

*software*  
... if ~~engineering~~ then NC State ...



# In the age of Software 2.0, what role for software engineers?

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cs, se, ai, ncstate, usa

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# Software 2.0: when software writes itself

## What does that mean, exactly?

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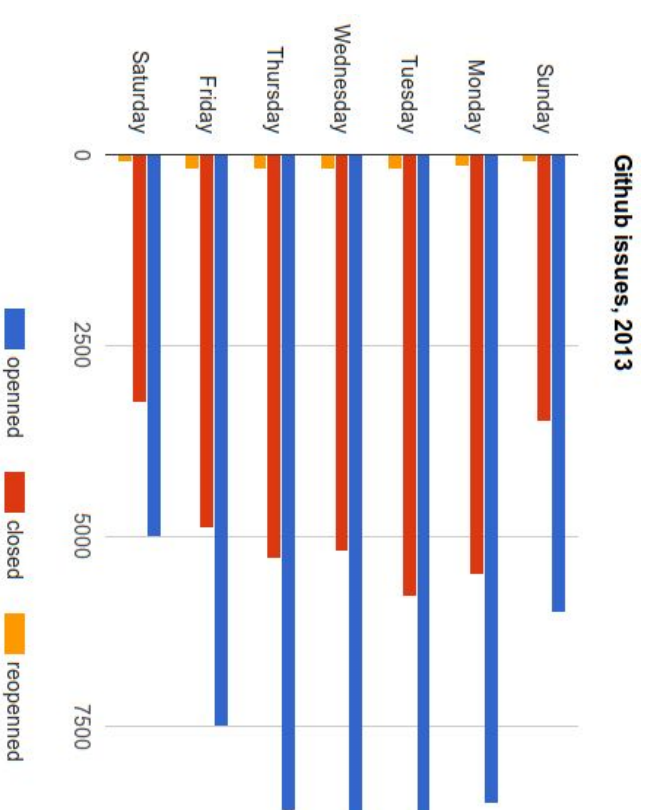
Erik Meijer

- Behind Every Great Deep Learning Framework Is An Even Greater Programming Languages
- Software 1.0:
  - coffee + human = code
- Software 2.0
  - humans say “**what**”
  - a agents automatically work out “**how**”



# A counter-view: Programmers > programming

- Still much space for **novel human creativity**
- Programmers do **not just sit in a backroom**, just filling in the details to a spec
- Programming is **about software engineering**
  - The search for feedback on ideas.
  - Half the issues in Github: never closed
  - Programmers spend much time negotiating **which, what how, when, who**
- Feedback can be handled many ways
  - See below
  - **Need humans + automation**
    - Not one replacing the other



# There are somethings humans just do better than AI

## Human factors:

- Convincing you that the system is trustable
- Helping you when the systems fails

## Current roles of SE experts

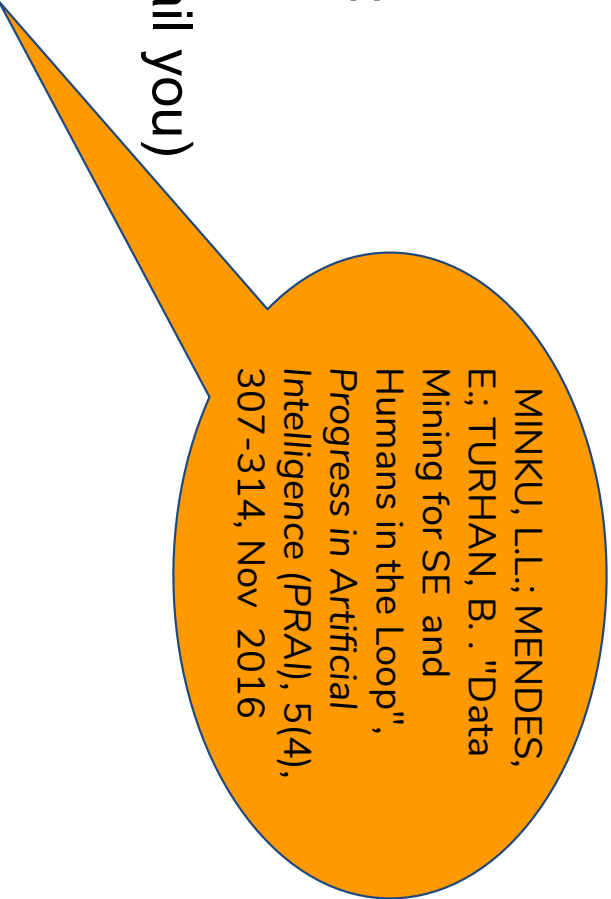
when adopting data mining approaches:

- Problem definition.
- Data collection.
- Data “surrogates” (when the joins fail you)
- Model building.
- **Managing organizational impact**

## Potential roles of SE experts

when adopting data mining approaches :

- Model building involvement.
- Expert domain knowledge.



MINKU, L.L.; MENDES, E.; TURHAN, B. . "Data Mining for SE and Humans in the Loop", Progress in Artificial Intelligence (PRAI), 5(4), 307-314, Nov 2016



## **AI = Not automatic. A large buffet of options. Needs skilled human engineers**



Can't just throw all problems at huge CPU farms

- Zhe's summer at Google: 3 years of CPU/day
- Wang et al., FSE'13. 15 years of CPU to evaluate software clone configurations
- Truede and Wagner: 30 years of CPU to tune clusters for each corpus

# Cannot get humans out of the loop (though some want to try)

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- “The notion of user cannot be precisely defined and therefore has no place in CS or SE”
  - Edsger Dijkstra, ICSE 4, 1979
- “.. kill living human experts and resurrect the dead ones”
  - Anonymous machine learning researcher, 1986



# Humans exist. We must work with them

- “The notion of user cannot be precisely defined and therefore has no place in CS or SE”
  - Edsger Dijkstra, ICSE 4, 1979
- Mathematically:
  - “User”= a force that shapes goal space
- Engineering = surfing goal space



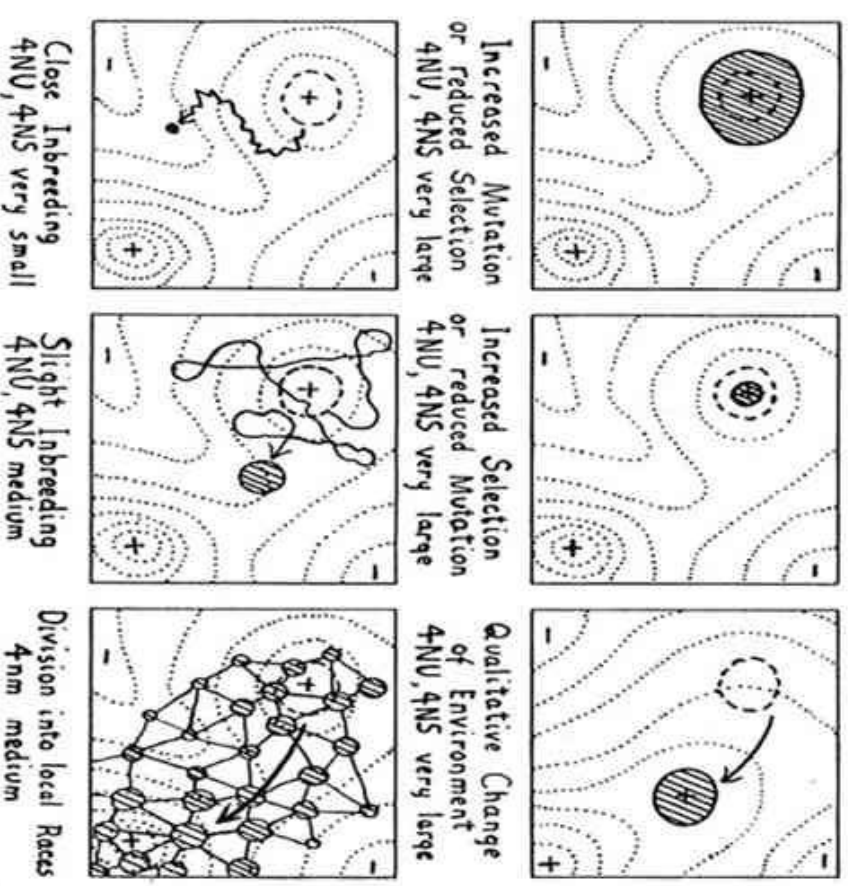
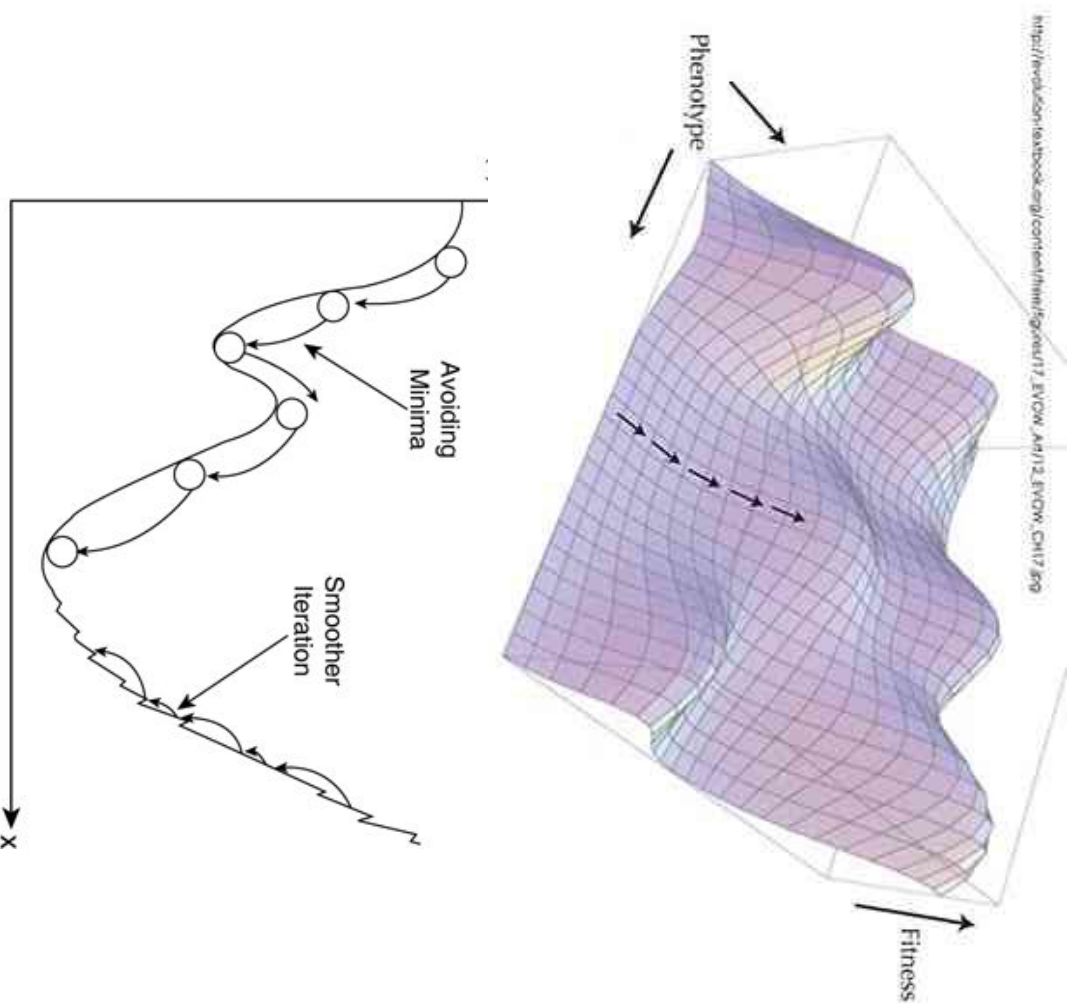
- SE = building + using software that surfs
  - Tim Menzies, FSE 2018





# The shape of goal space? Surfing?

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Brand's favorite landscape,  
1932 Rabbits.



# Complaint: “But that’s not SE”

## Reply “Times change”

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- Once upon a time, ...
  - SE was not about **users** (Dijkstra, 79)
  - SE was not about **testing** (cleanroom, Mills, 1985)
  - SE was not about **requirements** (Paulk, 1993)
    - “Analysis and allocation of the system requirements is NOT the responsibility of the SE group but is a prerequisite for their work”
  - SE was not about **deployment** (before CI)
  - SE was not about **AI**
- But AI software is still **software**
  - needs maintenance, validation, interfacing, usability additions
  - i.e. **AI needs software engineers**