Example-Driven Development

oscar.nierstrasz@feenk.com

The Trouble with TDD

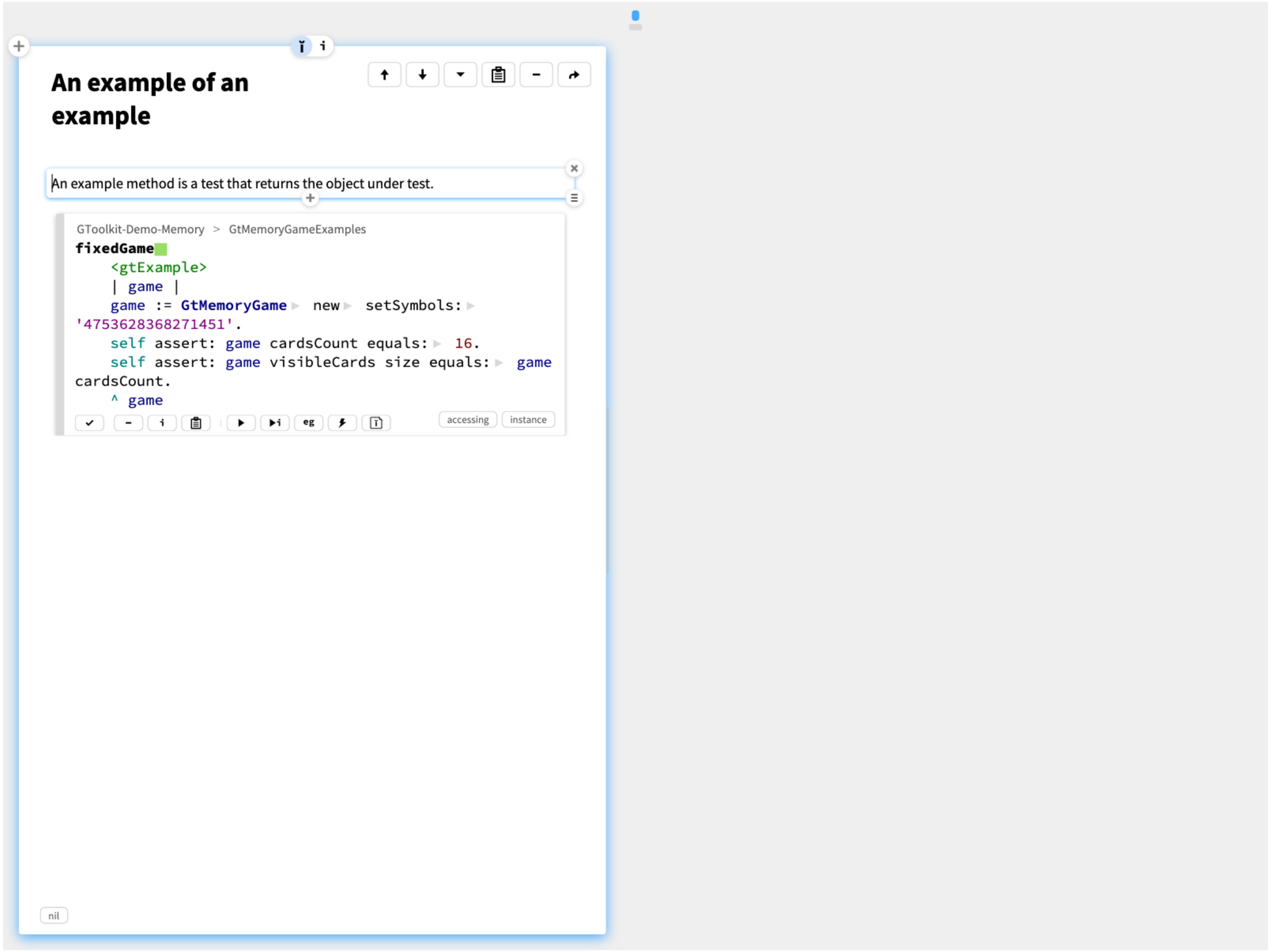
Where do tests come from?

How do we write the simplest code that passes?

What use is a green test?

What's an Example?

An example (method) is a test that *returns an example.*



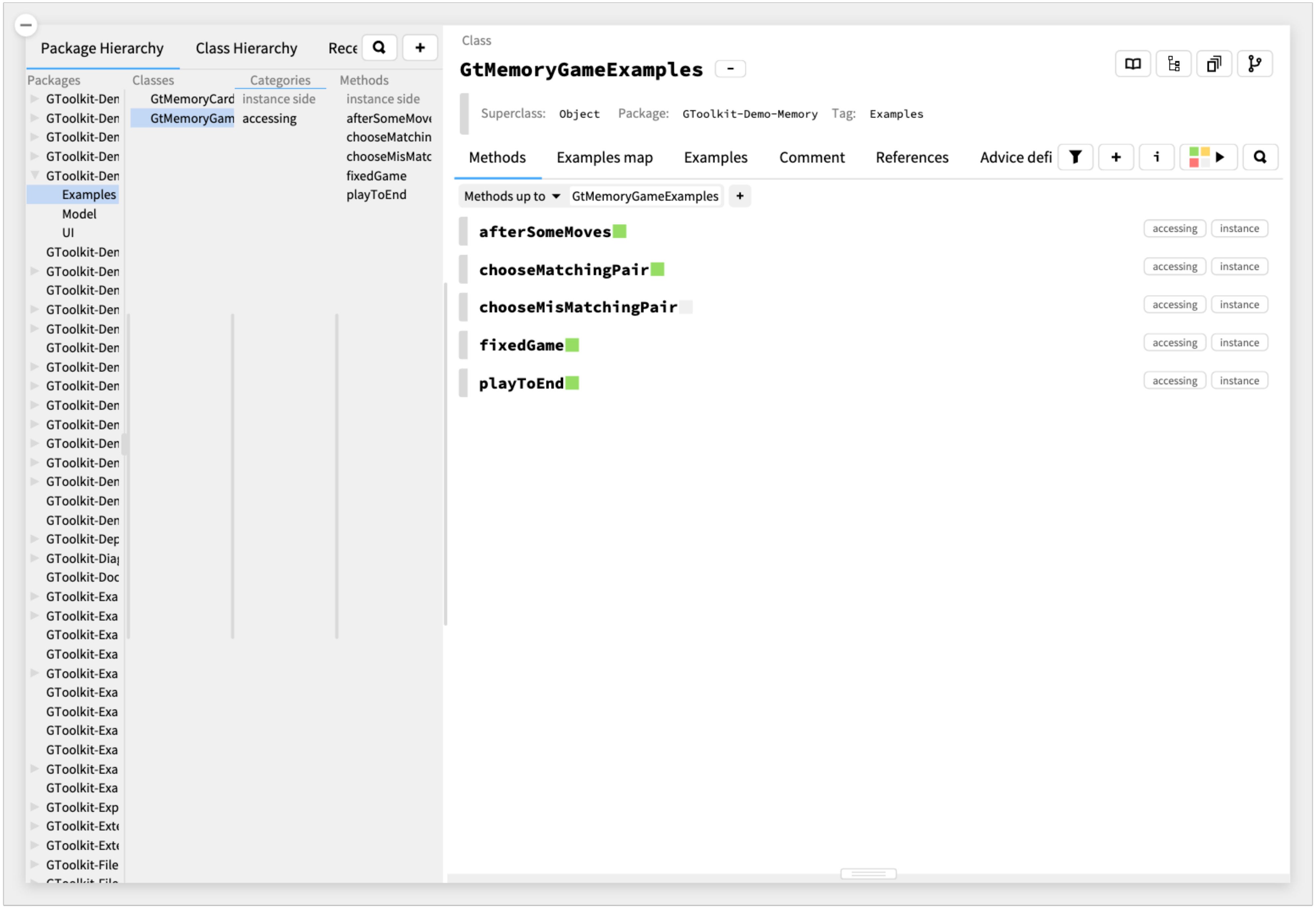
An example of an example

An example method is a test that returns the object under test.

GToolkit-Demo-Memory > GtMemoryGameExamples

```
fixedGame
    <gtExample>
    | game |
    game := GtMemoryGame new setSymbols:
'4753628368271451'.
    self assert: game cardsCount equals: 16.
    self assert: game visibleCards size equals: game
cardsCount.
    ^ game
```

Composing examples



Package Hierarchy | Class Hierarchy | Rece

Packages | Classes | Categories | Methods

GToolkit-Den
GToolkit-Den
GToolkit-Den
GToolkit-Den
GToolkit-Den
Examples
Model
UI
GToolkit-Den
GToolkit-Den
GToolkit-Den
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GToolkit-Doc
GToolkit-Exa
GToolkit-Exa
GToolkit-Exa
GToolkit-Exa
GToolkit-Exa
GToolkit-Exa
GToolkit-Exa
GToolkit-Exa
GToolkit-Exa
GToolkit-Exa
GToolkit-Exa
GToolkit-Exp
GToolkit-Ext
GToolkit-Ext
GToolkit-File

GtMemoryCard
GtMemoryGam

instance side
accessing

instance side
afterSomeMov
chooseMatchin
chooseMisMatc
fixedGame
playToEnd

Class

GtMemoryGameExamples

Superclass: `Object` Package: `GToolkit-Demo-Memory` Tag: `Examples`

Methods | Examples map | Examples | Comment | References | Advice defi

Methods up to GtMemoryGameExamples

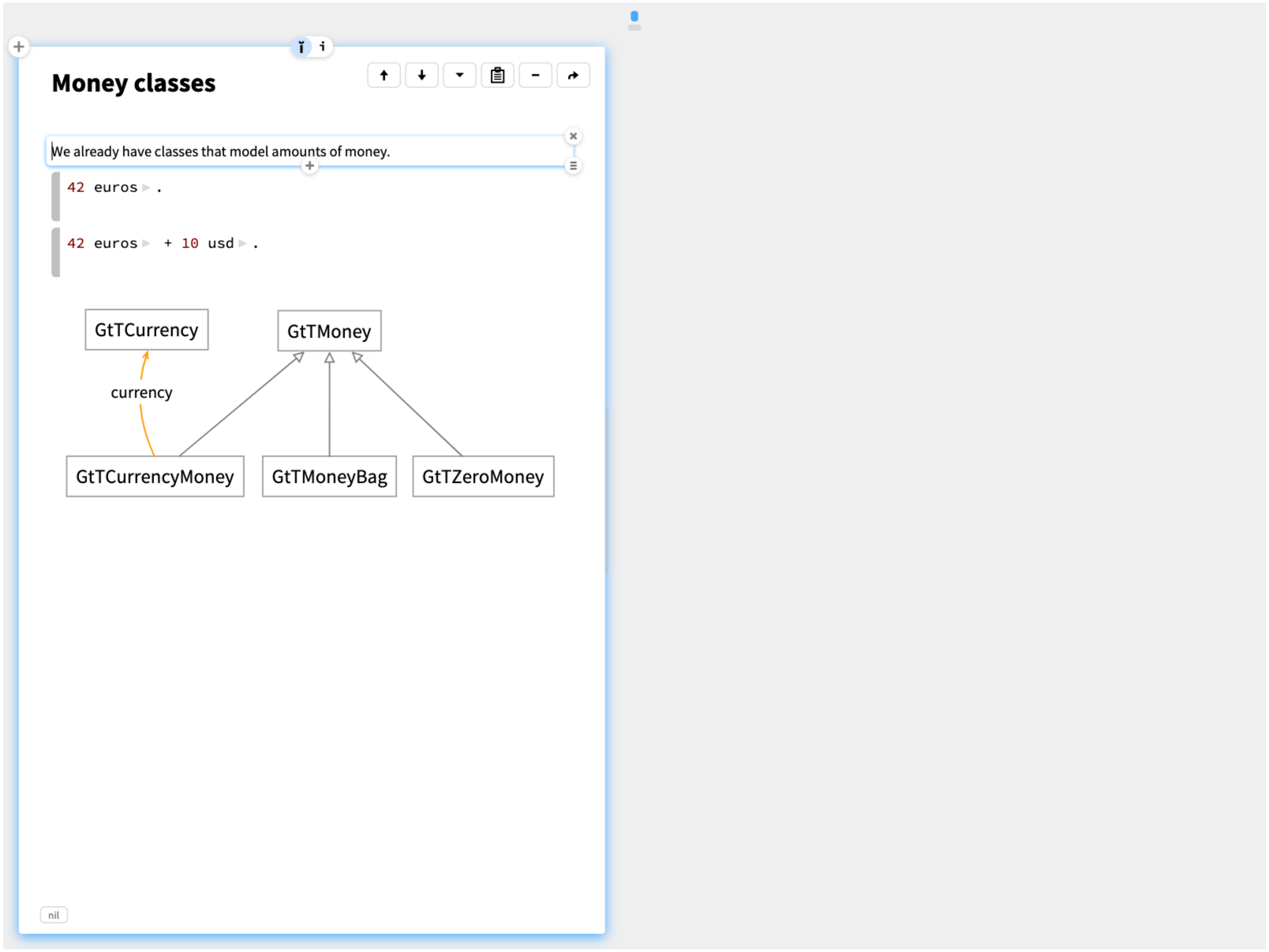
afterSomeMoves 🟩	accessing	instance
chooseMatchingPair 🟩	accessing	instance
chooseMisMatchingPair	accessing	instance
fixedGame 🟩	accessing	instance
playToEnd 🟩	accessing	instance

Why examples?

- Example composition reduces:
  - *code duplication,*
  - *cascading failures.*
- Examples can be reused in *live documentation.*
- EDD is an *exploratory approach* to TDD.

EDD Exercise: Modeling prices

A price can be something like 100 EUR.
Prices can be *added* or *multiplied*.
A price can also be *discounted* either by a fixed amount of money, or by a percentage.
All operations can be *combined arbitrarily*.
And for audit purposes, we want to *track* all operations that lead to a concrete amount of money.

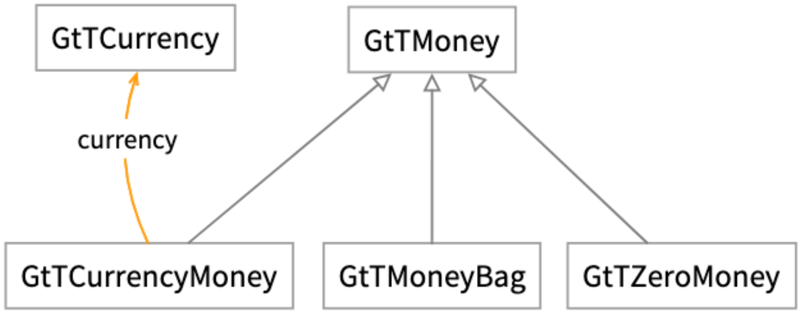


Money classes

We already have classes that model amounts of money.

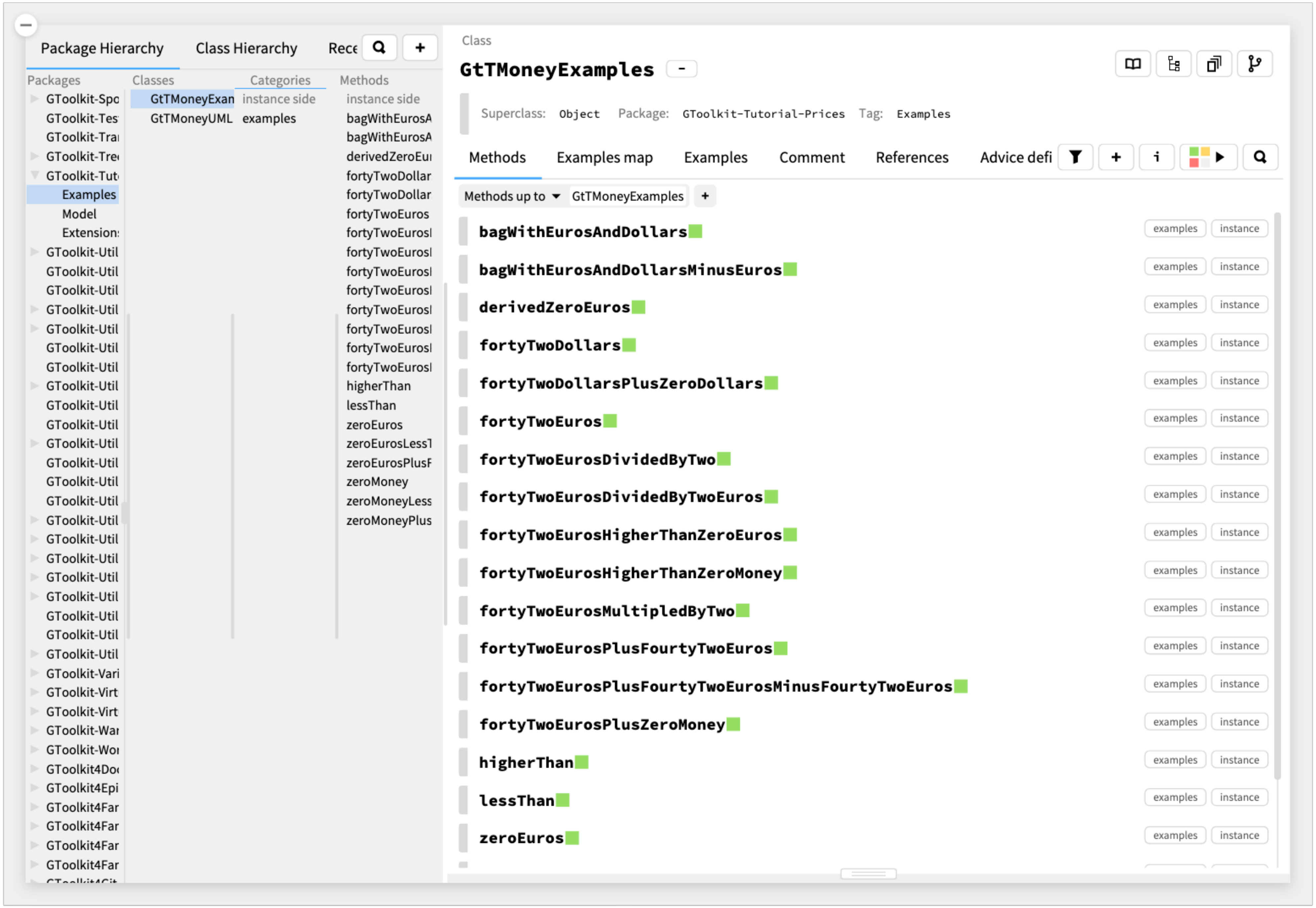
```
42 euros .
```

```
42 euros + 10 usd .
```



nil

Money Examples



Packages	Classes	Categories	Methods
GToolkit-Spo	GtTMoneyExan	instance side	instance side
GToolkit-Tes	GtTMoneyUML	examples	bagWithEurosA
GToolkit-Trai			bagWithEurosA
GToolkit-Tre			derivedZeroEu
GToolkit-Tut			fortyTwoDollar
Examples			fortyTwoDollar
Model			fortyTwoEuros
Extension:			fortyTwoEurosI
GToolkit-Util			fortyTwoEurosI
GToolkit-Util			fortyTwoEurosI
GToolkit-Util			fortyTwoEurosI
GToolkit-Util			fortyTwoEurosI
GToolkit-Util			fortyTwoEurosI
GToolkit-Util			fortyTwoEurosI
GToolkit-Util			fortyTwoEurosI
GToolkit-Util			higherThan
GToolkit-Util			lessThan
GToolkit-Util			zeroEuros
GToolkit-Util			zeroEurosLess1
GToolkit-Util			zeroEurosPlusF
GToolkit-Util			zeroMoney
GToolkit-Util			zeroMoneyLess
GToolkit-Util			zeroMoneyPlus
GToolkit-Util			
GToolkit-Util			
GToolkit-Util			
GToolkit-Util			
GToolkit-Util			
GToolkit-Util			
GToolkit-Util			
GToolkit-Vari			
GToolkit-Virt			
GToolkit-Virt			
GToolkit-War			
GToolkit-Wor			
GToolkit4Do			
GToolkit4Epi			
GToolkit4Far			
GToolkit4Far			
GToolkit4Far			
GToolkit4Far			

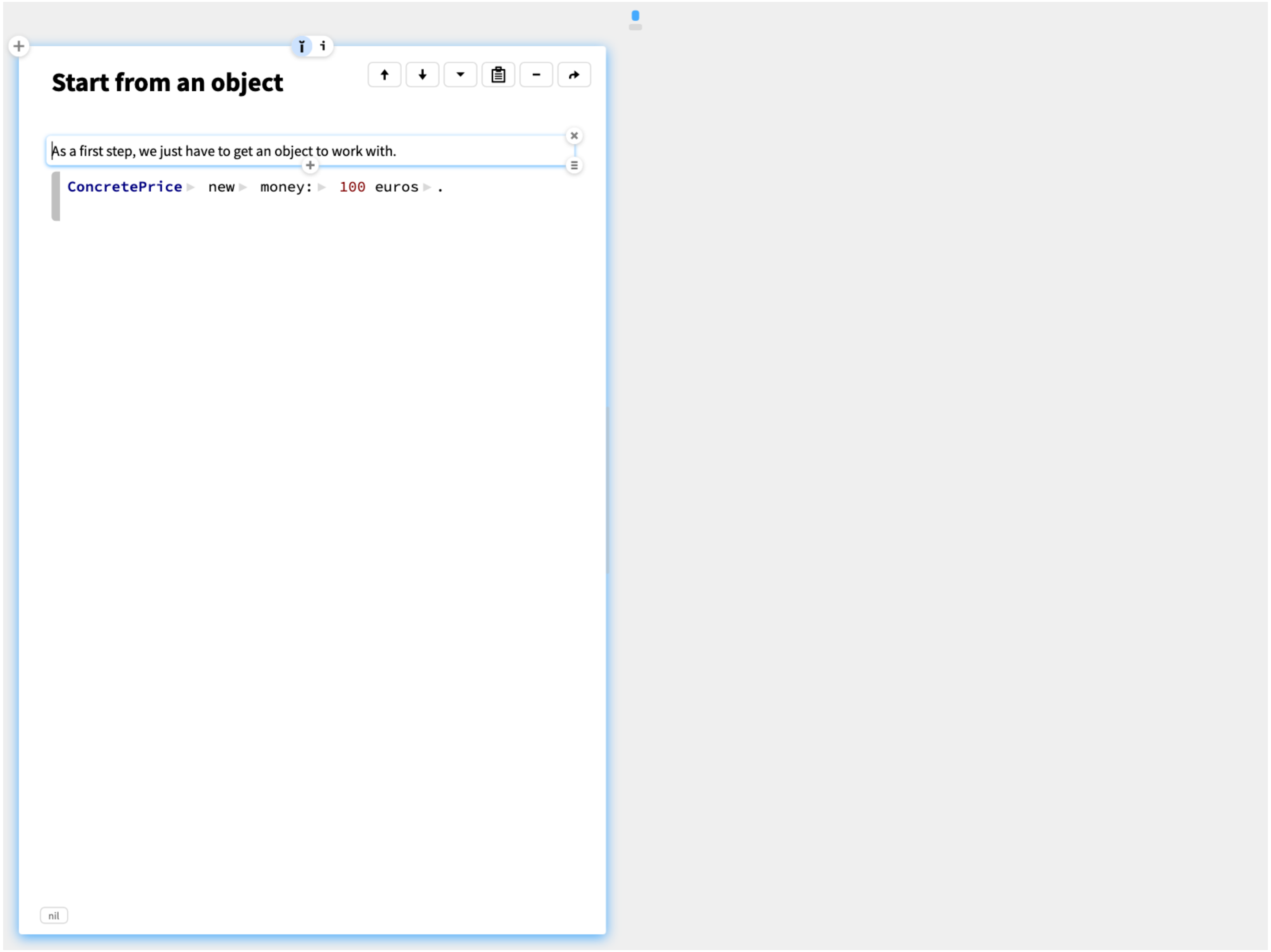
GtTMoneyExamples

Superclass: `Object` Package: `GToolkit-Tutorial-Prices` Tag: `Examples`

Method		
bagWithEurosAndDollars 🟩	examples	instance
bagWithEurosAndDollarsMinusEuros 🟩	examples	instance
derivedZeroEuros 🟩	examples	instance
fortyTwoDollars 🟩	examples	instance
fortyTwoDollarsPlusZeroDollars 🟩	examples	instance
fortyTwoEuros 🟩	examples	instance
fortyTwoEurosDividedByTwo 🟩	examples	instance
fortyTwoEurosDividedByTwoEuros 🟩	examples	instance
fortyTwoEurosHigherThanZeroEuros 🟩	examples	instance
fortyTwoEurosHigherThanZeroMoney 🟩	examples	instance
fortyTwoEurosMultipledByTwo 🟩	examples	instance
fortyTwoEurosPlusFourtyTwoEuros 🟩	examples	instance
fortyTwoEurosPlusFourtyTwoEurosMinusFourtyTwoEuros 🟩	examples	instance
fortyTwoEurosPlusZeroMoney 🟩	examples	instance
higherThan 🟩	examples	instance
lessThan 🟩	examples	instance
zeroEuros 🟩	examples	instance

Introducing a Concrete Price

A price can be something like 100 EUR.
Prices can be added or multiplied.
...

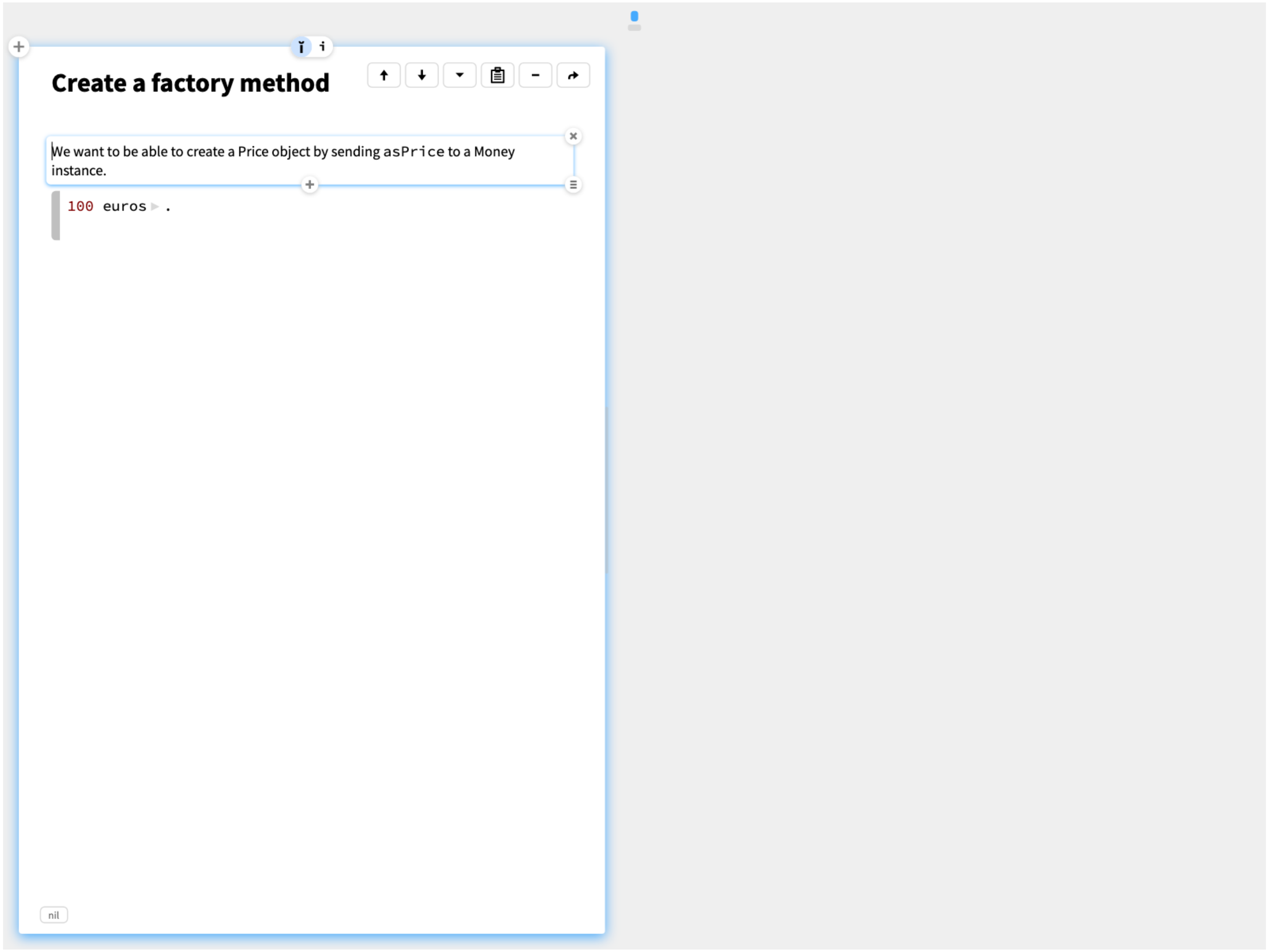


Start from an object

As a first step, we just have to get an object to work with.

```
ConcretePrice new money: 100 euros .
```

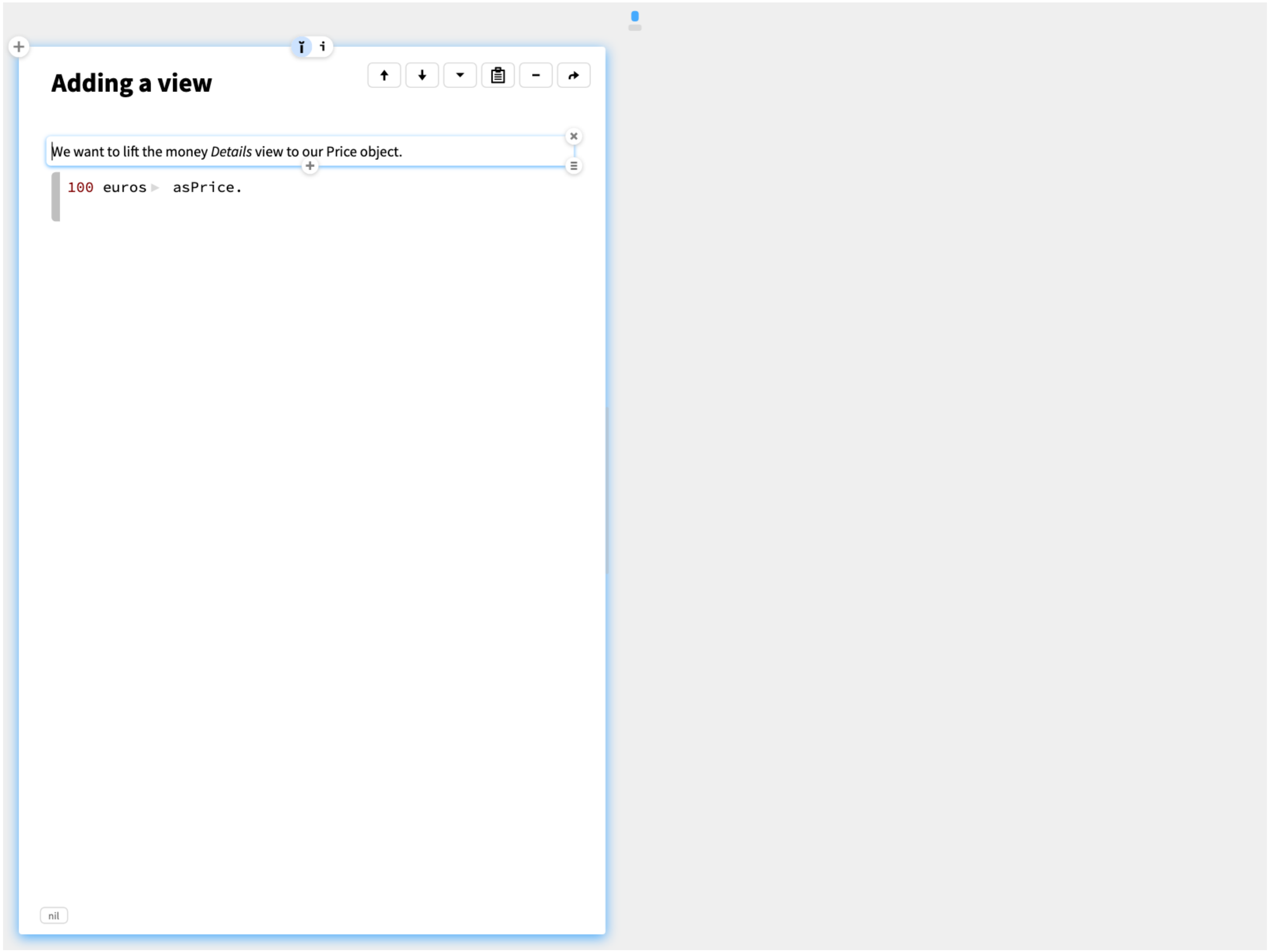
nil



Create a factory method

We want to be able to create a Price object by sending `asPrice` to a Money instance.

```
100 euros ▶ .
```

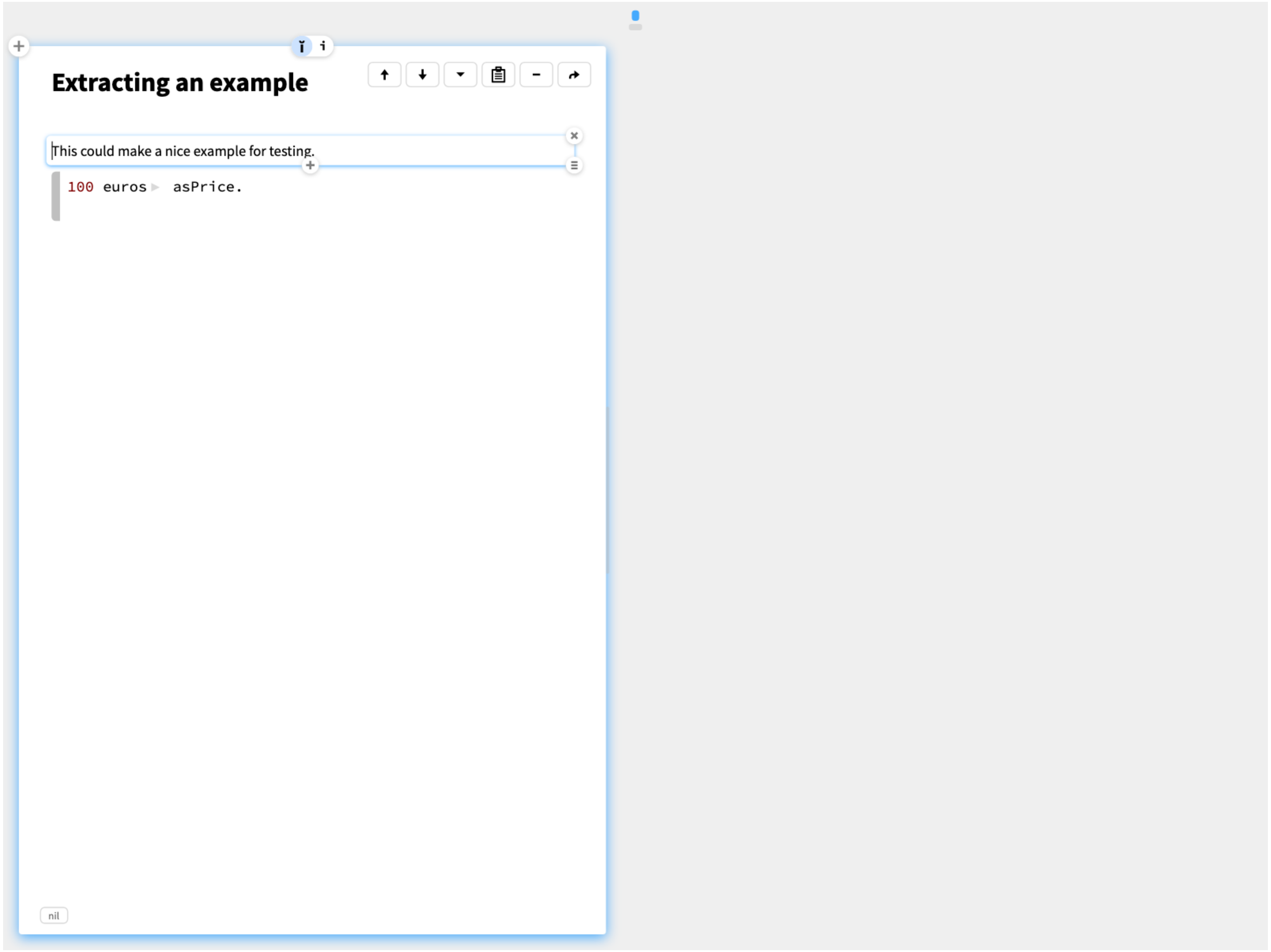


Adding a view

We want to lift the money *Details* view to our Price object.

```
100 euros asPrice.
```

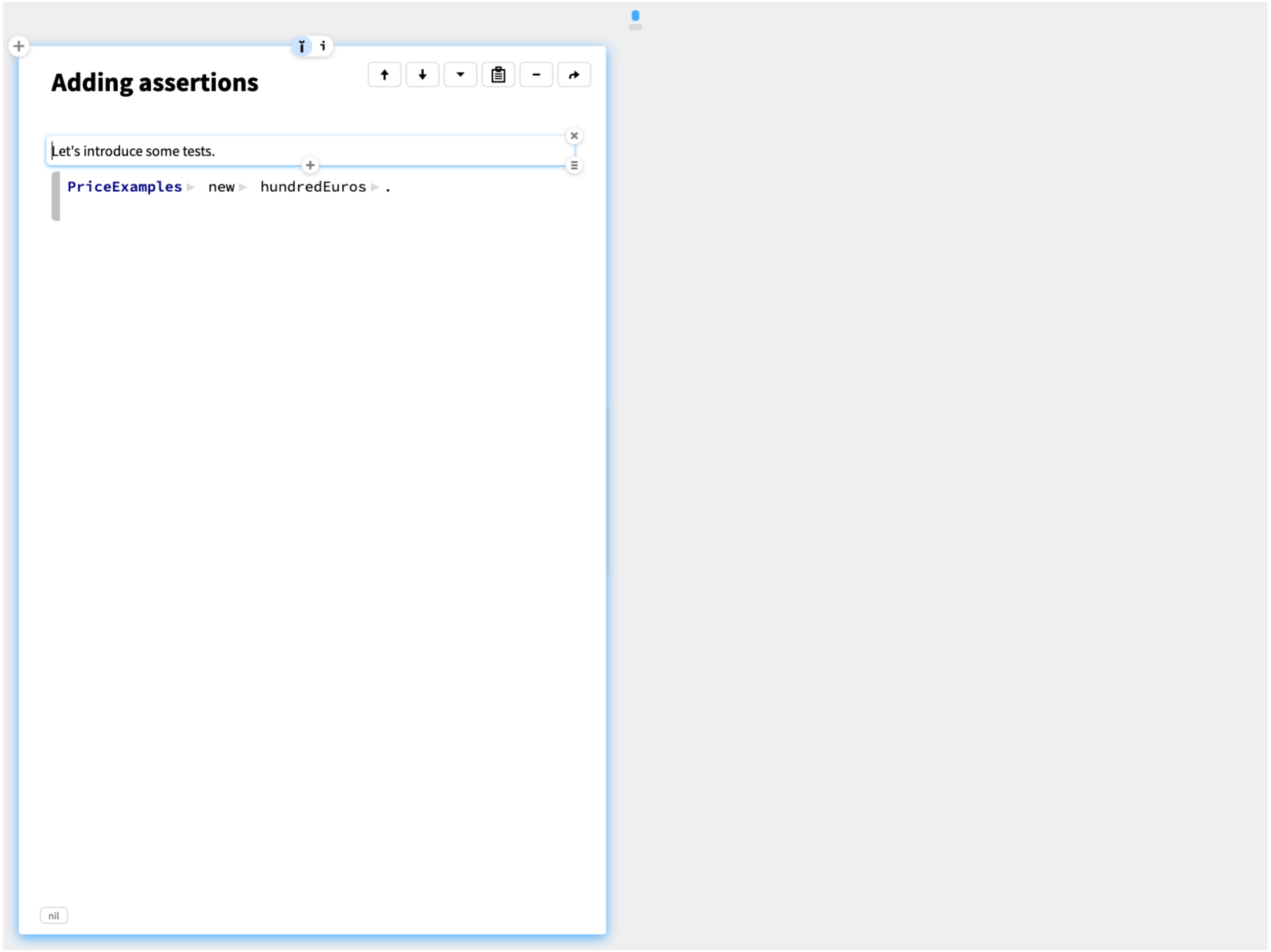
nil



Extracting an example

This could make a nice example for testing.

```
100 euros ▶ asPrice.
```

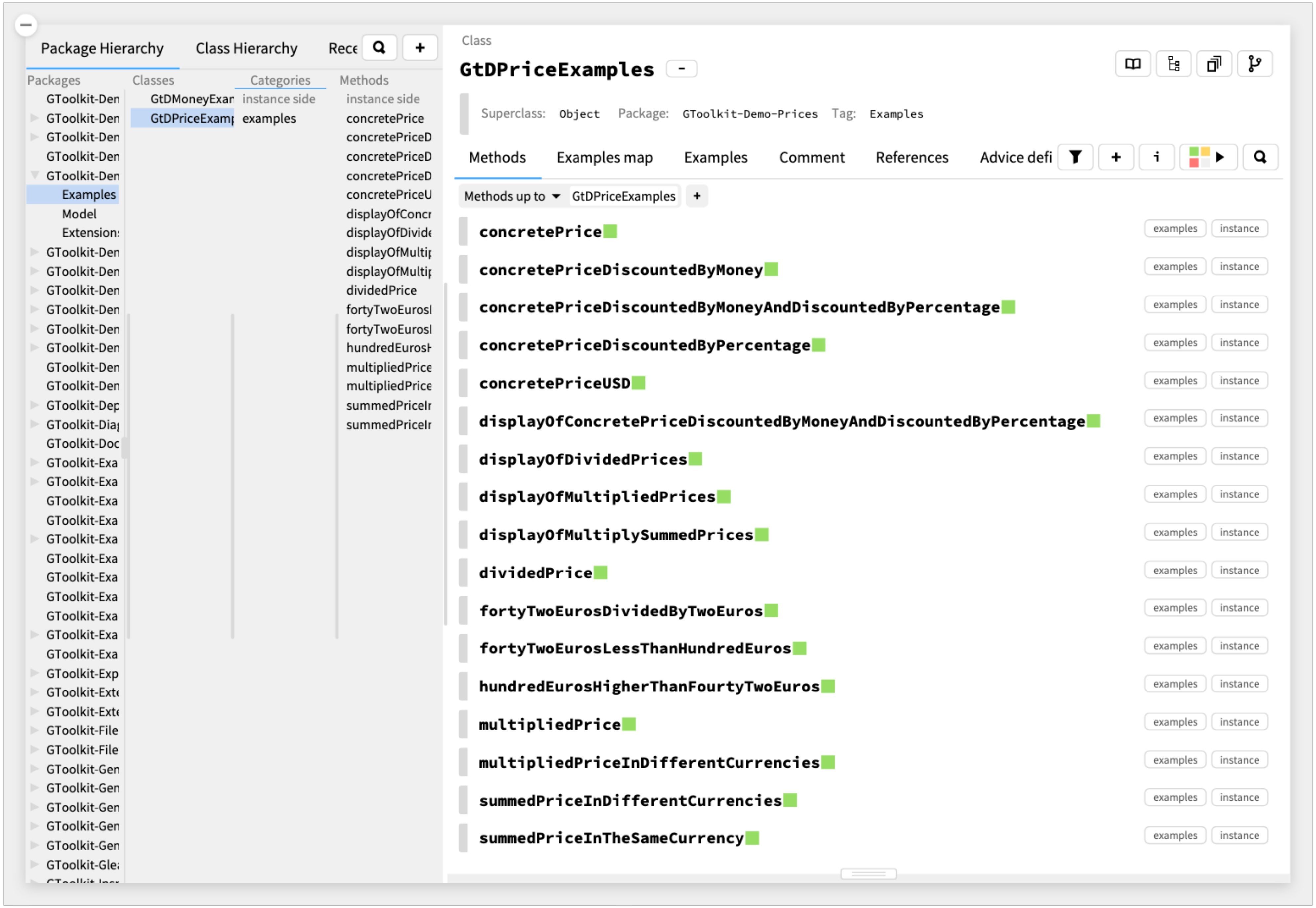


Adding assertions

Let's introduce some tests.

```
PriceExamples new hundredEuros .
```

Price Examples



Package Hierarchy | Class Hierarchy | Rece

Packages	Classes	Categories	Methods
GToolkit-Den	GtDMoneyExar	instance side	instance side
GToolkit-Den	GtDPriceExamp	examples	concretePrice
GToolkit-Den			concretePriceD
GToolkit-Den			concretePriceD
GToolkit-Den			concretePriceD
Examples			concretePriceU
Model			displayOfConcr
Extension:			displayOfDivide
GToolkit-Den			displayOfMultip
GToolkit-Den			displayOfMultip
GToolkit-Den			dividedPrice
GToolkit-Den			fortyTwoEurosI
GToolkit-Den			fortyTwoEurosI
GToolkit-Den			hundredEurosH
GToolkit-Den			multipliedPrice
GToolkit-Den			multipliedPrice
GToolkit-Dep			summedPriceIr
GToolkit-Diaj			summedPriceIr
GToolkit-Doc			
GToolkit-Exa			
GToolkit-Exa			
GToolkit-Exa			
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GToolkit-Exa			
GToolkit-Exa			
GToolkit-Exp			
GToolkit-Exte			
GToolkit-Exte			
GToolkit-File			
GToolkit-File			
GToolkit-Gen			
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Class

GtDPriceExamples -

Superclass: `Object` Package: `GToolkit-Demo-Prices` Tag: `Examples`

Methods | Examples map | Examples | Comment | References | Advice defi

Methods up to ▾ GtDPriceExamples +

concretePrice 🟩	examples	instance
concretePriceDiscountedByMoney 🟩	examples	instance
concretePriceDiscountedByMoneyAndDiscountedByPercentage 🟩	examples	instance
concretePriceDiscountedByPercentage 🟩	examples	instance
concretePriceUSD 🟩	examples	instance
displayOfConcretePriceDiscountedByMoneyAndDiscountedByPercentage 🟩	examples	instance
displayOfDividedPrices 🟩	examples	instance
displayOfMultipliedPrices 🟩	examples	instance
displayOfMultiplySummedPrices 🟩	examples	instance
dividedPrice 🟩	examples	instance
fortyTwoEurosDividedByTwoEuros 🟩	examples	instance
fortyTwoEurosLessThanHundredEuros 🟩	examples	instance
hundredEurosHigherThanFourtyTwoEuros 🟩	examples	instance
multipliedPrice 🟩	examples	instance
multipliedPriceInDifferentCurrencies 🟩	examples	instance
summedPriceInDifferentCurrencies 🟩	examples	instance
summedPriceInTheSameCurrency 🟩	examples	instance

EDD in a Nutshell

- Start with an *object*
  - *Prototype* behavior in the playground
  - *Extract* methods
  - Introduce useful *views*
- *Extract* examples
  - Prototype *assertions* in the playground
  - *Add them* to the example method
  - *Reuse* examples as setups for new examples