Delighted to share our perspective piece “Language is primarily a tool for communication rather than thought” now out in Nature: (with long-term collaborators (and friends) @spiantado and @LanguageMIT) 1/n

The functions of language and why it emerged have long been debated. We evaluate 2 key hypotheses about the function of language in modern humans: i) language subserves communication and ii) language mediates thinking (see Box 1 for discussion of variants of hypothesis ii). 2/n

These hypotheses make testable predictions. If language mediates thinking then ling. mechanisms should be engaged when we think, and thought should not be possible absent language. If language is a tool for communication, it should show hallmarks of efficient info transfer. 3/n

Why is NOW a good time to take stock? In the last 20yrs a) we’ve made progress in deciphering the basis of language, yielding a clear ‘target’ for testing the role of language in thought, and b) large lang corpora have become available along with novel analytic tools. 4/n

So: DOES LANGUAGE MEDIATE THOUGHT? TL;DR: No. For us, LANGUAGE: representations+computations that allow us to produce and interpret meaningfully structured word sequences; THOUGHT: knowledge of reasoning about the world, domain-general reasoning, cross-domain info integration 5/n

Language relies on dedicated areas (purple below). Their key properties include: a) representational abstractness (input+output modality independence) and b) representation+processing of words/syntax—components important to the lang-for-thought hyp. 6/n tinyurl.com/temfzd26
Using data from fMRI and patients with aphasia, we argue that the lang. system is NOT NECESSARY for thought (details: ). We also argue that having an intact lang. system does not imply being able to reason: i.e., language is NOT SUFFICIENT for thought. 7/n

And IS LANGUAGE AN EFFICIENT COMMUNICATION CODE? TL;DR: Yes. An efficient code should be easy to produce+understand, robust to noise, and learnable by humans. Human langs exhibit these properties at all levels of structure, including sounds, word forms+meanings, and syntax. 8/n
A common argument against language having evolved for communication is the prevalence of ambiguity. But ambiguity can be mathematically shown to be communicatively useful: it allows leaving out info that listeners already know, and enables re-use of short, easy-to-say forms. 9

ZOOMING OUT TO EVOLUTION: The view that lang. is simply a communic. system aligns with a continuity view of human evolution, where lang. properties—including its complexity—result from the multifaceted landscape in which it has evolved, where the system must be useful + usable. 10

The alternative—that language is the substrate for thinking—implies a sharp discontinuity between our species and others. This view centers language—perhaps innately—as the mechanism of change, which endowed us with a novel
Why does an intimate relationship between language and thought have an intuitive appeal? There are many reasons (see Supp Info in the paper). One important one is the desire for parsimony in explaining differences between humans and non-human animals.

Humans differ from other animals both the sophistication of their communication system and of their thoughts and cognition. A parsimonious account favors a single-factor explanation: i.e., humans evolved language, and the change in cognition was simply a consequence of this.

BUT: Evidence from human evolution suggests parallel increases in the sophistication of multiple cognitive systems. The association cortex—which houses processes above and beyond perception and motor control—expanded disproportionally in humans eg, @fennanik @RandyLBuckner

Human association cortex comprises multiple large-scale networks. The lang. network is just one of them. Several networks have been identified that support thinking and reasoning, including the Multiple Demand network, the Theory of Mind network, and the Default Network.

All these networks have expanded over the course of human evolution, and this expansion was associated with increases in many cognitive abilities ( @CantlonLab @spiantado).
In sum: Lang. serves a primarily communicative function and reflects, rather than gives rise to, the sophistication of human cognition. Instead of providing the substrate for thinking, language likely transformed our species through its external usage. 17/n

Language enabled cross-generational transmission of acquired knowledge. The cumulative effect of this transmission along with increased sophistication of our social and problem-solving abilities plausibly enabled us to create human civilizations. (eg, @JoHenrich) 18/n

See figure for some open questions. And thank you to so many of you (see Acknowledgments!) for help and comments over the last few months! 19/19

Open questions

Our understanding of human linguistic and cognitive capacities and the relationships between them remains incomplete. Here we highlight a few open questions.

(1) What is the nature of linguistic representations that the language-selective brain network stores and the computations that it performs during comprehension and production? Recent advances in artificial intelligence—the development of neural network models that excel at language 201—have provided language researchers with a suite of powerful tools to probe the neural codes of linguistic processing 202,206 (reviewed in ref. 206). These tools, combined with the increasing sophistication of neural recording approaches 207,208, should enable advances in our understanding of the human language system in the coming years.

(2) Does our thinking rely on symbolic representations 209–212, sub-symbolic or connectionist representations 213,214, or some combination of these? How do representations that mediate abstract thought arise from the biological neural networks that are our brains 215,216? Are any thought-related computations and the underlying neural circuits distinctly human, or do humans simply have more neural and cognitive resources 163,173 that lead to greater sophistication?

(3) How does the language network develop as children learn language? What cognitive functions do brain areas that are selective for language by age four 92,93 support before language is acquired? Although a number of studies have investigated responses to speech in newborn and infant brains 217,219, the functional changes that happen in the brain during the second half of the first year of life and during toddlerhood (age 6 months to 3 years), when children begin to link words to meanings and to use language communicatively, remain unknown because experimentation with spatially precise brain imaging approaches such as fMRI is challenging at this age.