The Scientific Mind:
Why should we care?

Some thoughts at the start of the
Third Advanced International Colloquium on
Building the Scientific Mind

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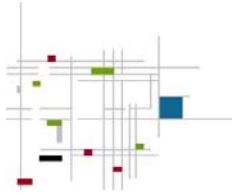


Structure of this conversation

1. Some of my own thoughts to start with.

2. Your thoughts to correct, amend and transcend mine.

But first some history.

BtSM History:

What came before, will follow, and otherwise relates to BtSM2009

- Overcoming the Underdevelopment of Learning (AERA Symposium, Montreal, 1999 - http://www.learndev.org/aera.html)
- Learning stories research (from 2000 - http://www.learndev.org/AECT2000Denver-LStories.html)
- Meaning of Learning dialogue (MOL—meetings, workshops, publications: http://www.learndev.org/MoL.html)
- Book of Problems dialogue (BOP—meetings and publications: http://www.learndev.org/BOP.html)
- The Scientific Mind dialogue (TSM—http://www.learndev.org/SciMind.html)
  - BtSM2005—The Hague (http://www.learndev.org/ColloquiumBuildingTSM2005.html)
    - BtSM—New Delhi (national meeting - http://www.insaindia.org/report-buildingscientificmind.pdf)
  - BtSM2007—Vancouver (http://www.learndev.org/BtSM2007.html)
  - BtSM2009—Cairo (http://www.learndev.org/BtSM2009.html)
    - Supplemented by meetings at the national level before and after.
  - BtSM2011—Stellenbosch
- Emerging ideas in the relevant literature
- **Sharing meals and walking together have often been crucial to furthering the dialogue. We are glad to continue the tradition.**

Key issues requiring attention

1. Re-imagining learning (beyond mere schooling) and the environments that foster it.
2. Mindsets that are essential to the human ability to interact constructively with change.
3. Deep understanding of what we are, where we come from, and what may ensue, i.e. awareness and appreciation of our home in the universe.
4. Figuring out what is required to change the conditions of learning in response to the challenges of our time.

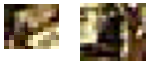
1

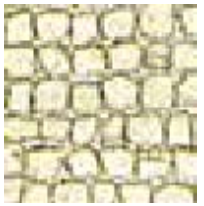
Re-imagining learning and the spaces where learning occurs.

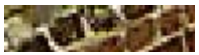
Let's first talk about learning.

What is it?

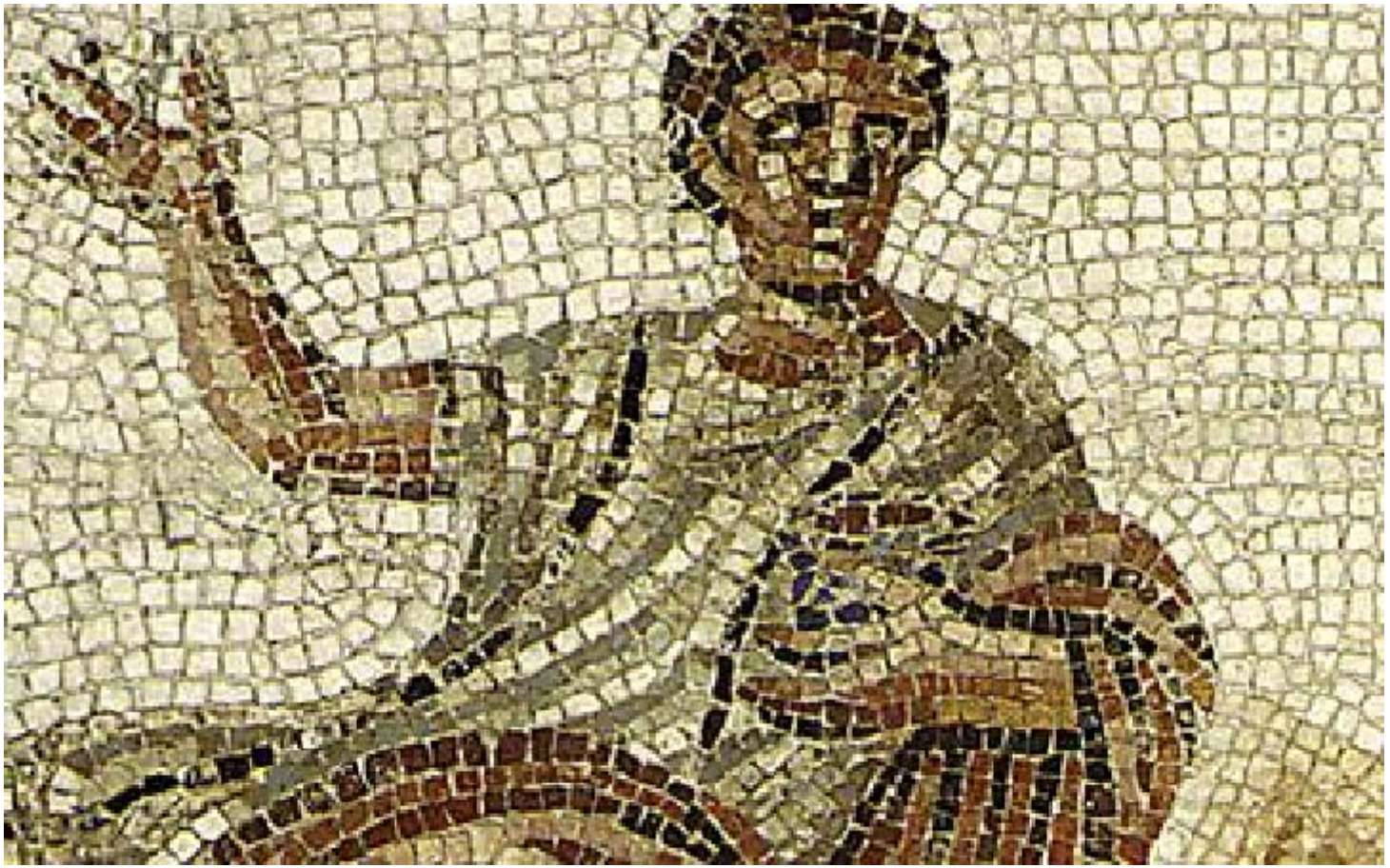
The little we know







Putting the picture together



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Placing things in context

Learning stories research

RESULTS:

What makes a learning experience meaningful?

- Ownership of knowledge.
- Maintained across the lifespan.
- Laying path for continued growth.
- Implications in the ‘real-life’ context.
- Teaching.
- Overcoming negative perceptions of self.
- Discovery of persistence as strategy to manage life’s challenges.

Learning undefined

*"Human learning is the **disposition** of **human beings**, **and** of the **social entities** to which they pertain, to engage in continuous **dialogue** with the human, social, biological and physical environment, so as to generate intelligent behavior to **interact constructively with change**."*

Visser , J. (2001). Integrity, completeness and comprehensiveness of the learning environment: Meeting the basic learning needs of all throughout life. In D. N. Aspin, J. D. Chapman, M. J. Hatton and Y. Sawano (Eds), *International Handbook of Lifelong Learning* (pp. 447-472). Dordrecht, The Netherlands: Kluwer Academic Publishers.

Schooling makes a minor contribution

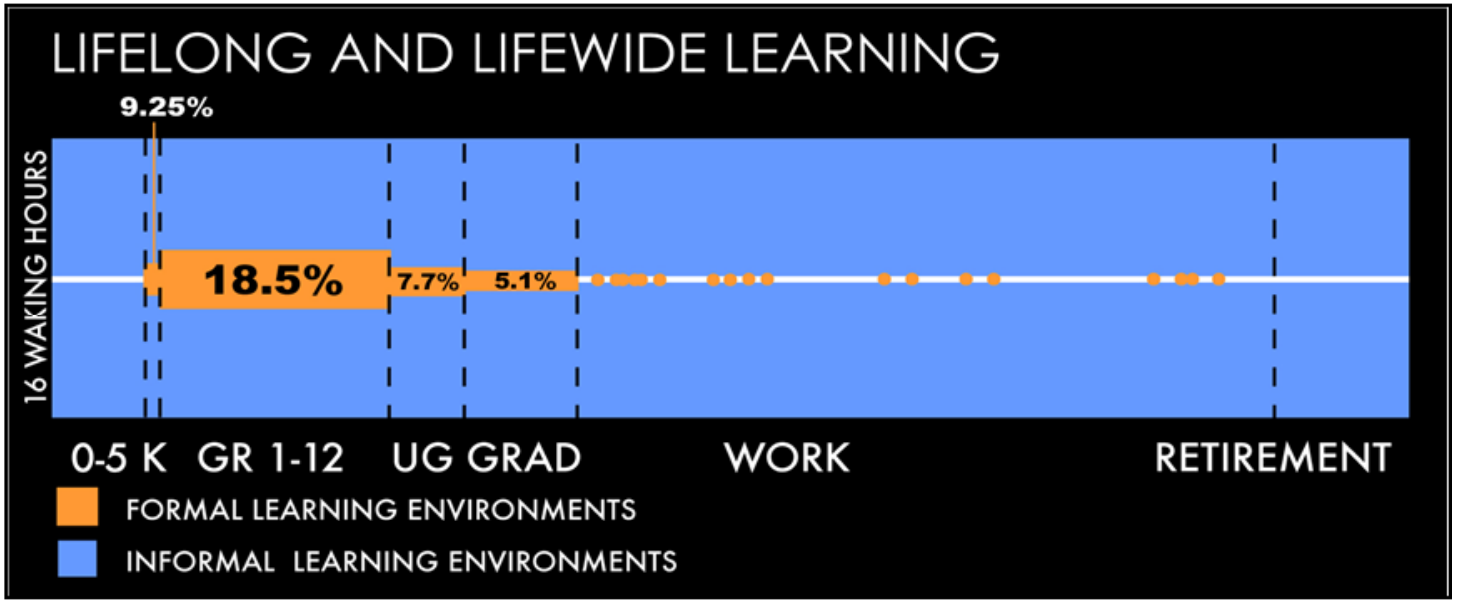


Figure 3-1. The LIFE Center's Representation of Lifelong and Lifewide Learning

Source: Bransford, J. D., Slowinski, M., Vye, N., & Mosborg, S. (2008). The learning sciences, technology and designs for educational systems: Some thoughts about change. In J. Visser & M. Visser-Valfrey (Eds.), *Learners in a changing learning landscape: Reflections from a dialogue on new roles and expectations* . Dordrecht, The Netherlands: Springer.

The learning landscape is one!

- Schooling only a relevant part if adequately conceived and designed:
  - Integral component of lifelong and lifewide learning journey.
  - Fluid connections with other learning spaces: family, nature, community, media, productive and creative activity, etc.
  - Driven by vision of today's problems and challenges and awareness of essential values.
  - Geared towards building the mind rather than storage of factual knowledge.
  - Ability to acquire knowledge and wisdom more important than possession of knowledge.
- Informal learning at least as crucial and pervasive, and certainly more diverse (probably even more important), but different in terms of deliberate intervention (different players).

Important foci for learning in school
(according to David Christian)

- Understanding our place in the universe:
  - Spatio-temporal perspective.
  - Questions of origin.
  - Planet earth as one among many products of the evolution of the universe.
  - Humans as the product (in ecological context) of physical, chemical and biological evolution.
  - History of human life on earth.
- Learning relevant skills for now, and the ability to acquire them in the future.
- Envisioning humanity's futures in a planetary perspective

(see http://www.learndev.org/dl/OriginsCurriculumIdeas.pdf and also Edgar Morin: Seven complex lessons in education for the future – http://unesdoc.unesco.org/images/0011/001177/117740eo.pdf).

Alternate perspective of what's important
(according to Kieran Egan)

Foster the development of the cognitive tools that shape our understanding.

Kind of understanding	How they work
Somatic	Bodily experience.
Mythic	Awareness of the known as embedded in the unknown; mystery; awe; metaphor.
Romantic	Identification with heroes; association with the transcendent qualities the heroes embody.
Philosophical	The world of ideas; conceptual frameworks; abstractions.
Ironic	Recognition of different meanings through different kinds of understanding; humor; ambiguity.

2

Mindsets essential to constructive interaction with change.

What's so special about humans?

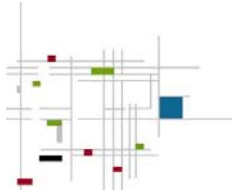
Consciousness.

We are unique and vulnerable.

Thoughtfulness (skepticism) is essential to our ability to interact constructively with the change we create and adapt to.

Human uniqueness (and vulnerability)

- Gerald Edelman: Higher order consciousness is a unique human feature. It is expressed in the ability to interpret the past and imagine the future.
- Blaise Pascal: Humans are *thinking reeds.*
- Stephen J Gould: “Consciousness, vouchsafed only to our species in the history of life on earth, is the most god-awfully potent evolutionary invention ever developed. Although accidental and unpredictable, it has given *Homo sapiens* unprecedented power both over the history of our own species and the life of the entire contemporary biosphere.”



In praise of thoughtfulness
(Skepticism – Gr. *Skeptic* = thoughtful)

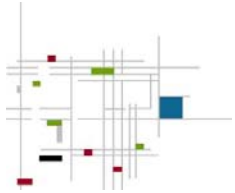
Carl Sagan (in 1987 Pasadena lecture on *The Burden of Skepticism*): "It seems to me that what is called for is an exquisite balance between two conflicting needs: the most skeptical scrutiny of all hypotheses that are served up to us and at the same time a great openness to new ideas. If you are only skeptical, then no new ideas make it through to you….

On the other hand, if you are open to the point of gullibility…, then you cannot distinguish useful ideas from the worthless ones. If all ideas have equal validity then you are lost, because then, it seems to me, no ideas have any validity at all."

Another call for thoughtfulness

Stephen J Gould: “Skepticism is the agent of reason against organized irrationalism—and is therefore one of the keys to human social and civic decency.”

Source (like the previous Gould quote): Shermer, M. (1997). *Why people believe weird things: Pseudo science, superstition, and other confusions of our time*. New York: W. H. Freeman and Company



3

Our home in the universe and what we made of it.

A reality check.

Humanity in perspective

Event	Real time	7-day time scale	
Universe	13.7 billion years ago	Day 1	
Life	3.43 billion years ago	Day 6	
Hominids	5 to 10 million years ago (¼ to ½ million generations)	Day 7	5 minutes ago
Humans	100 to 200 thousand years ago (5 to 10 thousand generations)		6 seconds ago
Agriculture	10000 years ago (500 generations)		< 0.5 sec ago
Galileo	4 centuries ago (20 generations)		< 0.02 sec ago

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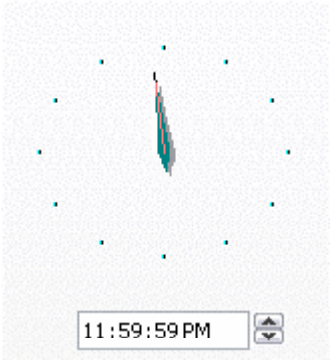
Consequences of human intervention

Agricultural revolution started half a second ago.



8000 BCE	8 million
0	250 million
1600	500 million
1800	1000 million
1960	3041 million
2000	6082 million
2008	6677 million

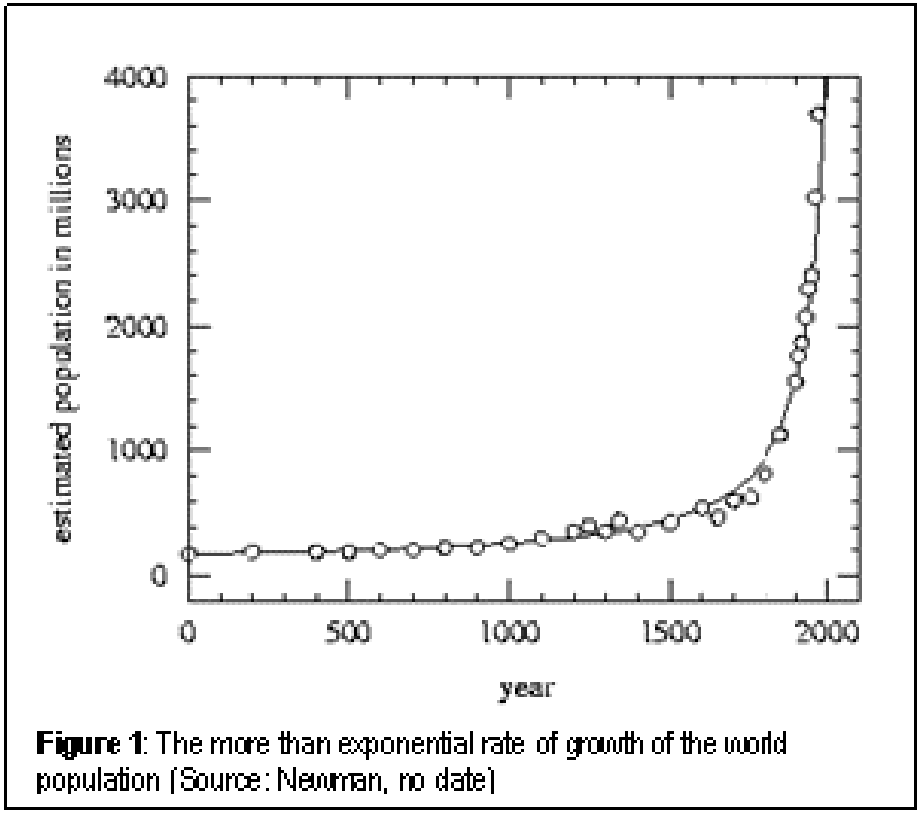


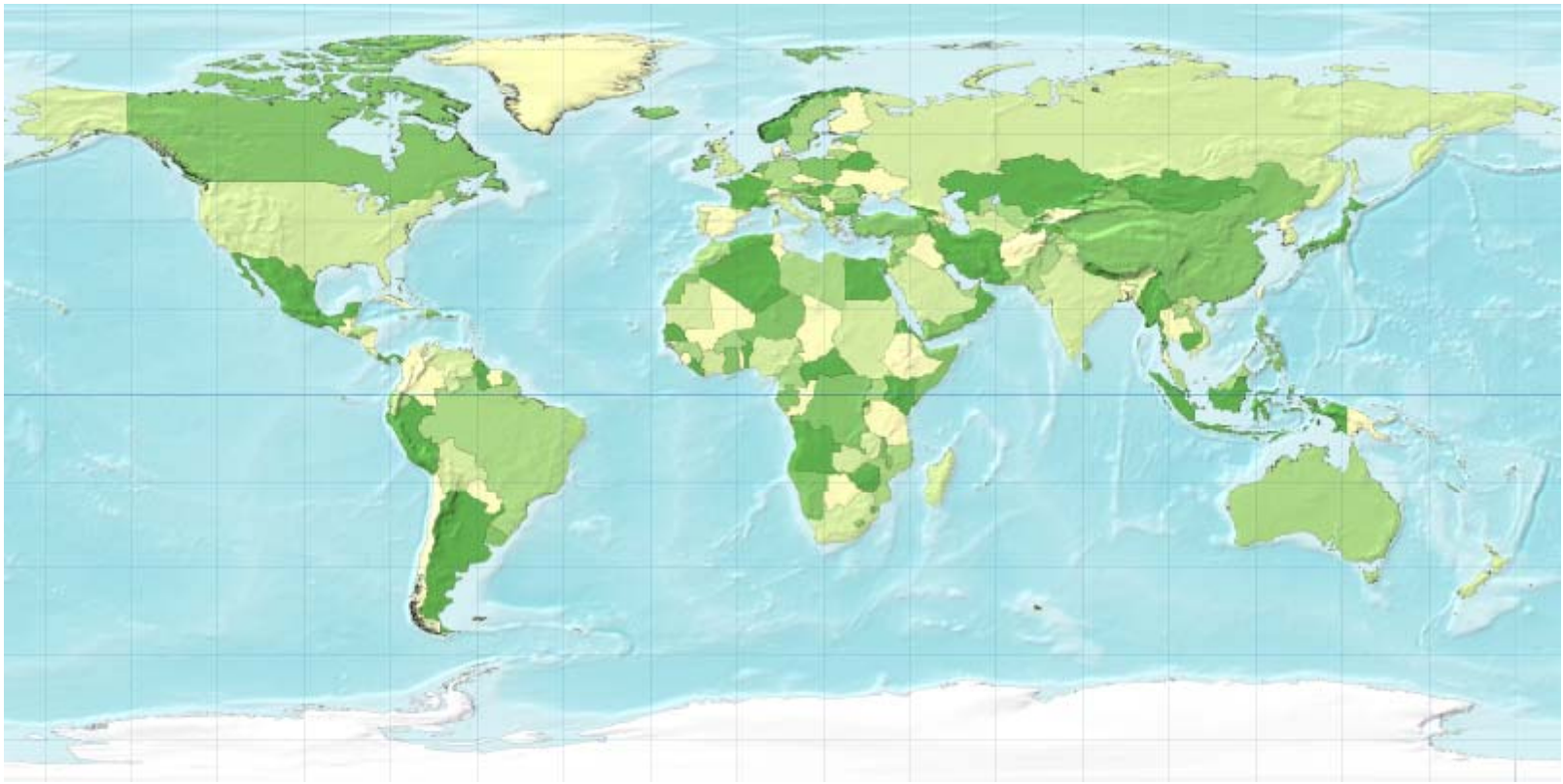
Figure 1: The more than exponential rate of growth of the world population (Source: Newman, no date)

The world: A distorted place to live in

Source: Images of the social and economic world – Mark Newman, University of Michigan

http://www-personal.umich.edu/~mejn/cartograms/

The world as we know it



Source: Images of the social and economic world – Mark Newman, University of Michigan

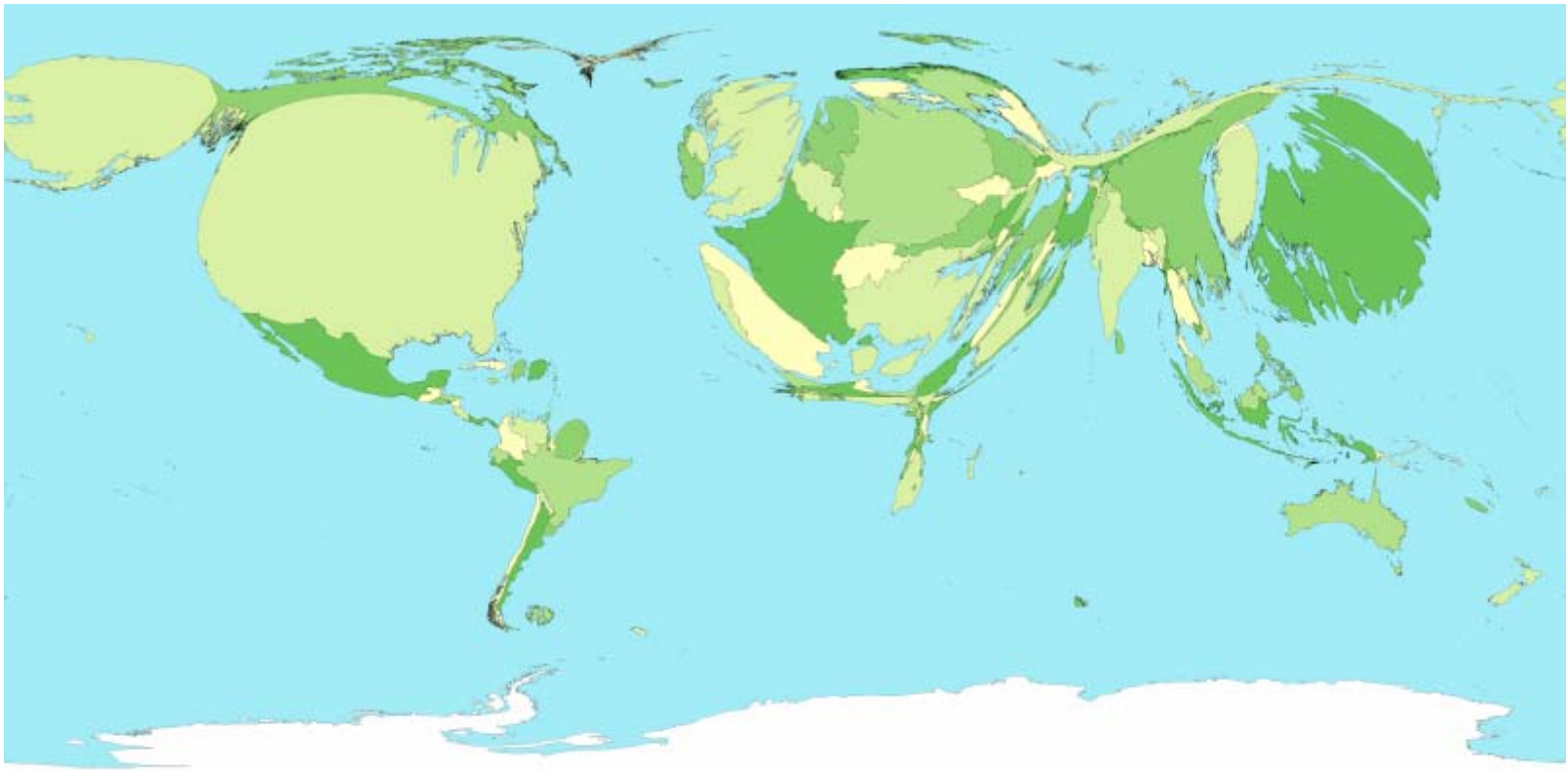
http://www-personal.umich.edu/~mejn/cartograms/

The world in population perspective

Source: Images of the social and economic world – Mark Newman, University of Michigan

http://www-personal.umich.edu/~mejn/cartograms/

The world by gross domestic product



Source: Images of the social and economic world – Mark Newman, University of Michigan

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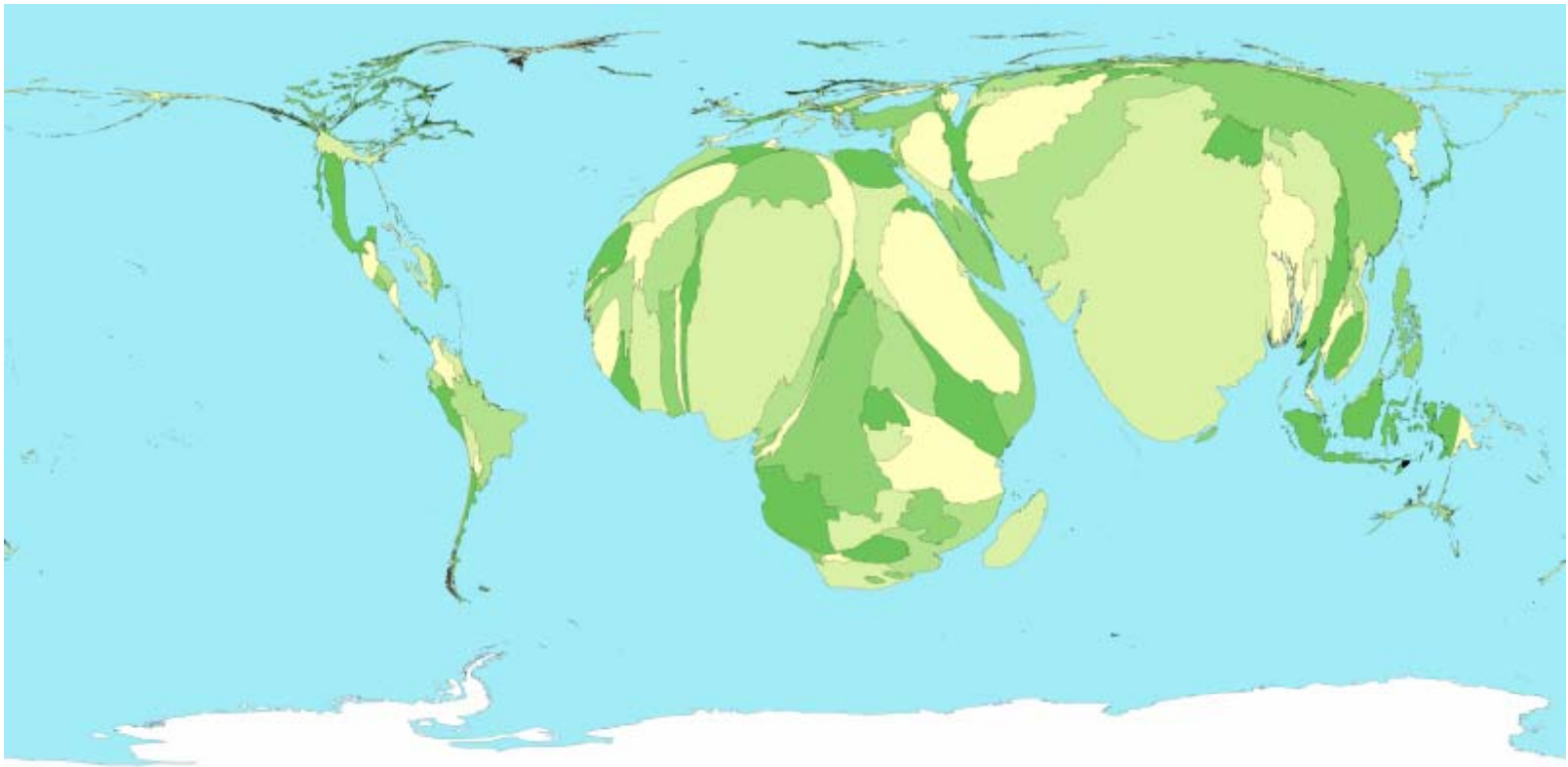
The world in child mortality perspective



Source: Images of the social and economic world – Mark Newman, University of Michigan

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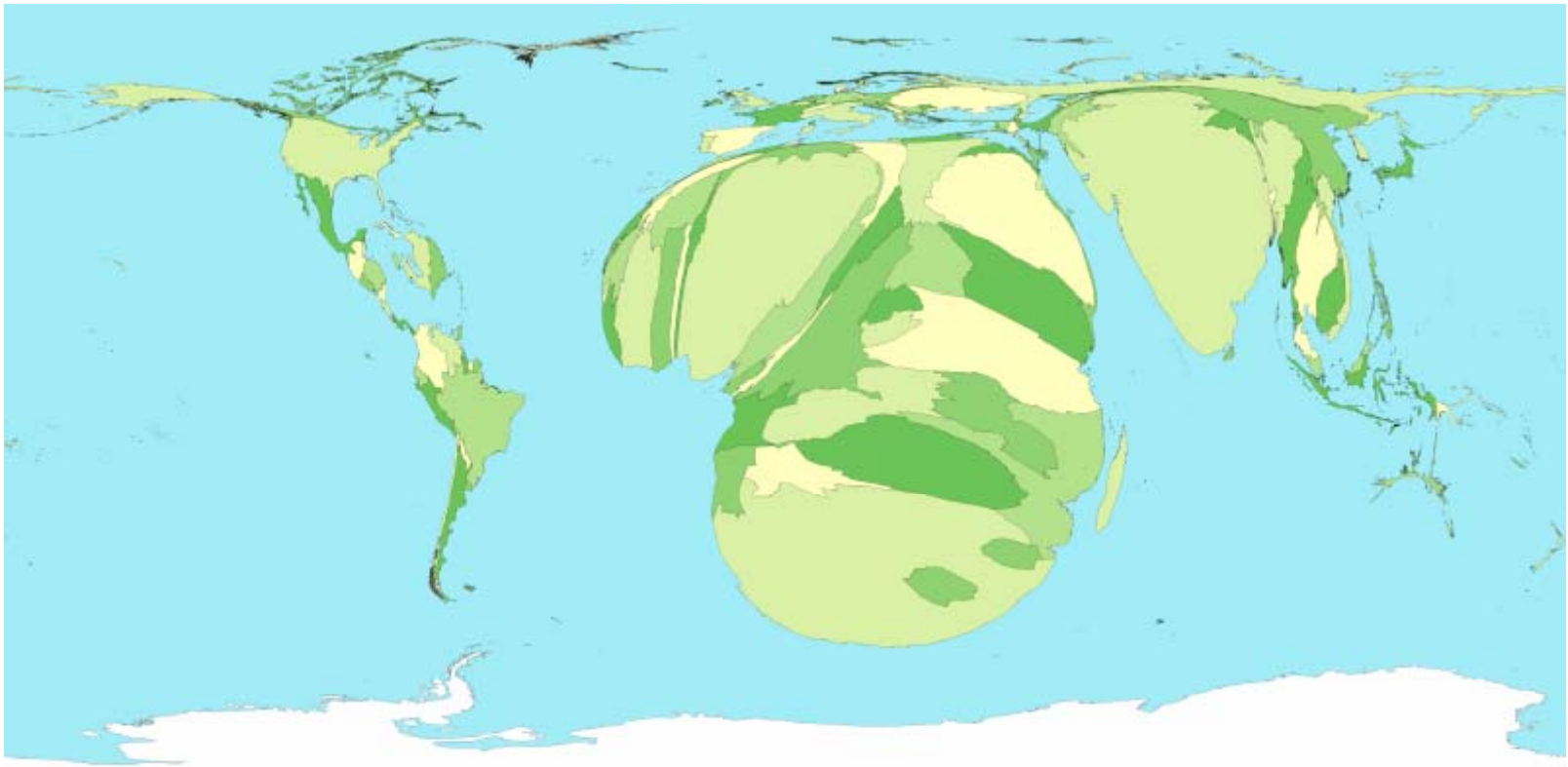
The world in HIV/AIDS perspective



Source: Images of the social and economic world – Mark Newman, University of Michigan

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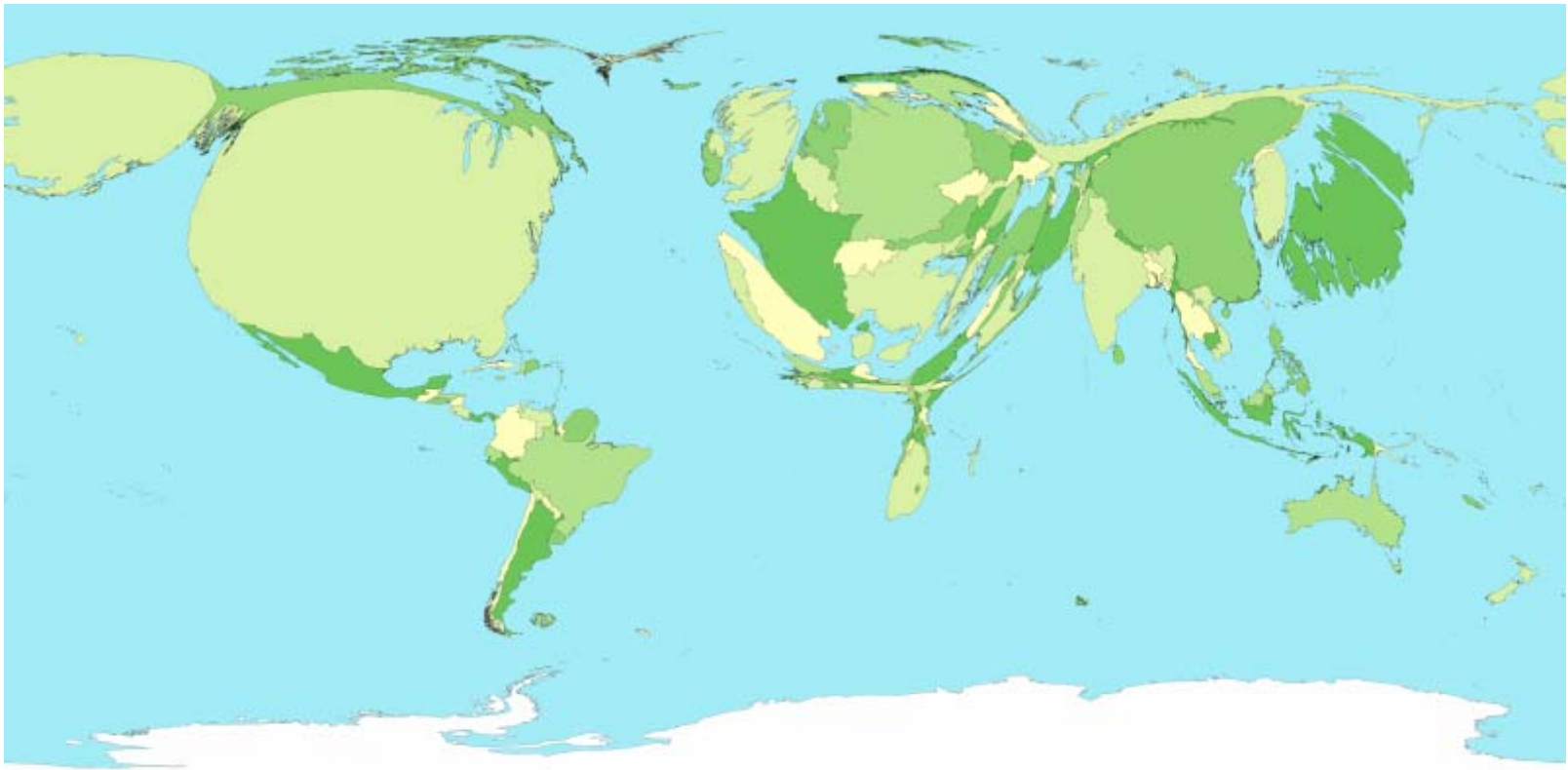
The world by spending on healthcare



Source: Images of the social and economic world – Mark Newman, University of Michigan

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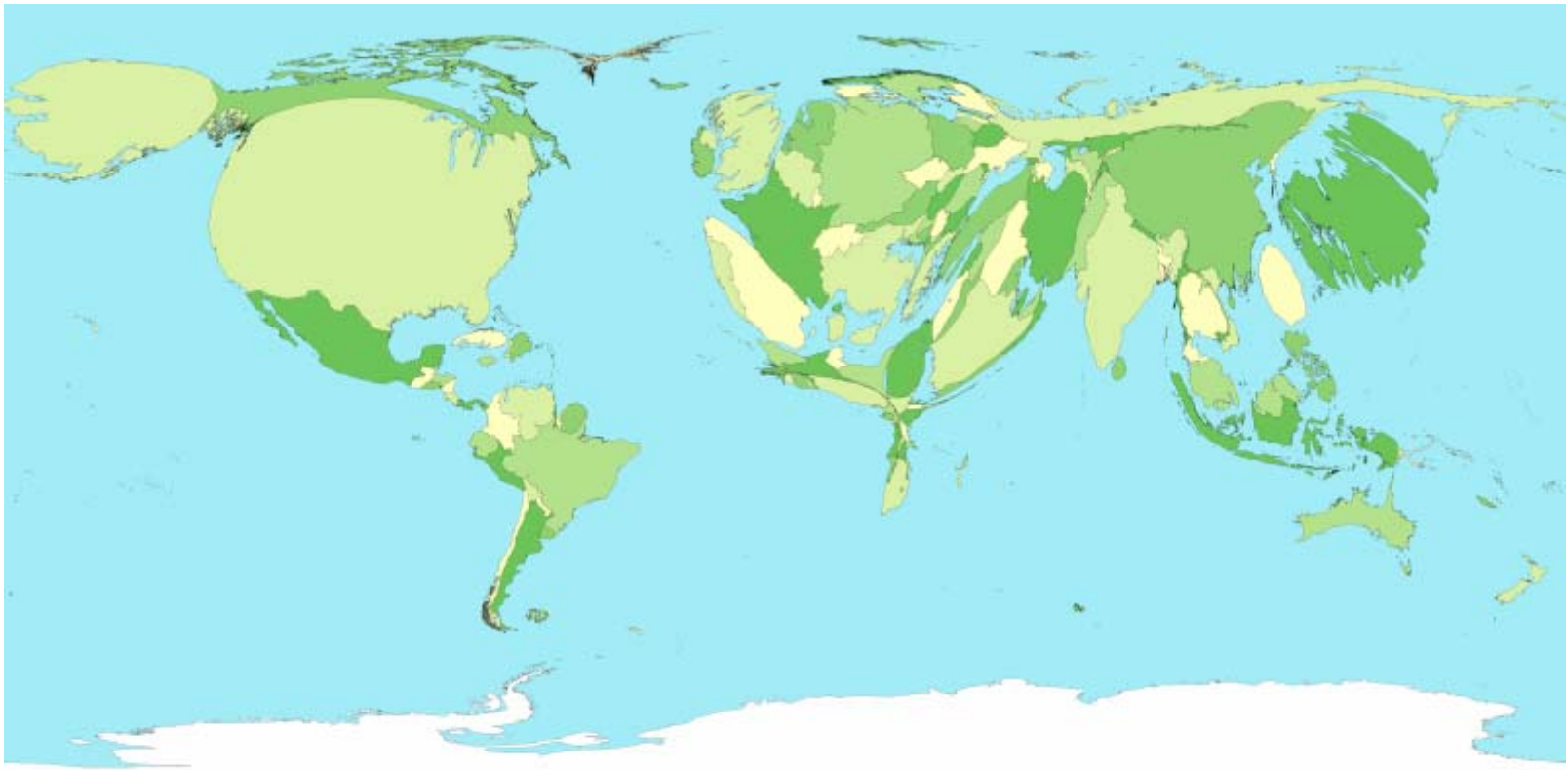
The world by energy consumption



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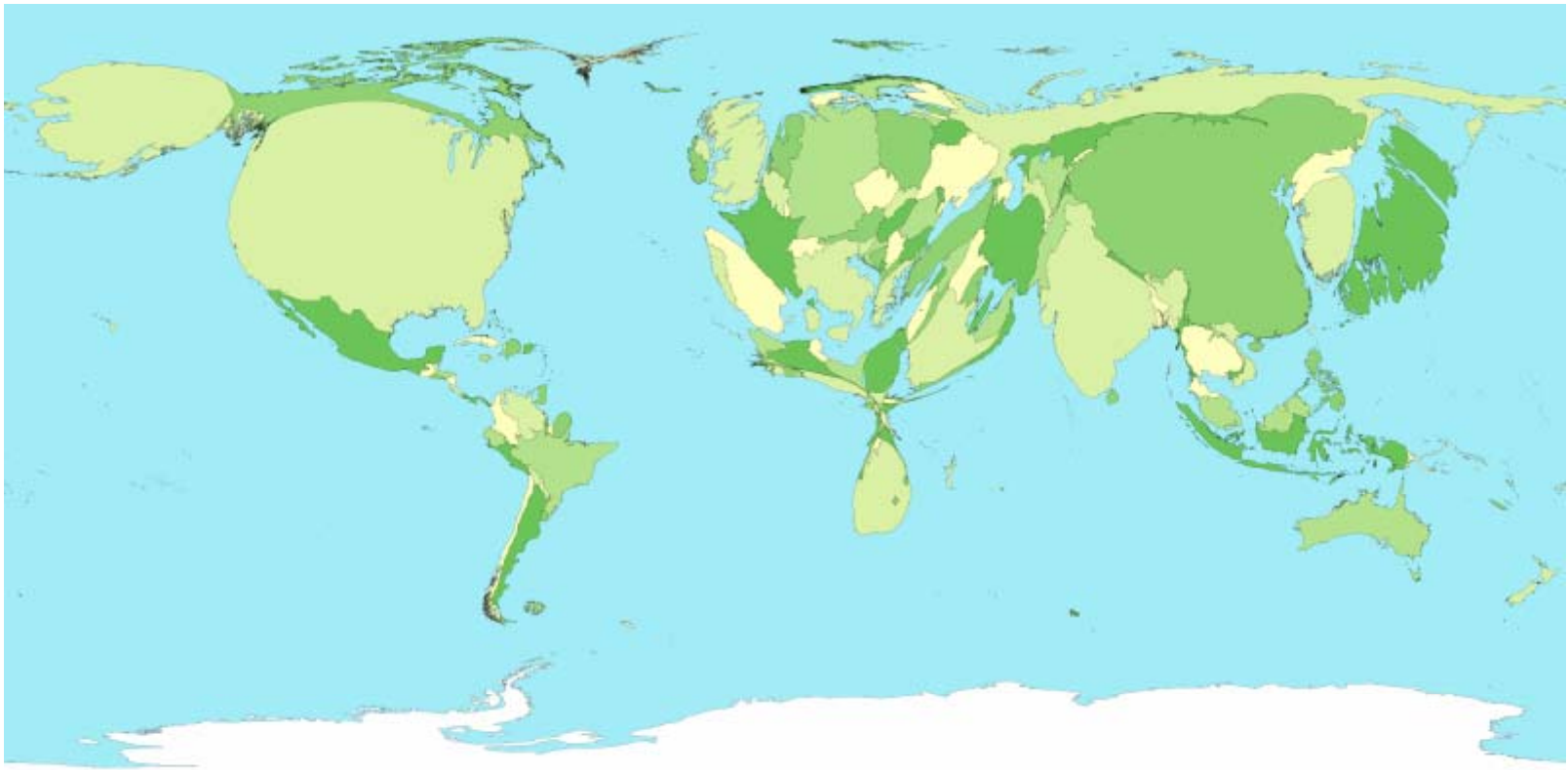
The world by greenhouse gas emission



Source: Images of the social and economic world – Mark Newman, University of Michigan

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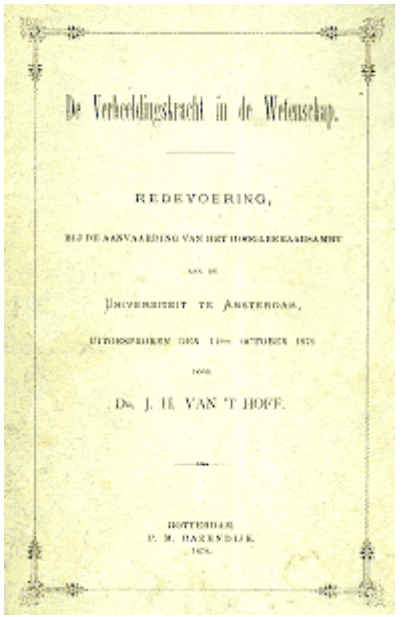
Should we be concerned?

- No apparent pre-ordained purpose.
- No certainty regarding our uniqueness in the universe.
- A potentially harmful species that could easily squander its heritage. Would it matter? Does it matter if we care?
- No answers from science about why we are here.
- Yet we evolved, and so did our nervous system, to feel concerned (ethically and aesthetically).
- It is only natural to be led by those concerns and interact with the world accordingly.

The conscious expression of concerns

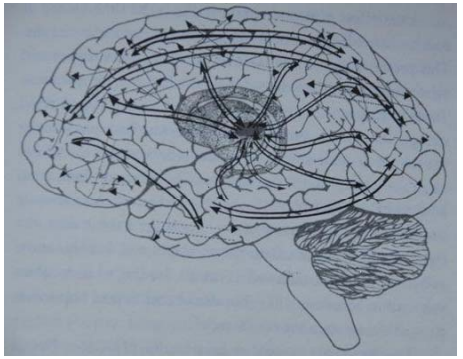

De Verbeeldingskracht in de Wetenschap.

REDEVOERING,

Universiteit te Amsterdam,

Dr. J. H. VAN 'T HOFF.

- We give conscious expression to these concerns through science and art.
- Both art and science are fed by the power of imagination:
  - Van 't Hoff, 1878 [De Verbeeldingskracht in de Wetenschap (Imagination in Science)];
  - Edelman, 2006 ["Science is imagination in the service of verifiable truth"]).
- And what about religion?



Religion

My view: Religions provide frameworks of metaphors of origin, purpose and destiny, within and through which generic patterns of human behavior evolved and became consolidated.

Awe may be at the roots of both science and religion; less so of art. Consolation may be found in both art (particularly music) and religion; less so in science.

Edgar Morin: Science gets us a long way, but it "opens onto undecidables where philosophical options and religious beliefs come into play through cultures and civilizations" (Seven complex lessons in education for the future [UNESCO] - http://unesdoc.unesco.org/images/0011/001177/117740eo.pdf)

Paul Tillich: God is indefinable and thus not confined by the mind or by words. Religion is direction or movement toward the ultimate or the unconditional. Faith/religion is thus expression of 'ultimate concern.'

4

Reflections on the meaning of learning

Essential problem at this juncture of evolutionary history:

Our capacity to invent and intervene is ahead of our ability to reflect responsibly and timely on the consequences of what we do.

…there is a need to reinstate in our thinking about learning a concern with ultimate values.

Implications for learning

…develop meta-cognitive abilities that allow us to ask pertinent questions, to set responsible goals and to use technology wisely in the pursuit of those goals.

Four levels of adaptive behavior

Level 1: Interaction with threats and opportunities in the environment through genetically transmitted preprogrammed responses, e.g. fight and flight responses.

Level 2: Acquisition of essential environment-specific abilities, such as mastery of the mother tongue, driven by an inherited predisposition to do so.

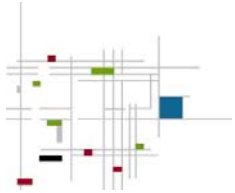
Level 3: Deliberate acquisition of specific skills, knowledge, habits and propensities, motivated by individual choices or societal expectations, usually by exposing oneself to a purposely designed instructional – or self-instructional – process.

Level 4: The development and maintenance of a lifelong disposition to dialogue with one's environment for the purpose of constructively interacting with change in that environment.

However, confusion often sets in at the school age.

Three problems:

1. Learning often confounded with schooling.
2. Need to move from a culture of instruction to a culture of learning.
3. Wrong preconceptions about learning.



The Trouble with Learning

Most currently held beliefs are out of touch with today's reality.

- Linked to school or instructional settings
- Linked to particular age group
- Acquisition paradigm
- Seen as individual activity
- Takes place in the heads of people
- Empty vessel metaphor
- Preparation for life
- Reaction to change
- Disciplinarity
- Compartmentalization of knowledge
- Limited slice of the intelligence spectrum (seen as fixed)
- Limited to specific space-time frames
- Favoring only certain learning styles
- Extrinsically motivated

(This list can be continued)

The Reinvention of Learning

Need to change beliefs, research, policy and practice in line with today's reality.

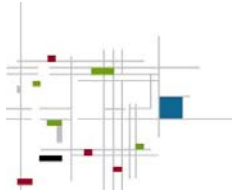
- Conceive of school or instructional settings in wider context
- Learning as lifelong disposition
- Participation paradigm
- Seen as individual and social activity
- Mainly takes place outside the heads of people
- Is dialogic
- Inherent feature of life (humans prepare for lifelong learning)
- Constructive participation in change
- Disciplinarity, multi-, inter-, and transdisciplinarity
- Consilience
- Multiple intelligences that can develop
- Multiple space-time frames
- Accommodating different learning styles
- Intrinsically motivated (motivation awakened through dialogue)

(This list can be continued)

Consider the following:

Human learning:

- Starts nine months before we are born and continues until we die (and it extends beyond our physical existence to the extent that we are all part of the social and historical process of the continual development of thought)
- Occurs in multiple contexts
- Has multiple dimensions
- Is engaged in by individuals and social entities (collectives of people who share a purpose).



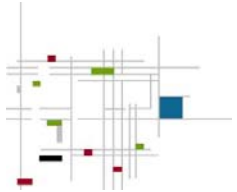
The kind of learning we need

- *If there is such a thing as "preparation for life," then it must be a preparation that allows us to cope with the unpredictable.*
- *Need to learn beyond disciplines; to enhance our ability to problematize; to work on problems creatively and collaboratively.*
- *Need to perceive of learning as an ecological phenomenon: Learning is generative; no learning stands on its own.*

At a societal level we must be aware of the need to develop "policies for the learning environment at large" that can ensure that learning becomes mutually reinforcing in the different, though interconnected, parts of the learning ecology.

5

The (scientific) mind



An essential resource: **THE MIND**

- Anglo-Saxon origin: *"gemynd"*= memory
- Two perspectives on memory:
  - memory as static concept (stored retrievable information)
  - memory as dynamic concept, i.e. giving meaning, intentionality.
- While we live, we are all "memories in the making"(Yusra Laila Visser, 1997).
- Susan Greenfield (2000): *"Mind . . . is the seething morass of cell circuitry that has been configured by personal experiences and is constantly being updated as we live out each moment"(p. 13).* In other words, it is, according to Greenfield, *"the personalization of the physical brain"(p.14)* through our experience.

Visser, Y. L. (1997). Personal communication.
Greenfield, S (2000). Private life of the brain. Harmondsworth, UK: Penguin.

An essential mindset:
THE SCIENTIFIC MIND

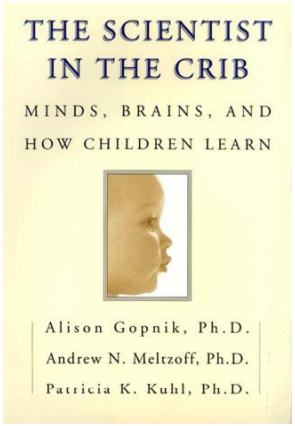
The spirit of science is alive in us at birth and during our earliest childhood years. In fact, evolution has set us op from before birth to display the kinds of behavior that can be associated with having a scientific mind.

Having a scientific mind is fundamental to our becoming aware of ourselves in relation to all that surrounds us, our universe. The extent of that universe is only limited by our unfolding capacity to comprehend it, emotionally and cognitively. Such comprehension is vital to our ability to play a consciously constructive role as an integral part of that same universe.

Nurturing the spirit of science is key to expanding the boundaries of our comprehension. *One can't begin soon enough!*

This is how it begins:

Walk upstairs, open the door gently, and look in the crib. What do you see? Most of us see a picture of innocence and helplessness, a clean slate. But, in fact, what we see in the crib is the greatest mind that has ever existed, the most powerful learning machine in the universe. The tiny fingers and mouth are exploration devices that probe the alien world around them with more precision than any Mars rover. The crumpled ears take a buzz of incomprehensible noise and flawlessly turn it into meaningful language. The wide eyes that sometimes seem to peer into your very soul actually do just that, deciphering your deepest feelings. The downy head surrounds a brain that is forming millions of new connections every day. That, at least, is what thirty years of scientific research have told us.



Gopnik, A., Meltzoff, A. N., & Kuhl, P. K. (1999). *The Scientist in the Crib*. New York: William Morrow and Company, Inc. (p. 1)

That book came out in 1999.

It's 10 years later now.

The child then born meanwhile ended up in school.

What has happened to its mindset?

The traditional schooling practice, with its emphasis on the acquisition of factual knowledge and lack of encouragement to explore and comprehend deeply, is possibly a major cause of the disappearance of curiosity. If so, it may be the single most important inhibitor of the development of the scientific mind.

The scientific mind: A multidimensional mindset

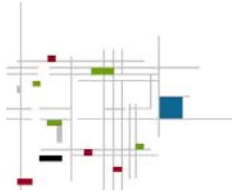
The scientific mind is a complex mindset. The following suggestions are offered as a starting point for the description of its multidimensional character:

- The spirit of inquiry
- The spirit of collaboration
- The quest for beauty (harmony, parsimony, wholeness)
- The desire to understand and do so profoundly
- The creative spirit
- The urge to be critical
- The spirit to transcend
- The spirit of building on prior knowledge
- The search for unity
- The building of the story of human knowledge and ability
- The spirit of construction

From: ***The Scientific Mind in Context*** concept paper.
http://www.learndev.org/dl/TSM-ConceptPaper.pdf

Opportunities in early childhood:
Opportunities for life.

The opportunities we take in early childhood, and subsequently throughout life, ultimately determine whether the child that was alive in us at birth will still live inside us as we fulfill our lives.



THANK YOU

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