

Future of ACT-R

ACT-R as a self-sustaining ecosystem

What is ACT-R?

- A theory of cognition
- The most successful example of cognitive architectures
- A tight community of researchers who share common goals
- A software application to model cognitive and neural processes

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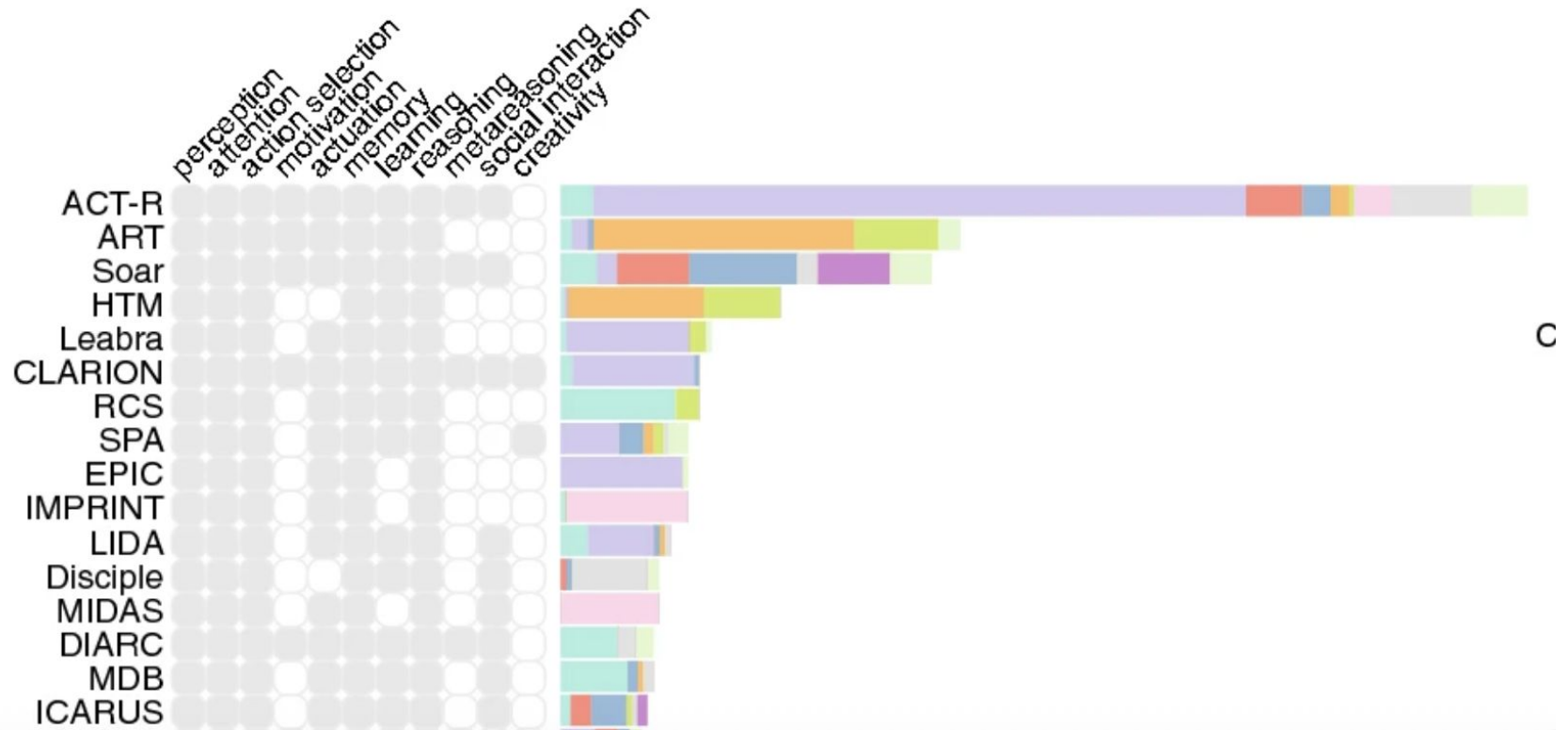
Some considerations

- ACT-R has a **much larger** user base than any other architecture
 - in 2020, it was > than the next 3 architectures combined

ACT-R Downloads in 2024



ACT-R Academic Output (up to 2020)



Some considerations

- ACT-R has a **much larger** user base than any other architecture
 - in 2024, it was > than the next 5 architectures combined
- Its support system is efficient but frugal
 - Supported entirely by the JA/CL teams at **CMU**
 - Supported entirely by **research grants**
 - Users do not pay for ACT-R, donate to ACT-R, or support ACT-R development

Current situation

ACT-R Use



ACT-R Support

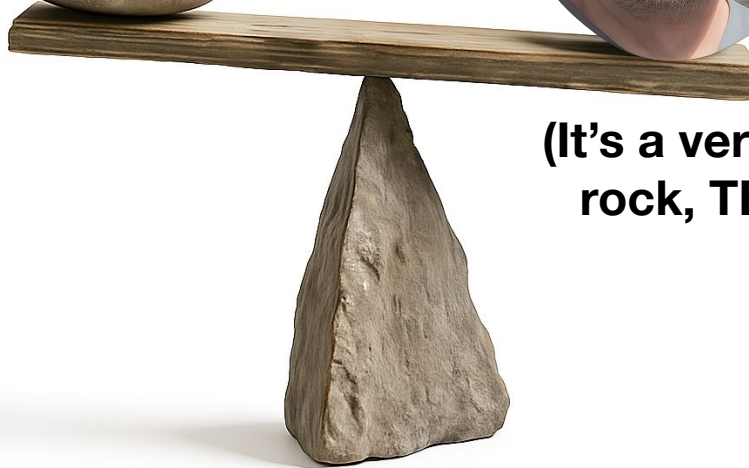
Current situation

ACT-R Use



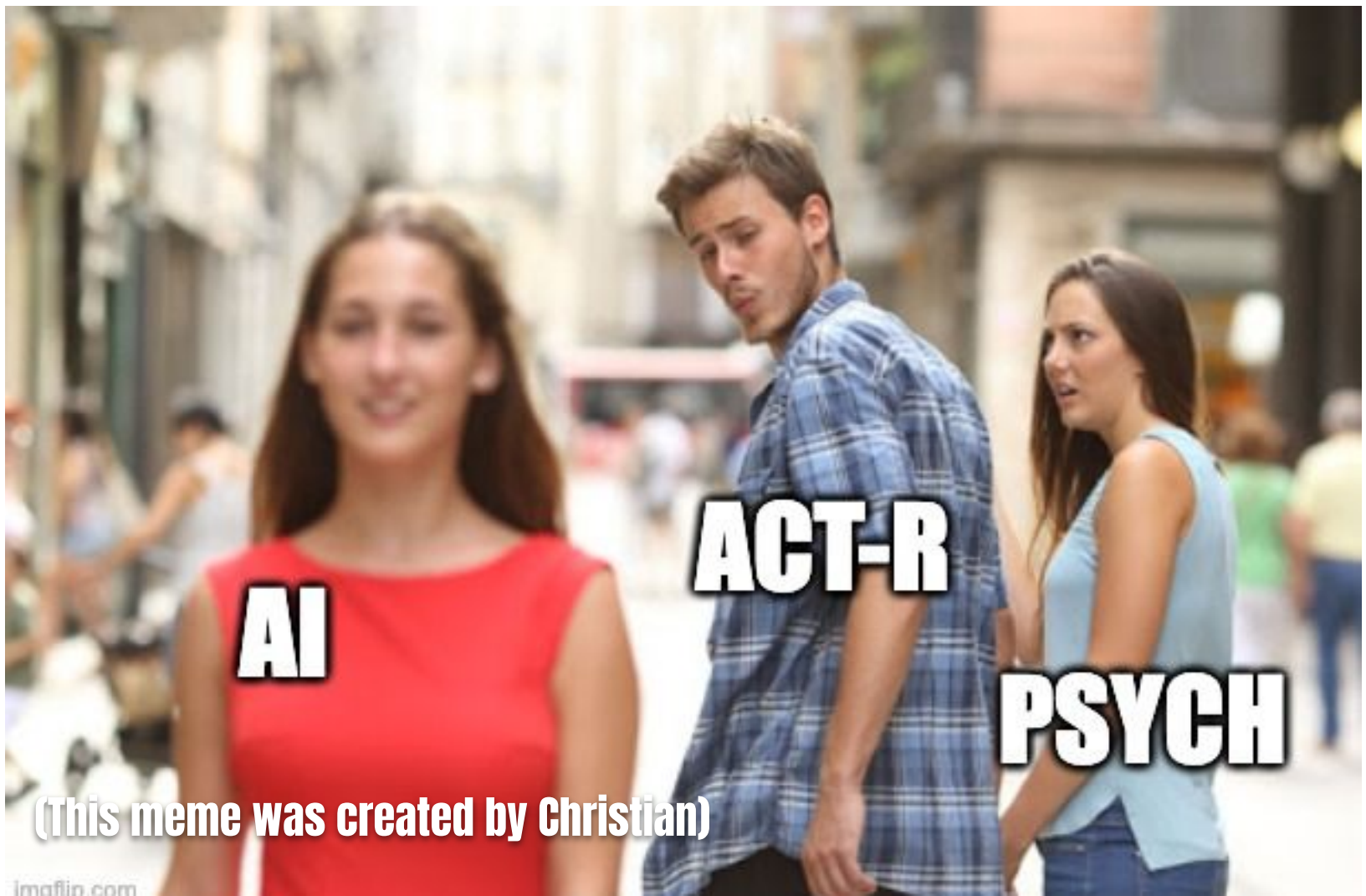
ACT-R Support

**(It's a very big
rock, TBH)**



Making the balancing act sustainable

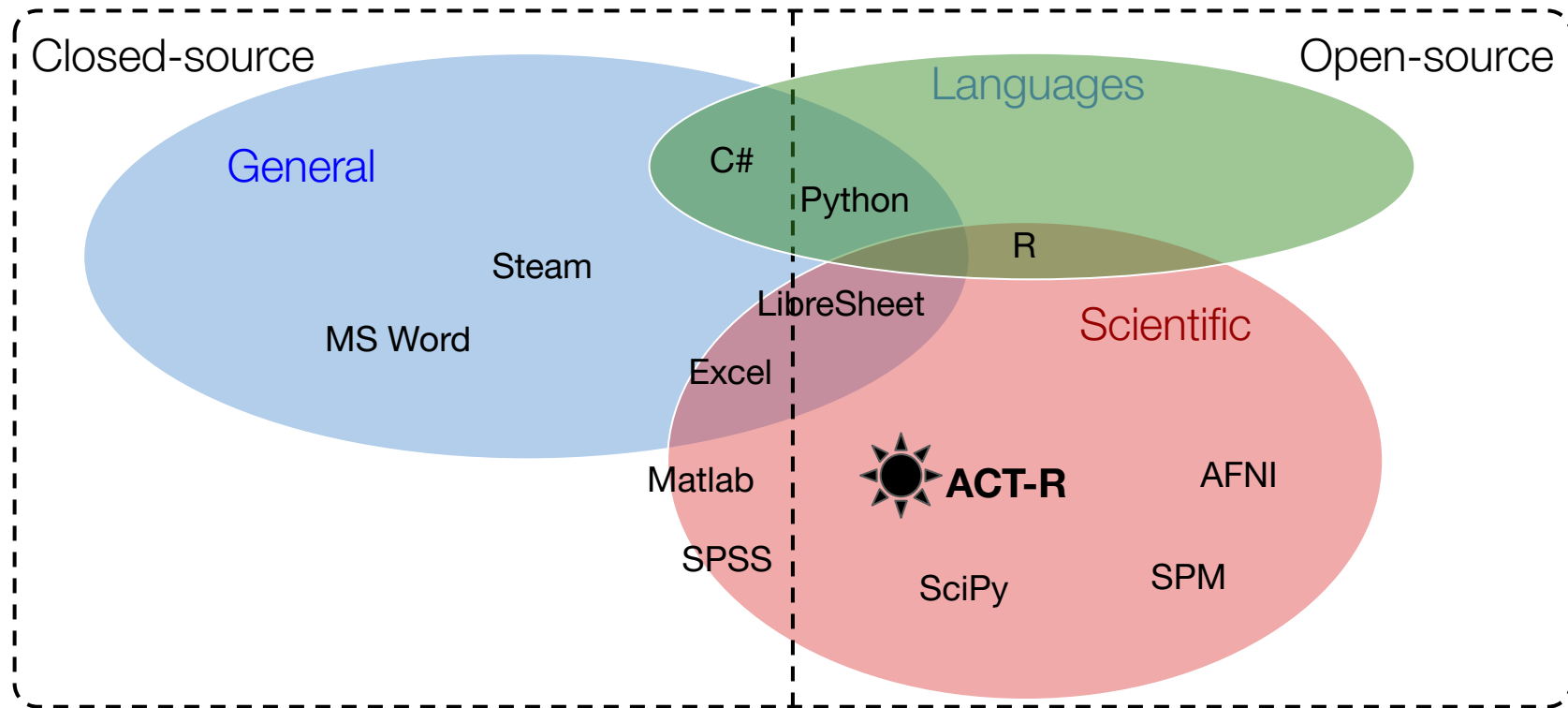
- The current community is **well supported**, but...
 - Downloads implies that user base is **growing**
 - Research funding is **dwindling**
 - Software and application landscape is **changing**
- Long-term support require re-thinking
 - **Integration** with broader set of tools and applications
 - More robust **pipelines**
 - Easier **scaling** of models
 - Opportunities and users exist to **in other domains** (beyond psychology)



(This meme was created by Christian)

How can we make ACT-R self-sustaining?

ACT-R in the software space



Examples of self-supporting scientific software

Three axes:

- Who decides/leads the development?
 - Community through code submissions and discussions
 - An elected team/council
 - The original team of developers
 - A Benevolent Dictator For Life (BDFL)
- How is it developed?
 - Bottom-up: Community can push code updates
 - Top-down: Leading team develops and maintains code
- How is it supported?
 - Research grants
 - Foundations (including dedicated foundations)
 - Industry partners

Examples of self-supporting scientific software



Python (currently, the most popular programming language)

- **Lead** by BDFL*; **bottom-up** development; **support** from Google/Meta/Apple through Python foundation



AFNI (beloved neuroimaging software)

- **Lead** by small team, **top-down** development; **support** from NIH exclusively



SPM (another classic neuroimaging software)

- **Lead** by Karl Friston and team at UCL; **top-down** development; **support** from Wellcome Trust



SciPy (enormous scientific computing/ML package for Python)

- **Lead** by a steering council; **bottom-up** development; **support** from industry sponsors and individual donations



R (the standard language of statistical analysis)

- **Lead** by R Core Team; **top-down** development; **support** from dedicated foundation



PsychToolbox (oldest platform for psych/neuroscience experiments)

- **Lead** by the original team; **top-down** development; **supported** through licensing

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ACT-R (the greatest cognitive architecture)

- **Lead** how? **Developed** how? **Supported** how?

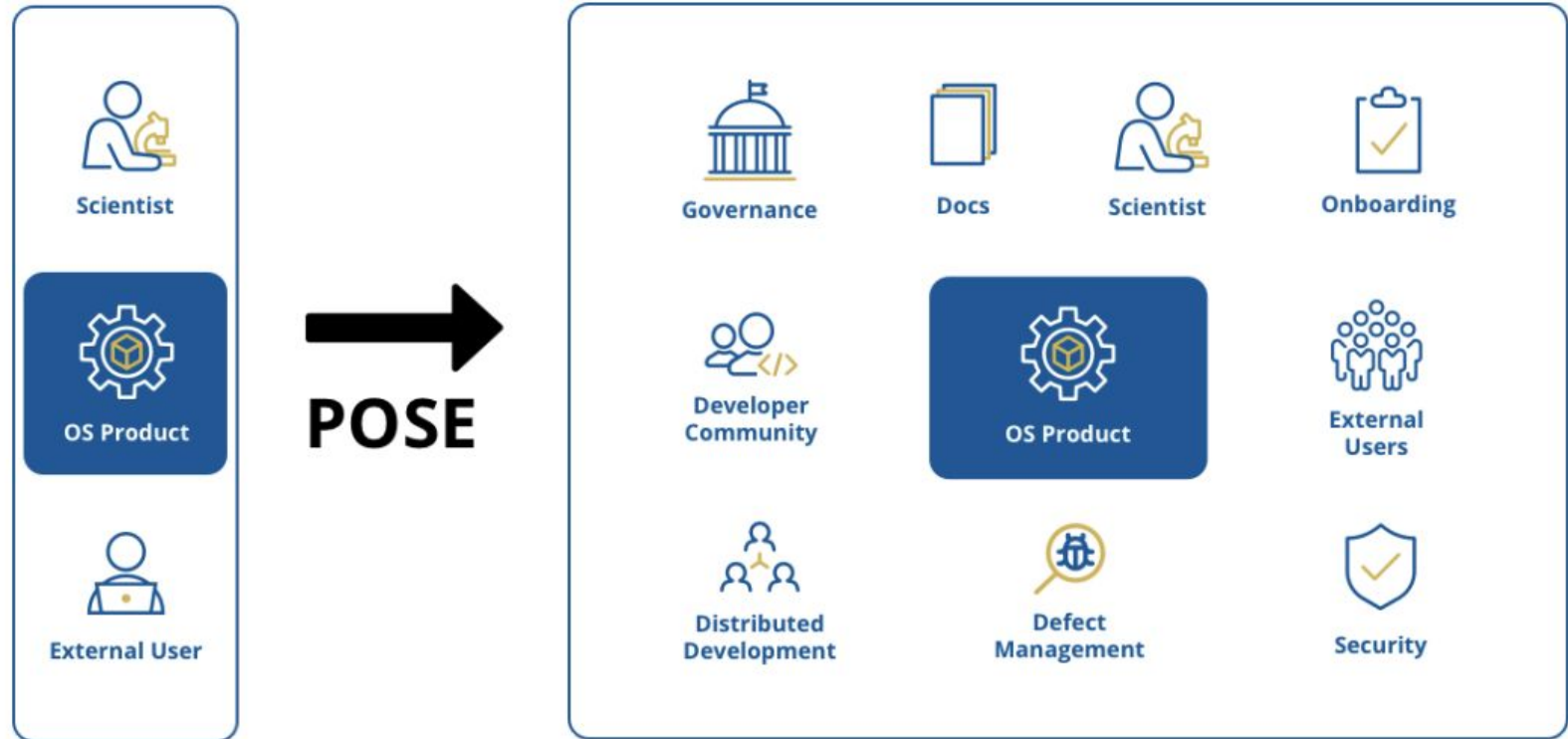
NSF POSE: **P**athways to **E**nable open-**S**ource **E**cosystems

A funding mechanisms from NSF to support open and **self-sustaining** software ecosystems

Two different stages:

- Phase 1: Ecosystem **Discovery**
 - Who uses ACT-R? How large is the community? How can people contribute?
- Phase 2: Ecosystem **Implementation**
 - Build a working, self-supporting software ecosystem
 - Significant support: up to 1.5M

NSF POSE



NSF POSE

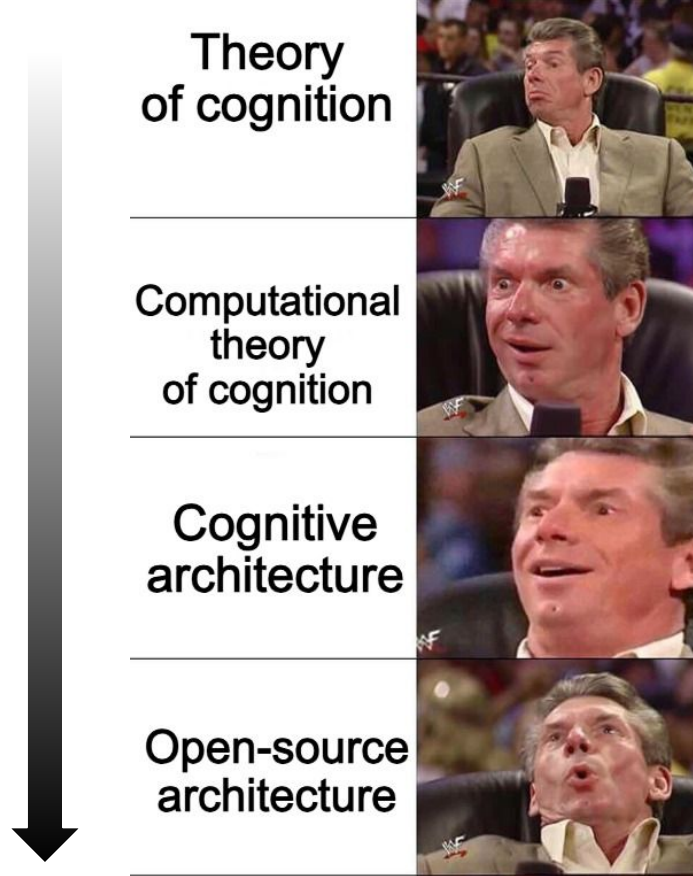
- ...We applied!
 - We = John, Christian, Kevin, Peter, Drew, Mark, and myself
- Got great reviews, recommended for funding
 - Not sure if recommended will translate to “funded”
- Grant would gives us **one year** to investigate current ACT-R uses, examine potential areas of growth, evaluate support models

NOTE: We took it upon ourselves to do the **discovery**. We are not claiming the role of development leads

Roadmap

- Be ready, we want to hear from you!
- In the **next year**, we will reach out to collect info about:
 - How you use ACT-R
 - What is your vision for ACT-R
- We plan to also reach out to:
 - Researchers who might be interested but do not use ACT-R yet
 - Researchers how have already developed other ecosystems
- If you know someone we should talk to, let us know!

History of ACT-R



Future of ACT-R

Theory
of cognition



Computational
theory
of cognition



Cognitive
architecture



Open-source
architecture



Self-sustaining
ecosystem



My personal vision

- ACT-R in Python
 - Easier integration with existing scientific software
- ACT-R on GitHub
 - Easier to manage repositories, bugs, community
 - Easier to fork and add modules
- Unit tools for models
 - Check model compatibility
- ACT-R modular
 - Plug and play modules
- Online tutorial / wiki
 - Interactive code examples in Python
- Online hackademy + video tutorials
- Community leadership

This panel

- **Seven** researchers
- **Seven** views of ACT-R
- **Three** professors
- **Two** researchers
- **One** entrepreneur
- **One** Dan

