Human Guidance (HG) Approaches for the GI of Software

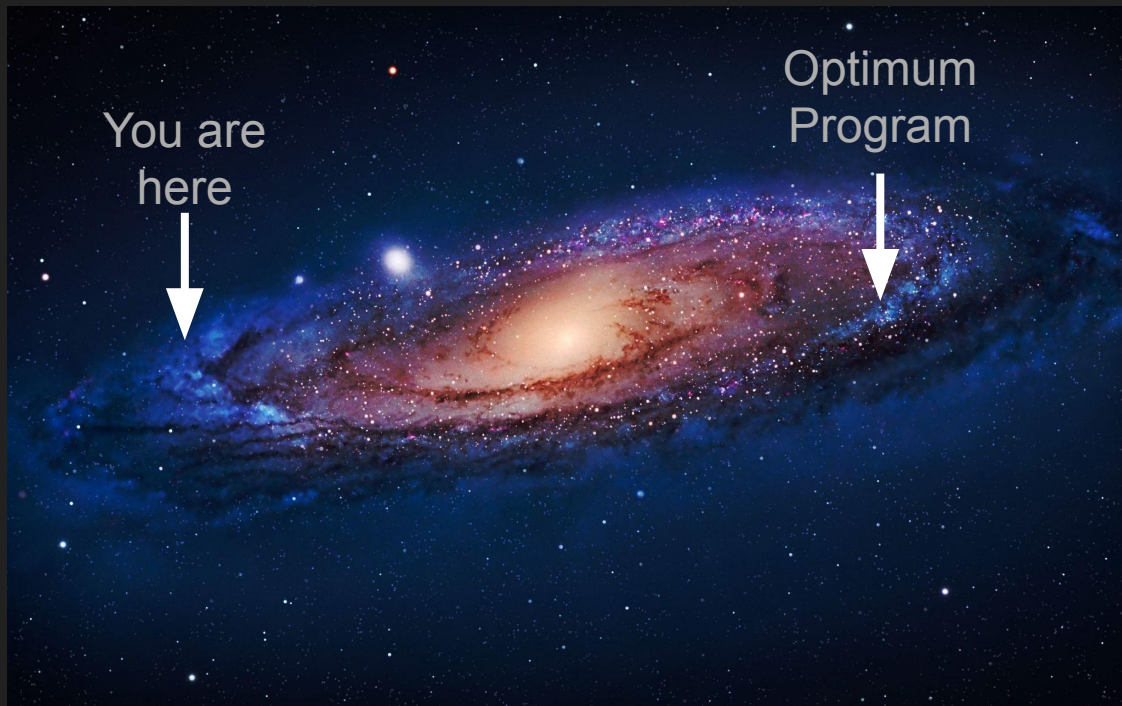Ben Craine, Penn Faulkner Rainford, Barry Porter

Content for presentation

- Why is GI for source code challenging?
- What **do** computers bring to the table?
- What **can** Humans bring to the table?
- How are we approaching the research of HG for GI of software?

- How much HG is too much HG?

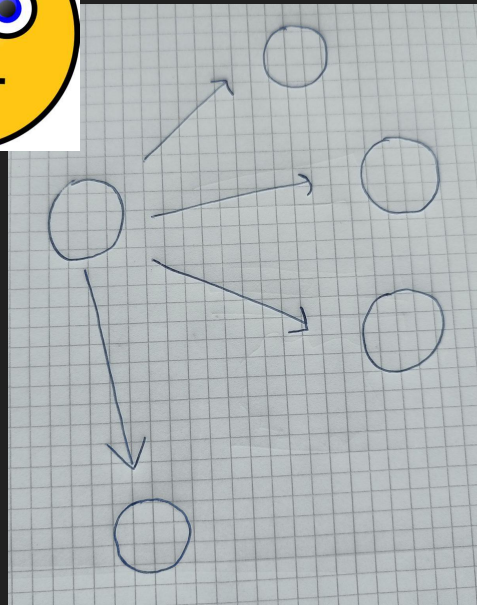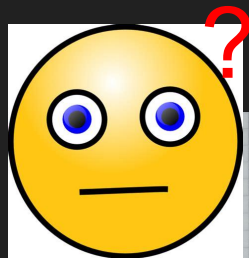# Why is GI for Source Code challenging?

- **Program Synthesis**
  - GP languages
  - This is not the search space you're looking for

- Performance based
  - Specific Environment
  - Search space lacks structure

Optimum Program

You are here

Why is GI for Source Code challenging?

- Program Synthesis
  - GP languages
  - This is not the search space you're looking for

- **Performance based**
  - Specific Environment
  - Search space lacks structure
  - **NEUTRAL DRIFT**

Intractably large, difficult to navigate (between optima) space.

Shrink the space and **improve the guidance**.

What do computers bring to table?

```
int hash (char key[])
{
    while (key.arrayLength < key.arrayLength) {
        int u = key.arrayLength while (key.arrayLength <= key.arrayLength) {

        } for (int v = 0 ; v < key.arrayLength ; v ++) {

        } bool w = 1 if (key.arrayLength < key.arrayLength) {

        }
    } int t = 153 bool o = 1 o = o & o o = 1 bool s = o int r = 743 bool q = 0 dec k = 0.0646989592914781568 bool g = 0 if (g) {

    } bool p = o g = 0 bool n = 0 dec b = 0.833825263118774358 b = 0.833825263118774358 bool m = 1 if (g) {
        if (g) {

        }
    } if (g) {
        g = 0
    } g = 0 dec l = 0.1296809694078885747 while (g) {

    } k = 0.0646989592914781568 while (g) {
        k = 0.0646989592914781568 while (g) {
            k = 0.0646989592914781568
        }
    } k = 0.0646989592914781568 if (g) {

    } int j = 453 dec h = 0.0925711451862721312 if (g) {

    }
    int result = 1
    g = 0 if (g) {
        j = 453
    } k = 0.0646989592914781568 dec f = 0.8836814713958702595 for (int e = 0 ; e < result ; e ++) {

    } dec d = 0.9305700700955970699 b = 0.833825263118774358 result = 1 if (key.arrayLength >= key.arrayLength) {
        int c = key.arrayLength if (g) {

        }
    } dec a = 0.8653064475373070635 a = 0.8653064475373070635 if (g) {

    }
    for (int i = 0 ; i < key.arrayLength ; i ++)
    {
        result = result * key[i]
        a = 0.8653064475373070635 result = key.arrayLength + key.arrayLength
    }
    return result % HT_LEN
}
}
```

```
g = 0 if (g) {
    j = 453
} k = 0.0646989592914781568 dec f = 0.8836814713958702595 for (int e = 0 ; e < result ; e ++) {

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    int c = key.arrayLength if (g) {

    }
```

- Genuine Novelty that improves the gene pool in unpredictable ways
    - Care needs taking when shrinking the search space
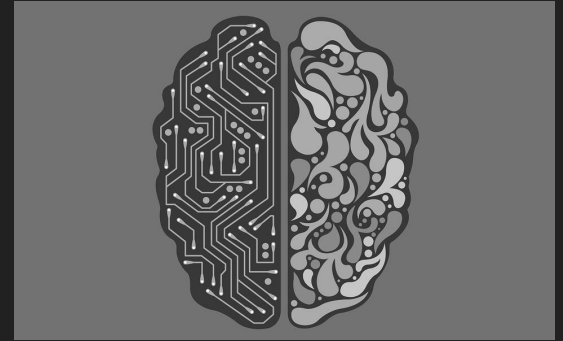
What Can Humans Bring to the Table?

- Best Practices

- Design Patterns

- Intuition

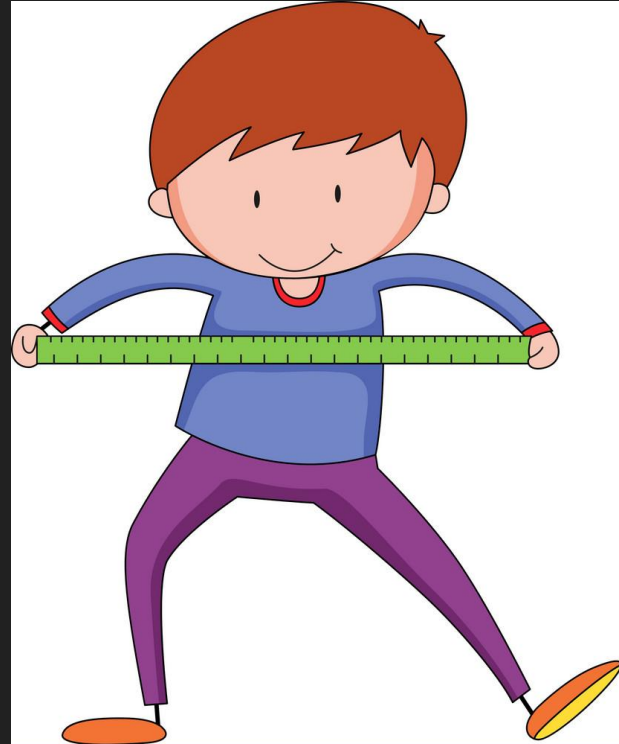# How are we approaching the research of HG for GI of software?

- **Holy Grail:**

    - To bring the best of machine and human intelligence together into one seamless, intuitive system
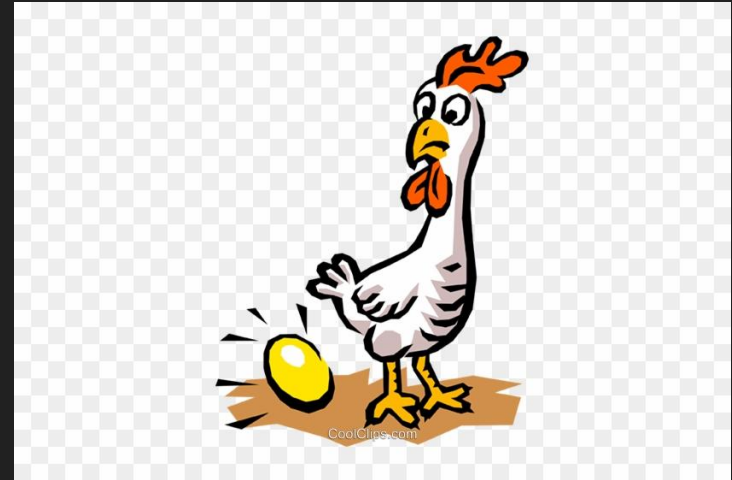
How are we approaching the research of HG for GI of software?

- **Finding a way of evaluating the efficacy of HG**

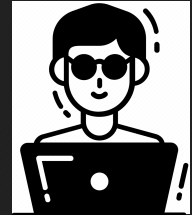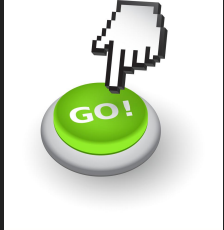- Start with controls or start with data?

How are we approaching the research of HG for GI of software?

- Finding a way of evaluating the efficacy of HG

- **Start with controls or start with data?**

How much HG is too much HG?

- Does HG enhance or override the GI process when it operates as intended?
    - Links back to our evaluation challenge

Fully automated

Fully Manual

Conclusion

Position:

- Particularly hard to guide a search through program space
- Automated guidance is improving yet still seems to fall short
- Therefore HG seems a reasonable avenue for research

Challenges:

- Evaluating HG
- Understanding what humans can contribute to search guidance that computers cannot

Open Questions:

- Does the level of HG required to reach our goals distort a GI process beyond its accepted definition?
- Are human intuitions about software cleanly expressible in terms of a guided search?

Thank you

Workshop organisers

Chairs and Committee

Review Feedback

Everyone attending

A special thanks to the Leverhulme Trust for supporting this research

Questions?