

# **Elm Workshop**

**Functional Kats February 2016**

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# What is Elm?

The best of functional programming in your browser  
— [elm-lang.org](http://elm-lang.org)

- Focussed on the web front end
- Strongly Typed (in a good way)
- ML inspired
- Compiles to Javascript
- Compiler is your friend (really!)

# Caveats

- Still a very young language
- Significant syntax changes still happening (though they try to minimize pain)

# What I'll be Covering

1. Getting started with Elm
2. Elm basics
3. Hopefully some Elm less basics 😊

Feel free to interrupt to ask questions and correct me.

# A Taste of Elm

```
module HelloWorld where
```

```
import Html exposing (h1, text, Html)
```

```
import Html.Attributes exposing (class)
```

```
main : Html
```

```
main =
```

```
    h1 [ class "welcome" ] [ text "Hello World!" ]
```

# A Taste of Elm (Graphical!)

```
module HelloText where

import Graphics.Element exposing (Element, leftAligned)
import Text exposing (..)

text : Text
text =
    Text.fromString "Hello World!"
        |> bold
        |> height 24

main : Element
main = leftAligned text
```

# Let's Get Started!

**Some Boring Setup Bits**

**Install Elm**

**<http://elm-lang.org/install>**

**NB version 0.16**



# Editor Setup!

# Install Atom (Controversial!)

# <https://atom.io>

```
3 import Html exposing (h1, text, Html)
4 import Html.Attributes exposing (class)
5
6 main : Html
7 main =
8   h1 [ class "welcome" ] [ tex "Hello World!" ]
9
```

error

Cannot find variable `tex`

Maybe you want one of the following?

# **Install Plugins**

## **language-elm**

## **linter**

## **linter-elm-make**

**settings -> linter-elm-make -> path -> /usr/local/bin/elm-make (or wherever it is)**

# Setup Code

```
git clone https://github.com/micktwomey/elm-functionalkats-tutorial.git  
cd elm-functionalkats-tutorial  
elm package install
```

**Note:** Always run `elm make` from `elm-functionalkats-tutorial`, everything has to be relative to `elm-package.json`

# Digression: Package Manager

## (It's very polite)

Some new packages are needed. Here is the upgrade plan.

Install:

```
elm-lang/core 3.0.0
evancz/elm-html 4.0.2
evancz/virtual-dom 2.1.0
```

Do you approve of this plan? (y/n) y

Downloading elm-lang/core

Downloading evancz/elm-html

Downloading evancz/virtual-dom

# Digression 2: Semantic Versioning

```
elm package diff evancz/elm-html 3.0.0 4.0.2
```

```
Comparing evancz/elm-html 3.0.0 to 4.0.2...
```

```
This is a MAJOR change.
```

```
----- Changes to module Html.Attributes - MAJOR -----
```

```
Removed:
```

```
    boolProperty : String -> Bool -> Attribute
```

```
    stringProperty : String -> String -> Attribute
```

```
----- Changes to module Html.Events - MINOR -----
```

```
Added:
```

```
    type alias Options =
```

```
        { stopPropagation : Bool, preventDefault : Bool }
```

```
    defaultOptions : Html.Events.Options
```

```
    onWithOptions : String -> Html.Events.Options -> Json.Decode.Decoder a -> (a -> Signal.Message) -> Html.Attribute
```

# Exercise 1: Hello World Yourself!

1. Fire up elm's reactor `elm reactor` in `elm-functional-kats-tutorial/`
2. Go to `http://localhost:8000/`
3. Open `exercises/HelloWorldYourself.elm` in your editor (easiest is usually to open the `elm-functional-kats-tutorial` in your editor and select the file).
4. Try running in the reactor (`http://localhost:8000/exercises/HelloWorldYourself.elm`) or compile with `elm make exercises/HelloWorldYourself.elm`
5. Let it explode and see what fun errors you get :)

# Errors You Might See

- Editor complains about missing `elm-make`. Check plugin settings and point to full path if needed.
- `... elm-make: thread blocked indefinitely in an MVar operation` -> <https://github.com/elm-lang/elm-make/issues/33>
- `elm make` complains about missing `Html` package. Check that you are running from `elm-functional-kats-tutorial` and `elm package install` works.



# HelloWorldYourself.elm

```
module HelloWorldYourself where
```

```
import Html exposing (..)
```

```
import Html.Attributes exposing (..)
```

```
main : Html
```

```
main =
```

```
    "Hello World Yourself!"
```

# Solution

```
module HelloWorldYourself where
```

```
import Html exposing (..)
```

```
import Html.Attributes exposing (..)
```

```
main : Html
```

```
main =
```

```
  h1 [ class "hello" ] [ text "Hello World Yourself!" ]
```

(Yes, the class is superfluous, you can leave those brackets empty.)

# Documentation

**<http://package.elm-lang.org>**

e.g. for Html.h1: <http://package.elm-lang.org/packages/evancz/elm-html/4.0.2/Html#h1>

# Digression 3: There's a REPL

```
elm repl
```

But I never use it, the compiler is far more helpful.

# Type Annotations

From Html.h1:

```
h1 : List Attribute -> List Html -> Html
```

Html.h1 takes a List of Attribute, and a List of Html and returns Html.

(Someone else can explain it better than me. Evan explained it to me and I promptly forgot.)

# Exercise:

# HelloWorldFunction.elm

Fill in the header function in HelloWorldFunction.elm

```
module HelloWorldFunction where
```

```
import Html exposing (..)
```

```
import Html.Attributes exposing (..)
```

```
header : ?
```

```
header title =
```

```
?
```

```
main : Html
```

```
main =
```

```
  header "Hello World"
```

# let

```
main =
```

```
    let
```

```
        pageTitle = "Hello World"
```

```
        header = h1 [] [ text pageTitle ]
```

```
    in
```

```
        header
```

# Exercise: HelloLet.elm

Fill in the let expression in HelloLet.elm



# Solution

```
module HelloLet where
```

```
import Html exposing (..)
```

```
header : String -> Html
```

```
header title =
```

```
    let
```

```
        fullTitle = "The title: " ++ title
```

```
        htmlTitle = text fullTitle
```

```
    in
```

```
        h1 [] [ htmlTitle ]
```

```
main : Html
```

```
main =
```

```
    header "Hello World"
```

# Pipes

Nifty syntax feature every language should have

```
(height 24 (italic (fromString "Hello World!")))
```

Becomes

```
fromString "Hello World!"
```

```
|> italic
```

```
|> height 24
```

# Quick Exercise: HelloPipe.elm

You know what to do, use pipes :)

```
main = leftAligned (height 24 (bold (fromString "Hello World!")))
```

# Solution

```
module HelloText where
```

```
import Graphics.Element exposing (Element, leftAligned)
```

```
import Text exposing (..)
```

```
main : Element
```

```
main =
```

```
    fromString "Hello World!"
```

```
    |> bold
```

```
    |> height 24
```

```
    |> leftAligned
```

# Types and Case

```
type MyType
  = Something
  | Else
  | Other String
```

```
useMyType : MyType -> String
```

```
useMyType myType =
```

```
  case myType of
```

```
    Something ->
```

```
      "Something"
```

```
    Else ->
```

```
      "Else!"
```

```
    Other string ->
```

```
      "Other: " ++ string
```

# Exercise: HelloTypes.elm

Can you complete HelloTypes.elm?

Hints:

1. Start by filling out the type definition
2. The compiler error should start guiding you to the right case statements
3. You might need more helper functions
4. List.map is new, it takes a function and applies it to each item in a list.

# Solution

```
type Greeting
  = Header String
  | UI (List String)
  | Paragraph String
  | Numbers (List Int)
```

# Solution Part 2

```
greeting : Greeting -> Html
greeting greet =
  case greet of
    Header header ->
      h1 [] [ text header ]
    Ul strings ->
      ul [] (List.map stringToLi strings)
    Paragraph para ->
      p [] [ text para ]
    Numbers numbers ->
      -- Ha! I cheated! I used syntax you haven't seen!
      ol [] (List.map (\x -> li [] [text (toString x) ]) numbers)
```



# Signals

Go from a static app to a dynamic app

slide\_examples/KeyboardSignals.elm:

```
main : Signal Element
main =
    Signal.map show arrows
```

Shows state of arrow keys.

# Interlude: Signal Visualization

Excellent signal viewer: <http://yang-wei.github.io/elmflux/>

# Exercise: ArrowPresses.elm

Render a different triangle for each arrow press.

See <http://package.elm-lang.org/packages/elm-lang/core/3.0.0/Graphics-Collage>

# Solution

See `solutions/ArrowPresses.elm`

What's with those `Debug.watch` calls?

## Bonus: Time Travel Debugging!

`http://localhost:8000/solutions/ArrowPresses.elm?debug`

# Models and State

We've seen views and signals, the next part is state.

# Records

```
type alias Model =  
  { x : Int  
    , y : Int  
    , colour: Color  
  }
```

```
model : Model
```

```
model = { x = 1, y = 2, color = Color.blue }
```

# Updating Records

```
newModel = { Model  
  | x = 1  
  , y = 2  
  , colour = Color.red  
}
```

You can't mutate a model, only return a new one.

# Mind Melting Bit: foldp

```
main : Signal Element
```

```
main =
```

```
  Signal.foldp update init Keyboard.arrows
```

```
    |> Signal.map view
```



# Exercise

Can you fill in the `initPlayer` and `update` functions in `exercises/ArrowModel.elm`?

# Solution

See solutions/ArrowModel.elm

```
initPlayer : Model
```

```
initPlayer =
```

```
  { x = 0
```

```
  , y = 0
```

```
  , shape = playerShape
```

```
  }
```

```
update : { x : Int, y : Int } -> Model -> Model
```

```
update {x, y} player =
```

```
  { player
```

```
  | x = player.x + (x * 10)
```

```
  , y = player.y + (y * 10)
```

```
  }
```

# Stuff I Haven't Covered

- Effects and Tasks (how you do HTTP requests)
- start-app (the canonical architecture pattern codified in a library)
- WebGL (did I mention Elm has a GL shader compiler tucked away in it?)

# Further Reading

- Elm Architecture Tutorial: <https://github.com/evancz/elm-architecture-tutorial/>
  - My warmup tutorial: <https://github.com/micktwomey/elm-tutorial>
- How to Create Tetris in Elm: <https://goo.gl/TgQeRy>
- <https://github.com/micktwomey/elm-functionalkats-tutorial>

