Faster and slower languages convey information at similar rates

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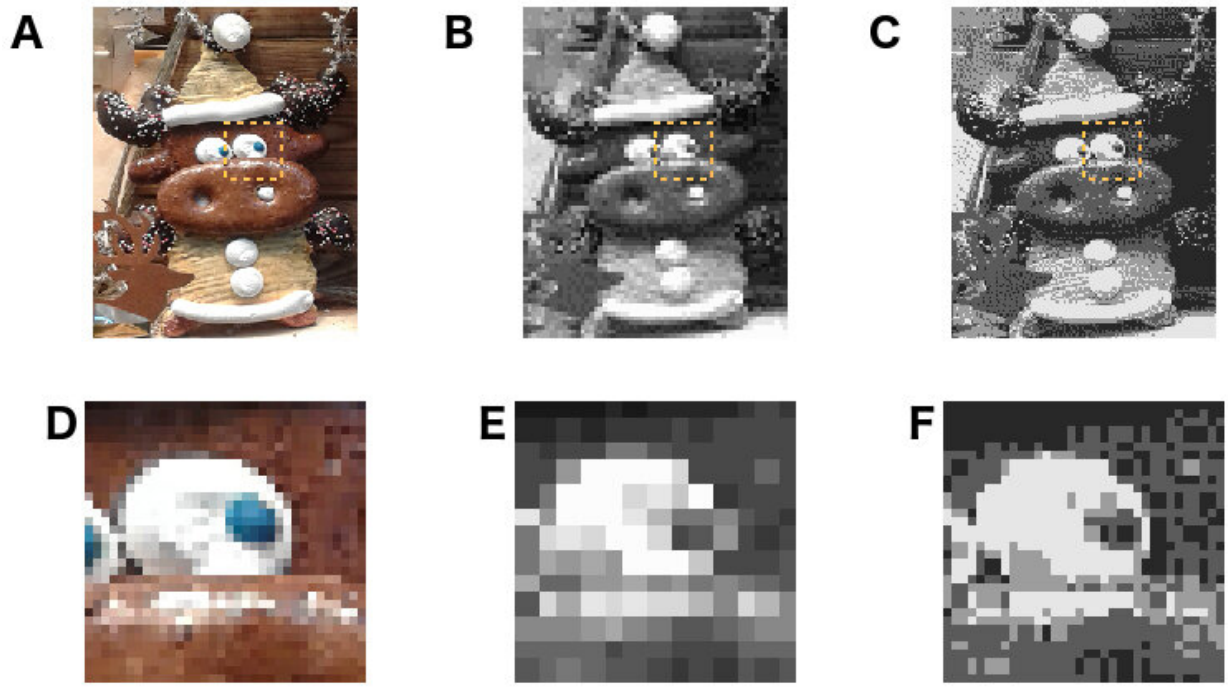

Language as a gingerbread reindeer: the two B/W versions use different resolutions and number of gray levels but encode the same info, just as languages trade off different strategies but are equally efficient. Credit: Dan Dediu, Université Lumière Lyon 2

Are some languages spoken faster than others? Are some structurally more complex? And, finally, are some better at transmitting information? These age-old questions might have received a surprising

answer in a new article published in the September 4th edition of *Science Advances*. The study, titled "Different languages, similar encoding efficiency: comparable information rates across the human communicative niche," conducted by an international and interdisciplinary team involving scientists at the Laboratoire Dynamique Du Langage/CNRS/Université Lyon 2 and Collegium de Lyon in Lyon, France, The University of Canterbury in New Zealand, Ajou University in Suwon, South Korea, and The University of Hong Kong in Hong Kong, reports the results of an information-theoretical analysis of 17 languages.

"Surprisingly, we find robust evidence that some languages are spoken faster than others (for example, Japanese and Spanish speakers produce about 50 percent more syllables per second than Vietnamese and Thai speakers). Also, some languages 'pack' more information per syllable due to their phonology and grammar (for example, English has about 11 times more types of syllable than are possible in Japanese)," explains co-author Dan Dediu. "However, more importantly, there is a trade-off between the two such that 'information-light' languages are spoken faster than the 'information-dense' ones, balancing out at a rate of about 39 bits/second in all languages in our sample. Crazy, isn't it?" asks Dr. François Pellegrino, lead author of the study and expert in linguistic complexity. These findings point at the existence of a relatively narrow optimal rate of information transmission, probably due to constraints, deeply embedded in the way our brains work, on how fast language can be processed and produced. However, there are several ways this optimum can be achieved: either you pack lots of information in each one of the few syllables coming out of your mouth, or you produce many fewer informative syllables. "It is like bird wings: you may have big ones that need few beats per second or you have to really flap the little ones you got, but the result is pretty much the same in terms of flying," adds Dr. Christophe Coupé, senior author of the study.

How is this optimum achieved? The authors suggest that each language and each speaker are a tightly coupled system, where changes in the structure of the language (due to normal processes of language change across decades or centuries) affect its informational content, and are compensated by the language users during development. "This may be one of the few true language universals out there and it results from pressures external to language," says Dr. Yoonmi Oh. Thus, languages and their speakers are like living systems inhabiting an ecological niche of information transmission.

A fascinating possibility is that acquiring a language may involve not only learning its sounds, grammar and words, but also its "preferred" rate of speech. So next time you complain that Spaniards speak too fast for your painfully-acquired phrasebook Spanish to keep up with, you might be right: adapt to the information-light syllables of Spanish syllables and just speed up!

More information: Christophe Coupé et al. Different languages, similar encoding efficiency: Comparable information rates across the human communicative niche, *Science Advances* (2019). DOI: 10.1126/sciadv.aaw2594

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