Biological ("Natural") Intelligence
6.S077
3 unit 6.034 add-on
Professor Robert C. Berwick
Honeybee “waggle dance”
Newborn babies’ cries

typical French cry

typical German cry
Kid: Nobody don't like me
Mom: No, say nobody likes me
Kid: Nobody don't like me
Mom: Say nobody likes me
Kid: Nobody don’t like me
Mom: No, no, say nobody likes me
Kid: Nobody don’t like me
…repeat 5 more times…
Kid: Oh, nobody don’t likes me!
Course mechanics

• 1 lecture/week, 3 units: either Weds 3-4pm or Friday 2-3pm (36-153, 36-155; you can switch sections as needed); lecture material will be posted; sign up & graded separately from 6.034

• 2 short written, “reading and response” type assignments on the lecture or related material (like Patrick’s 6.xxx)

• 1 slightly longer final written assignment due December 8, your choice subject to my approval (list of topics available – select by Nov. 1 and write a short statement of what you want to do)

• Possibly some (small!!) # of optional readings

• No exams

• Class participation important!

• Grade: 20% each ”reading & response;” 40% final assignment; 20% class participation (cf. “reading and response”)

• Questions?
Course topics

• Theme: Big Data vs. Small Data in biological learning; the role of “innate” constraints in learning

• Sometimes called “Plato’s problem”: how can we know so much, given so little experience? Classic example: language

• Topics will include, but are not limited to:
  o How honeybees learn to navigate using very, very few examples
  o Rage against the machine – when and why Big Data becomes harmful
  o From birdsong to syntax
  o How children learn the rules of language
  o When neural networks fail
  o Google MisTranslate®
  o Evolution by natural selection, and sex as search
  o Why only us? The evolutionary origin of human language
Small (or no) Data for Language, **not** “Big Data”

“Oh, one time one of my friends took me to a huge trucking garage where he works. This trucking garage repairs transportation trailer trucks and trailer cabs. You know how high they are. Well, I stayed at the garage for more than an hour and a half or two hours and I saw all the giant mechanical equipment there is. And I saw the small equipment for testing and cleaning out carburetors. And I was taken to a place where trucks were smashed up in an accident. And I saw one cab flattened down to about a foot high. The cab- you know how big the cab is- but it was squashed down about one foot. And I was amazed to see the trucks that got smashed up in an accident. And my mechanics friend told me that the driver who got out of that cab that was squashed down by accident, got out by a narrow escape. He came out alive. He was not killed but he was very badly injured.”
Navigation: ants (*Cataglyphis*)
Need to know position of sun!
The solar **emphemeris function** (at 42.5° North, Boston, June 20)
Training Period
2:30-6:30
Learning from Small Data - Method “TT”
Initial state, Honeybee (Apis), solar ephemeris

Local solar time (hour of day)
Shaded= space of all physically possible ephemeris functions