Use of Spatial and Temporal Patterns to Communicate Ocean Science
D.L. ‘West’ Marrin
Water Sciences & Insights

INTRODUCTION
The Patterns and Rhythms of Nature are Universally Recognized.

General Observations
- Sharing interdisciplinary perceptions for approaching or representing challenges requires effective communication
- Jargon, mathematics and symbols are seldom compatible with images or sounds recognizable to most laypersons
- Do words, symbols or numbers represent good candidates for a common language—or not?
- Patterns (both spatial and temporal) are reportedly more easily perceived and discerned by humans
- Scientific descriptions often refer to sheets, geometries, distributions, vibrations, frequencies, and cycles

INTRODUCTION (cont.)

EXAMPLES
Similar Patterns are Created by Very Different Physical Processes.

Fractals consist of spatial and temporal patterns that initially appear random, but describe a wide range of oceanic processes, forms, and events.

Scientific Data Can Be Presented as Patterns to Convey the Information.

Rhythmic patterns appear in diverse aspects of nature on different timescales and in human endeavors such as music, dance, and drumming.

CONCLUSIONS
Many Different Systems Exist for Communicating via Patterns.

Communicating Ocean Science
- Increased recent interest in art-science collaborations that can present concepts and data more effectively
- Both art and science can be expressed in terms of spatial and temporal patterns or as network transformations
- Whereas patterns may not communicate science’s subtle intricacies, they can present its essential messages
- Pattern "languages" have been developed for software design, architecture, and other technical applications
- Patterns may be systematically categorized, illustrated, ranked, and exemplified to create a common base that users can apply, modify and refer to when communicating

EXAMPLES (cont.)

EXAMPLES
Water Sciences & Insights
D.L. ‘West’ Marrin

Similar fractal patterns appear in diverse aspects of the ocean on many scales; describing only appearance, but also growth and transformation.

At a molecular level, the complex networks of seawater swap connections and geometries that allow it to flow and interact with other substances.

Rhythmic and Geometric Patterns

The physics and chemistry of seawater can be portrayed as schematics that present the phenomena as different color schemes or network patterns.

Hierarchical image of the structure of molecular seawater

Pattern Identification Methods

- **TYPE/SOURCE:** natural, ideal, and abstract
- **FRactal DIAsEmENs:** interior or perimeter (1D to 3D)
- **CONNECTIVITY:** functional, structural, or informational
- **TEMPLe MatchINg:** sum of overlapping regions with a "standard" or "model" pattern
- **SPACE CLASSIFYING:** assigns different regions of a pattern to distinct measurable dimensions
- **SYNtACTICAL DIAsEmENs:** partitions pattern and assesses relationships between sub-patterns

Ocean Patterns and Rhythms

- Temperature patterns associated with events such as ENSO are rhythmic and linked to terrestrial vegetation patterns
- The tides are rhythmic oscillations of the ocean surface resulting from gravitational and centrifugal forces
- Oceanic circulation patterns occur over a range of scales, as do those of phytoplankton and other marine organisms
- Chemical and geological data can be portrayed as patterns and rhythms in either static or dynamic modes
- Oceanographic engineering can be displayed as designs and operations in terms of repeated patterns and rhythms

Ocean Patterns and Rhythms (cont.)

Spirals and vortices appear in the atmosphere and ocean over a range of scales and in human designs that transcend both cultures and millennia.

The oceans play a lead role in global climate and myriad planetary processes via their influence on on continents, freshwaters, and the biosphere.

Spirals and vortices appear in the atmosphere and ocean over a range of scales and in human designs that transcend both cultures and millennia.

The oceans play a lead role in global climate and myriad planetary processes via their influence on on continents, freshwaters, and the biosphere.

Pattern Identification Methods (cont.)