
Nerd* sheldon = [[Nerd alloc] initWithName:@“Sheldon“];
Nerd* rajesh  = [[Nerd alloc] initWithName:@“Rajesh“];
Nerd* howard  = [[Nerd alloc] initWithName:@“Howard“];
NSArray* nerds = [NSArray arrayWithObjects: leonard, sheldon,
                                            rajesh, howard, nil];

NSIndexSet* matches = [nerds indexesOfObjectsPassingTest:^BOOL(id obj,
                                          NSUInteger idx, BOOL *stop) {
  Nerd* iNerd = obj;
  return iNerd.name.length == 7;
}];

/* matches: 0-1 */
```

Filtern

```
NSPredicate* predicate = [NSPredicate predicateWithBlock:^BOOL(id obj,
                                                              NSDictionary* bindings) {
  Nerd* iNerd = obj;
  return iNerd.name.length == 6;
}];

NSArray* matches = [nerds filteredArrayUsingPredicate:predicate];

/* matches: rajesh, howard */
```

Sortieren

```
NSArray* sortedNerds = [nerds sortedArrayWithOptions:NSSortStable
                                          usingComparator:
  ^NSComparisonResult(id o1, id o2) {
  NSUInteger len1 = ((Nerd*)o1).name.length;
  NSUInteger len2 = ((Nerd*)o2).name.length;
  return len1 < len2 ? NSOrderedAscending :
         len1 > len2 ? NSOrderedDescending : NSOrderedSame;
}];

/* sortedNerds: rajesh, howard, leonard, sheldon */
```

Demo

Funktionen
Höherer Ordnung

Funktionen Höherer Ordnung

```
NSArray* names = [nerds map:^BOOL(id obj) {
     return ((Nerd*)obj).name;
}];

// @“Leonard“, @“Sheldon“, @“Rajesh“, @“Howard“
```

```
BOOL allNamesShort = [nerds all:^BOOL(id obj) {
     return ((Nerd*)obj).name.length < 10;
}];

// YES
```

Funktionen Höherer Ordnung

```
- (BOOL)all:(BOOL (^)(id))block {
    NSParameterAssert(block);
    for (id obj in self)
       if(!block(obj))
           return NO;
    return YES;
}
```

```
- (BOOL)any:(BOOL (^)(id))block {
    NSParameterAssert(block);
    for (id obj in self)
        if(block(obj))
            return YES;
    return NO;
}
```

Funktionen Höherer Ordnung

```
- (NSArray*)map:(id (^)(id))block {
    NSParameterAssert(block);
    NSMutableArray* new = [NSMutableArray arrayWithCapacity:self.count];
    for (id obj in self) {
        id mapped = block(obj);
        [new addObject: mapped ? mapped : [NSNull null]];
    }
    return [new copy];
}
```

Funktionen Höherer Ordnung

```
@interface NSArray (MacounAdditions)
- (BOOL)all:(BOOL (^)(id obj))block;
- (BOOL)any:(BOOL (^)(id obj))block;
- (id)match:(BOOL (^)(id obj))block;
- (NSArray*)select:(BOOL (^)(id obj))block;
- (void)partitionIntoMatches:(NSArray**)outMatches
                     misses:(NSArray**)outMisses
                      block:(BOOL (^)(id obj))block;
- (NSArray*)map:(id (^)(id obj))block;
- (NSArray*)mapWithoutNull:(id (^)(id))block;
@end
```

Asynchroner Aufruf

Asynchroner Aufruf

- Alternative zu Delegation-Entwurfsmuster
- Vorteile
  - lineares Aufschreiben
  - keine sperrigen void*- oder NSDictionary-Kontexte
  - keine Ivars

Lineares Aufschreiben

```
@implementation MyViewController

- (IBAction)export:(id)sender
{
   NSURL* URL = ... ; // might be nil

   [self exportToURL:URL
   completionHandler:^(BOOL success, NSError* error) {
       if(error)
           [self presentError:error];
   }];
}

@end
```

Lineares Aufschreiben

```
@interface NSSavePanel

- (void)beginSheetModalForWindow:(NSWindow *)window
                completionHandler:(void (^)(NSInteger result))handler;

@end
```

```
- (void)exportToURL:(NSURL*)URL
  completionHandler:(void (^)(BOOL success, NSError* error))handler
{
  NSParameterAssert(handler);

  __block NSError* error = nil;
  if(!URL) {
    NSSavePanel* panel = [NSSavePanel savePanel];
    [panel beginSheetModalForWindow:self.view.window
                completionHandler:^(NSInteger result) {
                  if(result == NSFileHandlingPanelOKButton)
                    handler([self exportToURL:panel.URL error:&error], error);
                }];
  }
  else
    handler([self exportToURL:URL error:&error], error);
}
```

Alerts

Alerts

```
- (void)deleteNerd:(Nerd*)nerd
{
    NSAlert* alert = [[NSAlert alloc] init];
    alert.messageText = [NSString stringWithFormat:
                         @"Do you really want to delete %@?", nerd.name];
    [alert addButtonWithTitle:@"Delete"];
    [alert addButtonWithTitle:@"Cancel"];
    [alert beginSheetModalForWindow:self.view.window
                completionHandler:^(NSInteger result) {
                    if(result == NSAlertFirstButtonReturn)
                        [self doDeleteNerd:nerd];
                }];
}
```

Alerts

```
@interface NSAlert (MacounAdditions)

- (void)beginSheetModalForWindow:(NSWindow*)window
                completionHandler:(void (^)(NSInteger result))handler;

@end
```

Alerts

```
typedef void (^ModalBlock)(NSInteger resultCode);

@implementation NSAlert (MacounAdditions)

- (void)beginSheetModalForWindow:(NSWindow*)window
                completionHandler:(void (^)(NSInteger result))handler
{
    [self beginSheetModalForWindow:window
                      modalDelegate:self
                     didEndSelector:@selector(alertDidEnd:code:context:)
                        contextInfo:CFRetain([handler copy])];
}

// ...
```

Alerts

```
// ...

- (void)alertDidEnd:(NSAlert*)alert
                code:(NSInteger)code
             context:(void*)context
{
    [alert.window close];
    ModalBlock handler = (ModalBlock)context;
    handler(code);
    CFRelease(handler);
}

@end
```

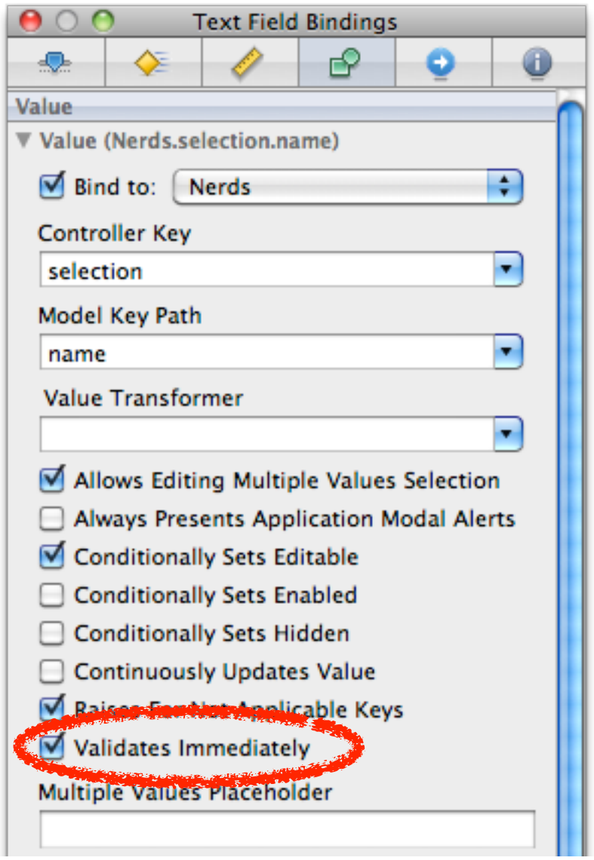
Key-Value-Validation

Key-Value-Validation

```
@protocol NSKeyValueCoding
// ...

- (BOOL)validateValue:(id*)ioValue
                forKey:(NSString*)key
                 error:(NSError**)outError;

// ...
@end
```



- Sucht nach

  `-(BOOL)validate<Key>:(id*)ioVal error:(NSError**)outError;`

Key-Value-Validation

```
@interface Nerd
// ...

- (BOOL)validateName:(NSString**)inOutName
                error:(NSError **)outError;

// ...
@end
```

```
- (BOOL)validateName:(NSString**)name error:(NSError**)err
{
  if([*name isEqualToString:@“Sheldon“]) {
    if(err)
      *err = [NSError errorWithDomain:@“de.Macoun“
                                 code:1234
                              message:@“This name belongs to an annoying nerd.“
                     recoverySuggestion:@“Do really want to use it?“
                              options:[NSArray arrayWithObjects:@“Yes“, @“No“, nil]
                                block:^(NSError* e, NSUInteger optionIndex) {
                                   if(optionIndex == 0) {
                                      self.name = *name;
                                      return YES;
                                   }
                                   return NO;
                                }];
    return NO;
  }
  return YES;
}
```

```
typedef BOOL (^MCNErrorRecoveryBlock)(NSError* error, NSUInteger optionIndex);
static NSString* const RecoveryBlockKey = @"de.macoun.NSError.recoveryBlock";

@implementation NSError (MacounAdditions)
+ (NSError*)errorWithDomain:(NSString*)domain
                       code:(NSInteger)code
                    message:(NSString*)message
          recoverySuggestion:(NSString*)recoverySuggestion
                    options:(NSArray*)options
                      block:(MCNErrorRecoveryBlock)block
{
  NSMutableDictionary* info = [NSMutableDictionary dictionary];
  [info setValue:message            forKey:NSLocalizedDescriptionKey];
  [info setValue:recoverySuggestion forKey:NSLocalizedRecoverySuggestionErrorKey];
  [info setObject:options           forKey:NSLocalizedRecoveryOptionsErrorKey];
  [info setObject:self              forKey:NSRecoveryAttempterErrorKey];
  [info setObject:[block copy]      forKey:RecoveryBlockKey];
  return [NSError errorWithDomain:domain code:code userInfo:info];
}
// ...
```

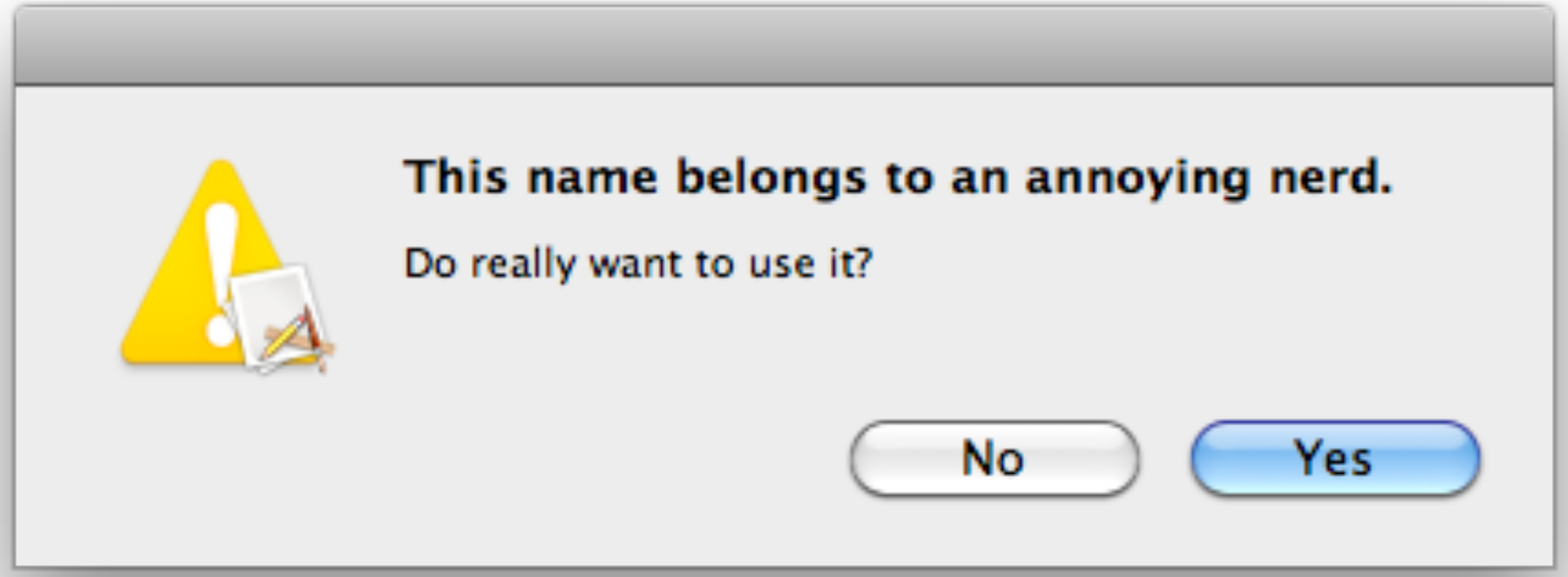
```
// ...

+ (BOOL)attemptRecoveryFromError:(NSError*)error
                    optionIndex:(NSUInteger)optionIndex
{
    MCNErrorRecoveryBlock block = [error.userInfo objectForKey:RecoveryBlockKey];
    return block(error, optionIndex);
}

// ...
```

```
// ...
+ (void)attemptRecoveryFromError:(NSError*)error
                     optionIndex:(NSUInteger)optionIndex
                        delegate:(id)delegate
              didRecoverSelector:(SEL)selector
                     contextInfo:(void*)contextInfo
{
    MCNErrorRecoveryBlock block = [error.userInfo objectForKey:RecoveryBlockKey];
    BOOL recovered = block(error, optionIndex);
    NSMethodSignature* sig = [delegate methodSignatureForSelector:selector];
    NSInvocation* invocation = [NSInvocation invocationWithMethodSignature:sig];
    invocation.selector = selector;
    invocation.target = delegate;
    [invocation setArgument:&recovered atIndex:2];
    [invocation setArgument:&contextInfo atIndex:3];
    [invocation invoke];
}
@end
```

- `-[NSResponder presentError:]`
- `-[NSResponder presentError:modalForWindow:delegate:didPresentSelector:contextInfo:]`



Alternative zum Ableiten von Klassen

Alternative zum Ableiten

Formatter

```
@interface MCNBlockFormatter : NSFormatter

@property (copy)  NSString* (^toStringBlock)(id object);
@property (copy)  BOOL      (^toObjectBlock)(id* object, NSString* string,
                                             NSString** errorDesc);

@end
```

Alternative zum Ableiten

Formatter

```
@implementation MCNBlockFormatter
@synthesize toStringBlock;
@synthesize toObjectBlock;

- (NSString*)stringForObjectValue:(id)anObject {
    return toStringBlock(anObject);
}

- (BOOL)getObjectValue:(id*)anObject
              forString:(NSString*)string
      errorDescription:(NSString**)error {
        return toObjectBlock(anObject, string, error);
}
@end
```

Alternative zum Ableiten

Formatter

```
PWBlockFormatter* cheapURLFormatter = [[MCNBlockFormatter alloc] init];

formatter.toStringBlock = ^(id value) {
  return ((NSURL*)value).absoluteString;
};

formatter.toObjectBlock = ^(id* value, NSString* string, NSString** err) {
  if(string == nil) {
    *value = nil;
    return YES;
  }
  *value = [NSURL URLWithString:string];
  return (*value) != nil;
};
```

Alternative zum Ableiten

Einfache Views

```
MCNBlockView* backgroundView = [[MCNBlockView alloc]
       initWithFrame:NSInsetRect(self.view.bounds, 5.0, 5.0)
           drawBlock:^(MCNBlockView* bView, NSRect dirtyRect) {
                        [[NSColor grayColor] set];
                        NSRectFill(dirtyRect);
                        [[NSColor redColor] set];
                        [NSBezierPath strokeRect:view.bounds];
                      }];

[self.view addSubview:backgroundView];
```

Alternative zum Ableiten

Einfache Views

```
@class MCNBlockView;

typedef void(^MCNDrawBlock)(MCNBlockView* view, NSRect dirtyRect);

@interface MCNBlockView : NSView

- (MCNBlockView*)initWithFrame:(NSRect)frame
                     drawBlock:(MCNDrawBlock)block;

@property (readonly) MCNDrawBlock drawBlock;

@end
```

Alternative zum Ableiten

```
@implementation MCNBlockView
@synthesize drawBlock;

- (MCNBlockView*)initWithFrame:(NSRect)frame
                     drawBlock:(MCNDrawBlock)block {
   NSParameterAssert(block);
   if (self = [self initWithFrame:frame])
      drawBlock = [block copy];
   return self;
}

- (void)drawRect:(NSRect)dirtyRect {
   drawBlock(self, dirtyRect);
}
@end
```

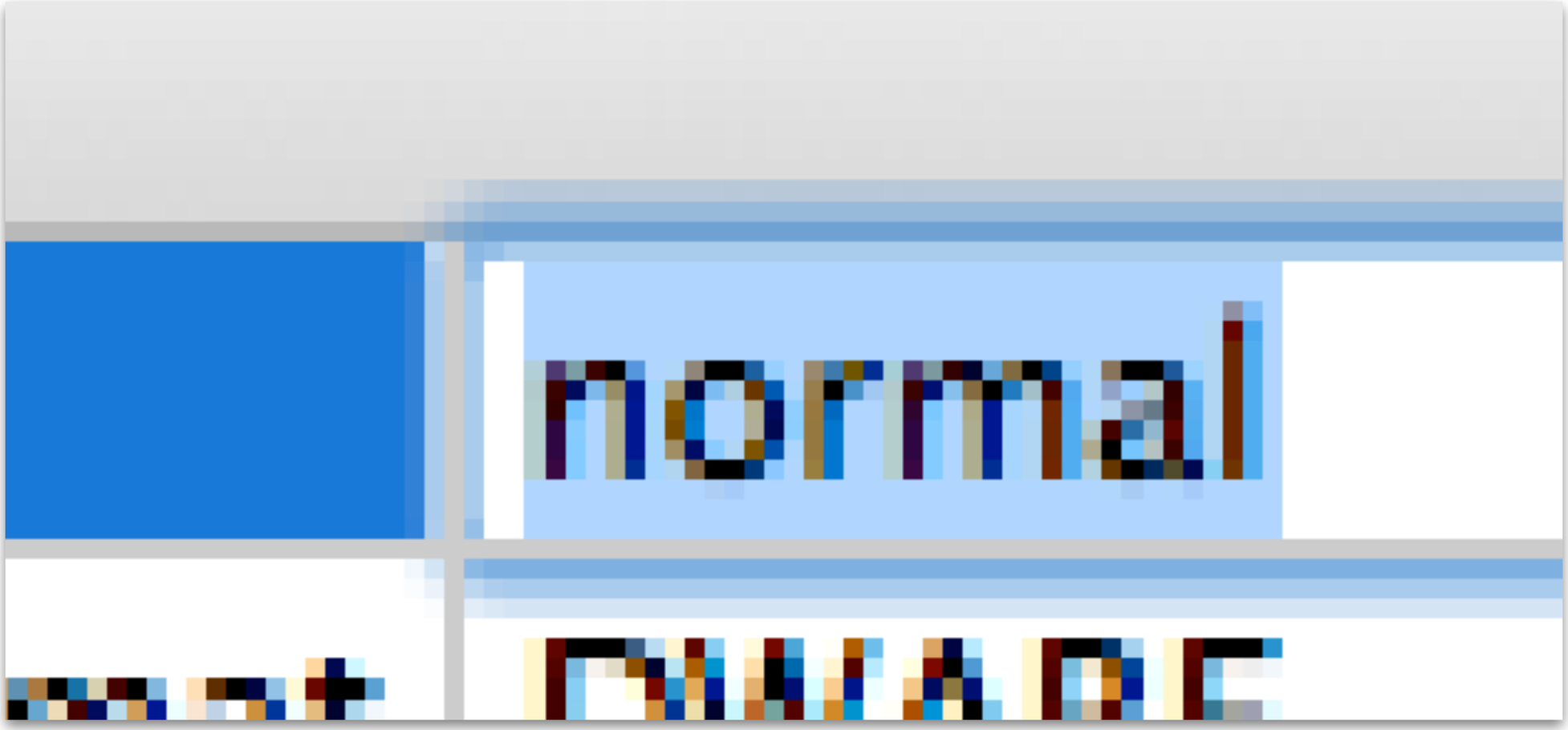
Fokusringe

Xcode

Setting	Value
Per-configuration Inter...	/Users/frank/Projekte/Builds...
Precompiled Headers C...	/var/folders/5x/5x8Qo87xH...
▼Build Options	
Build Variants	normal
Debug Information Format	DWARF
Enable OpenMP Support	☐
Generate Profiling Code	☐
Precompiled Header Us...	☑
Run Static Analyzer	☐
Scan All Source Files for...	☐
Validate Built Product	☐

Fokusringe

Xcode



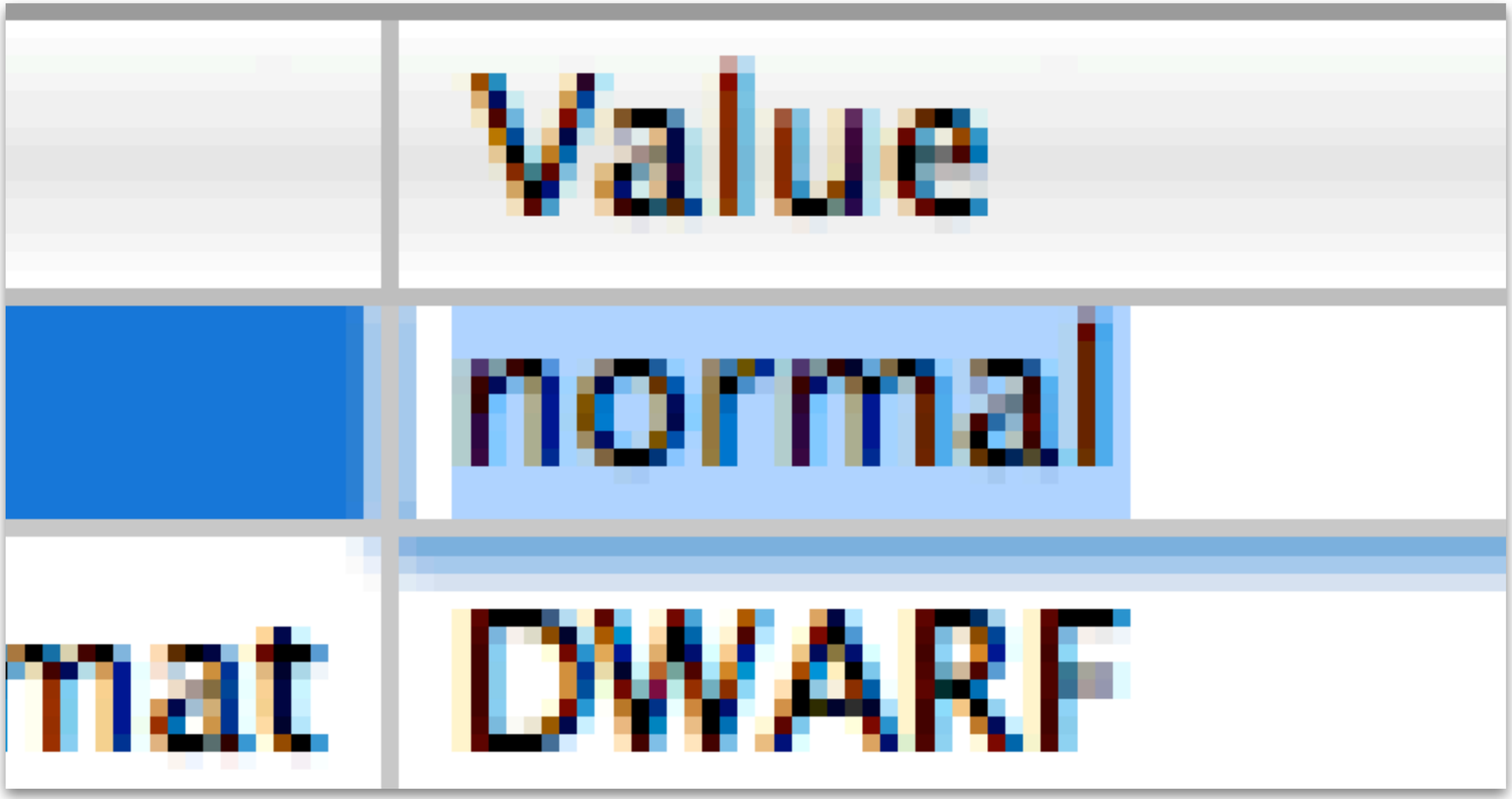
Fokusringe

Xcode

Setting	Value
Build Variants	normal
Debug Information Format	DWARF
Enable OpenMP Support	☐
Generate Profiling Code	☐
Precompiled Header Us...	☑
Run Static Analyzer	☐
Scan All Source Files for...	☐
Validate Built Product	☐
▼Code Signing	
Code Signing Entitlements	
Code Signing Identity	
Code Signing Resource ...	
Other Code Signing Flags	

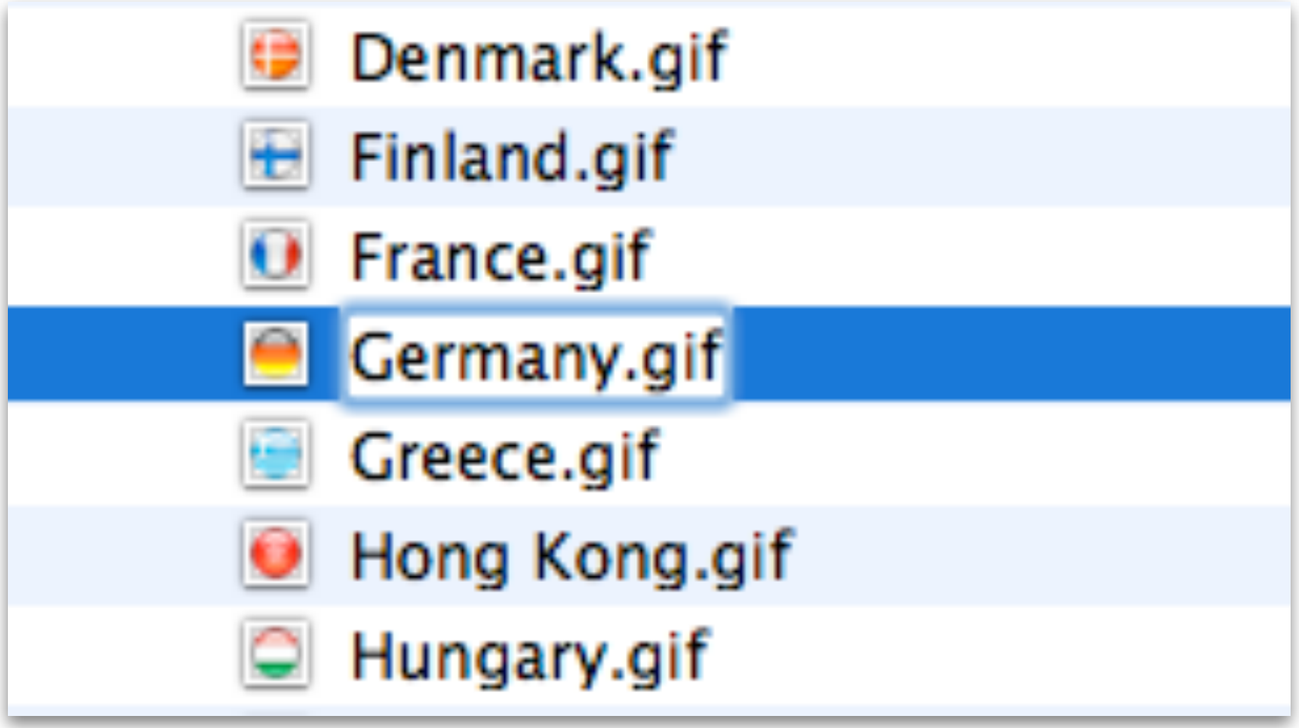
Fokusringe

Xcode



Fokusringe

Finder



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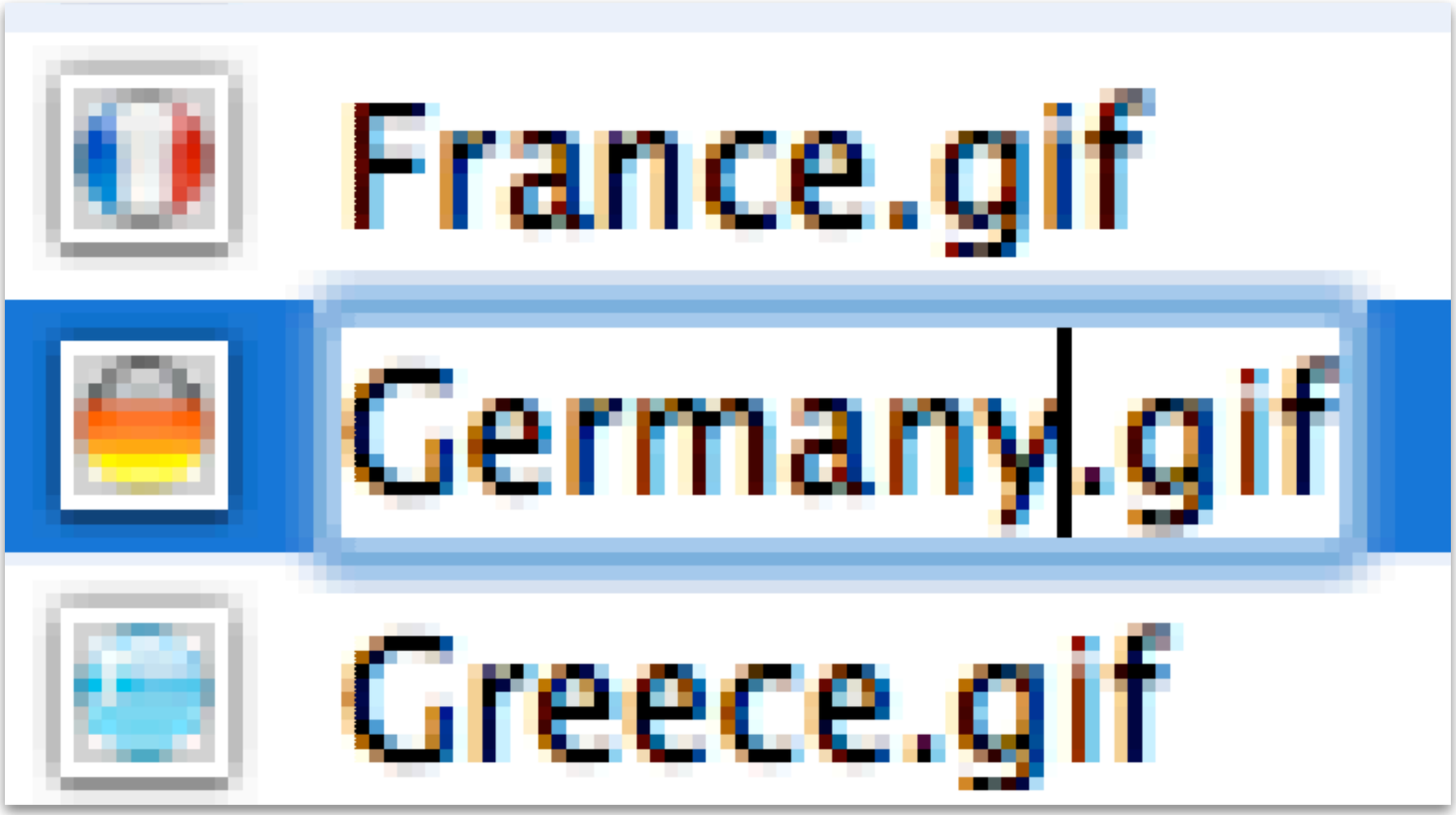
Finder



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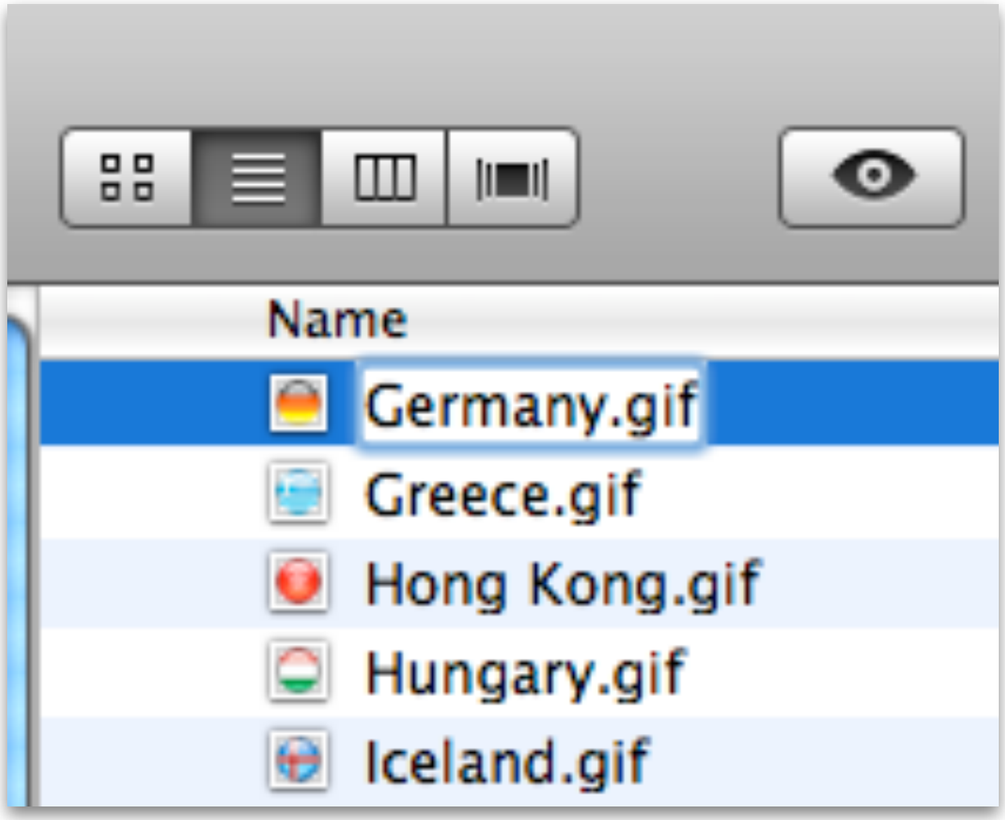
Finder am oberen Rand



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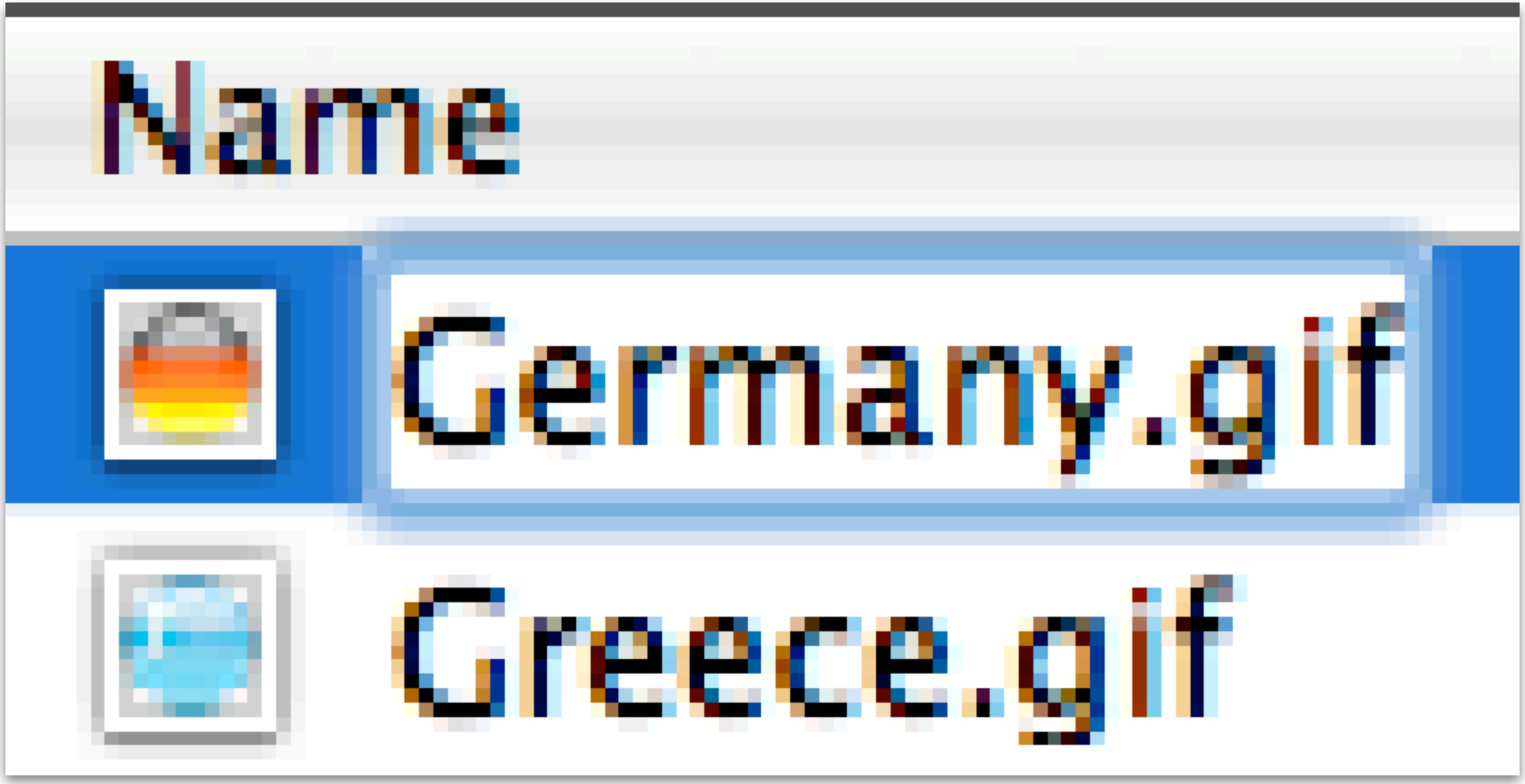
Finder am oberen Rand



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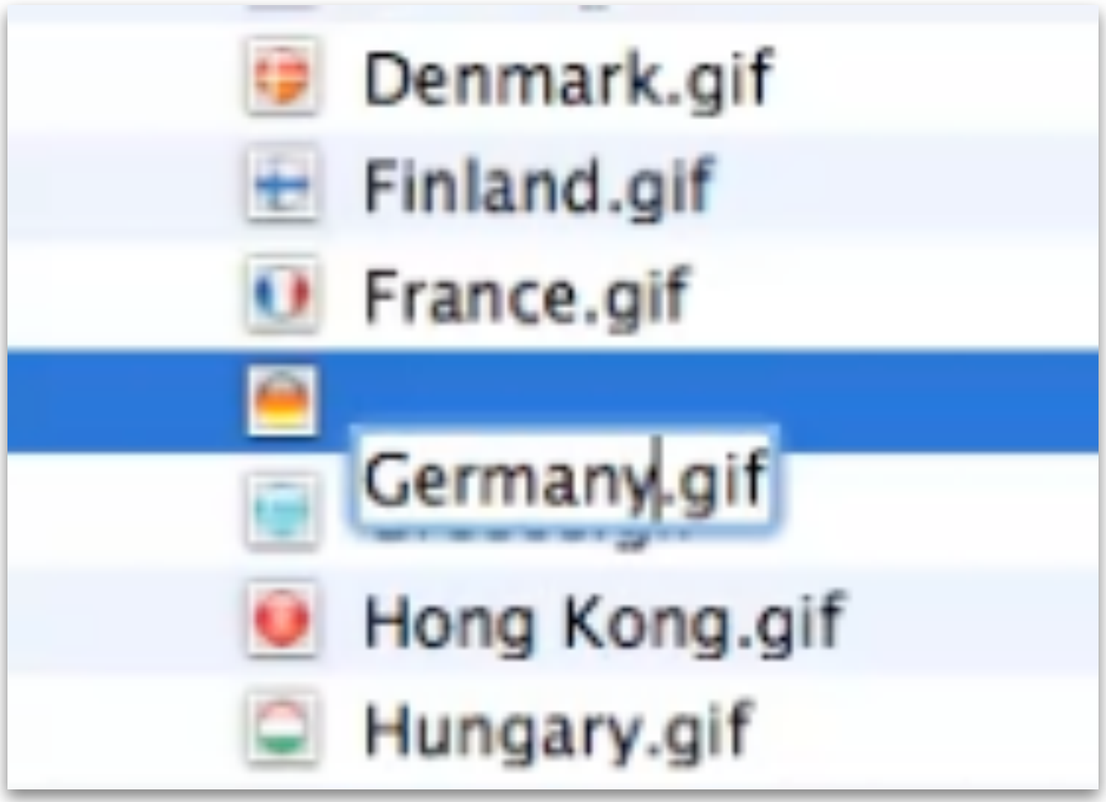
Finder beim Bewegen



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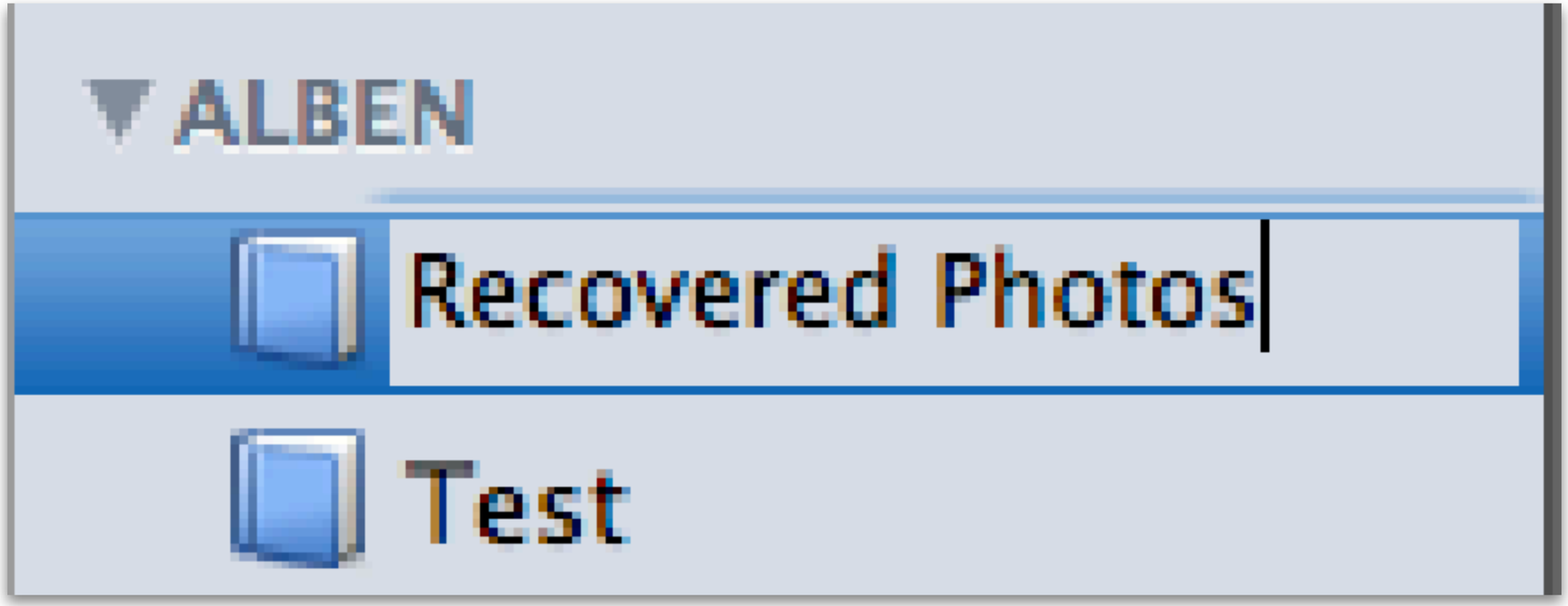
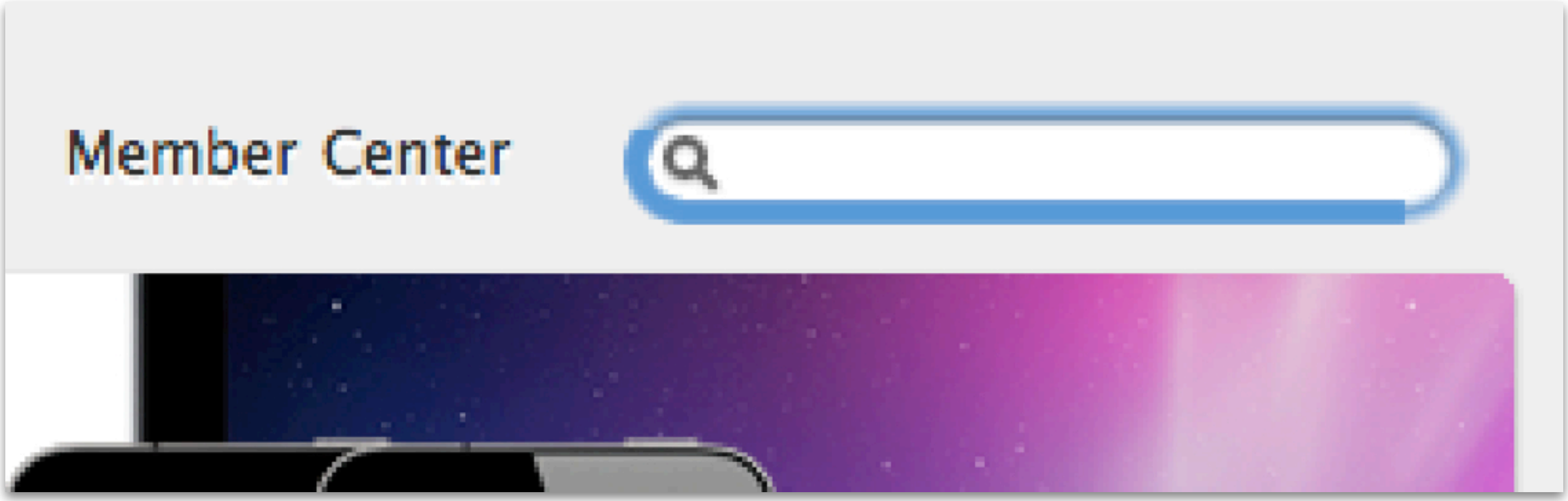
iPhoto



Fokusringe

Safari



Unsere Lösung

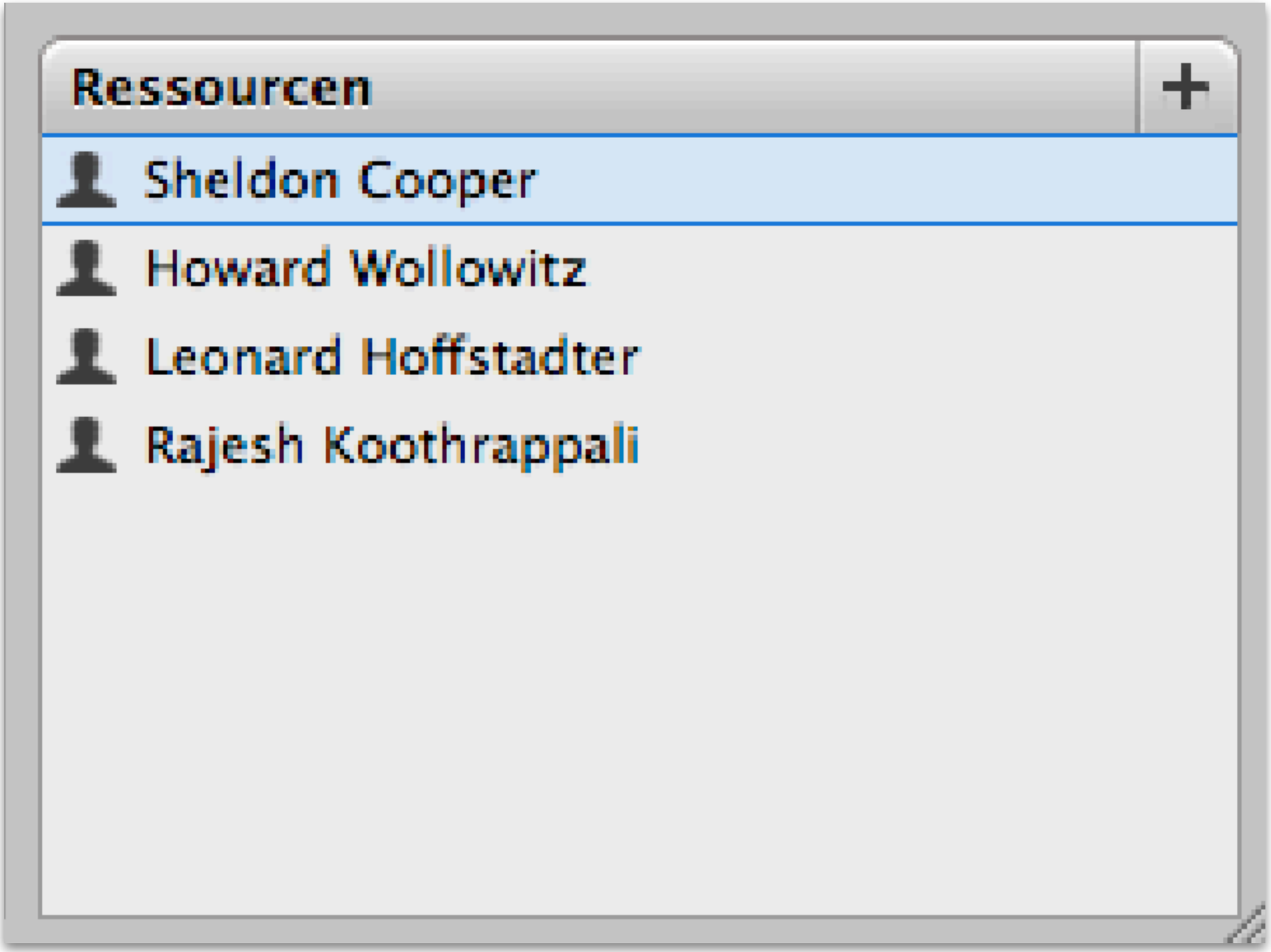
- Transparente Overlay-View über das gesamte Fenster
- Overlay-View ist letzte Subview der Window-Content-View
- Views die Overlays brauchen registrieren diese beim Fenster
- Zeichen- und Positionierungslogik werden als Block angehängt

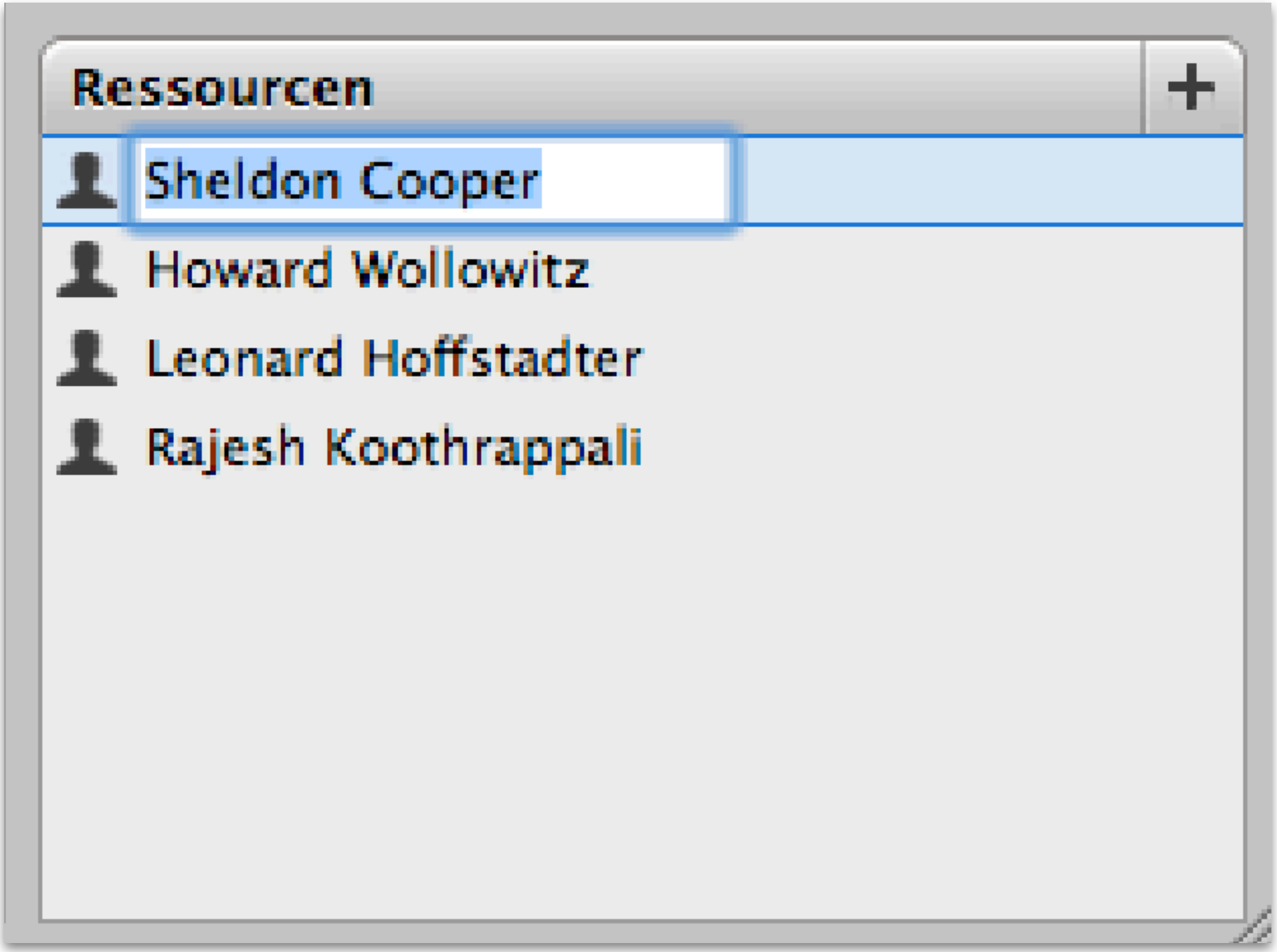
```
typedef void(^PWOverlayRectUpdater)(PWOverlay* overlay);
typedef void(^PWOverlayDrawer)(PWOverlay* overlay, CGRect dirtyRect);

@interface PWOverlay : NSObject
@property (readonly)    NSView*                referenceView;
@property (readonly)    NSView*                overlayView;
@property (copy)        PWOverlayRectUpdater rectUpdater;
@property (copy)        PWOverlayDrawer        drawer;
@property (readwrite)   CGRect                 rect;
@property (readwrite)   PWInteger              layer;
@end
```

```
- (void) createSelectionTopStrokeOverlayForRow:(PWOutlineRow*)row
{
  if (!rowSelectionLineOverlay_) {
    rowSelectionLineOverlay_ = [self.window createOverlayForView:self.bodyView];
    rowSelectionLineOverlay_.drawer = ^(PWOverlay* overlay, CGRect dirtyRect) {
      PWGraphicsContext* context = [overlay.overlayView contextForDrawRect];
      CGContextRef ctx = context.cgContext;
      CGContextSaveGState (ctx);

      CGRect lineRect = CGRectInset (overlay.rect, 1.0, 1.0);
      CGPoint p1 = CGPointMake (CGRectGetMinX (lineRect), CGRectGetMinY (lineRect));
      CGPoint p2 = CGPointMake (CGRectGetMaxX (lineRect), p1.y);
      CGSize offsets = { 0.0, 0.5 };
      p1 = PWSnapPointToPixel (ctx, p1, PWSnapToFullPixel, PWSnapToFullPixel, &offsets);
      p2 = PWSnapPointToPixel (ctx, p2, PWSnapToFullPixel, PWSnapToFullPixel, &offsets);
      CGContextSetStrokeColorWithColor (ctx, self.viewController.selectedRowStrokeColor);
      CGContextBeginPath      (ctx);
      CGContextSetLineWidth   (ctx, 1.0);
      CGContextMoveToPoint    (ctx, p1.x, p1.y);
      CGContextAddLineToPoint (ctx, p2.x, p2.y);
      CGContextStrokePath     (ctx);
      CGContextRestoreGState  (ctx);
};
```


Ressourcen
Sheldon Cooper
Howard Wollowitz
Leonard Hoffstadter
Rajesh Koothrappali


Ressourcen
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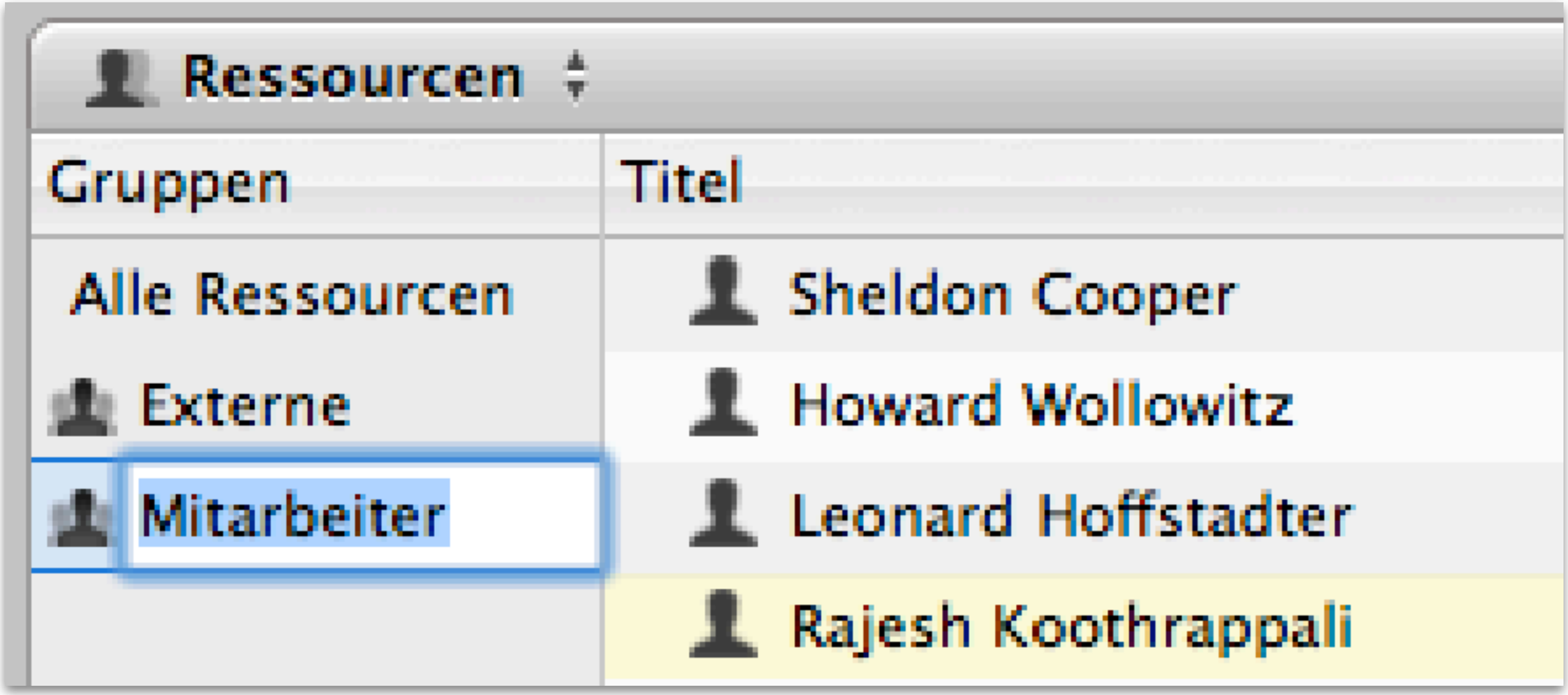
Leonard Hoffstadter
Rajesh Koothrappali


Ressourcen
Gruppen
Titel
Alle Ressourcen
Externe
Mitarbeiter
Sheldon Cooper
Howard Wollowitz
Leonard Hoffstadter
Rajesh Koothrappali

Fragen?

Vielen Dank

Macoun'10