Programmieren lehren lernen

Michael Sperber
@sperbsen

- Individualsoftware
- viele verschiedene Branchen
- **funktionale Programmierung**
- Scala, Clojure, Erlang, Haskell, F#, Racket, OCaml
- Beratung, Schulungen

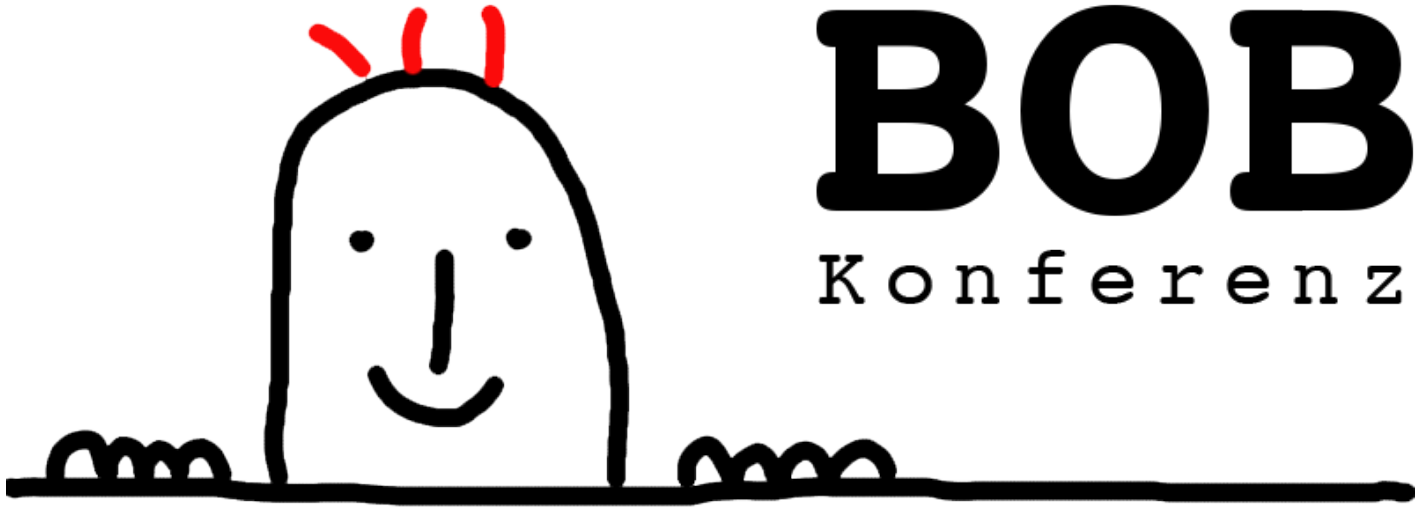
www.active-group.de

funktionale-programmierung.de

Summer BOB!

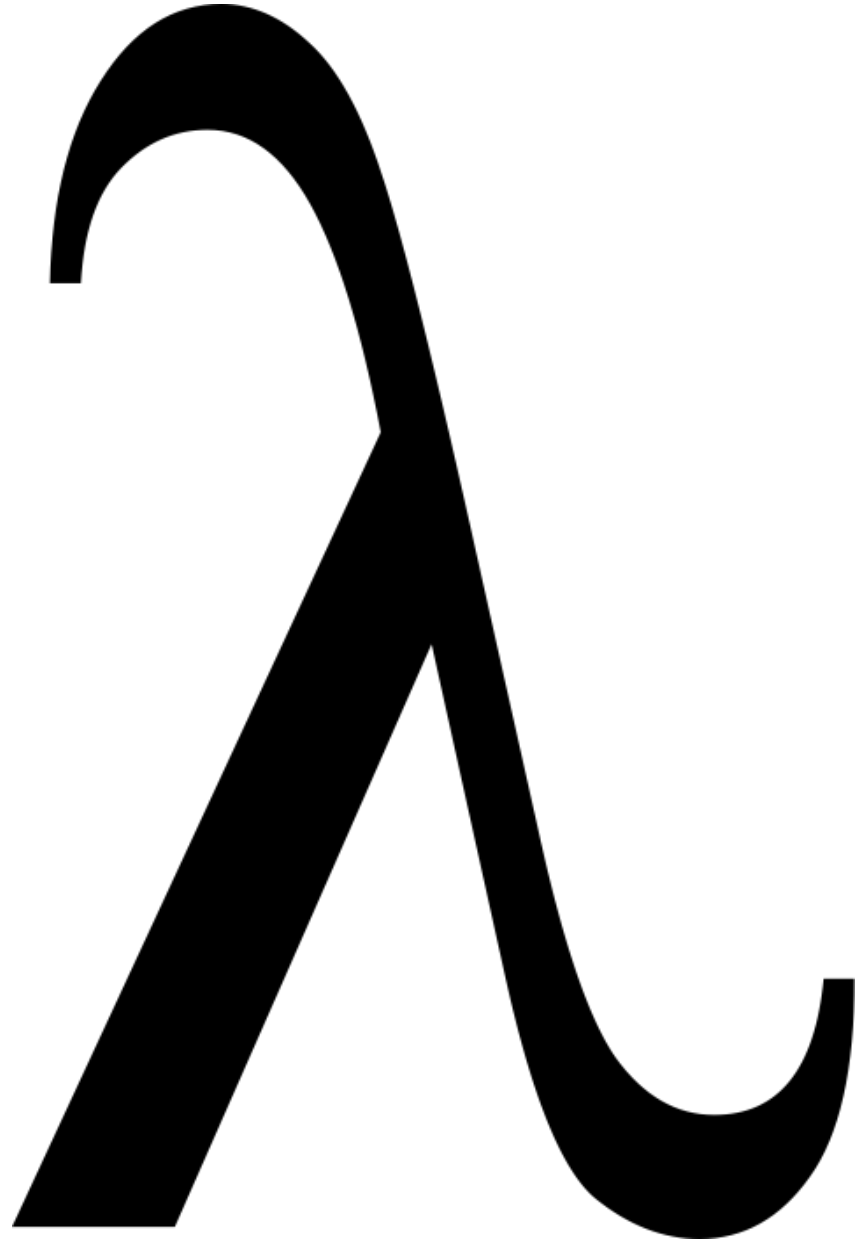
- 21. August
- gemeinsam mit International Conference on Functional Programming, 18. Aug 23. Aug
- viele Workshops on Haskell, Erlang, OCaml, Scheme, Art!
- Programm oben, Anmeldung läuft

bobkonf.de



Lehre

- AP Computer Science 1987/1988
  Radford High School
- Programmieren für Geisteswissenschaftler 1997-1999
- Info I 1999-2011
  Uni Tübingen
- professionelle Schulungen 2012-
- Kollegen, Freunde, Verwandte



https://commons.wikimedia.org/wiki/File:SPAWAR_sponsors_LEGO_robotics_STEM_event_151115-N-UN340-003.jpg


EXIT

Medals

```
1  #include <BOB3.h>
2
3  void setup() {
4    delay(1000);
5
6    // Zähler um eins erhöhen und wieder speicher
7    int boot_counter = recall();
8    boot_counter = boot_counter+1;
9    remember(boot_counter);
10
11   for (int i=0; i<boot_counter; i++) {
12
13
14
15
16   }
17   delay(1000);
18
19 }
20
21
22 void loop() {
23   // bleibt erstmal leer...
24 }
25
```

__info__

The Sentinel - der Wächter!

BOB3 soll mit dem Sentinel-Programm Dinge bewachen können, zum Beispiel eine Packung Kekse, deine Zimmertür oder dein Smartphone...

Dazu beobachtet BOB3 mit seinem IR-Sensor den zu überwachenden Bereich: Immer wenn sich der Wert des IR-Sensors zu sehr ändert, schlägt BOB3 Alarm, indem er rot mit seinen Augen blinkt!

Programmieren für Teenager

Früh übt sich. Die spielerische Herangehensweise motiviert und macht Spaß

start-coding.de

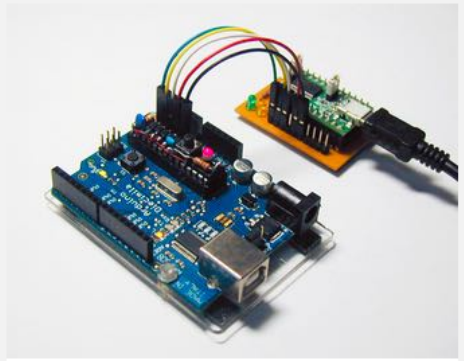
Eine Einführung in Raspberry Pi

Programmieren lernen mit Scratch

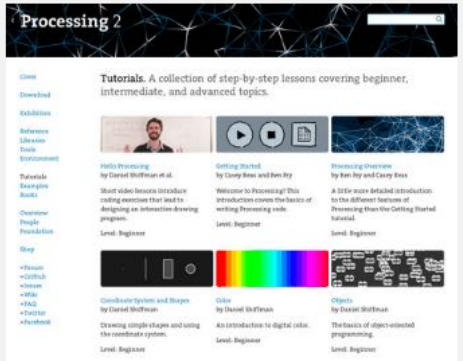
Minecraft mit Python erweitern

Lernangebote für alle Erwachsene

Früh übt sich. Die spielerische Herangehensweise motiviert und macht Spaß



Arduino: Der einfache Einstieg in die Elektronik.



Processing: eine grafische Programmiersprache.

Experimentiere mit Sound, Musik und Code.

GEFÖRDERT VOM
Bundesministerium für Bildung und Forschung

Eine Initiative des Bundesministeriums für Bildung und Forschung
Wissenschaftsjahr 2014
DIE DIGITALE GESELLSCHAFT

intel

BITKOM

Heinz Nixdorf Stiftung
Stiftung Westfalen

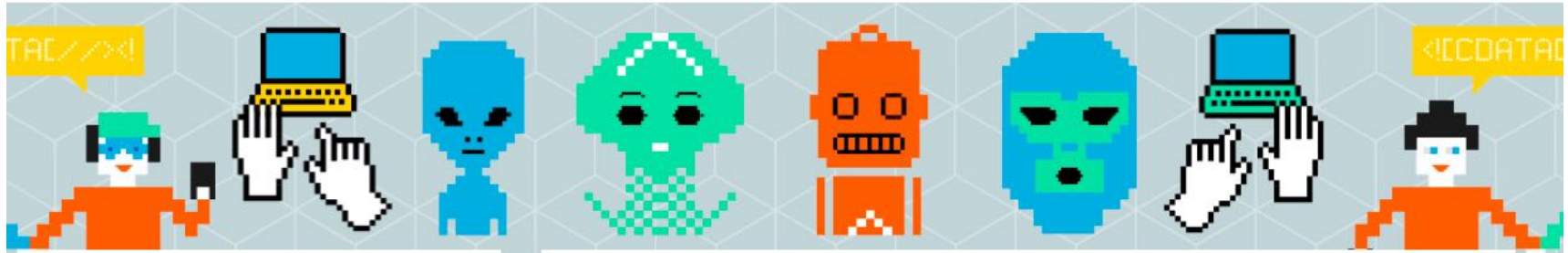
Gesellschaft für Informatik

JUGEND HACKT

UNTERSTÜTZEN NEWSLETTER PRESSE

Mit Code die Welt verbessern

WAS IST...? EVENTS HELLO WORLD PROJEKTE MITMACHEN FAQ TEAM PARTNER



INITIATIVEN

MATERIAL

WETTBEWERBE

Material

Top Tipps

Python

HTML und CSS

Ruby

Mobile

Hardware

Plattformen

"Jugend hackt" Hangouts

Sonstiges

Fehlt etwas?

Ziele?

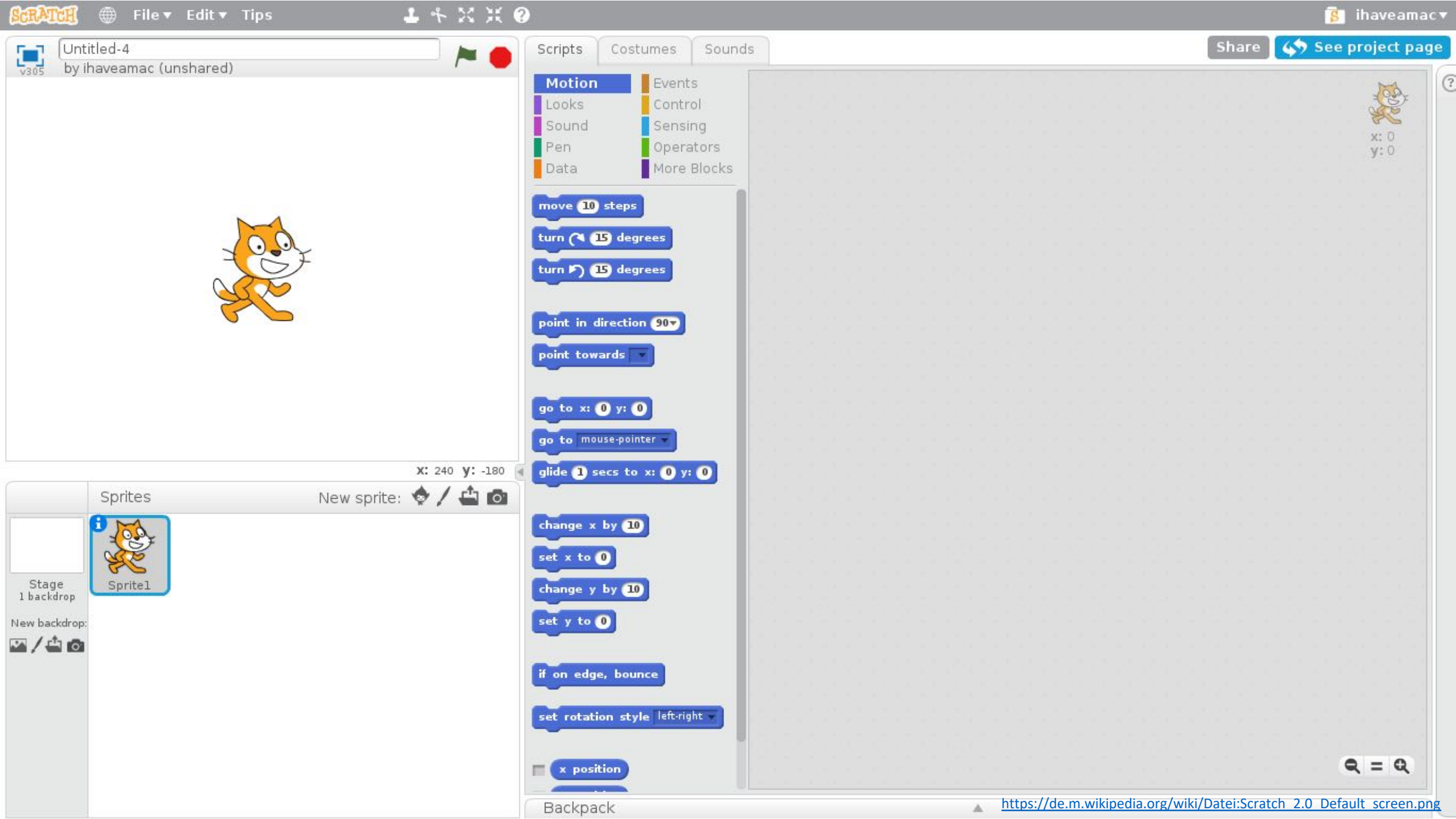
Söll
@soell6

Follow

Kinder für #Informatik begeistern!! Mit dem Informatik-Biber!

Bundesweite Informatikwettbewerbe @_BWINF
Auf der letzten der drei tollen #codingrobotik4kids. Heute in #Bonn und es ist ein Hit - über 1500 Kinder, 90 ehrenamtliche @deutschetelekom-Mitarbeiter und 25 unterschiedliche Initiativen, darunter auch wir. Ein Höhepunkt in diesem #Informatik-Somm…

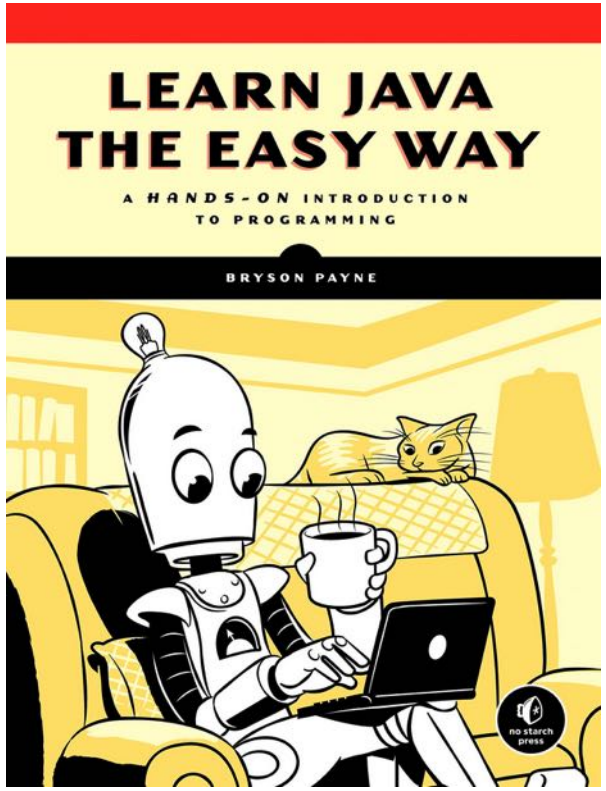
Show this thread



https://de.m.wikipedia.org/wiki/Datei:Scratch_2.0_Default_screen.png

Möglichst vielen Menschen beibringen, eigenständig Probleme mit Programmen zu lösen

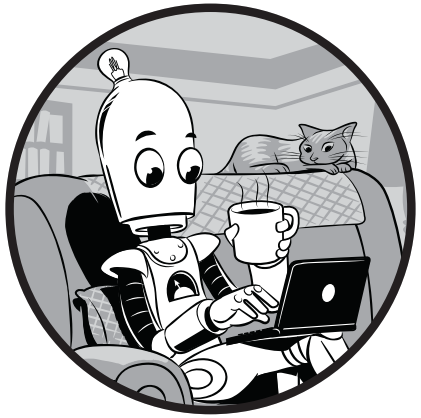
Teaching by Example



2017

2

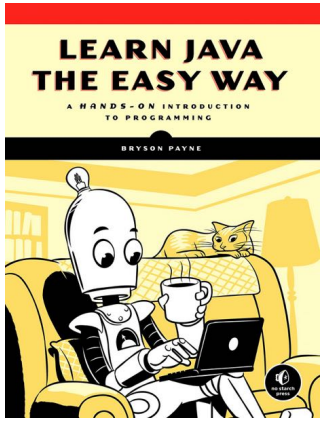
BUILD A HI-LO GUESSING GAME APP!



Let's begin by coding a fun, playable game in Java: the Hi-Lo guessing game. We'll program this game as a *command line*

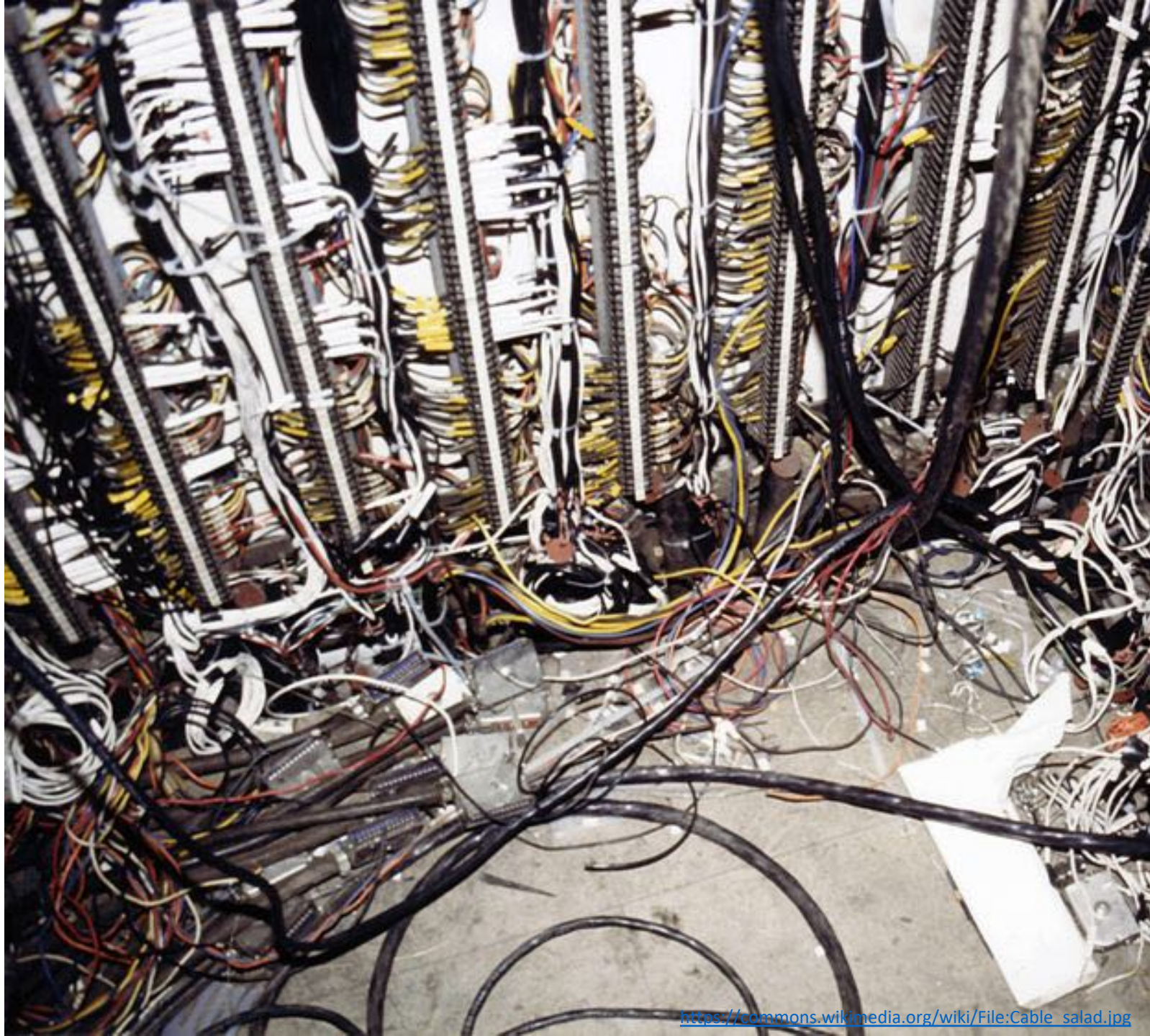
Teaching by Example

To create a `while` loop, we need to insert a `while` statement before the last three lines of code and then wrap the three lines for guessing inside a new pair of braces, as follows:




```
        int guess = 0;
        while(guess != theNumber)
        {
        System.out.println("Guess a number between 1 and 100:");
        guess = scan.nextInt();
        System.out.println("You entered " + guess + ".");
        }
    }
}
```

https://commons.wikimedia.org/wiki/File:Frustration.jpg



https://commons.wikimedia.org/wiki/File:Cable_salad.jpg

People are naturally curious, but they are **not** naturally good thinkers.

Daniel Willingham: *Why Don't Students Like School?* Jossey-Bass, John Wiley & Sons, 2009.

Factual knowledge precedes skill.

Daniel Willingham: *Why Don't Students Like School?* Jossey-Bass, John Wiley & Sons, 2009.

Memory is the residue of thought.

Daniel Willingham: *Why Don't Students Like School?* Jossey-Bass, John Wiley & Sons, 2009.

We understand new things in the context of things we already know.

Daniel Willingham: *Why Don't Students Like School?* Jossey-Bass, John Wiley & Sons, 2009.

Proficiency requires practice.

Daniel Willingham: *Why Don't Students Like School?* Jossey-Bass, John Wiley & Sons, 2009.

Cognition is fundamentally different early and late in training.

Daniel Willingham: *Why Don't Students Like School?* Jossey-Bass, John Wiley & Sons, 2009.

Children are more alike than different in terms of learning.

Daniel Willingham: *Why Don't Students Like School?* Jossey-Bass, John Wiley & Sons, 2009.

Intelligence can be changed through sustained hard work.

Daniel Willingham: *Why Don't Students Like School?* Jossey-Bass, John Wiley & Sons, 2009.

Teaching, like any complex cognitive skill, must be practiced to be improved.

Daniel Willingham: *Why Don't Students Like School?* Jossey-Bass, John Wiley & Sons, 2009.

1987

How to organize the composition. Sometimes, a particular assignment will not exactly fit into this outline form, but, generally, the form can be used as a guide to check against to be certain you are putting together your composition correctly.

I. Introduction (usually is 1 paragraph in length)

A. Attention Step

B. Background Information

1. any information required for an understanding of the thesis statement. For exampl
2. when a paper is analyzing a story, include its title, author, and some brief plot
etc. information.

C. Thesis Statement

1. purpose
2. scope
   a.
   b.
   c.
3. direction

II. Body (usually is 3 paragraphs, with each paragraph developing one of the areas of the thesis)

A. First Area of Scope (usually one paragraph)

1. transition
2. topic sentence
3. further explanation/clarification of the topic sentence
4. amplification of the topic sentence
   a. examples, details, proofs, quotes, etc., that support the topic sentence in
   b. some way
   c.
   etc.
5. concluding sentence

B. Second Area of Scope (usually one paragraph--developed in same manner as first body ¶)

1.
2.
3.
4.
   a.
   b.
   c.
5.

C. Third Area of Scope

1.
2.
3.
4.
   a.
   b.
   c.
5.

III. Conclusion (usually one paragraph in length)

A. Summary (Contains a transition and goes over the main points of the paper with the idea that the end is near)

1.
2.
3.

B. Ending Statement (usually is some judgment/opinion about the main idea of the paper. Ma be more than one sentence)

a.
b.
c.
3. direction

II. Body (usually is 3 paragraphs, with each paragraph developing one of the areas of the thesis)

A. First Area of Scope (usually one paragraph)
1. transition
2. topic sentence
3. further explanation/clarification of the topic sentence
4. amplification of the topic sentence
   a. examples, details, proofs, quotes, etc., that support the topic sentence in some way
   b.
   c.
   etc.
5. concluding sentence

B. Second Area of Scope (usually one paragraph--developed in same manner as first body ¶)

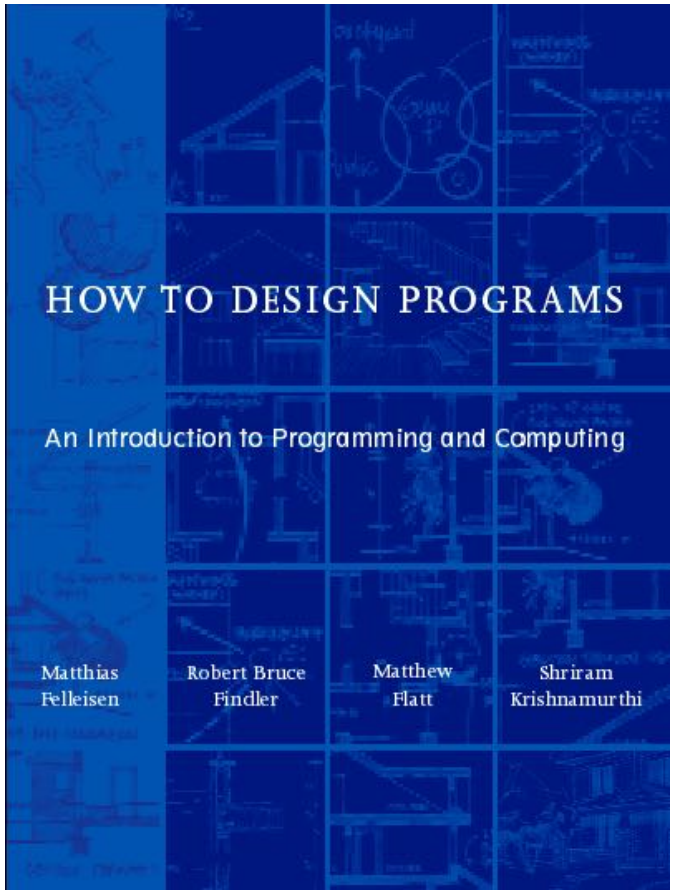
1s. 1.
2.
1s 3.
4.
a.
b.
c.
1s. 5.

a.
(1.)
(2.)
b.
(1.)
(2.)
c.
(1.)
(2.)

9 sents.

C. Third Area of Scope
1.
2.
3.
4.

Systematische Methoden



dein programm

DeinProgramm ist ein Projekt zur Anfängerausbildung im Programmieren, das seit 1999 an der Universität Tübingen und anderswo entwickelt wird. Die entstandenen didaktischen Konzepte, Software und Materialien wurden in zahlreichen Anfängerausbildungen erprobt und kontinuierlich verbessert.

Impact

Districts

Workshops

Courses

BOOTSTRAP

Equity • Scale • Rigor

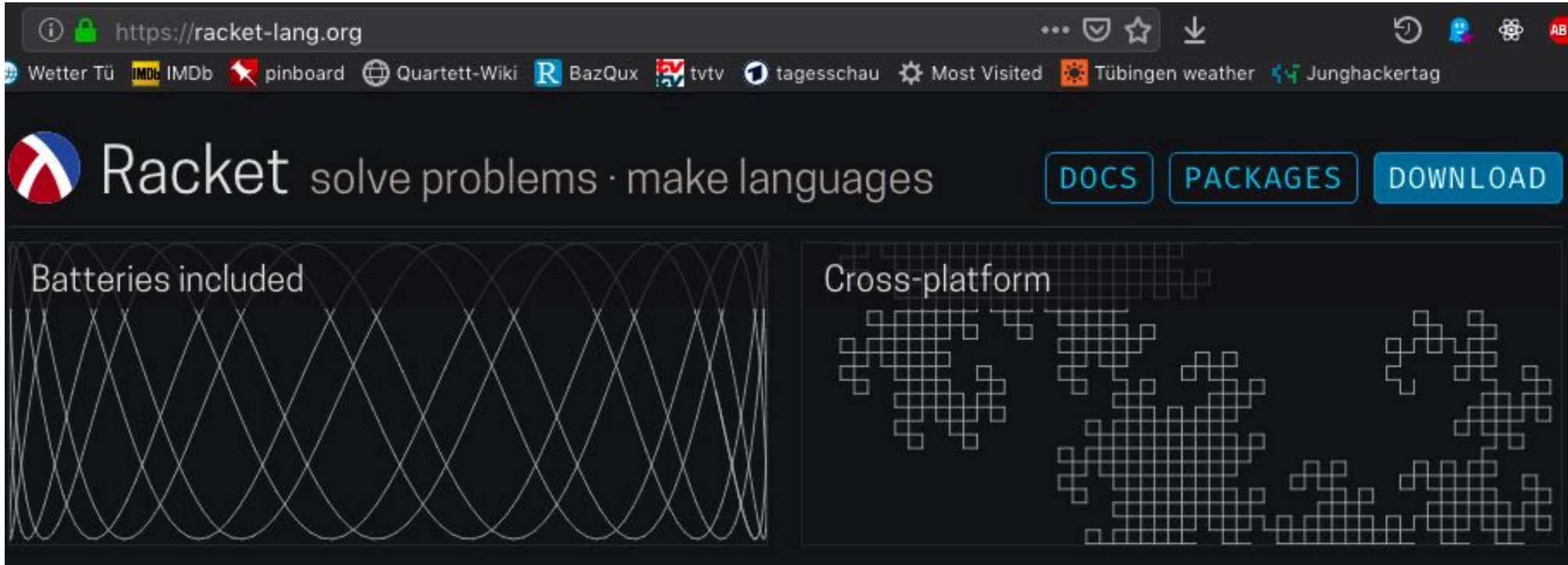
Computational modeling in Algebra, Physics & Data Science, for all students.

We craft research-based curricular modules for grades 6-12. Our materials reinforce core concepts from mainstream subjects like Math, Physics and more, enabling non-CS teachers to adopt our introductory materials while delivering **rigorous and engaging computing content drawn from CS classes at universities like Brown, WPI, and Northeastern.**

By leveraging the existing networks of Math, Social Studies, and Physics teachers, nationwide, **Bootstrap is built to scale**. We work with school districts across the country, reaching hundreds of teachers and thousands of students each year. Most of our teachers have also attended a Bootstrap Workshop, where they received specialized training to deliver the class.

Zutaten

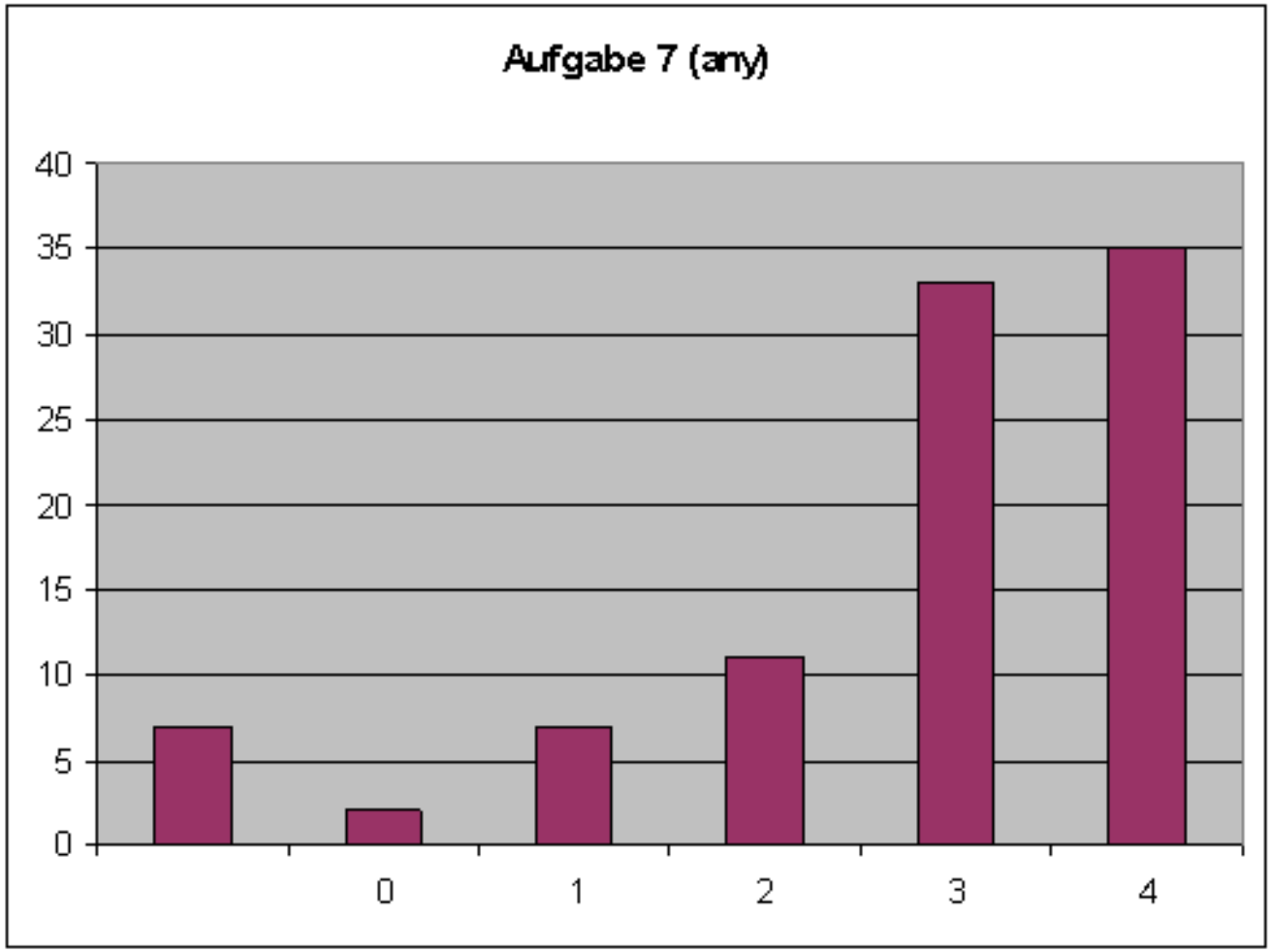
- Programmierumgebung für Anfänger
- Programmiersprachen für Anfängerinnen
- Konstruktionsanleitungen für systematische Programmentwicklung



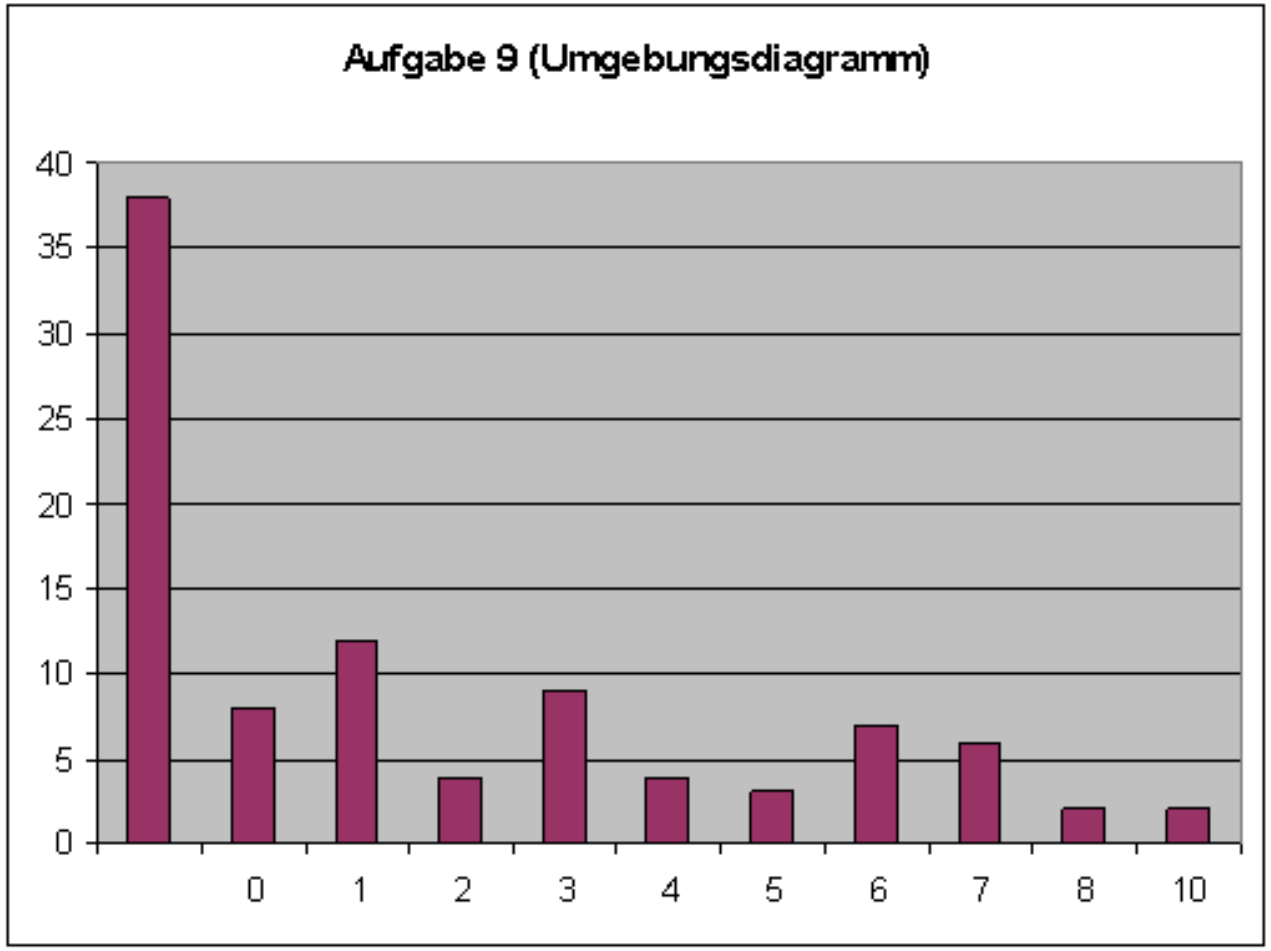
Übung

Durchsetzung

Measure



Observe & Measure



Konstruktionsanleitung

- Kurzbeschreibung
- Datenanalyse
- Signatur
- Tests
- Gerüst
- Schablone
- Rumpf

Datenanalyse: Zusammengesetzte Daten

- erkennen an **besteht aus** or **hat**
- schreibe **Datendefinition** in dieser Form
- **zähle** Bestandteile
- schreibe **Record-Definition**
- stelle sicher, daß die Anzahlen übereinstimmen

Funktion auf zusammengesetzte Daten

```
(define f
  (lambda (c)
    ... (sel1 c) ... (sel2 c) ...))
```

Gemischte Daten

- erkennen an **oder** oder **eins der folgenden**
- schreibe **Datendefinition** in dieser Form
- Fälle zählen
- **Signaturdefinition** schreiben
- sicherstellen, daß Anzahl übereinstimmt

Funktion auf gemischten Daten

```
(define f
  (lambda (m)
    (cond
      ((p1? m) ...)
      ((p2? m) ...)
      ...)))
```

Prinzipien

- keine Beispiele, deren Entstehung Du nicht erklären kannst
- jede Technik benennen
- jeden Schritt belohnen
- auf Form bestehen
- Erfolg messen
- kontinuierlich verbessern

Kreativität

“Before you can think out of the box, you have to start with a box”

“Destiny, quite often, is a determined parent. Mozart was hardly some naive prodigy who sat down at the keyboard and, with God whispering in his ears, let music flow from his fingertips. It's a nice image for selling tickets to movies, but whether or not God has kissed your brow, you still have to work. Without learning and preparation, you won't know how to harness the power of that kiss.”

Twyla Tharp: *The Creative Habit*. Simon & Schuster, 2006.

Für wen funktioniert das?

- Kinder >=11
- Programmieranfängerinnen
- Programmierer mit Vorerfahrung
- professionelle Entwicklerinnen

Program by Design

Program by Design is an innovative project for computing education that combines motivation with principles. On the surface we use engaging contexts—our "hello world" program is an animation, and students have the opportunity to program games, mashups, phones, etc.—while teaching a principled and scalable approach to computing. We have spent over fifteen years developing this curriculum, and have offerings at the middle-school, high-school and university levels (roughly, ages 10 and above). Our material is even used for in-house corporate training. As we discuss **in more depth**, we set out to address fundamental problems that students face. This has led to a series of innovations in programming environments, programming methodology, and programming languages.

- mehr Material: https://programbydesign.org/
- Links & Publikationen
- Software
- Buch (Englisch) „How to Design Programs“
  (print version MIT Press)

dein programm

- mehr Material: http://www.deinprogramm.de/
- Links & Publikationen
- Software
- Buch (deutsch) „Schreibe Dein Programm!“
  (in Entstehung, kostenlos, fertig 2019)

Potential

- erfolgreich Probleme lösen
- sprachliche Präzision
- sorgfältig arbeiten
- Mathematik praktizieren
- Probleme der Zukunft lösen