Some(slides)

```
val reasonsToUseNull = None
```

Who am I?

- Java (& Scala) Developer at Schantz A/S
- Polyglot curious, Coursera junkie
- Interested in HCI and Usability
- https://github.com/JKrag
- @jankrag
- Geek, builder and flyer of kites, reptile & cat breeder, Rubik's puzzle fan

Oh we wish...

```
val customer = Customers.findById(1234)
customer.getAccount(FUNSTUFF).getLastInterest.getAmount
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NullPointers !

Classic solutions (java)

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Nested if's

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if(customer != null {
   if(customer.getAccount(FUNSTUFF) != null) {
      if(customer.getAccount(FUNSTUFF).getLastInterest != null) {
         return customer.getAccount(FUNSTUFF).getLastInterest.getAmount
      }
   }

}
return null;
```

Classic solutions (java)

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Early returns

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if (customer == null) return null;
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still UGLY!

Same in Scala

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```scala
val customer = Customers.findById(1234)
if (customer != null) {
   val account = customer.account(FUNSTUFF);
   if (account != null) {
      val interest = account.getLastInterest
      if (interest != null)
         interest.amount
      else
         null
   } else
      null
} else
   null
```

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Even in Scala, Still UGLY!

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Even in Scala,
Still Ugly!

and error prone

non-existence

non-existence

Java

null, null, null, null :-(

non-existence

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Groovy (et al.)

Safe navigation operator

```
def amount = customer?.account?.interest?.amount
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non-existence

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Ceylon, Kotlin etc.

both nullable and null-safe types...

```
String name = null; //compile error: null is not an instance of String
String? name = null; //OK
```

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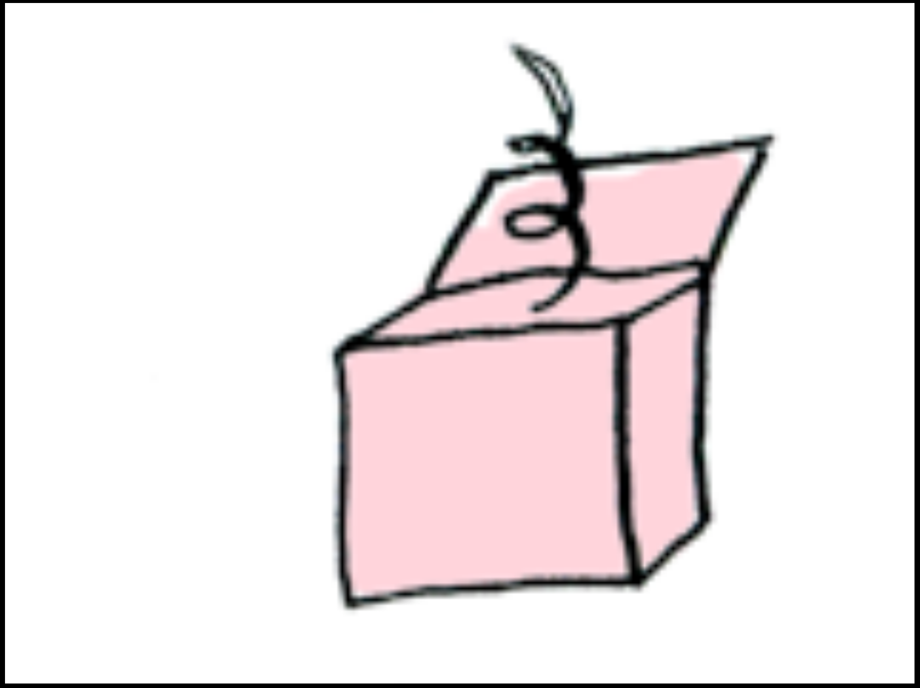
Scala .... patience...

We need something like:

Container



Empty container

Important: Same ‘shape’ outside

Let me present:

Let me present:

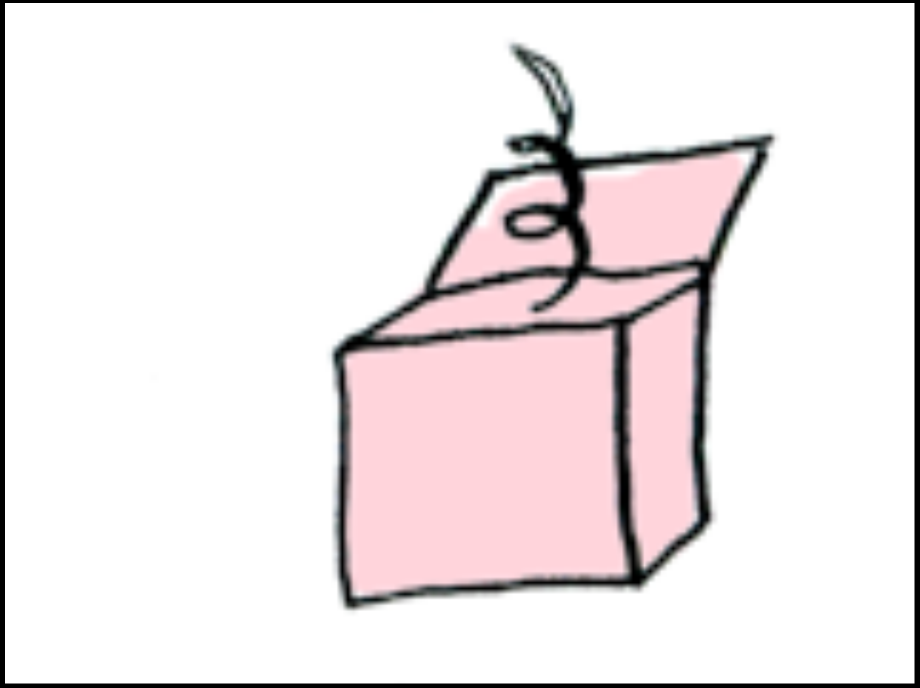
Option monad

Let me present:

Option monad SHHH

Scala's `Option` type:

Some(2)



None

Option - concept

```scala
sealed trait Option[A]

case class Some[A](a: A) extends Option[A]
case class None[A] extends Option[A]
```

Advantages

- Values that may or may not exist now stated in type system
- Clearly shows possible non-existence
- Compiler forces you to deal with it
- You won’t accidentally rely on value

Option - in RL

```scala
sealed abstract class Option[A] extends Product

case class Some[+A](a: A) extends Option[A]

case object None extends Option[Nothing]
```

Option - in RL

```
sealed abstract class Option[A] extends Product {
  def isEmpty: Boolean
  def get: A
 ...
}

final case class Some[+A](x: A) extends Option[A] {
  def isEmpty = false
  def get = x
}

case object None extends Option[Nothing] {
  def isEmpty = true
  def get = throw new NoSuchElementException("None.get")
}
```

WAT?

Creating Options

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- Direct:

```
val o = Some(3)
          //> o : Option[Int] = Some(3)
val n = None
          //> n : None.type = None
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BUT NEVER: val aaargh = Some(null)
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val n = None
     //> n : None.type = None
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```
BUT NEVER: val aaargh = Some(null)
```

- Factory method on companion object:

```
val o = Option(3)
     //> o : Option[Int] = Some(3)
val nn = Option(null)
     //> nn  : Option[Null] = None
```

```scala
val schroedingersBox : Option[Cat] =
   if(random.nextBoolean) then
      Some(Garfield)
   else
      None
```

Many mays to use

- isDefined
- isEmpty

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```
if (customer.isDefined)
  customer.account;
```

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- isDefined
- isEmpty

```
if (customer.isDefined)
  customer.account;
```

Much more type-safe and null-safe than original null-based java-flavour, but code just as ugly

get?

```
  three.get
  //> res10: Int = 3

nope.get
  //> java.util.NoSuchElementException: None.get
```

get?

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  three.get
  //> res10: Int = 3

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```

```
 $> Yay. We can still write the other
ugly version with Exception
handling :-)
```

Apprentice level: Pattern matching

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```
  val foo = request.param("foo") match
  {
  case Some(foo) => foo
  case None => "Default foo"
}
```

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  val foo = request.param("foo") match
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```

Sometimes useful, but...

at some point a Jedi you must become

What we really want is

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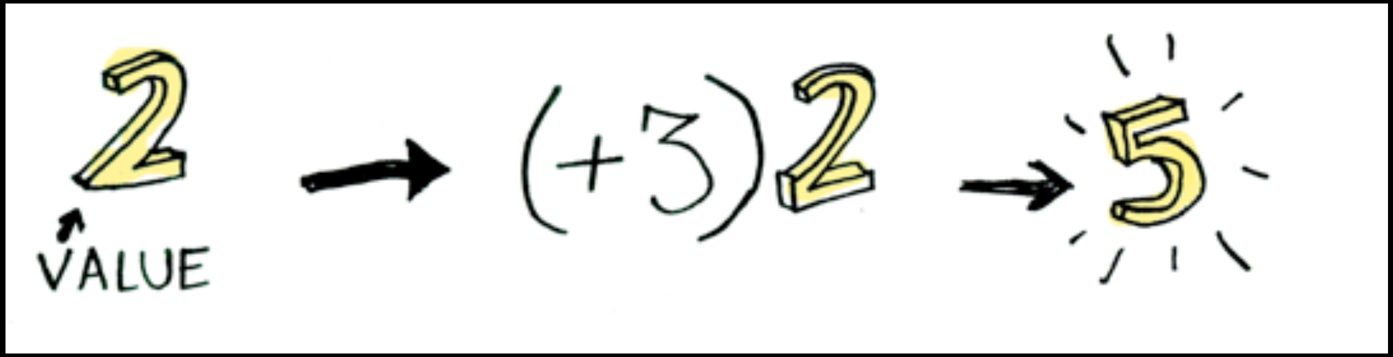
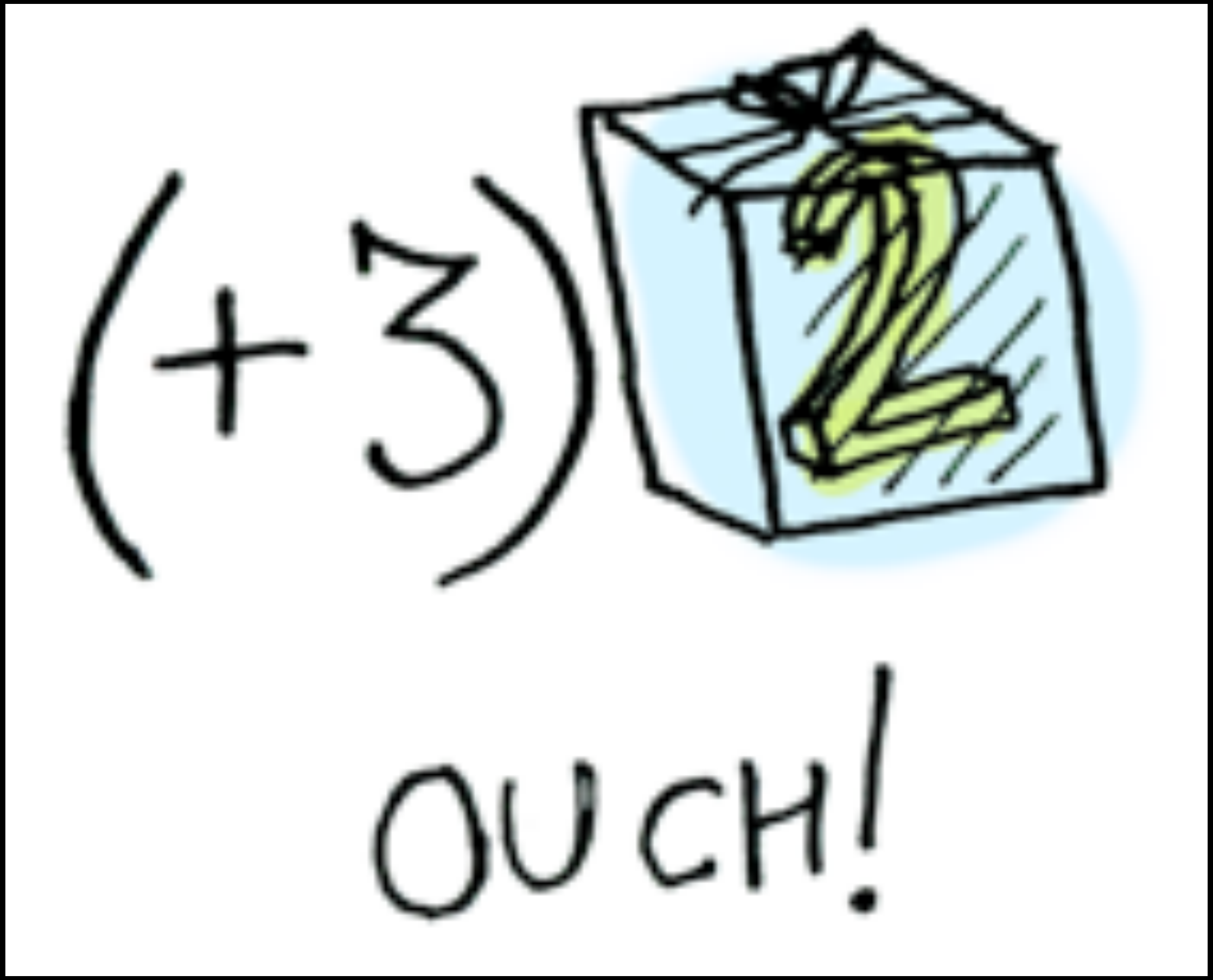
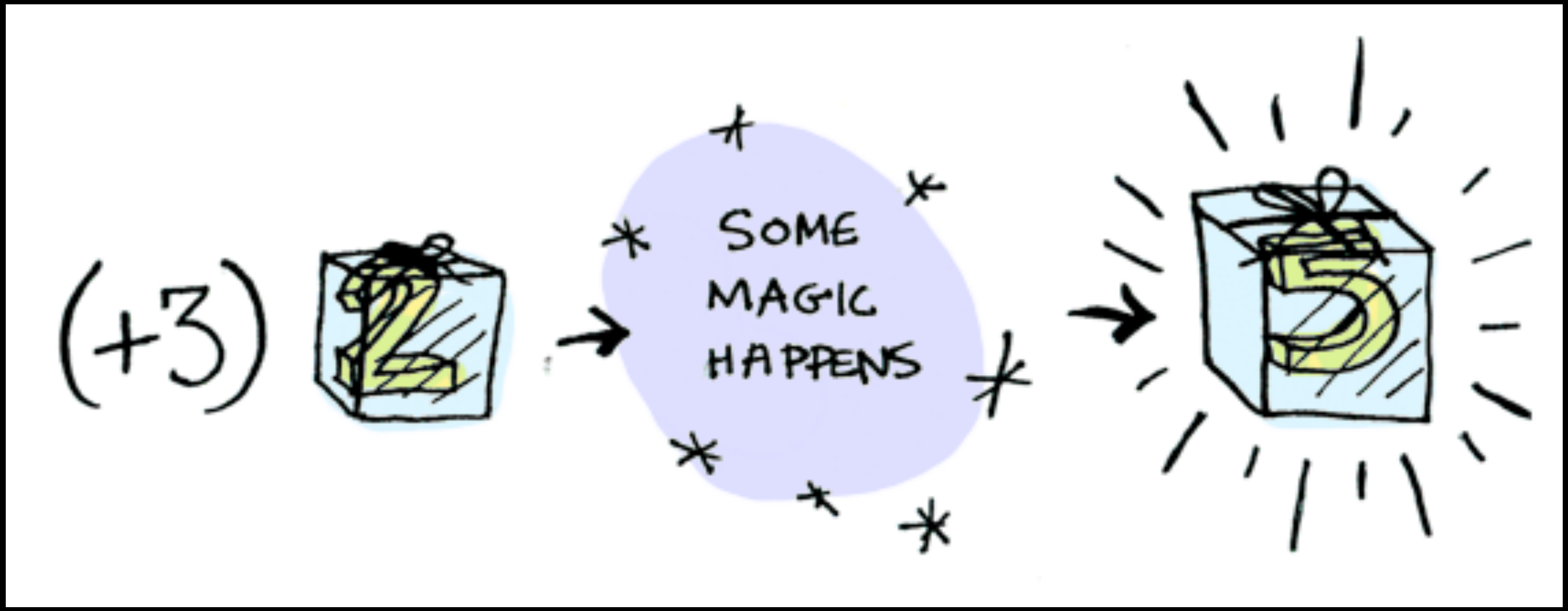


But...



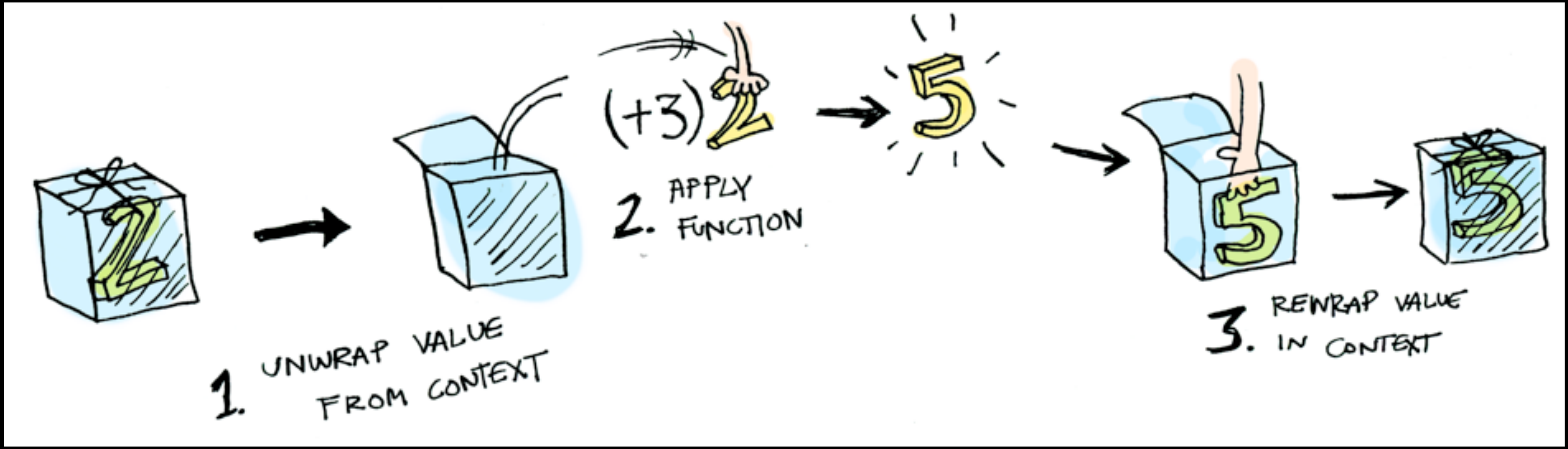
We want...?



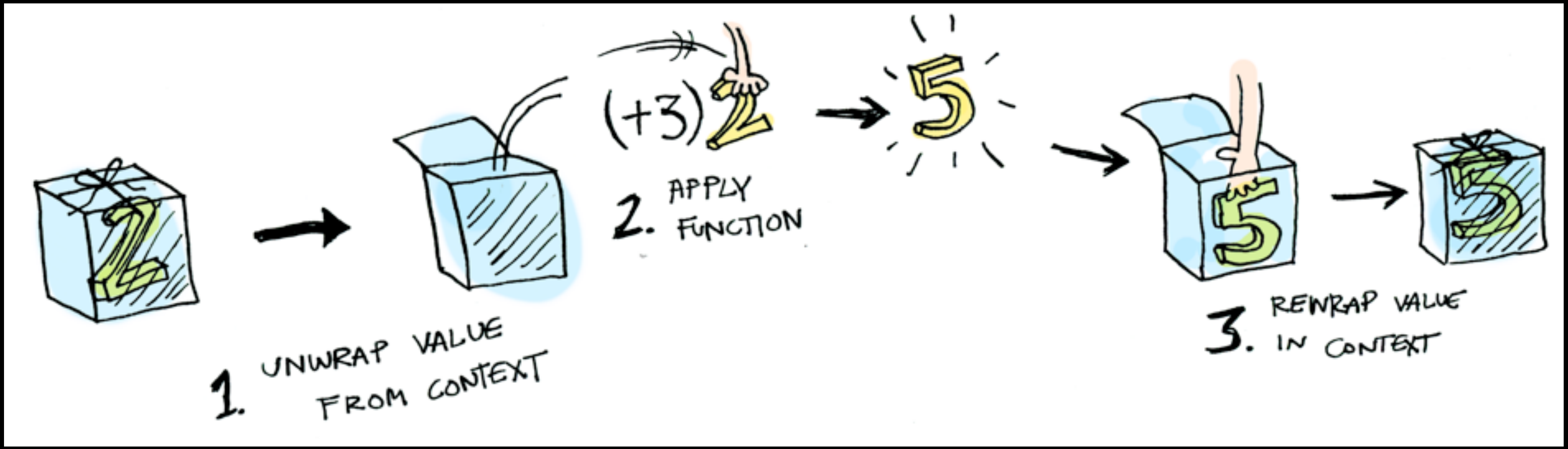
Padawan level: functional

- Treat Option as a (very small) collection
- “Biased” towards Some
- map, flatMap etc.
- and compose to your desire when the option contains a value

map

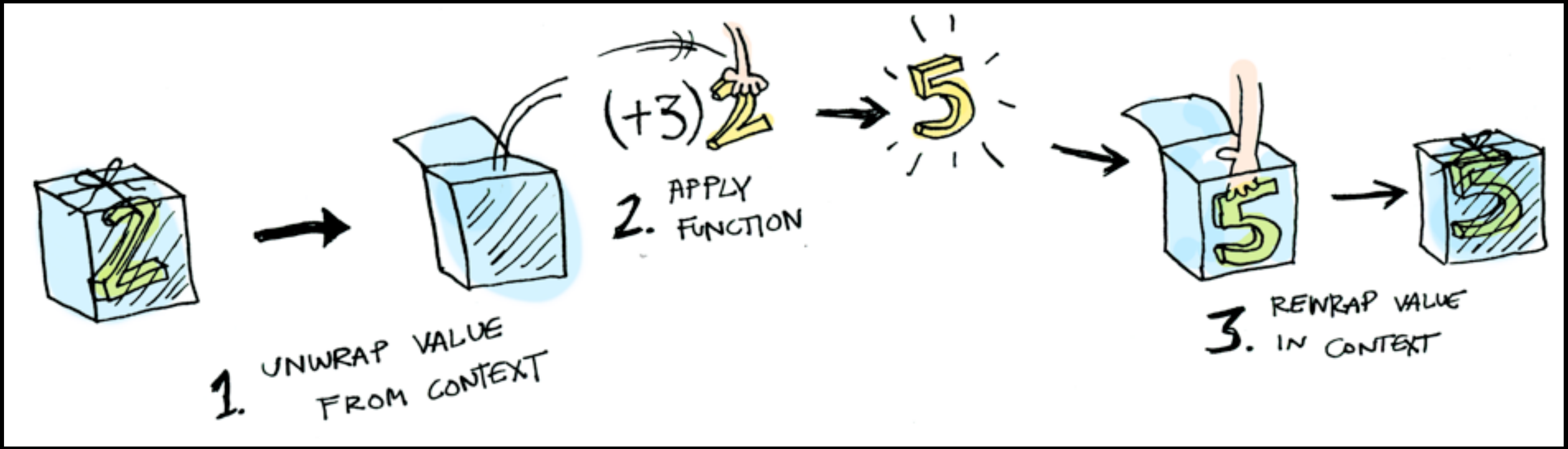

(+3)
2
5
1. UNWRAP VALUE FROM CONTEXT
2. APPLY FUNCTION
3. REWRAP VALUE IN CONTEXT

map



```
val three = Some(3)
    > three : Option[Int] = Some(3)
```

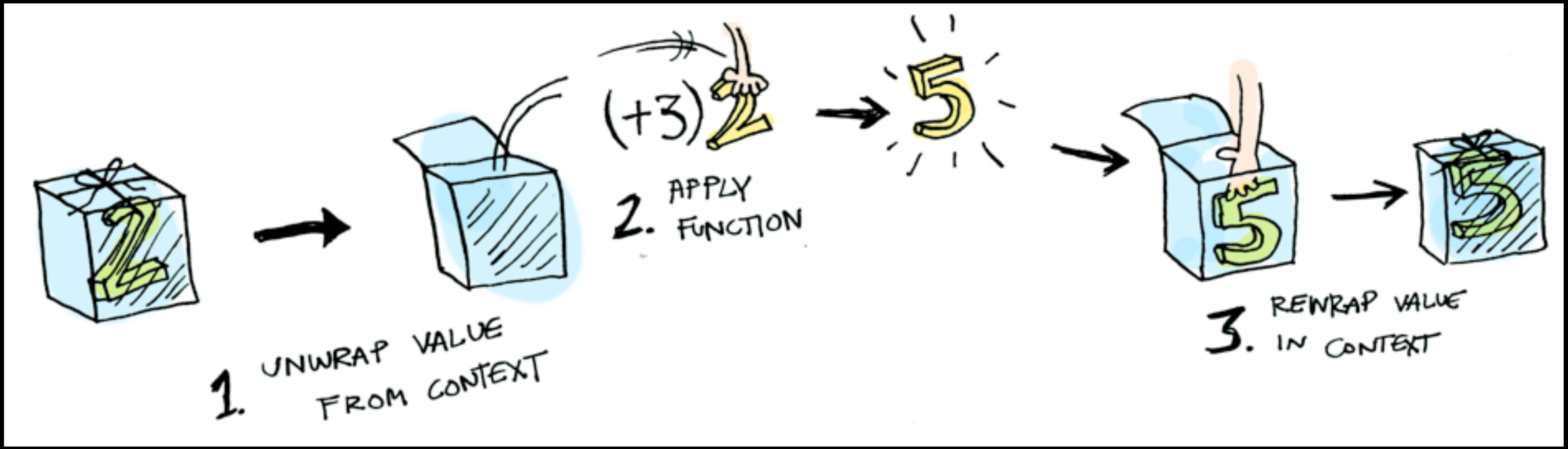
map



```
val three = Some(3)
     > three : Option[Int] = Some(3)

val res = three.map(_ + 3)
```

map



```
val three = Some(3)
     > three : Option[Int] = Some(3)

val res = three.map(_ + 3)


     > res: Option[Int] = Some(6)
```

map

```
option.map(foo(_))
```

equivalent to:

```
option match {
  case None => None
  case Some(x) => Some(foo(x))
}
```

Examples

Examples

```
def sqr(i:Int) = {i*i}
```

Examples

```
def sqr(i:Int) = {i*i}
val three = Option(3)
```

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def sqr(i:Int) = {i*i}
val three = Option(3)

three.map(i => sqr(i))
```

Examples

```
def sqr(i:Int) = {i*i}
val three = Option(3)

three.map(i => sqr(i))
        //> res4: Option[Int] = Some(9)
```

Examples

```
def sqr(i:Int) = {i*i}
val three = Option(3)

three.map(i => sqr(i))
        //> res4: Option[Int] = Some(9)
three.map(sqr(_))
```

Examples

```
def sqr(i:Int) = {i*i}
val three = Option(3)

three.map(i => sqr(i))
        //> res4: Option[Int] = Some(9)
three.map(sqr(_))
        //> res5: Option[Int] = Some(9)
```

Examples

```
def sqr(i:Int) = {i*i}
val three = Option(3)

three.map(i => sqr(i))
       //> res4: Option[Int] = Some(9)
three.map(sqr(_))
       //> res5: Option[Int] = Some(9)
three.map(sqr)
```

Examples

```
def sqr(i:Int) = {i*i}
val three = Option(3)

three.map(i => sqr(i))
       //> res4: Option[Int] = Some(9)
three.map(sqr(_))
       //> res5: Option[Int] = Some(9)
three.map(sqr)
       //> res6: Option[Int] = Some(9)
```

flatMap

```
option.flatMap(foo(_))

is equivalent to:

option match {
  case None => None
  case Some(x) => foo(x)
}
```

```
three.flatMap(x => Some(x.toString))
     Option[java.lang.String] = Some(3)

nah.flatMap(x => Some(x.toString))
     Option[java.lang.String] = None
```

Side effects: foreach

```
option.foreach(foo(_))


is equivalent to:

option match {
  case None => {}
  case Some(x) => foo(x)
}
```

```
three.foreach(println(_))
```

```scala
val userOpt = UserDao.findById(userId)

userOpt.foreach(user => println(user.name))


or, even shorter:

userOpt.foreach(println)
```

Working with lists

```
val o1 = Option(1)    //> o1  : Option[Int] = Some(1)
val o2 = Option(2)      //> o2  : Option[Int] = Some(2)
val o3 = Option(3)      //> o3  : Option[Int] = Some(3)
val l = List(o1, nope, o2, nah, o3)
         //> l  : List[Option[Int]]
             = List(Some(1), None, Some(2), None, Some(3))

l.map(_.map(sqr))
     //> res8: List[Option[Int]]
             = List(Some(1), None, Some(4), None, Some(9))

l.flatMap(_.map(sqr))
     //> res9: List[Int] = List(1, 4, 9)
```

Jedi level:
for comprehesions

```
val ageOpt = for {
  user <- UserDao.findById(userId)
  age <- user.ageOpt
} yield age
```

Jedi mind tricks

```
//we have a ‘User’ with mandatory name, but optional age

case class User(val name:String , val age:Option[Int])

def prettyPrint(user: User) =
  List(Option(user.name), user.age).flatten.mkString(", ")

val foo = User("Foo", Some(42))
val bar = User("Bar", None)

prettyPrint(foo)  //prints "Foo, 42"
prettyPrint(bar)  //prints "Bar"
```

```
val userOpt =
    UserDao.findById(userId) OrElse Some(UserDao.create)
```

```
or:
```

```
val user =
  UserDao.findById(userId) getOrElse UserDao.create
```

other option options

```scala
def filter(p: A => Boolean): Option[A]

def exists(p: A => Boolean): Boolean
```

fold
collect
iterator
toList

Resources

References, Thanks, Resources and further reading

- Attributions:
  - Thanks to Adit Bhargava for a great blogpost on monads in Haskel and for letting me use his cartoon drawings: http://adit.io/posts/2013-04-17-functors,_applicatives,_and_monads_in_pictures.html
  - For broadening my mind on higher-order use of Options: http://blog.tmorris.net/posts/scalaoption-cheat-sheet/
- Further reading
  - http://marakana.com/static/courseware/scala/presentation/comprehending-monads.html
  - http://blog.xebia.com/2011/06/02/scala-options-the-slick-way/