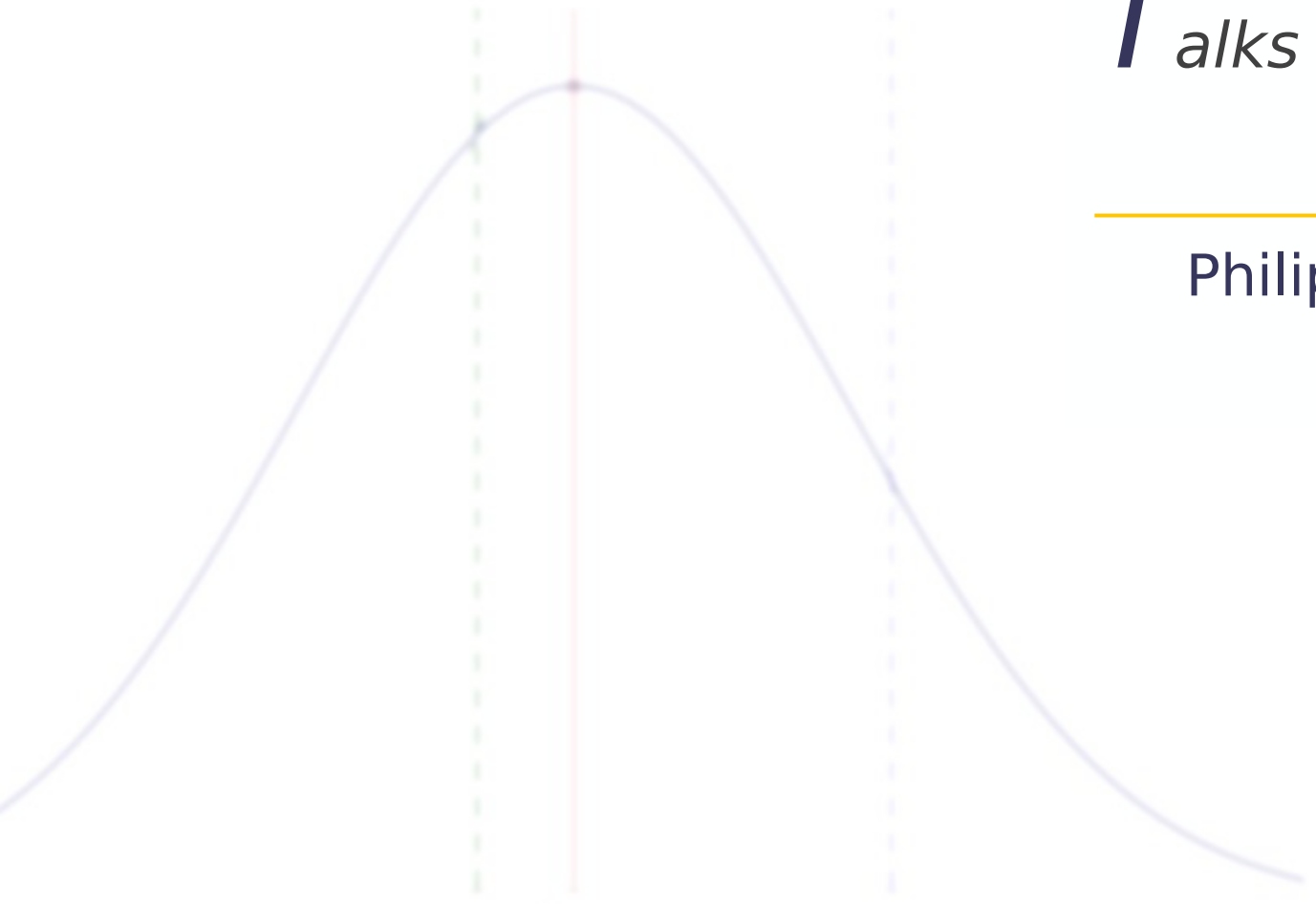


Talks

Philipp Eisenhauer

Material available on

Visit us!

UNIVERSITÄT BONN

High performance computing using Python

Philipp Eisenhauer

I draw on the material presented in:

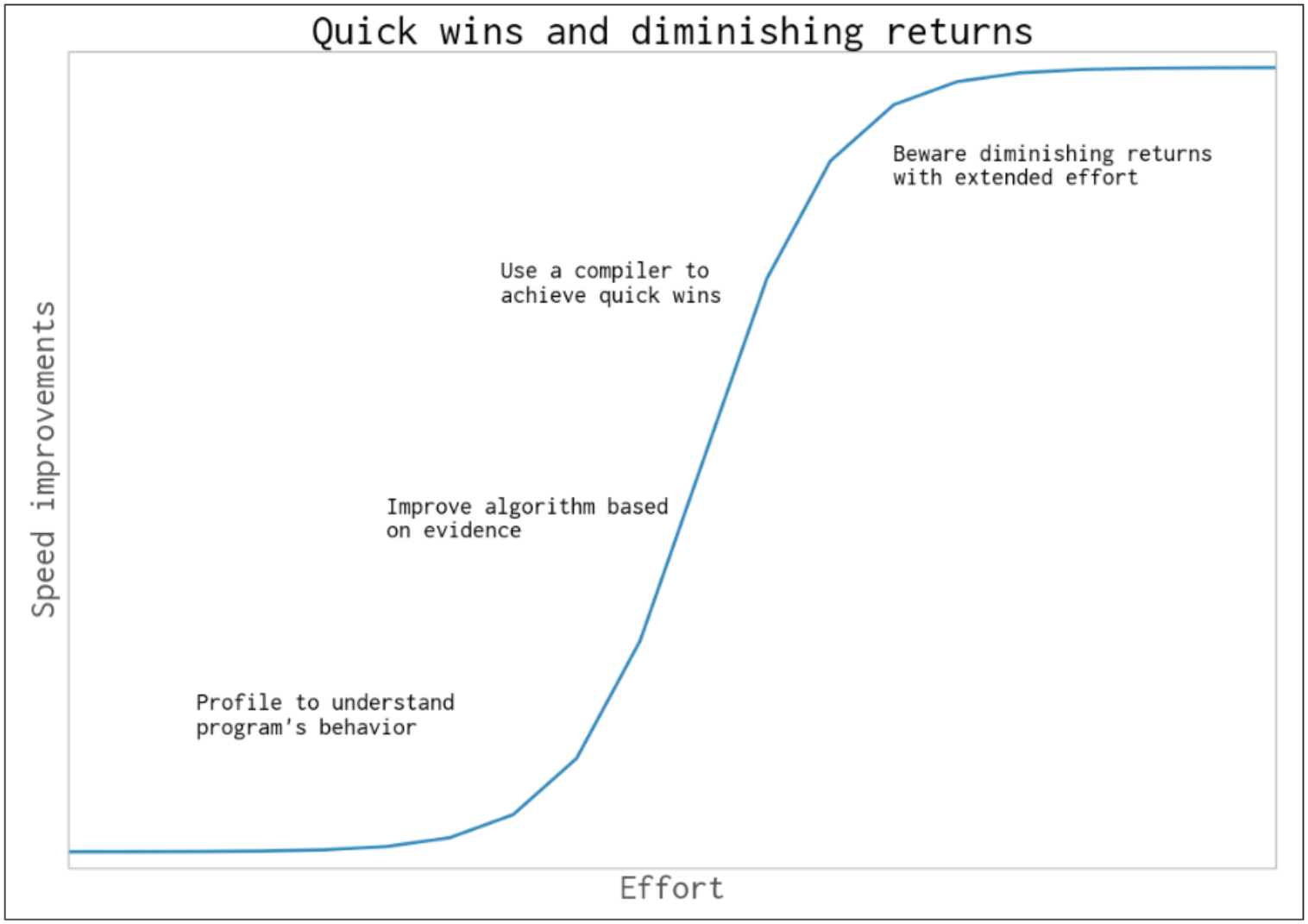
- Gorelick, M., & Ozsvald, I. (2014). *High performance Python*.
- Lanaro, G. (2017). *Python high performance*.

Profiling

- *Premature optimization is the root of all evil.*
- focus on readability
- set up development environment
- flesh out testing harness
- tackle performance bottlenecks

Points of attack

- pure Python
- high-performance libraries, SciPy Stack
- compilation to faster language
  - ahead-of-time, e.g. f2py, Cython
  - just-in-time, e.g. numba
- parallel processing
- distributed computing


Quick wins and diminishing returns
Speed improvements
Effort
Profile to understand program's behavior
Improve algorithm based on evidence
Use a compiler to achieve quick wins
Beware diminishing returns with extended effort

High-performance libraries

Vectorization

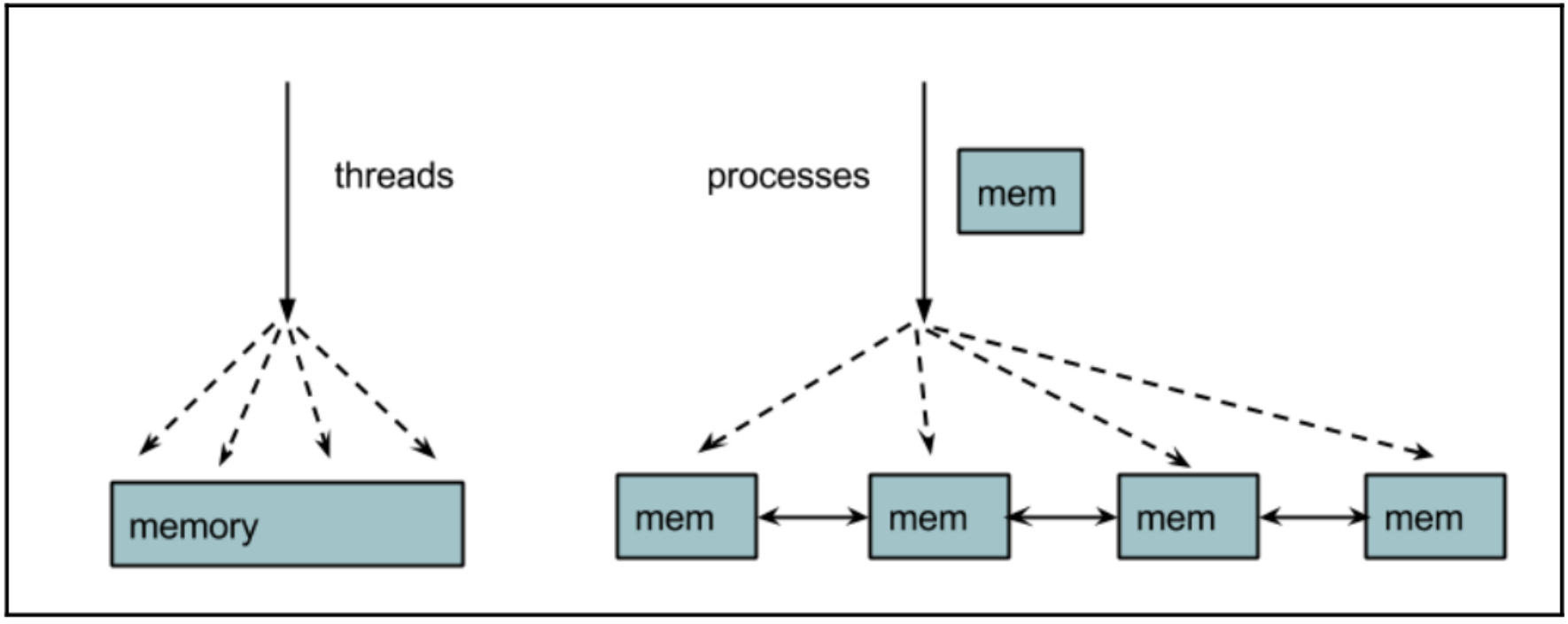
- Vectorization is when a CPU is provided with multiple pieces of data at a time and is able to operate on all of them at once. This sort of CPU instruction is known as SIMD (Single Instruction, Multiple Data).

Compilation to faster language

Parallel processing

Memory access

- shared memory
- distributed memory


threads
memory
processes
mem
mem
mem
mem
mem

Multiprocessing

- Let’s explore the multiprocessing module in a notebook.

Resources

Textbooks

- Lanaro, G. (2017). *Python high performance*.
- Gorelick, M., & Ozsvald, I. (2014). *High performance Python*.

Appendix

References

Gorelick, M., & Ozsvald, I. (2014). *High performance Python*.

Hahn, J., Todd, P. E., & van der Klaauw, W. (2001). Identification and estimation of treatment effects with a regression-discontinuity design. *Econometrica*, *69*(1), 201–209.

Lanaro, G. (2017). *Python high performance*.

Thistlethwaite, D. L., & Campbell, D. T. (1960). Regression-discontinuity analysis: An alternative to the ex-post facto experiment. *Journal of Educational Psychology*, *51*(6), 309–317.