

Daten verstehen und visualisieren

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@dominikus

Kunstuni Linz SoSe'15

Daten verstehen und visualisieren #5

Bis heute (1):

Sucht eine interessante Datenquelle aus dem Internet. Überlegt euch, welche Fragen sich der Leser stellen könnte. Visualisiert die Daten passend mit Processing. Fügt sinnvolle Interaktion hinzu.

Heute:

Experimentelle Datenrepräsentationen und Data Art

Physical Datavis

Sonification

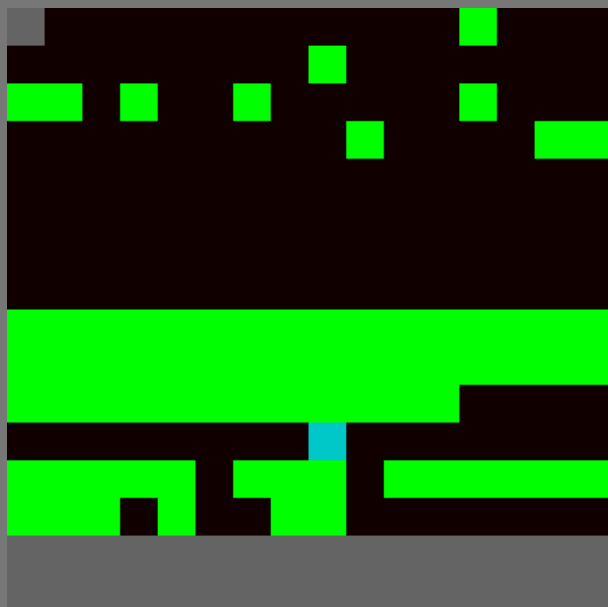
Wiederholung

Data Art

Definition für diese Vorlesung:

Eine Visualisierung ist
die **Repräsentation** von **Daten**
mittels **visueller Symbolik**,
die den **menschlichen Wahrnehmungsapparat**
zur **Mustererkennung** und
Suche ausnutzen *kann*.

1999



[close windows]

<-

?

2001/2002



[close windows]

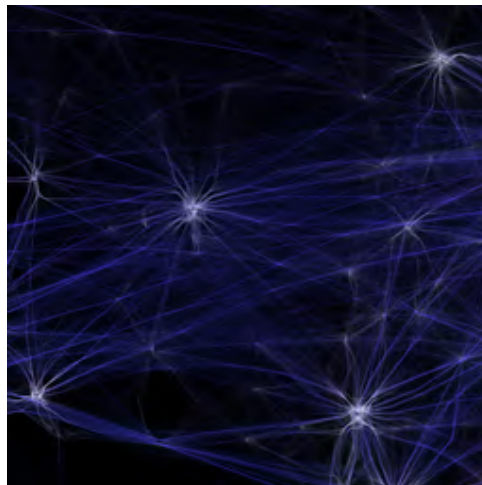
<-

?

Lisa Jevbratt (1999): 1:1(2)

http://128.111.69.4/~jevbratt/1_to_1/interface_v/index.html

Aaron Koblin



Aaron Koblin: Flight Patterns (2005)

<http://www.aaronkoblin.com/work/flightpatterns/>

JASON SALAVON

- [work](#)
- [info](#)



[The 1960s](#)



Jason Salavon: Every Centerfold Ever

<http://www.salavon.com/work/EveryPlayboyCenterfoldDecades/grid/11/>

project menu

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[the matrix](#)
[taxi driver](#)
[annie hall](#)
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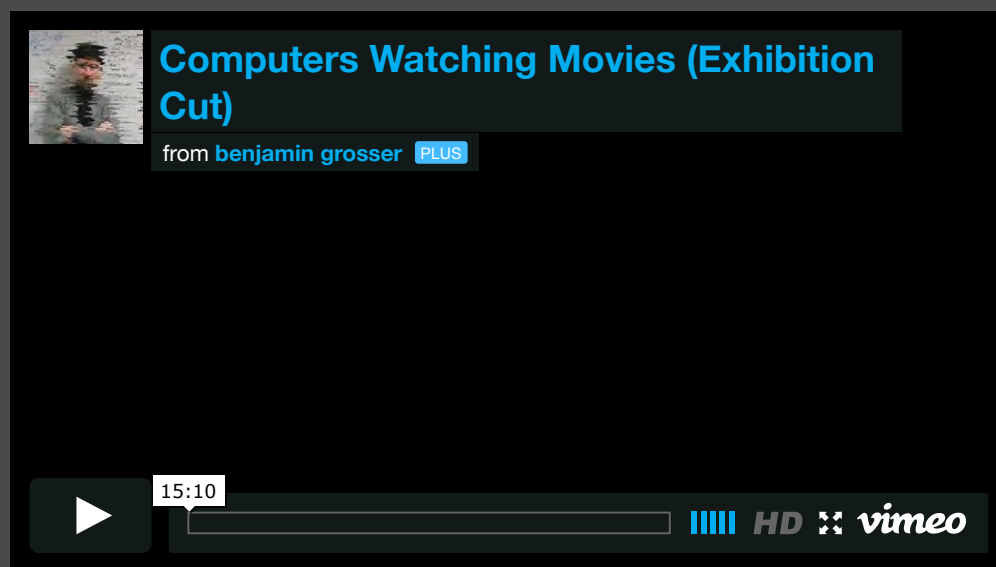
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Computers Watching Movies



Computers Watching Movies (Exhibition Cut)
computationally-produced HD video with stereo audio
(please play full screen)

Computers Watching Movies shows what a computational system sees when it watches the same films that we do. The work illustrates this vision as a series of temporal sketches, where the sketching process is presented in synchronized time with the audio from the original clip. Viewers are provoked to ask how computer vision differs from their own human vision, and

Benjamin Grosser: Computers Watching Movies

<http://bengrosser.com/projects/computers-watching-movies/>

DEAR DATA

Two women who switched continents get to know each other through the data they draw and send across the pond

[the latest delivery](#)

[by week](#)

[about the project](#)

[about us](#)

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Dear Data is a year-long, analog data drawing project
by [Giorgia Lupi](#) and [Stefanie Posavec](#).

We are currently at week 35 and will be updating
this site with regular deliveries, check back for more drawings!

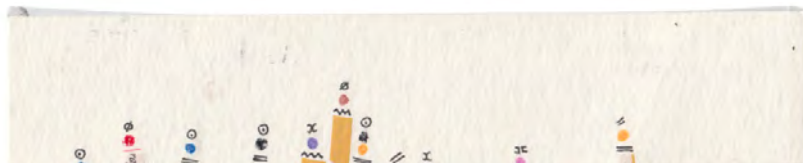
New cards are delivered on Wednesdays.

Week 20

A week of interesting things

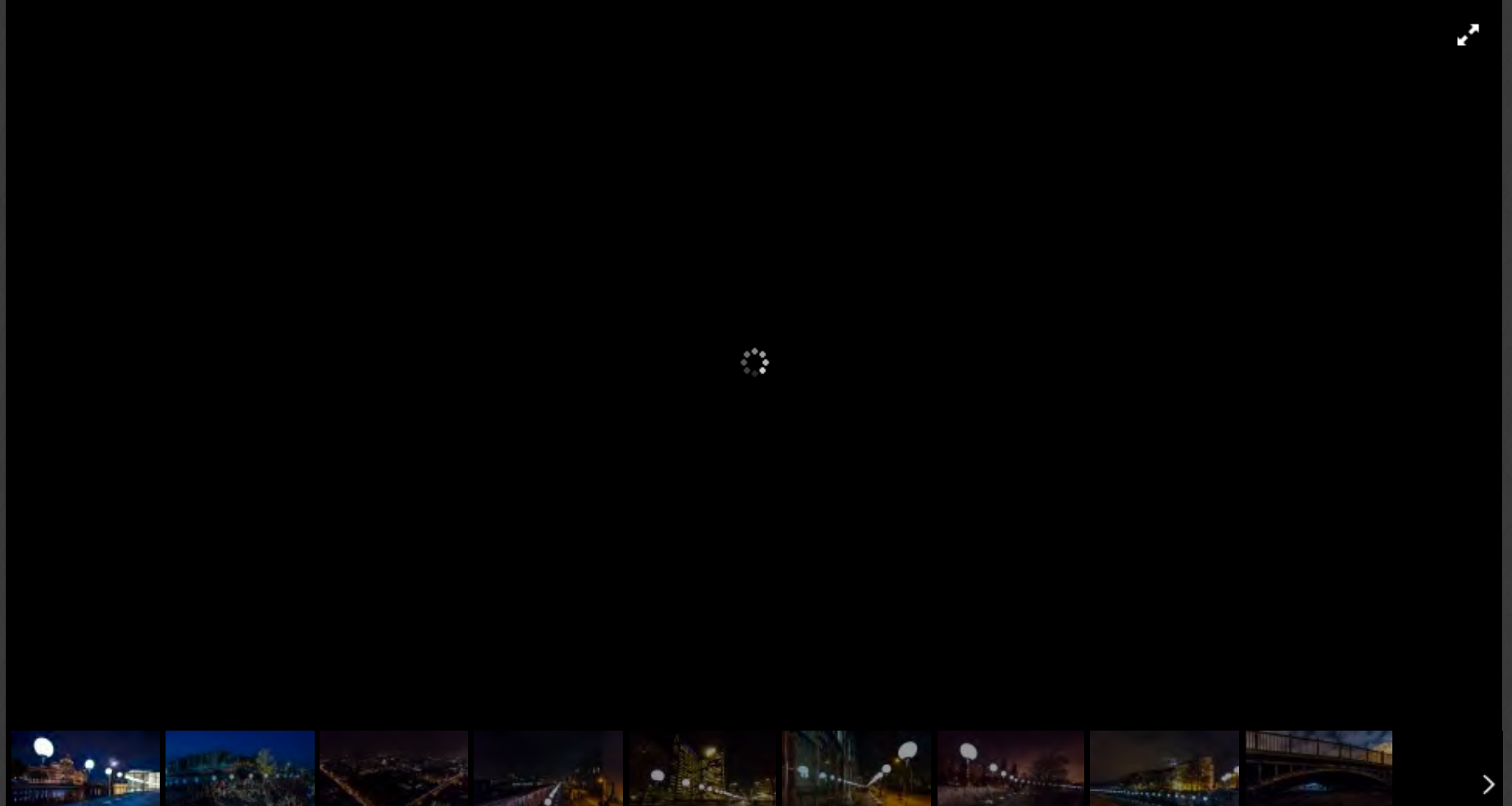
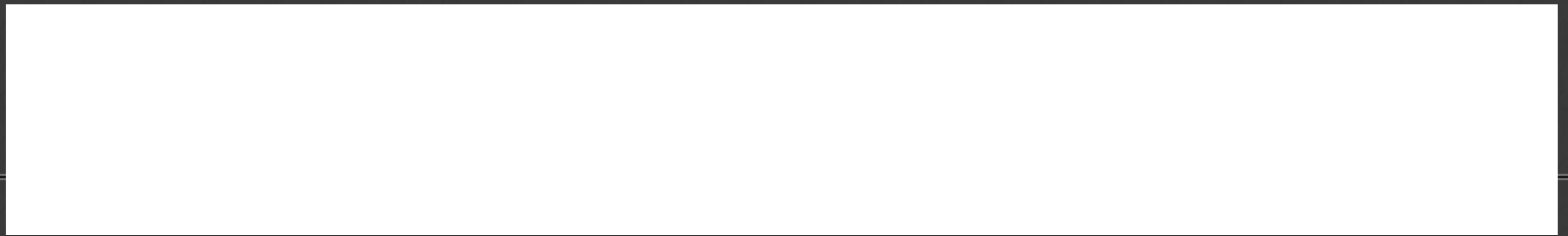
Giorgia

Stefanie



Stef Posavec & Giorgia Lupi: Dear Data

<http://www.dear-data.com/>



Christoph Bauder, Marc Bauder, WHITEvoid: Lichtgrenze

<http://lichtgrenze.de/>

Beat Blox



Beat Blox, en interaktiv musikmaskin som erbjuder ett fritt kreativt skapande utan krav på förkunskaper.

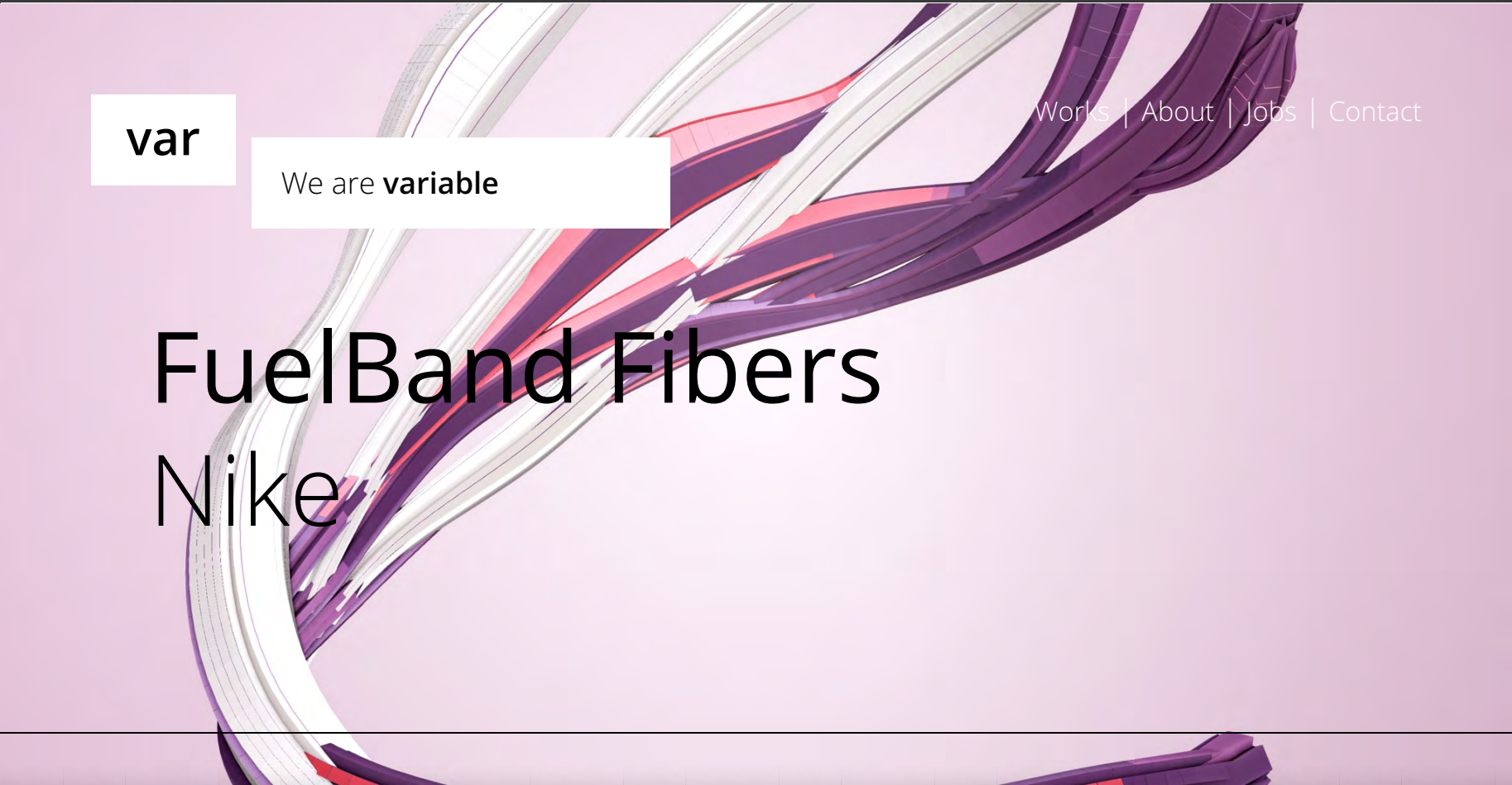
Running on [Cargo](#)

Per Holmquist: Beat Blox

<http://cargocollective.com/perholmquist/Beat-Blox>

Fathom: Year in Nike Fuel

<https://yearinnikefuel.com/>



var

We are **variable**

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FuelBand Fibers

Nike

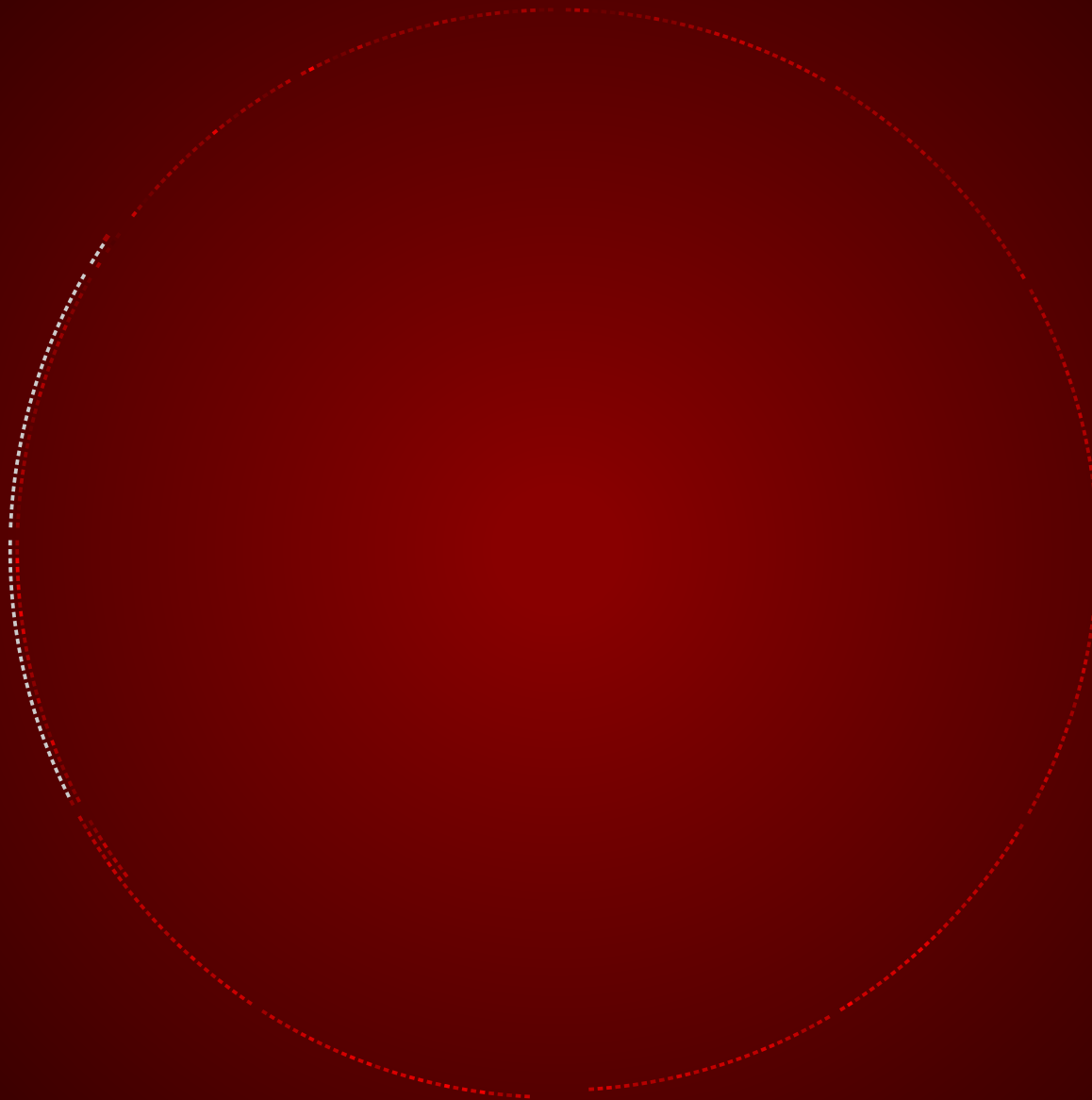
Fibers is a visualization of Nike FuelBand data from the trainings preceeding We Own The Night - Nike Women's 10K run.

To celebrate effort of preparing for the run Nike has chosen 7 influential

Variable: Fibers

<http://variable.io/fibers/>

one
human
heartbeat



t-24 hours

04 May 2015
18:35:59

heartrate

undefined
bpm

days lived

13600

expected days
remaining

16046

by Jen Lowe
about this project

Jen Lowe: One Human Heartbeat

<http://onehumanheartbeat.com/>

Baumgartner et al.: IBRoomba

<https://www.flickr.com/photos/ibroomba/3987484566/in/pool-roomba>



10:39 pm An M train is now departing.

Loading sound (0%) ?

Alex Chen: MTA.me

<http://www.mta.me/>

Alex Chen: Piano Phase

<http://www.pianophase.com/>

stackoverflow.jul.2013 ▾

Search by numerical userid

Filter:

1.0



100.0

[Order Prints](#)



About



Rob Seward: DEATH DEATH DEATH

<https://vimeo.com/11464150>

ZeitRaum

MEDIENKUNST AM FLUGHAFEN WIEN

[about](#) [team](#) [e-book](#) [press](#) [videos](#)

Textscapes

Ars Electronica Futurelab

Travelers' initial encounter with ZeitRaum is in the Check In 3 area, where an imposing wall of monitor screens straddles the corridors leading to and through the security checkpoint. A person's approach triggers a cloud of letters cascading down this wall. Once they come to rest at the bottom, these letters coalesce into texts that, in turn, form the topography of a landscape. Hills and valleys take shape in this way, all of them incessantly in motion because their growth is a function of current arrivals and departures. Every takeoff engenders a hill, every landing a valley.

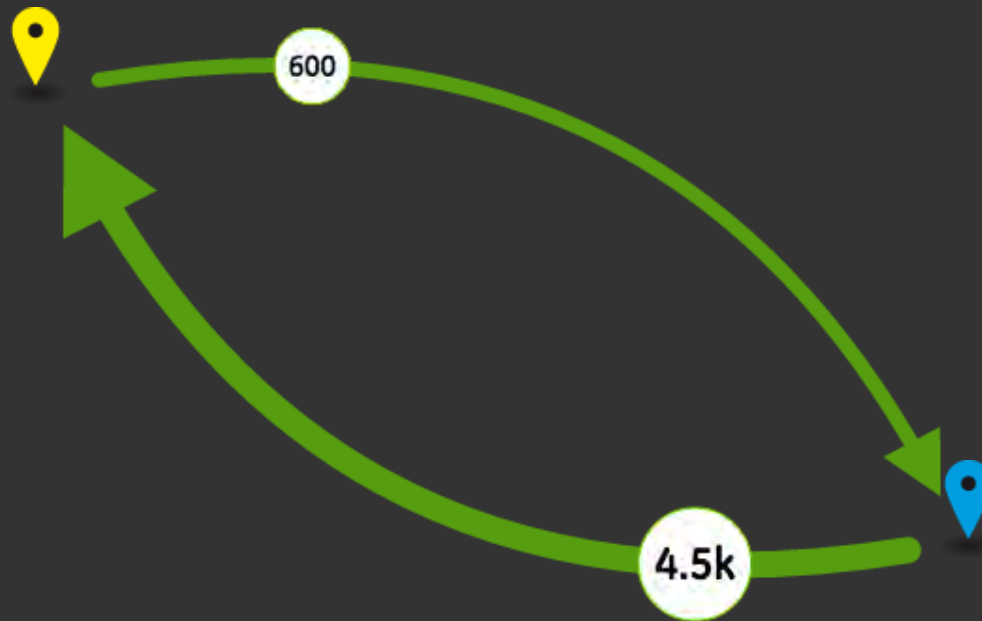


Futurelab: Textscapes

http://www.aec.at/zeitraum/textscapes_en.html

Mapbox: NYC Taxis

<https://www.mapbox.com/blog/nyc-taxi/>



hubcab

Get started ↑

Exploring New York City taxi trails and sharing
our way to a more sustainable urban future



With an ever-increasing trove of real-time urban data streams, we are able to see precisely where, how, and at what times different parts of our cities become stitched together as hubs of mobility. By using these pervasive, interconnected, and "smart" technologies, we

can begin to unravel the complexity of our travel patterns and identify how we can reduce

HubCab

<http://hubcab.org>

Hide Overlays

Add Map Labels

Remove Color-Coding

2010 Census Block Data

1 Dot = 1 Person

- White
- Black
- Asian
- Hispanic
- Other Race / Native American / Multi-racial

[What am I looking at...?](#)

Google



Dustin A. Cable | University of Virginia | Weldon Cooper Center for Public Service | Reference Data by Stamen Design

Dustin Cable: Demographic Dot Map

<http://demographics.coopercenter.org/DotMap/index.html>



We're sorry, Flickr [doesn't allow embedding within frames](#).

If you'd like to view this content, [please click here](#).

Eric Fischer: Locals and Tourists

<https://www.flickr.com/photos/walkingsf/sets/72157624209158632/>

A MORE PERFECT UNION
R. LUKE DUBOIS
NATIONAL MAPS
STATE AND CITY MAPS
ESSAY
PRESS
lukedubois.com
bitforms.com

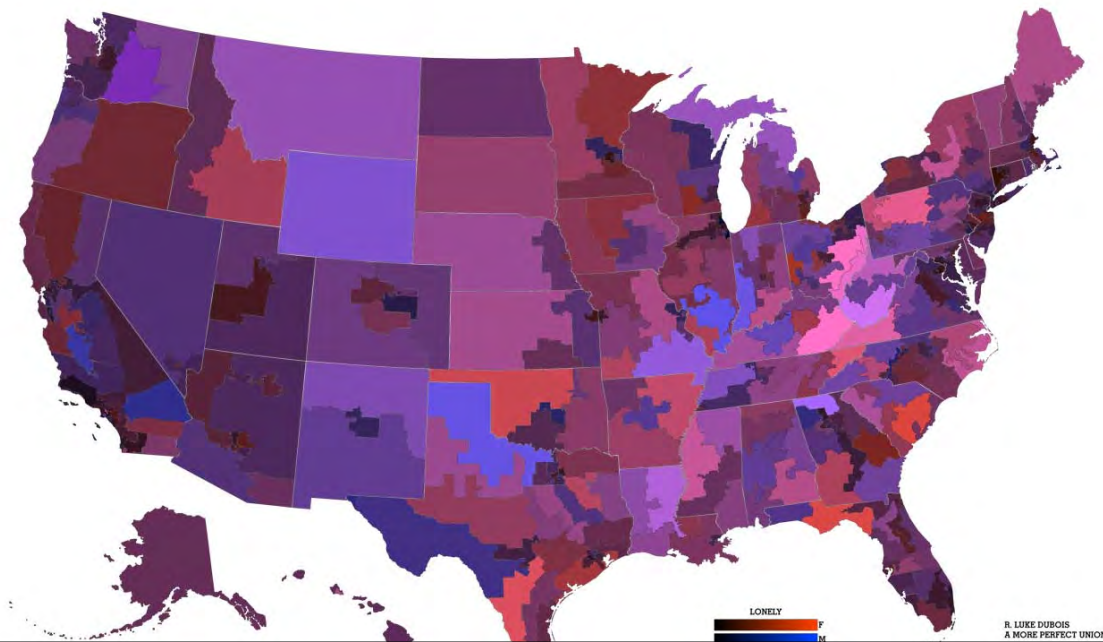
A More Perfect Union

National Maps

These are national choropleth maps showing the use of a single word in dating profiles across U.S. Congressional Districts, divided by gender as selected by members of dating sites used in the census. Red represents women, blue represents men. Brighter colors mean more singles using that word in their dating profiles.

©2008-2011 R. Luke DuBois. All rights reserved.
Artwork represented by [bitforms gallery](#), NYC.

the lonely:



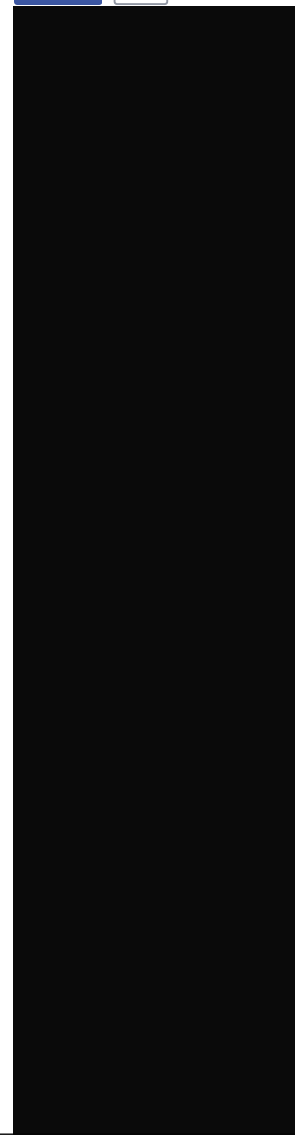
R. Luke DuBois (2008): A More Perfect Union

<http://music.columbia.edu/~luke/perfect/country.shtml>

[About](#)

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 Like 5.3k



Josh Begley: Prison Map

<http://prisonmap.com/>

Benedikt Groß, Joey Lee: Aerial Bold

<https://vimeo.com/108469230>



(<http://benedikt-gross.de/log/>)

[Generative Gestaltung \(http://www.generative-gestaltung.de/\)](http://www.generative-gestaltung.de/)

[Twitter \(https://twitter.com/bndktgrs\)](https://twitter.com/bndktgrs)

[Vimeo \(http://vimeo.com/bndktgrs\)](http://vimeo.com/bndktgrs)

[GitHub \(http://github.com/b-g/\)](http://github.com/b-g/)

Benedikt Groß (<http://benedikt-gross.de/log/>)

All Work (<http://benedikt-gross.de/log/work>)

Vita (<http://benedikt-gross.de/log/vita>)

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Works antidisciplinarily, is a speculative and a computational designer.

He currently lives in Stuttgart.

June 2013

The Big Atlas of LA Pools

tagged as:

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[\(http://benedikt-gross.de/log/tag/urban/\)](http://benedikt-gross.de/log/tag/urban/)

Idea & Concept

Benedikt Groß & [Joseph K. Lee \(http://jk-lee.com/\)](http://jk-lee.com/)

Graphic Design Books

[Anna-Luise Lorenz \(http://www.kingkasimir.de/\)](http://www.kingkasimir.de/) & [Julia Laub \(http://www.onformative.com/\)](http://www.onformative.com/)

Developed With

[ArcGIS \(http://www.esri.com/software/arcgis/\)](http://www.esri.com/software/arcgis/), [Basil.js \(http://basiljs.ch/\)](http://basiljs.ch/), [Processing \(http://www.processing.org/\)](http://www.processing.org/), [Python \(http://www.python.org/\)](http://www.python.org/), [QGIS \(http://www.qgis.org/\)](http://www.qgis.org/) and [Shapely \(https://github.com/sjillies/shapely\)](https://github.com/sjillies/shapely)

Crowdsourcing

[Clipping Factory \(http://www.clippingfactory.com/\)](http://www.clippingfactory.com/) and Amazon Mechanical Turk

All Work

Population.io – The World Population Project (<http://benedikt-gross.de/log/2014/11/population-io/>)

Tilehut.js (<http://benedikt-gross.de/log/2014/11/tilehut-js/>)

Aerial Bold: Kickstart the Planetary Search for Letterforms! (Funded) (<http://benedikt-gross.de/log/2014/10/aerial-bold-kickstart-the-planetary-search-for-letterforms/>)

HubCab – Exploring New York City Taxi Trails (<http://benedikt-gross.de/log/2014/03/hubcab-exploring-new-york-city-taxi-trails/>)

Avena+ Test Bed — Agricultural Printing and Altered Landscapes (http://benedikt-gross.de/log/2013/06/avena-test-bed_agricultural-printing-and-altered-landscapes/)

* You are here *

The LA Swimmer (<http://benedikt-gross.de/log/2013/06/the-la-swimmer/>)

The Big Atlas of LA Pools – Posters

Benedikt Groß: The Big Atlas of LA Pools

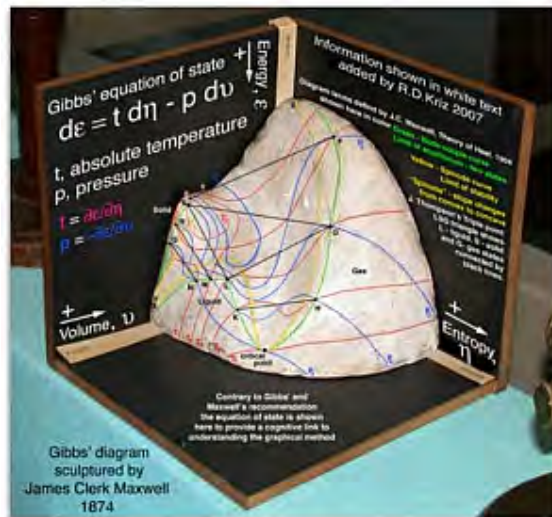
<http://benedikt-gross.de/log/2013/06/the-big-atlas-of-la-pools/>

Physical Datavis

List of Physical Visualizations

and Related Artifacts

1871 – Thermodynamic Surfaces



A physical visualization by Scottish physicist James Maxwell (left), constructed over the course of about seven months, from November 1874 to July 1875, based on the descriptions of thermodynamics surfaces described in two 1873 papers by American engineer Willard Gibbs. The molded shape depicts the geometry of the three-dimensional thermodynamic surface of the various states of existence of water: solid, liquid, gas, shown on Cartesian coordinates of the entropy (x), volume (y), and energy (z) of the body. Maxwell constructed it in Cambridge and famously sent it to Gibbs in 1875 as a gift of appreciation for his graphical work.

Similarly, James Thomson constructed a plaster pressure-volume-temperature plot (right) in 1871, based on data for carbon dioxide collected by Thomas Andrews.

Source: Hmolpedia. [Maxwell's Thermodynamic Surface](#).

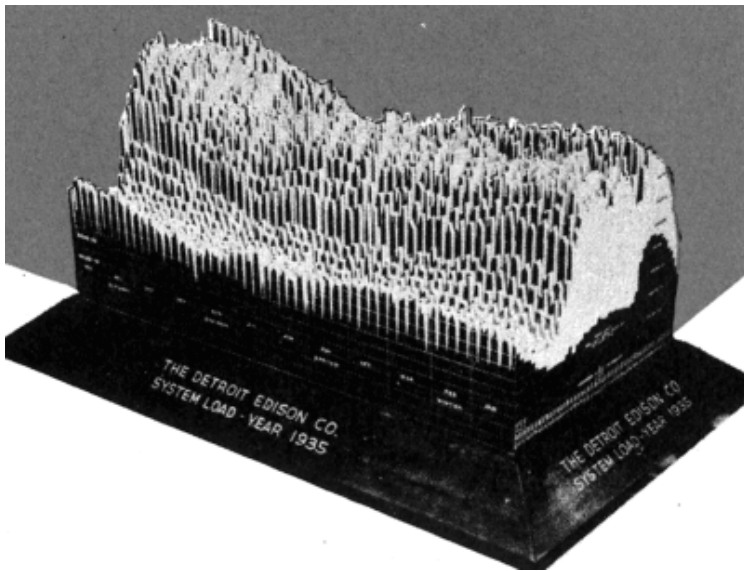
James Maxwell (1871): Gibbs' equation

<http://dataphys.org/list/thermodynamic-surfaces/>

List of Physical Visualizations

and Related Artifacts

1935 – 3D Visualizations of Power Consumption



A large 3D physical visualization made by the Detroit Edison Company showing electricity consumption for the year 1935, with a slice per day and each day split into 30 min intervals. Two other examples from different Edison electricity companies are discussed in Brinton's book. These physical visualizations seem to have been used to better anticipate power demands.

Sources:

1. Willard Cope Brinton (1939) [Graphic Presentation](#) pp 364-365.
2. Howard A. Spielman (2006) ["Virtual Reality" Circa 1935](#).

Detroit Edison Company (1935): Power Consumption

<http://dataphys.org/list/electricity-power-demand/>

Durrell Bishop (1992): Marble Answering Machine

<https://vimeo.com/19930744>

Abigail Reynolds

Works Biography Bibliography Contact

Mount Fear East London 2003



< 1 / 3 > ≡

Statistics for all violent crimes in
East London between 2002-2003.
145h x 540w x 425d cm

Abigail Reynolds (2003): Mount Fear

<http://www.abigailreynolds.com/works/44/mount-fear-east-london/#>

Peter Ørntoft: Information Graphics in Context

<https://www.behance.net/gallery/Information-graphics-in-context/924345>

Work

Contact

m

Infographics

marion for moodley brand identity

Caritas Kontaktladen Annual Report

marion for moodley brand identity

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Marion Luttenberger: Infographics

<http://marion-luttenberger.squarespace.com/#/infographics/>



handmadevisuals

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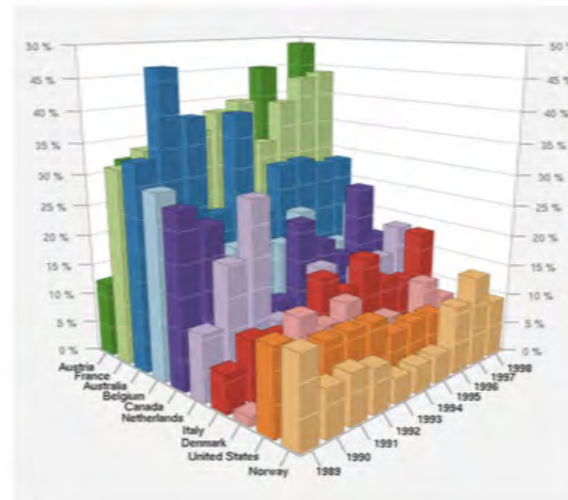
Handmade Projects

Jose Duarte: Handmade Visuals

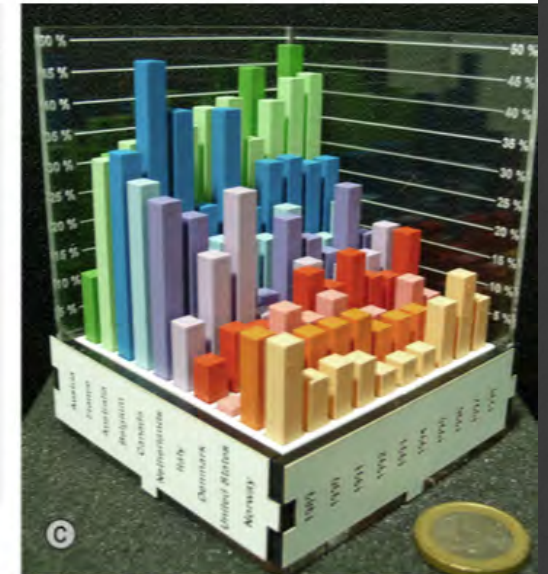
<http://www.handmadevisuals.com/>



(a)



(b)

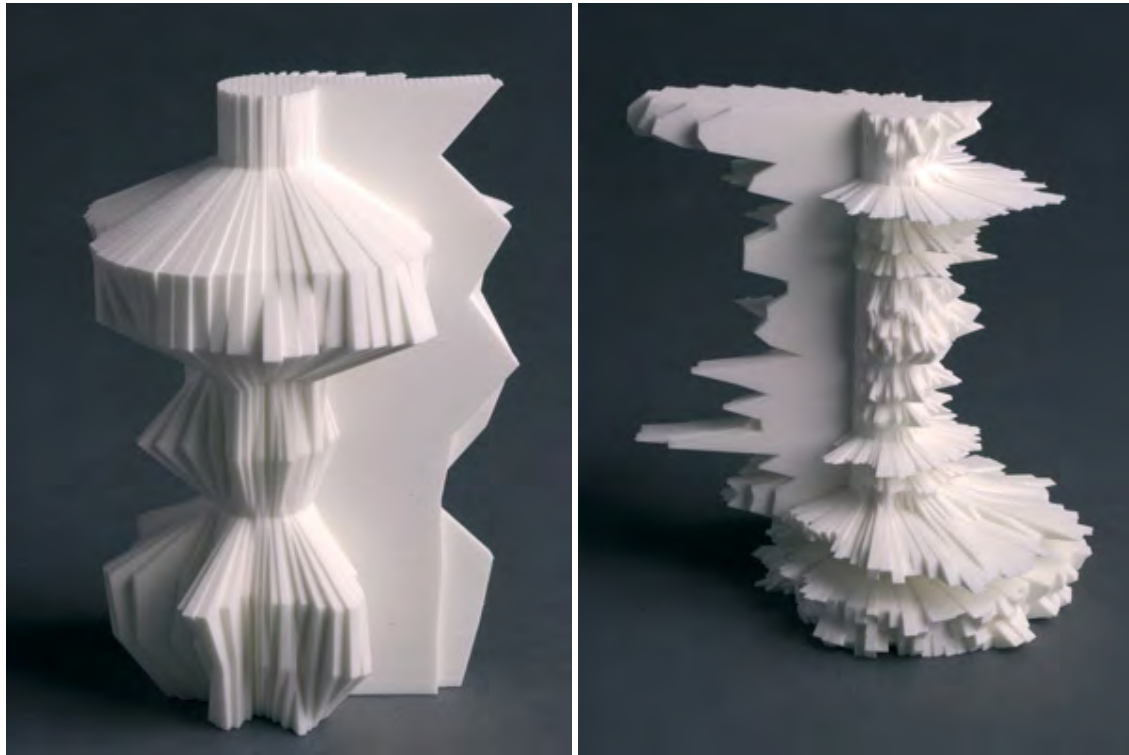


(c)

Jansen, Dragicevic, Fekete (2012): Evaluating the Efficiency of Physical Visualizations



Cylinder



Seahorses (left) & Designed (right).

Cylinder grew out of a desire to create truly complex objects which hint at the overwhelming detail present in nature. Working with [Drew Allan](#) we wished to create algorithmically generated works which would be rapid prototyped using techniques capable of sculpting extremely complex objects.

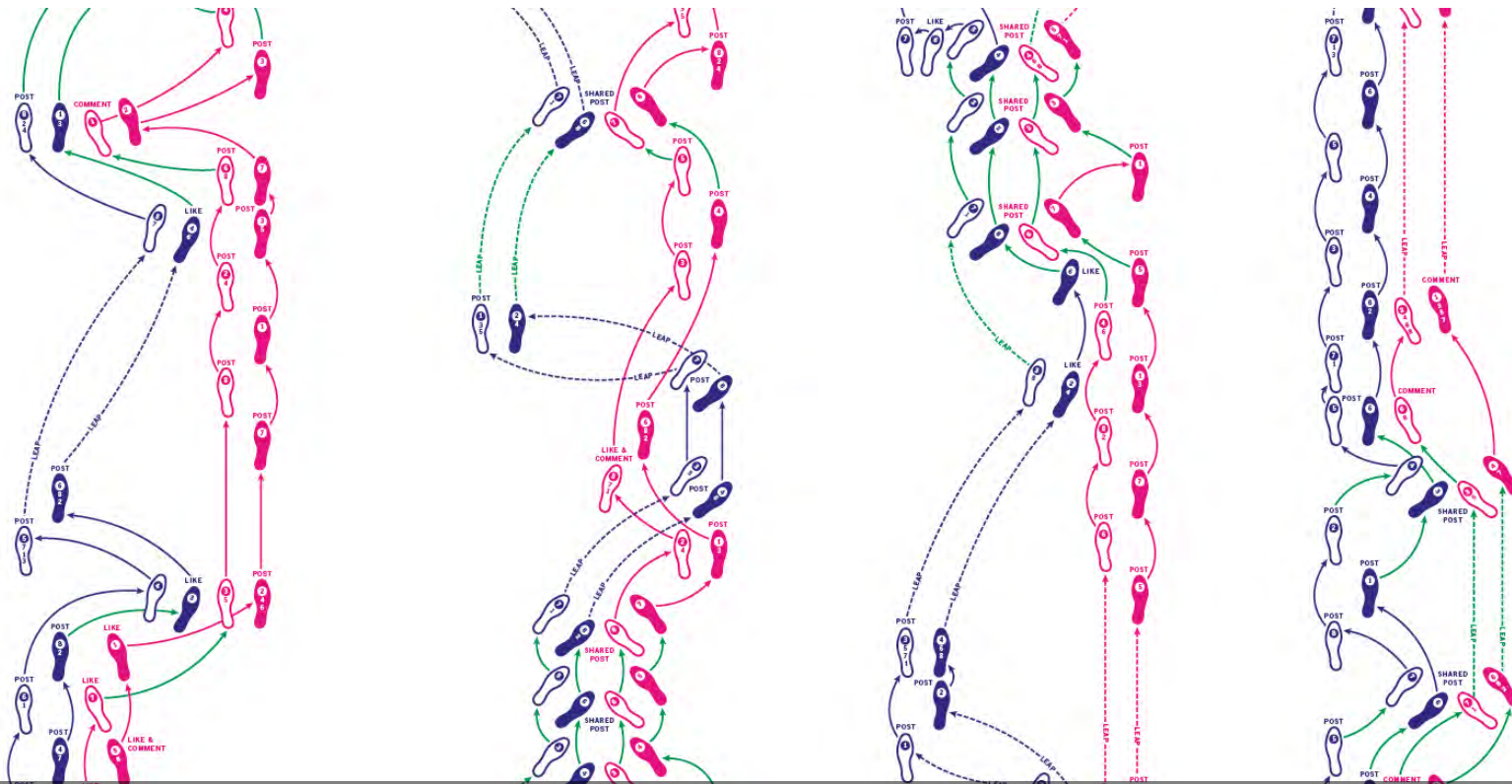
However, instead of using code to generate complexity we turned our attention to capturing natural complexity. Taking sound frequencies within the range of human hearing over a short period of time we rendered them in a tangible and permanent manner, as sculptures representing a sample of time.

Andy Huntington & Drew Allan (2003): Cylinder

STEFANIE POSAVEC

DATA, DATA + BOOKS, BOOKS, & THE REST. about 'shop' contact

Facebook Art Residency: Relationship Dance Steps



Stef Posavec: Facebook Dance Steps

<http://www.stefanieposavec.co.uk/data/#/facebook-art-residency-relationship-dance-steps/>



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On LEGO Powered Time-Tracking; My Daily Column

Posted by Michael Hunger on Aug 1, 2008 in [development](#), [fun](#), [lego](#) | [Subscribe](#)

I've had troubles with time tracking my worktime for all the years. I always found this to be a tedious burden and inconvenience. So one morning in my blue hour (reading in a cafe before work) I spent the time pondering the alternatives.

I started listing software and realworld solutions to timetracking that are possible and tried to contemplate if they would (or had) worked out for me.

software:

spreadsheets
plain text files

Michael Hunger (2008): LEGO Time Tracking

<http://jexp.de/blog/2008/08/on-lego-powered-time-tracking-my-daily-column/>

Vitamins (2012): Bit Planner

<https://vimeo.com/75500464>

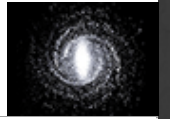
(<http://moritz.stefaner.eu/projects/emoto/heatmap/>)

Moritz Stefaner + Studio NAND (2012): Emoto

<http://www.emoto2012.org/>

Teehan + Lax (2013): Season in Review

<https://vimeo.com/70821480>



Gazing into the sublime: glass paperweights and keychains display data from astronomy, biology, math and physics.

Laser etching is a remarkable way to see complex 3D data. I use high-frequency lasers driven by hand-tooled software to create fine-grained, cleanly drawn structures.

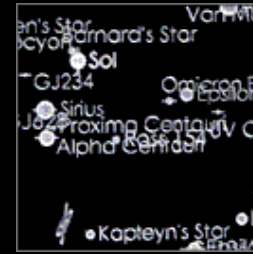
▽ ASTRONOMY

▽ BIOLOGY

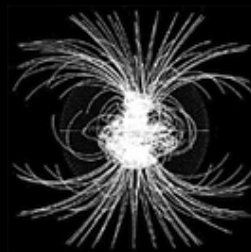
▽ PHYSICS & MORE

ASTRONOMY

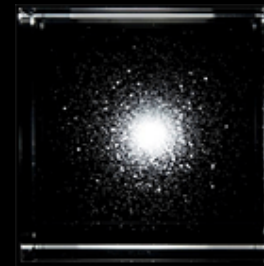
Milky Way Galaxy
Home sweet home



Star Map
Our stellar neighborhood



Geodynamo
Earth's magnetic field



Globular Cluster
A jewel of the sky

BIOLOGY

Bathsheba Grossman (2002-): Sculptures

<http://www.bathsheba.com/crystal/index.html>

Philips + RealView (2014): Holographic Visualizations?

<https://www.youtube.com/watch?v=I4VgUPvHohI>



CAVEs

The CAVE: audio visual experience automatic virtual environment

Full Text:  PDF

Authors: [Carolina Cruz-Neira](#) Electronic Visualization Laboratory
[Daniel J. Sandin](#) Electronic Visualization Laboratory and the School of Art and Design at the University of Illinois at Chicago
[Thomas A. DeFanti](#) Department of Electrical Engineering and Computer Science, Electronic Visualization Laboratory and UIC Software Technologies Research Center
[Robert V. Kenyon](#) University of Illinois at Chicago
[John C. Hart](#) Electronic Visualization Laboratory, University of Illinois at Chicago and the National Center for Supercomputing Applications, University of Illinois at Urbana-Champaign



 1992 Article



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Volume 35 Issue 6, June 1992
Pages 64-72
[ACM](#) New York, NY, USA
[table of contents](#) doi>[10.1145/129888.129892](#)

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Cruz-Neira et al (1992): The CAVE: audio visual experience automatic virtual environment
<http://dl.acm.org/citation.cfm?id=129892>

Cornell Medical School - 3D CAVE

<https://www.youtube.com/watch?v=rw-a8RnJ8l0>

monochōme



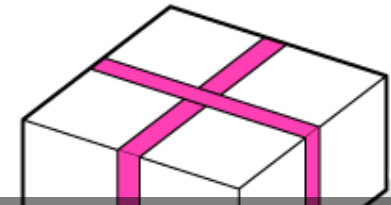
so how does this work?

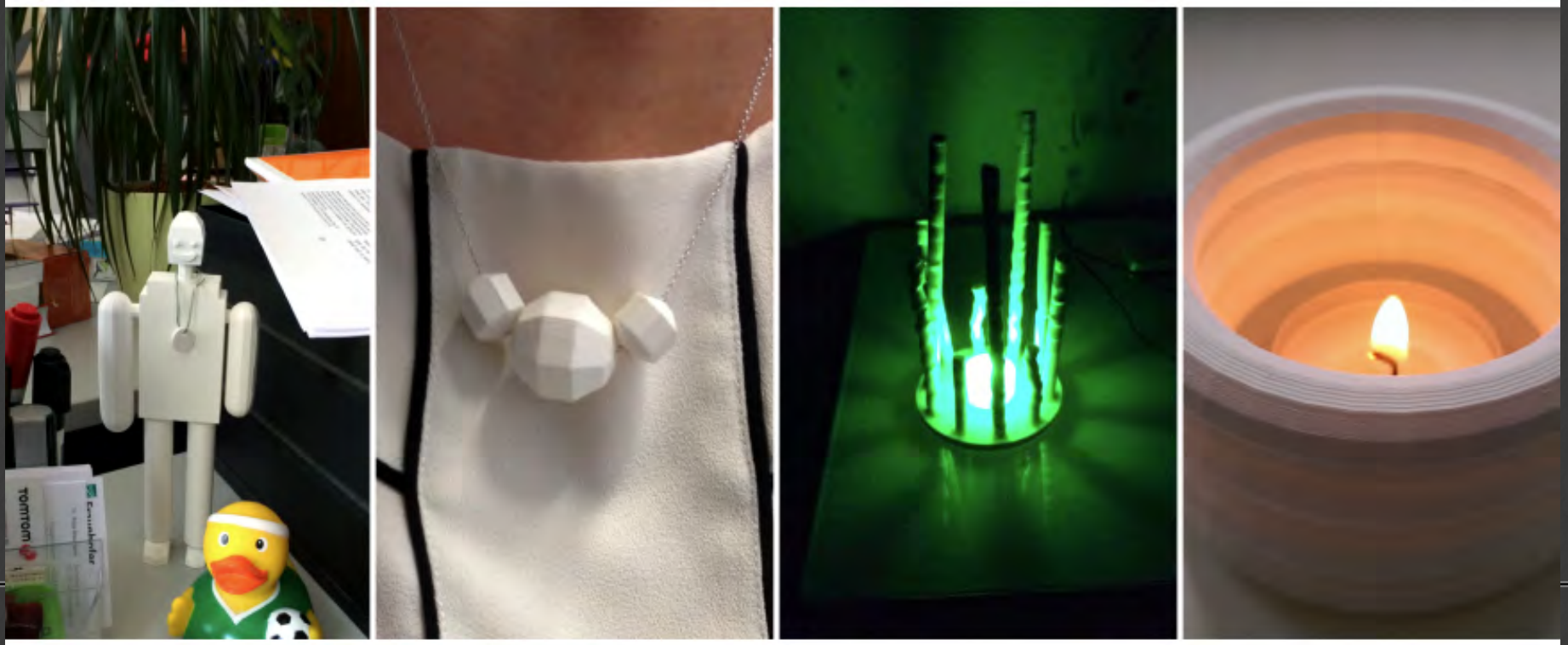
Make memories.

Whether it's for a friend, a loved one, or yourself, Meshu helps you make beautiful mementos from the places that are important to you.

[Make Your Own](#)[View Our Gallery](#)

Here's how it works:





Stusak et al. (2014): Activity Sculptures

Our task was to create friendly, accessible pieces that used open air quality data to inspire public engagement with the issue of air pollution.

Touching Air

Touching Air comprises three necklaces made of perspex segments of different textures.

Each necklace represents a week's worth of data from sensors measuring large particulate (PM10) levels. Since particulate matter damages the heart and lungs, we felt a neckpiece was an appropriate way of communicating this data.

The segments range in size from small to large and in texture from completely smooth to spiky and sharp to touch; the larger and spikier the segment, the more particulates in the air at that time.

By running their fingers over each necklace, the wearer can literally feel how the air quality

in Sheffield went up and down over the course of each week. Dangerous particulate levels have the potential to hurt/prick the finger of the



Stef Posavec (2015): Air Transformed

<http://www.stefanieposavec.co.uk/data/#/airtransformed/>

Project Description

- what is Onetrees?

Project Map

OneTree(s) TwoWheeling

- an initial Tour de San Francisco on Nov 5,6

Project Development & Timeline

Biological Clones

- how and why do you clone a tree?

Electronic Clones: A-Life Tree

- how and why do you simulate a tree?

Ecosystems

- why are the trees in pairs?

OneTrees Sites

- where are the trees?

Stump

- What is a printer queue virus good for?

Reference / Links

Mailing List

- how do I stay updated on OneTrees and Twowheeling?

People & Places

- who did this?

TwoWheeling Schedule - Nov 5-6, 2004.

Friday 11/5

- Noon. University Art Gallery, Berkeley
- 2-4pm. Oakland sites.
- 4-6pm. Ride to San Francisco Art Institute (SFAI)
- 6-8pm. SFAI. Performances by Heather + John Peter.
- 10pm- Urban Camping.

Saturday 11/6

- 8am. Castro sites.
- 1pm. Arrive at [Pond](#).
- 4pm. Ride to Palo Alto.
- 6pm. Bloggercon.

Natalie Jeremijenko: OneTrees

<http://www.nyu.edu/projects/xdesign/onetrees/>

Carbon Visuals (2012): NYC's greenhouse emissions

<https://www.youtube.com/watch?v=DtqSIp1GX0A>

Hal Watts (2010): Urban Water Needs

<https://vimeo.com/21561947>



Moritz Stefaner: Data Cuisine

<http://data-cuisine.net/>

Drinkify



I'M LISTENING TO

EG. JOHNNY CASH

WHAT SHOULD I DRINK?

 Follow @DrinkifyRecipes

Lindsay Eyink, Hannah Donovan, Matthew Ogle: Drinkify

<http://drinkify.org/>



Student Drinking Games

The X-Files Drinking Game



To play this game you'll need something to drink and some episodes of the X-Files. You can take sips and gulps of beer, wine or mixed drinks, or if you want to get wasted, use a whole load of pre-poured shots or half-shots laid out on the table.

How to Play

You'll need to take a drink every time one of the following situations takes place – as soon as you see it yell DRINK!!!! – whoever shouts it first does not have to take a sip.

1 Drink

- A computer does something computers cannot do.
- Mulder or Scully smile.
- Scully is called "Dana."
- Mulder is called "Fox."
- Scully gives some long "scientific" explanation.
- Mulder utters a wry witticism or "Mulderism" (two sips if Scully actually smiles as a result).
- Any character, including Mulder or Scully, shows their badge.
- Scully calls a connection/evidence "purely circumstantial" or "scientifically impossible."
- Mulder happens to know/notice some obscure fact which later helps solve the case.
- You see Smoking Man (smoking or not).
- Mulder talks to Deep Throat or Mr. X.
- Lone Gunmen appear/are consulted.

The X-Files Drinking Game

<http://www.studentdrinkinggames.com/tv-film/x-files.html>

Daito Manabe

https://www.youtube.com/watch?feature=player_embedded&v=LOikgDXaRTg

Sonification

File:Radioactive Alarm Clock - Luminous Dial.webm

From Wikimedia Commons, the free media repository



No higher resolution available.

Radioactive_Alarm_Clock_-_Luminous_Dial.webm (WebM audio/video file, Vorbis/VP8, length 1 min 18 s, 480 × 360 pixels, 264 kbps overall)

Summary

Description

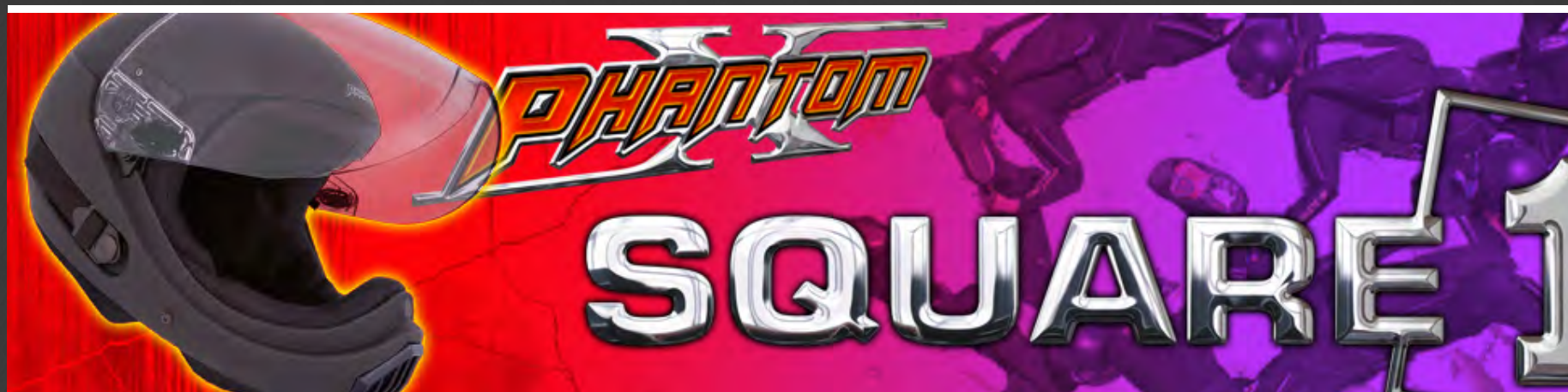
This video shows radioactivity from an old alarm clock with a luminous dial. A simple geiger counter with a pancake probe is used for the measurements.

This a Lexon brand clock, made in the 1960s. It was purchased as a Christmas present at B. Altman & Co., White Plains, NY., in the (early?) 1960s.

Geigerzähler

http://commons.wikimedia.org/wiki/File%3ARadioactive_Alarm_Clock_-_Luminous_Dial.webm

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[Optima II](#)



[Neoxs](#)



[Solo II](#)

Pro-Track... Audible Altimeter & Freefall Computer

PRO-TRACK is the most advanced, user friendly, and accessible audible altimeter/electronic logbook/freefall computer available to skydivers.

Audible Altimeter

<https://www.square1.com/manufacturers/square1/p230.asp>

Sound

[NEU](#)[Hirnströme](#)[Erdbebewegungen](#)[faule Bäume](#)[Kartoffeln](#)[Käse](#)[die Aare](#)[Bilder](#)[Webhits](#)[nicht hierzu gehörige](#)[Ausstellung](#)

KÄSE

Fr. 11. Dezember 2009

Käseklopfen 2009

Emmentaler ist der Urtyp der Grosslochkäse. Die Überprüfung des Reifegrades (Lochbildung, etwaige Rissbildung) des Emmentaler durch Anklopfen ist eine traditionelle Analysemethode in der Käsefabrikation. Sie ist auch Teil der Ausbildung zum Käser. Die Erfahrung wird vom Meister an seinen Lehrling durch praktische Übungen weitergegeben.

Grösse, Form und Verteilung der Löcher sind wichtige Kriterien bei der Gesamtbeurteilung eines Emmentalers. Der Prozess der Lochbildung wird vom Käser einerseits durch die Erhöhung des gesamten Käselaiibes als auch durch Anklopfen mit den Fingern oder einem Hammer überwacht.

Tonaufnahme im Gärraum der Käserei Jegenstorf von gleich grossen, aber unterschiedlich reifen Emmentaler



1. Reifewoche (Anklopfen mit den Fingern)

3. Reifewoche (Anklopfen mit den Fingern)

4. Reifewoche (Anklopfen mit den Fingern)

6. Reifewoche (Anklopfen mit den Fingern)

7. Reifewoche (Anklopfen mit den Fingern)

Käse!

1. HEAVEN



1:19



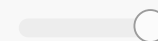
George & Jonathan: Music "Video"

<http://www.georgeandjonathan.com/>

Solar Beat

<http://www.whitevinyl.design.com/solarbeat/>

Listen to Wikipedia



[about](#) & [blog](#) & [app](#)

Ben Johnson (actor)

GLTSCR2

Cedar Cove (TV series)

Minuscule 474

Martin Truex Jr.

GLTP

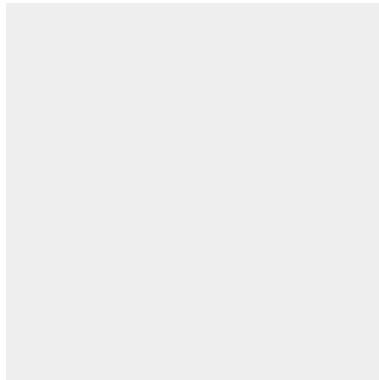
Granville Woods

Richard and Maurice McDonald

Donald B

Listen to Wikipedia

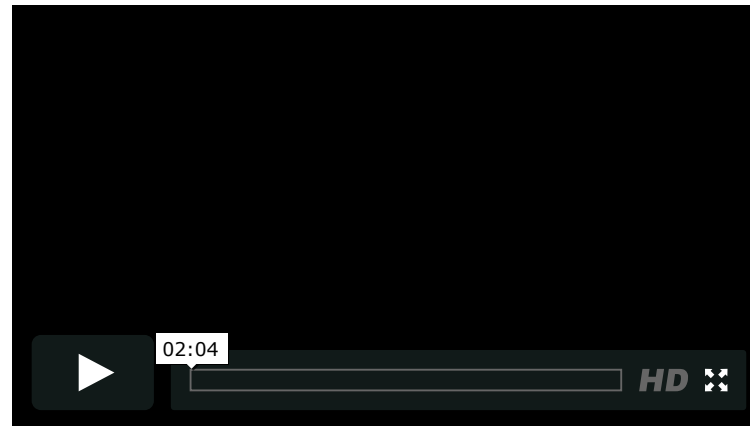
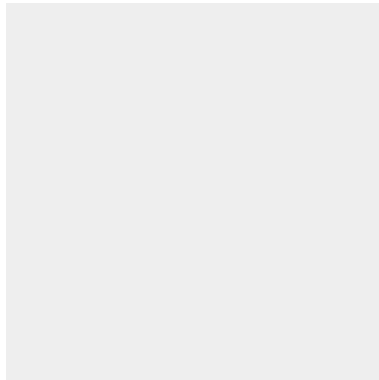
<http://listen.hatnote.com/>

**NEW WORK: *Forty-eight to Sixteen***

For nearly six years I've been commuting to work by bike from Brooklyn to midtown Manhattan. Though the route has evolved somewhat with different jobs and different apartments, the routine has been fundamental to how I've come to feel about New York and all its glorious and aggravating quirks. Biking for me is about a certain productive antagonism with the city, it's about the freedom granted by the urban flow.

My routines are about to get radically disrupted, and I wanted to preserve something of my morning ride. Yet that ride is so kinetic, it doesn't reduce to a photograph, or even a video. However, at the lab I've been immersed in sensor-play, and particularly interested in rhythmic data from biometrics and everyday behavior. So I started experimenting with different types of data from my ride.

Forty-eight to Sixteen is the result. It documents the commute (about 7.5 miles) with sensors for my heartrate, breathing, and the



NEW WORK: Quotidian Record

It's been a couple of months since I first showed this project at [Eyebeam](#), but I've just finished this video and the [documentation page](#).

With *Quotidian Record*, I'm interested in how you might record and make sense of the everyday — this project builds off of a year's worth of data that I recorded using my phone (using **OpenPaths**), starting May 1 in 2011. I then **clustered** all these points to discover what the most prominent places in my life were, and how they were connected. Each place gets assigned a step of the scale in the music, and each city a key. There's kind of an underlying pulse to the composition, each pulse which represents two hours of actual time. And what you hear on top of that are these little motifs, the geographic narratives that I cycle through over the course of my daily movements.

The fun part is that one rotation of the record corresponds to one

Brian House: Quotidian Record

<http://blog.brianhouse.net/post/31228661266>

Akko Goldenbeld (2011): Stadsmusiek

https://www.youtube.com/watch?t=13&v=XdE_L-cOwM0

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Published: February 26, 2010

Fractions of a Second: An Olympic Musical

At the Olympics, the blink of an eye can be all that separates the gold medalist from the 10th-place finisher. In some events, this is obvious. But in others, with athletes racing one by one, the closeness of the race is harder to perceive. Listen to the differences below.



Alpine skiing

The women's downhill course was extremely tiring, and, because it was more challenging than the men's course, it ended up separating the skiers by much larger margins. This pattern appears in the two speed events: the downhill and the super-G.

Amanda Cox/NYTimes (2010): Fractions of a second
http://www.nytimes.com/interactive/2010/02/26/sports/olympics/20100226-olysymphony.html?src=tptw&_r=0

Soundscapes of city pollution

Posted to [Visualization](#) | Tags: [environment](#), [sonification](#)

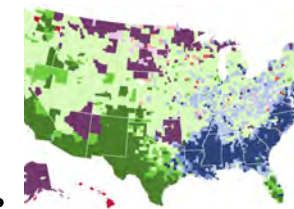


Aaron Rueben and Gabriel Isaacman used data from sampling air in tunnels, where there are a lot of cars, [to create unique soundscapes that represent the chemicals in the area](#).

We created sounds from air samples (atmospheric particulate matter collected on filters) by first using gas chromatography to separate the thousands of compounds in the air (try it with markers at home) and then using mass spectrometry, which gives us a unique "spectrum" for chemicals based on their structure, to identify the compounds and assign them tones. Some compounds end up sounding clear and distinct, while others blur together into unresolvable chords. The result is a qualitative, sensory experience of hard, digital data. You can actually hear the difference between the toxic air of a truck tunnel (clogged with diesel hydrocarbons and carcinogenic particulate matter) and the fragrant air of the High Sierras.



Projects



- [Mapping the Most Common Races # race](#)



City Pollution

<http://flowingdata.com/2012/09/13/soundscapes-of-city-pollution/>

PHANTOM TERRAINS



THE URBAN ENVIRONMENT IS ALIVE WITH HIDDEN
CURRENTS OF ELECTROMAGNETIC SIGNALS.

Streams of wireless data surge from internet exchanges and cellphone relays, flowing from routers to our devices and back again. This saturation of data has become a ubiquitous part of modern life, yet it is completely invisible to us. What would it mean to develop an additional sense which makes us continuously attuned to the invisible data topographies that pervade the city streets?

Frank Swain/Daniel Jones: Phantom Terrains

<http://phantomterrains.com/>

Helsinki Complaints Choir

<https://www.youtube.com/watch?v=ATXV3DzKv68>

Daniel Crawford: A Song of Our Warming Planet

<https://vimeo.com/69122809>

[Dennis P Paul](#)

Gestalter

An Instrument for the Sonification of Everyday Things (2012)



The surfaces of everyday objects are scanned and transformed into audible frequencies.

Dennis Paul: An Instrument for the Sonification of Everyday Things

<http://dennisppaul.de/an-instrument-for-the-sonification-of-everyday-things/>

Riedenklau et al. (2010): Tangible Active Objects and Interactive Sonification as a Scatter Plot Alternative for the Visually Impaired
<https://www.youtube.com/watch?v=ibnz3poa9RU#t=52>

[Start](#)

Create magic sounds from atomic nuclei

The Radioactive Orchestra (2011)

<http://www.nuclear.kth.se/radioactiveorchestra/>

Listen to CRaTER Live!

[Get Flash](#)



Follow @CRaTERLive



Tweet

215

CRaTER Live Internet Radio Station Sonification/Music Design

The six detectors and their associated cosmic ray counts can now be listened to in realtime as modal music. The range of data values within a 16 second span are scaled to the max value over that time so that the max value plays the lowest note out of a 4 octave scale starting from Midi note 36 or two octaves below middle C. Detectors are played in the following order 2,1,4,3,6,5. As the counts in detectors 2, 4 and 6 are generally higher than in 1, 3 and 5, the technique of playing the thick detector before each thin detector helps to make the music more intelligible as the downbeat notes generally will be lower in pitch.

Higher counts are mapped to lower pitches. When a detector received more counts, it sounds lower to signify more counts or a greater weight hitting it. When it receives fewer counts, it is higher pitched, receiving less energy or fewer particles hitting it.

As counts increase the harmony of a sustaining string section pitch conveys where the detectors max value within 16 seconds falls in relation to a maximum count value of 30000 counts per second. This pitch, again, will move lower as counts increase.

CRaTER Live Sonification Design

by Marty Quinn



**B: magnitude context
presented thru
sustained string section
pitch**

**A: (1) max value within 16 seconds determines
scale & instrument changes +
(2) data values spread within max value
presented as pitches remapped within 4 octaves (2).**

CRATER live radio

<http://prediccs.sr.unh.edu/craterweb/craterliveradio.html>



search Space.com



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+627722



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- [SEARCH FOR LIFE](#)
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X-Flare! New Sunspot Makes Presence Known | Video

Sunspot AR2339 unleashed an X2.7 solar flare on May 5th, 2015. A radio blackout alert was issued for areas over the Pacific Ocean by NASA/NOAA. NASA's Solar Dynamics Observatory (SDO) captured the fireworks in multiple wavelengths.

[WATCH MORE](#)



SHOWS



Solar storm particle sounds

<http://www.space.com/14897-solar-storm-sounds-particle-sonification-video.html>



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Loading...

Smellmap: Amsterdam



Smellmap
Amsterdam©KateMcLean2014

from **RCA IED** **PLUS**

Smellification?

<http://sensorymaps.com/portfolio/smellmap-amsterdam/>

Wiederholung

McCormick et al. (1987)

"Transformation of the symbolic into the geometric"

Bertin (1967)

"... finding the artificial memory that best supports
our natural means of perception."

Card, Mackinlay, Shneiderman (1999)

"The use of computer-generated, interactive, visual representations of data to amplify cognition."

Definition für diese Vorlesung:

Eine Visualisierung ist
die **Repräsentation** von **Daten**
mittels **visueller Symbolik**,
die den **menschlichen Wahrnehmungsapparat**
zur **Mustererkennung** und
Suche ausnutzen *kann*.

Wozu visualisieren?

1. Aufzeichnen
2. Analysieren
3. Kommunizieren

Daten

Metadaten

Daten **über** die Daten
Beschreibung!

Eine Typisierung:
Strukturiertheit!

1. strukturierte Daten
2. semi-strukturierte Daten
3. unstrukturierte Daten

Weitere Typisierung:
Dynamik!

1. Statische Daten
2. Dynamische Daten
(2,5. Echtzeitdaten)

Datentypen

1. Objekte

Juli

Ariane 5

Ware 1788332

Datentypen

2. Attribute

Juli:

Alter 7, Shirt Größe S, Lieblingsfrucht Birne

Ariane 5:

Baujahr 1996, Höhe 46m, Antriebe 2

Ware 1788332:

Gewicht 750g, Haltbarkeit 17.5.2015

Datentypen

3. Kanten (Verbindungen)

Juli:

befreundet mit Hans, Lilly und Thomas

Ariane 5:

Nachfolgermodell Ariane 6

Ware 1788332:

liegt im Regal neben Ware 1788291

Datentypen

4. Gitter (kontinuierlich)

Juli:

Gewicht im wöchentlichen Abstand

Ariane 5:

Treibstoffstand in Sekunden nach dem Start

Ware 1788332:

Entfernung zum nächsten Geschäft

Datentypen

5. Position

Juli:

Position: Orff-Grundschule, München

Ariane 5:

Höhe: 731m, Breite: 48.89364, Länge: 2.33739

Ware 1788332:

Regal 4, Ablage 7

Datensets

Ein Dataset ist eine Sammlung von Daten.

Datensets

Tabellen

enthalten **Objekte** und **Attribute/Positionen**.

	A	B	C	D	E
1		Alter	Gewicht	Augenfarbe	Haarfarbe
2	Kind 1				
3	Kind 2				
4	Kind 3				
5	Kind 4				
6					

Datensets

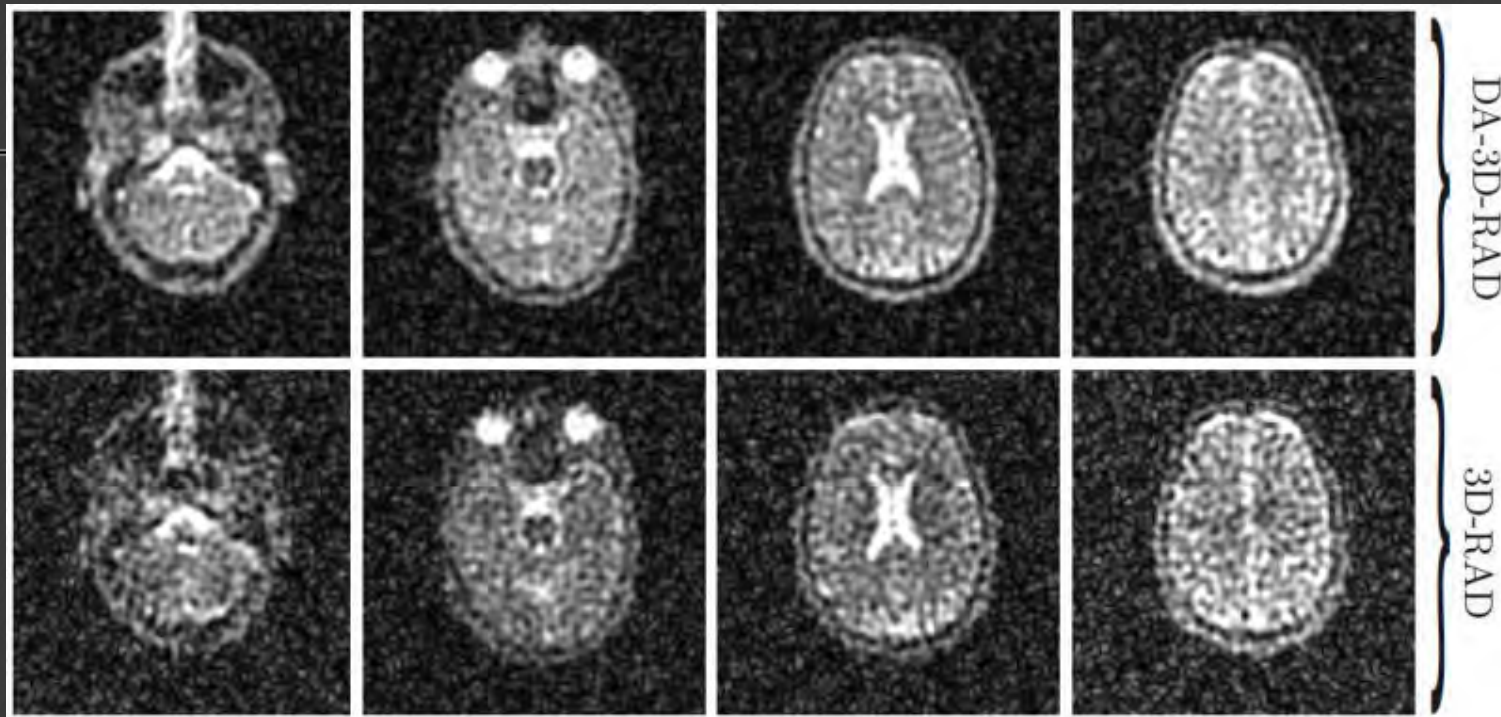
Netzwerke

enthalten **Objekte**, **Kanten** und **Attribute/Positionen**.

Datensets

Felder

enthalten **Gitter** (**Positionen** darin) und **Attribute**.



Attributtypen

Nominal/Kategorial

Ordinal

Kardinal/Metrisch

Attributtyp

Nominal/Kategorial

keine klare Reihenfolge

Rot, Grün, Blau

männlich, weiblich

Äpfel, Birnen, Bananen

Attributtyp

Ordinal

Reihenfolge, aber keine klaren Abstände

XS, S, M, L, XL

Baby, Kleinkind, Jugendlicher

Fußball-Bundesliga

Attributtyp

Kardinal/Metrisch

Messbare, berechenbare Abstände

734ml, 981ml, 1132ml

1,71m, 1,86m

14:34 Uhr, 18:29 Uhr

Sortierung

(für ordinale/kardinale Daten)

Sequentiell

Divergierend

Zyklisch

Sortierung **Sequentiell**

Werte gehen alle in eine Richtung

Höhe über N.N.
Baujahr bei Autos
Körpergröße

Sortierung

Divergierend

Werte gehen in zwei Richtungen von Nullpunkt aus

Erhebung (negativ für unter dem Meeresspiegel, sonst positiv)

Jahr eines geschichtlichen Ereignisses

Abweichung vom normalen Insulinspiegel

Sortierung

Zyklisch

Datenbereich wiederholt sich

Sekunden (0-60)

Jahre bis nächstes Schaltjahr (0-3)

Tonleitern (C, C#, D, D#, E, F, ...)

Wozu visualisieren?

1. Aufzeichnen
2. Analysieren
3. Kommunizieren

Analyseprozess:

Werte suchen

dann

Ablesen (ein Wert)

oder

Vergleichen (mehrere Werte)

oder

Zusammenfassen (viele Werte)

Was will ich finden?

Trends

Ausreißer

Bestimmte Muster (je nach Daten)

Attribute

1. Ein Attribut

Verteilung

Extremwerte

2. Viele Attribute

Korrelation

Ähnlichkeit

Netzwerke

Topologie

Pfade

Menschliche Wahrnehmung

Menschliche Wahrnehmung:

Top-Down ↓

versus

Bottom-Up ↑

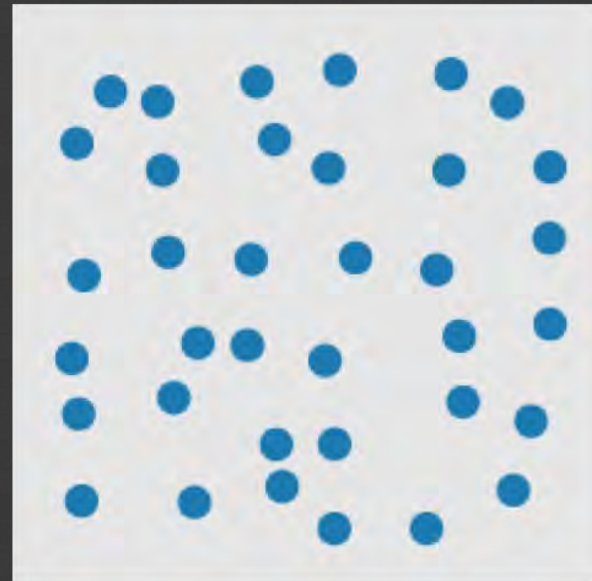
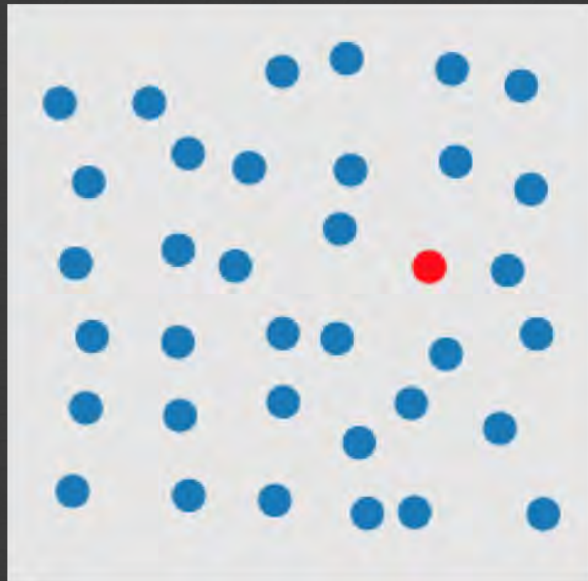
Prozesse

Optische Illusionen:

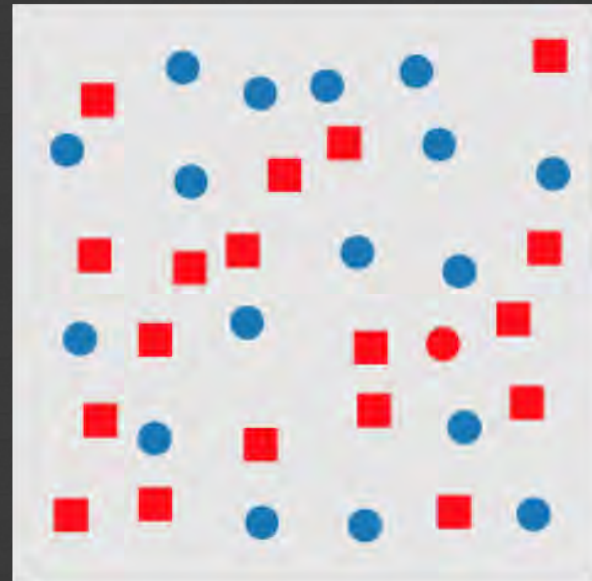
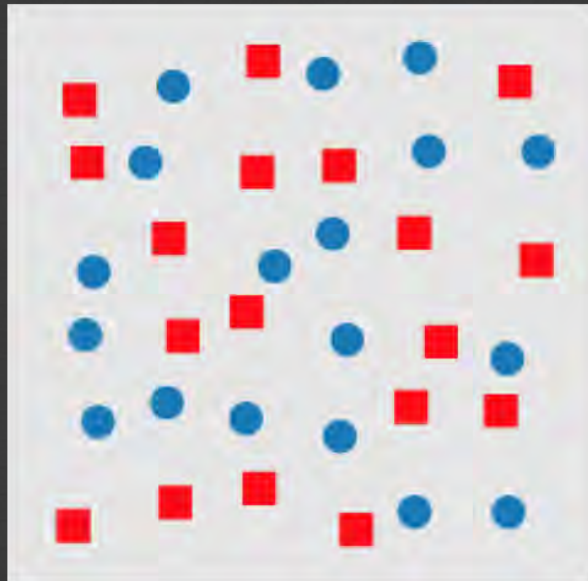
Inattentional Blindness (The Gorilla)

Change Blindness (Person Swap)

Präattentive Wahrnehmung



<http://www.csc.ncsu.edu/faculty/healey/PP/index.html>



Attributskombination: Suche den roten Kreis

<http://www.csc.ncsu.edu/faculty/healey/PP/index.html>

Gestalt Gesetze



Gesetz der Figur-Grund Beziehung

<http://www.robaweb.de/gdm/inhalt/VisuelleWahrnehmung/Gestaltwahrnehmung/03-Gestaltgesetze.html>

Für Visualisierung:

Präattentive Wahrnehmung um Muster erkennbar zu machen

Gestaltgesetze beachten

Optische Täuschungen vermeiden

Farben

Farben in Visualisierung:

- "Get it right in black and white"
- Farben hauptsächlich für Kategorien einsetzen
- Für Zahlen: Hauptsächlich Änderung in Helligkeit & Variation in Farbton/Sättigung
- Bei divergierenden Skalen: Blenden über neutrale Farbe



#8c510a
#d8b365
#f6e8c3
#f5f5f5
#c7eae5
#5ab4ac
#01665e

Visuelle Variablen

Visualization in a nutshell:

Datenvariablen

- **Enkodierung** via Visuellen Variablen ->

Markierungen

Marks as Items/Nodes

➔ Points



➔ Lines



➔ Areas



Marks as Links

➔ Containment

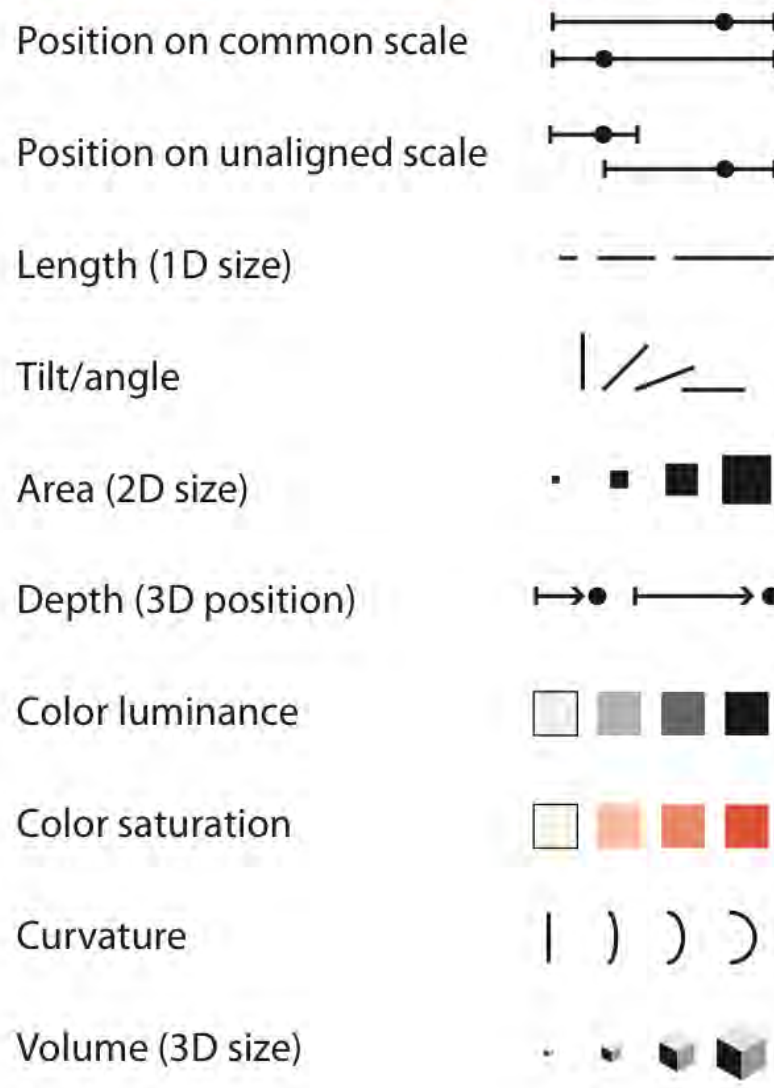


➔ Connection



Channels: Expressiveness Types and Effectiveness Ranks

➔ **Magnitude Channels: Ordered Attributes**



➔ **Identity Channels: Categorical Attributes**



Most
Effectiveness
Least

Munzner: Visuelle Variablen

Graphical Excellence

Edward Tufte

"Graphical excellence is that which gives to the viewer the greatest number of ideas in the shortest time with the least ink in the smallest space."

Graphical Integrity

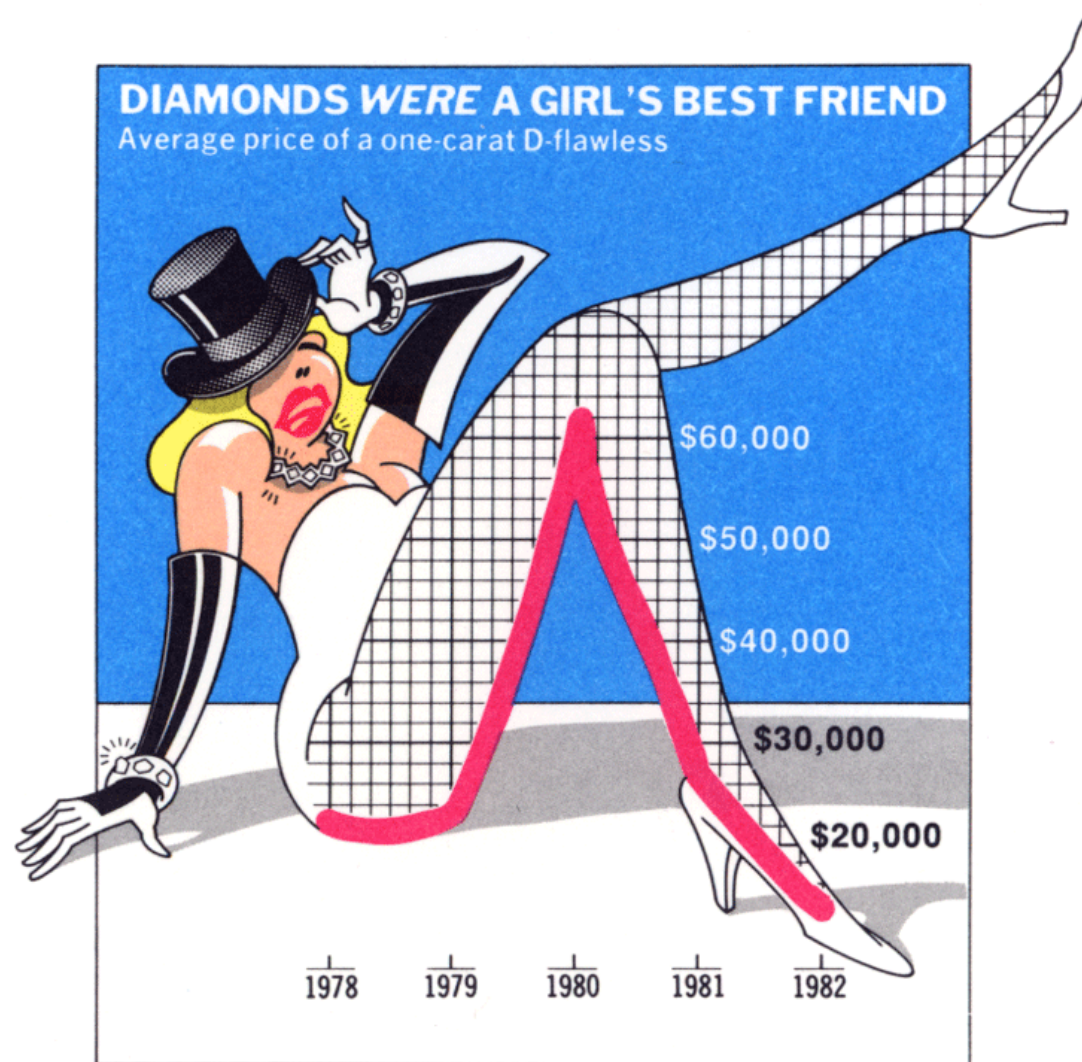
Lie Factor:

**Größe des Effekts in der Grafik
geteilt durch
Größe des Effekts in den Daten**

Graphical Excellence

Data-Ink Ratio:

**Datentinte
geteilt durch
Gesamte Tinte**



Interaktion

Direct Manipulation (1983):

Zusammengefasst: Virtuelle Objekte verhalten sich wie reale Objekte und lassen sich ebenso manipulieren.

Infovis-Mantra:

"Overview first, zoom and filter, details-on-demand"

Ben Shneiderman (1996)

Brushing and Linking

Interaktive Verknüpfung mehrerer Ansichten

"Brushing": Highlighting eines Ausschnitts der Daten

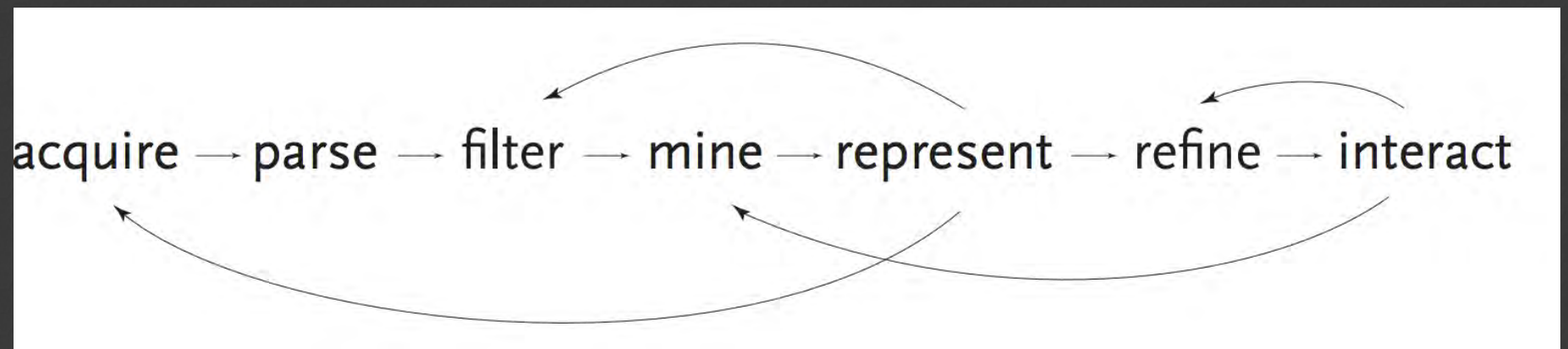
"Linking": Gleichzeitiges Hervorheben in anderen Ansichten

Jeff Heer & Ben Shneiderman (2012)

Interaktionskategorien

- **Daten/Ansicht bestimmen**
- **Ansicht verändern**
- **Dokumentation**

Prozess



Ben Fry: Process (2004)

<http://benfry.com/phd/dissertation-110323c.pdf>

Kritik

Methode aus dem Design:

Was funktioniert?

Was nicht?

Was könnte besser sein?

Speziell für Visualisierung:

Aufgaben des Lesers?

Erfüllt die Enkodierung diese?

Passt die Informationsarchitektur?

Funktioniert die Interaktion?

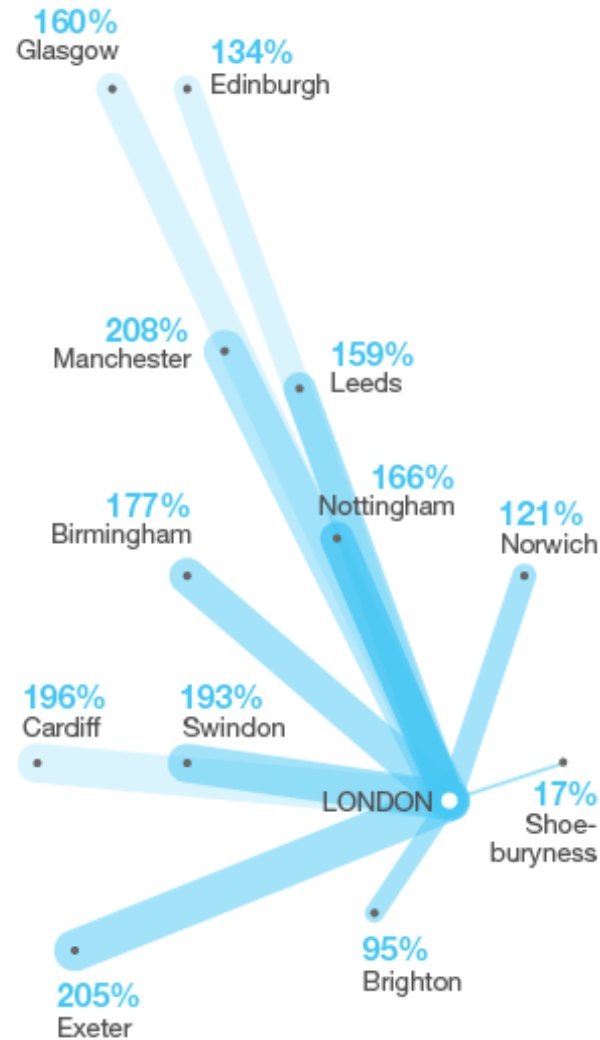
Comparison of increase in fares since 1995

Thicker lines show greater increase in fare

Season ticket



Single ticket



This line equates to inflation since 1995. A line thinner than this would mean a reduction in price in real terms.

Source: Barry Doe, rail analyst

BBC: Train Fares (2013)

<http://www.bbc.com/news/magazine-21056703>

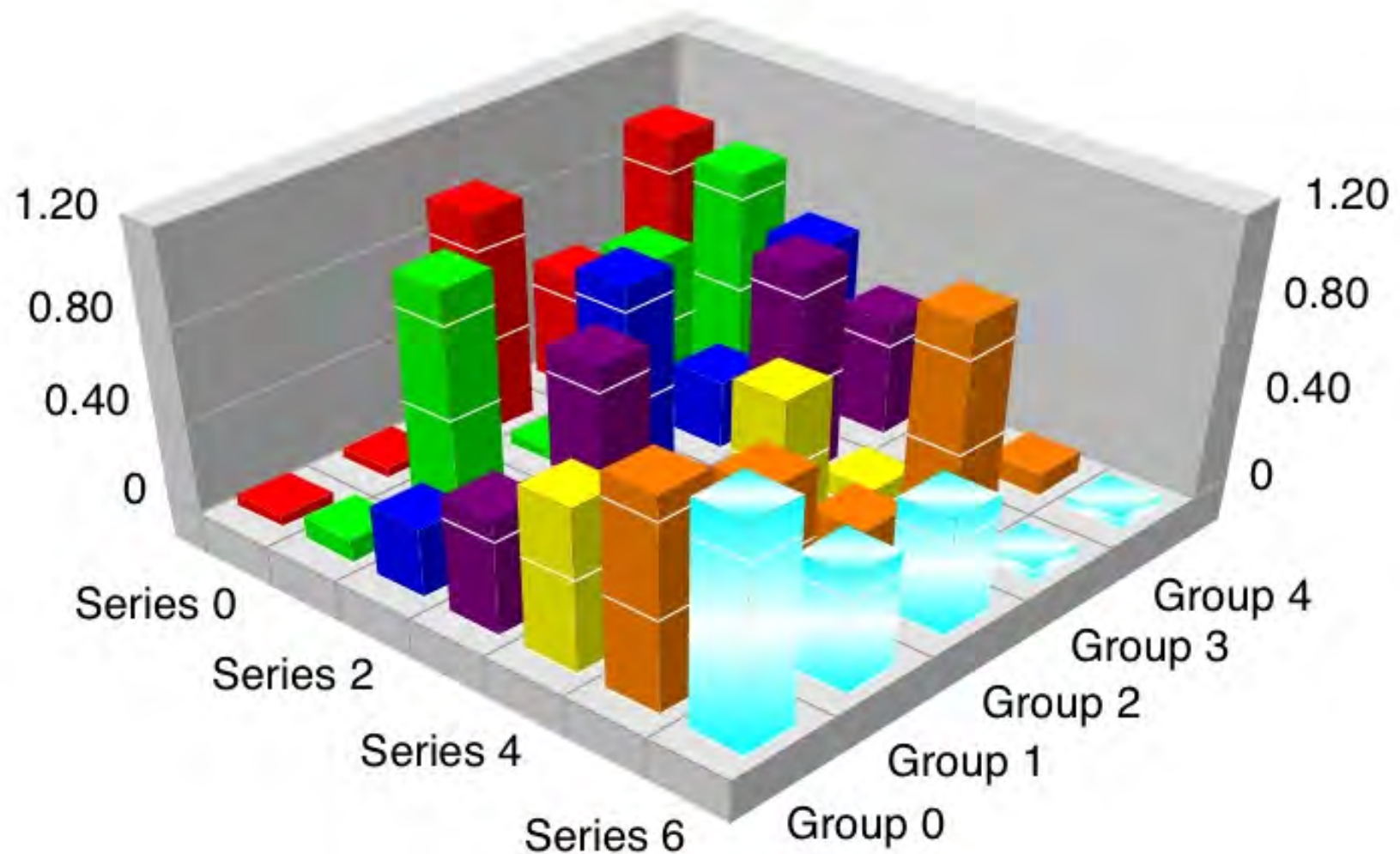
Multidimensionale Datensets

Multidimensional?

Multidimensional bedeutet, dass jedes Objekt im Datenset mehr als zwei Attribute hat. Diese lassen sich also nicht mehr einfach durch eine zweidimensionale Visualisierung darstellen.

Test Default viewAngleSetting

View Angle Setting 1



Probleme mit 3D: Verdeckung

<http://www.threedgraphics.com/tdg/products/tools/ioschart/samples.php>

Multidimensionale Visualisierung (1)

- **Erweiterte Charts**

- Bubble Charts
- Connected Scatterplot
- Treemap, Choropleth

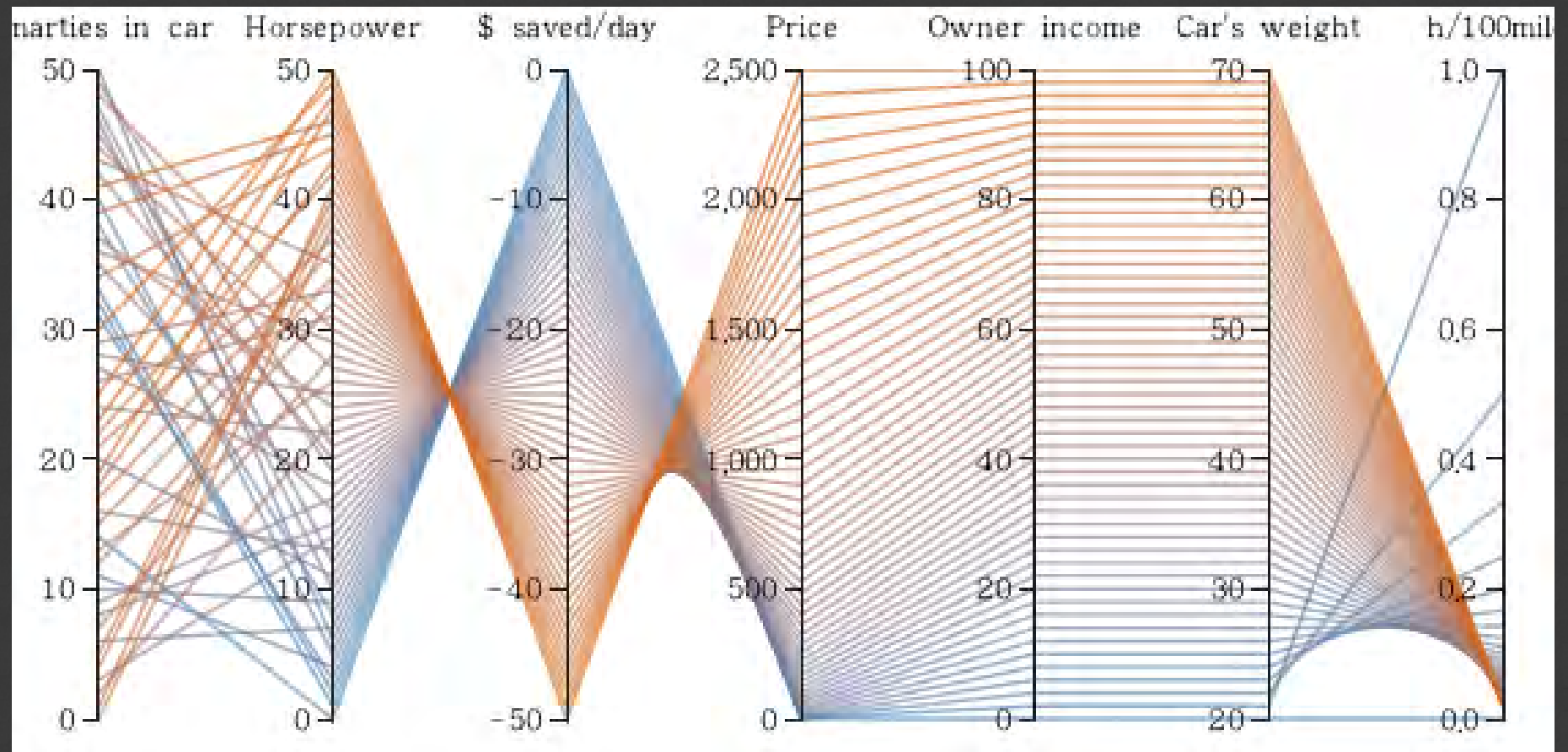
- **Kombinierte Charts**

- **Flächenbasierte Charts**

- Streamgraph
- Horizon Chart

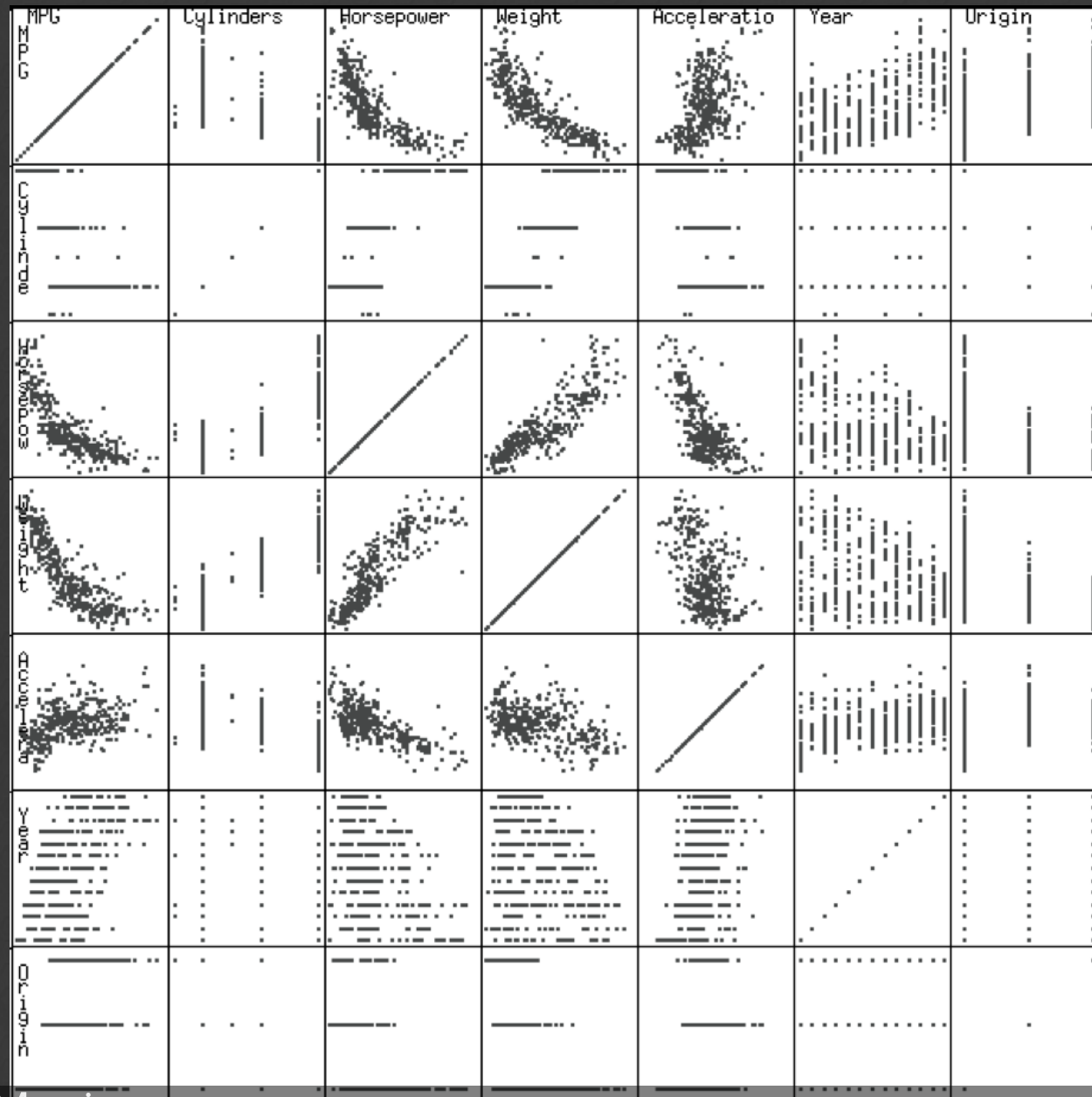
"Echte"
multidimension
ale

Visualisierungen



Parallel Coordinate Plot: Muster

<http://une-terre.blogspot.fr/2012/09/parallel-coordinates-read-out-patterns.html>



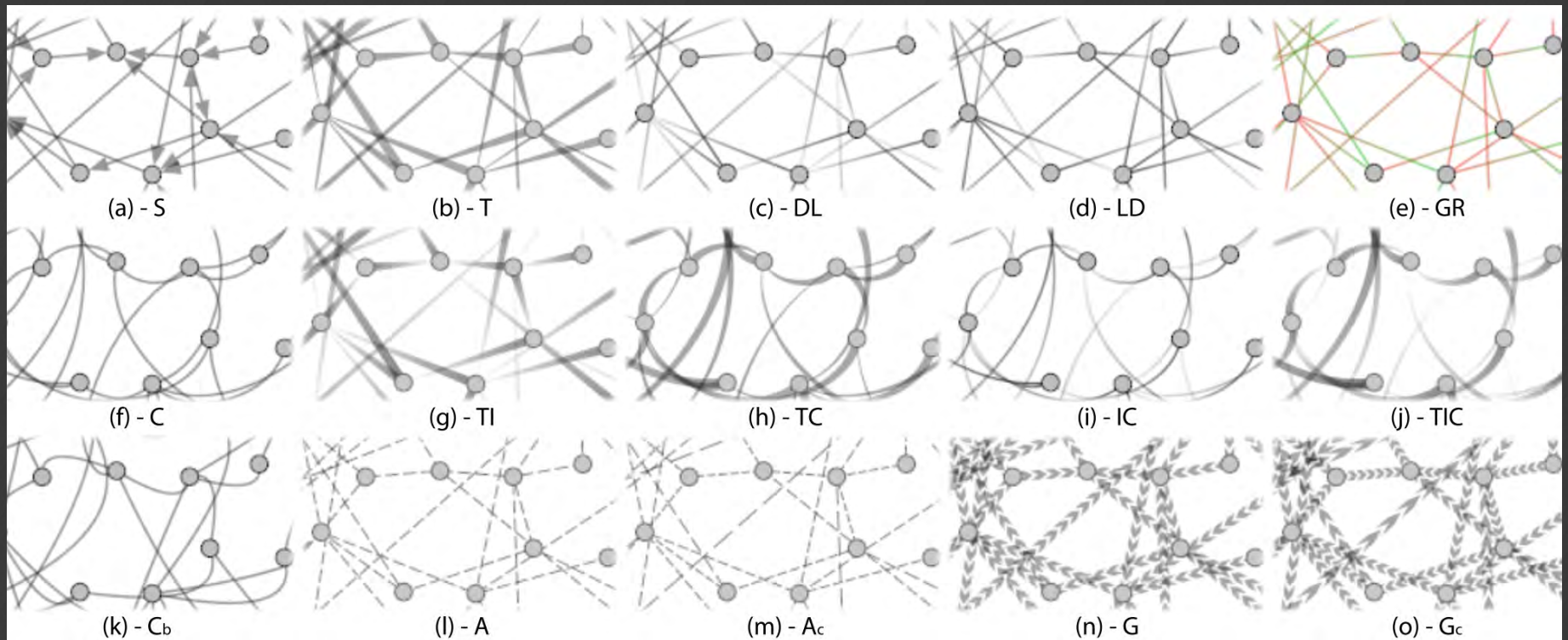
Scatterplot Matrix

Netzwerkdaten

Netzwerke

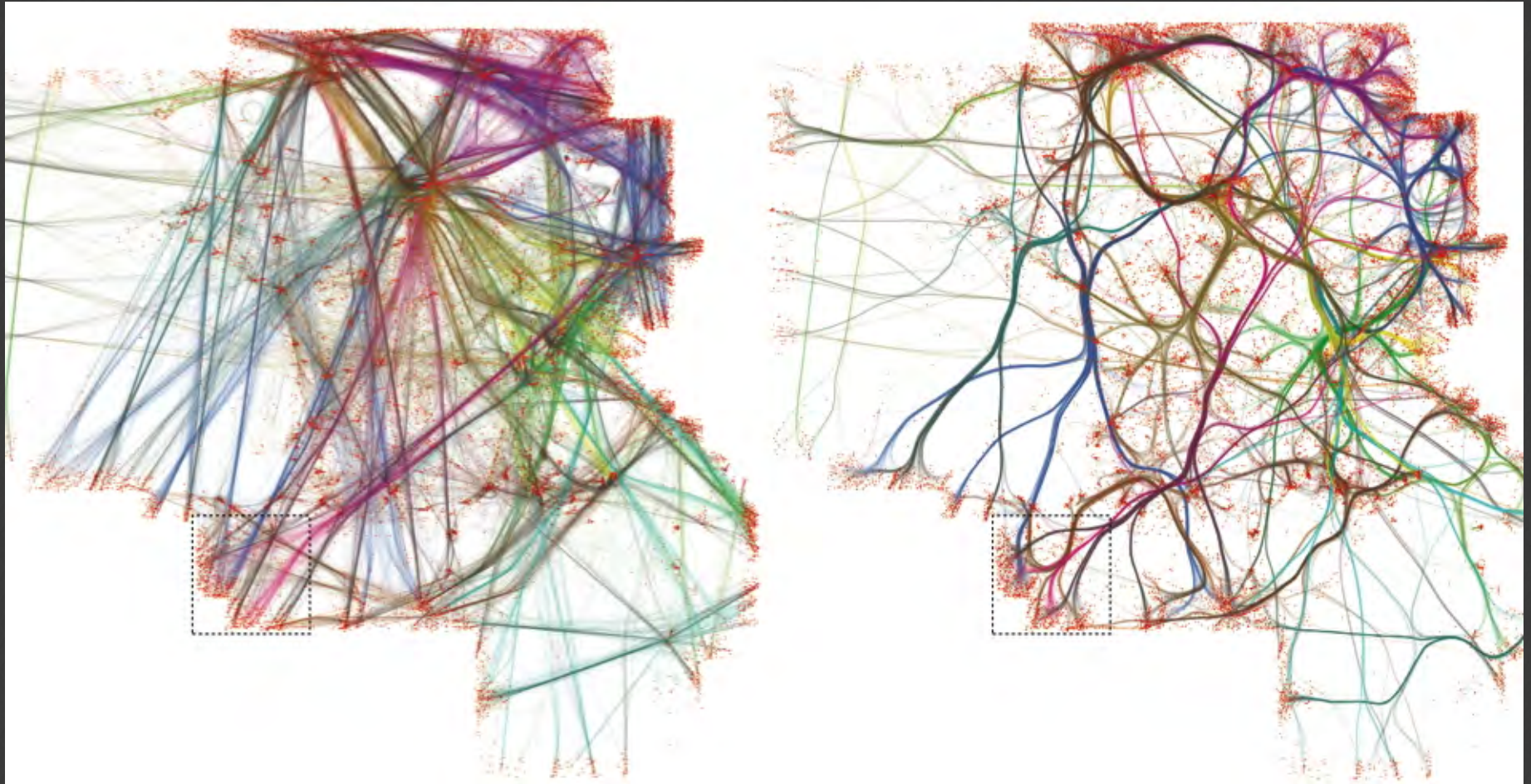
Netzwerkdaten bestehen aus **Knoten** und sie verbindenden **Kanten**.
Sowohl Knoten als auch Kanten können **Attribute** haben.

Node-Link Diagramme



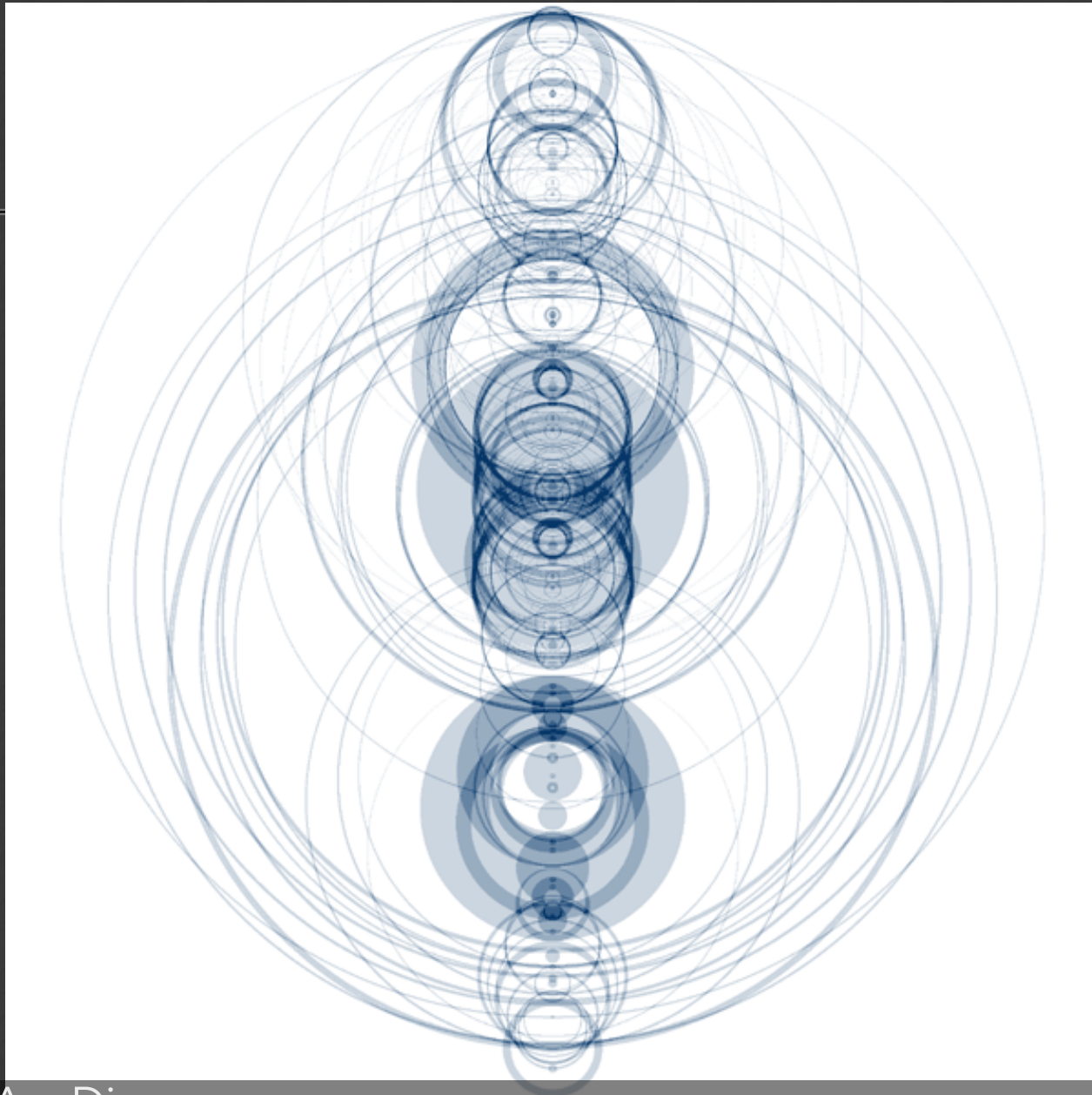
Edge Tapering

https://www.lri.fr/~isenberg/publications/papers/Holten_2011_AEP.pdf



Edge Bundling

<http://www.cs.rug.nl/svcg/InfoVis/ImageVis>



Spezialfall: Arc Diagrams

<http://www.bewitched.com/song.html>

Matrix

Wiederholung

Experimentelle Datenrepräsentationen und Data Art

Physical Datavis

Sonification

Wiederholung

Infos: <http://do.minik.us/teaching/dvuv/15>

Moodle: <https://www.moodle.ufg.at/moodle/course/view.php?id=172>