

How Sperm Whales Talk

Dialects, Pods, and the 2024 “Phonetic Alphabet” Off Dominica

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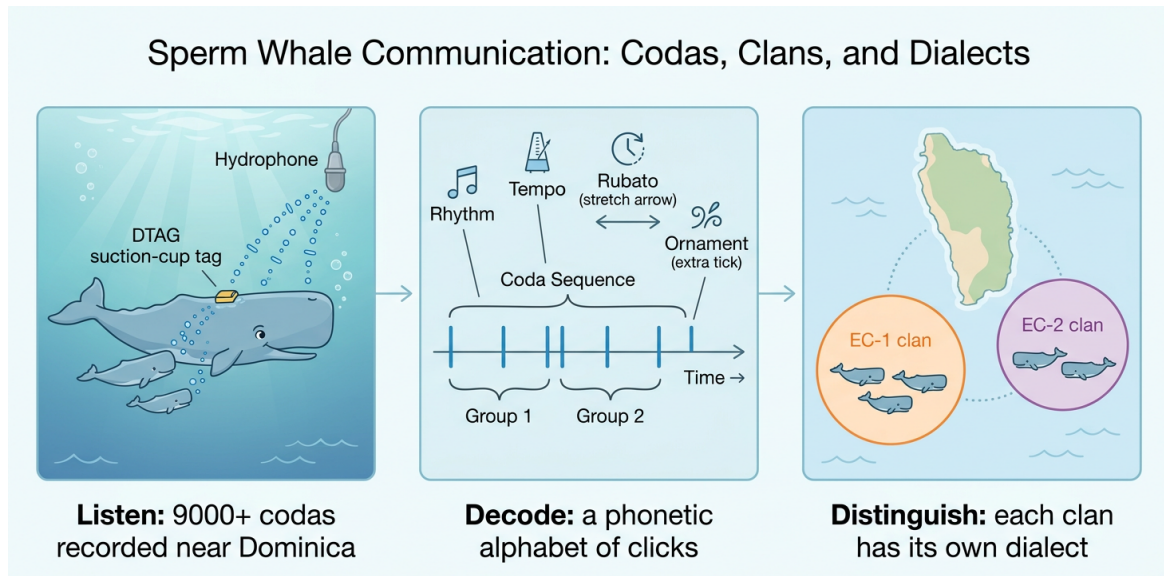


Figure 1: Graphical abstract. Researchers listen to thousands of clicks recorded by hydrophones and animal-borne tags off Dominica (*left*), decode the four acoustic “ingredients” that make up every coda (*center*), and use those fingerprints to tell the Eastern Caribbean’s two main vocal clans, EC-1 and EC-2, apart (*right*).

In a nutshell. Sperm whales talk in rhythmic bursts of clicks called *codas*. A 2024 study of the Dominica family showed those codas are built from four dials—rhythm, tempo, rubato, and ornament—creating a “phonetic alphabet” of at least 143 combinations. Each whale clan has its own accent, and individual whales even have recognizable voices.

If you lowered a hydrophone into the warm waters off Dominica, you would not hear singing. You would hear *typing*. The staccato clicks of sperm whales—the deepest-diving, biggest-brained animals on Earth—fill the water like Morse code. For two decades, marine biologists have wondered whether those clicks add up to anything we could call a “language.” This year, a team led by MIT’s Computer Science and Artificial Intelligence Lab and Project CETI gave us the strongest evidence yet that something remarkably structured is going on [1, 2]—and that each whale family in the Caribbean speaks with its own accent.

What “whale language” actually means

Sperm whales communicate in short bursts of clicks called *codas*. A coda is a tiny rhythmic pattern, usually three to twelve clicks long and over in less than two seconds—think of a Morse phrase tapped out on the ocean floor. Researchers do not claim codas carry words or grammar in the human sense. What they *do* show is that codas are far from random: they have repeatable

shapes, they cluster into “types,” and different whale groups use different sets of types. That is the textbook definition of a *dialect* [3, 4].

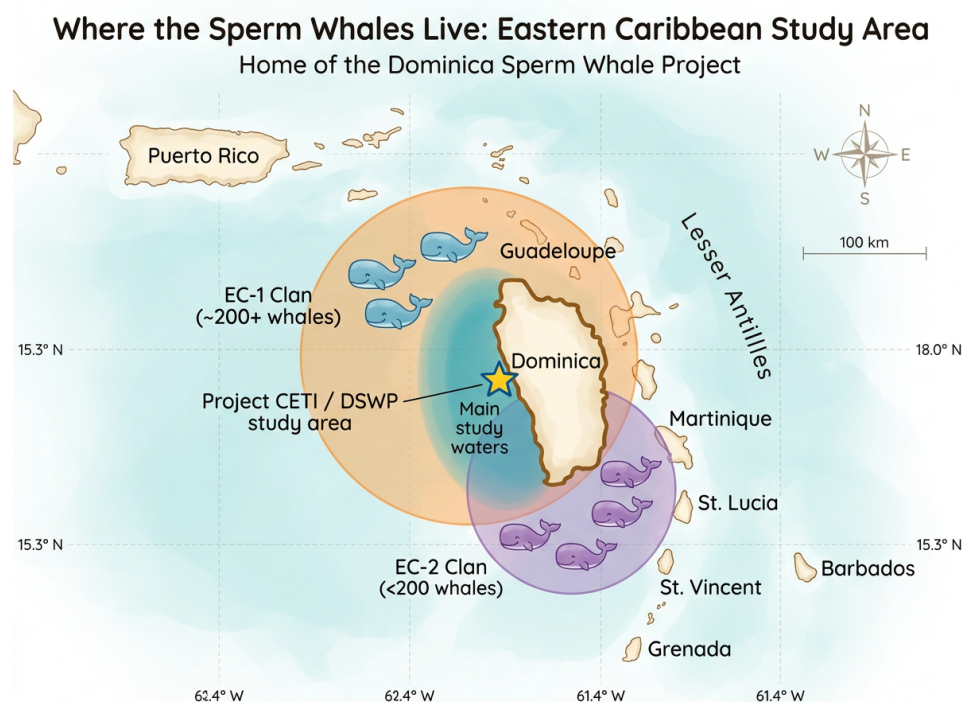


Figure 2: Where the study pods live. The Dominica Sperm Whale Project follows roughly 600 sperm whales along the Lesser Antilles. Two vocal clans share these waters but never socialize: **EC-1** (>200 whales, orange) and **EC-2** (<200 whales, purple) [5, 6].

What’s new this year off Dominica

In May 2024, Sharma and colleagues published an analysis of nearly 9,000 codas recorded by the Dominica Sperm Whale Project—the same families that biologist Shane Gero has been following since 2005 [1]. Using machine-learning tools, they argued that codas are not just a fixed list of phrases. Instead, every coda is built from four ingredients: **rhythm** (the tap pattern), **tempo** (overall speed), **rubato** (subtle stretching, like a jazz musician bending the beat), and **ornament** (an extra “grace-note” click added at the end). Mix these four dials in different ways and you get at least 143 distinct combinations from just 21 base types—a “phonetic alphabet” that could encode far more meanings than anyone previously imagined [7].

Anatomy of a Coda: How to Read a Sperm Whale Click Sequence

Example: the 1+1+3 coda — a clan signature in the Eastern Caribbean

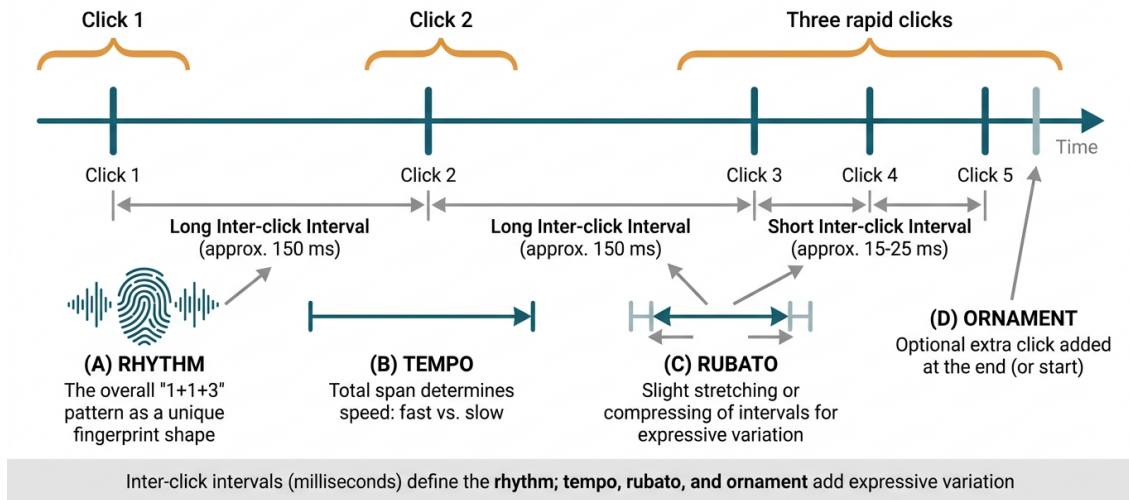


Figure 3: Anatomy of a coda. A worked example of the famous “1+1+3” coda—a five-click signature common to the Eastern Caribbean. The *rhythm* (A) is the fingerprint pattern of inter-click intervals; *tempo* (B) is the overall speed; *rubato* (C) stretches part of the pattern; and *ornament* (D) is an optional extra click. Together, these four dimensions form the phonetic alphabet [1].

How scientists tell the pods apart

Sperm-whale society in the Caribbean is layered. A handful of females and calves form a *social unit*, or pod; units that share dialects belong to a much larger *vocal clan*. The Eastern Caribbean has two such clans—EC-1 and EC-2—that share the same waters but never socialize, like neighbors who simply don’t speak the same language [3]. To tell them apart, researchers measure the time between every click (the *inter-click interval*) and look for fingerprints. In Gero’s 2016 study, a statistical classifier identified the correct pod from a four-click coda **88% of the time** and individual whales with up to **83% accuracy** [4]. The 2024 work goes further: even tiny “rubato” stretches seem to carry the speaker’s identity, like a familiar voice on the telephone.

Why a curious neighbor should care

We are still far from translating whale-talk. But knowing that codas have a phonetic alphabet, that they vary by clan, and that they even betray individual voices changes the conversation. It tells us the world’s largest toothed predator passes culture between generations—and that protecting one whale really does mean protecting a community of speakers [8].

A One-Screen Glossary

Click	A single, sharp broadband sound a sperm whale makes by snapping air through its enormous nasal passage. The basic “letter” of whale-speak.
Coda	A short, rhythmic burst of 3–12 clicks lasting under two seconds. The “word” or “phrase.”
Inter-click interval (ICI)	The fraction of a second between two consecutive clicks. The pattern of ICIs is what makes a coda recognizable.
Pod (social unit)	A small family group, usually 6–12 related females and their young. Eastern Caribbean pods are tiny by sperm-whale standards.
Vocal clan	A much larger “culture”—hundreds of whales across many pods that share the same coda dialect. EC-1 and EC-2 are the two big Caribbean clans.
Dialect	The repertoire of coda types that one clan uses and another doesn’t. Like a regional accent.
Phonetic alphabet	The 2024 idea that every coda is built from four dials —rhythm, tempo, rubato, and ornament—producing 100+ combinations.
Rhythm / Tempo	The pattern of clicks (rhythm) and how quickly the whole coda is delivered (tempo). Stable across contexts.
Rubato / Ornament	Subtle stretching of the pacing (rubato) and an optional extra click (ornament). These vary by speaker and situation.
DTAG	A suction-cup “black box” that records sound and motion from a single whale’s back, attaching peacefully and falling off after hours.
Project CETI / DSWP	The Cetacean Translation Initiative (CETI) and the Dominica Sperm Whale Project (DSWP), the two groups behind the 2024 findings.

References

- [1] Pratyusha Sharma, Shane Gero, Roger Payne, David F. Gruber, Daniela Rus, Antonio Torralba, and Jacob Andreas. Contextual and combinatorial structure in sperm whale vocalisations. *Nature Communications*, 15(1):3617, 2024.
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