Software Construction

2013-2014
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UNIVERSITEIT VAN AMSTERDAM

CWI

What this course is about

- You all know programming, right?

- But what is good code?

- How to *reason* about good code?

- What is *beautiful* code?

- Think about it.

This course is *not* about

- Data structures

- Algorithms

- Programming language X

- Paradigm X (though: OO)

- GUI programming

- Web applications

- Concurrency

- Performance

- Graphics programming

- Mathematics

- Computational complexity

- ...

Representative books
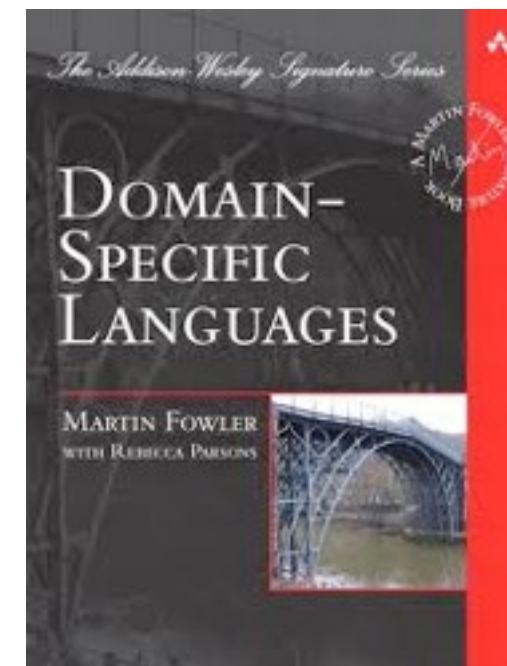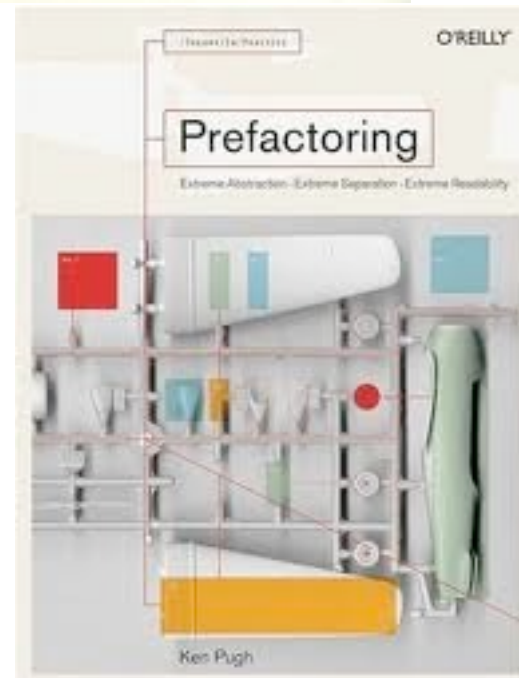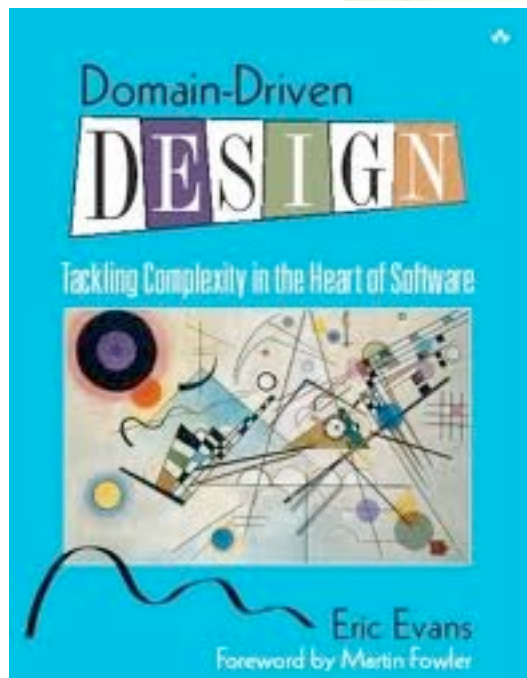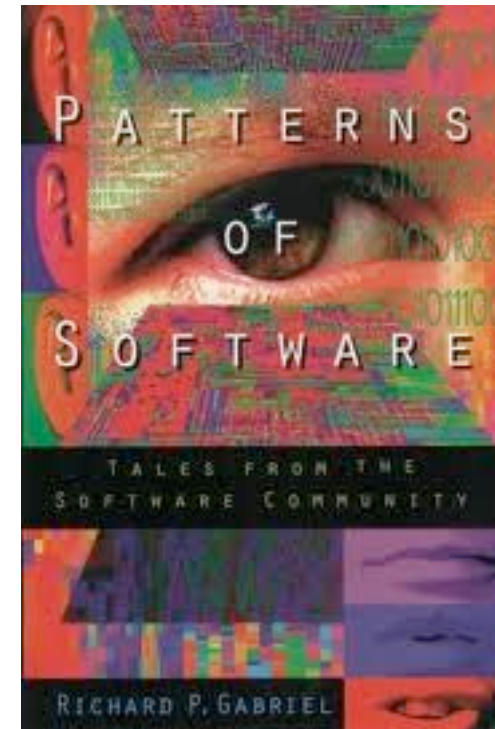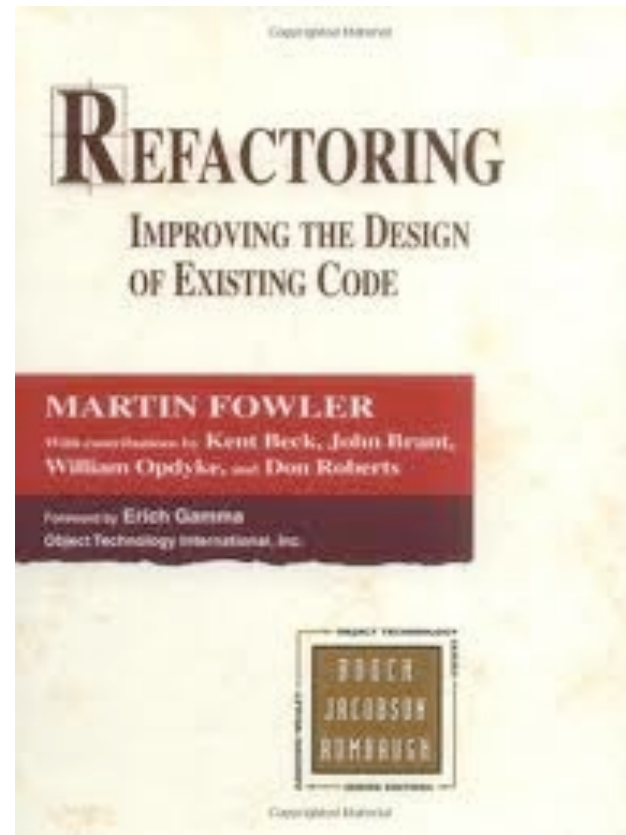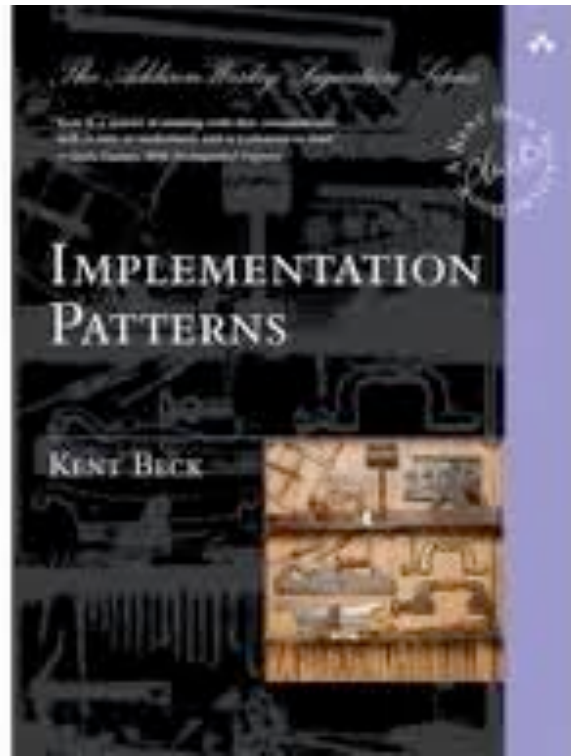
Learning goals

- Create good low level designs

- Produce clean, readable code

- Reflect upon techniques, patterns, guidelines etc.

- Assess the quality of code

- Apply state of the art software construction tools

Program
something
hard

(new techniques,
concepts, tools)

(refactoring, smells, design,
separation of concerns, etc.)

Relentless focus
on quality

Program
something
hard

(new techniques,
concepts, tools)

Dev
tools

(refactoring, smells, design,
separation of concerns, etc.)

Relentless focus
on quality

http://candraadi.wordpress.com/2012/10/17/programmer/
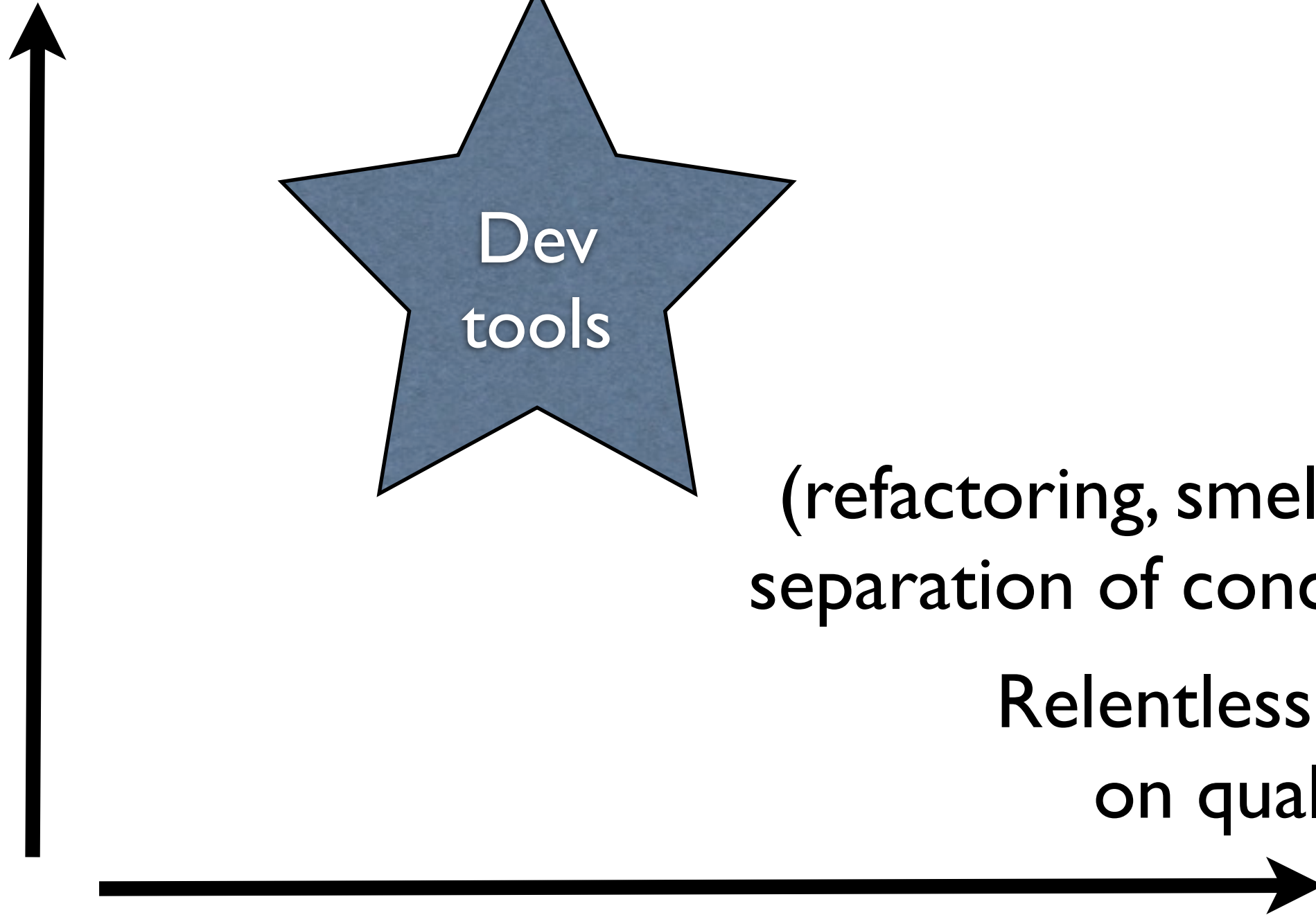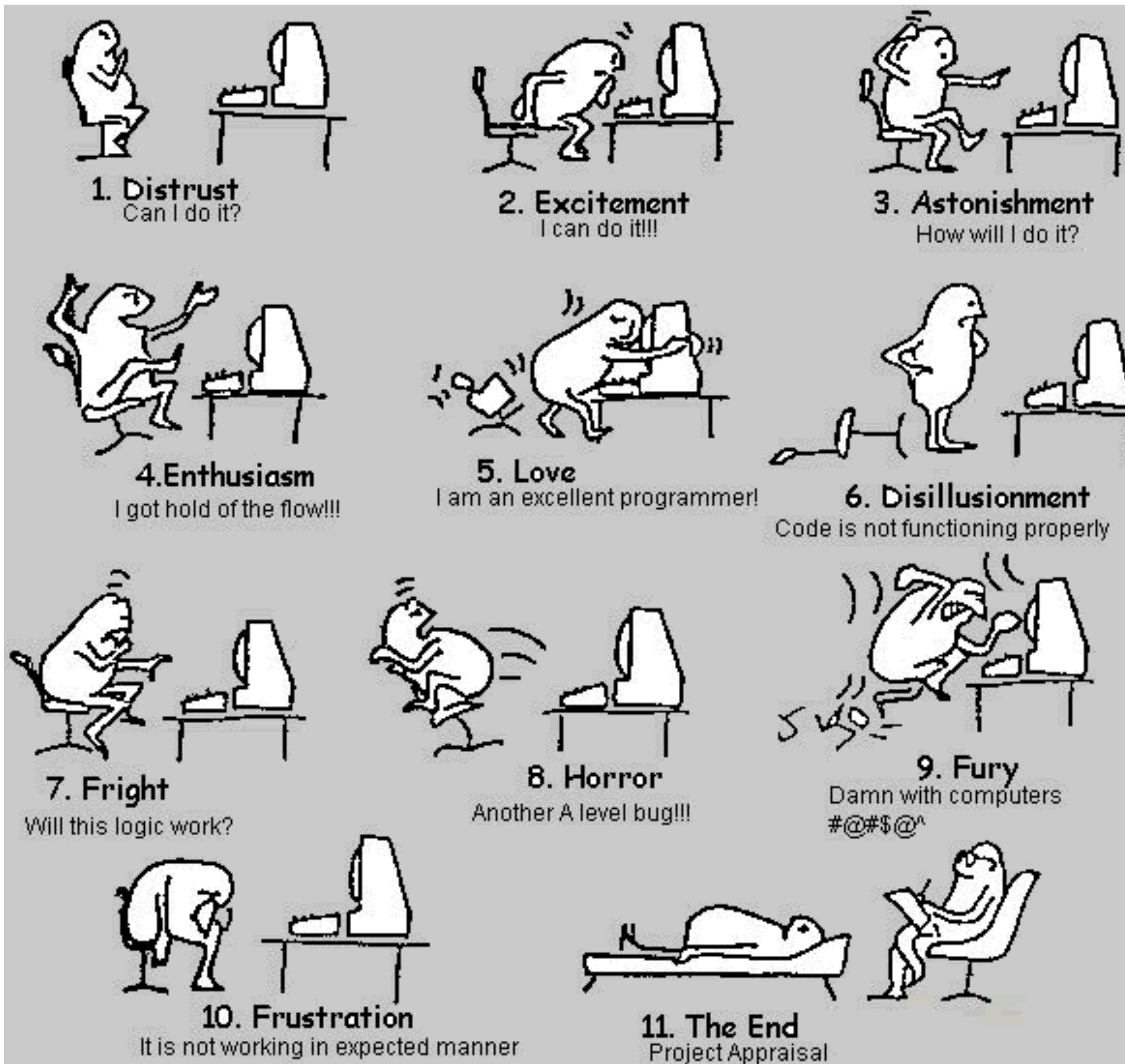
We are back!
Rotterdam (NL)

This course

- Quality comes first

- Be your own worst critic

- Refactor mercilessly

- Aim to become code literati

- Better to read code, than to write code

- If it works it's not good enough

If it works, it's not good enough

If it works, it's not good enough

If it works, it's not good enough

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If it works, it's not good enough

If it works, it's not good enough

Working code is necessary, but not sufficient

Overview

- Lectures

- Theory

- Research paper + review

- Lab assignment

- Concluding

Lectures

Topics of the lectures

- Syntax analysis: grammars, parsers

- Domain-specific languages: why and why not

- Code quality: tangling, scattering, duplication , smells

- Language engineering: interpreters, type checking.

- ....

- Bertrand Meyer, *Applying "Design by Contract"*, 1992, Meyer92.

- Karl J. Lieberherr, Ian M. Holland, *Assuring Good Style for Object-Oriented Programs*, 1989, LieberherrHolland89.

- Robert C. Martin, *The Open-Closed Principle*, 1996, Martin96.

- D. L. Parnas, *On the criteria to be used in decomposing systems into modules* , 1972, Parnas72

- Jonathan Aldrich, *The Power of Interoperability: Why Objects Are Inevitable*, Onward! Essays, 2013 [Aldrich13].

- W. Wulf and Mary Shaw, *Global variable considered harmful*, 1973, [WulfShaw84].

- John Hughes, *Why functional programming matters*, 1990 [Hughes90].

- Robert C. Martin, *Design principles and design patterns*, [Martin00].

- Erich Gamma, Richard Helm, Ralpha Johnson, John Vlissides, *Design Patterns: Abstraction and Reuse of Object-Oriented Design*, ECOOP 93 [GammaEtAl93]

- Kent Beck and Martin Fowler, Bad Smells in Code (Chapter 3, *Refactoring*)

- Kent Beck, A theory of programming, (Chapter 3, *Implementation Patterns*)

- Kent Beck, *Aim, fire*, IEEE Software, [BeckTODO]

- Jeff Bay, *Object Calisthenics*.

- Kent Beck, Erich Gamma, *JUnit Test Infected: Programmers Love Writing Tests*,

Take home exam

- Work out assignments at home

- No grade, but you must *pass* them

- Additional material

  - Exercises in Programming Style
    (by Crista Lopes)

Lab assignment

Form 1040

Department of the Treasury—Internal Revenue Service (99)

U.S. Individual Income Tax Return **2012** OMB No. 1545-0074 | IRS Use Only—Do not write or staple in this space.

For the year Jan. 1–Dec. 31, 2012, or other tax year beginning , 2012, ending , 20 | See separate instructions.

Your first name and initial	Last name	Your social security number

If a joint return, spouse's first name and initial	Last name	Spouse's social security number

Home address (number and street). If you have a P.O. box, see instructions. | Apt. no.

▲ Make sure the SSN(s) above and on line 6c are correct.

City, town or post office, state, and ZIP code. If you have a foreign address, also complete spaces below (see instructions).

Foreign country name	Foreign province/state/county	Foreign postal code

Presidential Election Campaign
Check here if you, or your spouse if filing jointly, want $3 to go to this fund. Checking a box below will not change your tax or refund. ☐ You ☐ Spouse

Filing Status

Check only one box.

1 ☐ Single
2 ☐ Married filing jointly (even if only one had income)
3 ☐ Married filing separately. Enter spouse's SSN above and full name here. ▶
4 ☐ Head of household (with qualifying person). (See instructions.) If the qualifying person is a child but not your dependent, enter this child's name here. ▶
5 ☐ Qualifying widow(er) with dependent child

Exemptions

6a ☐ **Yourself.** If someone can claim you as a dependent, **do not** check box 6a . . . . .
b ☐ **Spouse** . . . .

c Dependents:

(1) First name Last name	(2) Dependent's social security number	(3) Dependent's relationship to you	(4) ✓ if child under age 17 qualifying for child tax credit (see instructions)
			☐
			☐
			☐
			☐

If more than four dependents, see instructions and check here ▶ ☐

d Total number of exemptions claimed . . . .

Boxes checked on 6a and 6b
No. of children on 6c who:
• lived with you
• did not live with you due to divorce or separation (see instructions)
Dependents on 6c not entered above
Add numbers on lines above ▶

Income

Attach Form(s) W-2 here. Also attach Forms W-2G and 1099-R if tax was withheld.

If you did not get a W-2, see instructions.

Enclose, but do not attach, any payment. Also, please use **Form 1040-V.**

7	Wages, salaries, tips, etc. Attach Form(s) W-2	7	
8a	**Taxable** interest. Attach Schedule B if required	8a	
b	**Tax-exempt** interest. **Do not** include on line 8a . . .	8b		
9a	Ordinary dividends. Attach Schedule B if required	9a	
b	Qualified dividends	9b		
10	Taxable refunds, credits, or offsets of state and local income taxes	10	
11	Alimony received	11	
12	Business income or (loss). Attach Schedule C or C-EZ	12	
13	Capital gain or (loss). Attach Schedule D if required. If not required, check here ▶ ☐	13	
14	Other gains or (losses). Attach Form 4797	14	
15a	IRA distributions .	15a		b Taxable amount . . .	15b	
16a	Pensions and annuities	16a		b Taxable amount . . .	16b	
17	Rental real estate, royalties, partnerships, S corporations, trusts, etc. Attach Schedule E	17	
18	Farm income or (loss). Attach Schedule F	18	
19	Unemployment compensation	19	
20a	Social security benefits	20a		b Taxable amount . . .	20b	
21	Other income. List type and amount	21	
22	Combine the amounts in the far right column for lines 7 through 21. This is your **total income** ▶	22	

Adjusted Gross Income

23	Reserved	23	
24	Certain business expenses of reservists, performing artists, and fee-basis government officials. Attach Form 2106 or 2106-EZ	24	
25	Health savings account deduction. Attach Form 8889 .	25	
26	Moving expenses. Attach Form 3903	26	
27	Deductible part of self-employment tax. Attach Schedule SE .	27	
28	Self-employed SEP, SIMPLE, and qualified plans . .	28	
29	Self-employed health insurance deduction . . .	29	
30	Penalty on early withdrawal of savings	30	
31a	Alimony paid b Recipient's SSN ▶	31a	
32	IRA deduction	32	
33	Student loan interest deduction	33	
34	Reserved	34	
35	Domestic production activities deduction. Attach Form 8903	35	
36	Add lines 23 through 35 . . . . ▶	36	
37	Subtract line 36 from line 22. This is your **adjusted gross income** . . . . . ▶	37	

For Disclosure, Privacy Act, and Paperwork Reduction Act Notice, see separate instructions. Cat. No. 11320B Form **1040** (2012)

Wednesday, February 12, 14

Questionnaire Language (QL)

```
form Box1HouseOwning {
  "Did you sell a house in 2010?" hasSoldHouse: boolean
  "Did you by a house in 2010?" hasBoughtHouse: boolean
  "Did you enter a loan for maintenance/reconstruction?"
hasMaintLoan: boolean
  if (hasSoldHouse) {
    "Private debts for the sold house:" privateDebt: money
    "Price the house was sold for:" sellingPrice: money
    "Value residue:" valueResidue = sellingPrice - privateDebt
  }
}
```

Did you sell a house in 2010? ☑
Did you by a house in 2010? ☐
Did you enter a loan for maintenance/reconstruction? ☐
Private debts for the sold house:

20

Price the house was sold for:

200

Value residue:

180

LWC 2013

Contents [hide]

Language Workbench Challenge 2013

Part 1: front end

- Parser: text to abstract syntax tree (AST)

- AST hierarchy

- Type checker

Programming language

- Use any programming language that's in the list on github

- Java: you may want to use one of the provided parsing skeleton

  - *Rats!*, Jacc, ANTLR

-

Part 2: Back end

- Implement questionnaire engine

- GUI representation of questionnaire

- Build an *interpreter*

Honor's track

- Do the assignment Object Algebra style

    - show extensibility of the language

    - implement additional operations

- Implement graphical editor framework on top of Rascal

    - Evaluate using QL assignment

Github

- Assignment to be completed *individually*

  - (except honor's track)

- http://github.com/software-engineering-amsterdam/poly-ql/

- Use of this repository is **required**!

- Commit often!

Grading of lab assignments

- Functionality

- Tests

- Simplicity

- Modularity

- Layout and style

- Separation of concerns

Grading of lab assignments

- Functionality
- Te
- Simplicity
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- Layout and style
- Separation of concerns

Simplicity

Some advice up-front

- Naming, layout, indentation

- Encapsulation, modularity, separation of concerns, reuse

- Don't repeat yourself (DRY)

- Library and tool selection and use

- Unit testing

More advice

- Use asserts sensibly

- No global, static, non-final variables

- You ain't going to need it (YAGNI)

- Avoid premature optimization

- Use comments for rationale

- *Compiling **and** working code*

Grading (ctd.)

- First part: your grade is *indicative*

  - hint to improve your code

- Second part: we review all code

  - this will be your *final* grade for the lab

- Grading is on-site: *you* show your code

- Grade is less important than personal improvement is

Passing this course

- Be present at all lectures

- Pass the 2 theory tests

- Successfully complete lab assignments

  - = beautiful, working code

- Final grade: final lab grade

Concluding

- All information is on Github

- Primary contact = me (storm@cwi.nl)

- Please follow @SoftwCons

What's next

- For the remaing time:

  - start searching for parser generators

  - Tweet link + programming language @SoftwCons

  - #pgen