Writing: Evolutionary and cognitive perspectives

Or: Why it makes sense that writing is hard.

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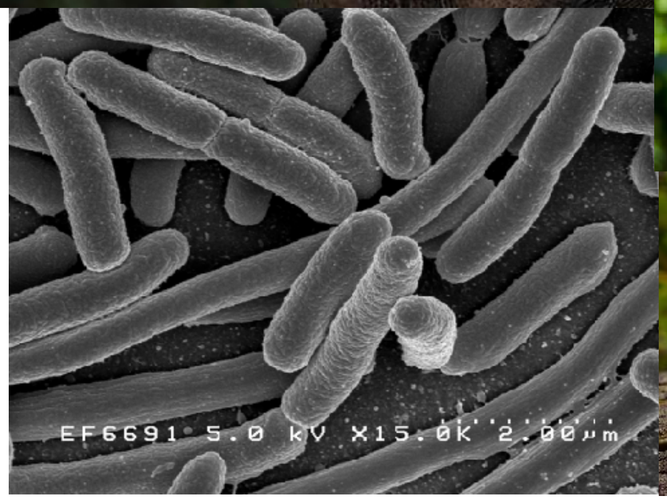
Communication is widespread, language is unique - and a human universal



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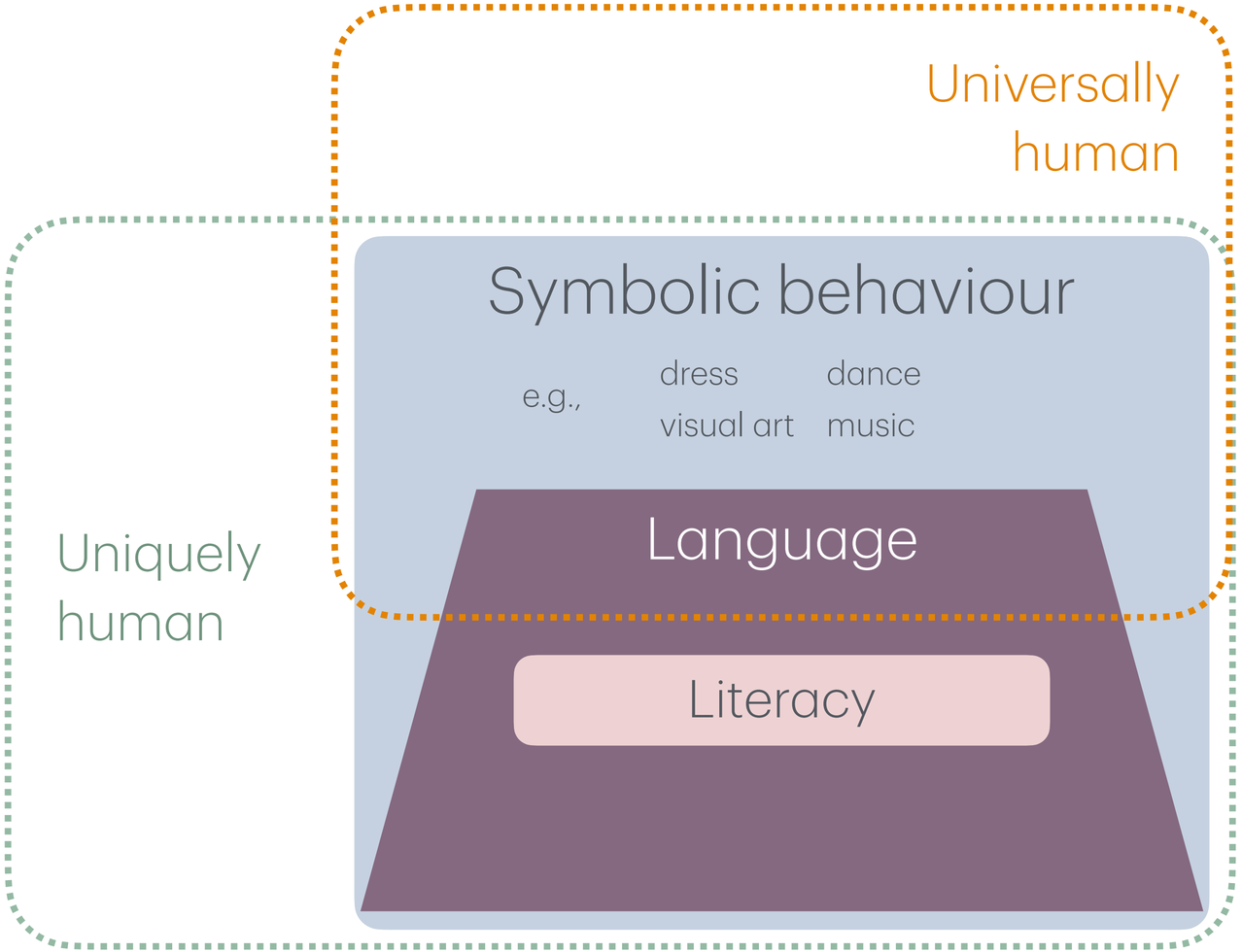
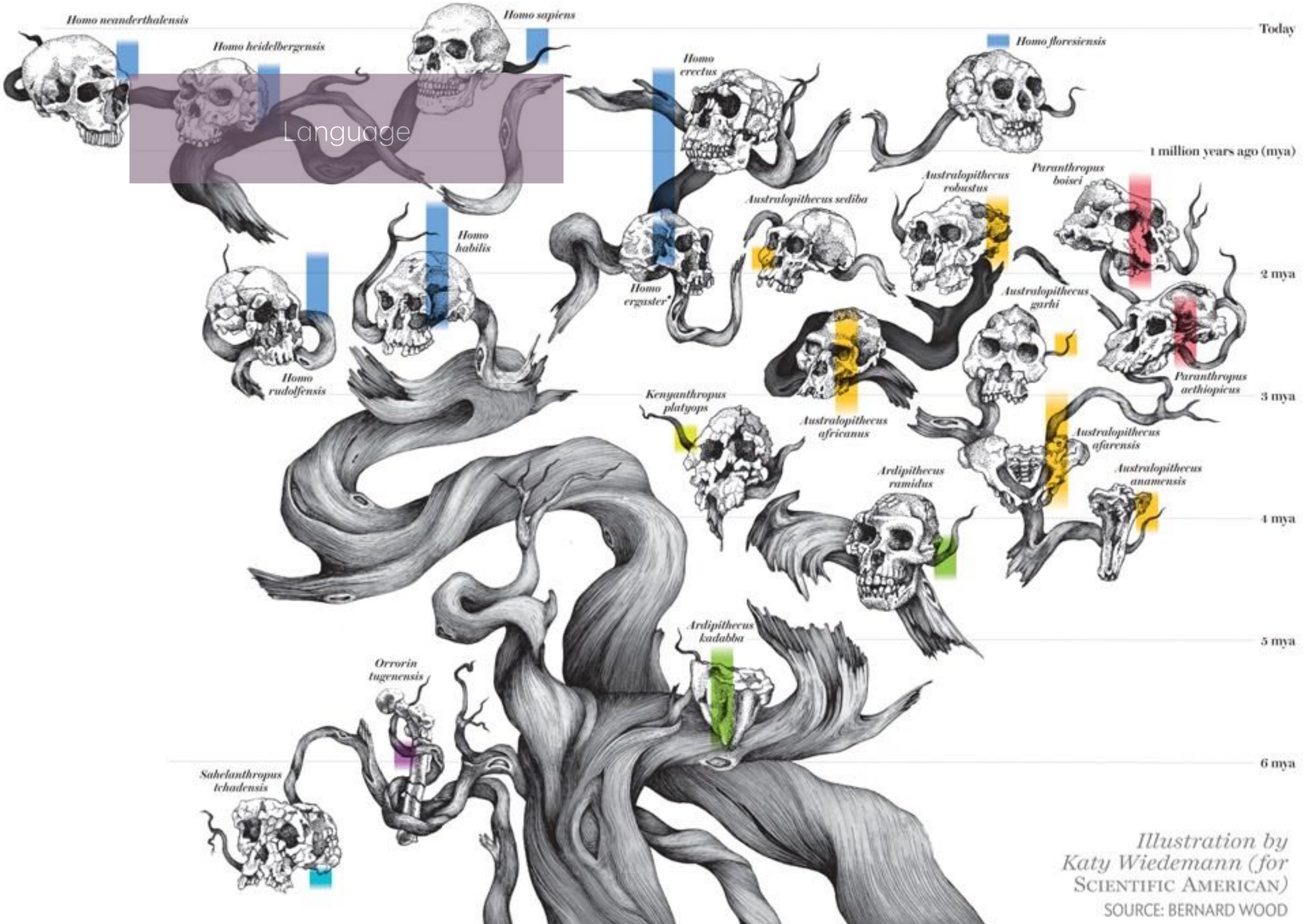
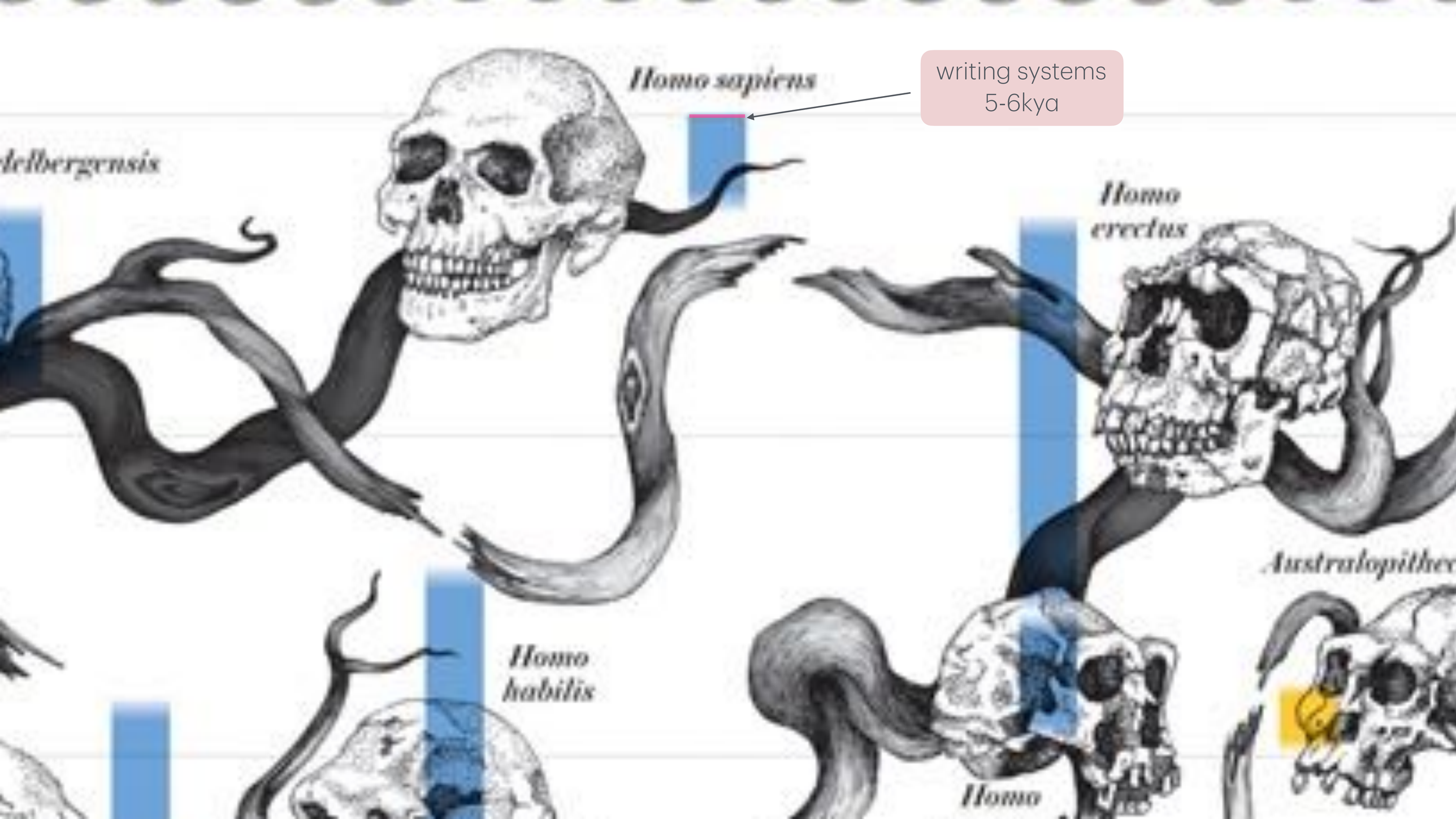
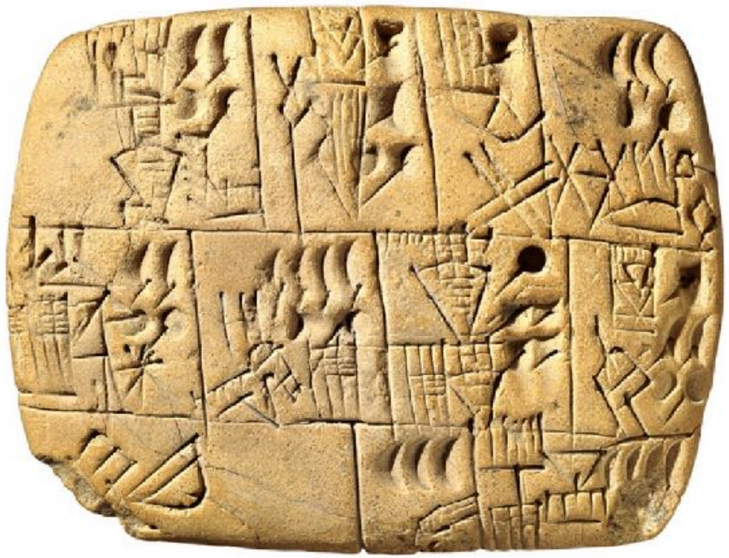



Homo neanderthalensis
Homo heidelbergensis
Homo sapiens
Homo floresiensis
Homo erectus
Language
Today
1 million years ago (mya)
Australopithecus robustus
Paranthropus boisei
Australopithecus sediba
Homo habilis
Homo ergaster
Australopithecus garhi
2 mya
Homo rudolfensis
Paranthropus aethiopicus
Kenyanthropus platyops
Australopithecus africanus
Australopithecus afarensis
3 mya
Ardipithecus ramidus
Australopithecus anamensis
4 mya
Ardipithecus kadabba
5 mya
Orrorin tugenensis
Sahelanthropus tchadensis
6 mya
Illustration by Katy Wiedemann (for Scientific American)
SOURCE: BERNARD WOOD


Homo sapiens
writing systems
5-6kya
delbergensis
Homo
erectus
Australopithec
Homo
habilis
Homo

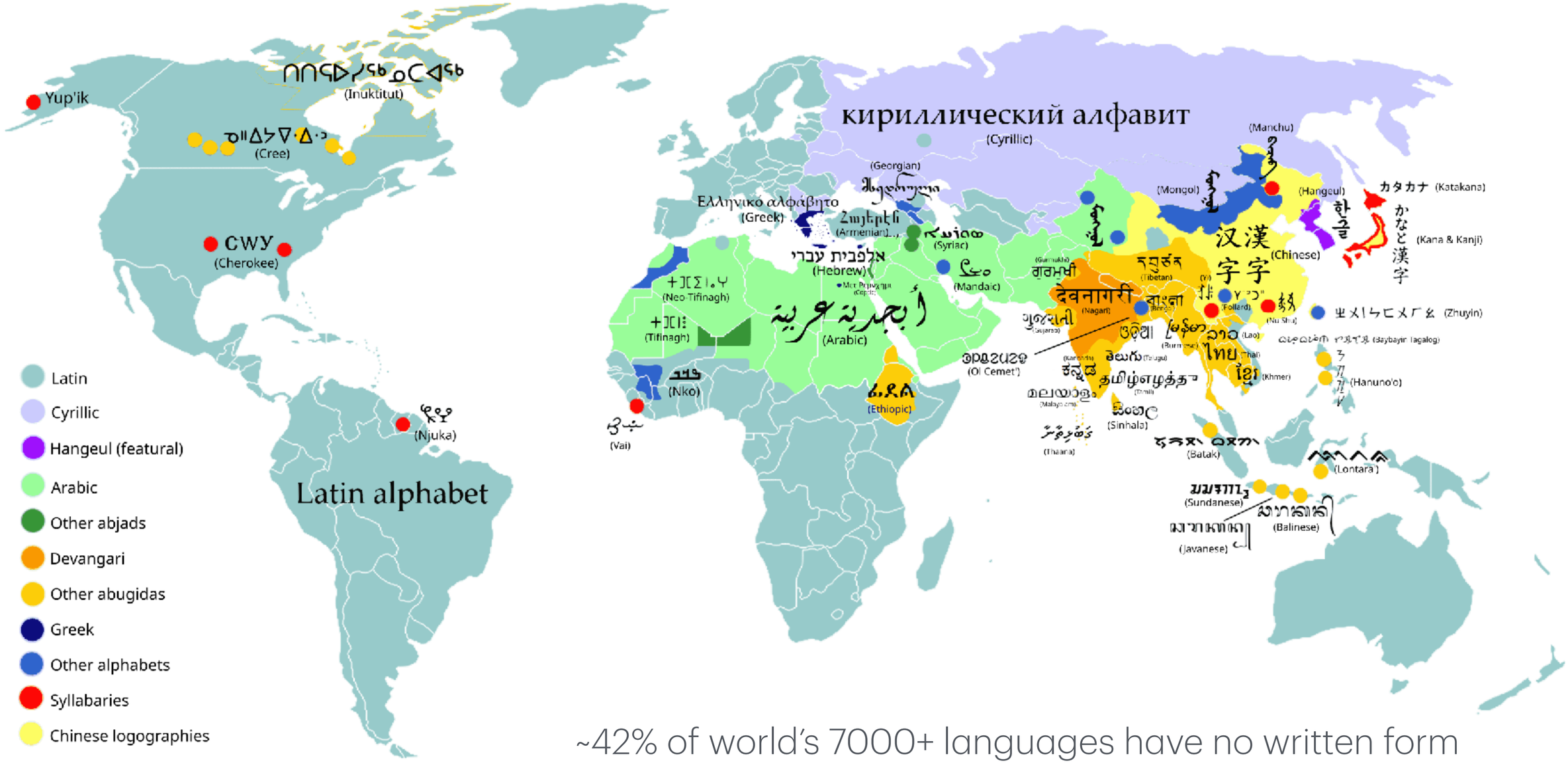
Writing is (language) technology: the first external data storage

Proto-writing
(mnemonic)



Writing, a model of language e.g.,
Cuneiform, ~ 3500 BCE

LLMs
(~2022 CE)



~42% of world's 7000+ languages have no written form

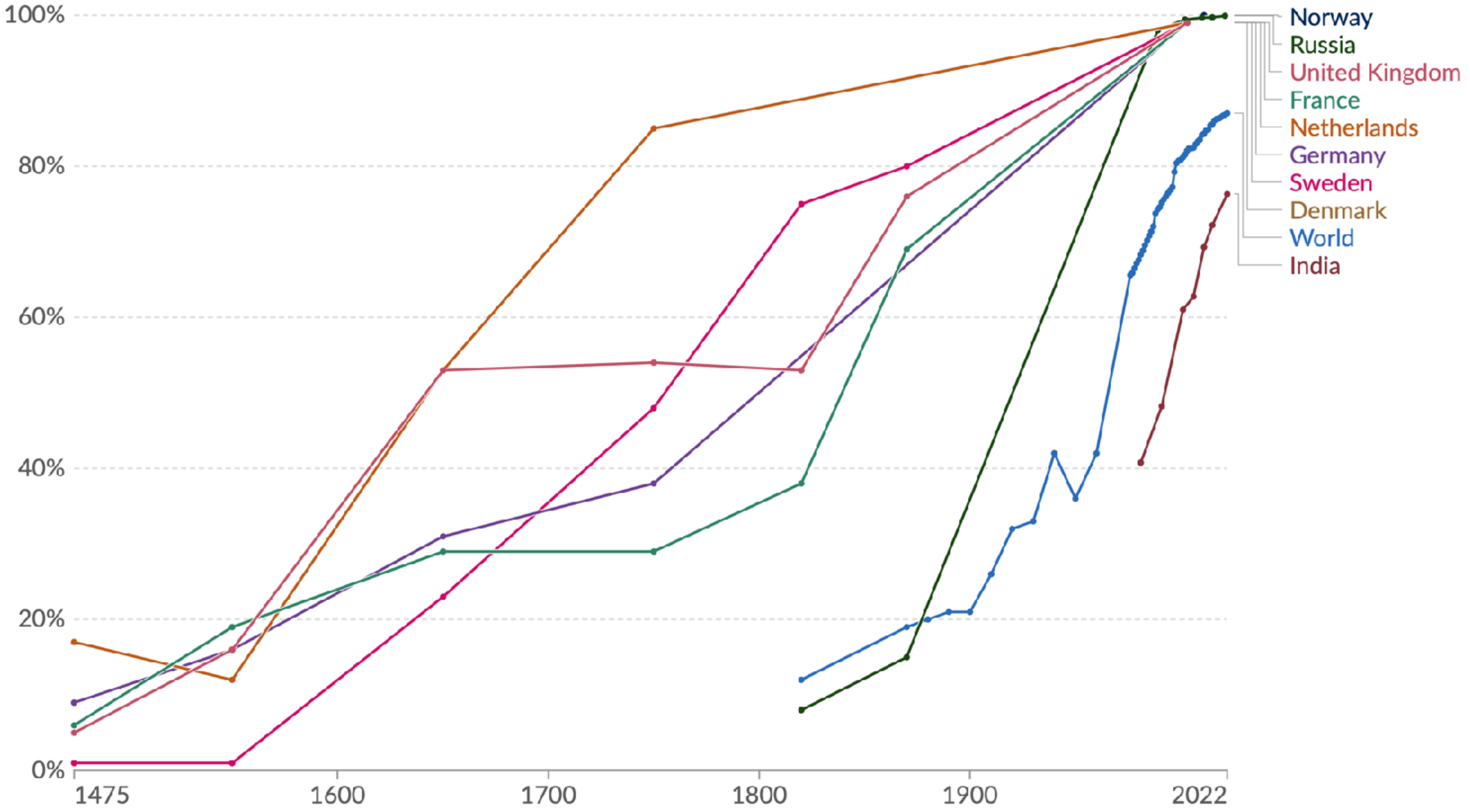
This includes 100% of the 200+ signed/tactile languages, for which a written form is not possible

Map by Nickshanks | Wikimedia commons

Literacy rate, 1475 to 2022

The share of adults aged 15 and older who can both read and write.

Our World in Data



Data source: World Bank (2023); Various sources (2018)

OurWorldInData.org/literacy | CC BY

Note: Specific definitions and measurement methodologies vary across countries and time.

Not just technologically new; different functionally and cognitively

Writing	Speech/Sign
Effortfully taught/learned	Effortlessly acquired
Asynchronous (until recently)	Synchronous
(semi) Permanent	Rapid fading
Audience potentially unknown/unintended	Audience likely known, has shared context

Look at this, but **do not read it**.

Despite all this, for most modern human adults, **reading acts like a reflex.**

Is the same true of writing?

"If a story is in you, it has to come out."

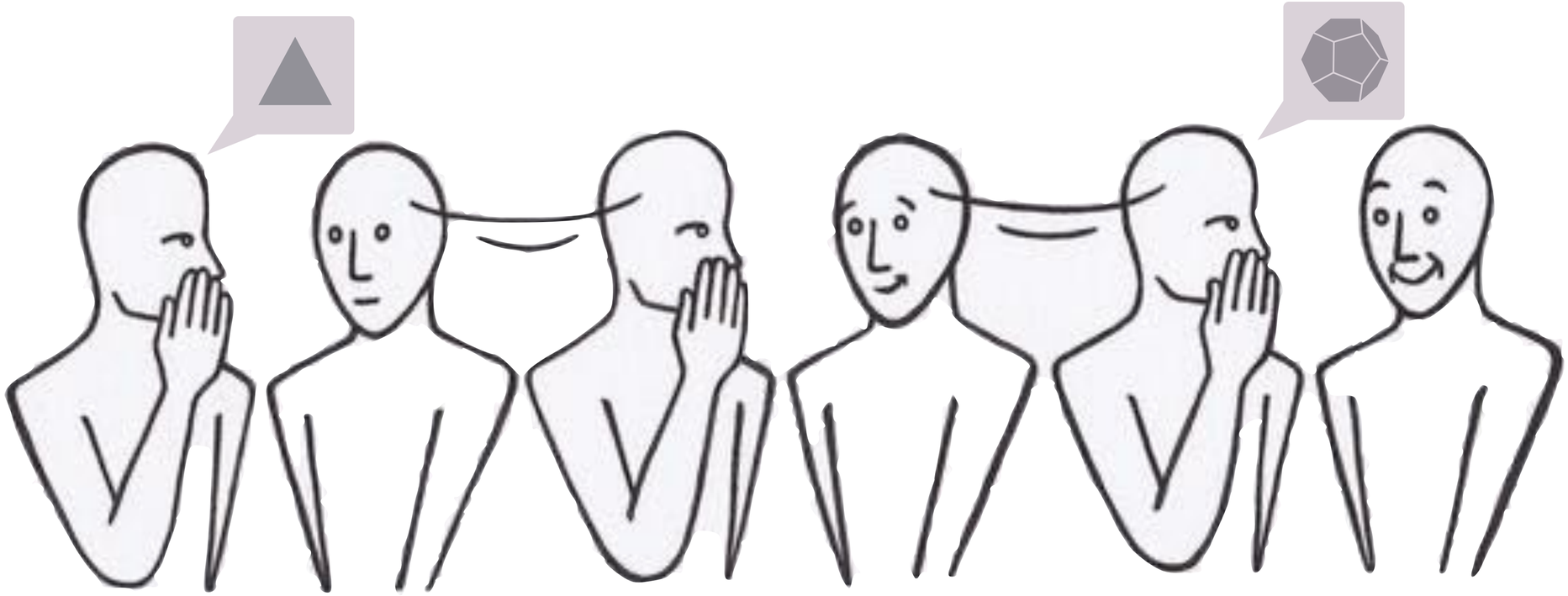
- William Faulkner

Maybe if you're Faulkner? But probably not for everyone.

Why is writing harder than reading?
Even in speaking or signing, **comprehension always outpaces production**.

Permanence and audiences

Spoken/signed language has a known* audience and an ephemeral signal; writing can broadcast indefinitely and last thousands of years.



With writing, you can’t necessarily rely on the reader; **you need to rely on the words.**

Make sure everything is ready a little bit earlier than usual on the day of the event

sure.

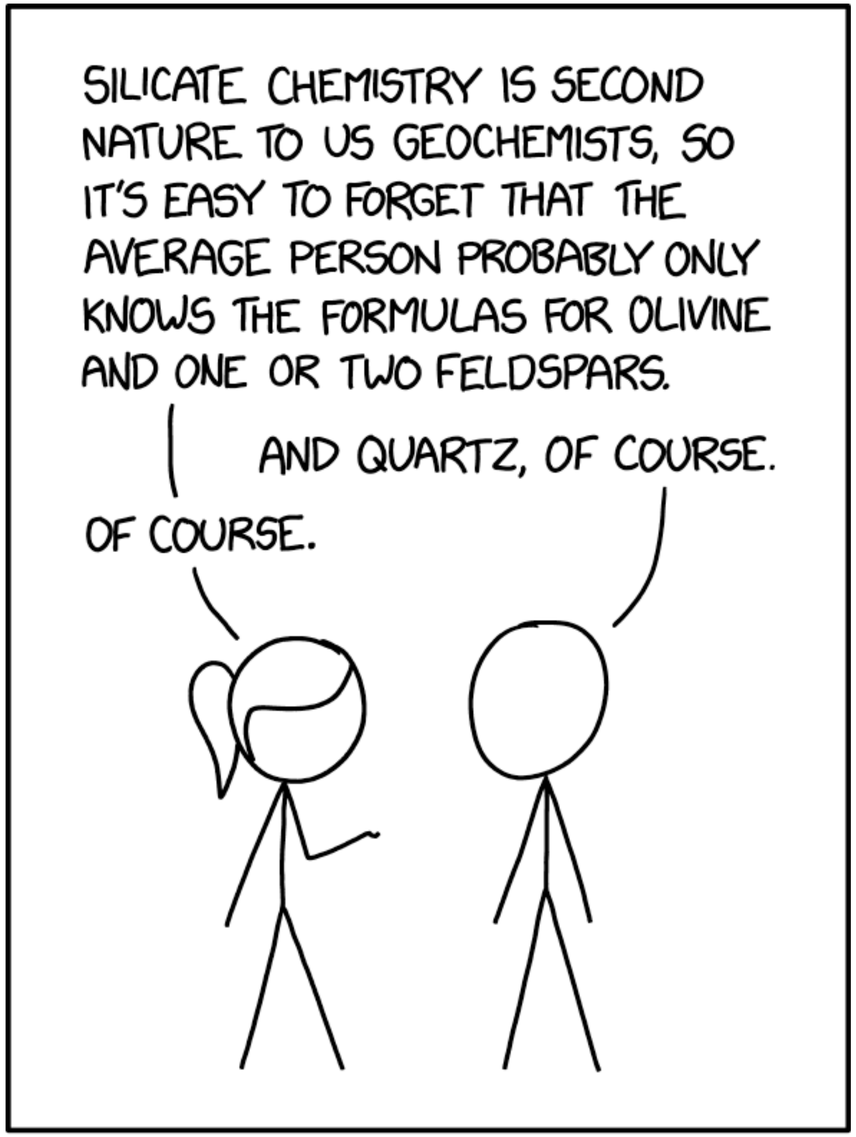
An often discussed dimension of the locality conditions on allomorphy is visibility. An equally important dimension is intervention: when do the trigger and target stop seeing each other? Through the lens of a detailed analysis of Greek verbal morphology, I examine the conditions under which intervention forces the insertion of a default exponent. On the basis of two case studies on affixal allomorphy and one on stem allomorphy, I argue that patterns of intervention are easily accommodated under adjacency-based theories of the locality of allomorphy, and mysterious under less restrictive alternatives.

?????

Paparounas, L (2024) Visibility and Intervention in Allomorphy: Lessons from Modern Greek. *Linguistic Inquiry* 55 (3): 537–577. doi: https://doi.org/10.1162/ling_a_00479

The curse of knowledge

I've probably been cursed in this very talk.



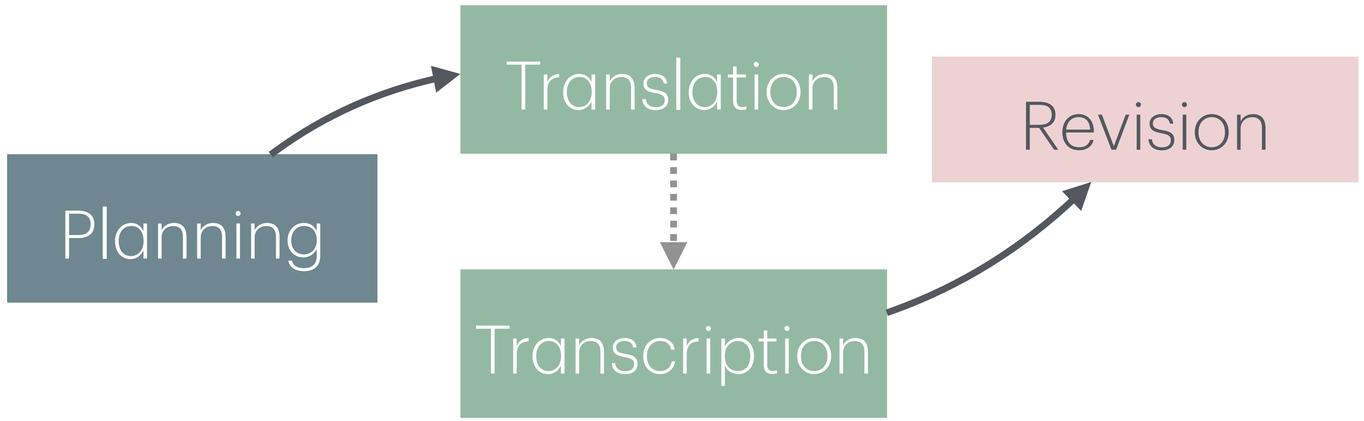
EVEN WHEN THEY'RE TRYING TO COMPENSATE FOR IT, EXPERTS IN ANYTHING WILDLY OVERESTIMATE THE AVERAGE PERSON'S FAMILIARITY WITH THEIR FIELD.

https://xkcd.com/2501/

Why is the curse of knowledge difficult to beat? It requires **mental recursion**.

All these mental gymnastics *while* writing.

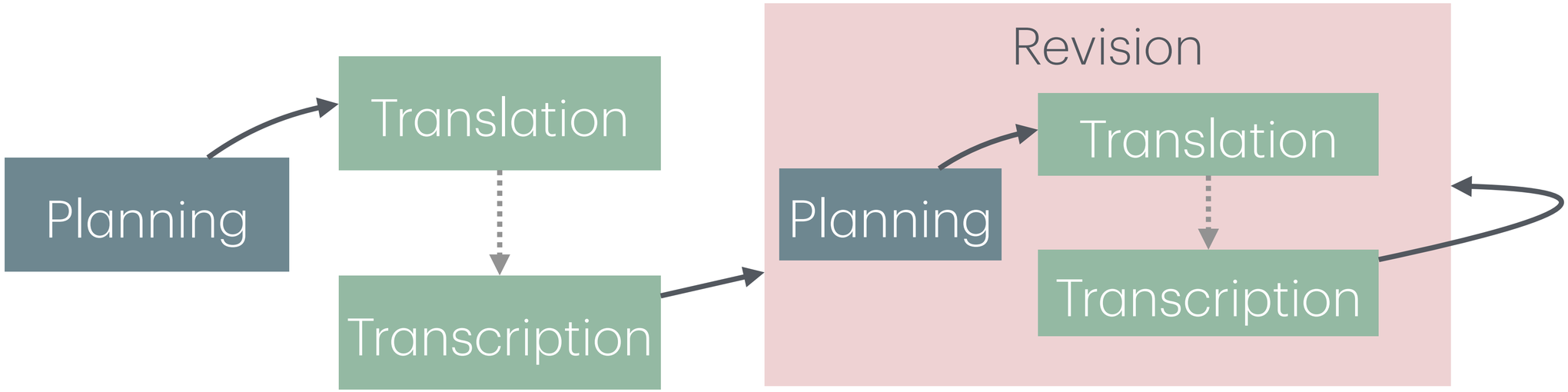
The traditional view of the writing process



Lo Sardo, D. R., Gravino, P., Cuskley, C., & Loreto, V. (2023). Exploitation and exploration in text evolution. Quantifying planning and translation flows during writing. *PloS one*, *18*(3), e0283628.

*Designed more to teach than *explain*.

Writing is itself a *recursive process*.



Lo Sardo, D. R., Gravino, P., Cuskley, C., & Loreto, V. (2023). Exploitation and exploration in text evolution. Quantifying planning and translation flows during writing. *PloS one*, *18*(3), e0283628.

Writing is a non-linear process, but the product is experienced linearly by the reader, uninterrupted by the writer.

This is different than spoken or signed language production, where we engage frequently in feedback and repair.

Effective revision is a kind of self-repair (or if you have a good editor, other-initiated repair)

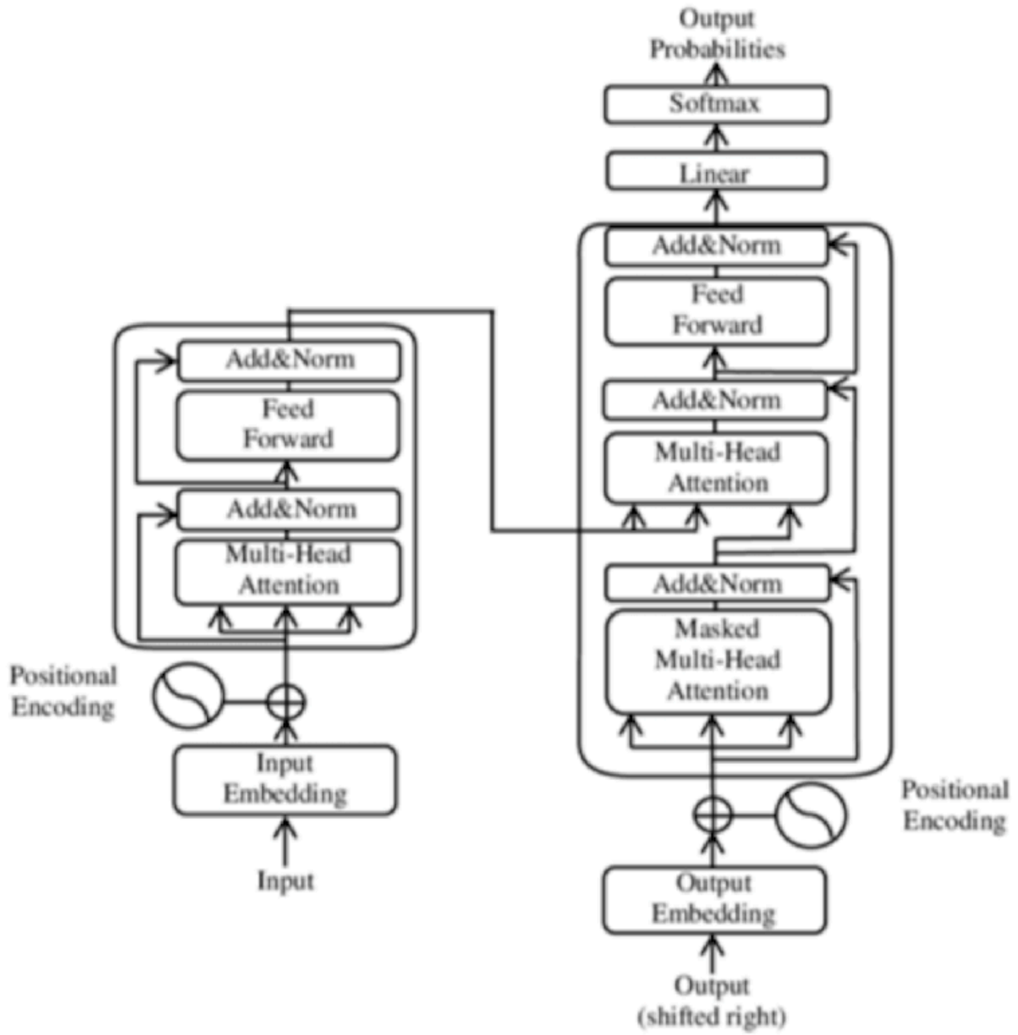
Dingemanse, M., Roberts, S. G., Baranova, J., Blythe, J., Drew, P., Floyd, S., ... & Enfield, N. J. (2015). Universal principles in the repair of communication problems. *PloS one*, *10*(9), e0136100.

Factors affecting the through line

What prevents an effective experience for the reader?

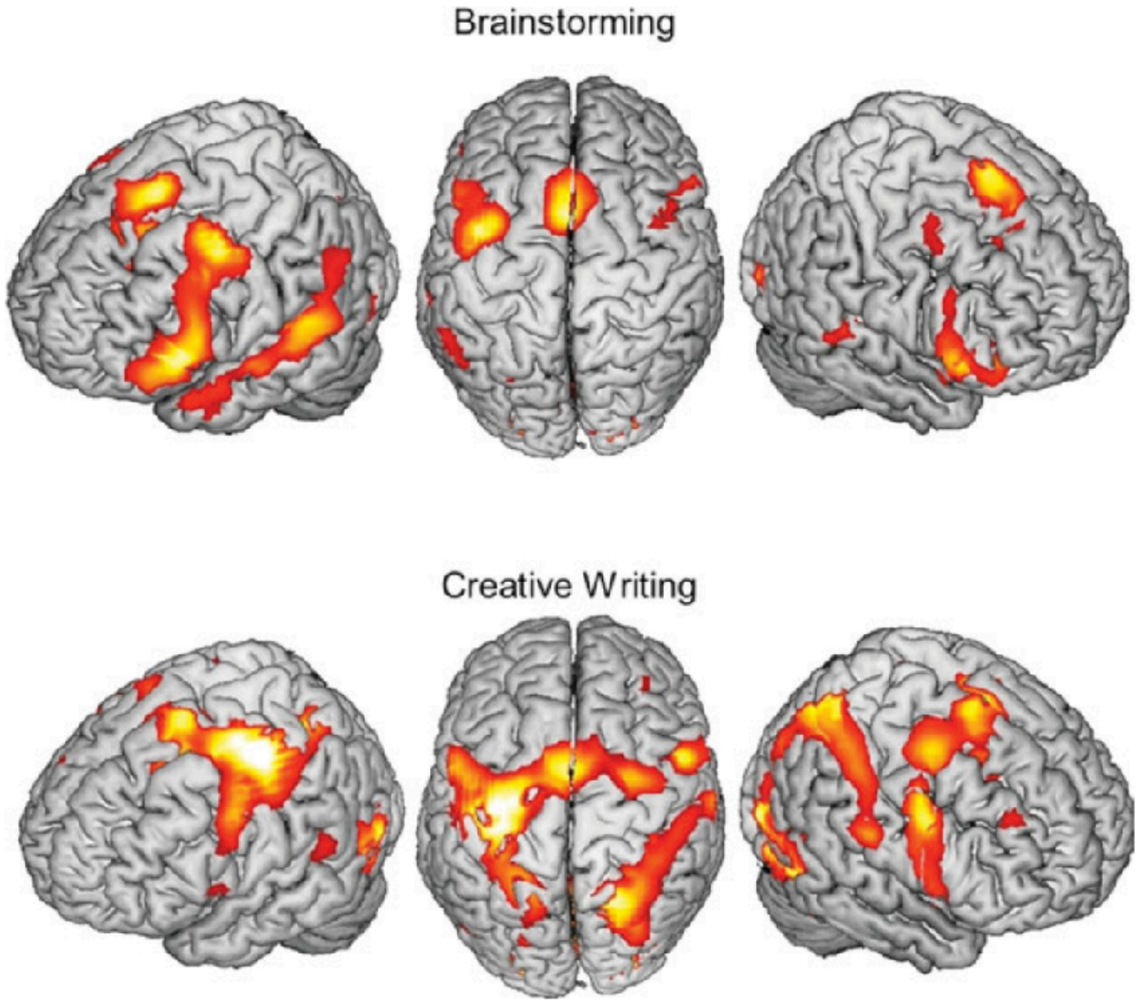
- The curse of knowledge means writers may “skip steps” in explanation, which can seem to the reader like logical leaps
- The mental recursion involved in taking the perspective of the reader is cognitively taxing, especially when *also* trying to write. Glitches are likely.
- The non-linear process (but linear product) increases the risk of creating a “corrupted timeline”, e.g., mentioning a new concept several times before actually explaining it.

Writing is non-linear, text generation *is* linear.



Vaswani et al., (2017) Attention is all you need. https://arxiv.org/abs/1706.03762

How does good writing happen?
What makes for an effective writing *process*
(not just product) under naturalistic conditions?



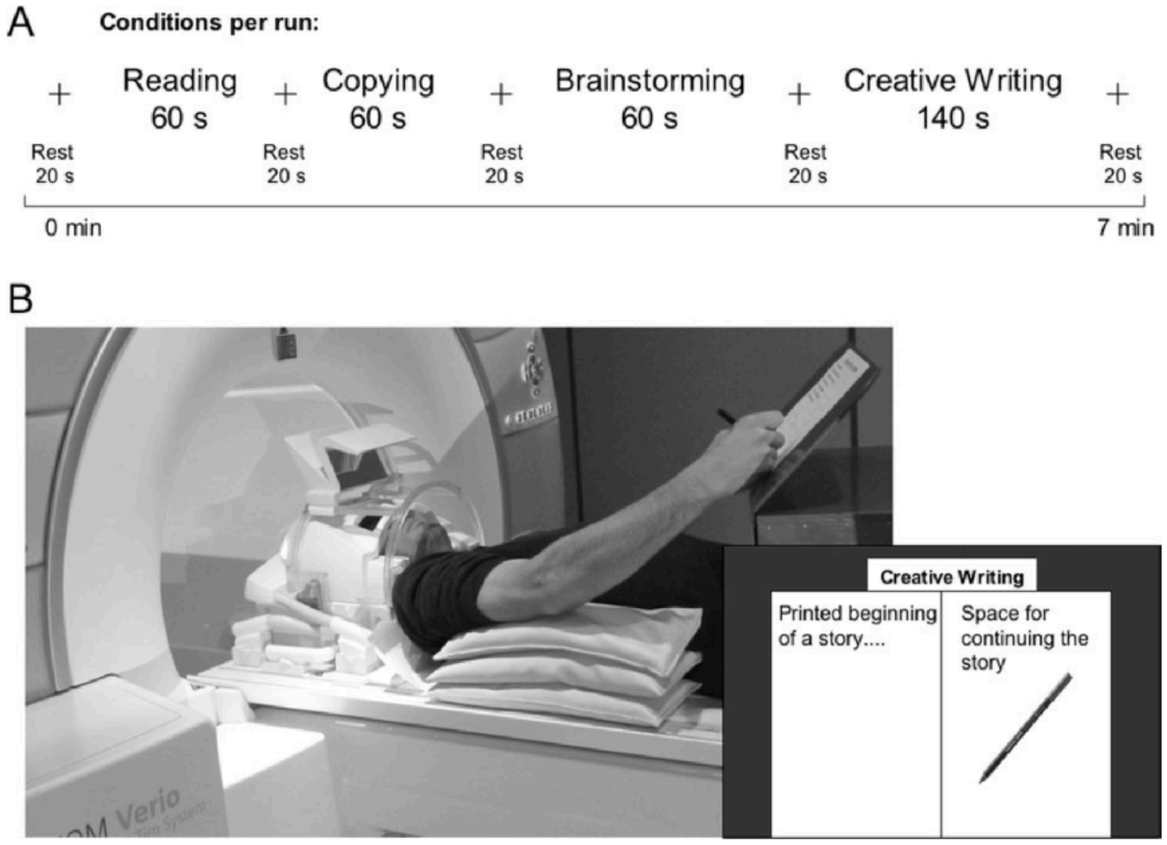


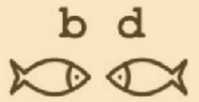
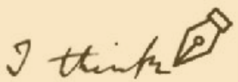
Figure 2.

Overview of the cortical activation map for the main effects of the conditions "brainstorming" (top row) and "creative writing"

Shah, C., Erhard, K., Ortheil, H. J., Kaza, E., Kessler, C., & Lotze, M. (2013). Neural correlates of creative writing: an fMRI study. *Human brain mapping*, *34*(5), 1088-1101.

The vast majority of research on language and cognition relies on (English) reading and writing.

...we know lots about reading, but much less about writing, and tend to conflate both with "language processing"

	English	Global diversity
	Mirrored graphs hinder mirror invariance detection	Written **Tamil** does not have mirrored graphs and its users are better at identifying mirror invariance
	Left-to-right cognitive biases evident in memory and attention are said to be innate	Readers of **Arabic** and **Hebrew** show right-to-left cognitive biases in accordance with their writing direction
	Auditory pitch and spatial height are inherently associated in non-linguistic tasks	**Farsi** and **Turkish** speakers do not display robust non-linguistic associations between pitch and height
	Large numerosities rely on a generative vocabulary for large numbers	Speakers of **Tsimané** resort to approximate number representations in simple numerical matching tasks according to their verbal count range
	Underdeveloped semantic distinctions in vocabulary render domains (like olfaction) less salient and memorable	Speakers of **Jahai** and **Semaq Beri** can reliably identify around a dozen "basic" smell categories, each of which receives its own linguistic label
	A relative frame of reference is used to represent and remember the location of objects	Speakers of **Guugu Yimithirr** remember objects and locations according to absolute coordinates
	Right-branching phrase structure is associated with better recall of the last (vs. initial) item in non-linguistic sequences	Speakers of **Japanese** and **Korean** (left-branching languages) have better recall for the initial (vs. last) element in non-linguistic sequences
	Absence of negatively biased mental verbs slows down the development of Theory of Mind (ToM)	Children acquiring **Spanish** (which has verbs indicating false belief) have better performance in false-belief tasks
	Describing caused motion events succinctly affects early allocation of visual attention in causal events	**Greek** speakers (who use different linguistic strategies for caused motion events) display a different pattern of visual attention

Blasi, D. E., Henrich, J., Adamou, E., Kemmerer, D., & Majid, A. (2022). Over-reliance on English hinders cognitive science. *Trends in cognitive sciences*, *26*(12), 1153-1170.

Likely substantial individual, cultural, and genre-related variation we know little about…

Thank you!

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