

11

Information Visualization

Daniel Gonçalves, Sandra Gama

Evaluation and PIV



01

EVALUATION

The Quality of a Visualization...

“How cool!”

Important, but not enough!



Evaluation!

What works

Even if not “cool”...

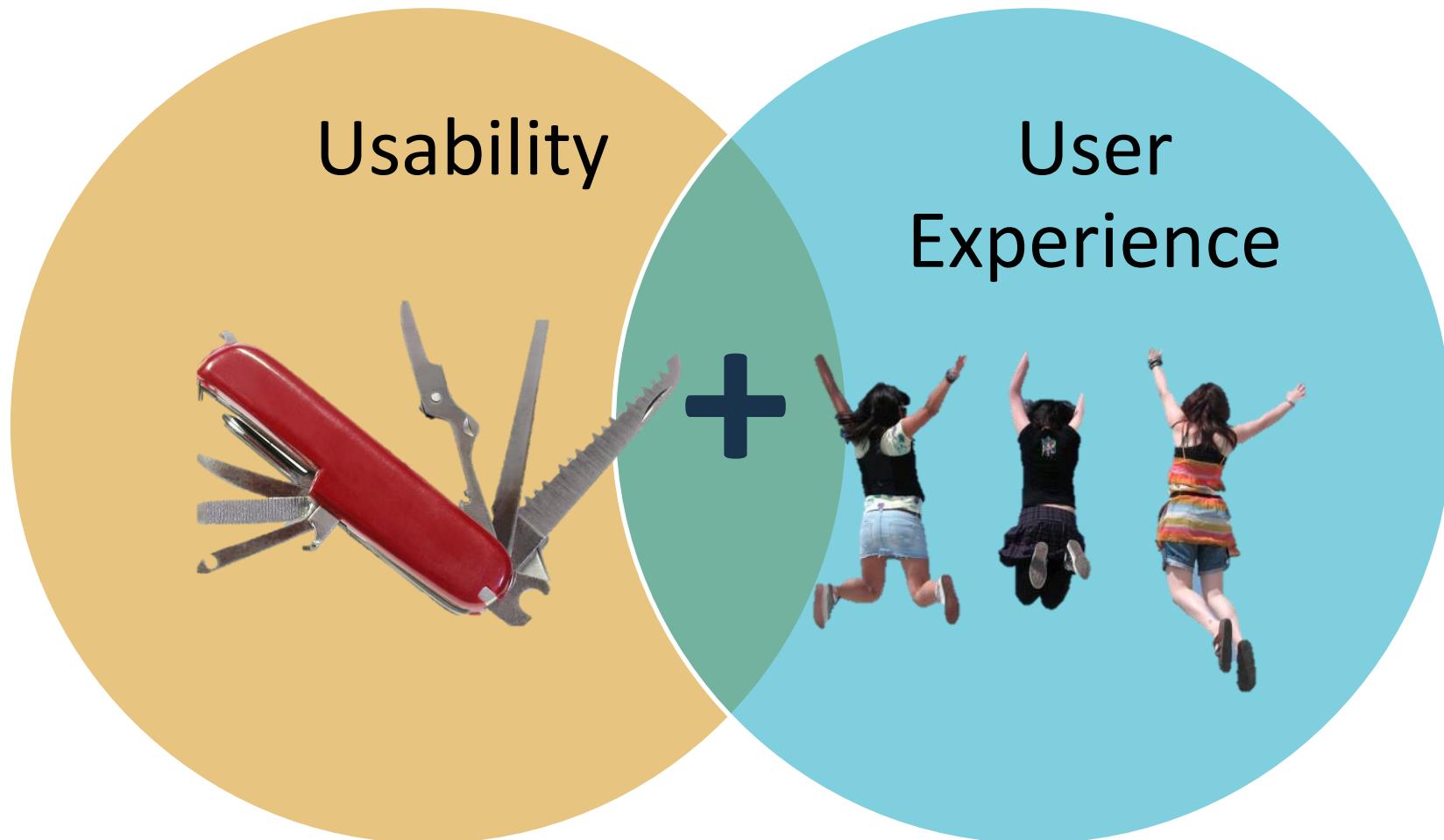
Why it works

What to improve

Not “because the professor had me do it”...

Evaluation in HCI

Evaluate + Identify Problems



Evaluation Methods



Analytical



Empirical

Methods

Predictive

GOMS, KLM,...

Experts

Heuristic evaluation

User tests

Usability + UX

For InfoVis

Predictive

GOMS, KLM,...



Makes sense, but not very relevant. Instead: provide strong rationale for the idioms based on perceptual principles

Experts

Heuristic evaluation

User tests

Usability + UX

For InfoVis

Predictive

~~GOMS, KLM,...~~

Technique justification

Experts

Heuristic evaluation



Specialized heuristic sets exist

User tests

Usability + UX

For InfoVis

Predictive

~~GOMS, KLM,...~~

Technique justification

Experts

Heuristic evaluation with specialized heuristics

User tests

Usability + UX



Usability + Usefulness!

For InfoVis

Predictive

Technique justification

Experts

Heuristic evaluation with specialized heuristics

User tests

Usability + UX + Utility

Heuristics for InfoVis

An Heuristic Set for Evaluation in Information Visualization, [Forsell and Johannesson, 2010]

H1 – Information coding

Perception of information is directly dependent on the mapping of data elements to visual objects. This should be enhanced by using realistic characteristics/techniques or the use of additional symbols.

H2 – Minimal actions

Concerns workload with respect to the number of actions necessary to accomplish a goal or a task.

H3 – Flexibility.

Flexibility is reflected in the number of possible ways of achieving a given goal. It refers to the means available to customization in order to take into account working strategies, habits and task requirements.

H4 – Orientation and help

Functions like support to control levels of details, redo/undo of actions and representing additional information.

H5 – Spatial organization

Concerns users' orientation in the information space, the distribution of elements in the layout, precision and legibility, efficiency in space usage and distortion of visual elements.

Heuristics for InfoVis

An Heuristic Set for Evaluation in Information Visualization, [Forsell and Johannesson, 2010]

H6 – Consistency

Refers to the way design choices are maintained in similar contexts, and are different when applied to different contexts.

H7 – Recognition rather than recall

The user should not have to memorize a lot of information to carry out tasks.

H8 – Prompting

Refers to all means that help to know all alternatives when several actions are possible depending on the contexts

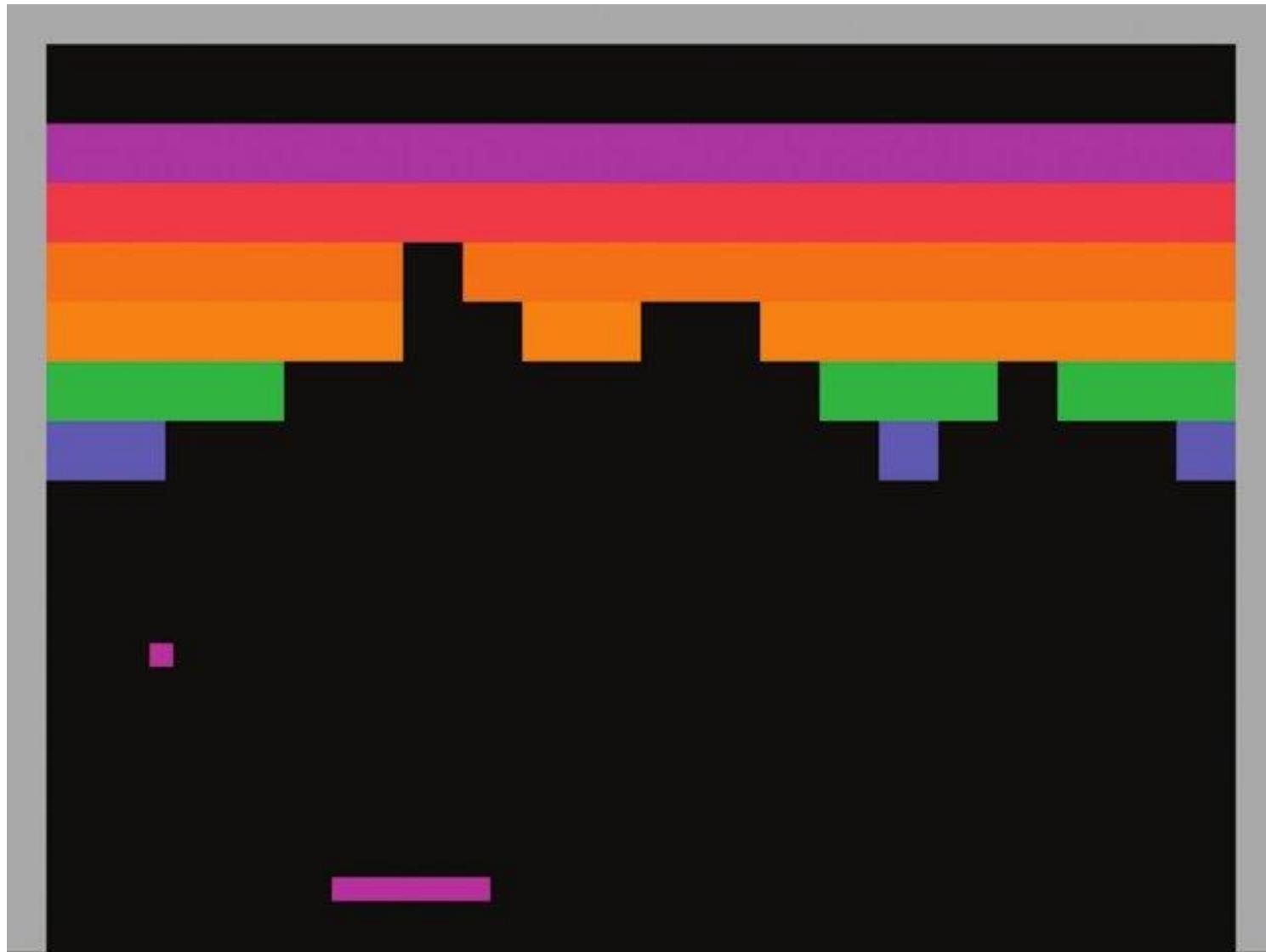
H9 – Remove the extraneous

Concerns whether any extra information can be a distraction and take the eye away from seeing the data or making comparisons.

H10 – Data set reduction

Concerns provided features for reducing a data set, their efficiency and ease of use

Breakout!



Let's do a Heuristic Evaluation!

H1 – Information coding

H2 – Minimal actions

H3 – Flexibility.

H4 – Orientation and help

H5 – Spatial organization

H6 – Consistency

H7 – Recognition rather than recall

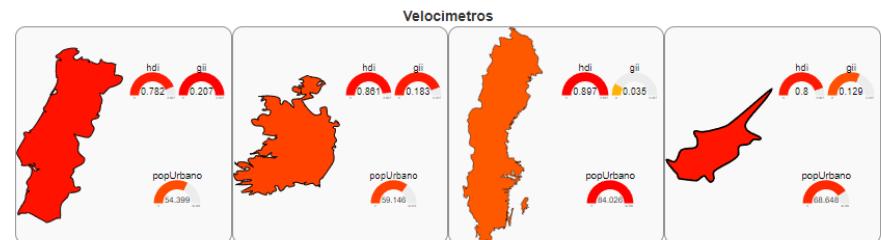
H8 – Prompting

H9 – Remove the extraneous

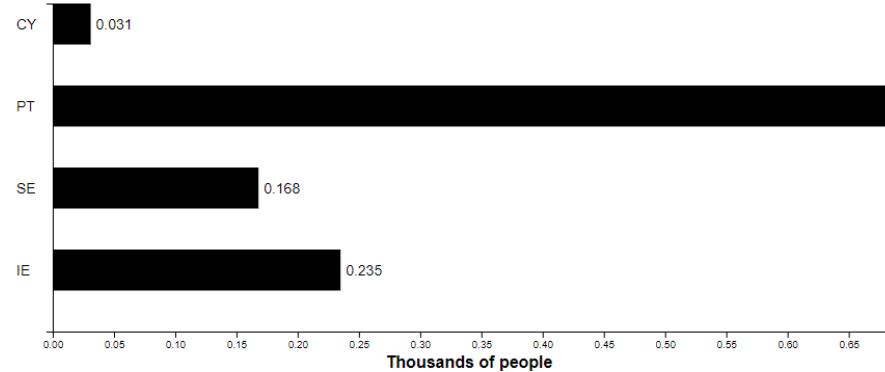
H10 – Data set reduction

Migration in Europe

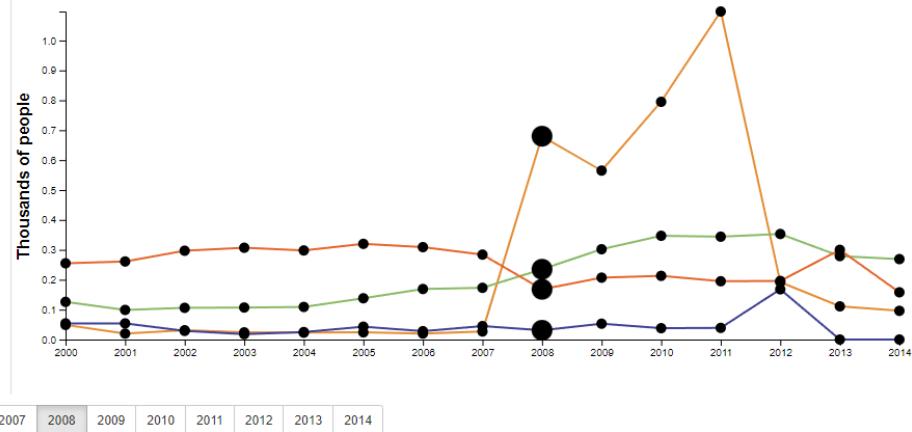
Migration @ Europe

Add CountrySettings

Emigration in 2008



Emigration over time



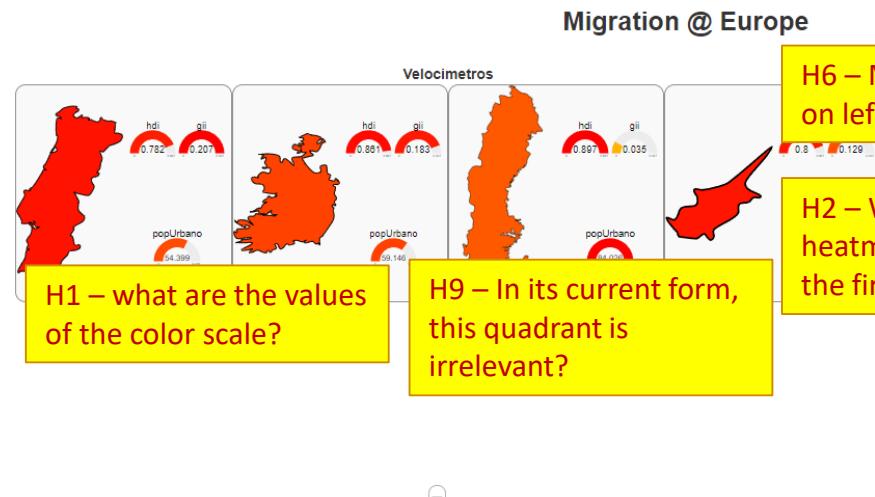
The Vis

Live here:

<https://web.tecnico.ulisboa.pt/~ist13898/vi-ah/>

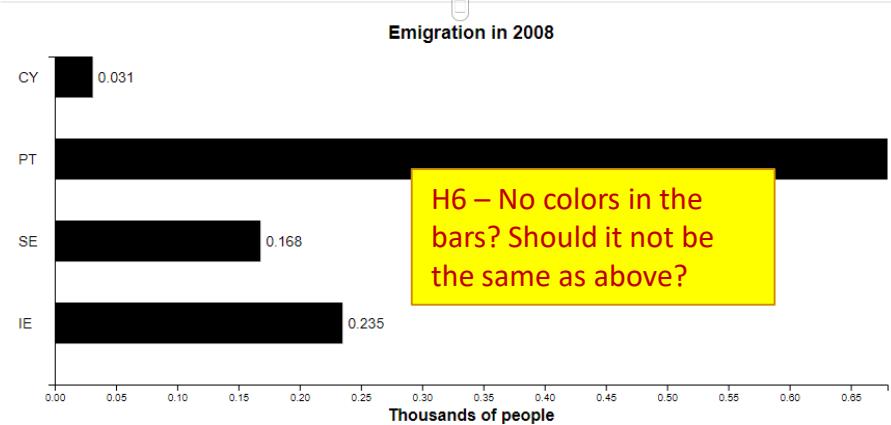
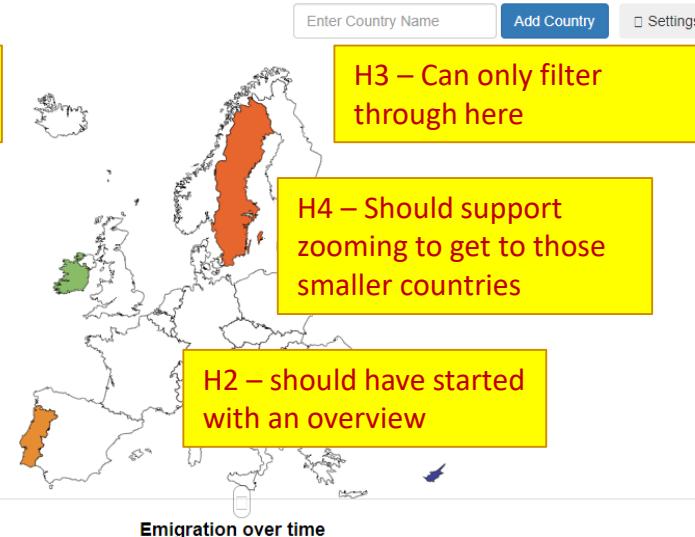
Annotate your problems on jamboard: circle
the affected areas, indicate the violated
heuristic(s)

Migration in Europe (some problems!)



H6 – Map colors different on left and right

H2 – Why not show the heatmap on the right in the first place?



H3 – Must start with the map!



H4 – Cannot really get any more information (tooltips, etc.)

H4 – Not obvious what you can do with this vis

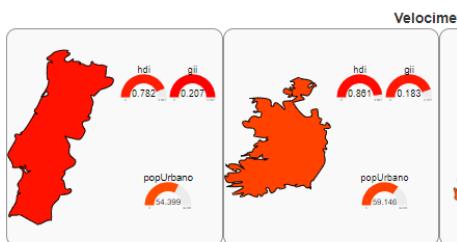
Cardinal Sins

Migration @ Europe

Enter Country Name

Add Country

Settings

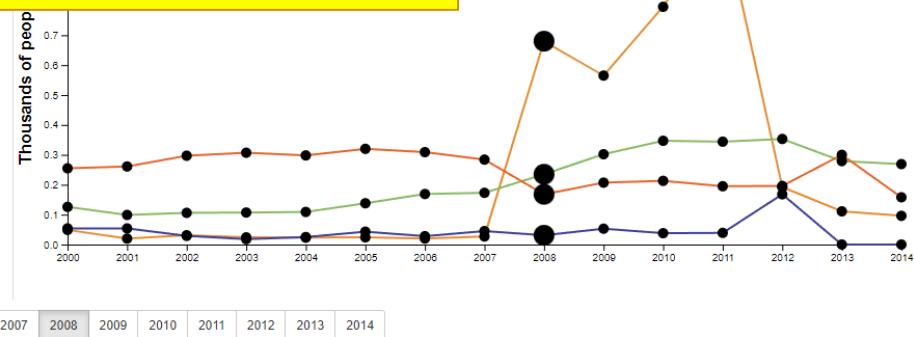
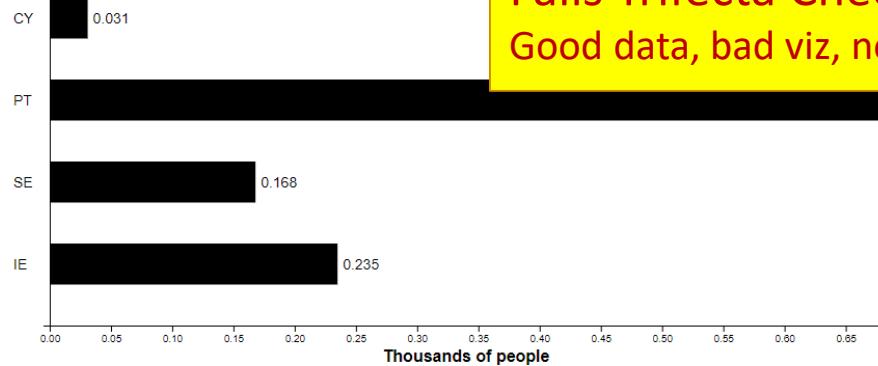


Has a starting point

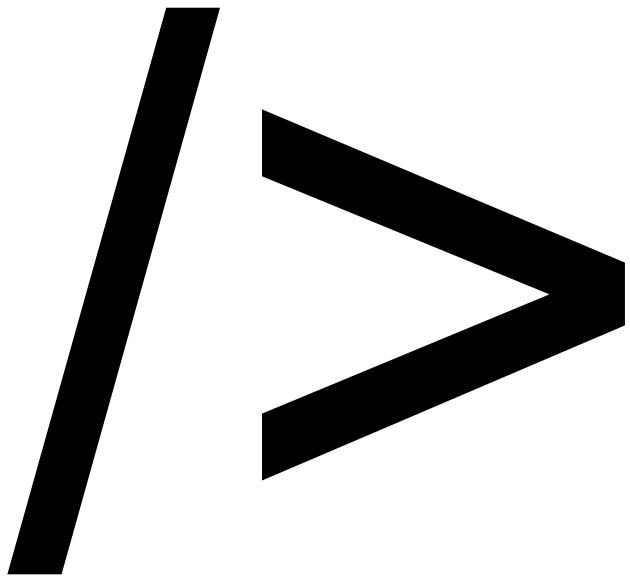
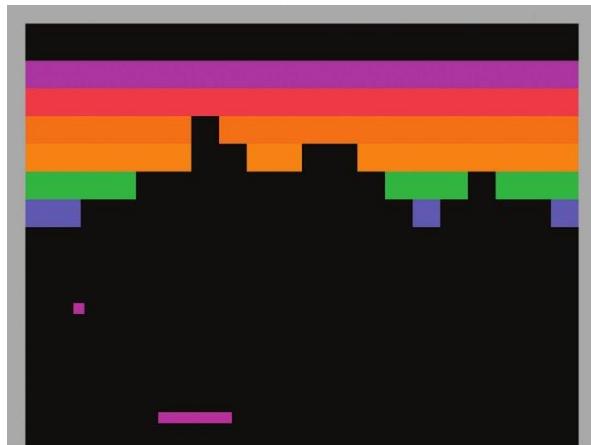
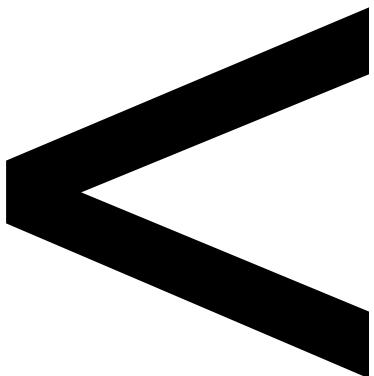
Does not follow InfoVis Mantra
(overview first, details on demand)

Fails Trifecta Checkup
Good data, bad viz, no obvious questions

Emigration index



Breakout Over!



User Studies

Controlled Experiments

Quantitative

Time, errors, etc.



User Studies

Subjective Assessments

Observation

Questionnaire / interview



Evaluate Utility!

Case studies

Don't care about time, errors, etc.

Speak aloud protocol

Take notes, record video

Get user feedback

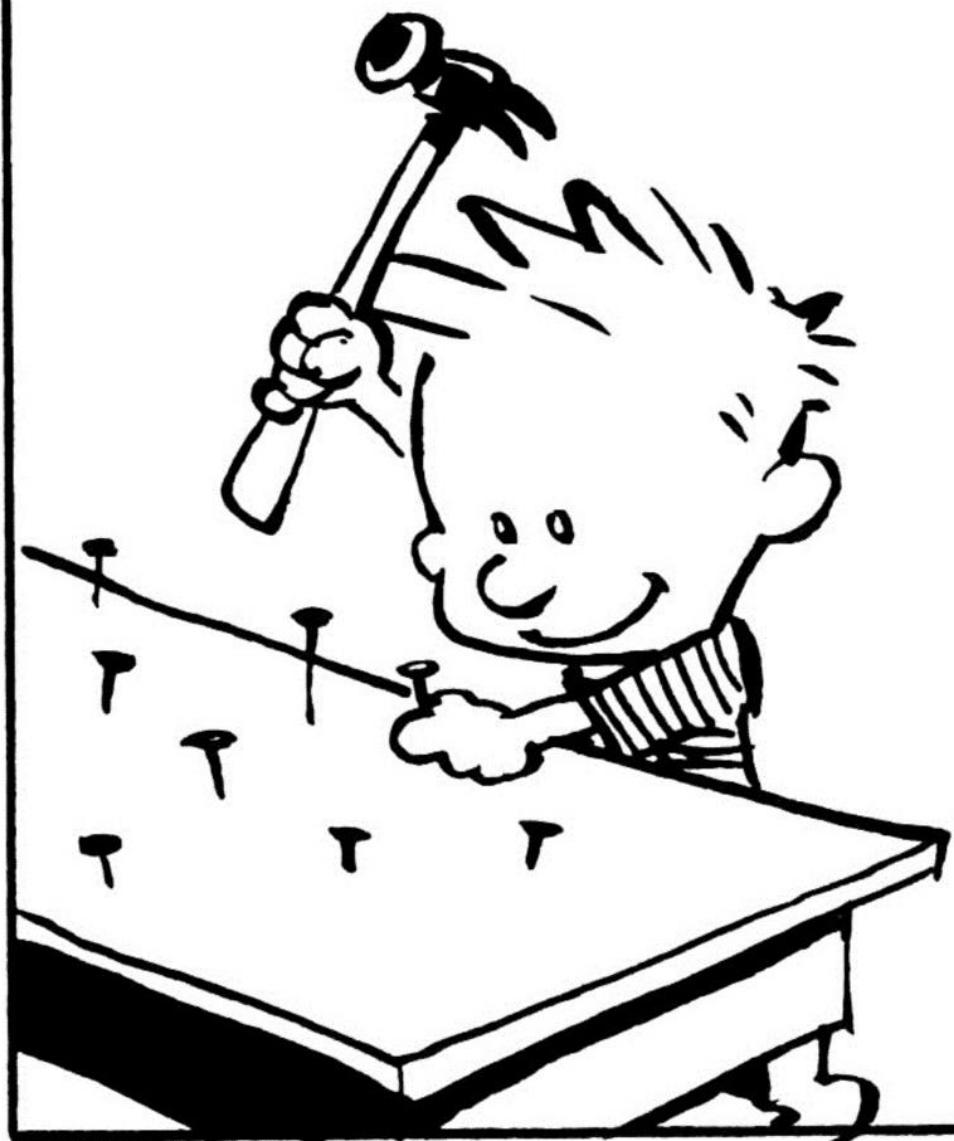
Found relevant things?

Surprising insights?

Got correct answers to questions?

A cartoon illustration of a bald man with a large, bulbous nose. He is wearing a green turban and a purple feather in his hair. He has a mustache and is holding a white rectangular sign with both hands. The sign contains the text "THERE WILL NOW BE A BRIEF INTERMISSION".

**THERE WILL
NOW BE A
BRIEF
INTERMISSION**





**THERE WILL
NOW BE A
BRIEF
INTERMISSION**

02

PERSONAL INFORMATION MANAGEMENT

Not (just) this...

Inbox - Microsoft Outlook

File Edit View Go Tools Actions Help

Type a question for help

New | Reply | Reply to All | Forward | Find | Type a contact to find | ? |

Mail

Favorite Folders

- Inbox
- Sent Items

All Mail Folders

- Personal Folders
 - Deleted Items
 - Drafts
 - Inbox
 - Junk E-mail
 - Outbox
 - Sent Items
 - Search Folders

Mail

Calendar

Contacts

Tasks

Inbox

Arranged By: Date Newest ...

Two Weeks Ago

Outlook 2003 Team 19.0... Welcome to Microsoft Off...

Welcome to Microsoft Office Outlook 2003

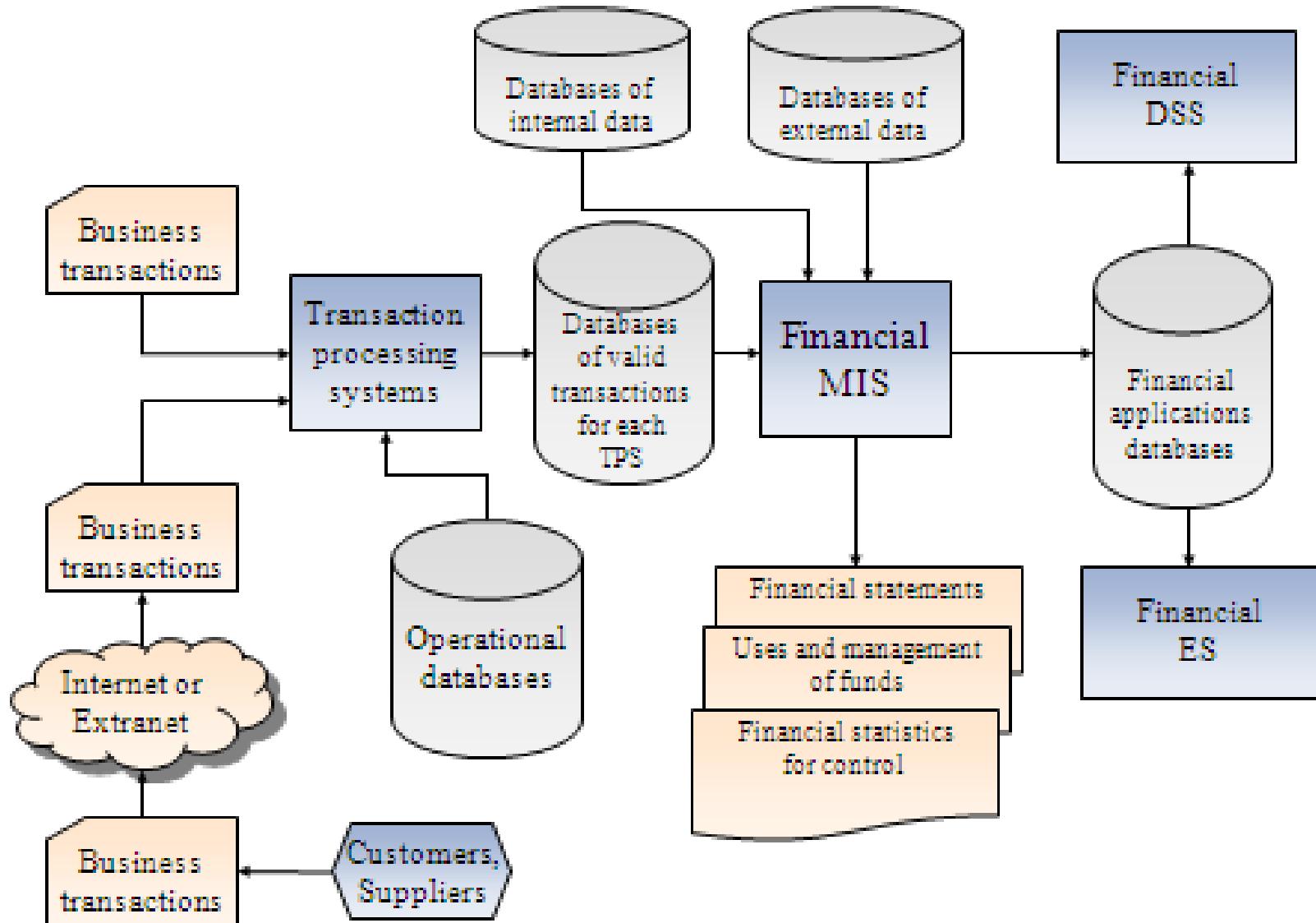
Outlook 2003 Team [olteam@microsoft.com]

To: New Outlook User

Thank you for using Microsoft® Office Outlook® 2003! This version of Outlook includes new capabilities designed to *help you access, prioritize, and act on communications and information* so that you may use your time more efficiently and more easily manage the ever-increasing flow of incoming e-mail.

To give you some idea of what is possible with Outlook 2003, we have put together a list of our favorite new features.

Definitely Not This...



Formally...

“The Practice and the study of the activities a person performs in order to acquire or create, store, *organize, maintain, retrieve*, use, and control the *distribution* of information items such as documents (paper based and digital), Web pages, and email messages for everyday use to complete tasks (work-related and not) and to fulfill a person’s various roles (as parent, employee, friend, member of a community, etc.).”

—William Jones & Jamie Teevan

Better...

Keeping Found
Things Found

Where is *that* document?



Here?

The screenshot shows a Windows file explorer window with the following details:

Path: Users > Daniel > Documents > IST > PhD > Tese

Toolbar buttons: Organize, Views, Open with Adobe Reader 8, Print, E-mail, Share, Burn, Search.

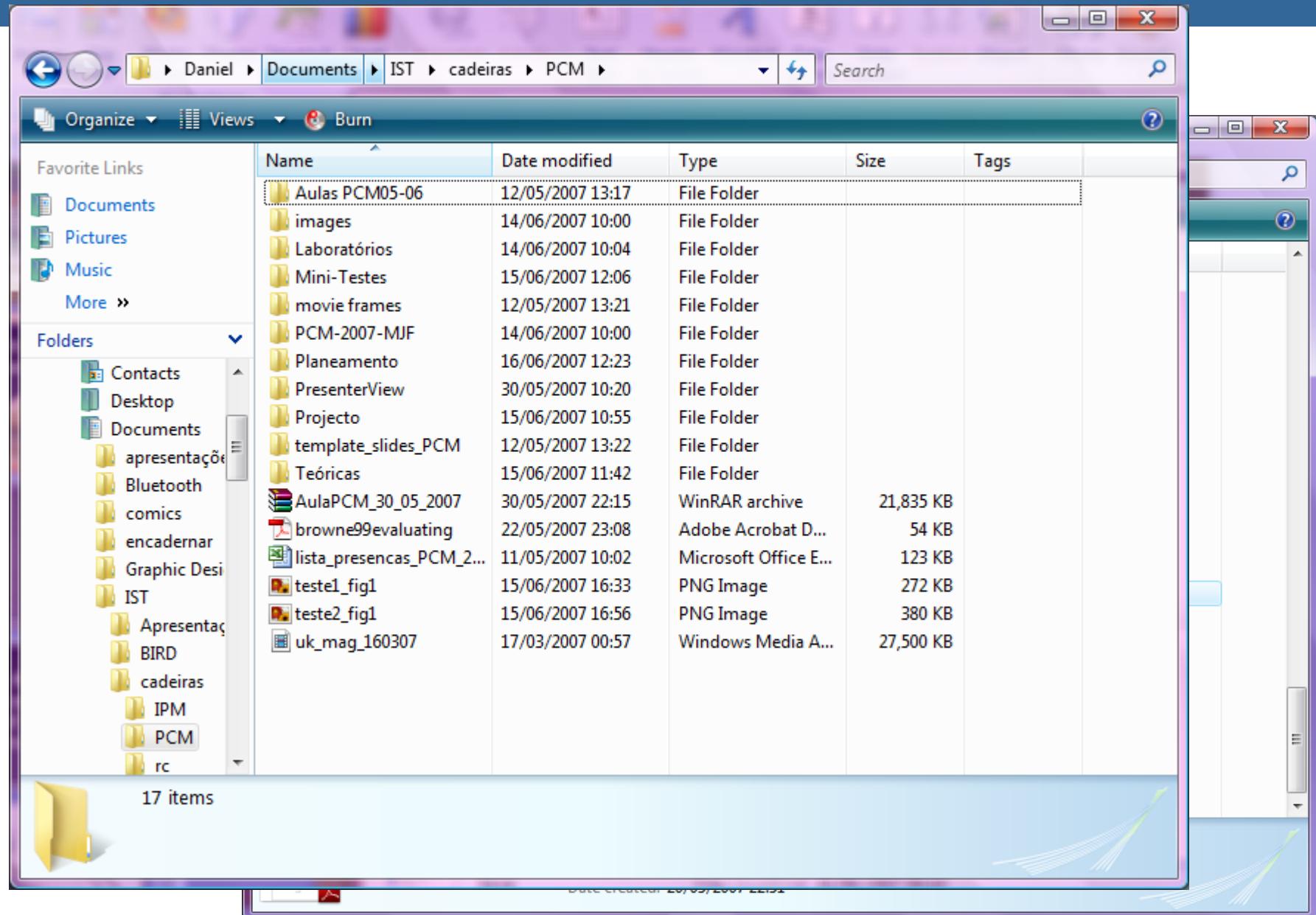
File list table:

Name	Date modified	Type	Size	Tags
stories_to_computers.a...	20/05/2007 23:50	AUX File	10 KB	
stories_to_computers.tex	14/06/2007 18:58	TEX File	110 KB	
stories_to_computers.t...	12/04/2007 11:01	TEX~ File	108 KB	
tese.aux	20/05/2007 23:50	AUX File	6 KB	
tese.bbl	15/04/2007 14:27	BBL File	30 KB	
tese	15/04/2007 14:27	Performance Mon...	2 KB	
tese.bst	27/11/1998 01:01	BST File	26 KB	
tese	20/05/2007 23:48	DVI File	764 KB	
tese.lof	20/05/2007 23:50	LOF File	7 KB	
tese	20/05/2007 23:50	Text Document	71 KB	
tese.lot	20/05/2007 23:50	LOT File	7 KB	
tese.out	02/02/2007 11:43	OUT File	3 KB	
tese	21/06/2007 09:10	Adobe Acrobat D...	10,255 KB	
tese.tex	21/06/2007 08:59	TEX File	4 KB	
tese.tex~	13/04/2007 10:03	TEX~ File	4 KB	
tese.toc	20/05/2007 23:50	TOC File	14 KB	
tese	21/06/2007 09:41	WinRAR ZIP archive	9,955 KB	
tese_completa	12/04/2007 20:01	Adobe Acrobat D...	10,453 KB	
tese_sonia	12/04/2007 20:03	Adobe Acrobat D...	4,701 KB	
utils	03/02/2007 18:16	Text Document	1 KB	
utils.txt~	02/02/2007 16:30	TXT~ File	1 KB	

Details for selected file 'tese':

File name: tese
Type: Adobe Acrobat Document
Date modified: 21/06/2007 09:10
Size: 10.0 MB
Date created: 20/05/2007 22:51

Here?



Here?

The screenshot shows a Windows file explorer window with a purple theme. The address bar at the top displays the path: Users > Daniel > Documents > IST > PhD. A search bar is located to the right of the address bar. Below the address bar is a toolbar with icons for Organize, Views, Explore, E-mail, Share, and Burn.

The left sidebar has sections for Favorite Links (Documents, Pictures, Music, More) and Folders (Folders, PhD). The Folders section shows a tree view of the 'PhD' folder containing subfolders like Actas, Avaliação de PBFs, Candidatura, etc.

The main area is a grid view showing the contents of the 'PhD' folder. The columns are Name, Date modified, Type, Size, and Tags. The 'Name' column is sorted. The grid contains the following data:

Name	Date modified	Type
Avaliação de PBFs	12/05/2007 13:26	File Folder
Candidatura	12/05/2007 13:27	File Folder
Caracterizacao EDPs	12/05/2007 13:27	File Folder
Conferências	12/05/2007 13:28	File Folder
Defesa	24/06/2007 14:56	File Folder
EDPs 2	12/05/2007 13:28	File Folder
Final Survey	12/05/2007 13:28	File Folder
First Prototype	12/05/2007 13:49	File Folder
Logo	12/05/2007 13:49	File Folder
Novos	12/05/2007 13:49	File Folder
Onto	12/05/2007 13:49	File Folder
Papers	12/05/2007 13:50	File Folder
Pedidos 2006	12/05/2007 13:50	File Folder
Planos de Trabalhos	12/05/2007 13:50	File Folder
ppt	12/05/2007 13:50	File Folder
Prototype	12/05/2007 14:45	File Folder
RDF	12/05/2007 14:56	File Folder
Recall	12/05/2007 14:56	File Folder
Reunião	12/05/2007 14:56	File Folder
Sotrytelling Experiment	12/05/2007 15:02	File Folder
Tese	21/06/2007 13:46	File Folder

At the bottom of the grid, there is a tooltip for the 'Tese' folder: 'Tese File Folder Date modified: 21/06/2007 13:46'.

Or Here?

The screenshot shows the Thunderbird email client interface. On the left, there's a sidebar with icons for Favorite Links, Documents, Pictures, Music, and Folders. The Folders section is expanded, showing a tree view of local folders under "Local Folders". The "Inbox" folder is selected, revealing its contents. The main pane displays the inbox with several messages listed. One message is selected, showing its details: Subject: [CdA] Novo curso do Observatório Céu Austral, From: Paulo Gomes Varella <ceaustral@yahoo.com.br>, Sender: ClubedAstronomia@yahooquorpos.com.br, Reply-To: ClubedAstronomia@yahooquorpos.com.br, Date: 21/06/2007 20:21, To: ClubedAstronomia@yahooquorpos.com.br. The message body contains text about a new course at the Observatory Céu Austral.

Inbox - Thunderbird

File Edit View Go Message Tools Help

Get Mail Write Address Book Reply Reply All Forward Tag Delete Junk Print View: All Subject or Sender

All Folders Local Folders

Inbox Associations ACM Eurographics GPCG eScrabble Hobbies BAMagazine CdA Cinema e-nigma Ficção Científica Jokes mailxmail Runagate Rampant Veils&Pikes IST Cadeiras PCM RC CEPEI Conferences DEI GELO IMMI NCG PIM-Disc Projects BIRD EUROHOME IntelMI MM-Fabulous TFCs Misc Client

Subject: Preparação dos mestrados 2007/2008
Reserva de sala
Re: Preparação dos mestrados 2007/2008
[CdA] Novo curso do Observatório Céu Austral
Foto das 38 Semanas
[CdA] Novidades nos classificados de Astronomia do CasB
Re: Novidades?
Amazon.co.uk - Your Cancellation (026-0135563-8649224)

Sender: Daniel Gonçalves
Daniel Gonçalves
Leonel Câmara
Paulo Gomes Varella
Sonia Gonçalves
Ayatola-Gmail
Carlos António
order-update@amazon.co.uk

Date: 21/06/2007 19:15
21/06/2007 19:17
21/06/2007 19:42
21/06/2007 20:21
21/06/2007 20:33
21/06/2007 20:50
21/06/2007 22:00
21/06/2007 23:17

Subject: [CdA] Novo curso do Observatório Céu Austral
From: Paulo Gomes Varella <ceaustral@yahoo.com.br>
Sender: ClubedAstronomia@yahooquorpos.com.br
Reply-To: ClubedAstronomia@yahooquorpos.com.br
Date: 21/06/2007 20:21
To: ClubedAstronomia@yahooquorpos.com.br

NOVO CURSO DO OBSERVATÓRIO CÉU AUSTRAL

Olá, tudo bem? Encontram-se abertas as inscrições para o curso "CIÊNCIAS DO CÉU E DA TERRA: LEITURAS DA NATUREZA" que será ministrado pelo Observatório Céu Austral em parceria com a Associação Palas Athena, ao longo do mês de julho. Para mais informações, acesse nosso site (www.ceaustral.pro.br ou www.ceaustral.astrodatabase.net) e, na página inicial, clique no nome do curso na programação das atividades. Lá você encontrará todas as informações sobre o curso e o processo de inscrição. Qualquer dúvida entre em contato conosco: ceaustral@yahoo.com.br ou ceaustral@ig.com.br

Um abraço. Paulo Varella e Regina Atulim.

+ Comunidade Clube d'Astronomia no orkut
<http://www.orkut.com/Community.aspx?cmm=471782>

+ Site do Clube

Date modified: 21/06/2007 13:46

Unread: 0 Total: 14350

OMG! Kill Me Now!!!



Where is *that* song?



How to organize these?



All the papers about PIM?



Where is that message Mary sent?



How to organize my HD?



On an Ideal World...

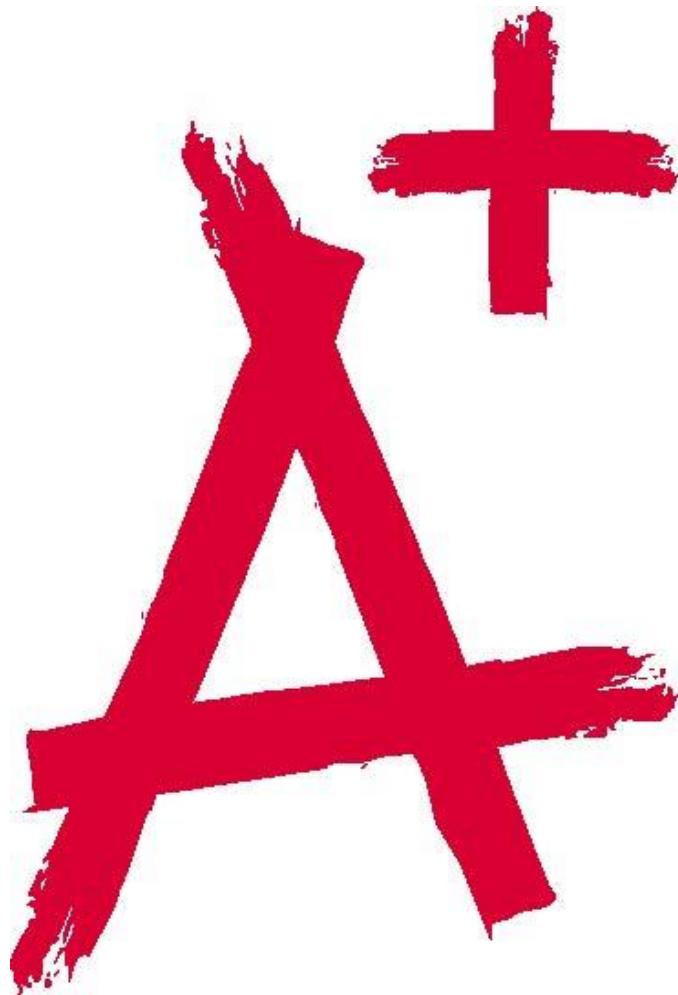
We always have the right information

In the right place

At the right time

In the right form

With sufficient completeness



PERSONAL Information



What is This?



What is This?

Buildings

Skyscrapers

Shoreline

Lights

Hong-Kong

I.M. Pei Bank of China

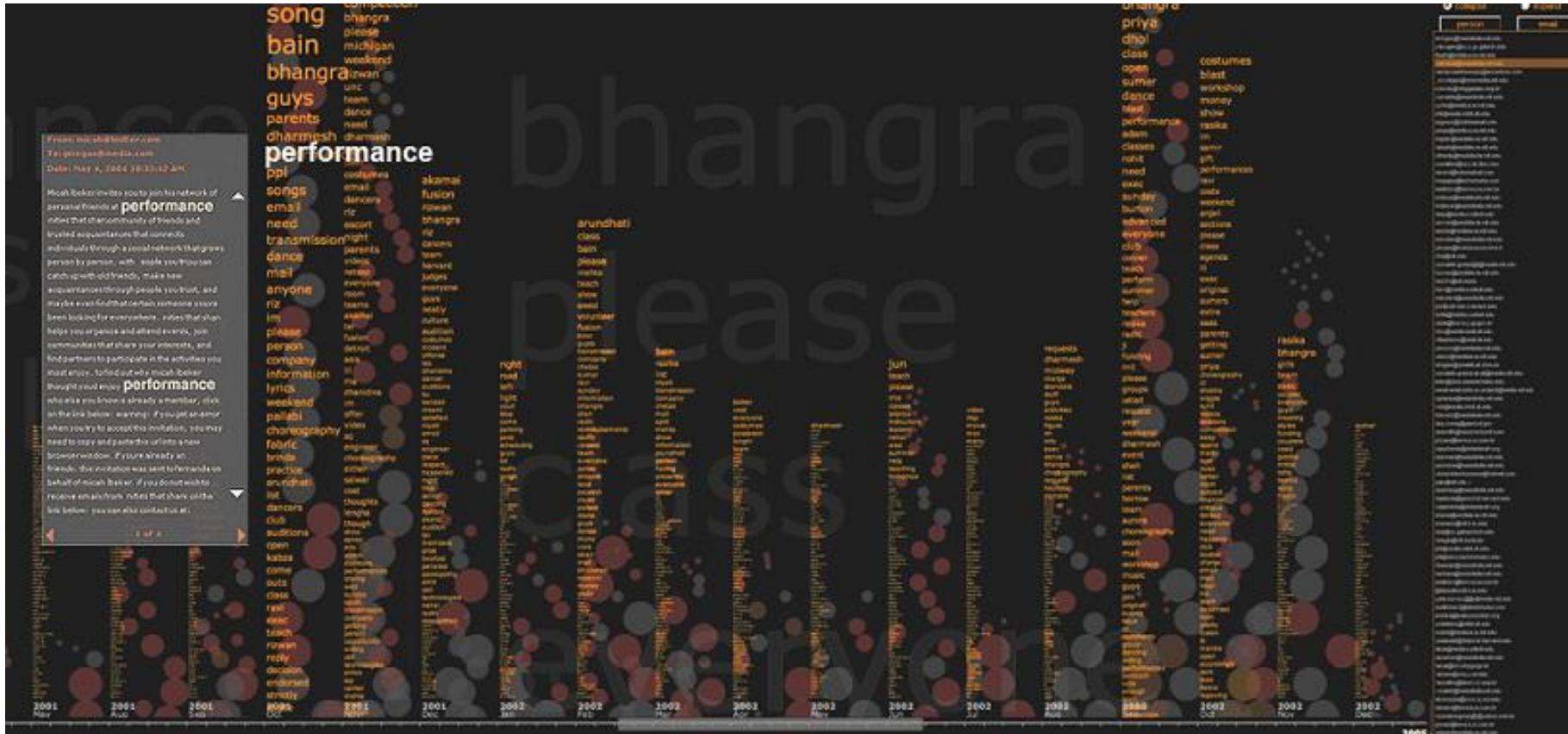


What is This?

A view of HK island from Kowloon during the IUI2010 conference in Feb 2010 that I attended with my wife and son, coming back from a tour of Macau, taken using my Canon camera, from the Avenue of Stars, where *that* music was playing, after looking at Jackie Chan's palm prints on the ground, (...)



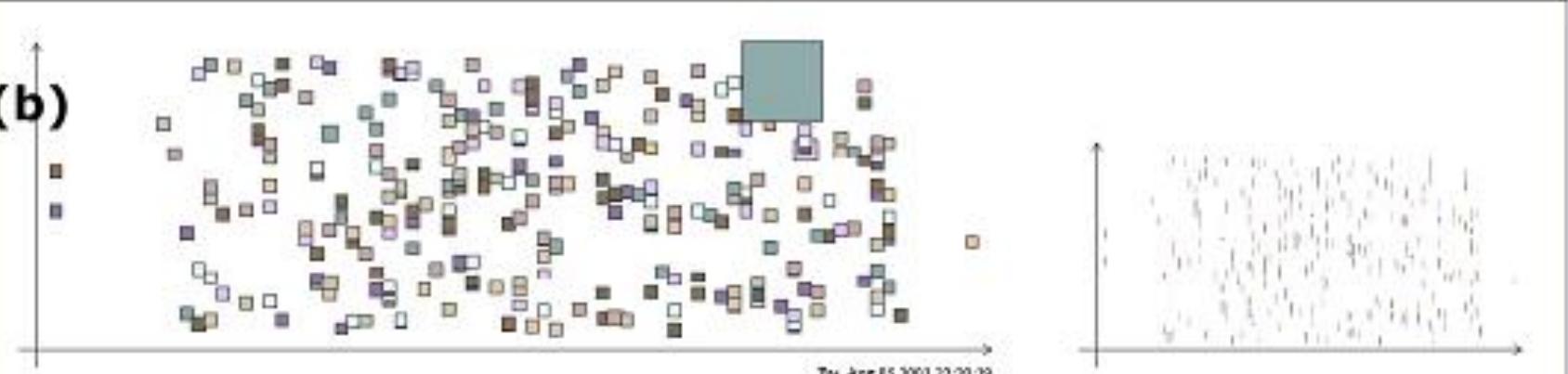
The mail

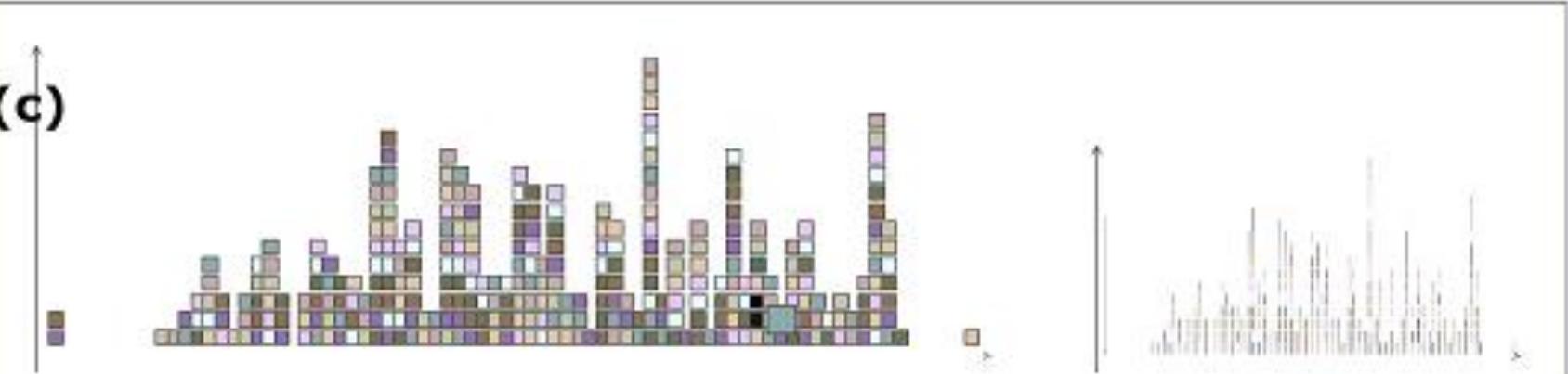


MailView

(a) Date : Tue Aug 05 22:20:45 BST 2003
From : <www@twinkl.com>
To : "j"
Subject : ICC USA MOBILE TECHNOLOGY !!!

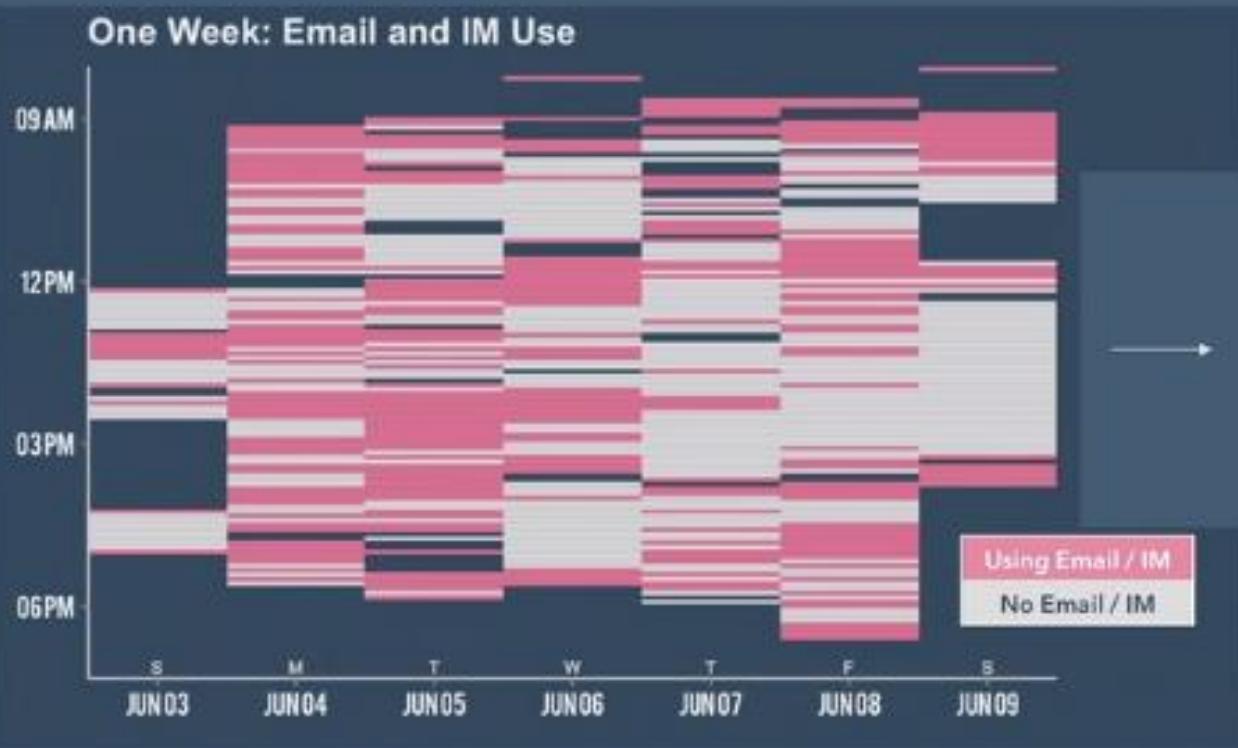
1 (4.0%) : =09<TD>
2 (4.0%) : ROWSPAN=5D1
3 (5.0%) : =09
4 (2.0%) : Content-Type:
5 (2.0%) : Content-Transfer-Encoding:
6 (2.0%) : =_NextPart_94915C5ABAP209
7 (2.0%) : Content-ID:
8 (2.0%) : Content-Description:
9 (2.0%) : base64
10 (2.0%) : image/jpg
11 (2.0%) : @SEED2F
12 (2.0%) : COLSPAN=5D1
13 (1.0%) : =AAAAA.....AAAAA
14 (1.0%) : HEIGHT=5D1></TD>

(b) 
Tue Aug 05 2003 22:20:39

(c) 

Focus!

<https://quantifiedself.com/show-and-tell/?project=1120>



Whoa that's 40 - 60% of my day
using Email / IM...

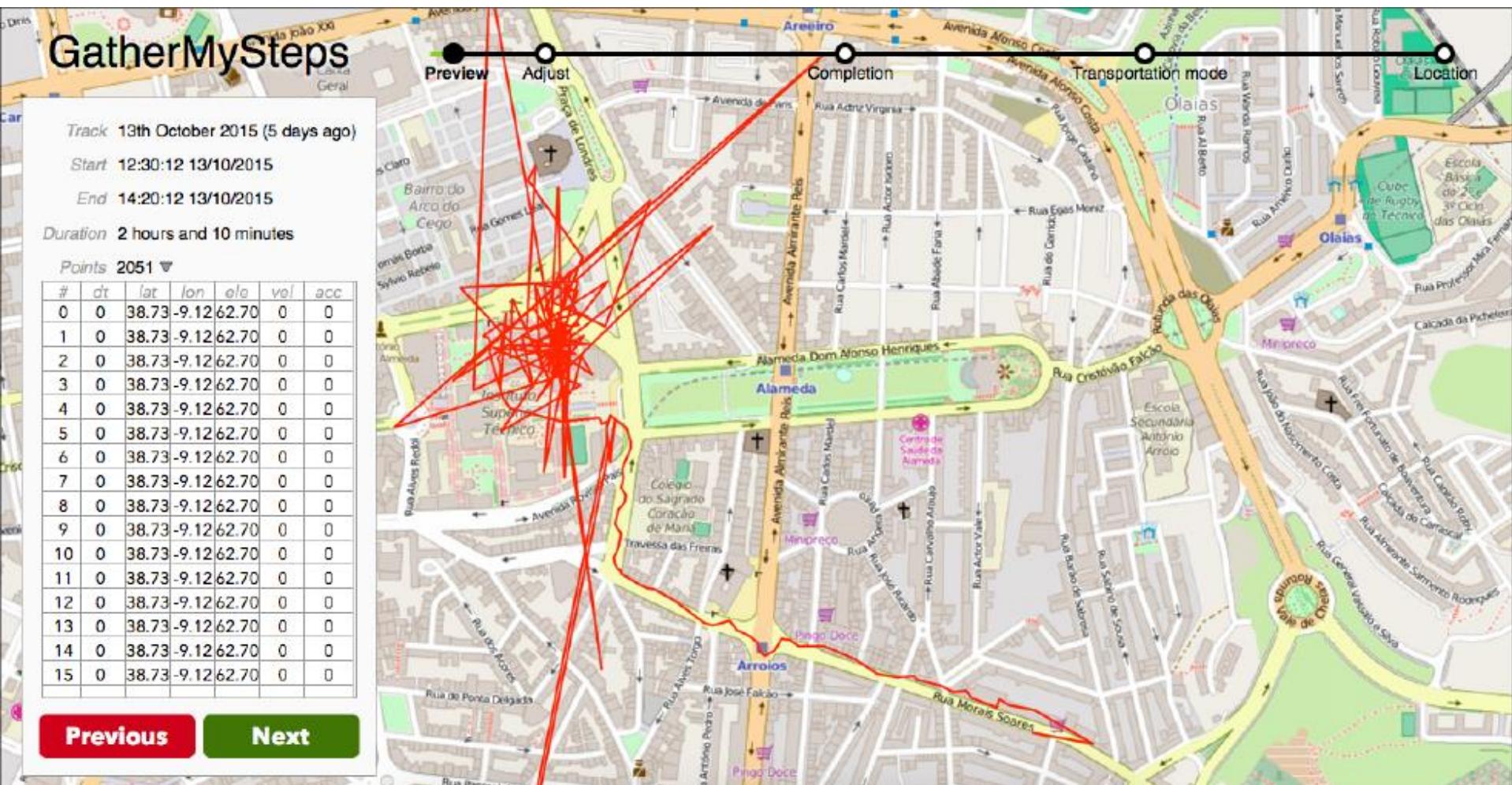
and not much time left
for focusing.

TreVi (Sandra Gama)

Lifelogging

“The process of tracking personal data generated by our own behavioral activities.”

GatherMySteps



GatherMySteps

GatherMySteps

Preview Adjust Completion Transportation mode Location

Track 13th October 2015 (5 days ago)

Start 12:30:12 13/10/2015

End 14:20:12 13/10/2015

Duration 1 hour and 50 minutes

Points 2051 ►

Sub-tracks

Start 12:30:12 13/10/2015
End 13:30:12 13/10/2015
Duration 1 hour
Points 1200
[Join](#) [Split](#) [Edit](#)

Start 13:30:12 13/10/2015
End 14:20:12 13/10/2015
Duration 50 minutes
Points 851
[Join](#) [Split](#) [Edit](#)

Previous [Next](#)

The map displays a walking route starting at the University of Lisbon (Universidade de Lisboa) and ending at the Arco da Ribeira in Oeiras. The route is color-coded: yellow for the primary walk segments and orange for a segment near the end. A blue line indicates a transportation mode segment. The map is overlaid with a navigation interface: 'Preview' (green dot), 'Adjust' (black dot), 'Completion' (white dot), 'Transportation mode' (grey dot), and 'Location' (grey dot). On the left, a summary table provides details for the track and its sub-tracks. At the bottom, 'Previous' and 'Next' buttons are visible.

GatherMySteps

GatherMySteps

Preview Adjust Completion Transportation mode Location

Track 13th October 2015 (5 days ago)

Start 12:30:12 13/10/2015

End 14:20:12 13/10/2015

Duration 1 hour and 50 minutes

Points 2051 ►

Sub-tracks

█ Start 12:30:12 13/10/2015
End 13:30:12 13/10/2015
Duration 1 hour
Points 1200

█ Start 13:30:12 13/10/2015
End 14:20:12 13/10/2015
Duration 50 minutes
Points 851

Previous Next

The map displays a walking route in Lisbon. The main route is a solid black line starting at 'Areeiro' and ending at 'Oeiras'. There are two sub-tracks: one in orange and one in blue. The orange sub-track starts at 'Areeiro', goes through 'Alameda Dom Afonso Henriques', 'Instituto Superior Técnico', 'Colégio do Sagrado Coração de Maria', 'Travessa das Freiras', and 'Pingo Doce' before returning to the main route. The blue sub-track starts at 'Areeiro', goes through 'Alameda Dom Afonso Henriques', 'Instituto Superior Técnico', 'Colégio do Sagrado Coração de Maria', 'Travessa das Freiras', and 'Pingo Doce' before continuing along the main route. The map also shows several other streets and landmarks in Lisbon.

GatherMySteps

GatherMySteps

Track 13th October 2015 (5 days ago)

Start 12:30:12 13/10/2015

End 14:20:12 13/10/2015

Duration 1 hour and 50 minutes

Points 2051 ►

Sub-tracks

Start	12:30:12 13/10/2015
End	13:30:12 13/10/2015
Duration	1 hour
Points	1200

Transportation modes

- #1 50m Bike
- #2 10m Foot

[Join](#) [Split](#) [Edit](#)

Start	13:30:12 13/10/2015
End	14:20:12 13/10/2015
Duration	50 minutes
Points	851

Transportation modes

- #1 50m Foot

[Join](#) [Split](#) [Edit](#)

[Previous](#) [Next](#)

The map displays a walking route from Areeiro to Olaias, Portugal. The route starts at Areeiro, passes through Alameda Dom Afonso Henriques, and ends at Olaias. The route is color-coded in green, yellow, and blue, indicating different transportation modes. A legend on the right side of the map shows symbols for Preview, Adjust, Completion, Transportation mode, Location, and a black dot.

GatherMySteps

GatherMySteps

Track 13th October 2015 (5 days ago)

Start 12:30:12 13/10/2015

End 14:20:12 13/10/2015

Duration 1 hour and 50 minutes

Points 2051 ►

Sub-tracks

Start 12:30:12 13/10/2015
End 13:30:12 13/10/2015
Duration 1 hour
Points 1200
Start location Home
End location Instituto Superior Técnico canteen

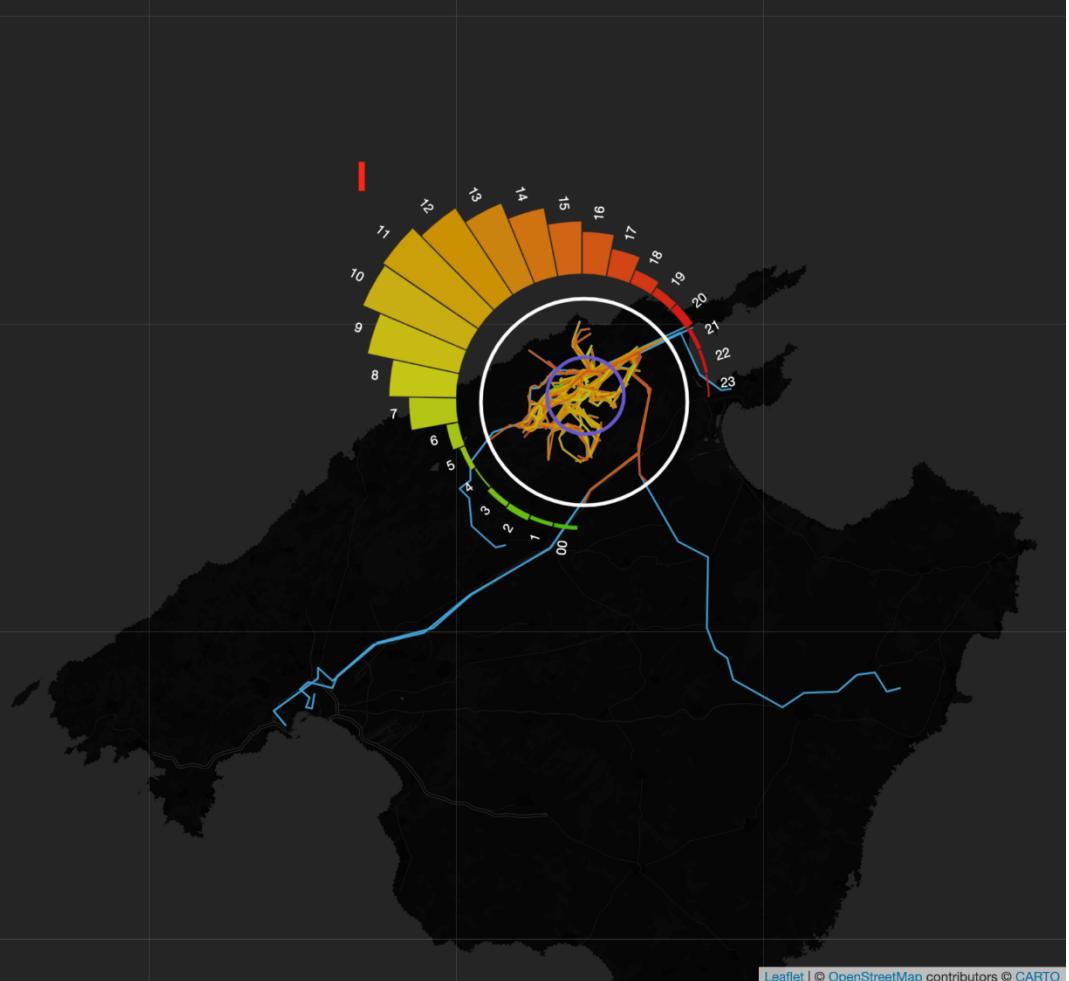
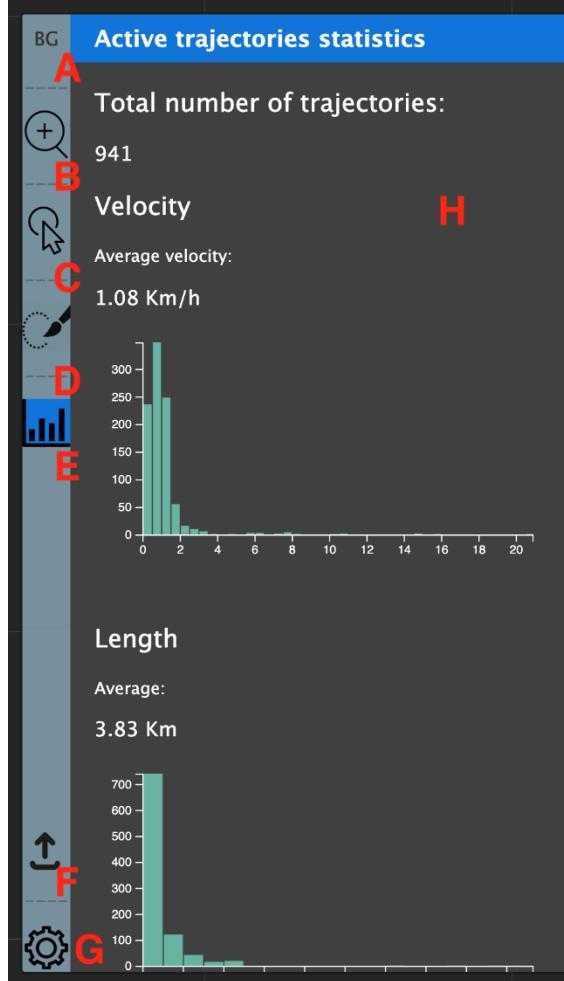
Start 13:30:12 13/10/2015
End 14:20:12 13/10/2015
Duration 50 minutes
Points 851
Start location Instituto Superior Técnico canteen
End location Instituto superior Técnico classroom (FA1)

Preview **Adjust** **Completion** **Transportation mode** **Location**

The map displays a walking route starting from the Instituto Superior Técnico canteen, walking through the Alameda area, crossing the Avenida Almirante Reis, and continuing through the Olaias neighborhood. The route is color-coded in green and blue, with green segments representing the main track and blue segments representing sub-tracks. The map also shows various landmarks such as the Clube de Rugby do Técnico, Escola Secundária António Arroio, and the Vale de Oelas roundabout.

FastGeo

Tiago Pereira



FastGeo



Where Have I Been?

WHERE HAVE I BEEN Visualizing Personal Geolocation Data

4

1

2

3

09:18 13:23 13:46

09:54 13:14 13:27

09:16 12:52 13:09

10:46 12:14 12:57

12:13 12:24

07:42 08:17 09:19 09:57 13:31

19:32 19:47

local 0m route duration local 0m duration

Search Clear

Mapa Satélite

Montelavar

Pêro Pinheiro

Lousa

Fanhais

Loures

Sant de A

Terrugem

N250-1

A16

N542

N539-3

NB

N543

N117

Belas

E16

Odivelas

IC17

Porteli

Amadora

Pontinha

Porto Se

Oeiras

N6

Alges

Almada

Costa da Caparica

Caparica

Rio Tejo

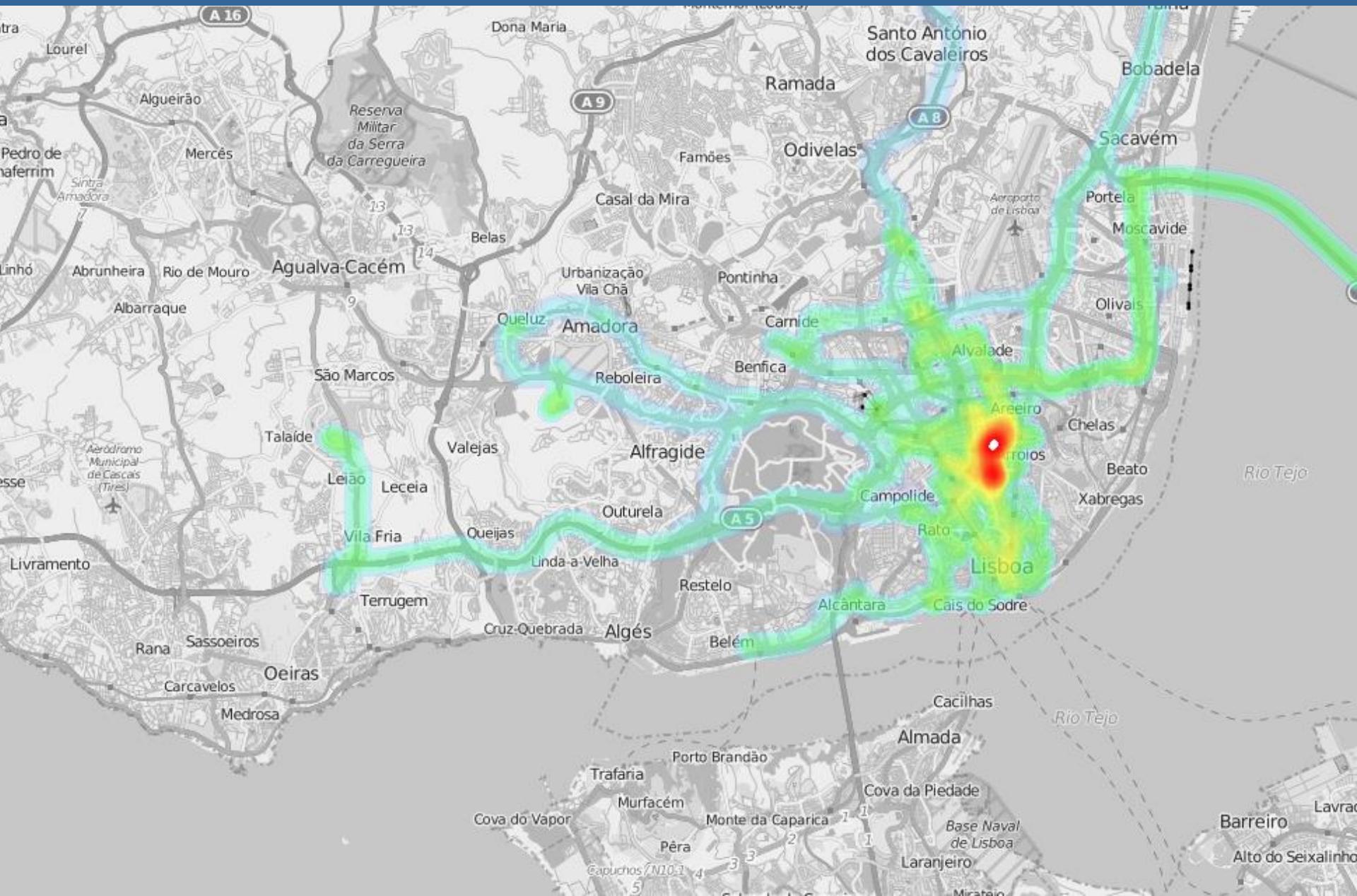
Google Dados do mapa Termos de Utilização Comunicar um erro no mapa

Leaflet © OpenStreetMap contributors © CARTO

Heatmap of Paths



Heatmap of Paths



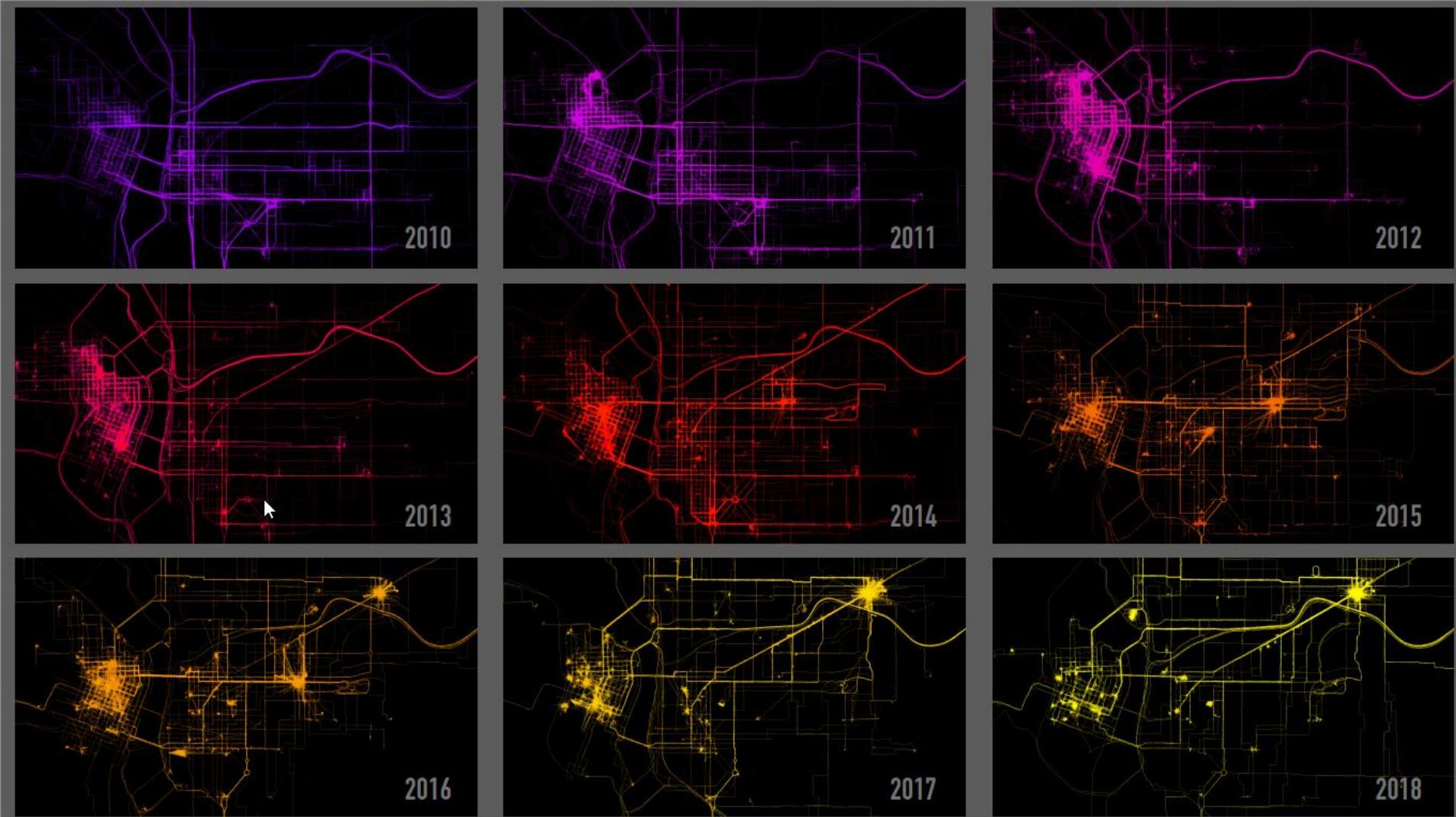
Ten Years of location tracking

http://media.quantifiedself.com/slides/1106_AParecki_TenYearsTrackingLocation.pdf



Ten Years of location tracking

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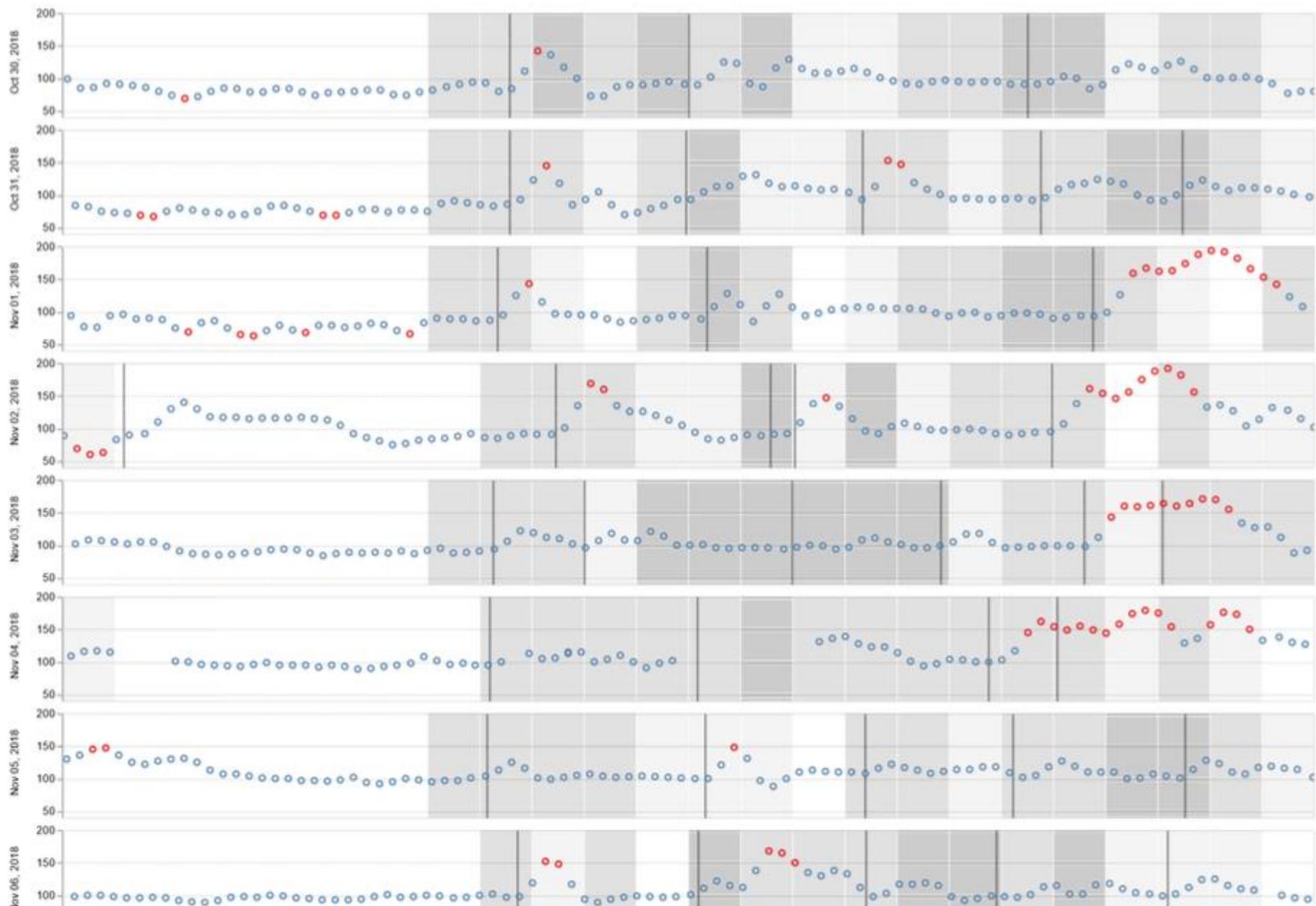
LifeTraces

Spatial Visualization of Activities,
Communications and Interactions

David Ledo, University of Calgary (2011).

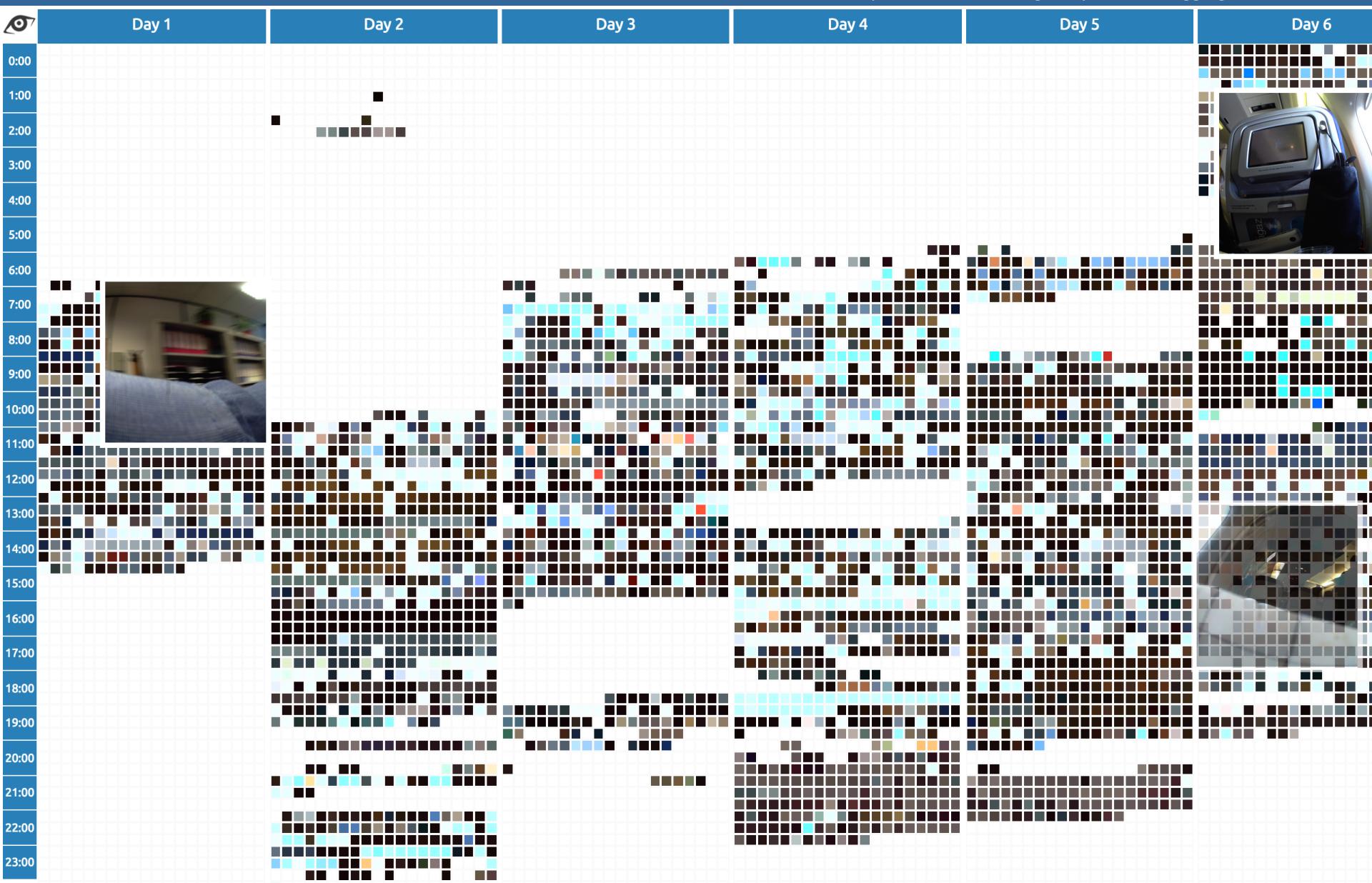
Glucose

<https://quantifiedself.com/blog/qs-guide-testing-food-with-blood-glucose/>



EyeAware

<https://dublin.sciencegallery.com/lifelogging/colourlifewall/>



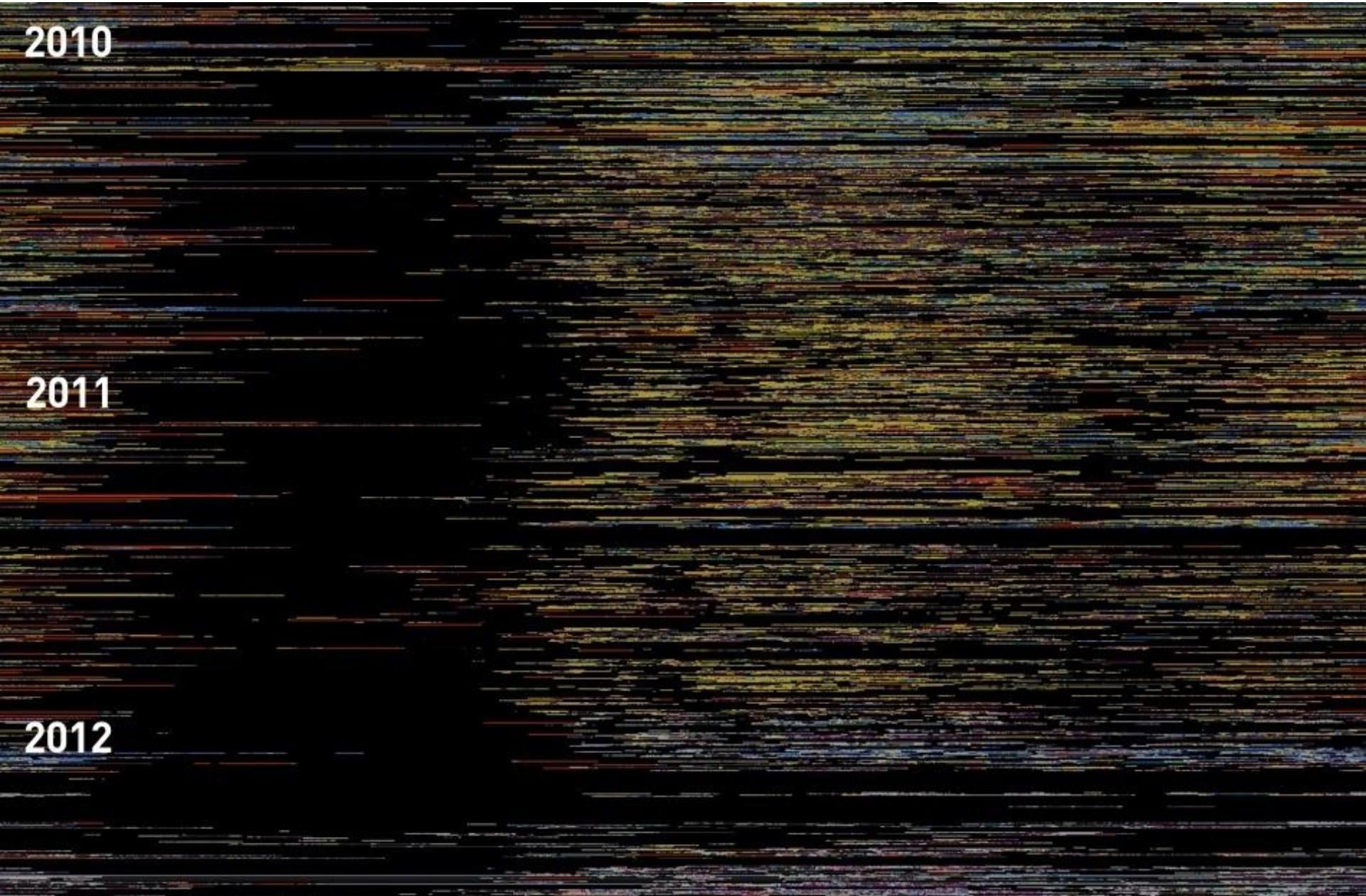
Every Day of My Life

<http://marcinignac.com/projects/everyday-of-my-life/>

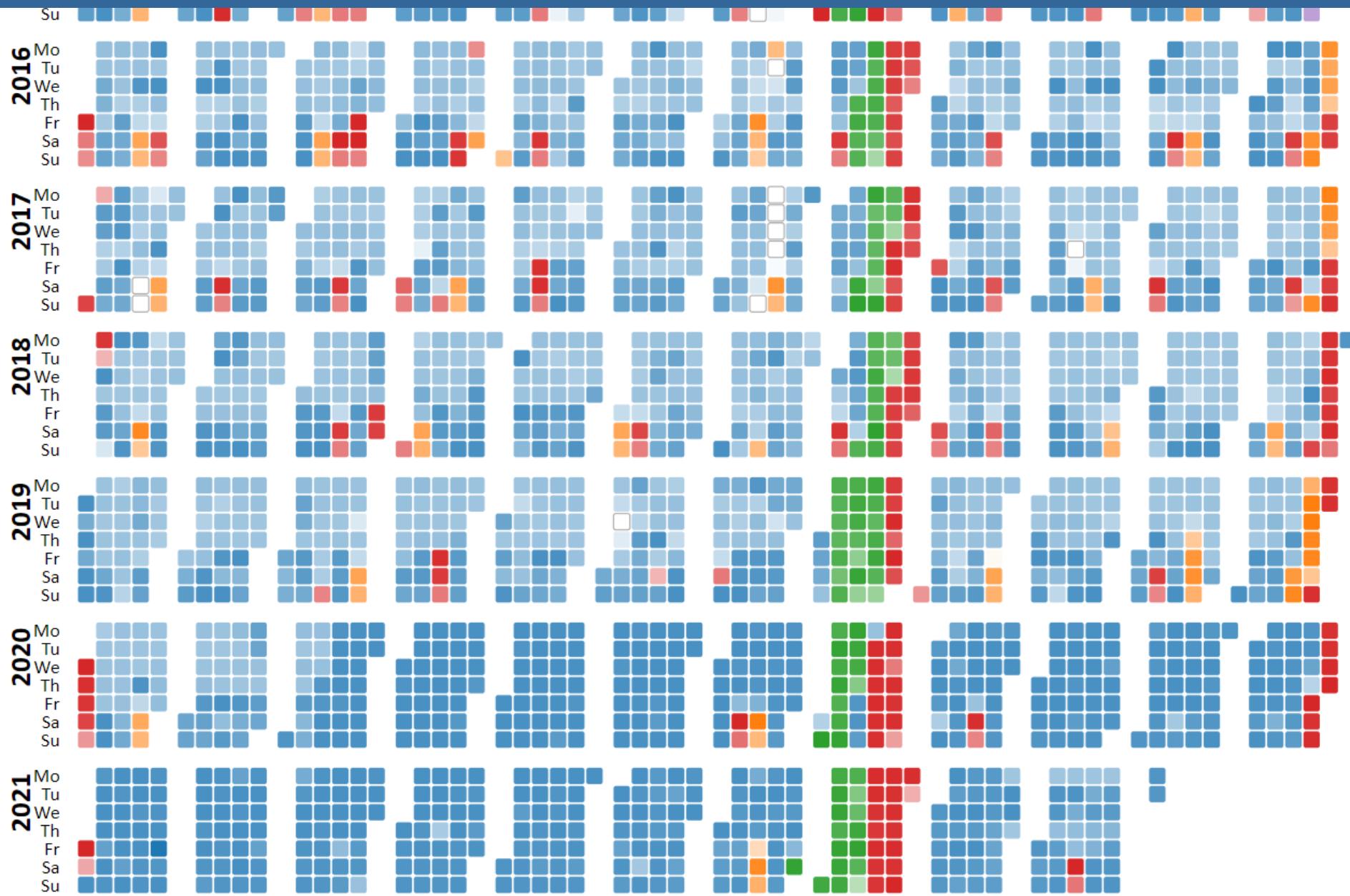
2010

2011

2012

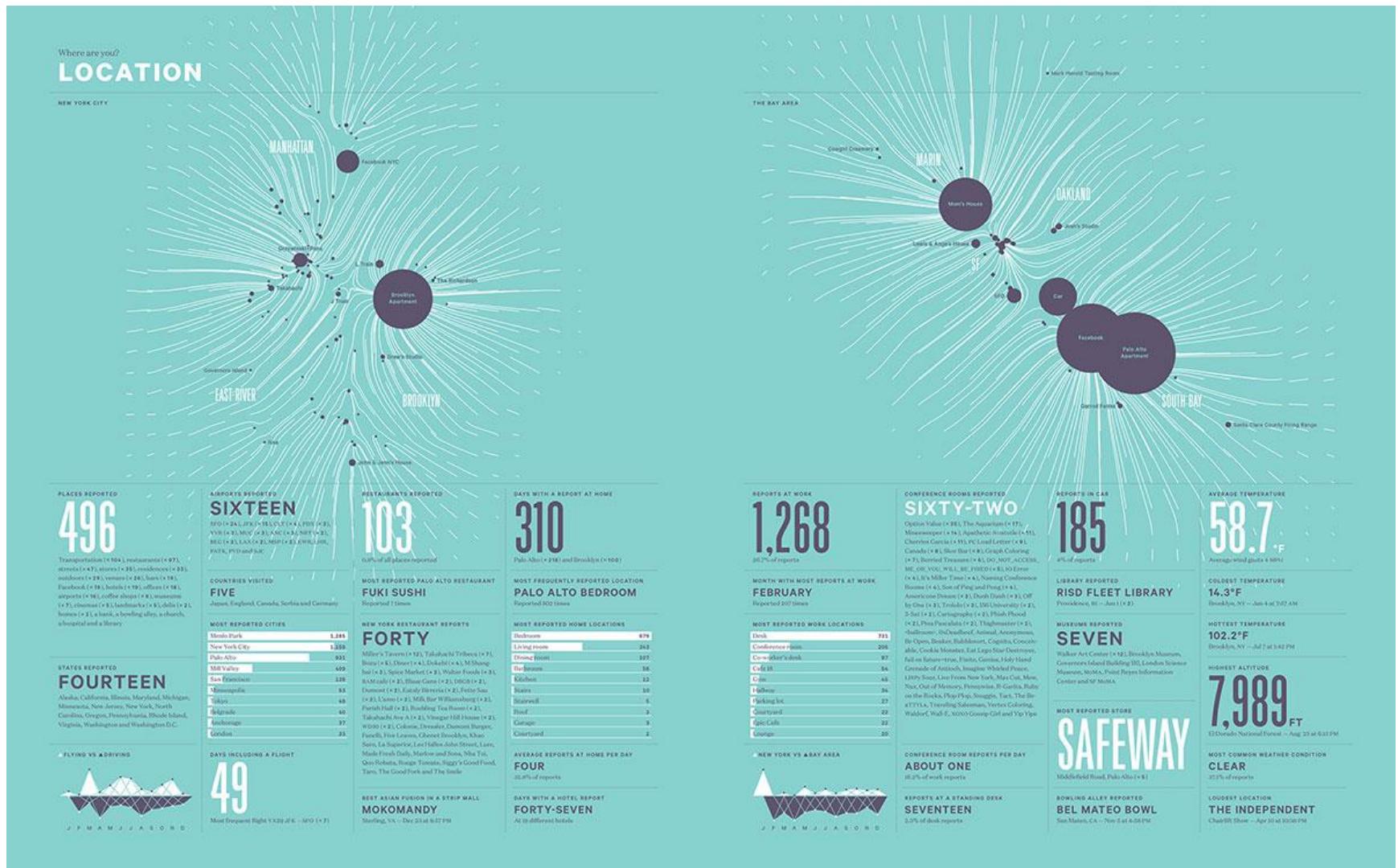


Every Day of My Life



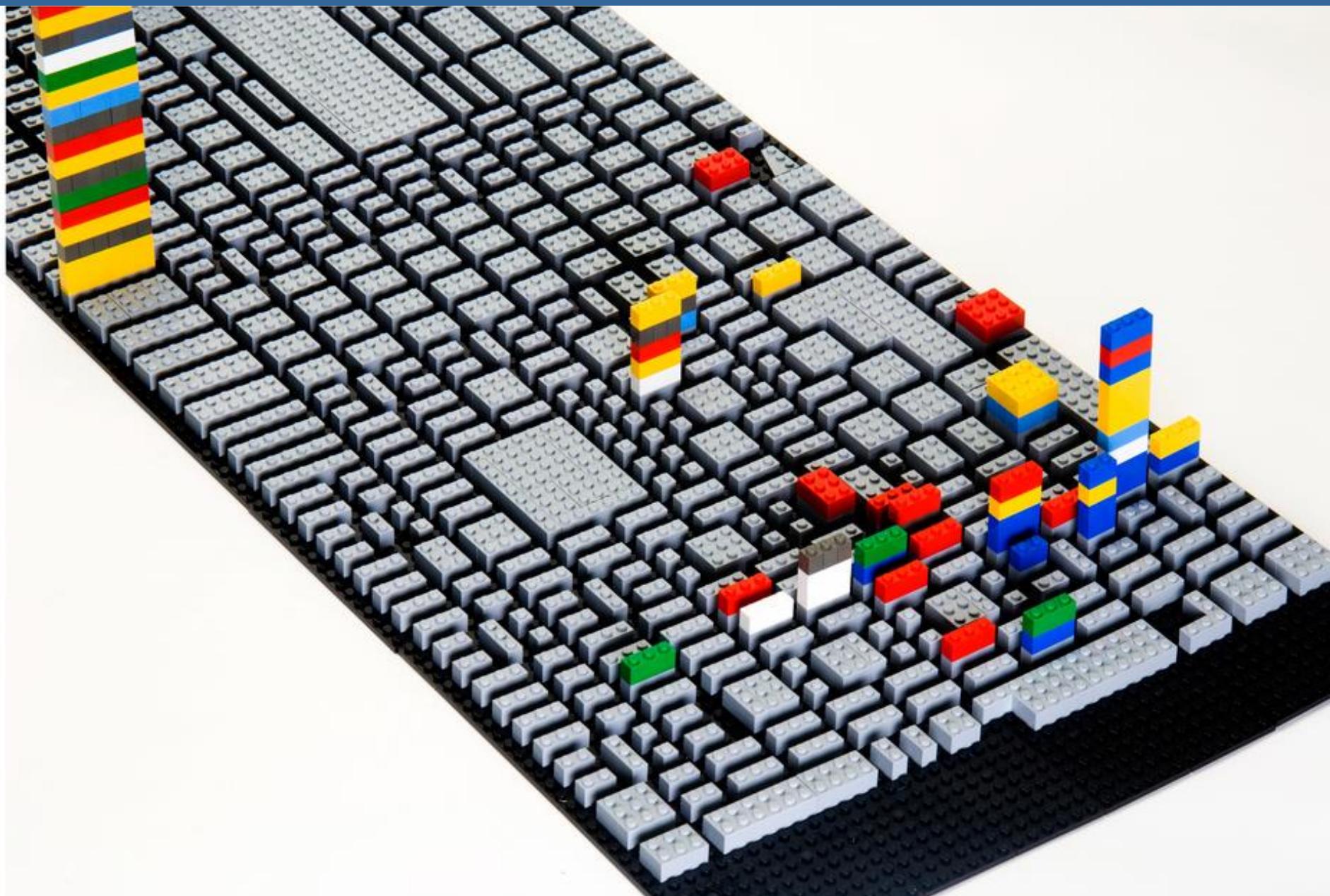
Feltron Annual Report

<http://feltron.com/>



Psychogeographical Mapping

<http://www.corynig.com/projects/u9jvw8esr3u8t29j1mzfmayj1325qj>



Knitting Personal Data

<http://www.leafcutterdesigns.com/projects/creative-knitting-projects.html>



QUESTIONS?