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Building the Scientific Mind:
Learning for a complex world

Thoughts and motivations to ponder
by panelists and members of the audience

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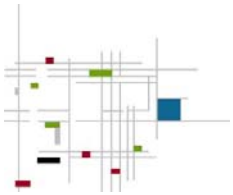

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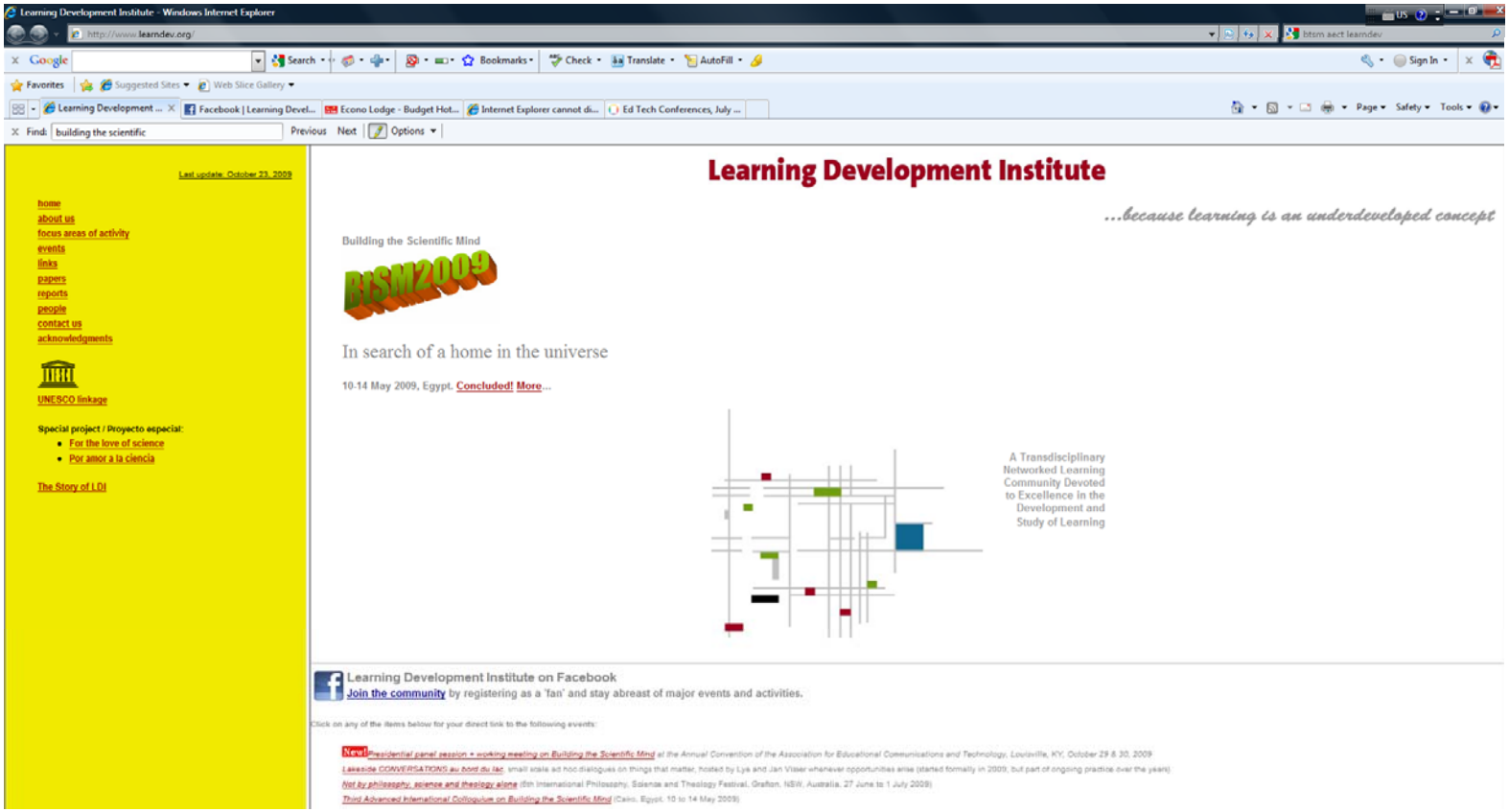
The debate so far:

Check out:

learndev.org/BtSM_at_AECT2009.html



Or check us out at: **facebook.com/learndev/**

Relevance and importance

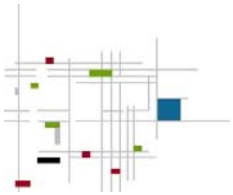
Constructive interaction with complex interconnected problems of planetary dimension is becoming increasingly essential to human well-being and survival.

To get an idea of the nature of some of the problems:

see next slides!

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	1 a.m.
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)		< 0.4 sec ago
Galileo	377 years ago (19 generations)		14 ms ago
DNA	56 years ago (3 generations)		2 ms ago
The Web	20 years ago (1 generation)		0.7 ms ago



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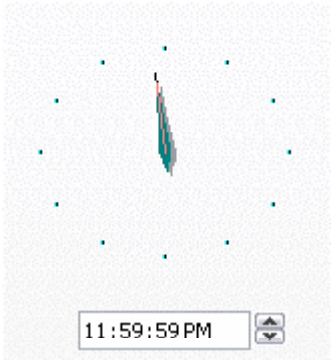
ANTHROPOCENE 8 ms ago

some 11 generations (latter part of 18th century)

Considering these and many other major and still growing impacts of human activities on earth and atmosphere, and at all, including global, scales, it seems to us more than appropriate to emphasize the central role of mankind in geology and ecology by proposing to use the term 'anthropocene' for the current geological epoch. The impacts of current human activities will continue over long periods. According to a study by Berger and Loutre (14), because of the anthropogenic emissions of $C0_2$, climate may depart significantly from natural behaviour over the next 50,000 years. (see Paul J. Crutzen: http://www.mpch-mainz.mpg.de/~air/anthropocene/Text.html)

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
now	**6794 million and counting**

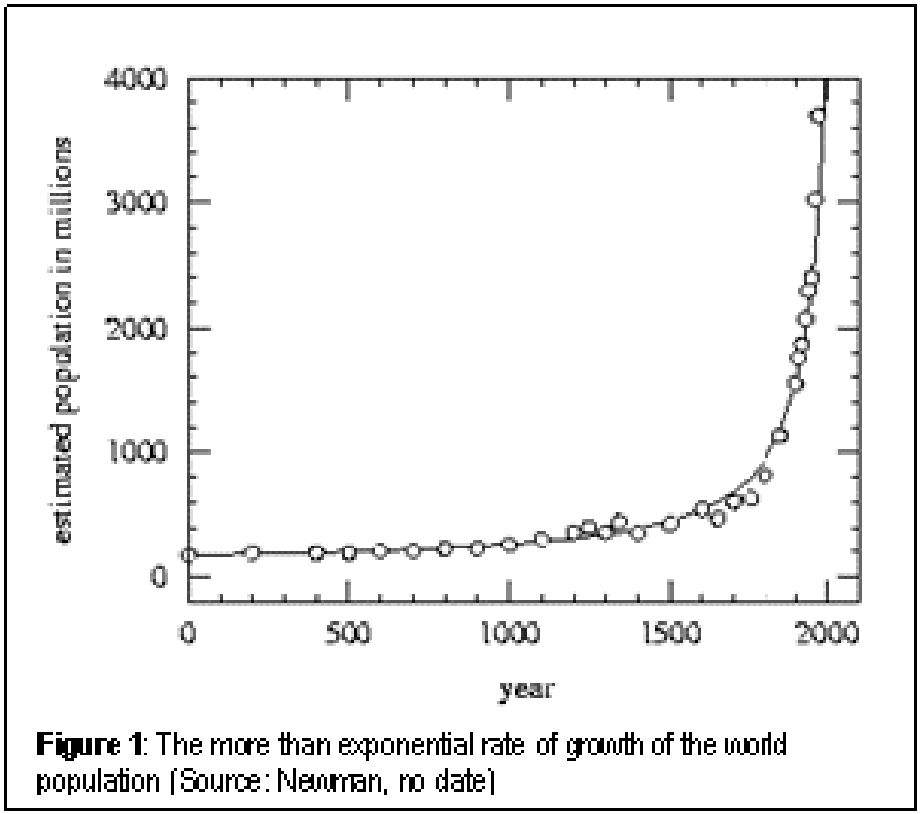


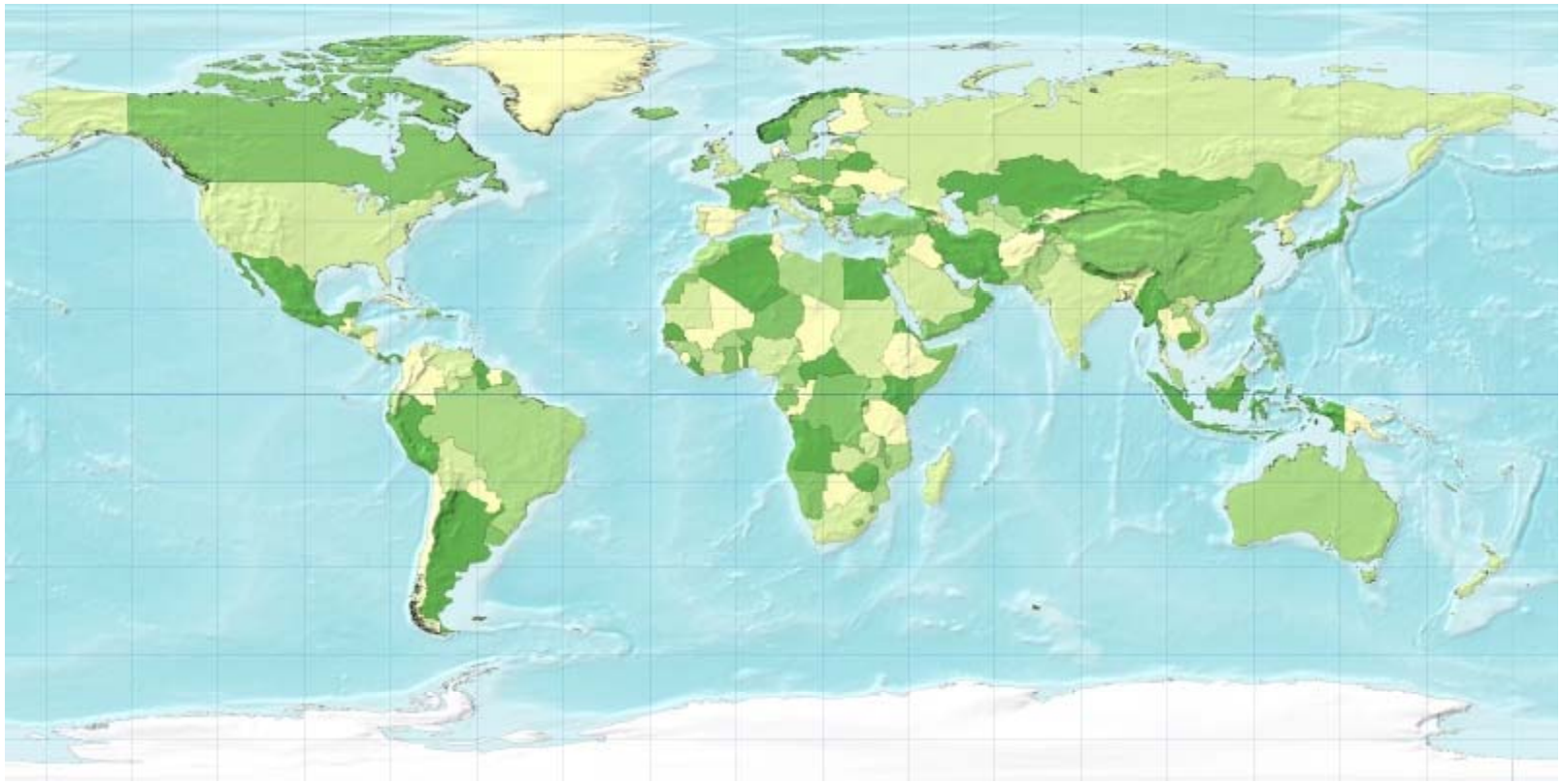
Figure 1: The more than exponential rate of growth of the world population (Source: Newman, no date)

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

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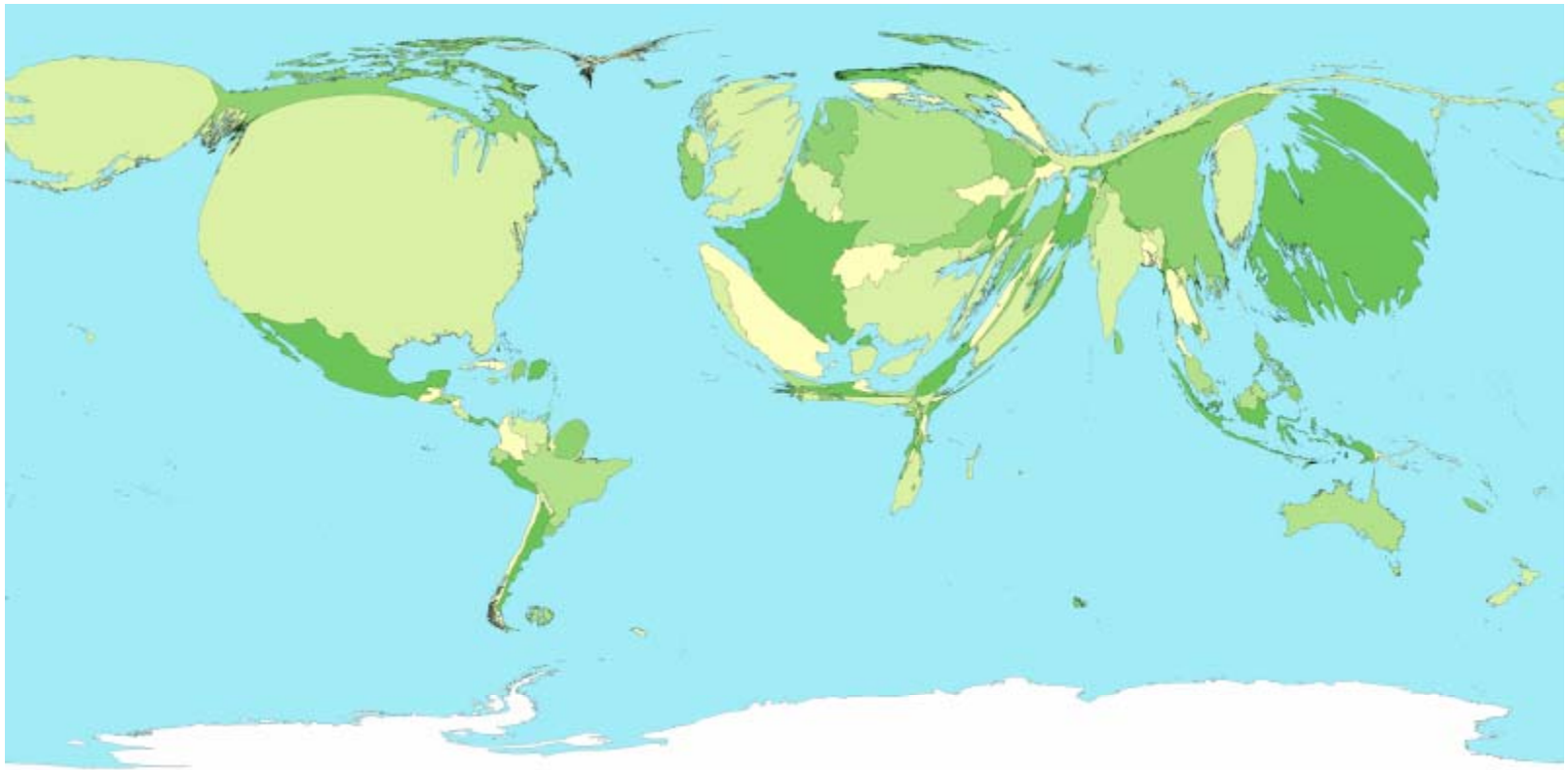
The world by gross domestic product



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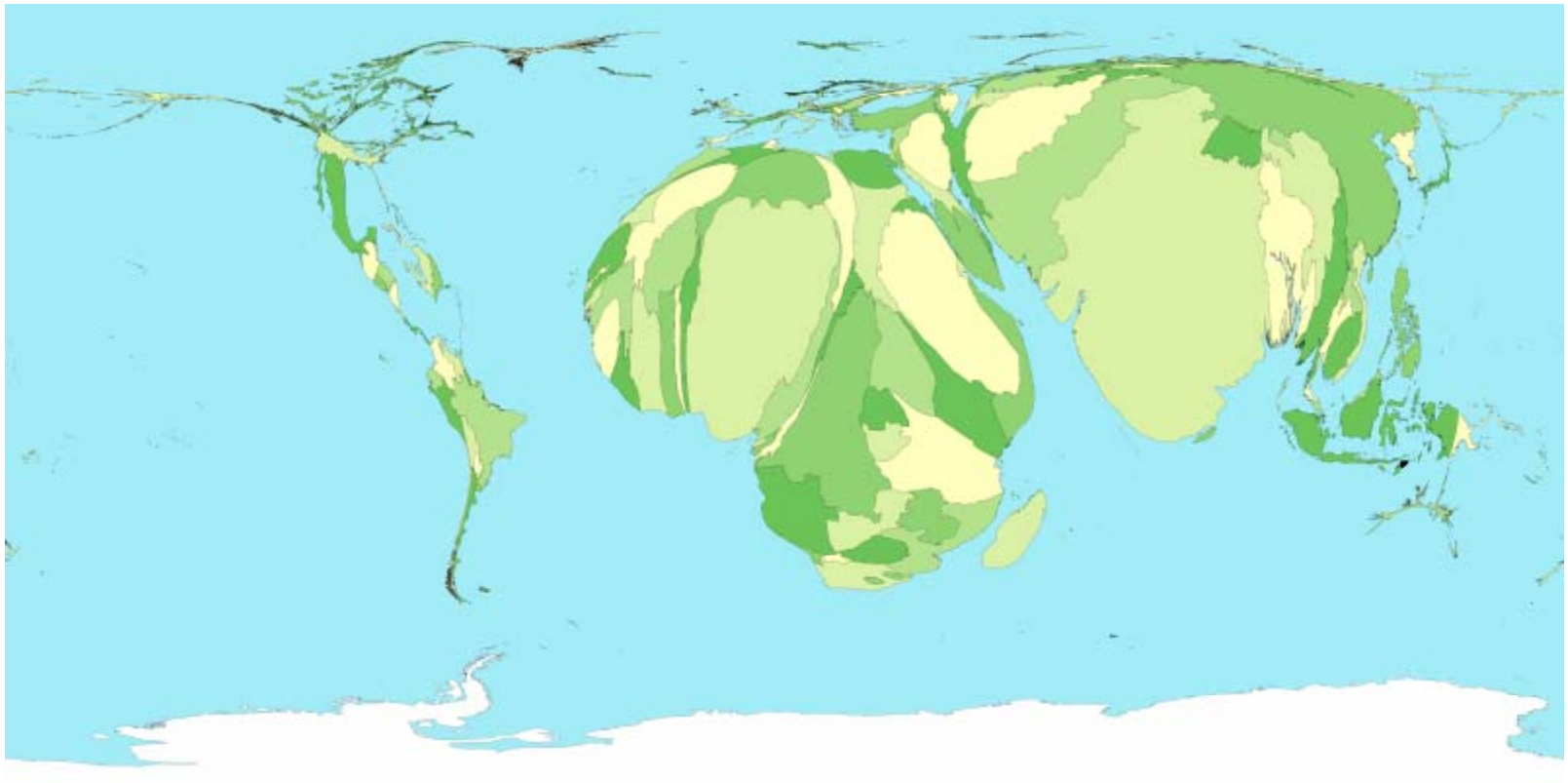
The world in child mortality perspective



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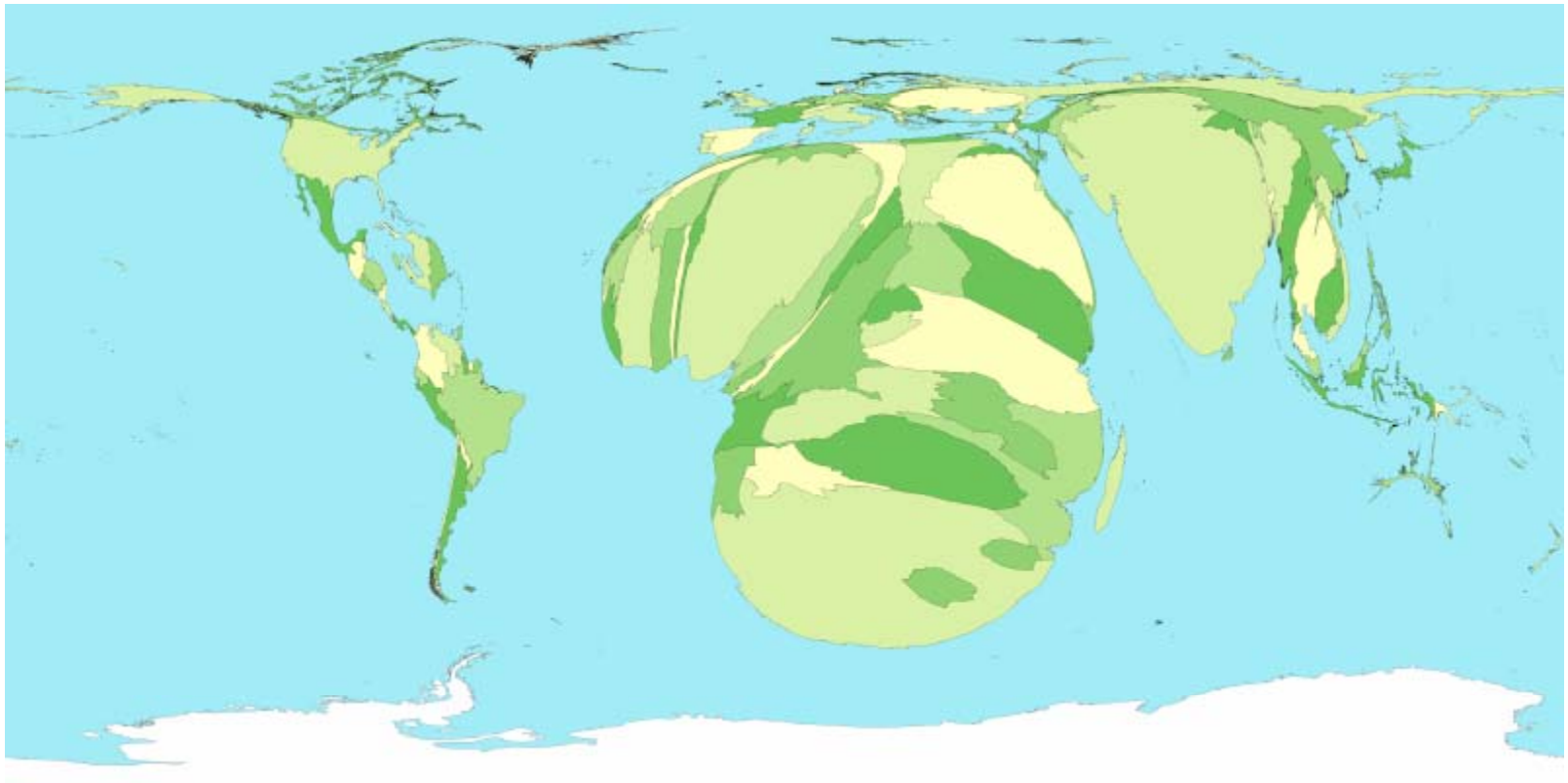
The world in HIV/AIDS perspective



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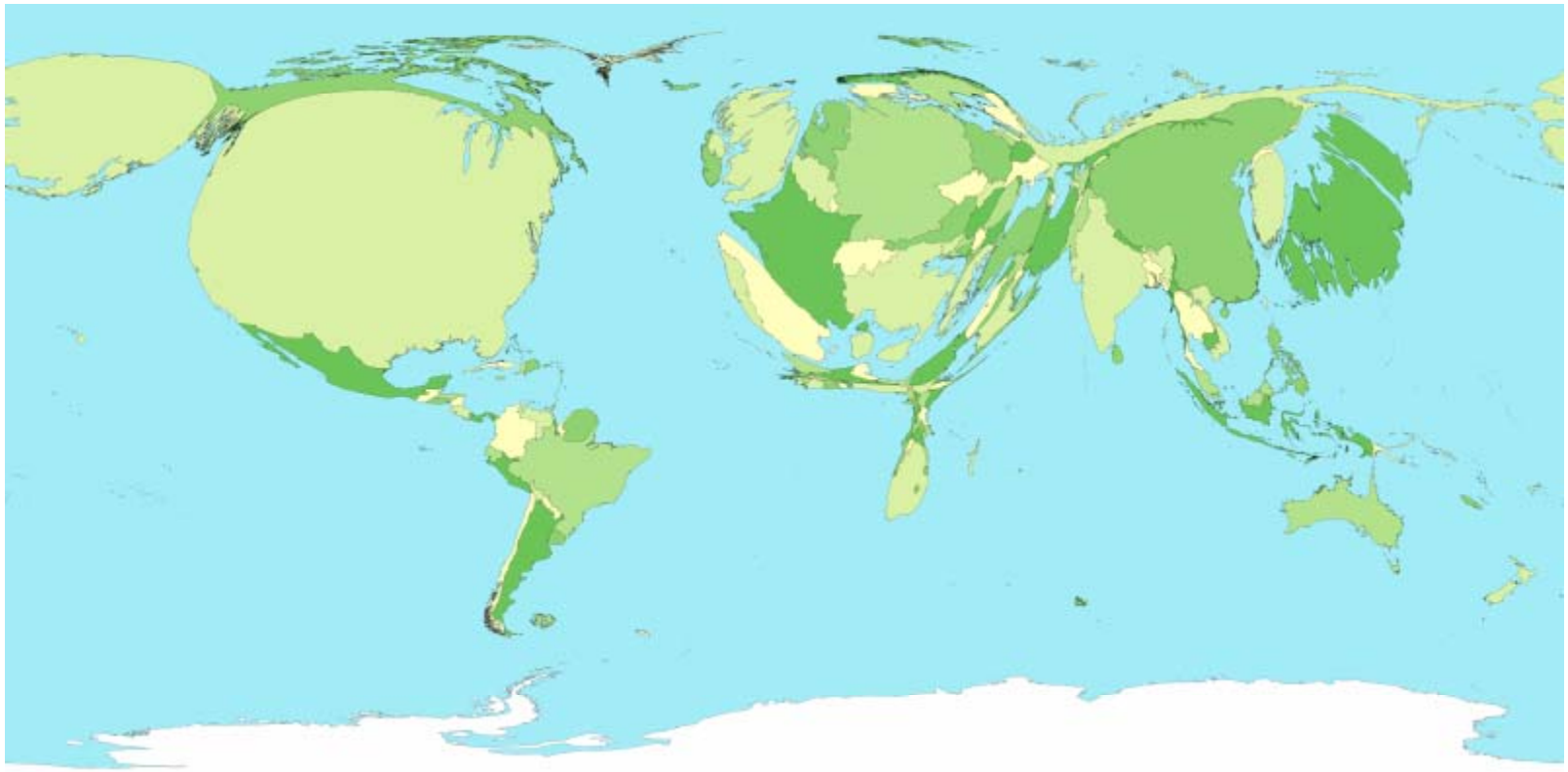
The world by spending on healthcare



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

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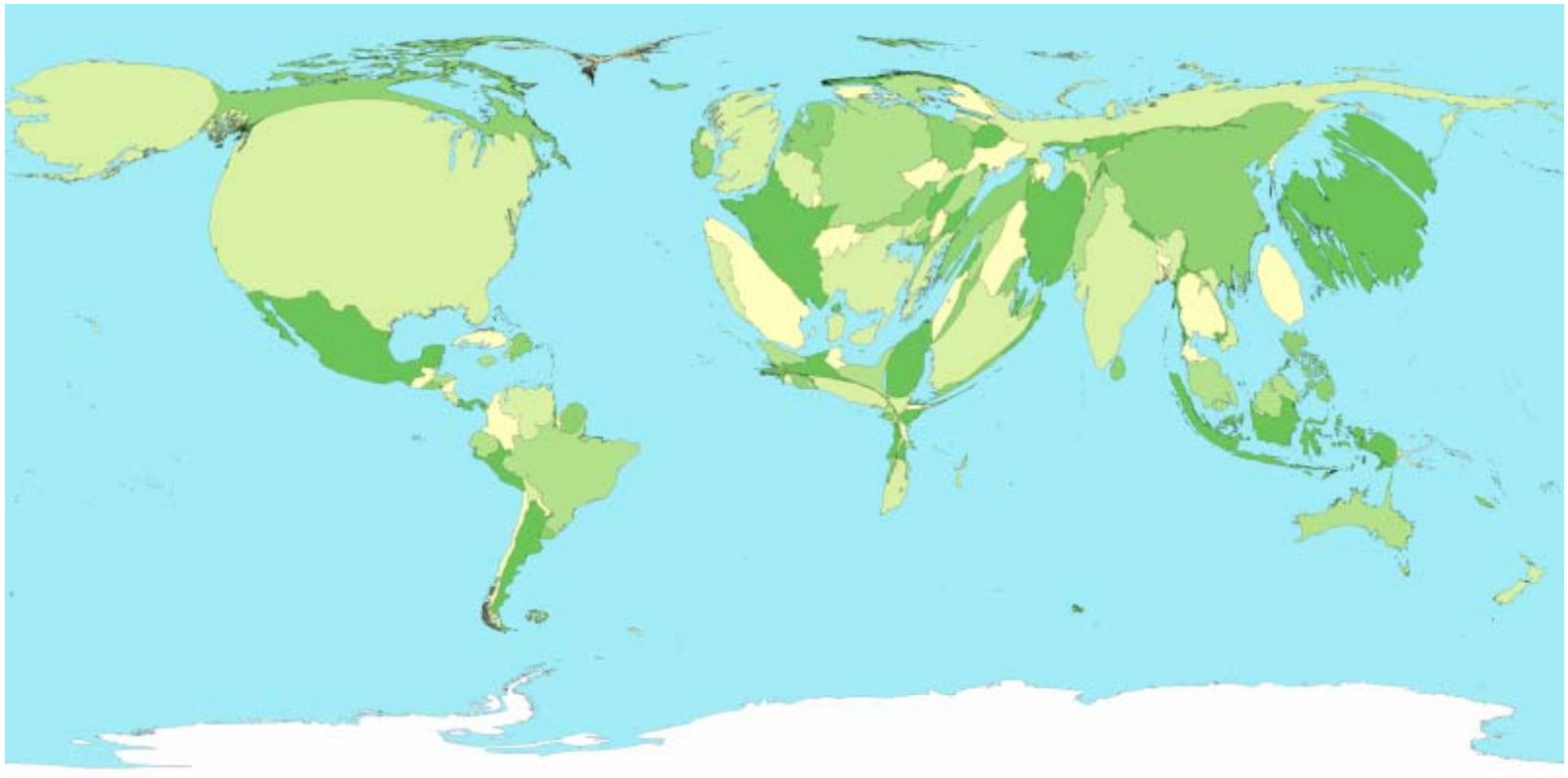
The world by energy consumption



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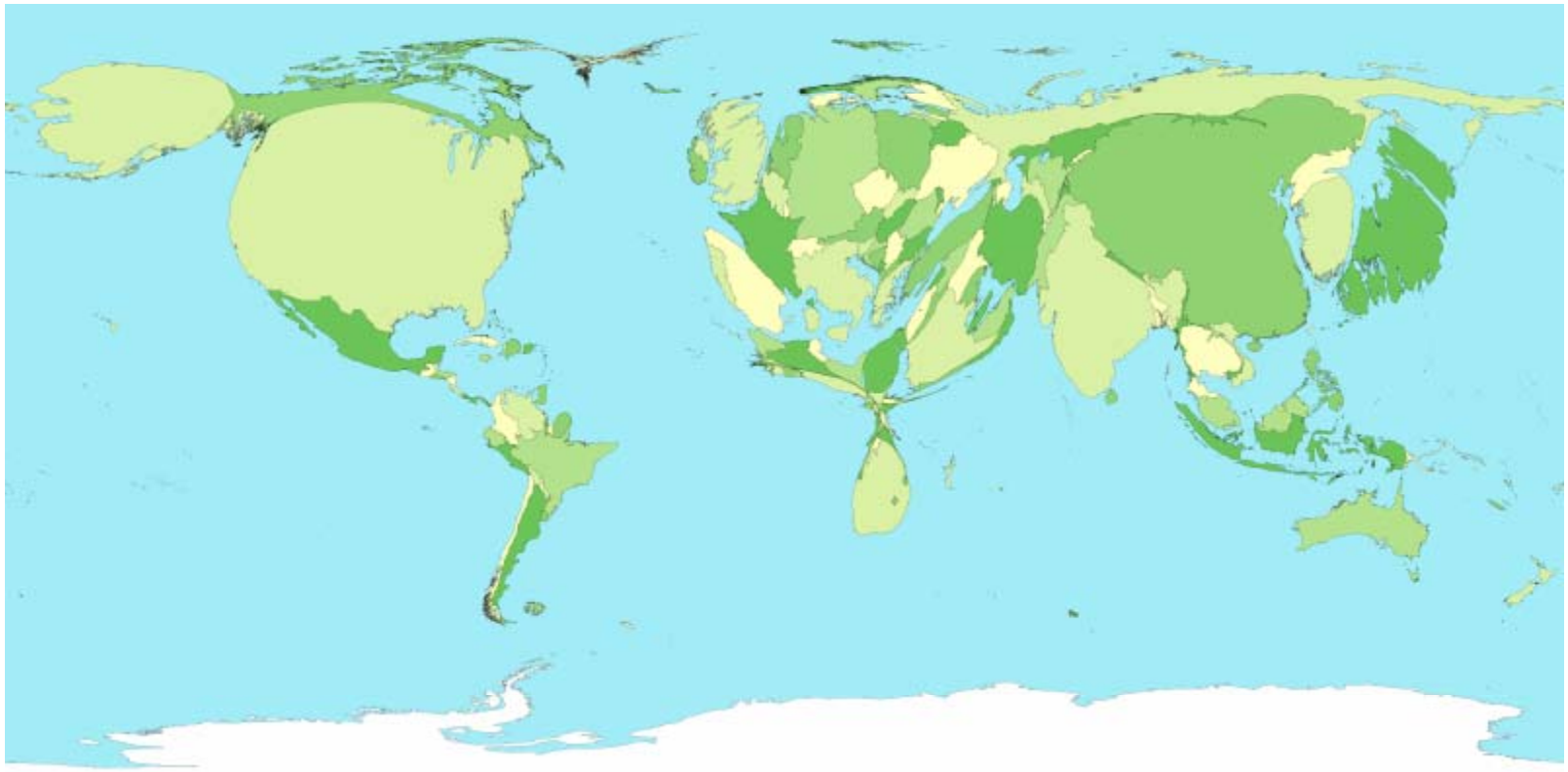
The world by greenhouse gas emission



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Care for fostering the emergence and subsequent growth of habits of mind

These are but some of the problems.

They all require clear thinking

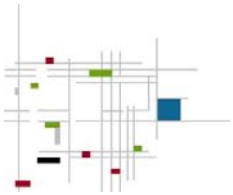
and compassionate identification

not only by experts and politicians

but by the world's citizenry at large.

We must learn to learn differently, at an enhanced level of complex awareness, developing appropriate habits of mind.

Care for the scientific mind seems a useful entry point for rethinking human learning.



The learning landscape extends beyond the realm of schooling and training

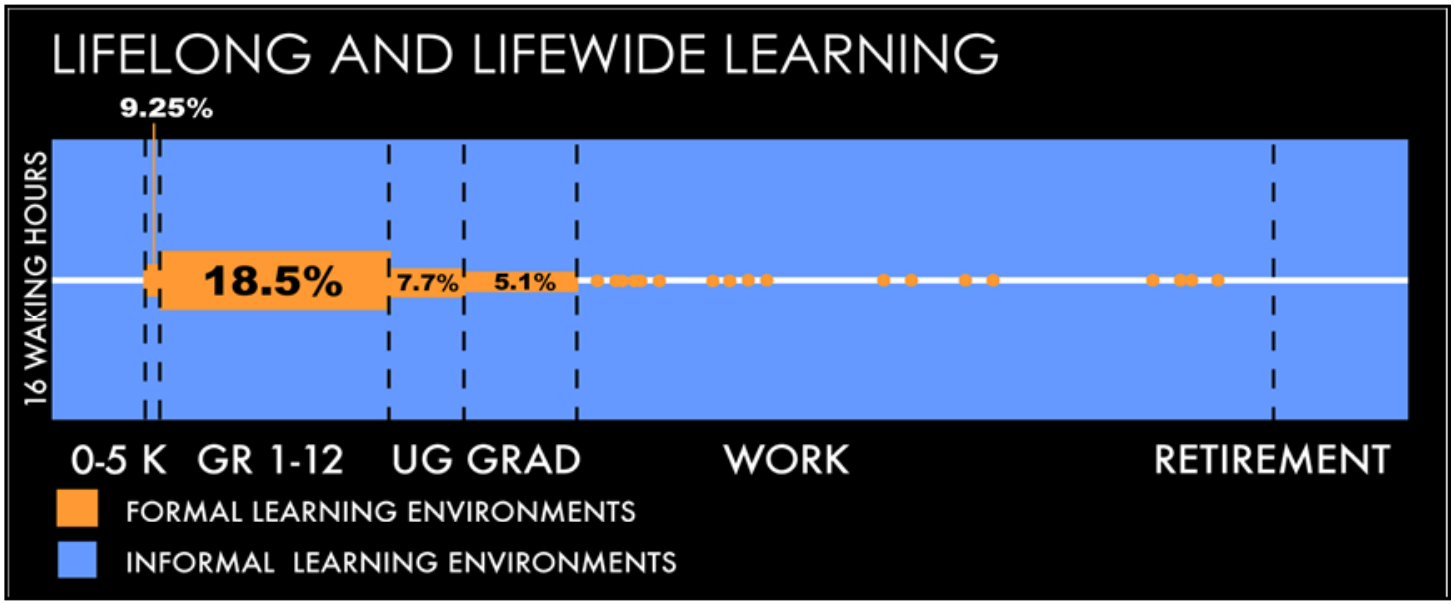


Figure 3-1. The LIFE Center's Representation of Lifelong and Lifewide Learning

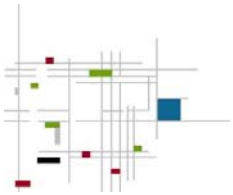
Source: Bransford, J. D., Slowinski, M., Vye, N., & Mosborg, S. (2008). The learning sciences, technology and designs for educational systems: Some thoughts about change. In J. Visser & M. Visser-Valfrey (Eds.), *Learners in a changing learning landscape: Reflections from a dialogue on new roles and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

Multi-dimensional nature of the scientific mind (as well as of many other mindsets)

1. The spirit of inquiry.
2. The spirit of collaboration.
3. The quest for beauty (harmony, parsimony, wholeness).
4. The desire to understand and do so profoundly.
5. The creative spirit.
6. The urge to be critical.
7. The spirit to transcend.
8. The spirit of building on prior knowledge.
9. The search for unity.
10. The building of the story of human knowledge and ability.
11. The spirit of construction.

Habits of mind inspired by the best we may derive from the millennia-long history of the development of science

- Passion to find out.
- Wanting to make sure one sees things correctly.
- Open to considering alternatives.
- Being delighted when proven wrong.
- Valuing the scrutiny of one's peers.
- Seeking to arrive at shared conclusions based on shared evidence.
- Obstinately refusing to fool oneself and one's fellow human beings.
- And so on.



Science education as we know it is not necessarily propitious to nurturing the scientific mind

- Look for different curriculum philosophies.
- Consider alternative pedagogical and andragogical approaches.
- Don't think of learning beyond the schooling and training setting as of secondary or tertiary importance. We are daily exposed to great opportunities to develop our mind and to serious threats to damage its potential in informal learning settings.
- It's time to start caring for the conditions of learning in all possible learning spaces. Not just the school.

Thank you and over to my colleagues:

- Glen Bull
- Michael Hannafin
- Charles Reigeluth
- Michael Spector
- Brent Wilson