

Embodied Mathematics and Education;
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The diagram consists of three light blue circles. On the left, a large circle contains the text 'An Embodied Experience'. Inside this circle is a smaller white circle containing the text 'Mathematical Understanding'. To the right of the large circle are two smaller circles stacked vertically. The top circle contains the text 'Cognitive Mechanisms (Referential Systems grounded in physical sensations/ activities)'. The bottom circle contains the text 'Innate abilities with basic addition/ Subtraction'. The circles are arranged to suggest that embodied experience and cognitive mechanisms both contribute to mathematical understanding, while innate abilities provide a foundational layer of skills.

An Embodied Experience

**Mathematical
Understanding**

**Cognitive Mechanisms
(Referential Systems
grounded in physical
sensations/
activities)**

**Innate abilities with
basic addition/
Subtraction**

Conceptual Metaphors
(to make the abstract concrete)

Argument is War

Arithmetic is object
collection

Arithmetic is object
Construction

Grounding
Metaphors (Correlations between
sensory and abstract)

Arithmetic is motion
along a path

Measuring
Stick

Image Schema (patterns of thought
derived from senses and
perceptions systems)

Container
Schema

Conceptual Metaphors and
Blends

Perception, Culture and Language

Where does Mathematics
Come from?

“Even the most abstract mathematical concept bears traces of its origin in physical perception and motor activity, and is this, embodied.”

Each layer of metaphor carries the structure to other domains

Complex Networks grow as domains are connected

Geometric rotations around a point and the embodied act of rolling or spinning

Relying on a Single Metaphor

Using inappropriate metaphors

Red Cards or Queen Cards; missing the intersection

Vector as a Force V . Vector as a Journey

Addition always leads to a larger quantity (Object collection and Integers)

Difficulties with Math

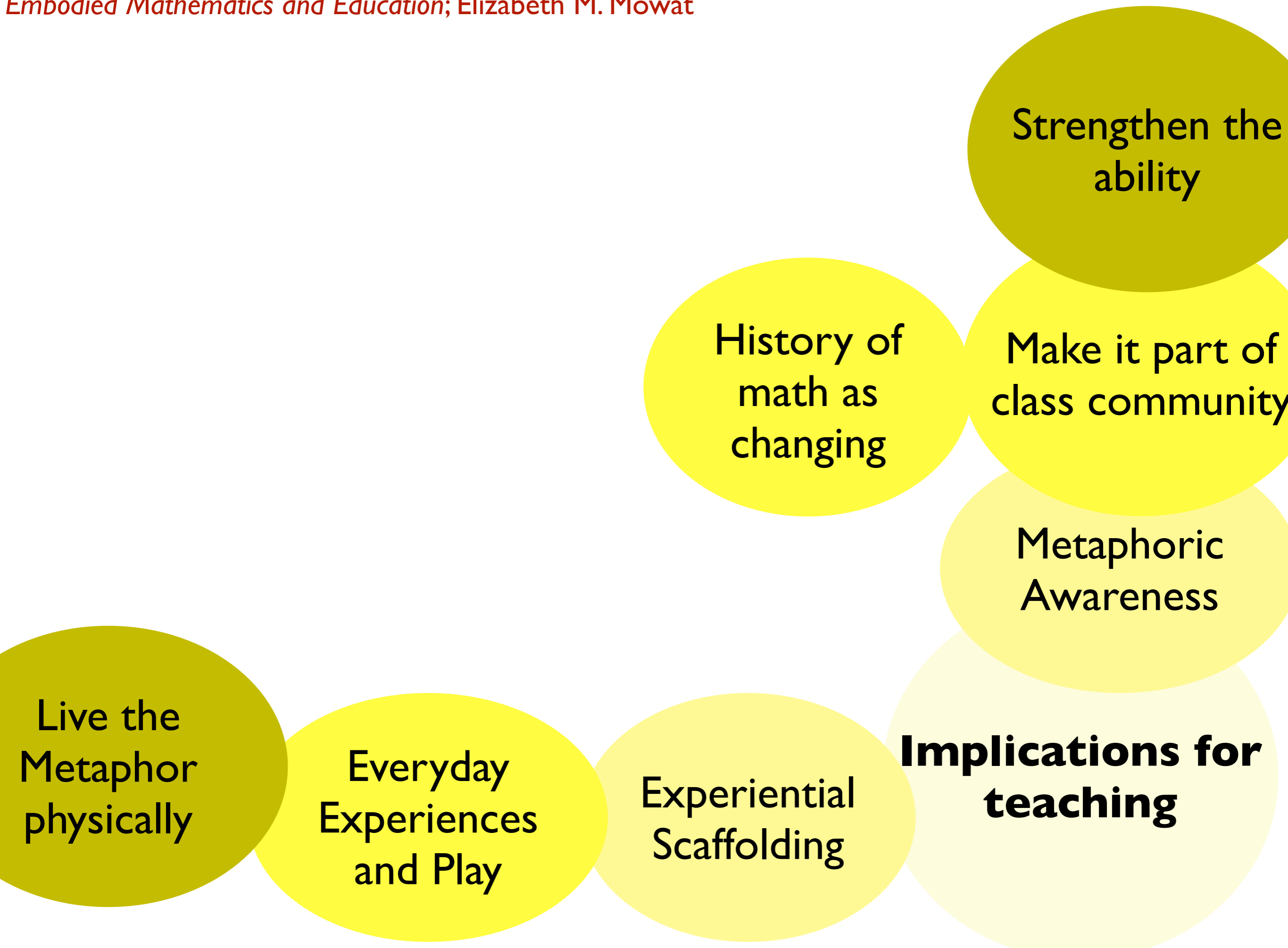
Not Integrating Multiple Metaphors

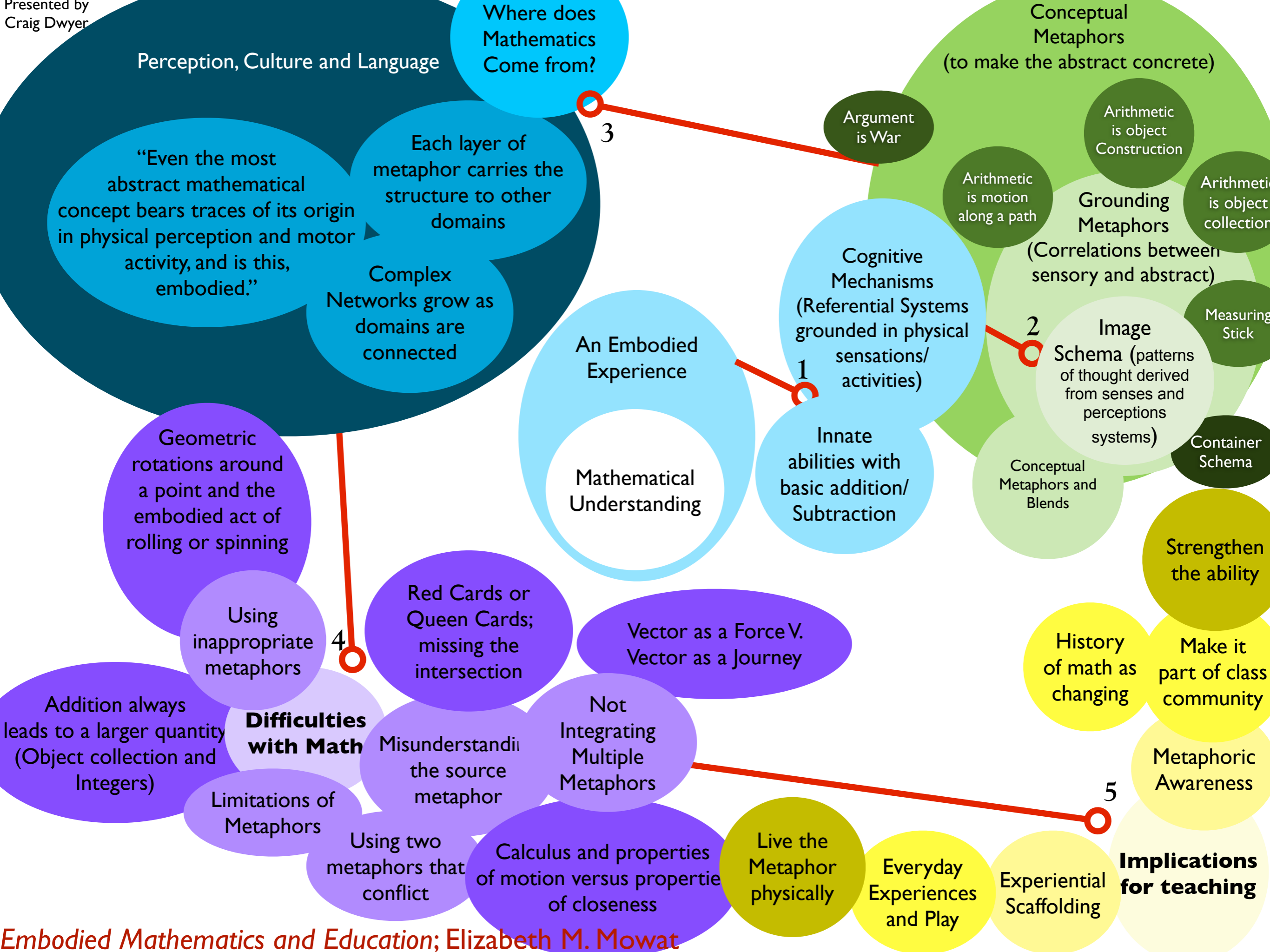
Misunderstanding metaphors

Limitations of Metaphors

Using two metaphors that conflict

Calculus and properties of motion versus properties of closeness





??Questions??

How does our culture affect our understanding of mathematics? How does a changing culture (or language) affect the metaphors and understanding? Can we understand a changing culture?

What is embodied in the “*Digital Natives*” generation that perhaps is not embodied in us?

Is tracing metaphors and errors in metaphors a useful practice for you as an educator?

Is this work accessible to administrators, teachers, students, parents (educational communities)?
Would it be possible to implement into our existing system of math education?

Is schooling an embodied experience, or is it disembodied?

What is the role of our physical bodies in math class? Do classrooms allow for a space to explore metaphors of the physical, cultural, and linguistic worlds?