(for once) On Time

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Amii Meetup
2020 October 15
Approximating Time

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Approximating Memory?

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Goal for today:

get you thinking about **time** and how it is involved in the operation of learning machines.
Place cells and grid cells in animals and machines:
Cueva & Wei (2018). *ICLR*;
temporal modulation, independent of location and behavior

**Time cells in the hippocampus**, as studied by MacDonald et al. (2011), *Neuron* 71, 737–749.
The animal brain uses time to:

- Remember the past to **predict the future**;
- Recognize and generate **temporal patterns**;
- Create the subjective **perception of time** (be able to make the flow of time visible and representable);
- **Project** back/forth in time (remember and simulate)

Adapted from *Your Brain is a Time Machine*, Buonomano (2017), N.Y. : W.W. Norton & Company.
My view:

- time is a thing to **represent** and turn into state;
- time is a thing to **predict**;
- timing is a thing to **control**;
- time is a thing to use in **planning** and meta-learning.
Considerations:

- Prospective and retrospective time;
- Objective vs subjective time;
- Multiple scales: milliseconds, seconds, minutes, hours, days, years, eons;
- Retiming and rescaling of temporal events;
- Entrainment & aligning to temporal patterns.

Buonomano (2017), N.Y. : W.W. Norton & Company.
Desirable agent abilities:

- **Represent** time since an event(s);
- **Estimate** time until a future event(s);
- **Scale & adapt** to event intervals;
- **Align** to rhythmic events;
- **Use** and change the environment to implement objective time.
Some themes of my own ongoing work:

- Understand **prospective and retrospective timing** in machine agents;
- Understand how agents use (and build) representations of how time has flowed and how it will flow during life-long decision making.
Some suggestions for the present:

- **Take your time.** Focus on personal understanding at your own pace.

- **Protect time** for yourself. You are more important than your perceived productivity.

- **Make time** to do things that help your physical and mental well-being.
Time’s up
(and questions)