

# 19<sup>th</sup> IABSE Congress Stockholm

September 21-23, 2016



## A Summary

Lennart Elfgren

Chair of the Scientific Committee, 19th IABSE Congress Stockholm  
Luleå University of Technology, Sweden

Challenges in Design and Construction of an Innovative and Sustainable Built Environment

# Contents

- Some reflections on the Congress
- Keynote presentations
- Where do we come from and where do we go ?
- What can we do?
- How can we contribute ?

# Reflections

352 Papers, Proceedings 3110 pp – A wealth of information

Seven themes with 62 sessions:

A - Analysis (11 sessions / 67 papers)

C - Construction and Production (6/33)

F - Forensic (3/15)

L - Loads (5/29)

M - Materials (7/36)

R - Repair & Maintenance (9/55)

S - Structures (21/117)

- **Digital models, twin digital structures**

- **Innovation, recycling**

- **Learning from failure**

- **Seismic, Fire, Wind, Climate**

- **New advanced concrete, FRP, steel**

- **Assessment, SHM, LCC, LCA**

- **Landmark structures, E39, Dynamics**

It was possible to visit up to 10 full sessions, i.e. max some 15 %



**Many thanks to Listeners, Speakers, Authors, Session Chairs, Facilitators  
Members of the Scientific and the Organizing Committees, SC Secr. Dr Johan Jonsson  
Colleagues in the Swedish Universities of the Built Environment (LTH; CTH; KTH; LTU)**



**IABSE CONGRESS  
STOCKHOLM, 2016**

*Challenges in Design and Construction of an Innovative  
and Sustainable Built Environment*

**REPORT**

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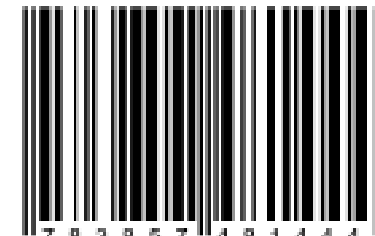
Lennart Elfgren and Johan Jonsson

*Chair and Secretary of the Scientific Committee*

Mats Karlsson, Lahja Rydberg-Forsbeck and Britt Sigfrid

*Chair and Secretaries of the Organising Committee*

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9 7 8 3 8 5 7 4 8 1 4 4 4

3110 pp

# Keynotes

**Sustainable Asset (Infrastructure) Management - A view from Asia**

*Fujino, Yozo*

**Innovative Tunneling in a Sustainable Built Environment**

*Jesel, Thomas*

**Coastal Highway Route E39**

*Stensvold, Børre*

**Trends within Sustainable Bridge Operation and Maintenance**

*Sandager Jensen, Jens*

**Sustainable concrete**

*Scrivener, Karen*

**Sustainable Cities are Cities that are made for and with people**

*Søholt, Helle*

# Sustainable Asset Management – An Asian View

Yozo FUJINO

Yokohama National University,  
Institute of Advanced Sciences



## Social Common Capital

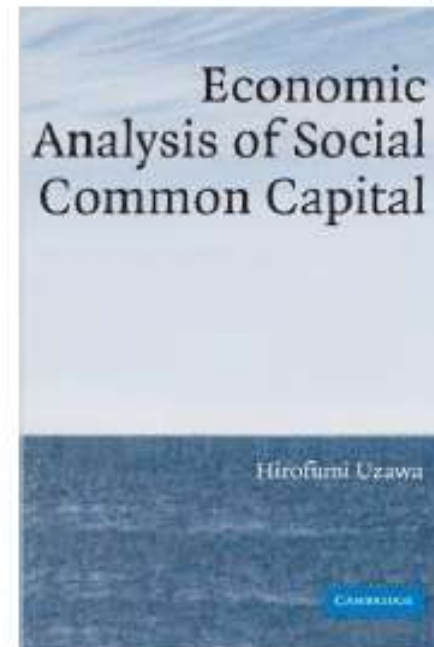
Asset of the society  
for the society

*Public, not private*

- 1) Nature  
water, air, river, soil etc.
- 2) **Civil Infrastructure**  
roads, ports, rails, bridges  
dams, etc.
- 3) Social rules/systems  
transportation/health  
education/police/  
defense systems



Prof. H. Uzawa (1928-2014)



United Nation University  
Published in 2012



Editor: Prof Dasgupta  
(Cambridge Univ.)

Instead of GDP (basically based on consumption), recommend to use IWI

IWI = Social capitals consists of  
1) Nature  
2) Man-made **infrastructure**,  
3) Human capital  
that can be delivered to the next generation

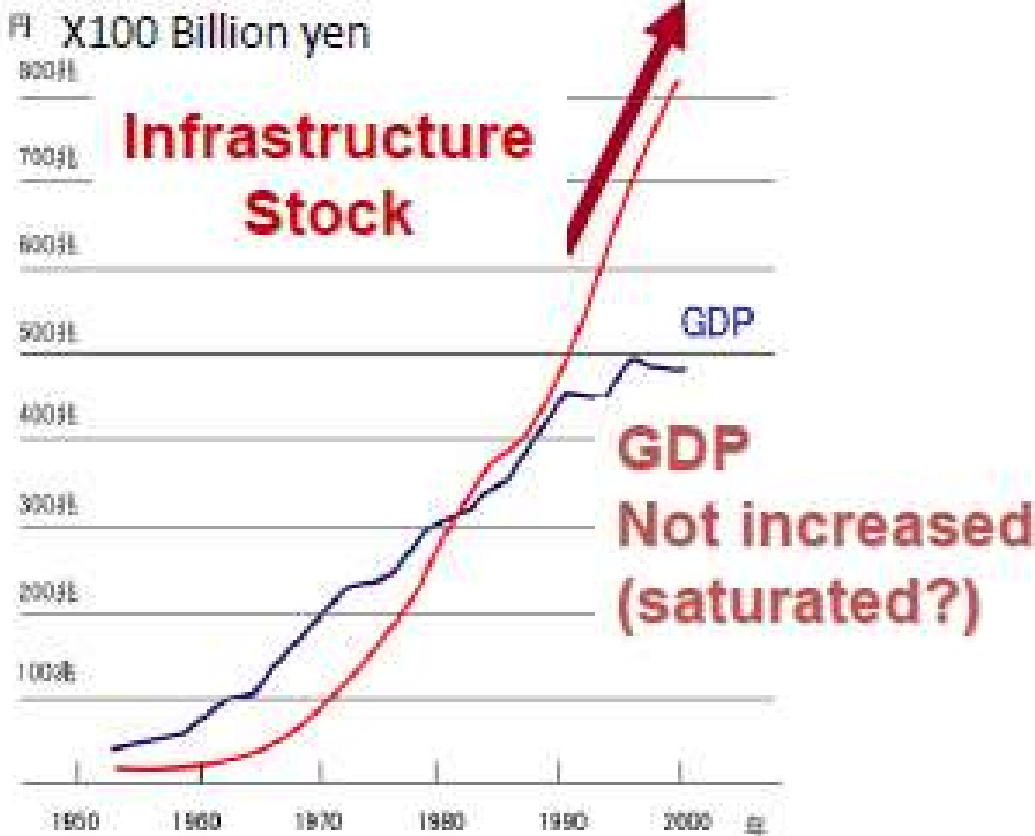


2014 edition

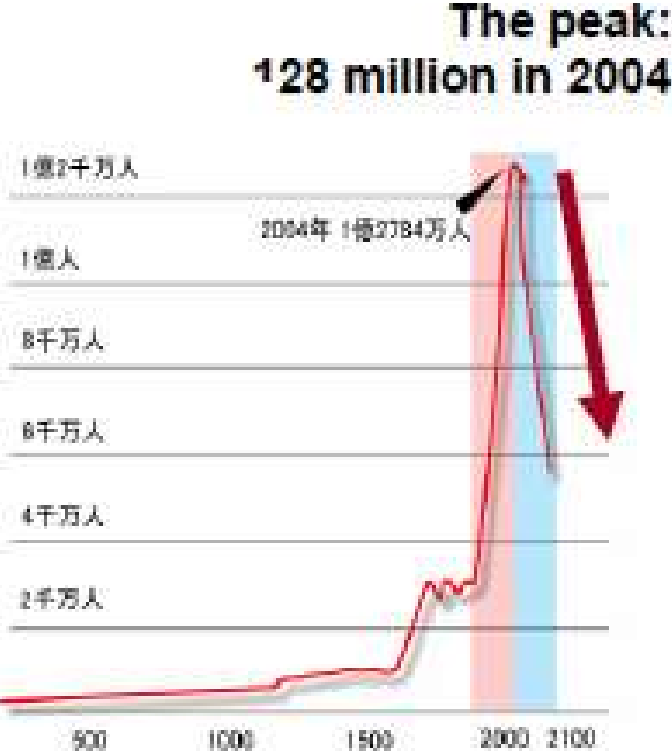


# Japan's turning point

## Continuously Increased Stocks



## Depopulation



Efficient management is absolutely necessary

# Strategic Innovation Programs

## 10 SIP Programs

Innovative combustion  
technology



**Masanori Sugiyama**  
Toyota Motor Corp.

Structural Materials for  
Innovation(SM+I)



**Teruo Kishi**  
Univ. of Tokyo, NIMS

Next-generation  
technology for ocean  
resources exploration



**Tetsuro Urabe**  
Univ. of Tokyo, JMEC

Infrastructure  
maintenance,  
renovation and  
management



**Yoizo Fujino**  
Yokohama National Univ.

Tech. for creating next-  
generation agriculture,  
forestry and fisheries



**Takeshi Nishio**  
Hosei Univ.

Next-generation power  
electronics



**Tatsuo Ohmori**  
Mitsubishi Electric Corp.

Energy carrier



**Shigeru Muraki**  
Tokyo Gas Co.,Ltd.

Automated Driving  
System



**Hiroyuki Watanabe**  
Toyota Motor Corp.

Enhancement of societal  
resiliency against  
natural disasters



**Masayoshi Nakashima**  
Kyoto Univ.

Innovative  
design/manufacturing  
technologies



**Naoya Sasaki**  
Hitachi, Ltd.

**Total 300 M€ per year 5-years program**

# Key technologies in SIP infrastructure

- 1) Accurate yet simple/high speed/inexpensive  
**condition assessment**

NDT, sensing/monitoring, robotics

- 2) High-accurate **long-term performance prediction**  
(~10~30~ years)

*theoretical approach* for various situations

needs extensive data for model validation

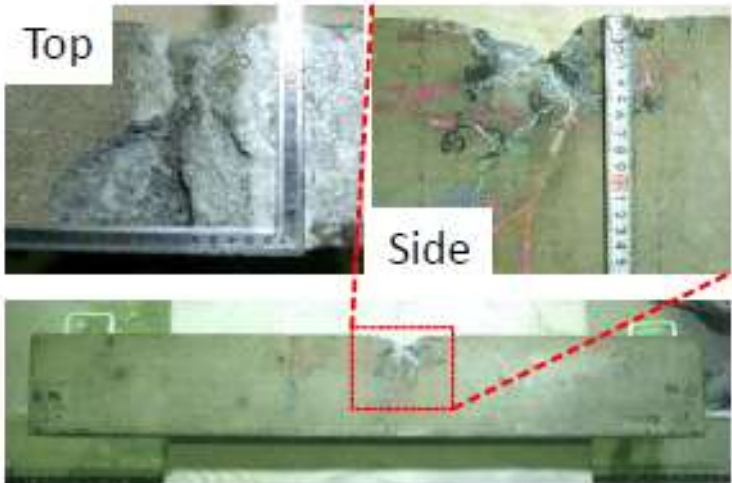

- 3) **Durable high-quality concrete/material** for repair/  
replacement

- 4) **Data-based management** of large amount of infrastructure  
ICT, big data, AI etc.

*Making full use of advanced technologies*

# Practical application of precast concrete member with super-high durability concrete Okayama University

【Investigation of fatigue loading effects on freeze-thaw resistance in concrete】

Crushed sand	Blast furnace slag fine aggregate
 <p>Freeze-thaw 360 cycles, Fatigue test 2.3 mil.</p>	 <p>Freeze-thaw 600 cycles, Fatigue test 4 mil.</p>

- Development of concrete strong against cold weather & cyclic loading with blast furnace slag
- Development of quality management system for blast furnace slag fine aggregate



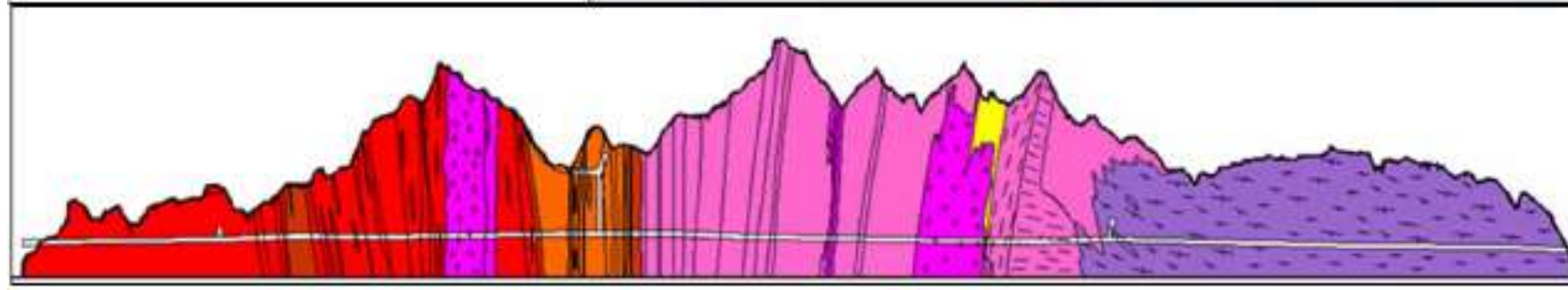
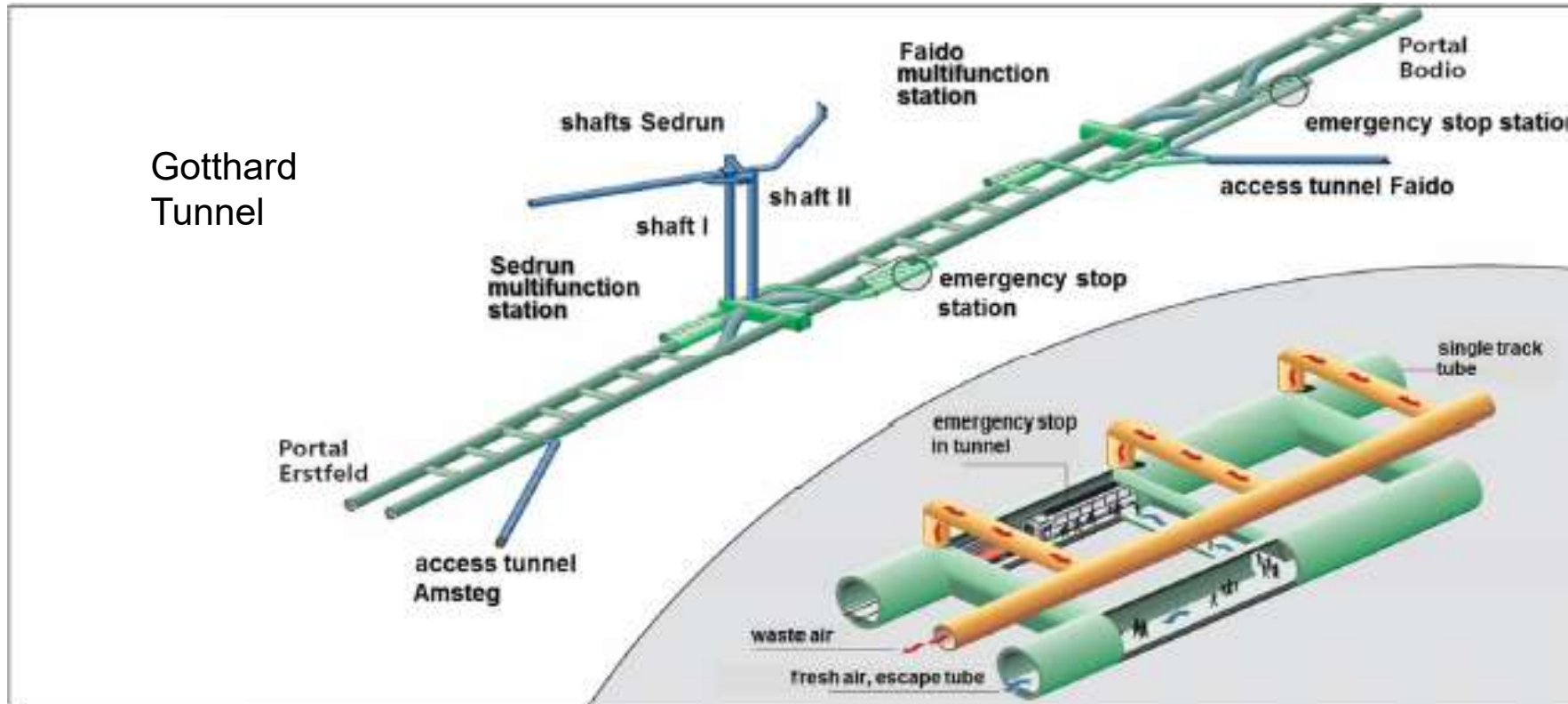
To prolong life of concrete deck slab



# Innovative Tunnelling in a Sustainable Built Environment

Tomas Jesel, Switzerland

*Director Tunnelling Division, Amberg Engineering Ltd*



# Coastal Highway Route E39

Børre Stensvold, Norway  
*Norwegian Public Roads*



340 GNOK  
20 years

# Trends within Sustainable Bridge – Operation and Maintenance

Jens Sandager Jensen, Denmark

*COWI A/S, Kongens Lyngby, Denmark*

## Agenda

1. Introduction
2. Corrosion Protection Plan
3. O&M Manual
4. Structural Health Monitoring Systems
5. Life Cycle Costs and Life Cycle Assessments
6. Risk Analysis
7. Conclusions

Management

Bridge Management System



## 2. Corrosion Protection Plan

- The CPP shall demonstrate that the chosen construction materials achieve the required service life. This includes optimisation of e.g. :
  - Drainage
  - Concrete cover (and possible use of membranes)
  - Concrete mix
  - Use of admixtures to reduce cracking (permeability)
  - Reinforcement type
  - Fibre reinforcement of concrete
  - Steel grade (fatigue)
  - Steel coating system
  - Preparation for cathodic protection





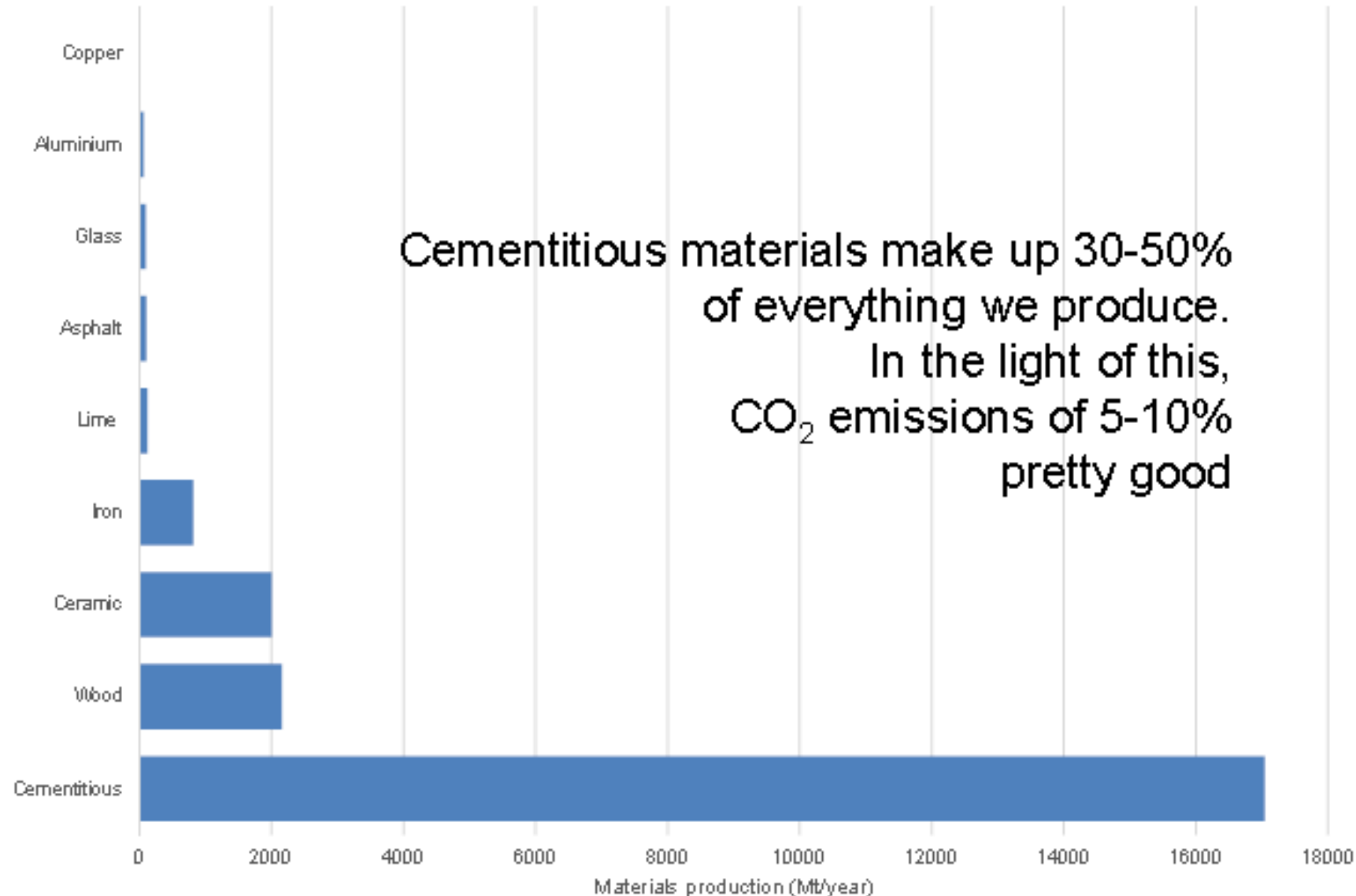
# 5. Life Cycle Costs and Life Cycle Assessments

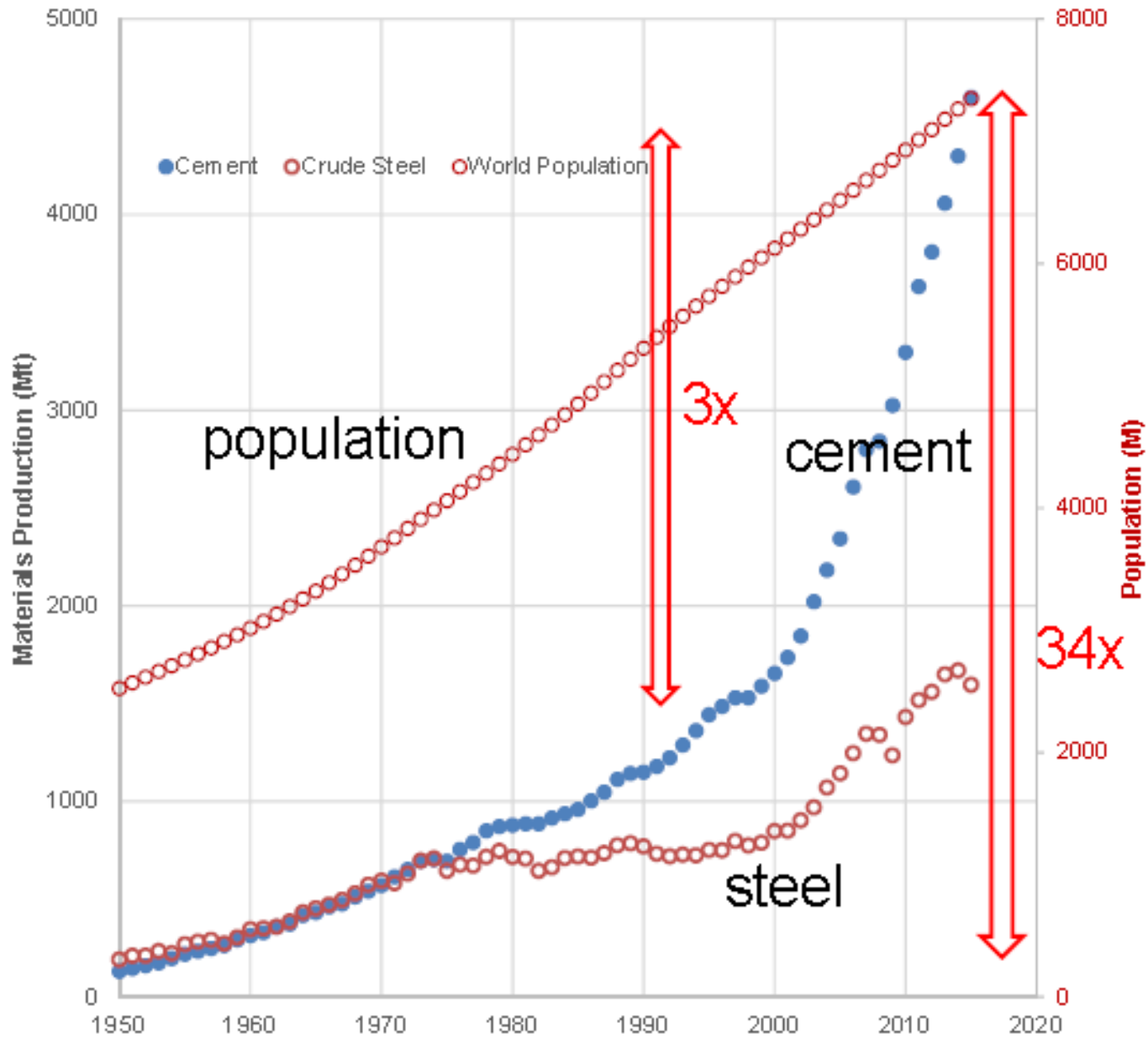
> Two recent research projects reflect this awareness



# Sustainable Concrete

Karen Scrivener, Switzerland  
*EPFL Lausanne, Switzerland*





More cement is used with higher standard of living

To reduce CO<sub>2</sub> emissions clinker has to be reduced by using Supplementary Cementitious Materials (SCM) as Fly ash, Lime stone, Slag or Calcined clay.  
Karin Scrivener is now working with calcined clay

Andrzej Cwirncen, LTU, is working with alternative binders

Vladimir Ronin, LTU, is working with Chemo-Mechanical activation

# A Sustainable City is a City for People

Helle Soeholt, Denmark

*Co-Founder and CEO, Gehl Architects Denmark*

## 'Urban Innovation' attracts





# Times Square - before

Before the  
project

90%  
road space

10%  
people space



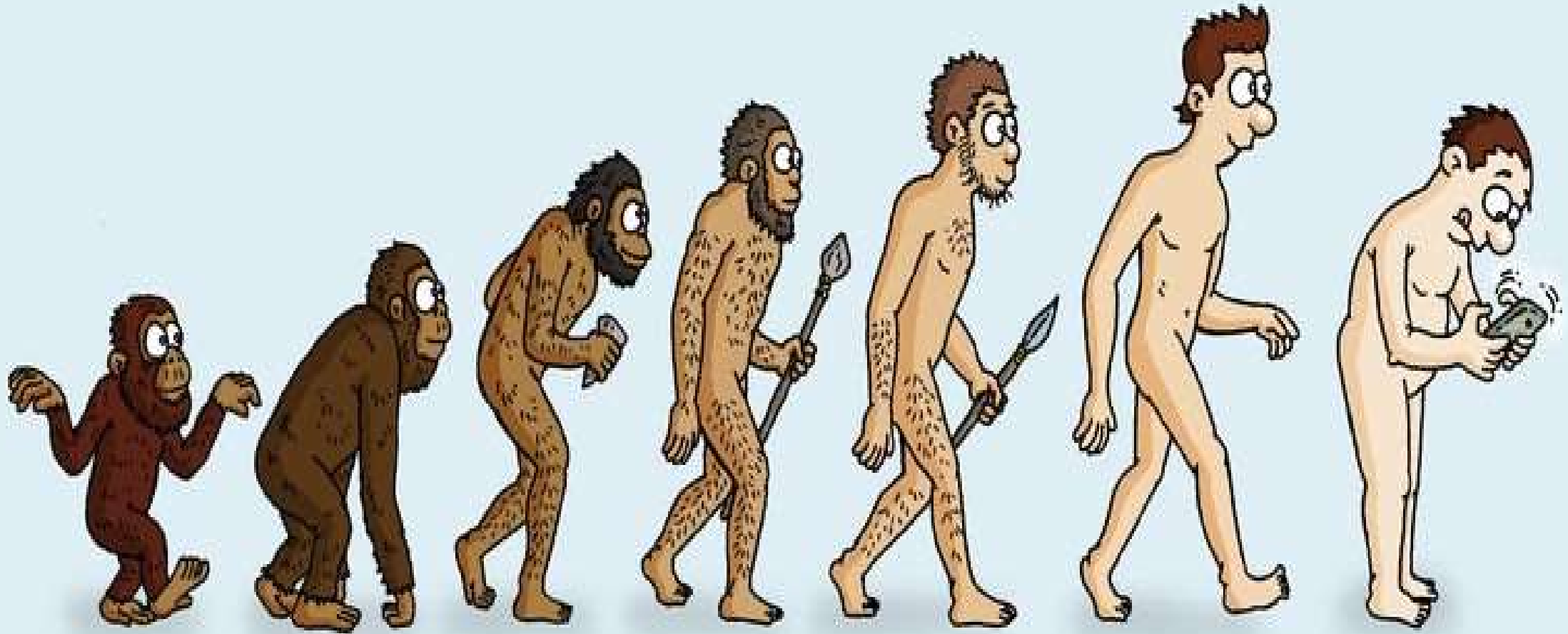
# Times Square - after

After the  
project

10%  
road space

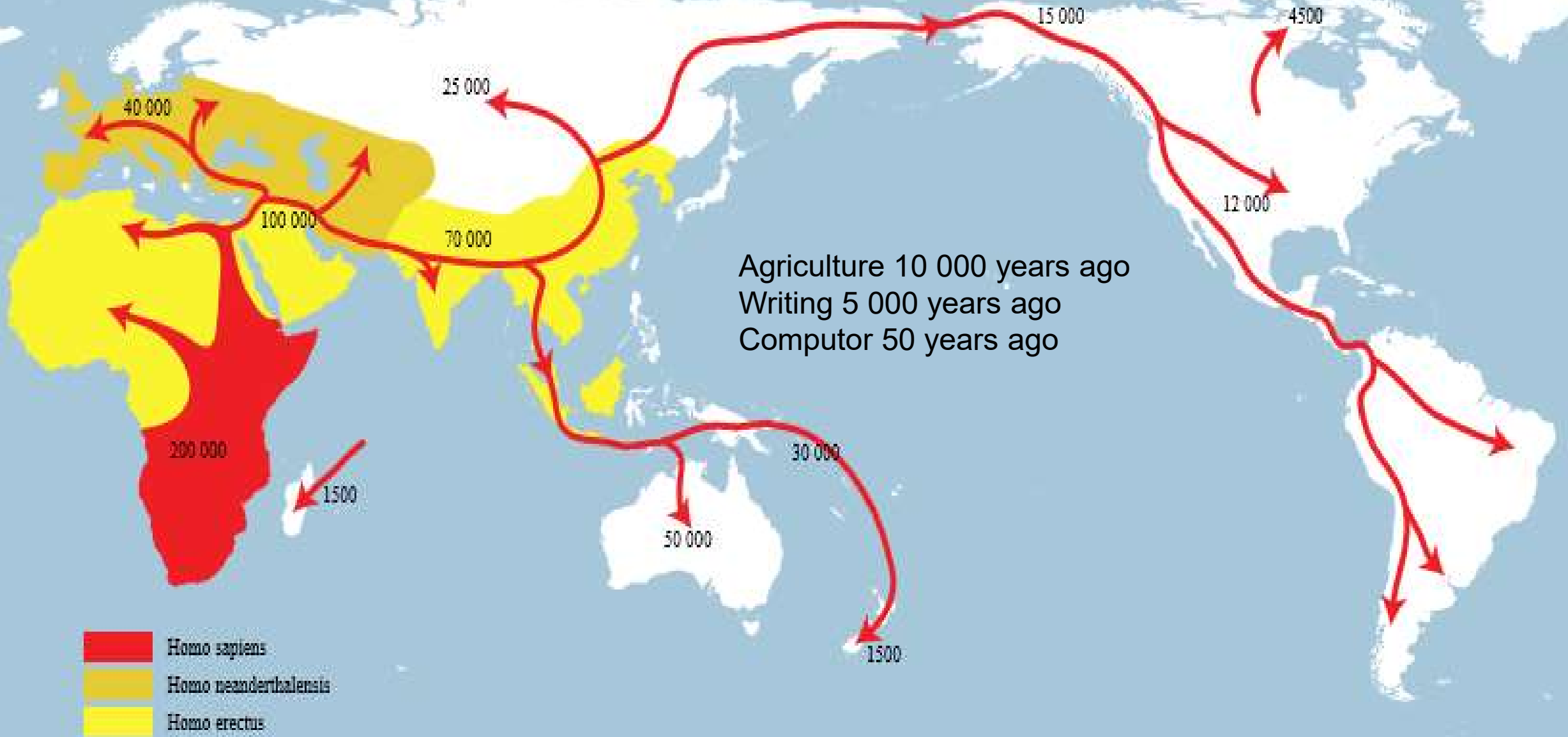
90%  
people space

# Where do we come from and where do we go?



2011 by Steve Kaplan

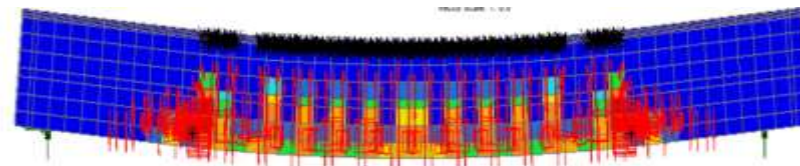
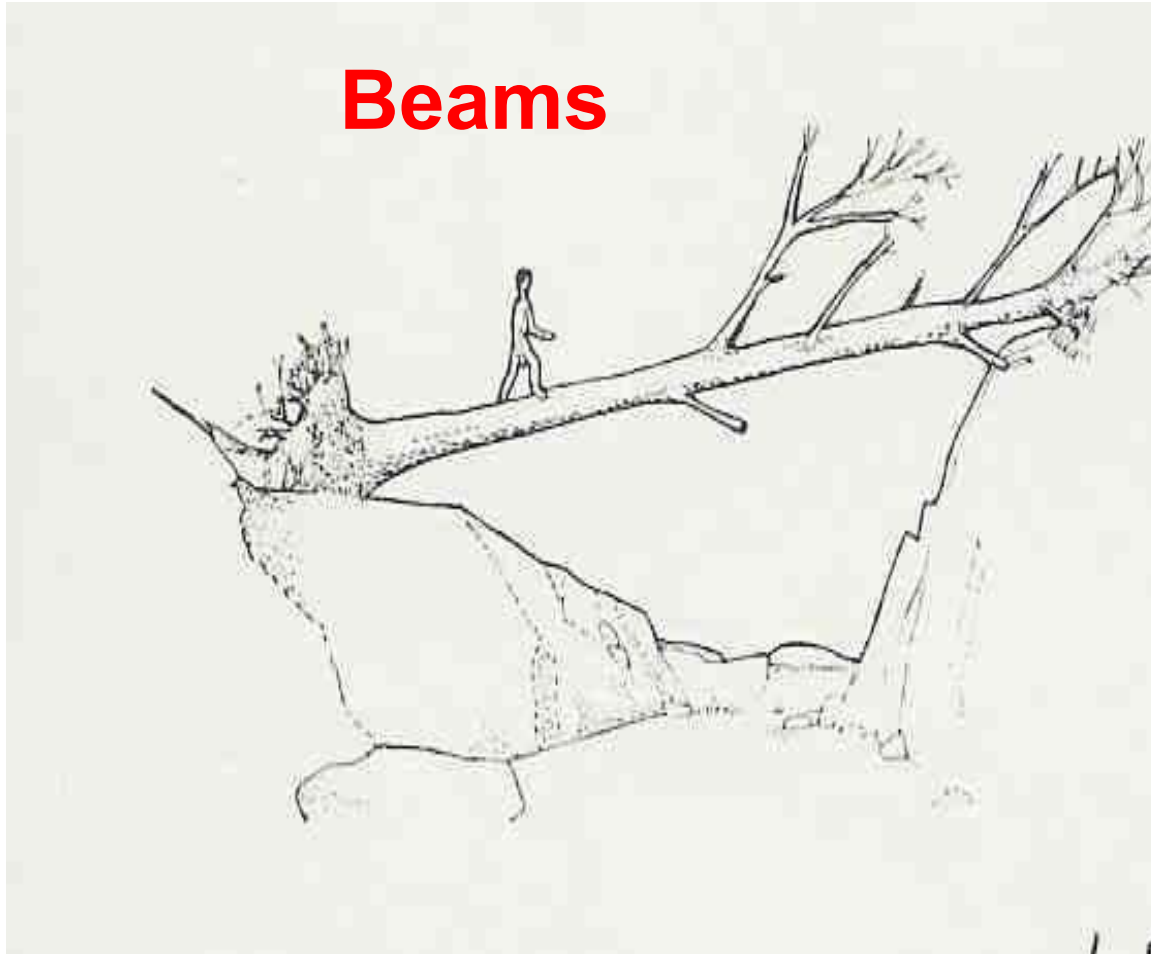
# Out of Africa some 100 000 years ago





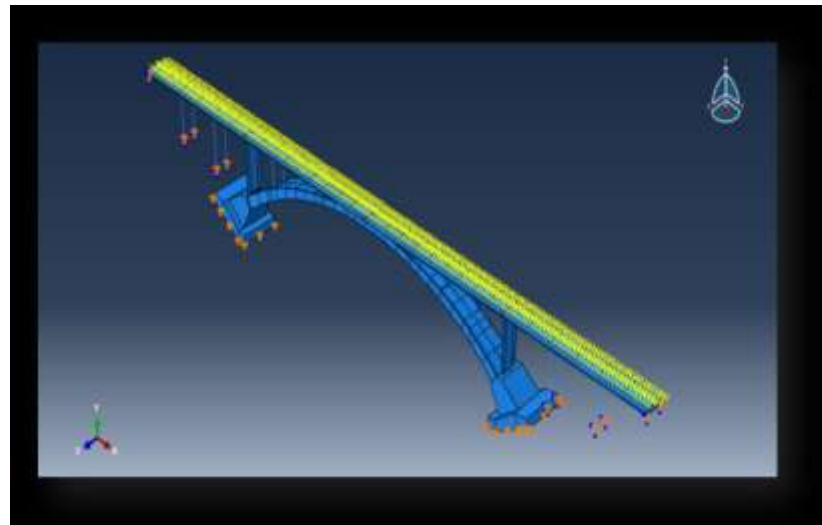
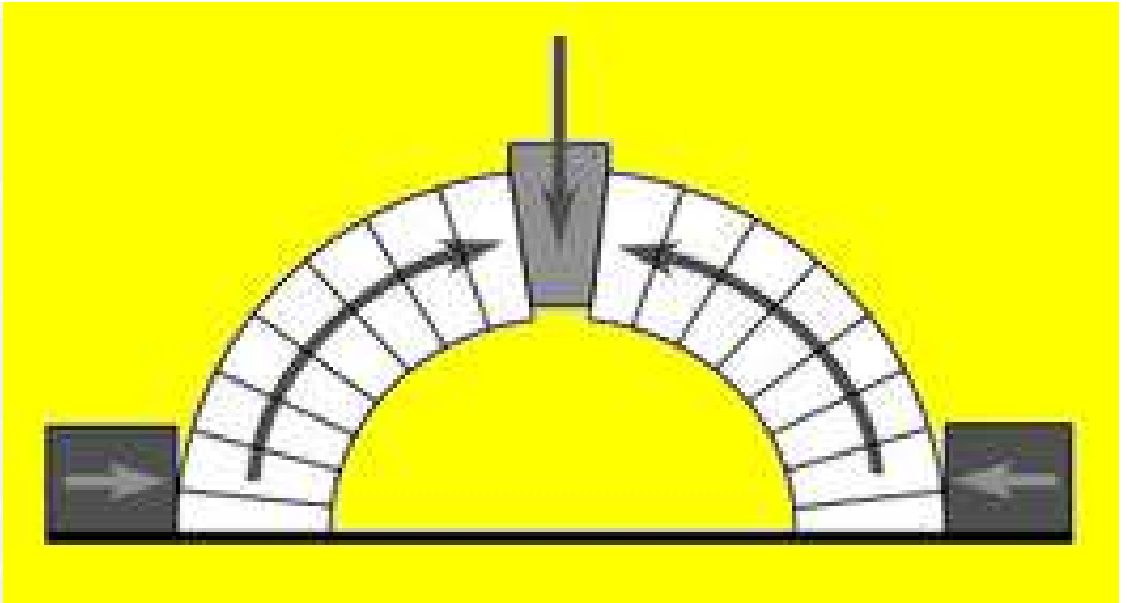
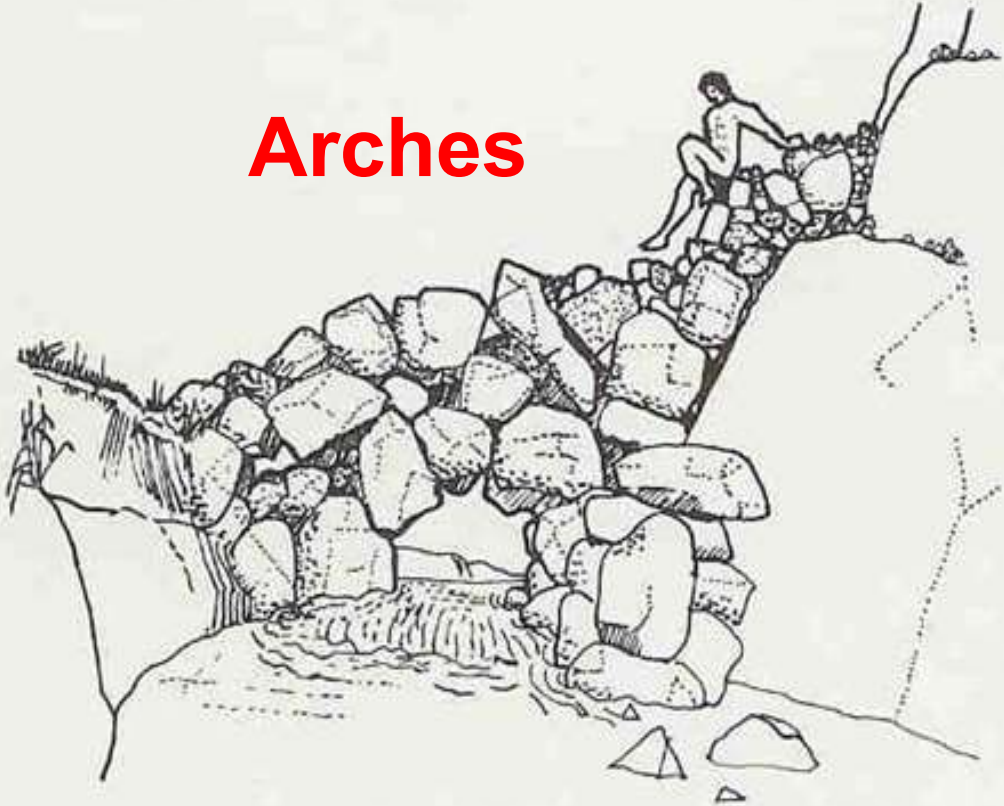
# Out first bridges

## Beams

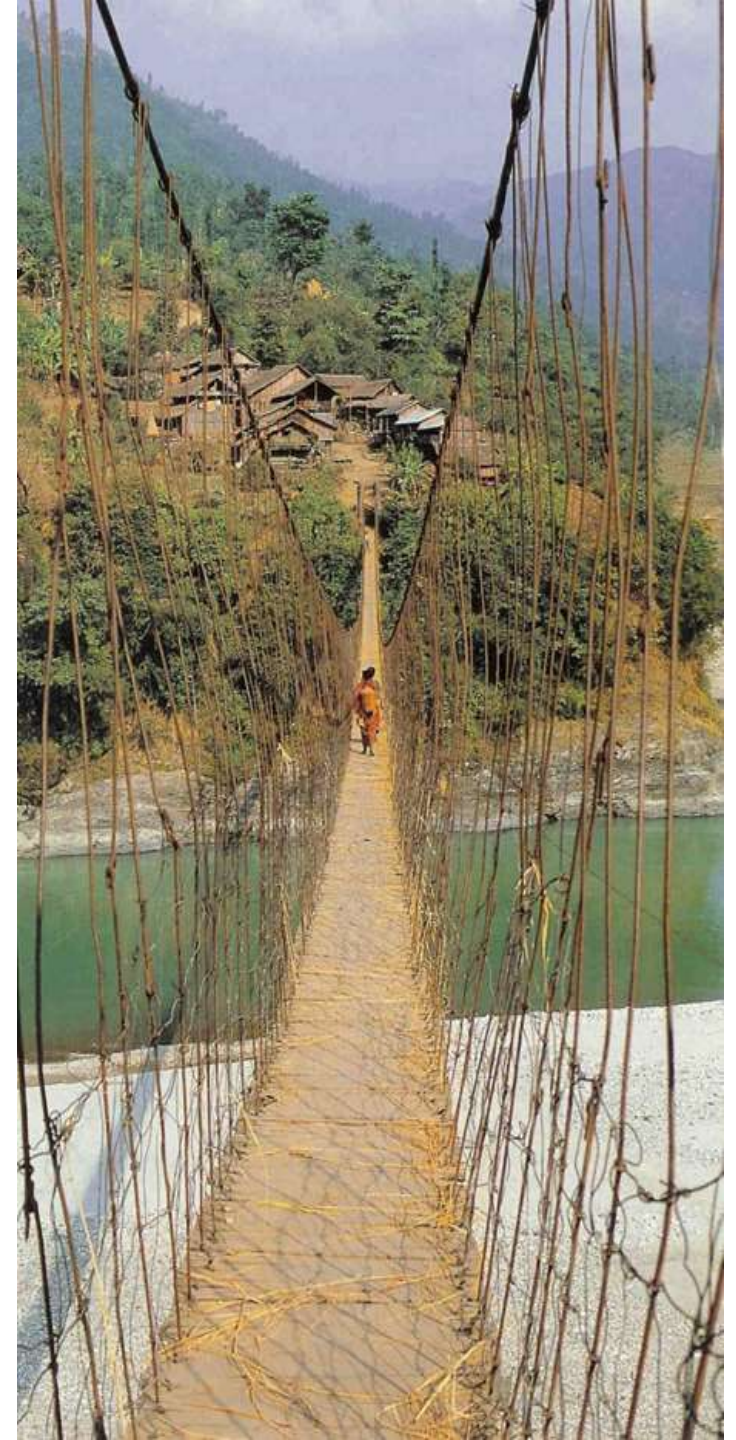


Digital twin structures

# Arches

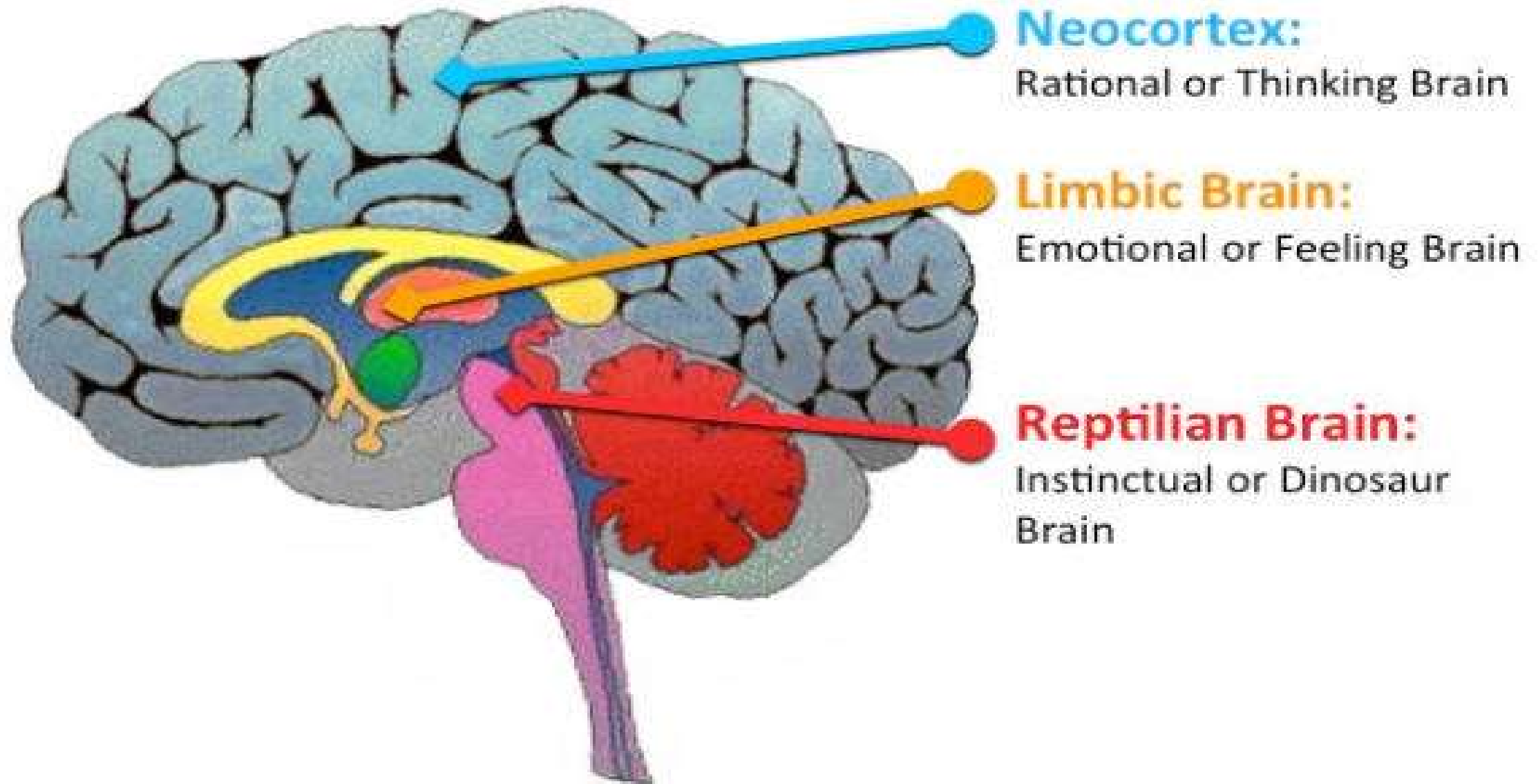


# Suspension Bridges





## WHY ? - Our Brains



### **Neocortex:**

Rational or Thinking Brain

### **Limbic Brain:**

Emotional or Feeling Brain

### **Reptilian Brain:**

Instinctual or Dinosaur Brain

***Conscious Mind: 10%***

1. analyzes
2. thinks and plans
3. short-term memory

---

***Sub-conscious Mind: 90%***

1. long-term memory
2. emotions & feelings
3. habit patterns, relationship patterns, addictions
4. involuntary bodily functions
5. creativity
6. developmental stages
7. spiritual connection
8. intuition

**Subconscious Mind**

Tracks 100's to 1000's of tasks at once.

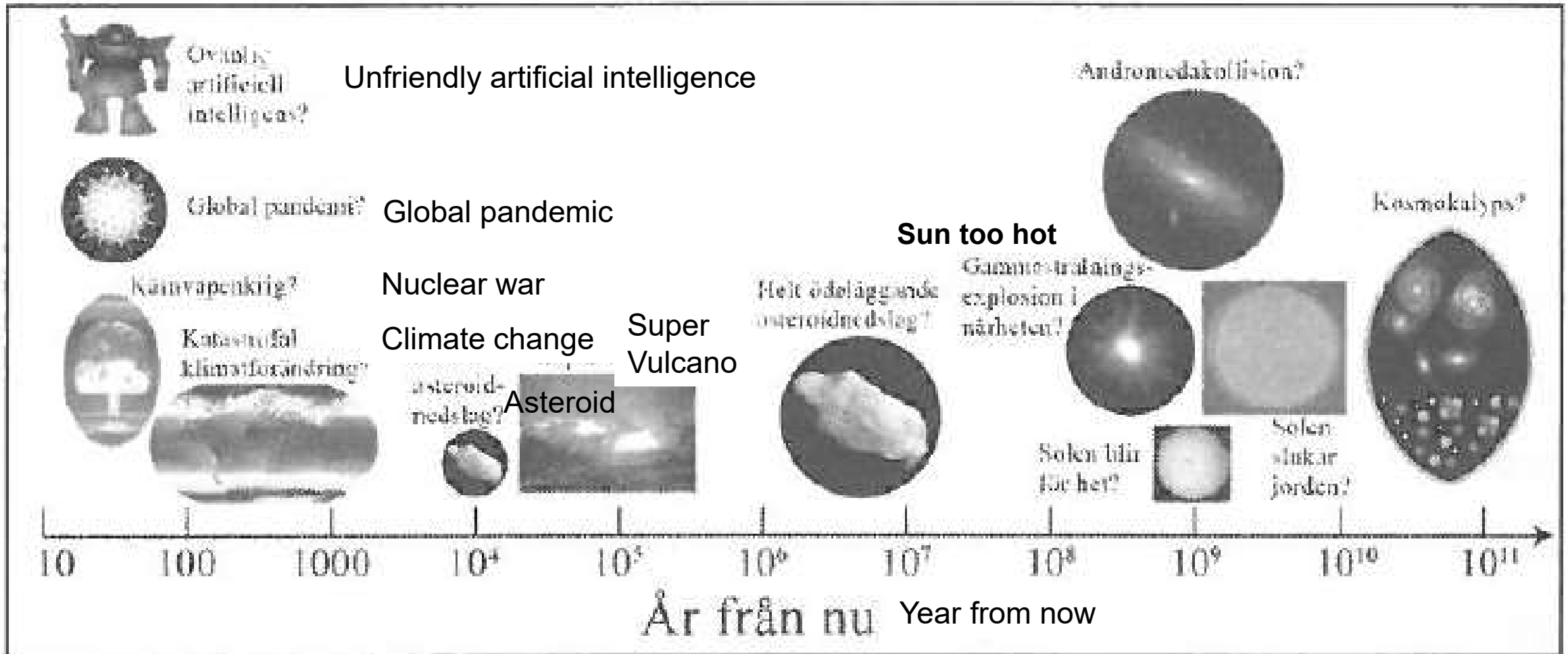
Millions of bits of information processed each second.

**Conscious Mind**

Tracks 4 to 5 tasks at once.

Less than 100 bits of information processed each second.

# Our greatest threats



Max Tegmark (2015): Our Mathematical Universe



## How can we contribute to IABSE/Society ?

We can work together and

- create a vision of a sustainable future
- restrain our bad properties (greed, shortsightedness, killing enemies)
- strengthen our good abilities (to think, cooperate and love)

We can go home and consider:

- What have I learnt ?
- What can I copy/develop ?
- How can I contribute ?

The one who shares most, is the best scientist

*Challenges in Design and Construction of an Innovative and Sustainable Built Environment*







Thank you for your kind attention

*The “Harry Potter Bridge” at Glenfinnan in Scotland built in concrete with no reinforcement by sir Robert McAlpine (“Concrete Bob”) in 1897-1901.*