

An aerial photograph of a city skyline at sunset. The sky is filled with soft, orange and yellow clouds. In the foreground, there are several tall, modern skyscrapers. The city extends into the distance, with a mix of high-rise buildings and lower residential areas. The overall atmosphere is warm and serene.

# Knowledge Visualization

**The power of visualization. Examples from 15 years of experience in using visual tools in project management.**

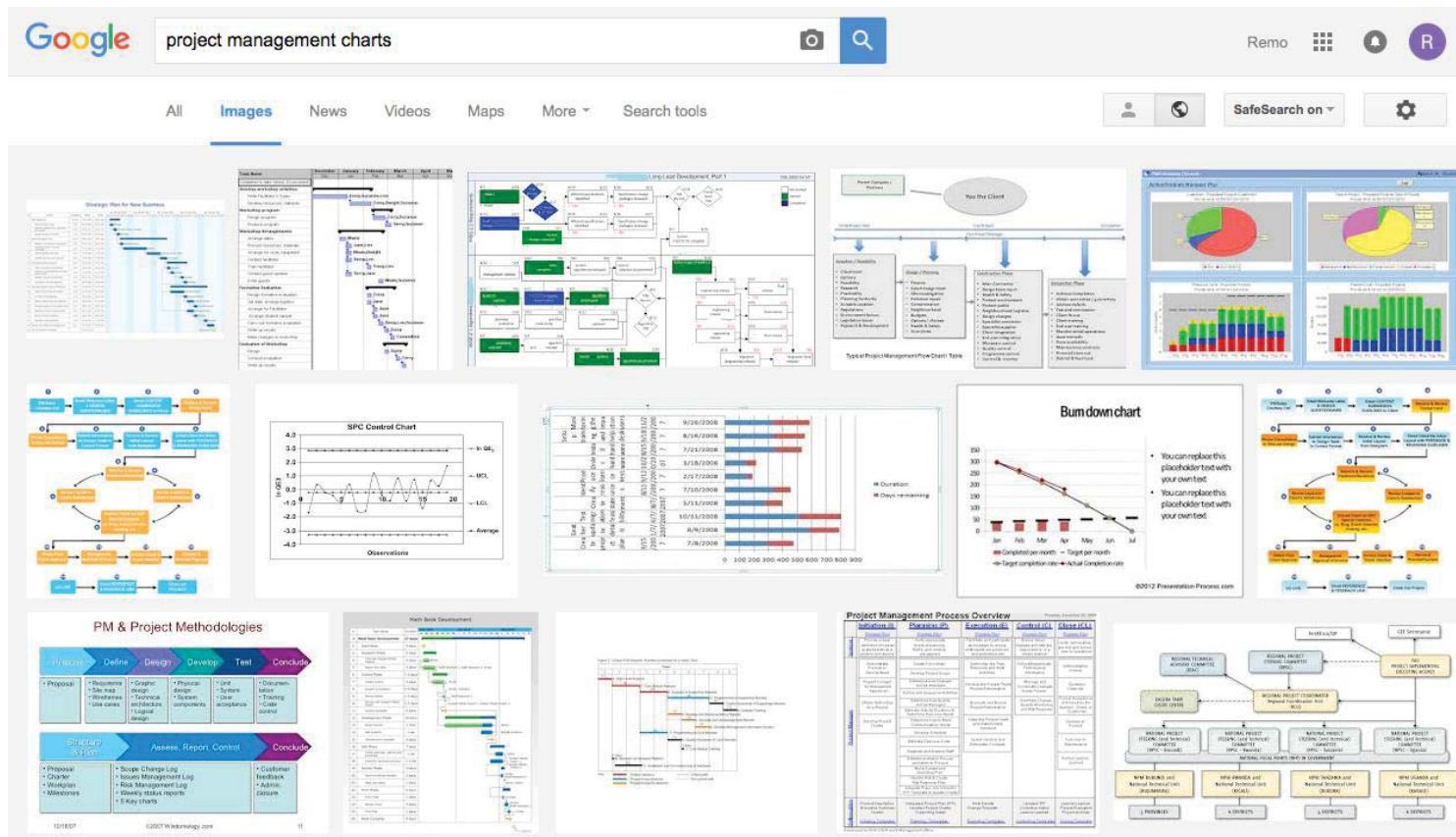
Examples from two sources:

**Part 1: Own Company**, Switzerland ([remo@burkhard.swiss](mailto:remo@burkhard.swiss))

**Part 2: Singapore-ETH Centre**, Singapore ([remo.burkhard@sl.ethz.ch](mailto:remo.burkhard@sl.ethz.ch))

# Where you are today.

BURKHARD



## Where you may be in 60 minutes.

BURKHARD

Knowledge Visualization is a key success factor in all areas and aspects of project management, such as

Coordination, progress reports, communication, up selling, audits, accounting, controlling, hiring the best talents, IT, systems, viral marketing, stakeholder involvement, media, diplomacy, etc.

Today, I would like to convince you that:

The number 1 skillset of a successful project manager is his or her ability to develop and use creative visual formats in all aspects of the project management spectrum.

## My background: Passion for Creativity

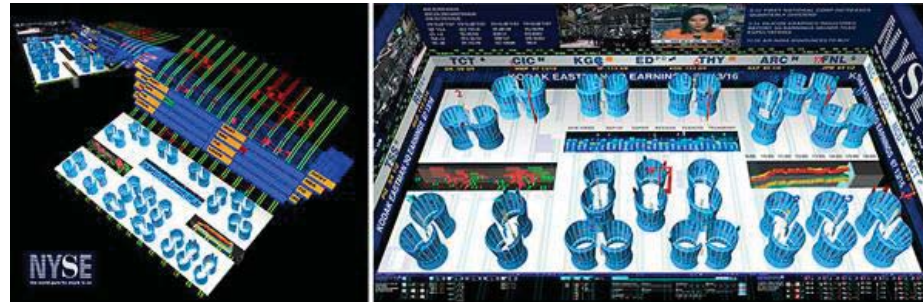
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- Master of Architecture at ETH
- PhD on Knowledge Visualization, introducing **Knowledge Visualization**
- CFA Level II Candidate, Java Programmer, HSK Level III, MAS CMFAS 6
- 50 publications
- Consulted > 100 corporate clients and universities and NGOs
- Since 2000: Three SMEs (20+ people)
- Since 2010: Managing Director of ETH Singapore (160+ people)
- Since 2015: MD (90%) and (10%) own projects.



# 1998: 3D New York Stock Exchange

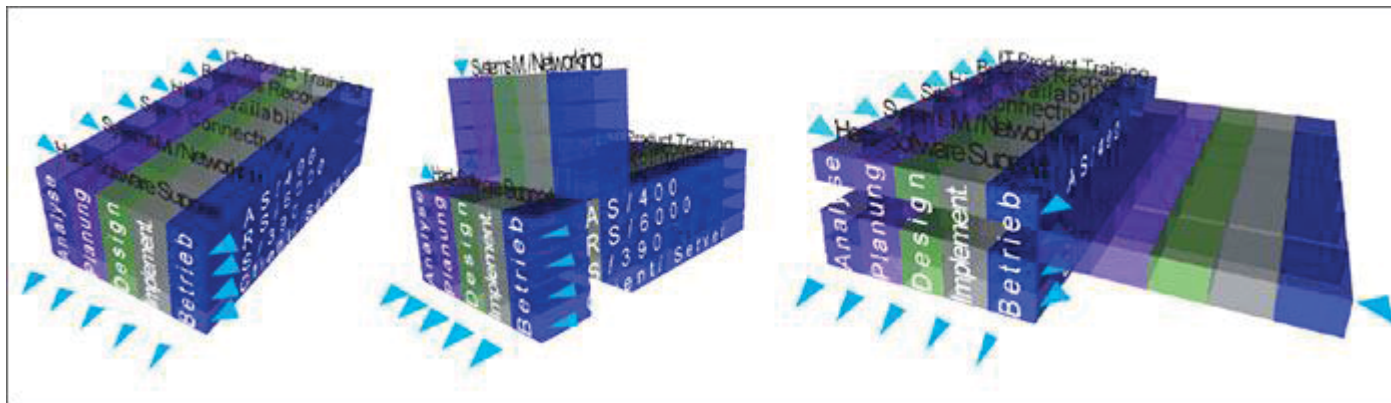
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In my internship, I developed a passion for visualization.

Source: Asymptote Architecture, NY

I came back to Zurich and did a similar smaller project for IBM. People liked the cover more than my 3D application.



# 2001: Founding of vasp datastructure GmbH

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I learned Java and programmed version 0.1 of a TreeMap Tool. We developed it further to a commercial tool with Macrofocus.com, but selling was not easy at all.



macroCUS

Home Products Solutions Services About

Desktop  
Server  
API

Overview Features Documentation Datasets Try it Download Purchase Support

Looking for a good TreeMap visualization tool?  
You've just found the best.

February 11, 2016  
TreeMap v. 3.8.0 released! You will find it in the [download area](#)...

January 1, 2016  
We wish you an [animated 2016!](#)

**Turn your data into stunning treemap visualization**  
TreeMap provides an easy, yet extremely powerful means of creating beautiful treemaps for analytical and presentation purpose. Importing data from a wide variety of file formats (including of course Excel), as well as connecting to databases (such as MySQL and SQL Server) is a breeze... and it scales to big data.

**Configure everything and aggregate data with ease**  
The visual appearance of a treemap is highly configurable. Size, color, height, and labels can be mapped to any attribute. Many options allow you to further fine-tune the display. Coloring schemes can be adjusted to the last detail and the resulting treemaps can be rendered flat, or with a pseudo-3D cushion look with customizable light source.

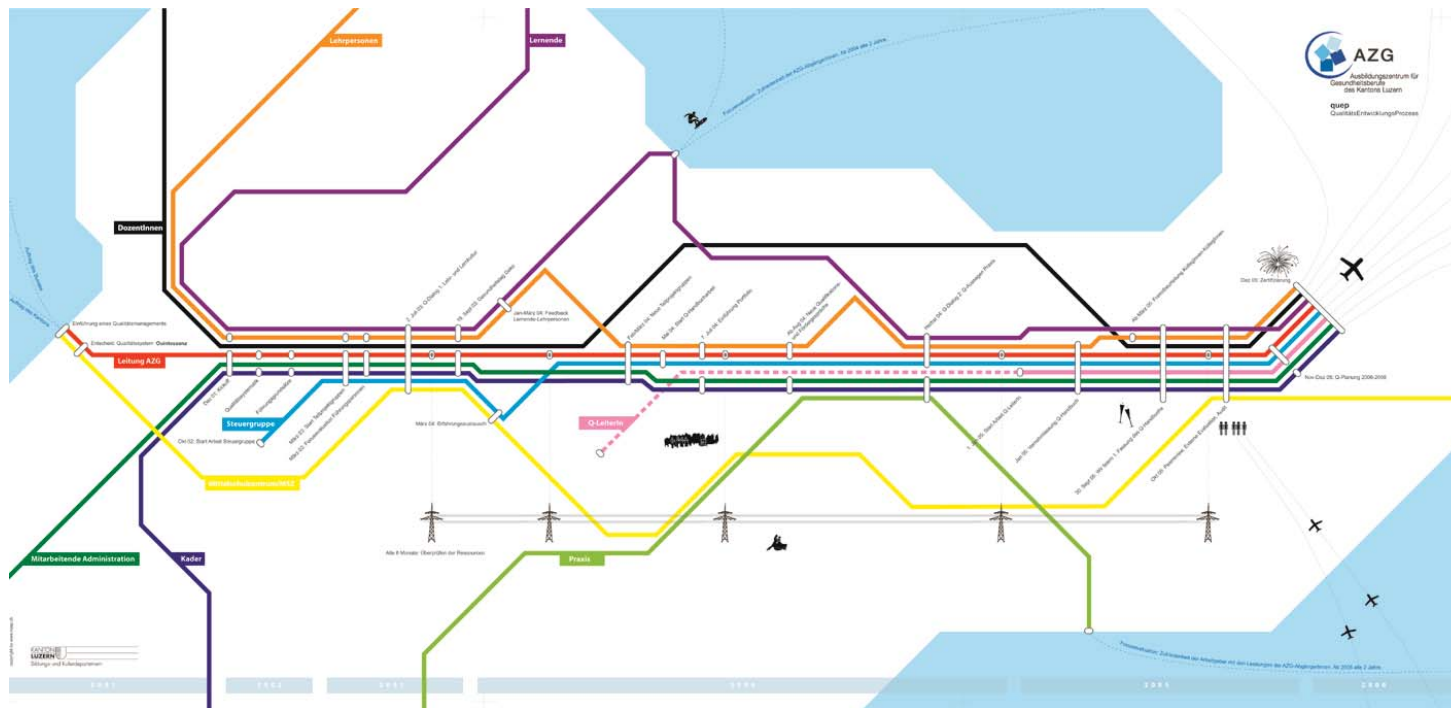
**Choose your favorite treemap layout**  
Treemaps works by dividing the display surface so that the area of each entry is proportional to the data values. In addition to the classic treemap layout algorithm, TreeMap also features a number of alternative layouts such as a squarified variant that harmonizes aspect ratios of the rectangles, or the aesthetically pleasing circular, tan cloud, and Voronoi layouts.

Source: Macrofocus.com, jointly developed Treemap with in 2003.

# 2001: Project Tube Map

# 2001: Project Tube Map

Instead we got multiple requests for “Big Pictures”. For example, we were asked to find a new way to excite 300 employees for a long-term project and invented the project tube map.

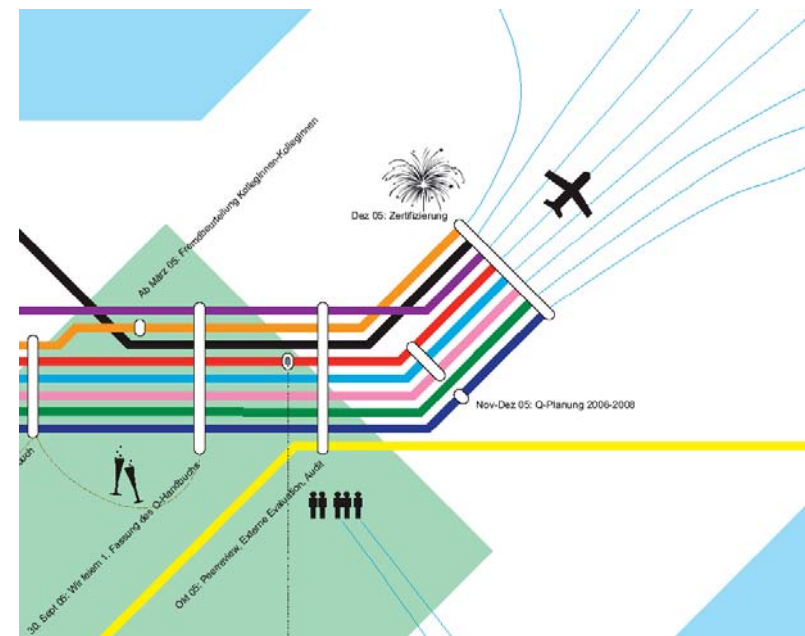
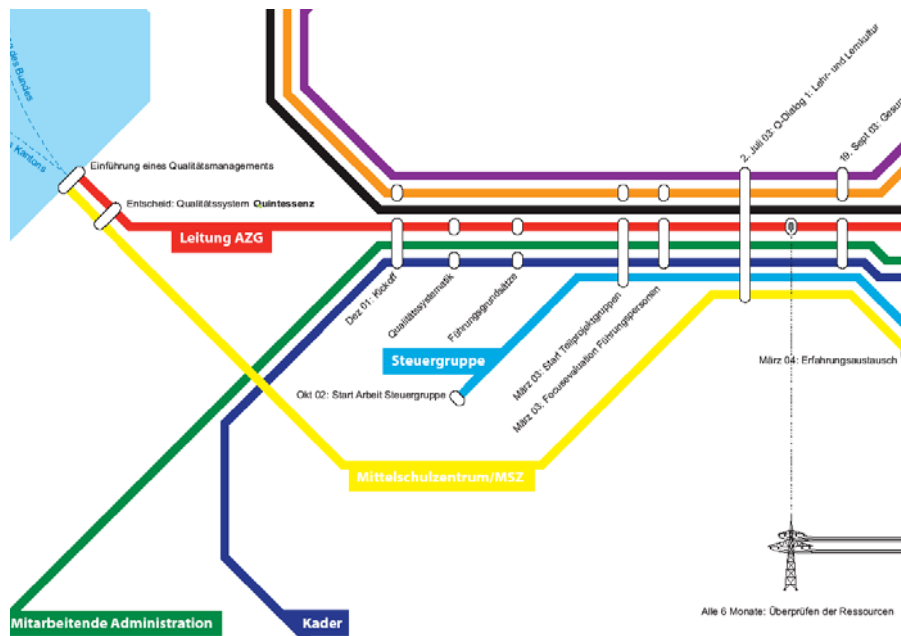


Source: vasp.ch Remo Burkhard and Michael Meier

# 2001: Project Tube Map 2x4m

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It was a huge success and we have learned that there is something else than information visualization.



Source: vasp.ch Remo Burkhard and Michael Meier



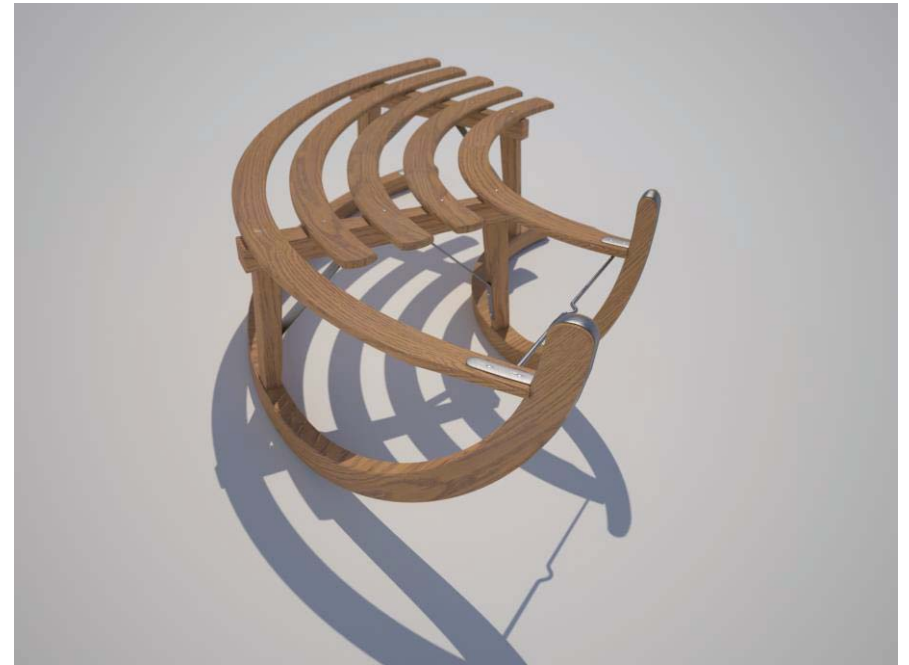
## 2001: Seminar on Power of Images





# 100 projects on customized 3D renderings

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Source: vasp.ch Remo Burkhard and Michael Meier

# Virtual Photography for Marketing

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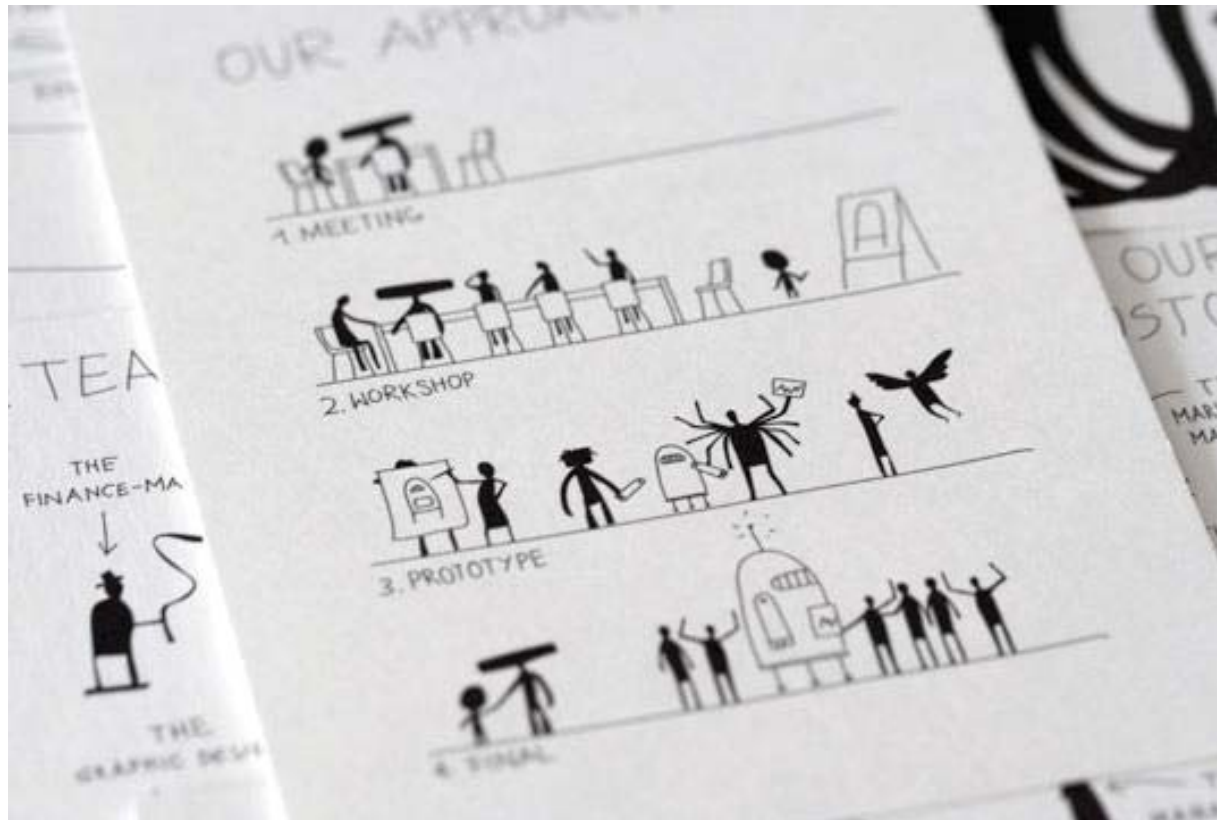


Source: [www.marenco-swisshelicopter.com](http://www.marenco-swisshelicopter.com)

Source: vasp.ch Remo Burkhard and Michael Meier

Agency asked for a new way to depict their process

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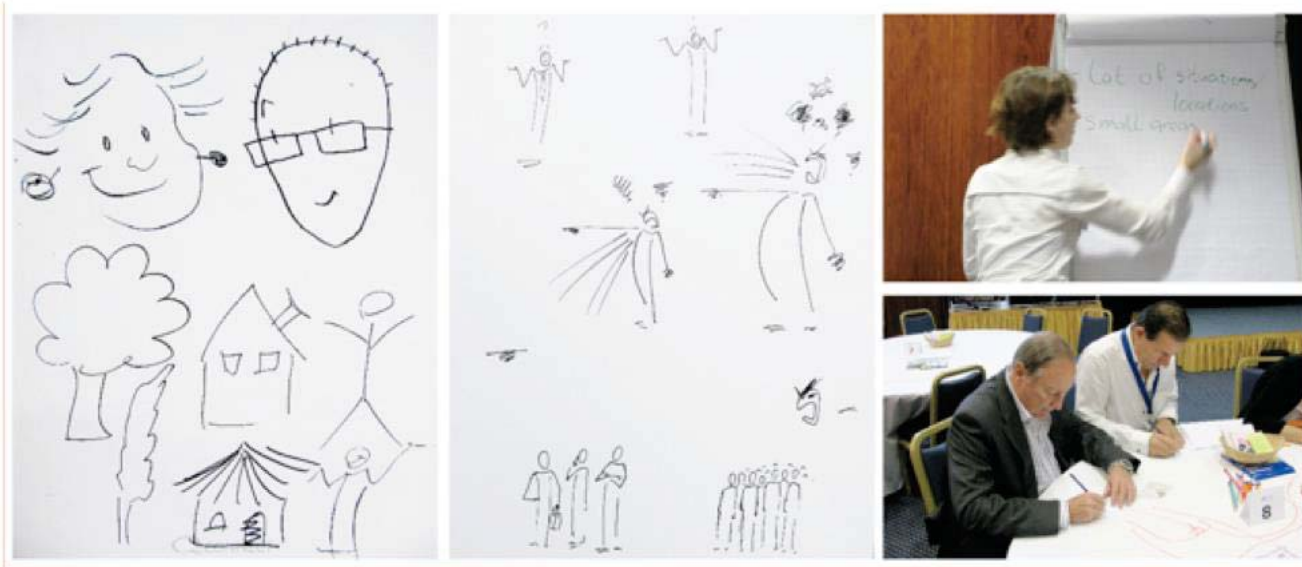


Source: vasp.ch Remo Burkhard and Michael Meier

# Best Seller: Sketch Academy Course

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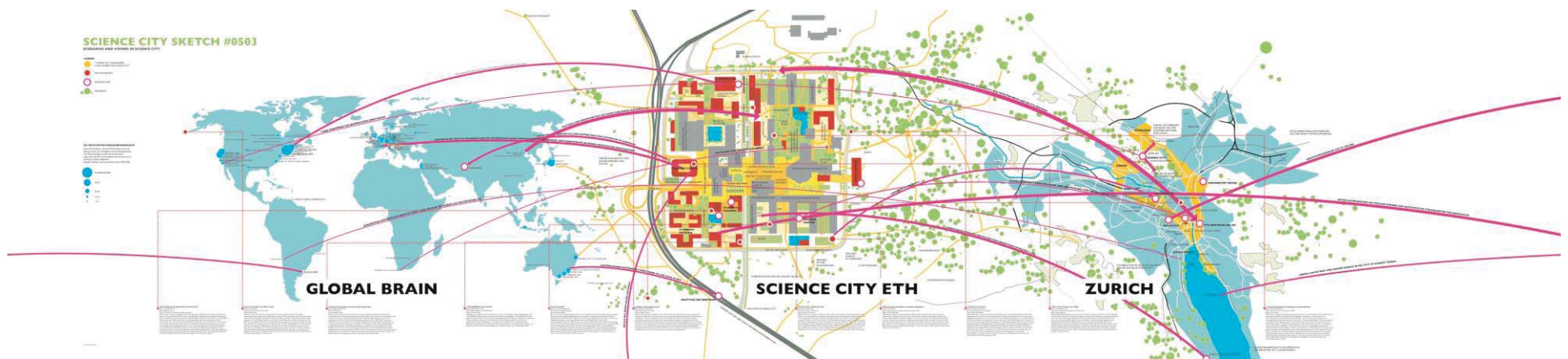
## Abendseminar: Zeichnen für Nichtzeichner



Source: [vasp.ch](http://vasp.ch) Remo Burkhard and Michael Meier

# Science City Map: Information Overload Experiment

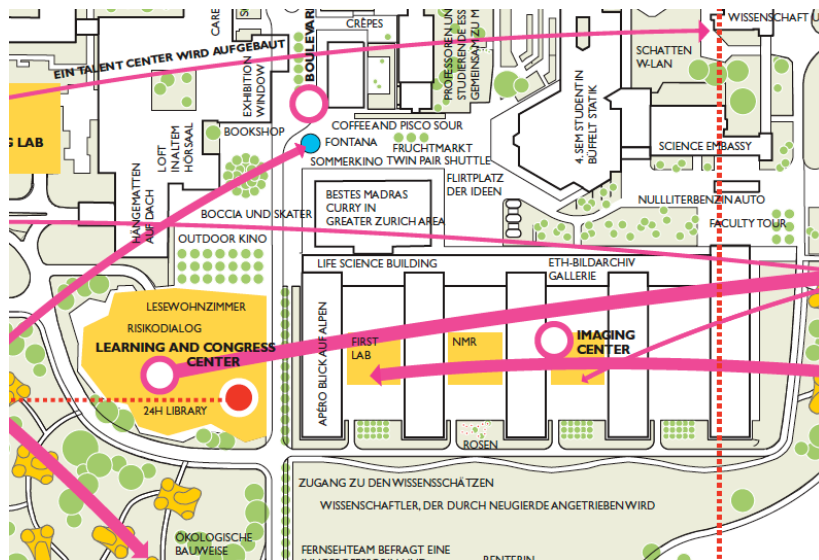
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Source: [vasp.ch](http://vasp.ch) Remo Burkhard and Michael Meier

# Power of Story Telling

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## Sinnlabor und Visualization Lab

Name: Edward L. Newell, 53

Beruf: Kunstsammler und Mäzen

Kultur: England, London

2005: Ich unterstütze Kunstschaffende, weil ich deren Leidenschaft bewundere. Seit kurzem unterstütze ich auch Wissenschaftler. Denn in Science City hat mich die Idee des Sinnlabors überzeugt. Das Sinnlabor liegt am Schnittpunkt von Kunst und Wissenschaft. Hier werden Methoden entwickelt, wie abstrakten Inhalten, Informationen, komplexen Sachverhalten und wissenschaftlichen Resultaten Sinn gegeben und wie dieser dargestellt werden kann. Damit sowohl Experten wie Laien die Inhalte schneller begreifen und sich vorstellen können. Es ist etwas Neues, Faszinierendes. Eine Schnittstelle zwischen Kunst, Philosophie, Kommunikation und dem E-Science Lab. Im Sinnlabor forschen Wissenschaftler aus Philosophie, Soziologie, Marketing, Design, Kunstgeschichte, Architektur und der Informatik. Was mich, als Kunstsammler, bis heute nicht loslässt, ist die Grundidee, dass hier durch die Visualisierung den Informationen Sinn gegeben wird.





Source: vasp.ch Remo Burkhard and Michael Meier

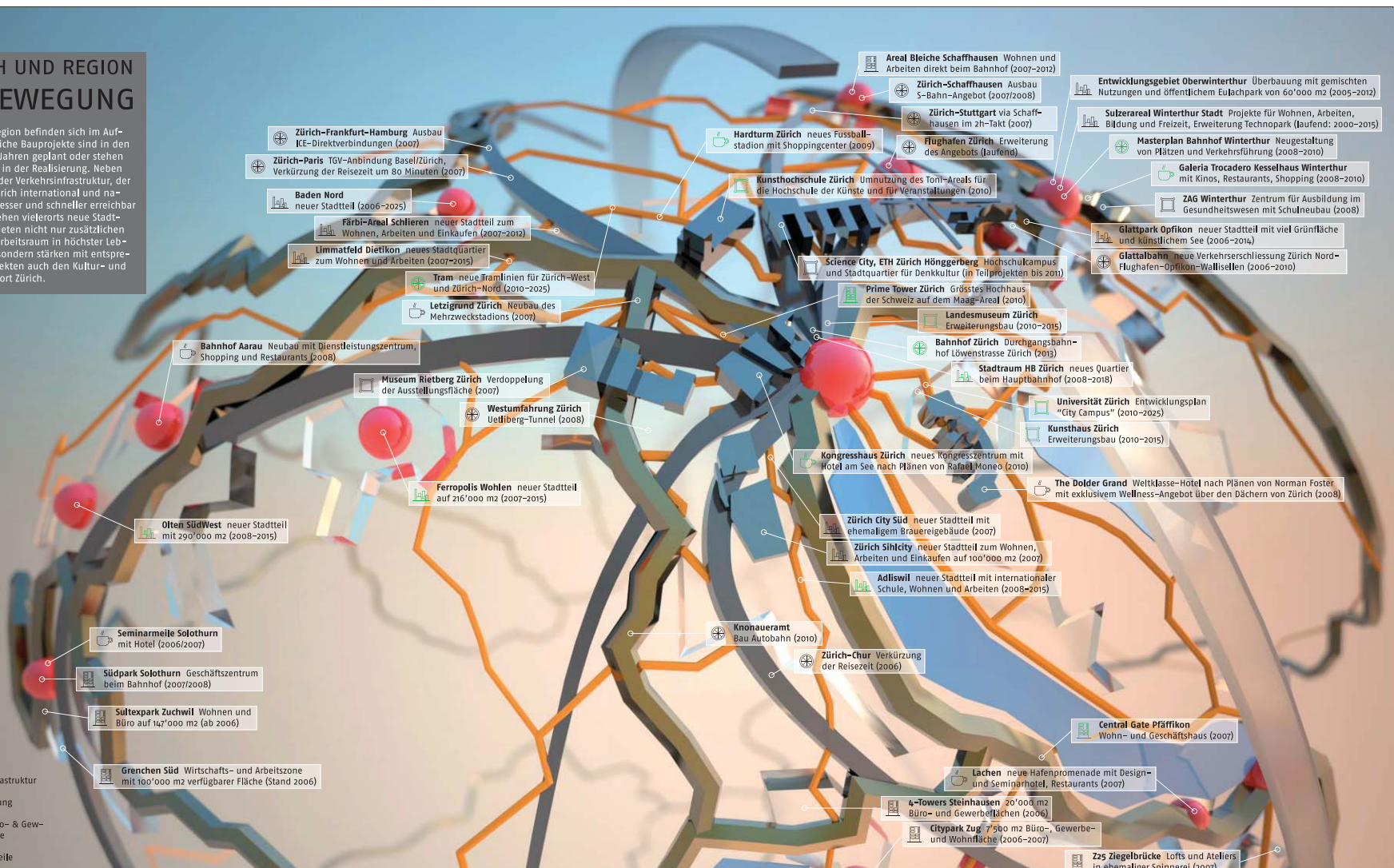




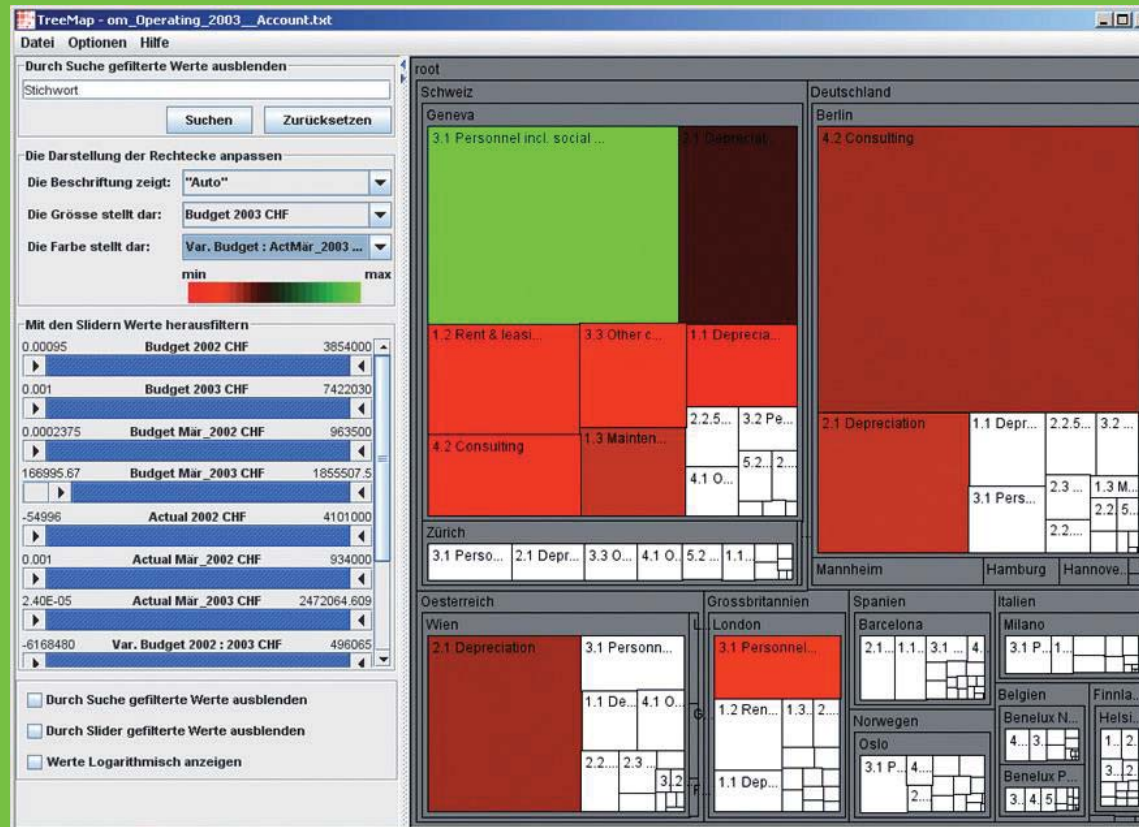
## ZÜRICH UND REGION IN BEWEGUNG

Zürich und Region befinden sich im Aufbruch. Zahlreiche Bauprojekte sind in den kommenden Jahren geplant oder stehen bereits heute in der Realisierung. Neben dem Ausbau der Verkehrsinfrastruktur, der die Region Zürich international und national noch besser und schneller erreichbar macht, entstehen vielerorts neue Stadtteile. Diese bieten nicht nur zusätzlichen Wohn- und Arbeitsraum in höchster Lebensqualität, sondern stärken mit entsprechenden Projekten auch den Kultur- und Wissensstandort Zürich.

-  Verkehrsinfrastruktur
-  Kultur, Bildung
-  Wohn-, Büro- & Gewerbegebäude
-  Neue Stadtteile



# Finally, the first Tree Map Project with real data.



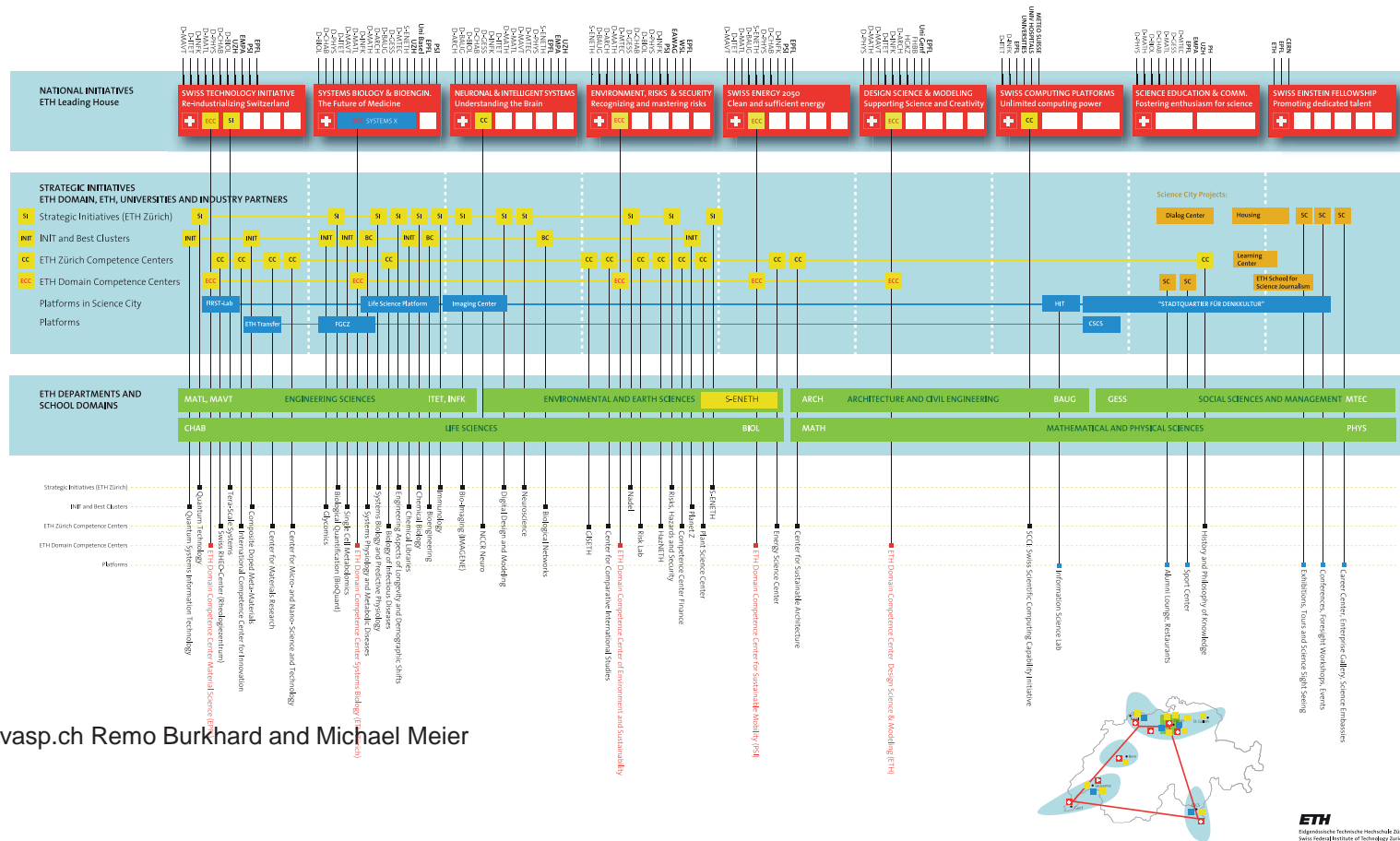
Source: vasp.ch Remo Burkhard and Michael Meier

# More Big Pictures

## Strategische Planung ETH Zürich

ETH Zürich  
 Institut für Strategie und Management  
 gerhard.schmidt@ethz.ch

BURKHARD



Source: vasp.ch Remo Burkhard and Michael Meier



Maps for Risk Awareness BURKHARD

Maps for Risk Awareness BURKHARD

## GROSSWETTERLAGE FOOD

Risiken der Lebensmittelbranche (Mai 2004)

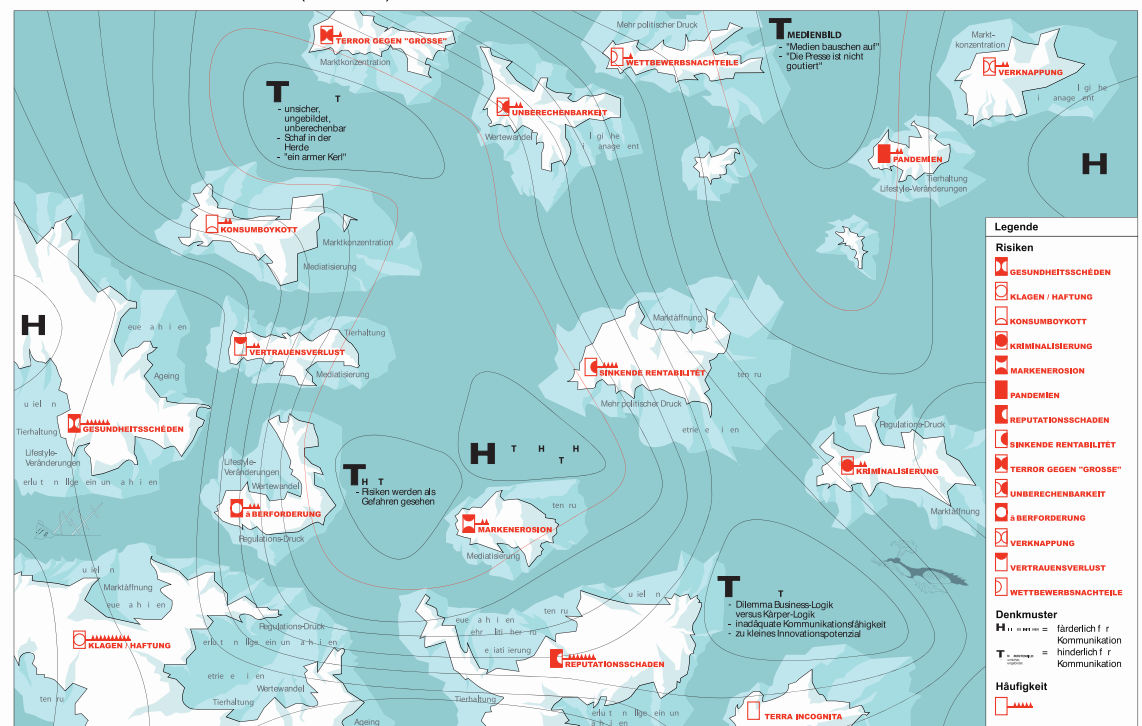
[illegible]

Auswertung / Analyse von Interviews mit den Teilnehmern der Risiko-Plattform "FOOD". Mai 2004.  
Autoren team: Dr. Christoph Meß, Betty Zucker, Thomas Breibach.

Source: vasp.ch Remo Burkhard and Michael Meier

## GROSSWETTERLAGE FOOD

## Risiken der Lebensmittelbranche (Mai 2004)



Knowledge Visualization: [www.vasp.ch](http://www.vasp.ch)

SUE

## GESELLSCHAFTLICHE ENTWICKLUNGEN

POLITIK &amp; REGELUNGEN

## MARKT-KONSTELLATIONEN

## KONSUMENTEN- MEINUNG

WISSEN

## RESSOURCEN

## RENTABILITÉT

# Risk Assessment Workshop February 2014

Example Company Private Limited

VisualManager®



Source: vasp.ch Remo Burkhard and Michael Meier



# Software: Visual Manager

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Source: [vasp.ch](http://vasp.ch) Remo Burkhard and Michael Meier and Chair for Information Architecture (ETH Zurich)

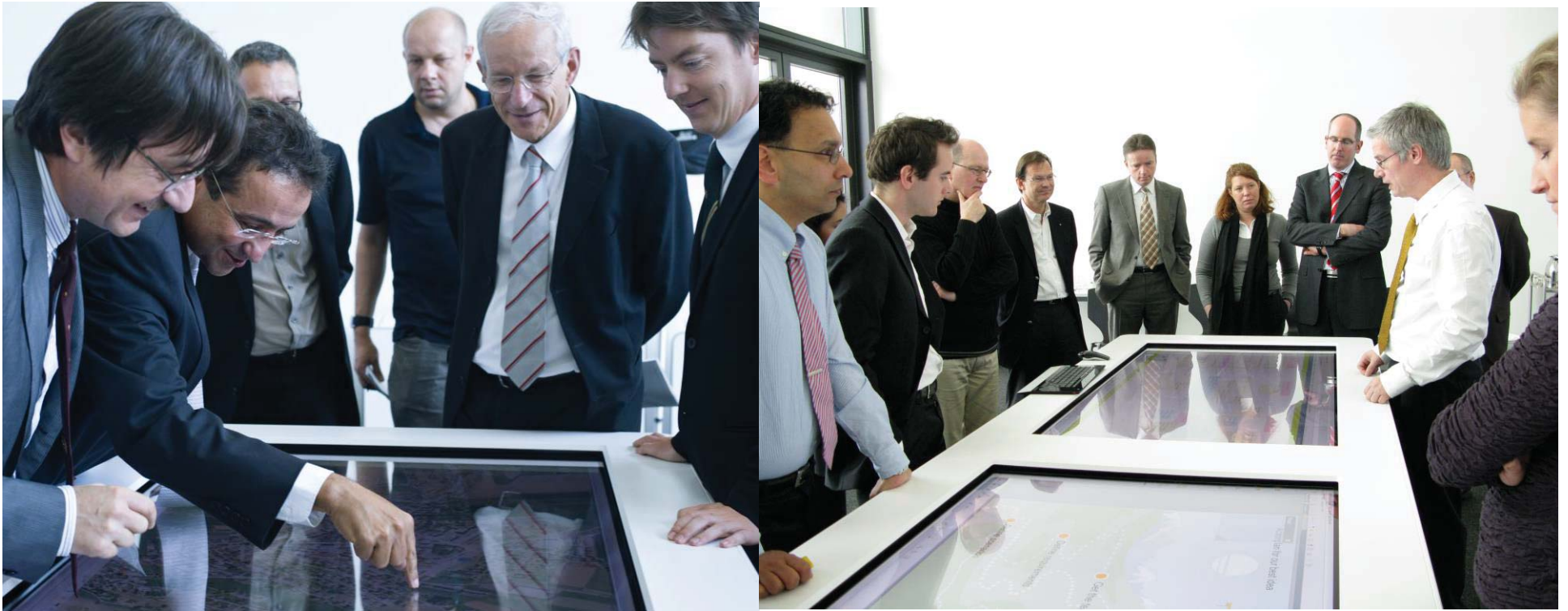
# Brainstorming Sessions with Research Teams

BURKHARD



# Risk Assessment Workshops with Board Members

BURKHARD



Source: [vasp.ch](http://vasp.ch) Remo Burkhard and Michael Meier and Chair for Information Architecture (ETH Zurich)





# Today, IV and KV are well accepted fields.

BURKHARD



**iV2015** - 9<sup>th</sup> International Conference  
**Knowledge Visualization and Visual Thinking**  
21, 22, 23 and 24 July 2015  
The University of Barcelona • Barcelona • Spain •  
<http://www.graphicslink.co.uk/IV2015/>  
<http://www.ub.edu/web/ub/en/>

## Introduction

In an increasingly complex world, Knowledge Visualization and Visual Thinking are gaining importance in all areas of science, business and society. Analogue and digital visual approaches aim to support the creation, application and communication of knowledge and insights – particularly in situations where people from different educational, cultural and professional backgrounds collaborate.

Whilst Information Visualization (IV) focuses on the use of computer-based tools to explore large data sets, Knowledge Visualization (KV) and Visual Thinking investigate (a) how to create and transfer insights between individuals and within groups, (b) how to manage and reduce complexity and to allow understanding, and (c) how to support learning, communication and interaction through new approaches and techniques.

Knowledge Visualization aims to facilitate the mutual transfer of facts, insights, experiences, values, expectations, perspectives, opinions and predictions. Researchers and practitioners in the domains of Knowledge Visualization and Visual Thinking develop strategies, tools and methods to make knowledge visible and to improve processes through which knowledge can be identified, accessed, assessed, shared, discussed, applied and generally managed.

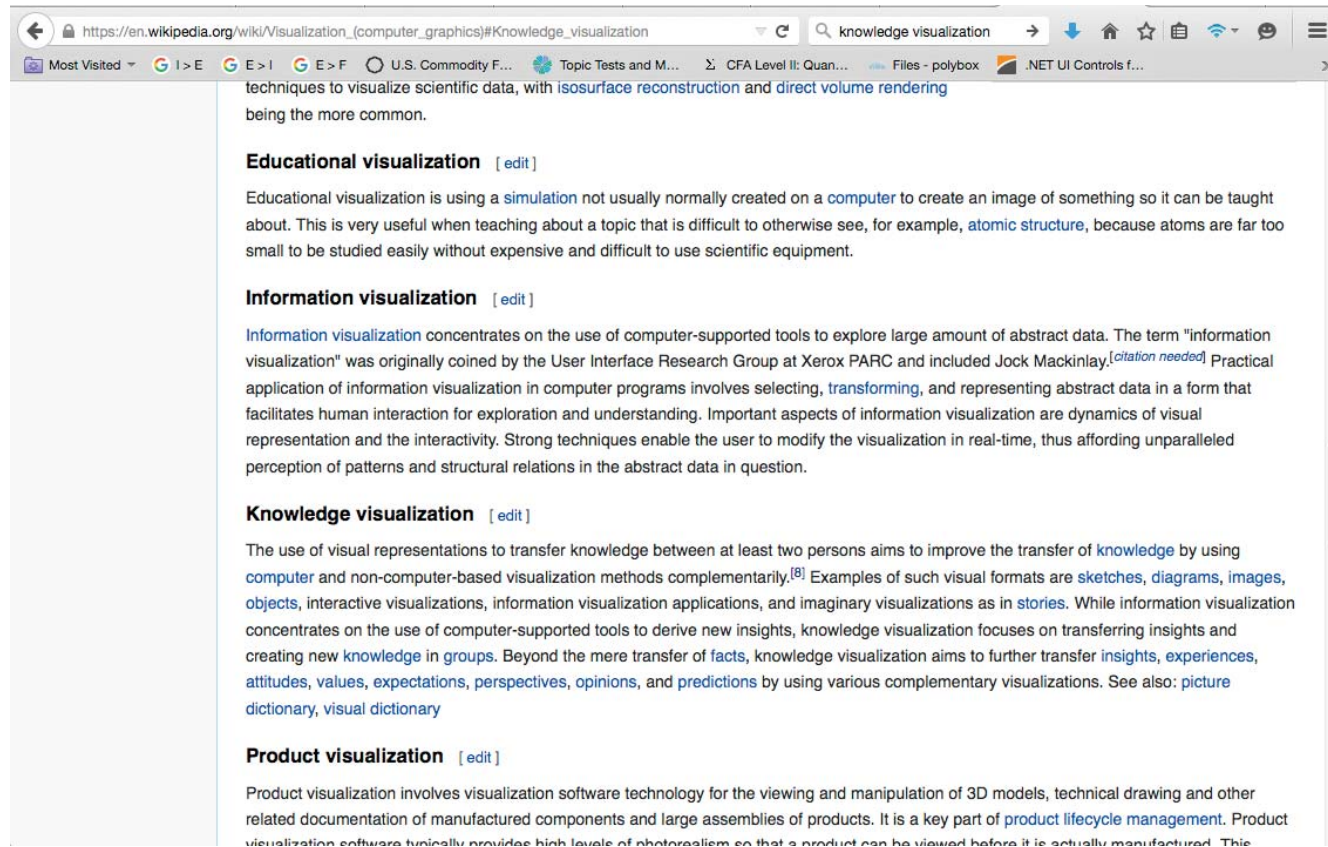
## Objective

The Symposium on Knowledge Visualization and Visual Thinking is an international, interdisciplinary forum for contributions from fields such as Knowledge Management and Visualization, Information Design and Architecture, Cognitive Science, Argument Mapping, Business Sketching, Visual Analytics, Arts, Interface Design, Business Analysis, Project Management, Economics, Market Research, Learning Sciences, Media and Communication Studies.

The joint aim is to address and discuss theories, methodologies, techniques, applications, evaluations and case studies related to the visualization of knowledge and to processes which involve visual thinking.

# Today, IV and KV are well accepted fields.

BURKHARD



The screenshot shows a web browser window with the Wikipedia page for 'Knowledge visualization'. The address bar shows the URL 'https://en.wikipedia.org/wiki/Visualization\_(computer\_graphics)#Knowledge\_visualization'. The page content includes sections for 'Educational visualization', 'Information visualization', 'Knowledge visualization', and 'Product visualization'. The 'Knowledge visualization' section is highlighted, discussing the use of visual representations to transfer knowledge between at least two persons, aiming to improve the transfer of knowledge by using computer and non-computer-based visualization methods complementarily. Examples of such visual formats are sketches, diagrams, images, objects, interactive visualizations, information visualization applications, and imaginary visualizations as in stories. While information visualization concentrates on the use of computer-supported tools to derive new insights, knowledge visualization focuses on transferring insights and creating new knowledge in groups. Beyond the mere transfer of facts, knowledge visualization aims to further transfer insights, experiences, attitudes, values, expectations, perspectives, opinions, and predictions by using various complementary visualizations. See also: picture dictionary, visual dictionary.

techniques to visualize scientific data, with [isosurface reconstruction](#) and [direct volume rendering](#) being the more common.

### Educational visualization [\[ edit \]](#)

Educational visualization is using a [simulation](#) not usually normally created on a [computer](#) to create an image of something so it can be taught about. This is very useful when teaching about a topic that is difficult to otherwise see, for example, [atomic structure](#), because atoms are far too small to be studied easily without expensive and difficult to use scientific equipment.

### Information visualization [\[ edit \]](#)

[Information visualization](#) concentrates on the use of computer-supported tools to explore large amount of abstract data. The term "information visualization" was originally coined by the User Interface Research Group at Xerox PARC and included Jock Mackinlay.<sup>[*citation needed*]</sup> Practical application of information visualization in computer programs involves selecting, [transforming](#), and representing abstract data in a form that facilitates human interaction for exploration and understanding. Important aspects of information visualization are dynamics of visual representation and the interactivity. Strong techniques enable the user to modify the visualization in real-time, thus affording unparalleled perception of patterns and structural relations in the abstract data in question.

### Knowledge visualization [\[ edit \]](#)

The use of visual representations to transfer knowledge between at least two persons aims to improve the transfer of [knowledge](#) by using [computer](#) and non-computer-based visualization methods complementarily.<sup>[6]</sup> Examples of such visual formats are [sketches](#), [diagrams](#), [images](#), [objects](#), interactive visualizations, information visualization applications, and imaginary visualizations as in [stories](#). While information visualization concentrates on the use of computer-supported tools to derive new insights, knowledge visualization focuses on transferring insights and creating new [knowledge](#) in [groups](#). Beyond the mere transfer of [facts](#), knowledge visualization aims to further transfer [insights](#), [experiences](#), [attitudes](#), [values](#), [expectations](#), [perspectives](#), [opinions](#), and [predictions](#) by using various complementary visualizations. See also: [picture dictionary](#), [visual dictionary](#)

### Product visualization [\[ edit \]](#)

Product visualization involves visualization software technology for the viewing and manipulation of 3D models, technical drawing and other related documentation of manufactured components and large assemblies of products. It is a key part of [product lifecycle management](#). Product visualization software typically provides high levels of photorealism so that a product can be viewed before it is actually manufactured. This



# Case Study: Future Cities Laboratory I

(SEC) SINGAPORE-ETH CENTRE 新加坡-ETH 研究中心

Examples of how we used visualizations in the research project Future Cities.



**CREATE**  
Campus for Research Excellence And Technological Enterprise

**ETH** zürich



**NANYANG**  
TECHNOLOGICAL  
UNIVERSITY

**NUS**  
National University  
of Singapore

PAUL SCHERRER INSTITUT  
**PSI**

**SMU**  
SINGAPORE MANAGEMENT  
UNIVERSITY



*Knowledge and ideas for a sustainable urban future:*

- **Science:** Understanding urban systems in their full complexity
- **Technology:** tools to improve construction, management and planning
- **Design:** scenarios for a more sustainable urban future
- **Partnership** and dialogue



# Future Cities Laboratory Structure

(SEC) SINGAPORE-ETH  
CENTRE 新加坡-ETH  
研究中心

## DISCIPLINARY EXPERTISE

**A** Architecture, Planning & Urban Design

**B** Mobility & Transportation Planning

**C** Sociology & Psychology

**D** Landscape & Ecosystems

**E** Energy Systems

**F** Materials & Engineering

**G** Information Technology

## TRANSDISCIPLINARY SCENARIOS & RESEARCH MODULES

### SCENARIO 1 HIGH-DENSITY MIXED-USE CITIES

- 1.1 The *Grand Projet*
- 1.2 Ecosystem Services
- 1.3 Energy Systems
- 1.4 Dense and Green

**A B C D E F G**

### SCENARIO 2 RESPONSIVE CITIES

- 2.1 BigData-Informed Urban Design
- 2.2 Cyber Civil Infrastructure
- 2.3 Engaging Mobility
- 2.4 Cognition, Perception, and Behaviour

**A B C D E F G**

### SCENARIO 3 ARCHIPELAGO CITIES

- 3.1 SIJORI and Extended Urbanisation
- 3.2 Urban-Rural Systems
- 3.3 Alternative Construction Materials
- 3.4 Tourism and Urbanisation

**A B C D E F G**

## GLOBAL NETWORK

Government Agencies  
URA, HDB, LTA, BCA, NEA, NParks

Universities (Singapore-based)  
NUS, NTU, SUTD, A\*Star, MIT, TUM

Universities (Regional)  
UI, Chulalongkorn, ITB, IIHS

Universities (International)  
MIT, Harvard, NYU, UCL, TU Delft

Industry  
Schindler, Shell, Siemens

NGOs  
Borda, Mercy Corps, KPC

Inter-Governmental Agencies  
World Bank, ADB, UN Habitat

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SMU  
SINGAPORE MANAGEMENT  
UNIVERSITY

SUTD

# High-density, Mixed-use Cities

(SEC) SINGAPORE-ETH CENTRE 新加坡-ETH 研究中心

## *Increasing sustainability in compact cities*



The *Grand Project*: Towards Adaptable and Liveable Urban Megaprojects



Dense and Green Building Typologies



Multi-Scale Energy Systems for Low Carbon Cities



Ecosystem Services in Urban Landscapes

CREATE  
Campus for Research Excellence And Technological Enterprise

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NUS  
National University  
of Singapore

PAUL SCHERRER INSTITUT  
PSI

SMU  
SINGAPORE MANAGEMENT  
UNIVERSITY

SWT



# Archipelago Cities

(SEC) SINGAPORE-ETH CENTRE 新加坡-ETH 研究中心

## *Sustainable development of extended SE Asian cities*



Urban-Rural Systems: Seeding Adaptive Infrastructure



SIJORI: Territories of Extended Urbanisation



Tourism and Cultural Heritage



Alternative Construction Materials

CREATE  
Campus for Research Excellence And Technological Enterprise

ETH zürich

EPFL

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UNIVERSITY

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National University  
of Singapore

PAUL SCHERRER INSTITUT  
PSI

SMU  
SINGAPORE MANAGEMENT  
UNIVERSITY

SWT

# Responsive Cities

(SEC) SINGAPORE-ETH CENTRE 新加坡-ETH 研究中心

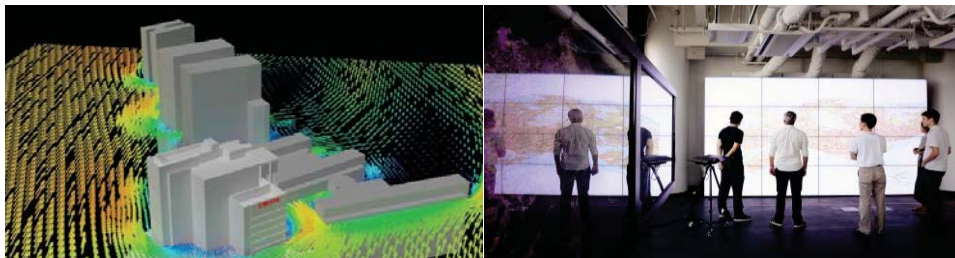
## *Harnessing IT to improve the urban environment*



Cognition, Perception & Behaviour in Urban Environments



Engaging Mobility



Big Data-Informed Urban Design



Cyber Civil Infrastructure

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UNIVERSITY

**SWT**

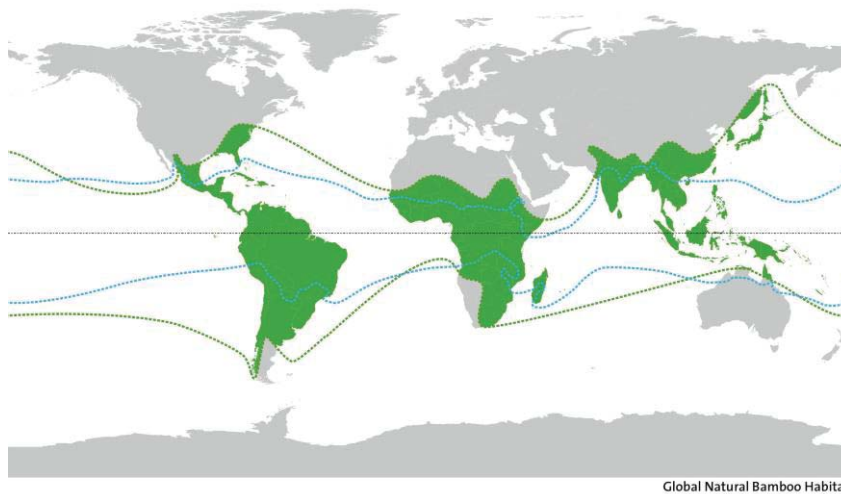
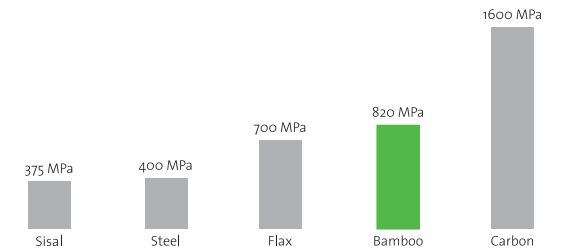




## “Bamboo Concrete”

### Benefits of Bamboo as a construction material:

- Grows in most developing countries
- It is a renewable resource, cheap, light and strong
- Tensile strength is double that of construction steel
- Produced as a composite material, it could be used as reinforcement in concrete structures



# Simulation Platform

(SEC) SINGAPORE-ETH CENTRE 新加坡-ETH 研究中心

## SMALL

BUILDING TECHNOLOGY



## MEDIUM

URBAN DESIGN

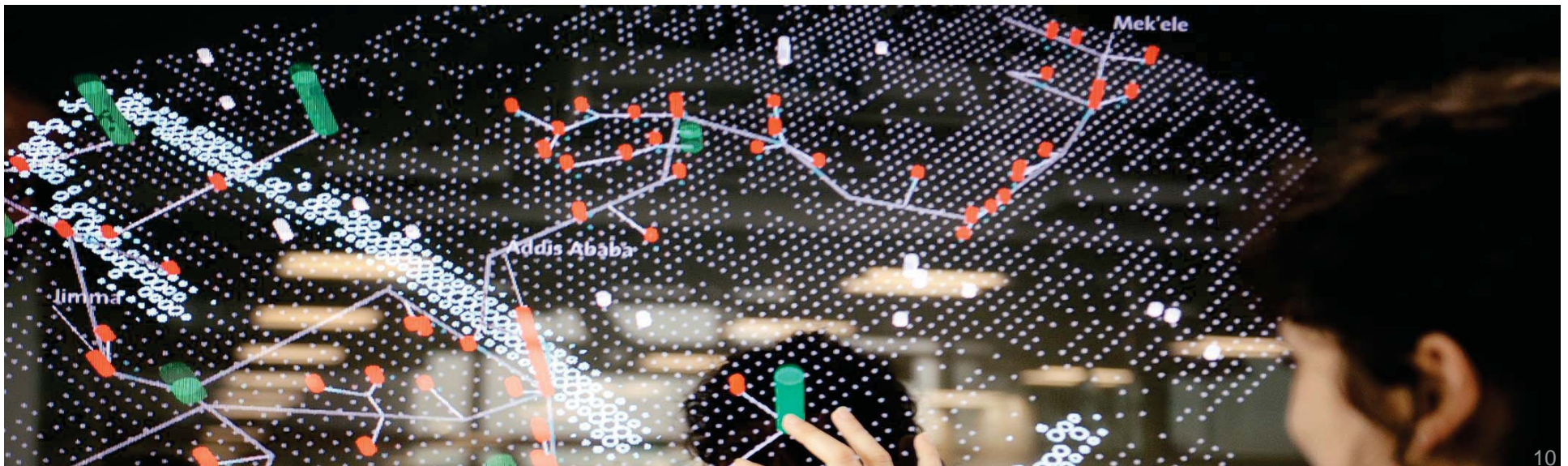


## LARGE

TERRITORIAL PLANNING



Data -> Simulation -> Visualization > Discussion -> Decisions

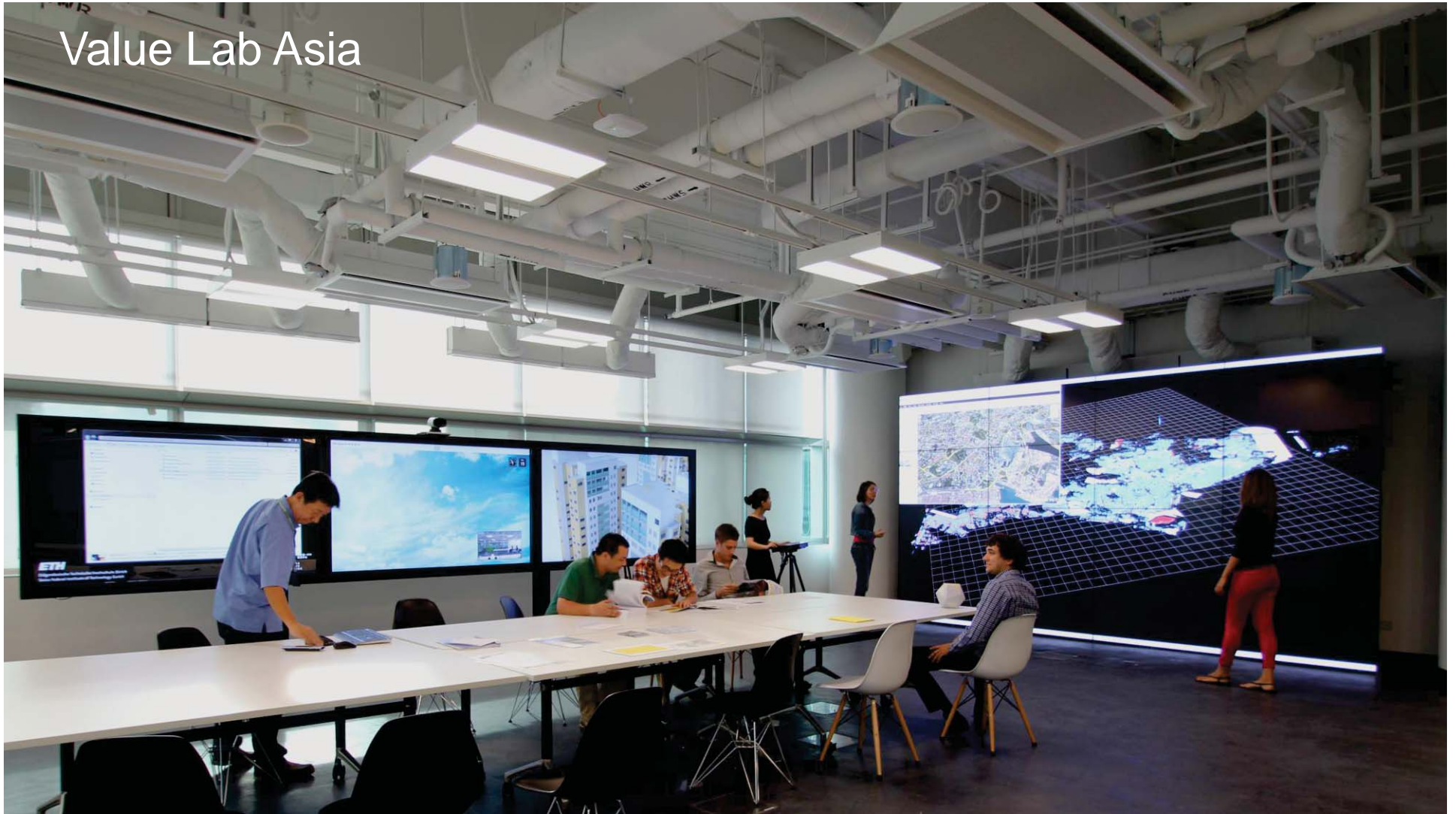




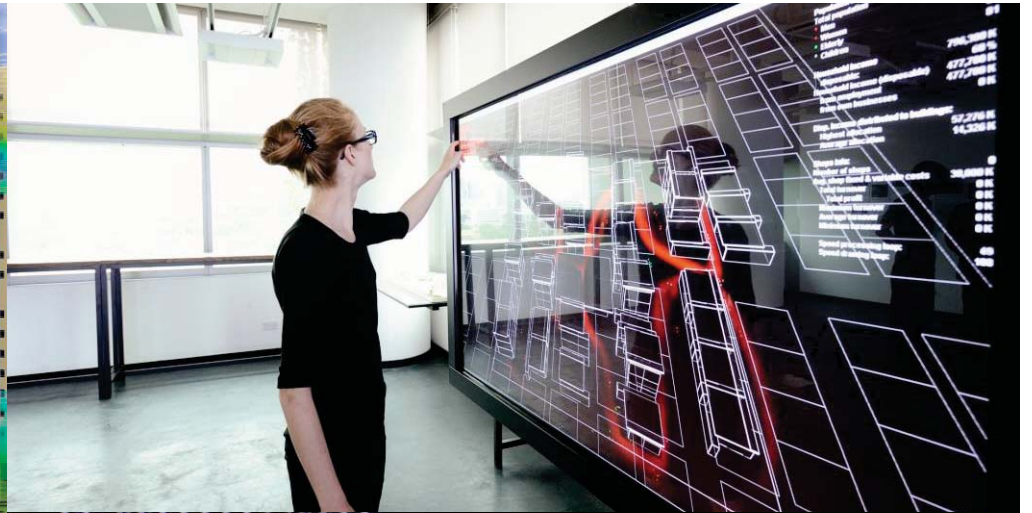
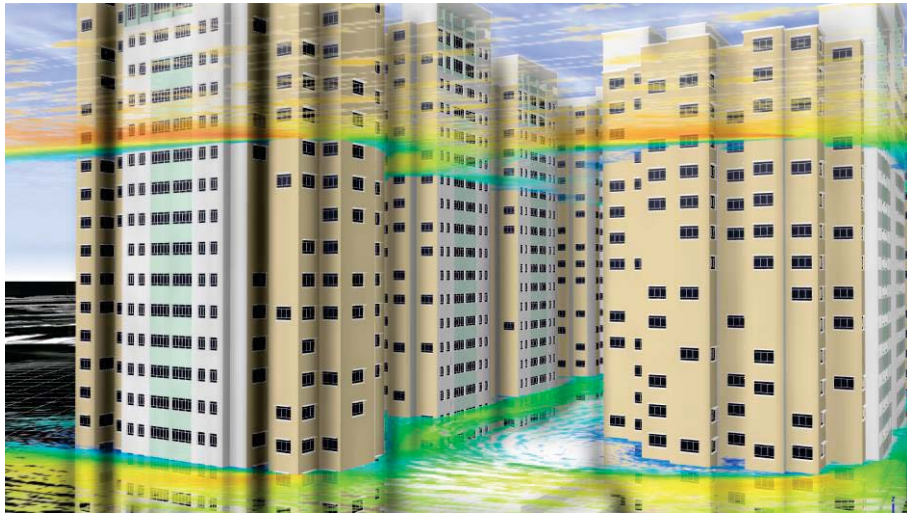
# Value Lab Asia



# Value Lab Asia









5 million agents



2.3 million places  
of work



80'000 home  
locations



79'635 links



362 subway lines



630'000 cars



Source: Dr Alex Erath, Future Cities Laboratory



# In the media

**CNN** News Regions Video TV Features Opinions More... International Edition Search CNN  
U.S. China Asia Middle East Africa Europe Americas

## 5 ideas every city should steal from Singapore

By Meera Senthilingam, for CNN  
Updated 1205 GMT (1905 HKT) June 12, 2015



The aim should be a thriving neighbourhood that young entrepreneurs and the pioneer generation call home.

## Keep the old in Lavender, create space for the new

**By FINE DIAL ANNA GAGO FOR CNN**  
SINGAPORE'S 1950s-era public housing is a treasure trove of architectural and historical value. It is a place where generations have lived, and it is a place where the future is being built. The government is now looking at ways to preserve the old while creating space for the new. In the Lavender district, the government is planning to build a new housing estate, but it wants to keep the old. The old buildings are being renovated and converted into modern housing. The new buildings are being built in the same area, but they are designed to be more modern and more sustainable. The government is also looking at ways to create more green space in the area. The aim is to create a thriving neighbourhood that young entrepreneurs and the pioneer generation call home.

THE STRAITS TIMES

WORLD | A19

## President Tan looks for takeaways in Zurich

He tours Zurich lab showcasing work on flood management

By YASMINE HANNA  
ZURICH



ing the World's Income Supplement and Innovation Credit scheme. Nonetheless, the Zurich Laboratory's constant search for innovative, environmentally sustainable solutions offers good learning points for Singapore.

"Creating livable and sustainable cities is a continuous learning journey and it includes the challenges of meeting the

THE STRAITS TIMES SATURDAY, JANUARY 24, 2015

## Virtual crowds for new transport real

Simulation model will help planners explore land use

By JENNIFER HONG

AN INTRICATE simulation of Singapore's transport network is the work of a team of planners and engineers. The model will help planners explore land use and transport demand, and better understand how land use and transport demand are linked.



THURSDAY, AUGUST 21, 2014

THE STRAITS TIMES

## Cool savings with new air-con system

Cheaper and more efficient

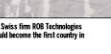
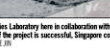
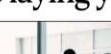
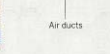
An international school will use a prototype set of new energy-efficient technologies and design features that together promise 50 per cent in building cost savings and over 40 per cent in energy savings for a 50-storey office building.



An artist's impression of the 20,000 sq m addition to UNESKO's Silver campus to be completed by next year.

Conventional building

Future Cities Laboratory design



Flat, cold water radiators attached to ceiling save space compared to conventional air ducts

Sloped windows let light in while avoiding heat

Air ducts

Ventilation ducts integrated into concrete slabs draw air in from outside

Bulky mechanical equipment hidden along corridor or at end of floor

ST GRAPHICS

Swiss-Singaporean breakthrough could cut energy costs by 40%

By GRACE CHUA

A CHEAPER, more efficient air-con system to run a 50-storey office building helped by a team of Swiss and Singaporean researchers.

The system, which could save 40 per cent in energy costs, will be used for the first time in a 50-storey office building in Singapore. The system is a breakthrough in energy efficiency, and it could save 40 per cent in energy costs. The system is a breakthrough in energy efficiency, and it could save 40 per cent in energy costs.

The potential savings are significant, says the researchers. The system is a breakthrough in energy efficiency, and it could save 40 per cent in energy costs.

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HOME

## Getting S'poreans to walk more often

Study on walking patterns under way as part of healthy lifestyle drive

By FENG ZHENGMING  
FUTURE CITIES LABORATORY

A YEAR-LONG project focused on the city centre has been started to shed light on why and how Singaporeans walk.

ARCHITECTURE CONSTRUCTION DESIGN ENGINEERING PROPER

## The Bamboo Revival: Green Structures

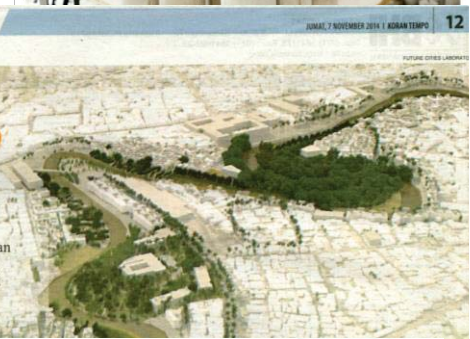


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## Ilmu & Teknologi

## Mimpi 'Kota Sungai' di Ciliwung

Future Cities Laboratory melakukan kajian multidisiplin. Konsep permukiman yang sesuai dengan kondisi banjir di bantaran Sungai Ciliwung.



SATURDAY, SEPTEMBER 14, 2013

THE STRAITS TIMES

## Cool way to transform Rochor's hot back alleys

Proposal to shift shophouses' air-con units, introduce outdoor dining

By DAVID DE



It is part of a larger study the FCL is conducting in the district.

## Exhibition 1 at URA





# Exhibition 2 at URA

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**SMU**  
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UNIVERSITY

**SWT**

# Pavilion at WCS

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Video: Example



# Summary

(SEC) SINGAPORE-ETH CENTRE 新加坡-ETH 研究中心

Knowledge Visualization is a key success factor in all areas and aspects of project management, such as

Coordination, progress reports, communication, up selling, audits, accounting, controlling, hiring the best talents, IT, systems, viral marketing, stakeholder involvement, media, diplomacy, etc.

Today, I would like to convince you that:

The number 1 skillset of a successful project manager is his or her ability to develop and use creative visual formats in all aspects of the project management spectrum.

Thank you!  
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