Coastal Science and Engineering
Quo Vadis?

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J.W. Kamphuis
Queen’s University at Kingston
→kamphuis@civil.queensu.ca←
Abstract:

This paper traces the development of coastal science and engineering and then tries to give some indication of a path into the future.
Concerns

- **Different** – This paper is different from the other papers presented.
- **Is this the place?**
- **Do we need this kind of historical analysis/peptalk?**
- **Difficulty** – \((2 \times \frac{3}{2} + 2 \times \frac{3}{4}) = \frac{1}{3}\)
What?

• This is a discussion.
• It is not a finished work – just a summary of some of my ideas.
• I can only present part of the material I have.
• I will (soon) post something: civil.queensu.ca
• This discussion needs all of us.
• I hope to generate some ideas
• I hope to hear from you
The history of Coastal Science and Engineering is related to the history of civilization and societal development.
Quick Review of some Concepts
Quick Review

Thinking (Western)

- **Age of Providence** – Please the god(s) and all is well

- **Age of Enlightenment** – Replace inscrutable laws of fickle god(s) with constant laws of nature, which can be studied and understood and in time we should be able to chart our own course.

- **A change in model** – *Paradigm shift*
Enlightenment resulted in:

- Systematic science to understand nature.
- Rapid expansion of knowledge about the laws of nature.
- Given enough time, we can understand everything and act accordingly to “improve the world”.
- The modern era has begun
But… :

- Philosophers such as Nietzsche and Heidegger began to question the “Yes we Can!” euphoria.
- This began in the late 19th Century
- It is a general perception today.
- This is the postmodern era.
- Everywhere, except in some areas of science and technology (and of course business).
Coastal Engineering grew up in the “Late Modern” age

- Wave forecasting for WW II landings
- Large expansion of facilities needed
- Shores and shore protection.
- ICCE began 1950.
Modern Aspects of Coastal Science and Engineering

- Given time and funding we could improve solutions and give accurate answers
- Funding was there
- The need for improvements to shores and facilities was there
- The computer arrived, increasing the euphoria
But then.....

- We began to distrust the basic tool of coastal engineering and research, the (hydraulic) model.
- Models had reached practical limits
- They could only provide answers up to a certain level of accuracy.
- Larger models would not produce better results and became too expensive for the clients.
And we found...

- There were no single, unique approaches and answers.
- Good coastal engineering is not necessarily considered good.
- This was our version of the end of modernity.
Quick Review

The End of Modernity

- Appears at different times in different disciplines.
- Philosopers – 19th Century
- Some Scientists and Engineers – 21st Century
At the End of Modernity

- Three Keywords:
  - Uncertainty
  - Sustainability (on a world scale)
  - Pluralism
Where to in Education?
Modern Concept of Learning
(Wolterstorff)

- It is a **Communal** activity
- Based on common human convictions (rational **Consensus**) of the players.
- We use our shared human capacities of Perception, Introspection, Reason
- To move toward a (higher) body of knowledge that also enjoys consensus.
- Single-Minded: **Consensus** ⇒ **Consensus**
PostModern Concept of Learning: (Wolterstorff)

• Consensus turns out to have been white, heterosexual, male, colonialist, whatever

• There are other viewpoints ⇒ Introduces Pluralism

• Many now say that all learning is “particularist and perspectival”

• The old model of “properly conducted” learning collapsed.
PostModern Aspects of (Higher) Education

- Accessibility
- Business
- Universities and Colleges meet on common ground (universities ↓)
Direction in Education

- **From**: a hierarchical system: Recognised universities hire professors of repute who teach students through **Structured lectures** (+ tutorials)

- **To**: more flexible education with dialogue, focusing on **Teaching theory + skills + relationships**
And to:

- Integrated learning (incorporates pluralism).
- Greater emphasis on design courses, teamwork, interdisciplinarity, communication, self-directed learning, problem solving.
- Seminars, workshops replace formal lectures.
That Fits Because:

- Students who:
  - learned through Sesame Street clips,
  - listen only to sound bites,
  - are accustomed to < 4sec images.
- Cannot sit through a 50 min lecture anyway
  - Even with slides, video and pizzaz
That fits because:

- Students who have been coached (in music, sports, etc.)
- Respond well to project work guided by “resource persons”.
That fits because:

- Students’ internet experience is useful for multi-input and multi-tasking
- Power Point and Internet fit with case studies, projects, pictures and practical examples.
But...

- There is a danger:
  - “knowledge” suffers at the hands of “experience”.
  - Engineering **is different** from hockey.
  - Hockey theory? Fluids theory!
ASCE “Civil Engineering Body of Knowledge for the 21st Century”
Where to in Research?
Present day research tends to be refinement of what we know. Much of our research is expected to provide new insight through:

- New and better measurements
- More sophisticated computer programs
- Lack of reading has caused the wheel to be re-invented.
Research is:

- Present trend is toward research factories:
  - They are businesses that must produce a line of product (papers, HQP’s),
  - They cannot be too novel – dead ends don’t pay off,
Where to in Research?

- We need more innovation, particularly now, at the turn of an era.
- We need a culture change from safe, comfortable, à la moderne, mechanistic.
- Paradigm Shift.
We need more pluralistic viewpoints; more inter-disciplinary and integrated research

Engineering research needs less emphasis on diagnosis and more emphasis on cure.

- We need more application
- More development
- More engineering
Authority

- Modern: Governments
  - Funded (research and education)
  - Managed (research and education)
  - Comfortable employer.

- Postmodern: **Pluralistic** mix of stakeholders, property owners, environmental groups, tourism industry and government.

- Vague (**uncertain**) instructions.
Accept that we live in a postmodern culture.

Accept uncertainty
- In authority, direction, results, solutions.

Learn to communicate postmodernity and uncertainty.
- Particularly to clients who do not want to hear this.
Recognise that there are no ultimate solutions – just optimum solutions

Optimisation of solutions includes not just:
- Financial
- Client satisfaction

But also:
- Sustainability (on a world scale)
- Pluralism - Biological, sociological, etc impacts
Quo Vadis?

Teaching and Research needs to become:

- More innovative (less extension of Status Quo)
- Move from diagnosis (analysis) to cure (synthesis).
Summary

- We must realise that times are a-changing (have changed actually) – a **paradigm shift from modern to postmodern** is a useful concept to include in our thinking.
- We need to change with the times in teaching, research, science and engineering.
- We need to adapt to different authority.
Summary

- We need to understand, incorporate and communicate
  - Uncertainty
  - Sustainability
  - Pluralism.
- We need to get clients used to these.
- We need to address real problems instead of just perfecting what we know.
In this time of upheaval in our thinking and doing, we must remain hopeful and confident.

Yes, we can!, but differently.

Times of change are times of opportunity!

Summary