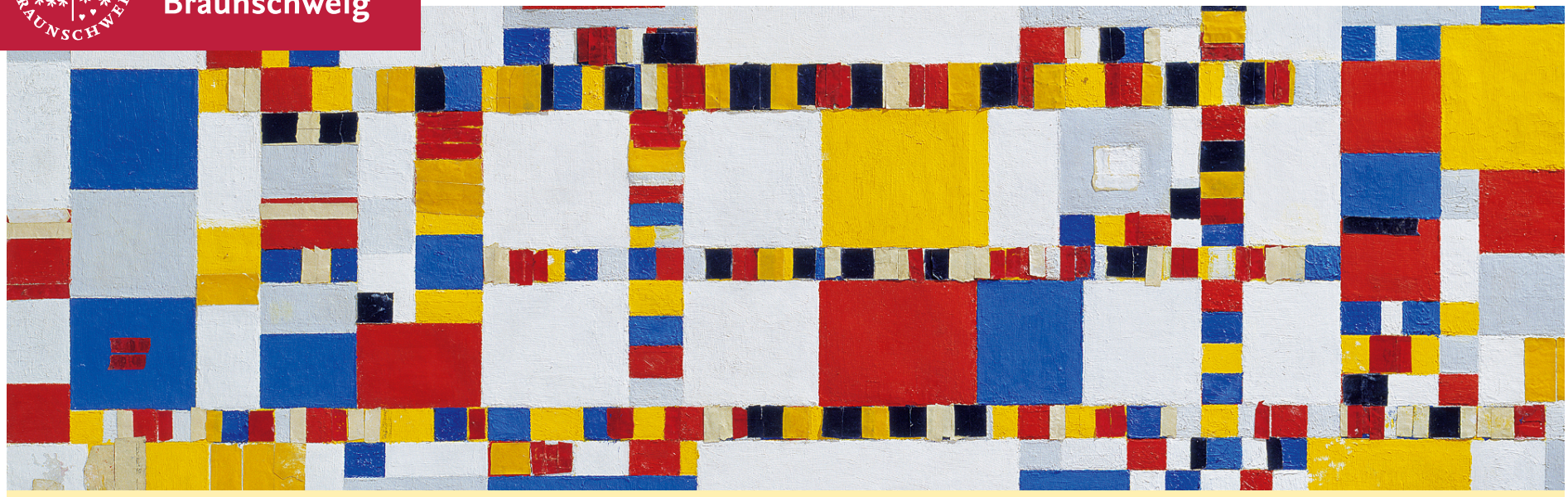
Technische Universität Braunschweig

Institut für Softwaretechnik und Fahrzeuginformatik



Esoteric Programming Languages

Seminar: Programming Languages Through the Ages

Sebastian Morr

2015–02–06

Brainfuck

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- Motivation: Small compiler (296 bytes)
- **Minimalist syntax**, only eight commands:
  `> < + - , . [ ]`
- "brain fuck" = hard or complicated thing

Examples

```
>>>,-----.<<<++++++++++.
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Input: `f`

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Input: `f` Output: `a`↩

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Examples

```
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Input: f Output: a↩

```
+++++[->+<]
```

```
-[>,[<<[-<]++[->+]->-]<<<<
<<<<<<+[-<++++++++[->++++++
<]>.[-]>+]-]
```

Examples

```
>>>,-----.<<<++++++++++.
```

Input: `f` Output: `a`↩

```
+++++[->+<]
```

```
-[>,[<<[-<]++[->+]->-]<<<<
<<<<<+[-<++++++++[->++++++
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```

Input: `h`

Examples

```
>>>,-----.<<<++++++++++.
```

Input: `f` Output: `a`↩

```
+++++[->+<]
```

```
-[>,[<<[-<]++[->+]->-]<<<<
<<<<<+[-<++++++++[->++++++
<]>.[-]>+]-]
```

Input: `h` Output: `01101000`

Significance

- Best-known esoteric programming language

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```
>+>+>+>+>+>+>>>>++++++++++[>+>+++>+++++>+++++++>++++++++++<<<<<-]
>..>++>>.>+++++.+++++.--------------.++++++++++..++++++++++++.<<
<.>>++++++++++++++.>----------------------.+++++++++.--.+++++.
-------.<<<.>>-----.>++++++++++++++.----------------.+++++++++
+++.<<<.>>+++++.>----------.---.<<<.>>+++.>++++++++++.+++.------.
--------.<<<<.>>-----.............................<<..>>>-------.
>++++++++.----------.++++++++++++.---------.+++++++++++++++.<<+
++++++++++++.<.>>-.>--.++.----------------.<<<<.>>>------------.>+
++++++++.-.++++++.----------.+++++.---------.+++++++++.++++++.<
<.<.>>++++++++++++.>----------------.----.++++++++++++++++.<<<.>>-
```

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- **Weird** names, operators and properties
- “Compiler Language With No Pronounceable Acronym”
- Fun manual!

Example: Multiplying by two

```
PLEASE WRITE IN .1

DO COME FROM (42)

DO :1 <- .1$#0
DO :2 <- #65535$#1
DO .1 <- :1~:2

(42) DO READ OUT .1

PLEASE GIVE UP
```

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.1 = 110110
:1 = 110110 $ 000000
```

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:1 = 101000101000
:2 = 111111 $ 000001
```

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Input

```
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```

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:1 = 101000101000
:2 = 101010101011
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Output

```
CVIII
```

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```

Input

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```

```
.1 = 1 1 0 1 1 00
:1 = 101000101000
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Output

```
CVIII
CCXVI
CDXXXII
...
ICL275I: DON'T BYTE OFF MORE
THAN YOU CAN CHEW
```

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Here is an illustrative example.

Bad:

```
DO :3 <- '"'"'"'".1$':1~#32768'"~"#1109$#1"'$':1~#128'"~#2735'$':1~"
   #546$#0"'"~"#43679"'$':1~"#1365$#0"'"~"#1023$#63"'$'"'"'".1$#0
   "~#34959'$':1~"#0$#1170"'"~#11007'$':1~"#0$#2925"'"~"#2005$#255"'
```

Good:

```
DO :3 <- '"'"'"'".1$':1~#32768'"~"#1109$#1"'$':1~#128'"~#2735'$':1~
   "#546$#0"'"~"#43679"'$':1~"#1365$#0"'"~"#1023$#63"'$'"'"'".1$#0"~
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- Eric Raymond released **C-INTERCAL** in 1990
- “Large”, active community
- Google released a style guide in 2007
- Donald Knuth wrote a bug report in 2010

Here is an illustrative example.

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- Motivation: be difficult to parse
- First **two-dimensional** language
- “Befunge” mistyping of “before”

Examples

```
>v
^<
```

Examples

```
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^<
```

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```
>v
^<
```

Examples

```
>v
^<
```

Examples

```
>v
^<
```

Examples

```
>v
^<
```

```
v>0 v
>?<.<
 >1 ^
```

Examples

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>v
^<
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Examples

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```

Output: 1011110010...

Examples

```
>v
^<
```

```
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>?<.<
 >1 ^
```

Output: 1011110010...

```
666*+.@
```

Examples

```
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Examples

```
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```
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Output: 1011110010...

```
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Output: 42

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- IRC client with 10,000 characters

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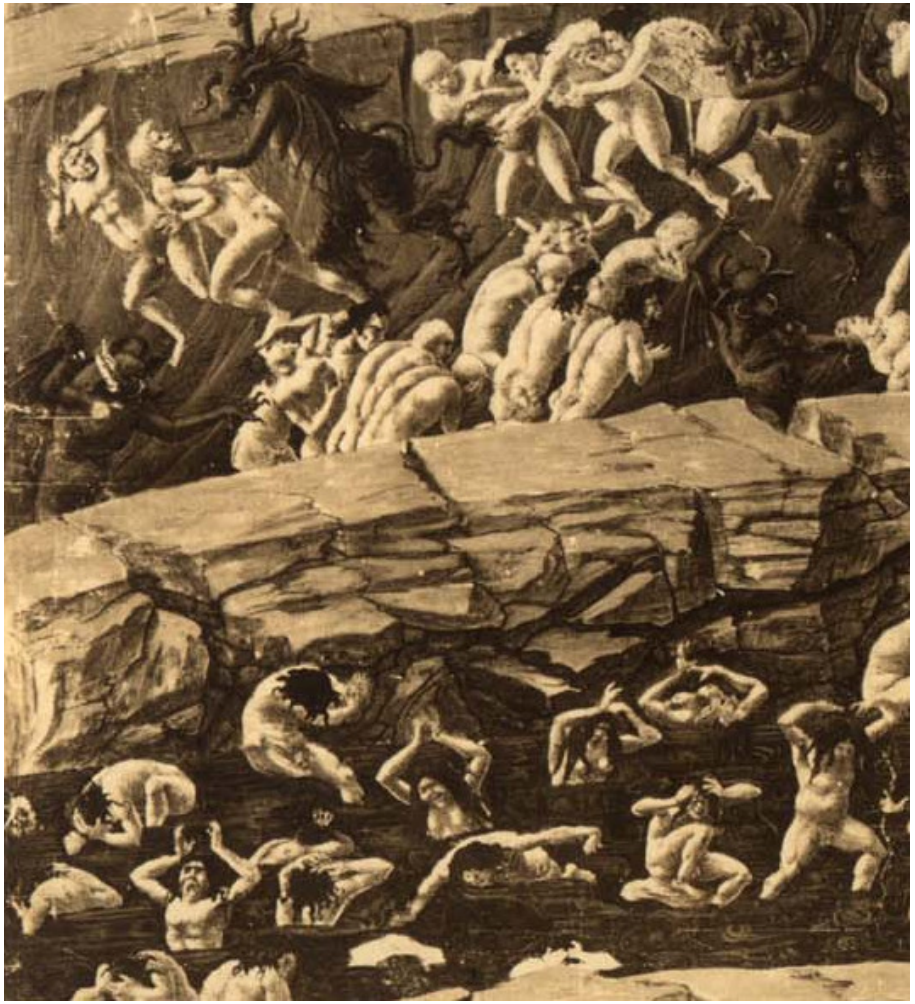
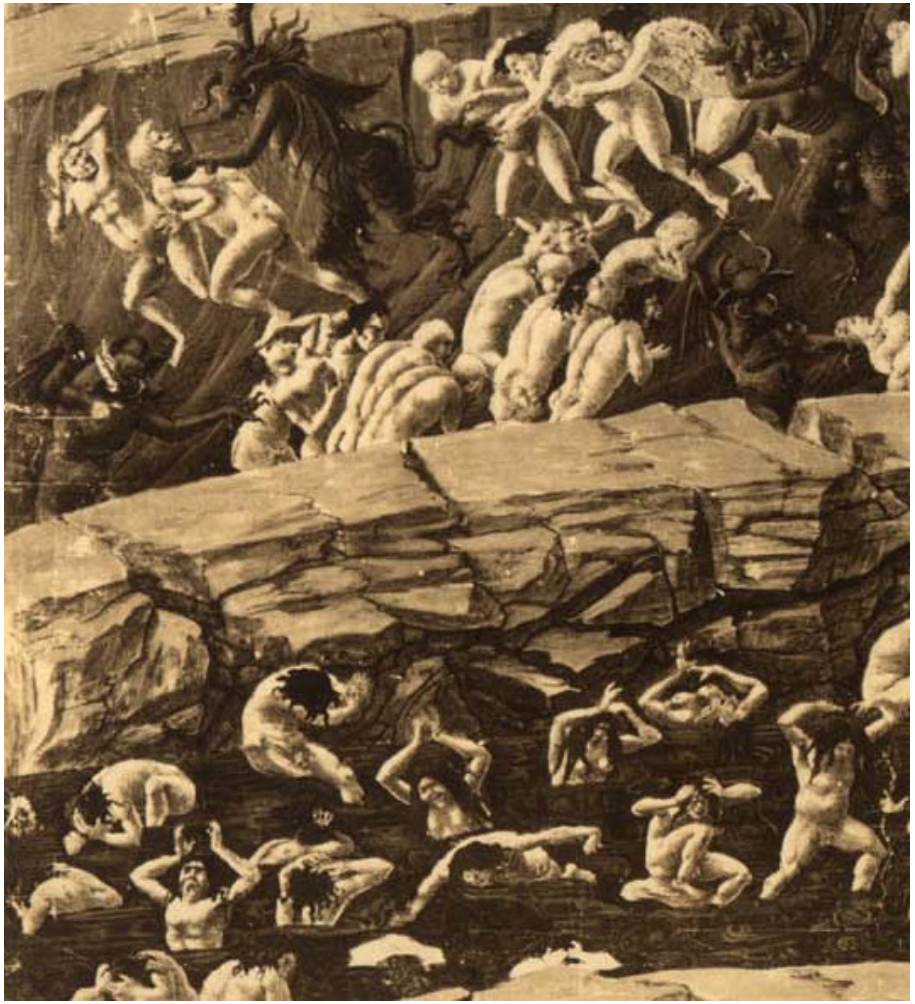
- *Malebolge* is the eighth circle of Hell in Dante's *Inferno*



Malbolge

- Created in 1998 by Ben Olmstead
- Motivation: be incomprehensible and **hard** to use
- *Malebolge* is the eighth circle of Hell in Dante's *Inferno*
- Took two years to write the first nontrivial program



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- Apply a substitution encryption

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For each instruction:

- Subtract 33, add C, mod with 94
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- If we now have one of `j i * p / < v o`, execute that instruction
- Subtract 33
- Apply a different substitution encryption

Description

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- CPU with three registers A, C, and D
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Execution

For each instruction:

- Subtract 33, add C, mod with 94
- Apply a substitution encryption
- If we now have one of `j i * p / < v o`, execute that instruction
- Subtract 33
- Apply a different substitution encryption
- Increment C and D

Example: Hello world

```
(=<‘$9]7<5YXz7wT.3,+0/o’K%$H"’~D|#z@b=‘{ˆLx8%$X
mrkpohm-kNi;gsedcba‘_ˆ]\[ZYXWVUTSRQPONMLKJIHGFE
DCBA@?>=<;:9876543s+0<oLm
```

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Output

```
HEllO WORld
```

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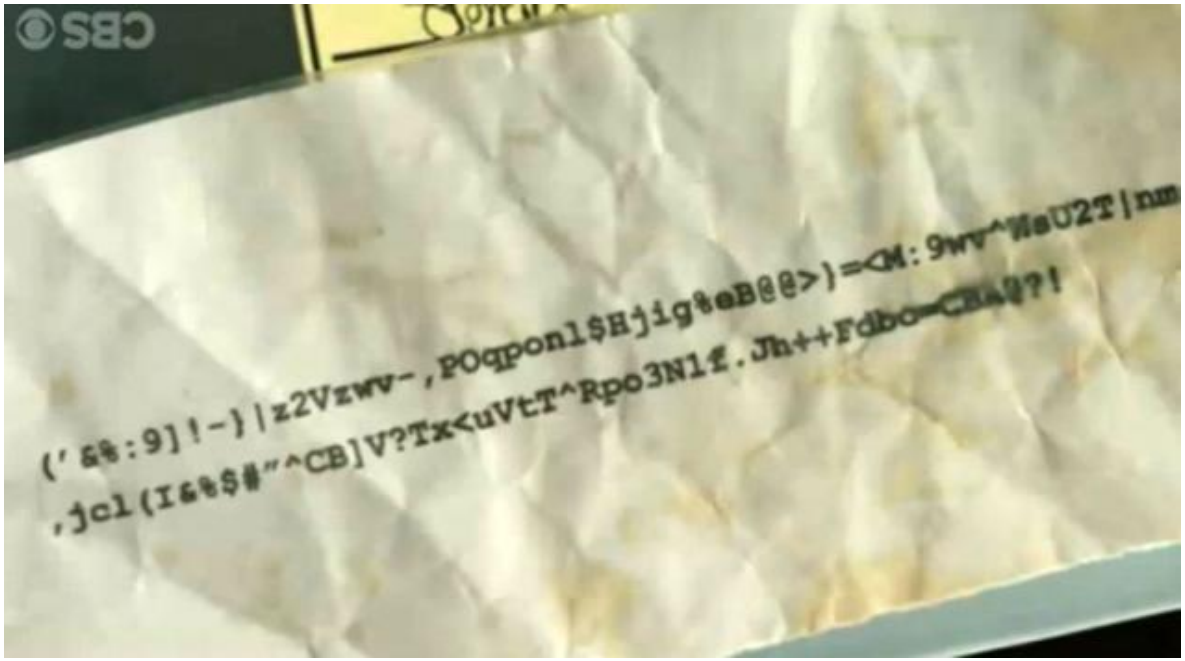
- Appearance in *Elementary*:



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- **Themed** language

Example: Powers of two

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                    A Demonstration of Power.

Romeo, a spacy man.
Juliet, a powerful Italian lady.

          Act I: The act where it all happens.
                 Scene I: Juliet's insult.

[Enter Romeo and Juliet]

Romeo: You charming angel! Open your heart!

Juliet: You are a disgusting smelly lying rotten
  dirty pig! You are as small as the difference
  between nothing and thyself!
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Juliet, a powerful Italian lady.

          Act I: The act where it all happens.
                 Scene I: Juliet's insult.

[Enter Romeo and Juliet]

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Output

```
2 4 8 16 32 64
```

Significance

- Proposed DeCSS implementation

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- Actual Shakespeare performance in 2007:

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Good Ressource: `http://esolangs.org`

Thanks!

Sebastian Morr
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http://morr.cc
@blinry