

Image based algorithm to support interactive data exploration

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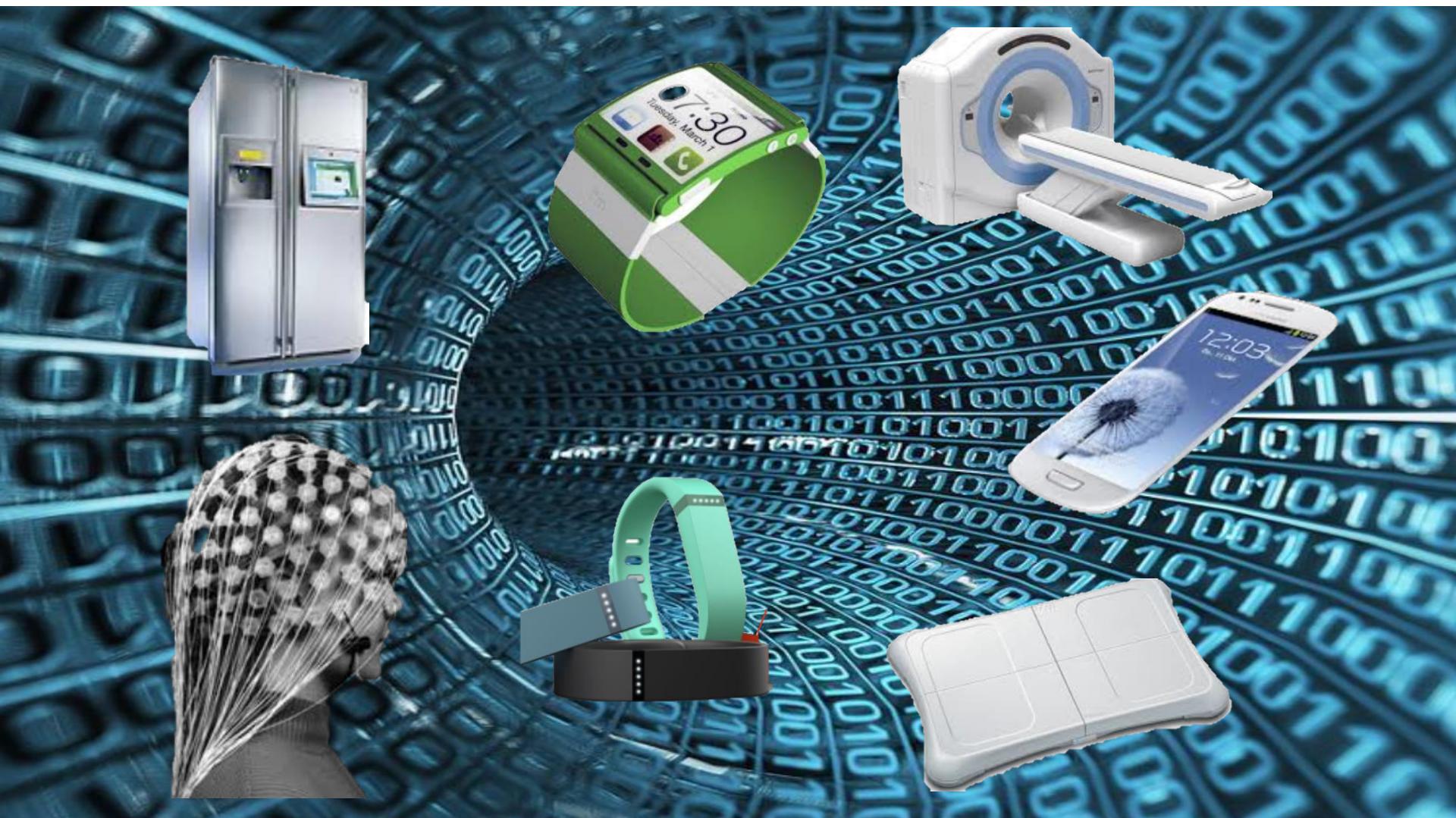
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Laboratoire
d'Informatique
Interactive

K H R O N O S
GROUP



How to support data exploration?

The key to supporting this task is not only to **visualize data**, but also to allow users to **interact with them**.

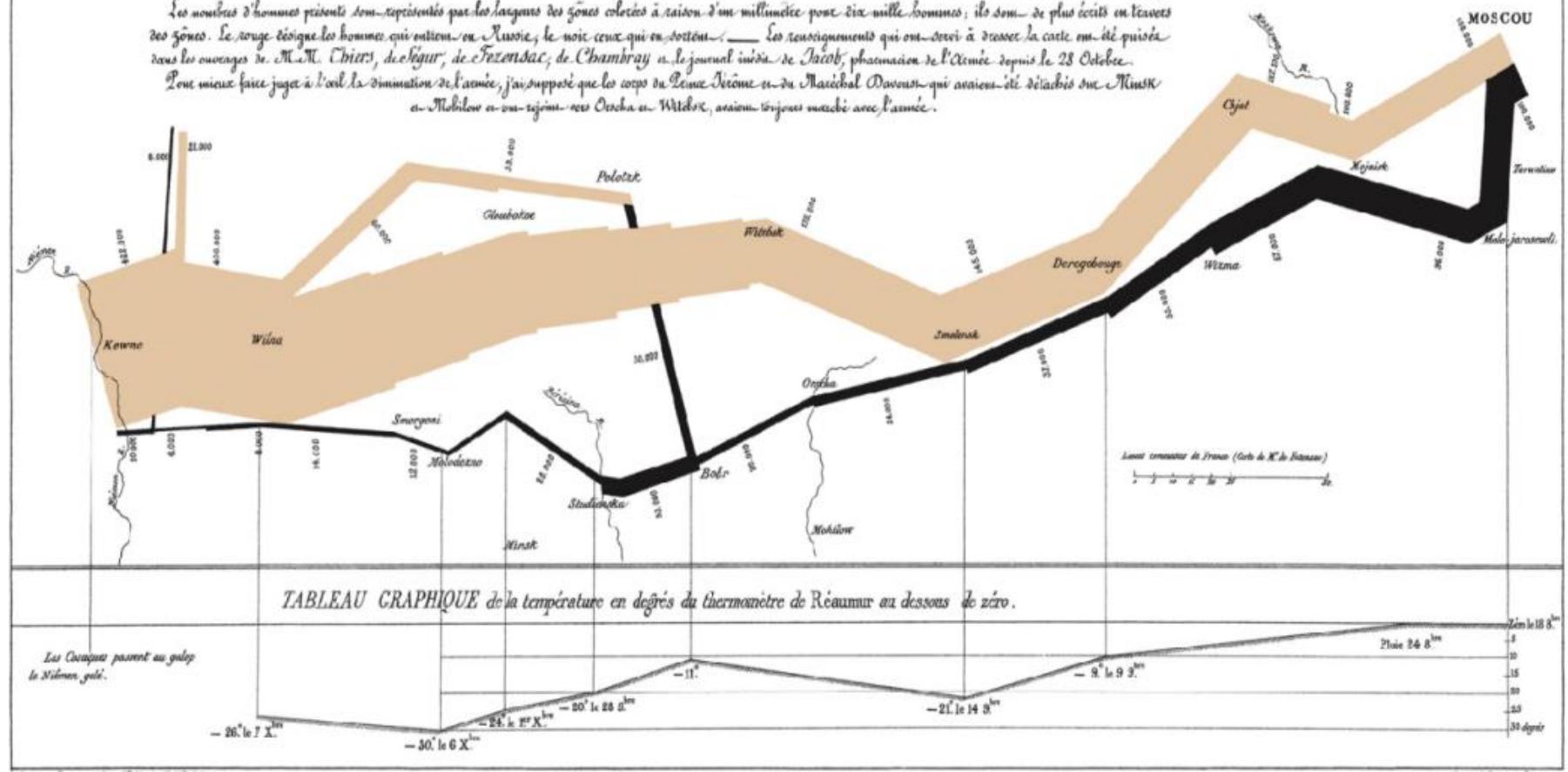
I explored new computing techniques called **pixel-based algorithms** so as to support efficient interactive visualizations for the exploration of **large datasets**.

Carte Figurative des pertes successives en hommes de l'Armée Française dans la Campagne de Russie 1812-1813.

Destinée par M. Minard, Inspecteur Général des Ponts et Chaussées au trésoré de Paris, le 20 Novembre 1869.

Les nombres d'hommes perdus sont représentés par les largesses des zones colorées à raison d'un millimètre pour deux-mille hommes; ils sont de plus écrits en lettres des zones. Le rouge désigne les hommes qui entrent en Russie; le noir ceux qui en sortent. — Les renseignements qui ont servi à dresser la carte ont été pris à tous les ouvrages de M. Chiers, de Segur, de Fozendac, de Chambray et le journal intime de Jacob, pharmacien de l'Armée depuis le 28 Octobre.

Pour mieux faire juger à l'œil la diminution de l'armée, j'ai supposé que les corps du Prince Napoléon et du Maréchal Davout, qui avaient été détachés sur Minsk et Maliblou en un régime vers Orléans et Wladikovitch, avaient marché avec l'armée.



Napoleon's march 1869

Joseph Minard 1896. Tufte, E.R., **The Visual Display of Quantitative Information**, Graphics Press, Cheshire, Connecticut, 1983.

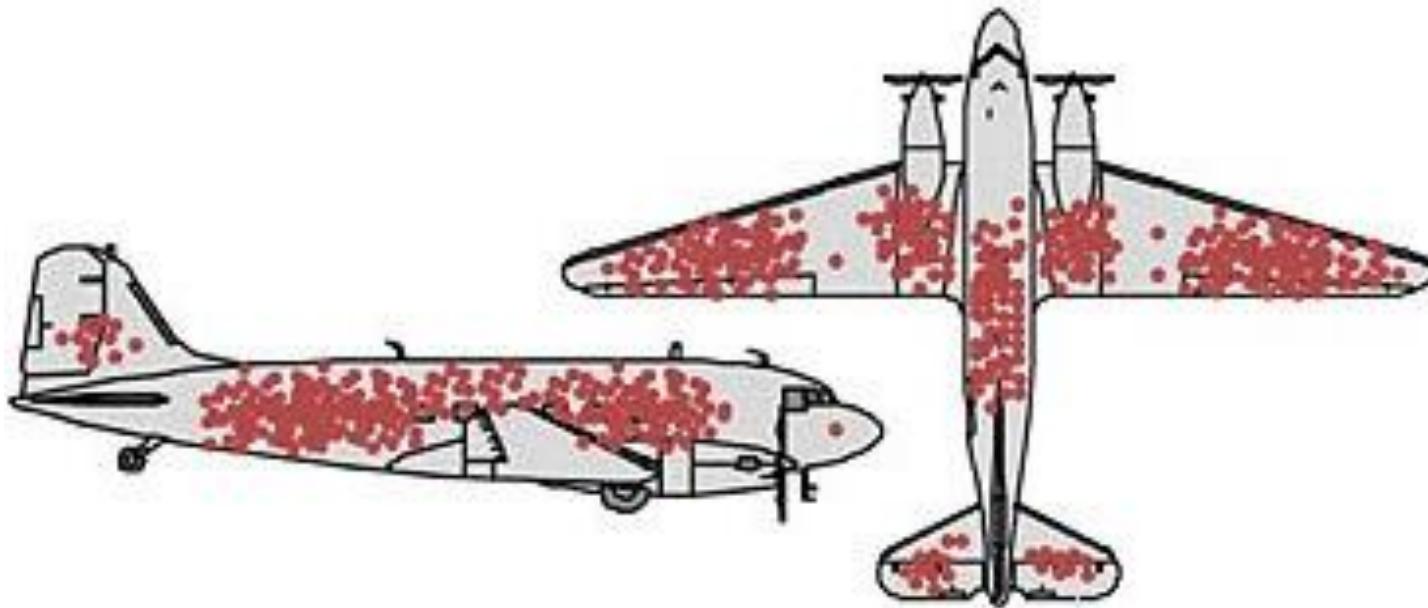
Henry Drury Harness 1837

[The 1837 Maps of Henry Drury Harness](#)

Passagen conveyance Dublin



“maps “ of bullets holes in returning aircrafts



conclusion about armoring airplanes?

Video

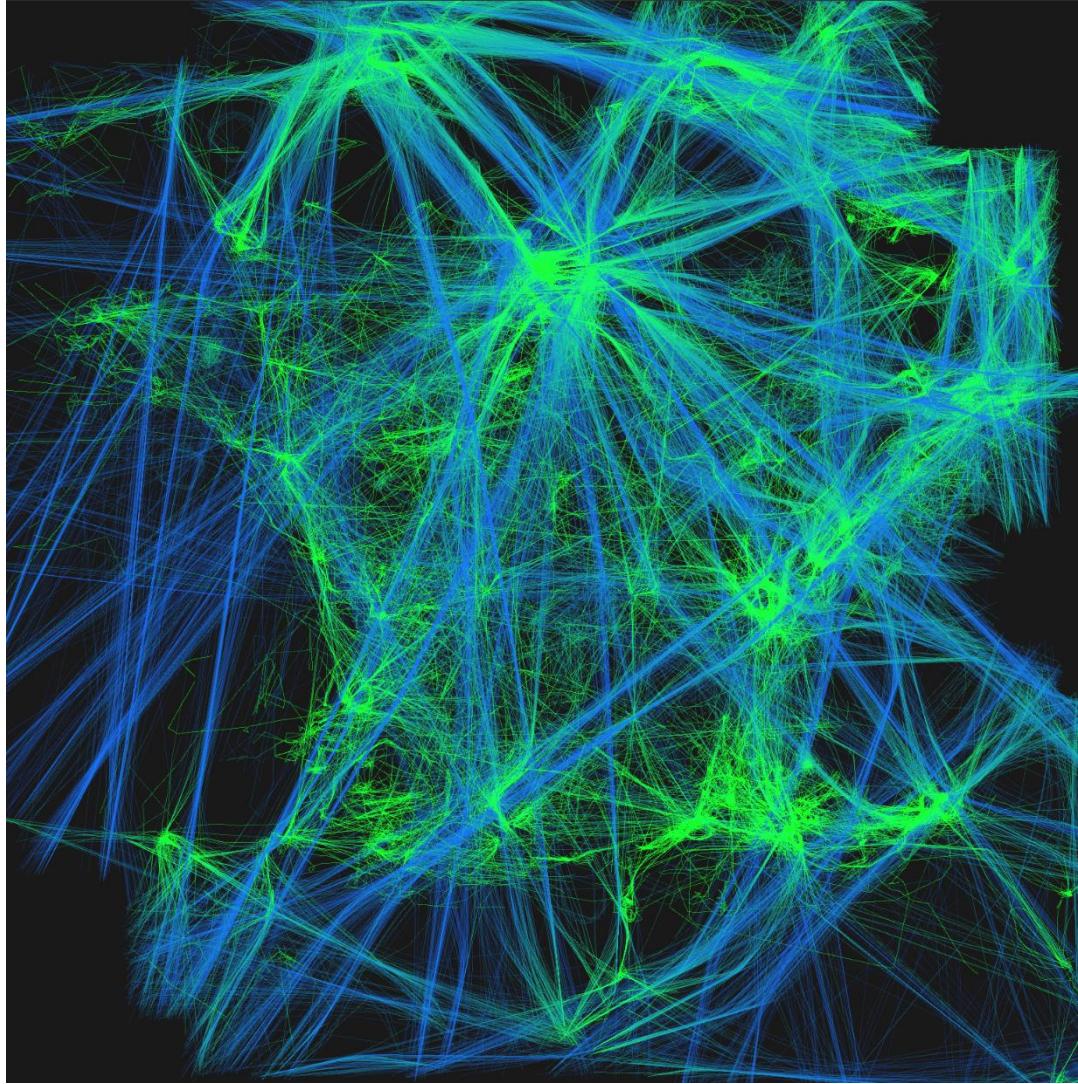
Abraham Wald (World War II)
3

Brushing and linking

FromDady



from Data to Display



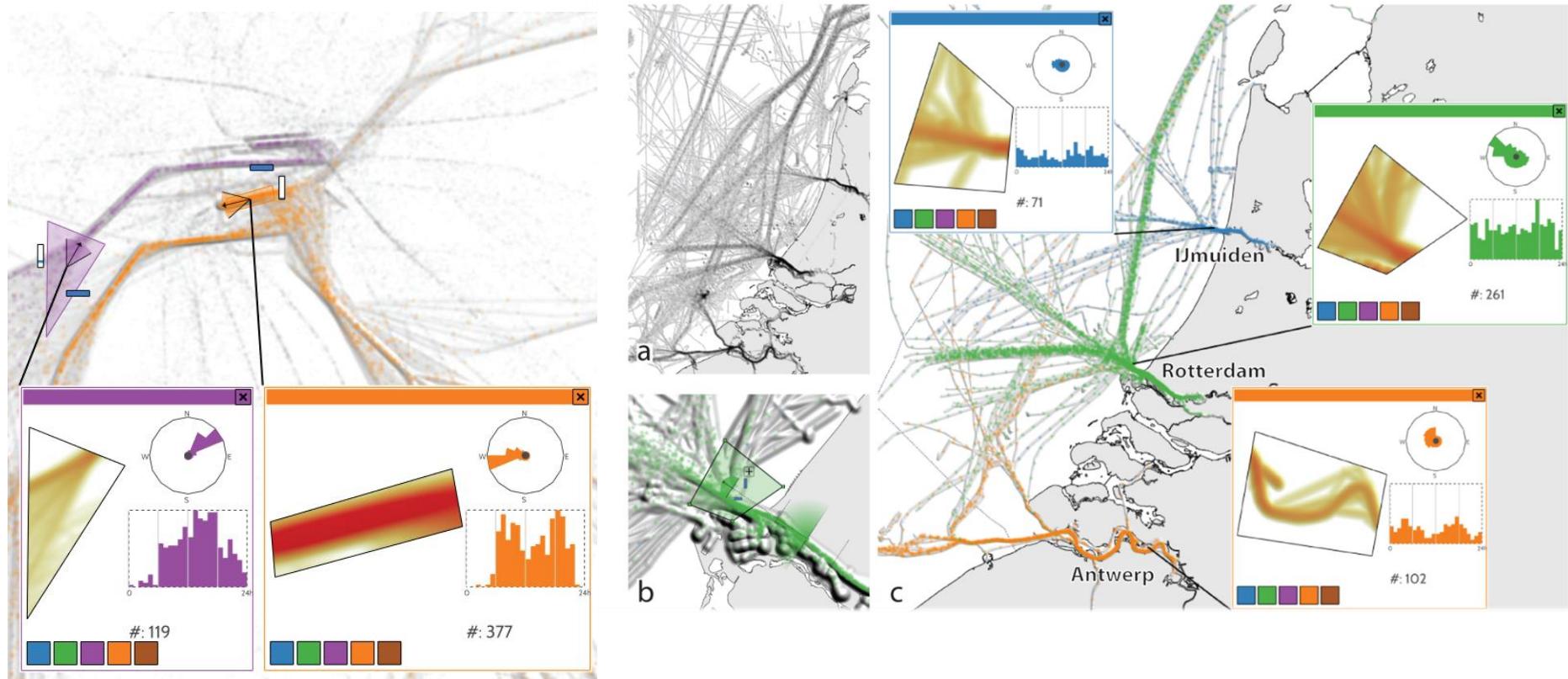
EXE: <http://recherche.enac.fr/~hurter/FromDaDy/FromDaDy.rar>

Hurter, C., Tissoires, B., Conversy, S.

FromDaDy: spreading data across views to support iterative exploration of aircraft trajectories.

In IEEE Transactions on Visualization and Computer Graphics xx(y), (Proceedings of IEEE InfoVis 2009).

*Outgoing investigation: What if system...
How the flows get reallocated when an harbor is closed,,,*

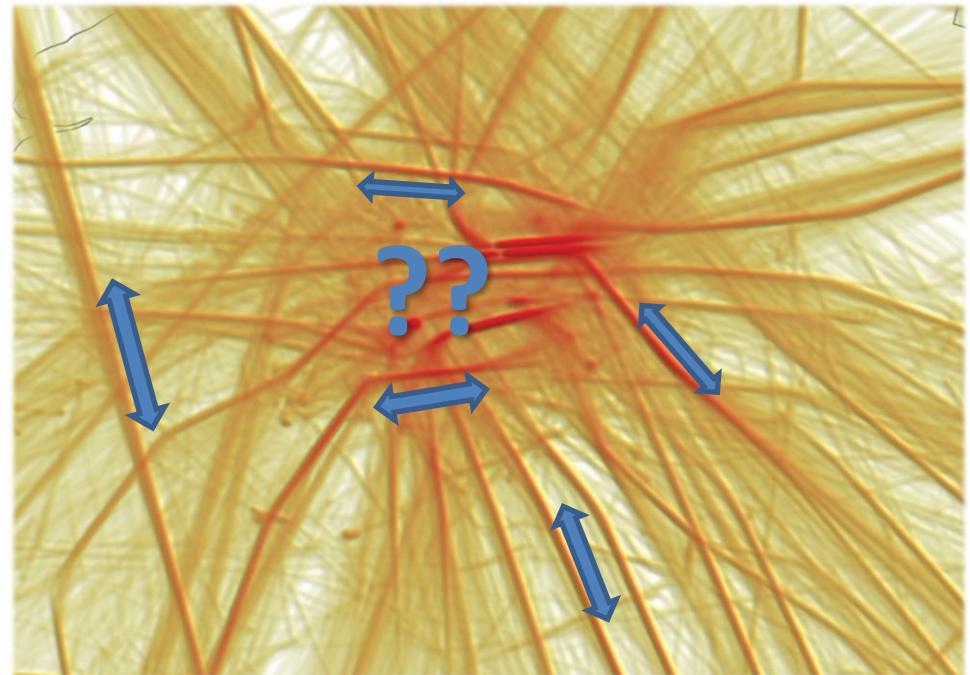


Roeland Scheepens, Christophe Hurter, Huub van de Wetering, Jarke van Wijk
Visualization, Selection, and Analysis of Traffic Flows
*In IEEE Transactions on Visualization and Computer Graphics xx(y),
(Proceedings of IEEE InfoVis 2015).*

<http://recherche.enac.fr/~hurter/AnimatedParticles/AnimatedParticles.html>

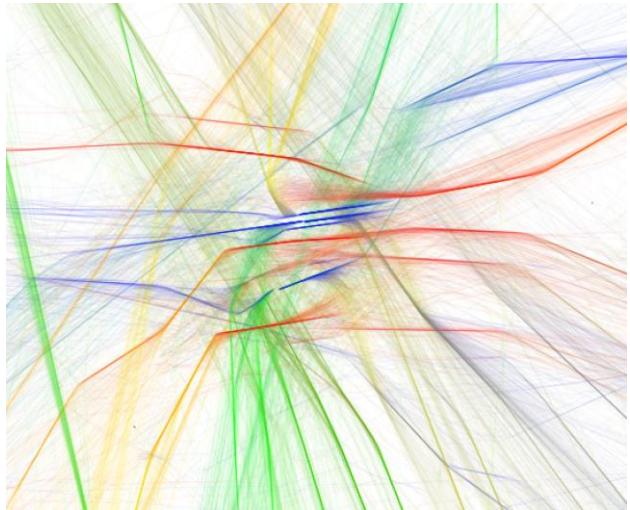
Context

- Moving objects with **functional relationship**.
- Users
- Traffic Flows

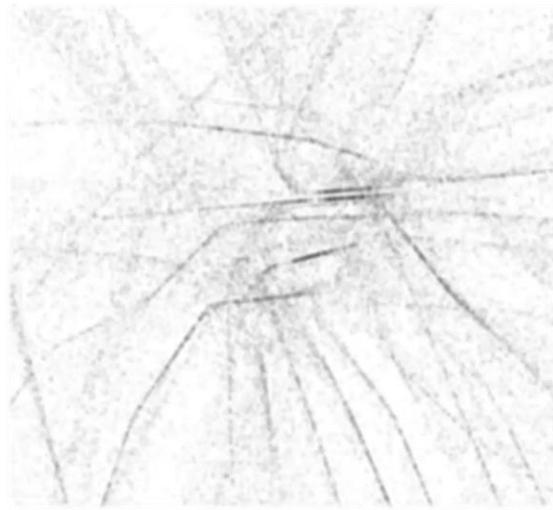


Visualization

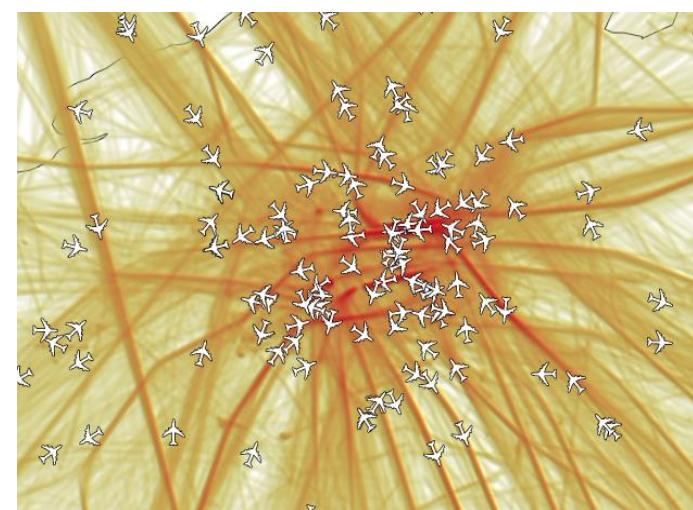
- Direction of flows



Colors?



Animated Particles!

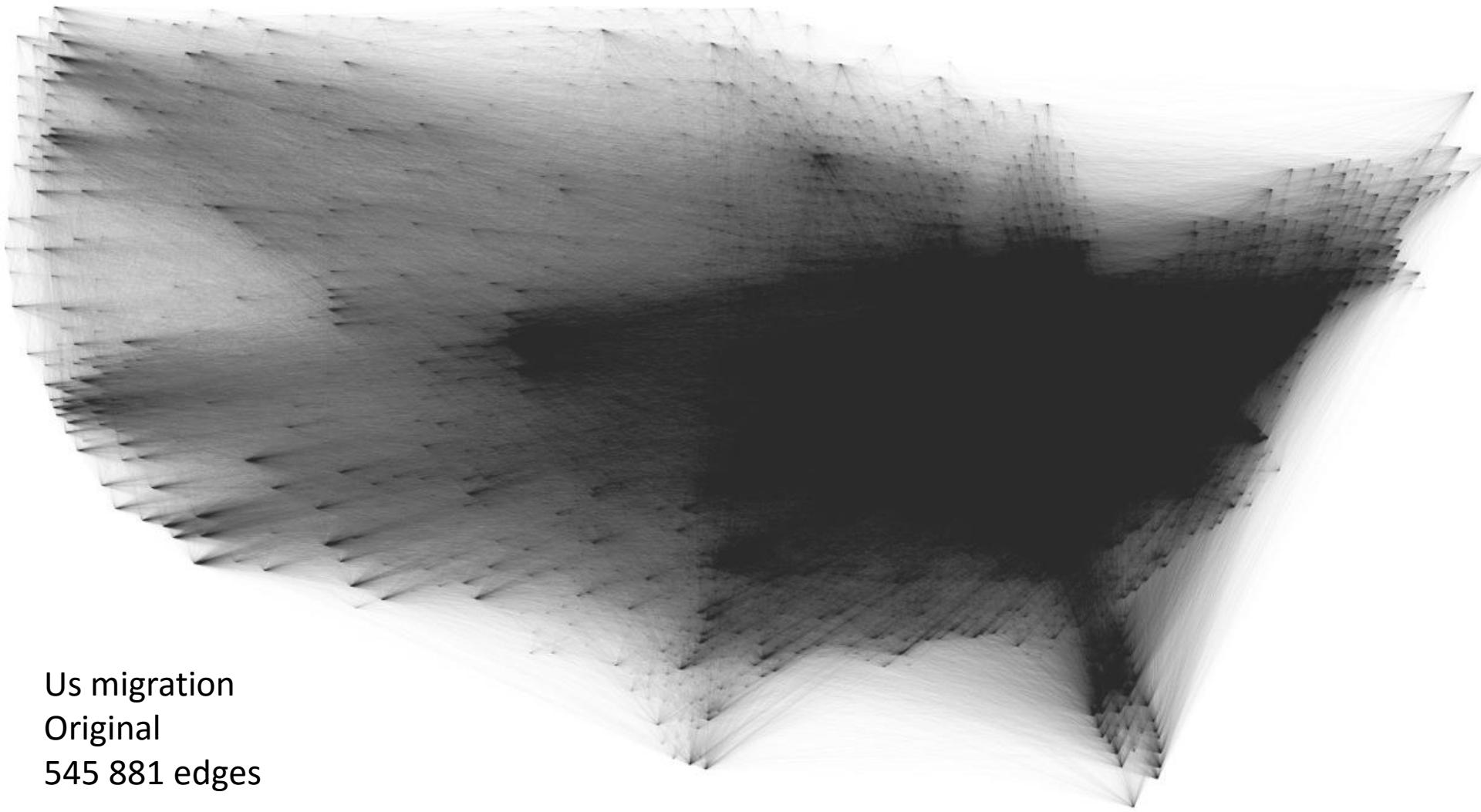


Glyphs?

View simplification
Edge Bundling techniques

County-to-county migration flow files

(<http://www.census.gov/population/www/cen2000/ctytoctyflow/>). These data come from the Census 2000 long-form question on residence 5 years ago and contain the number of people who moved between counties.

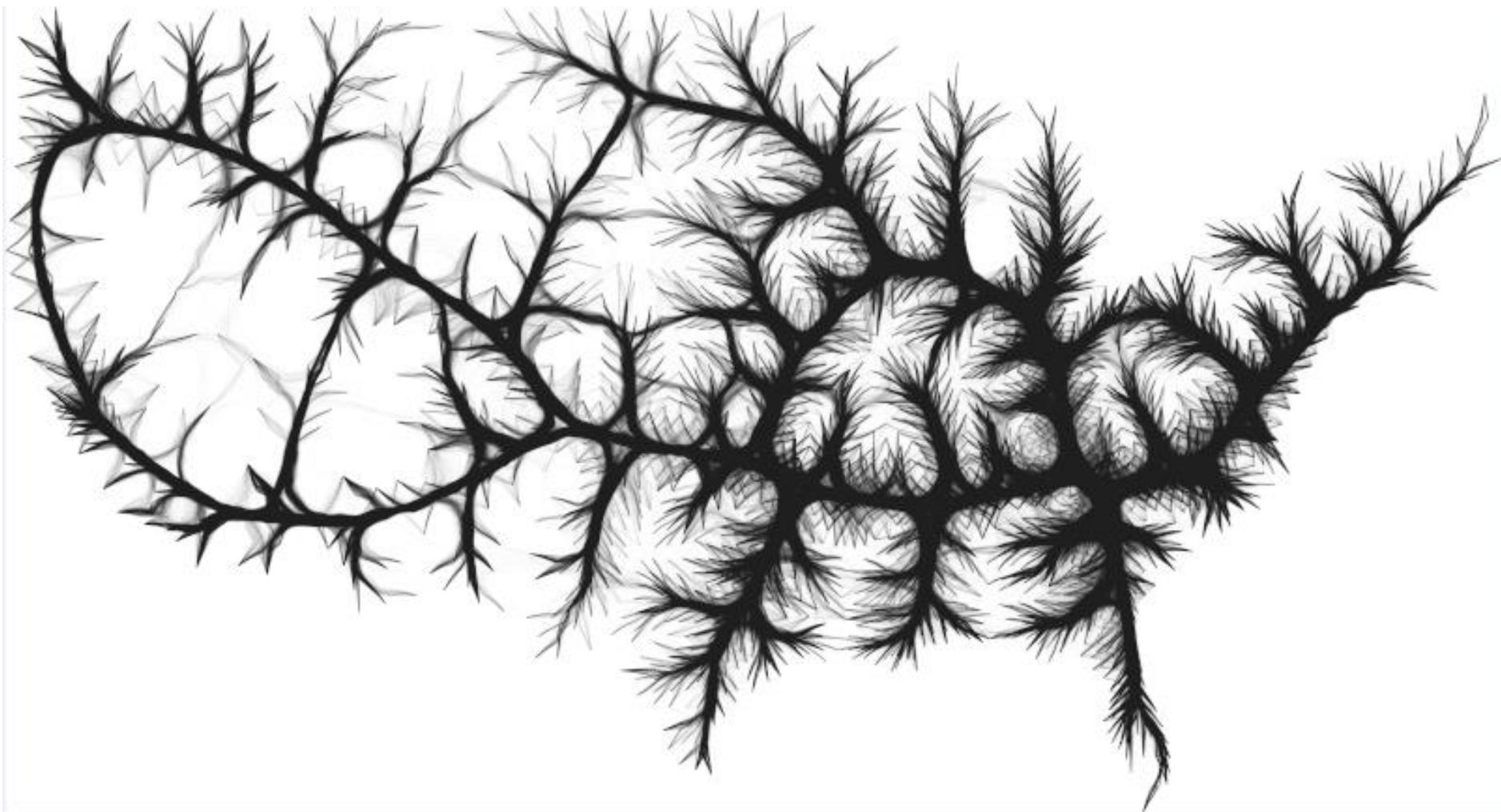


Us migration

Original

545 881 edges

Bundled

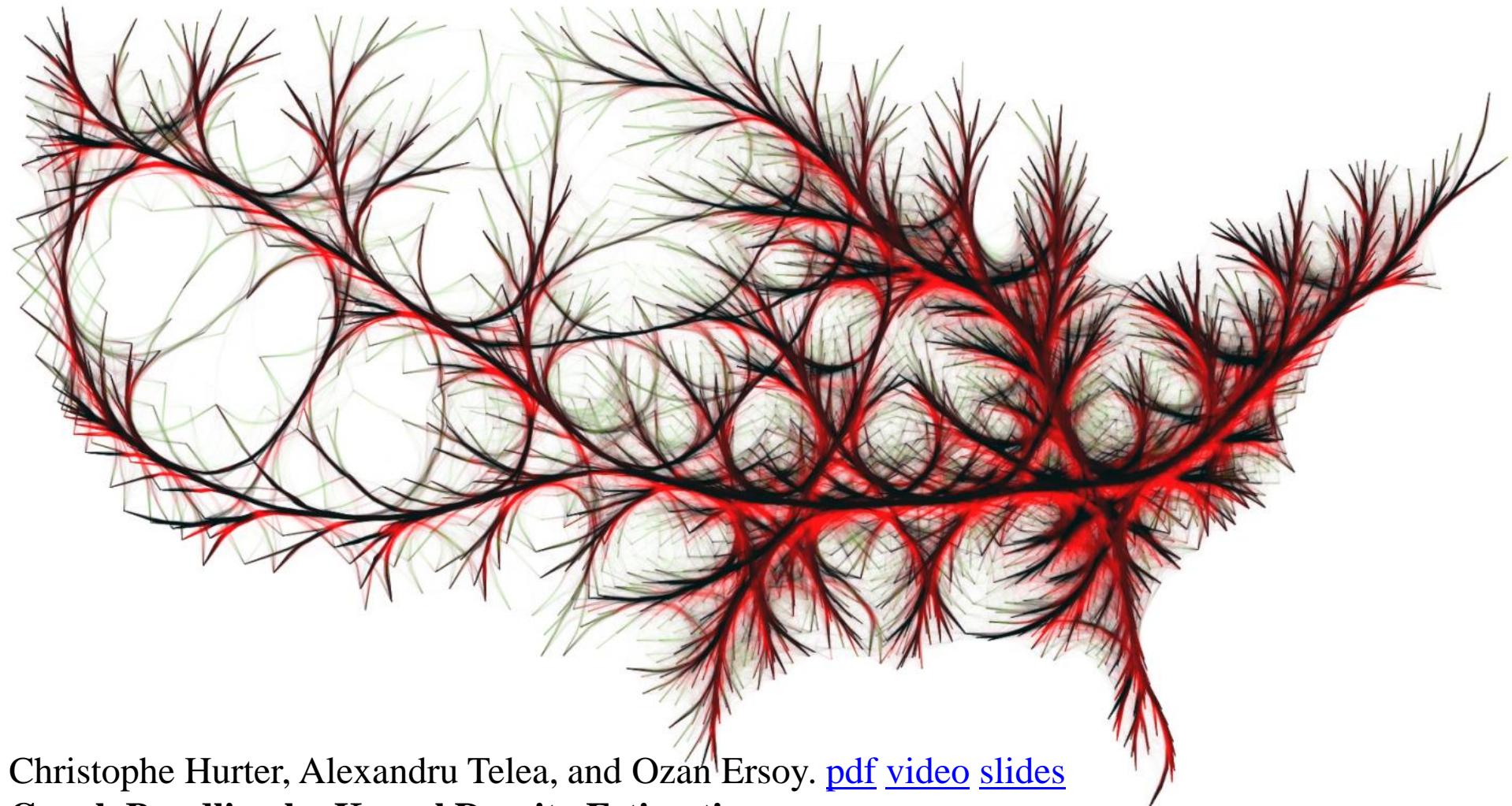


Us migration

Kernel Density Based Edge Bundling

22 million vertexes

Shading



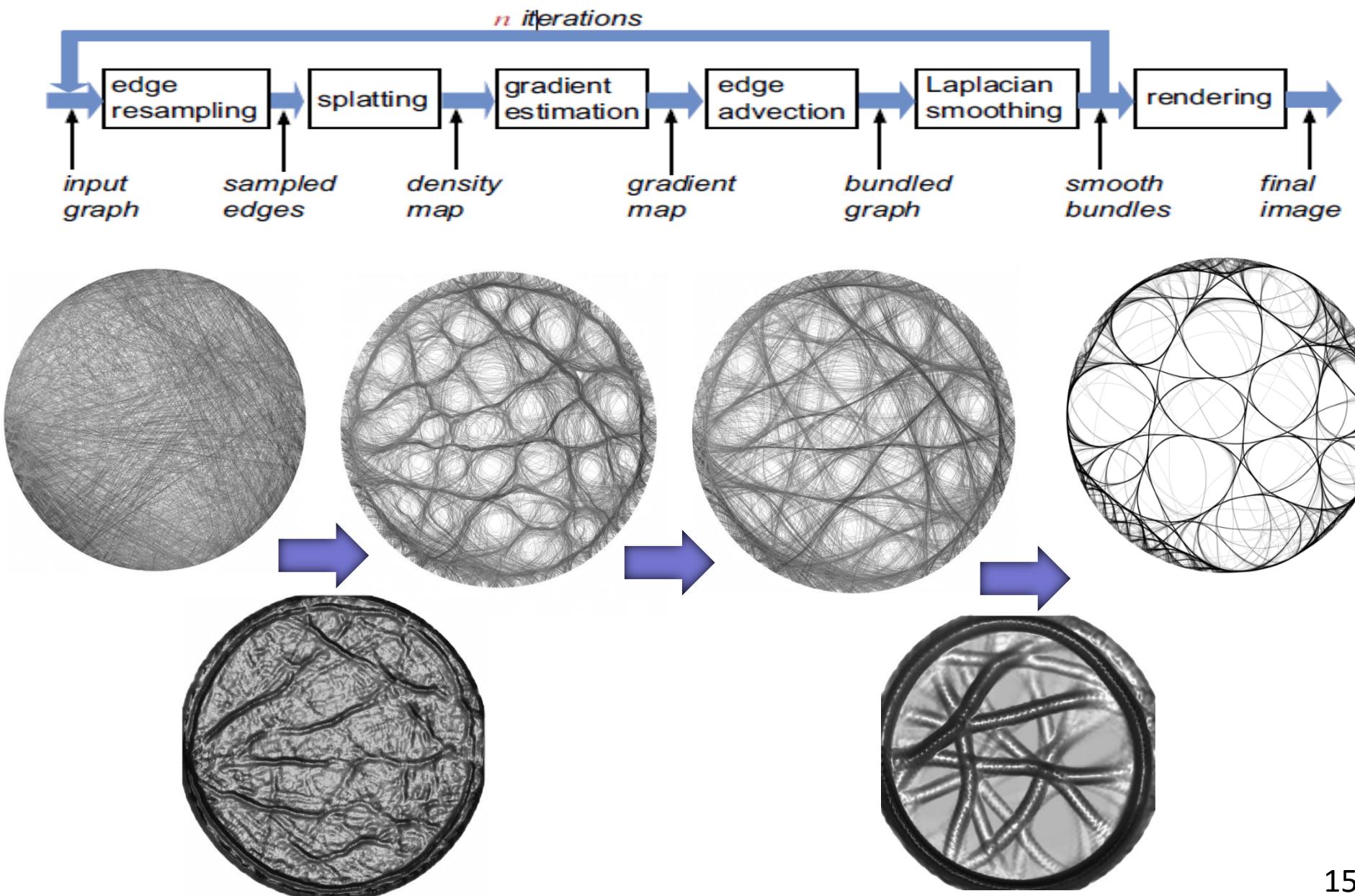
Christophe Hurter, Alexandru Telea, and Ozan Ersoy. [pdf](#) [video](#) [slides](#)

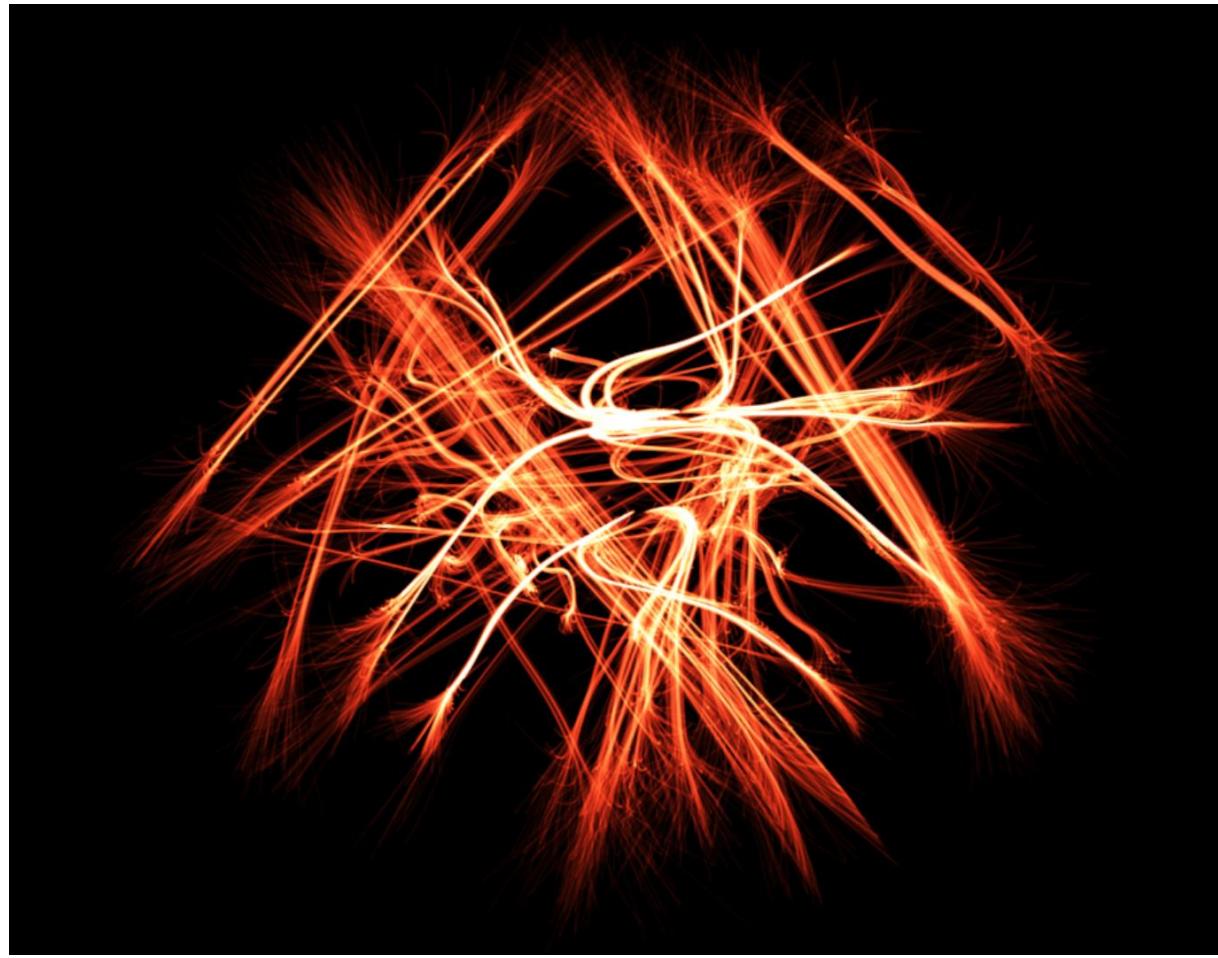
Graph Bundling by Kernel Density Estimation.

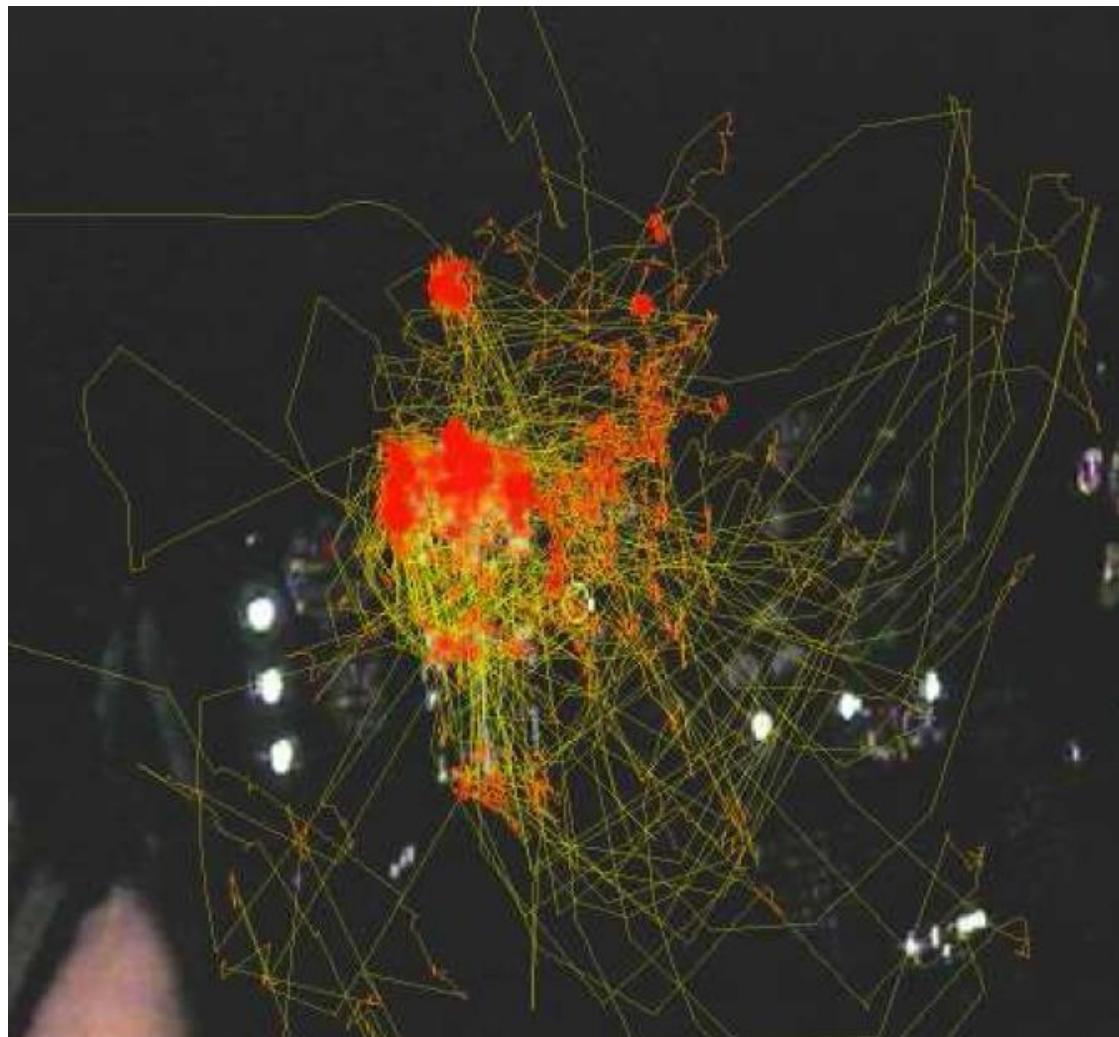
EuroVis 2012. Computer Graphics Forum journal.

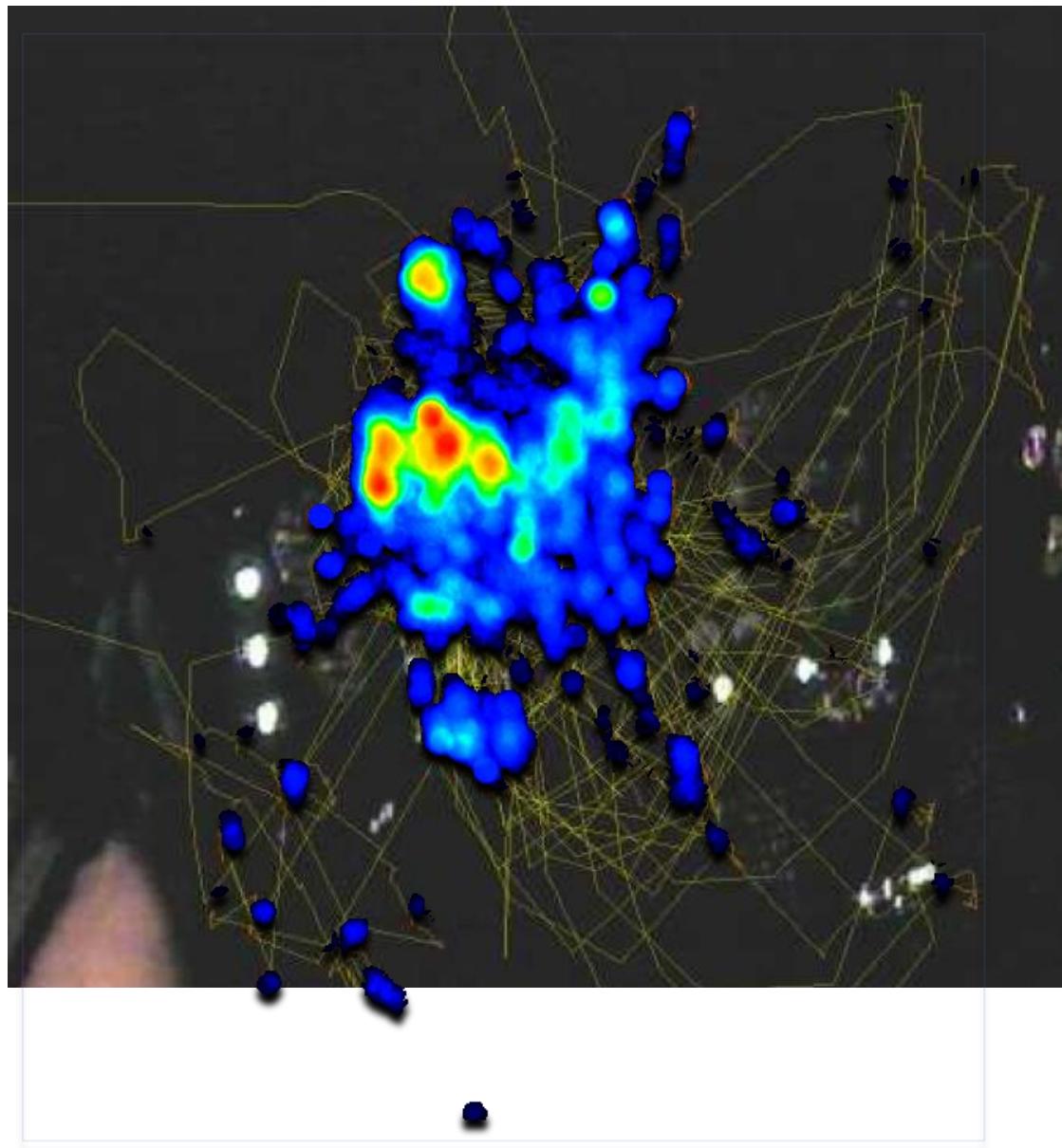
[Visual Studio C# code instance](#) (GPU version)
[Visual Studio C# code instance](#) (CPU version),

KDEEB pipeline

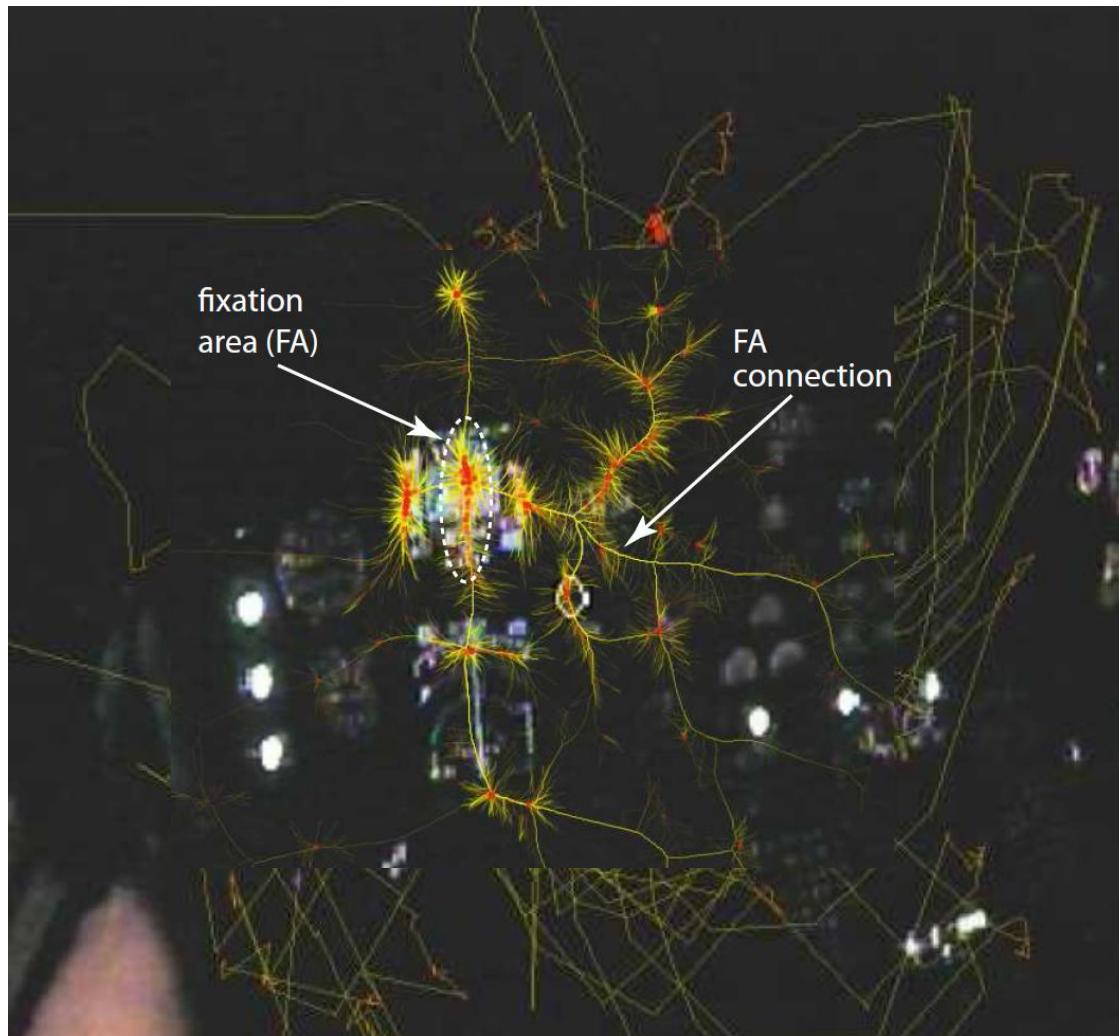












Hurter, C.; Ersoy, O.; Fabrikant, S.; Klein, T.; Telea, A.,

Bundled Visualization of Dynamic Graph and Trail Data.

(TVCG) *Visualization and Computer Graphics, IEEE Transactions on*, vol.PP, no.99, pp.1,1

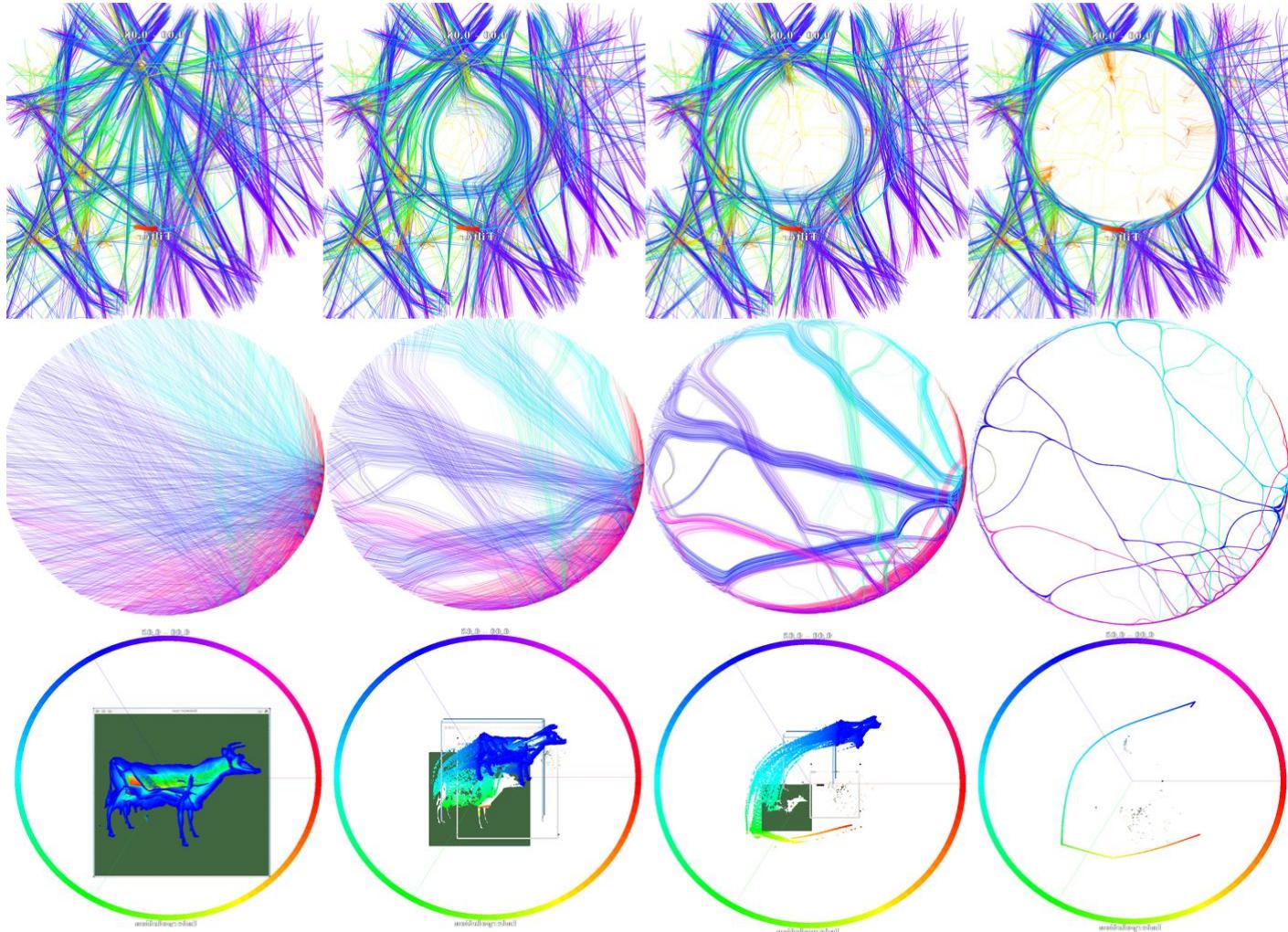
doi= 10.1109/TVCG.2013.246

View animation

MoleView

ColorTunneling

The MoleView



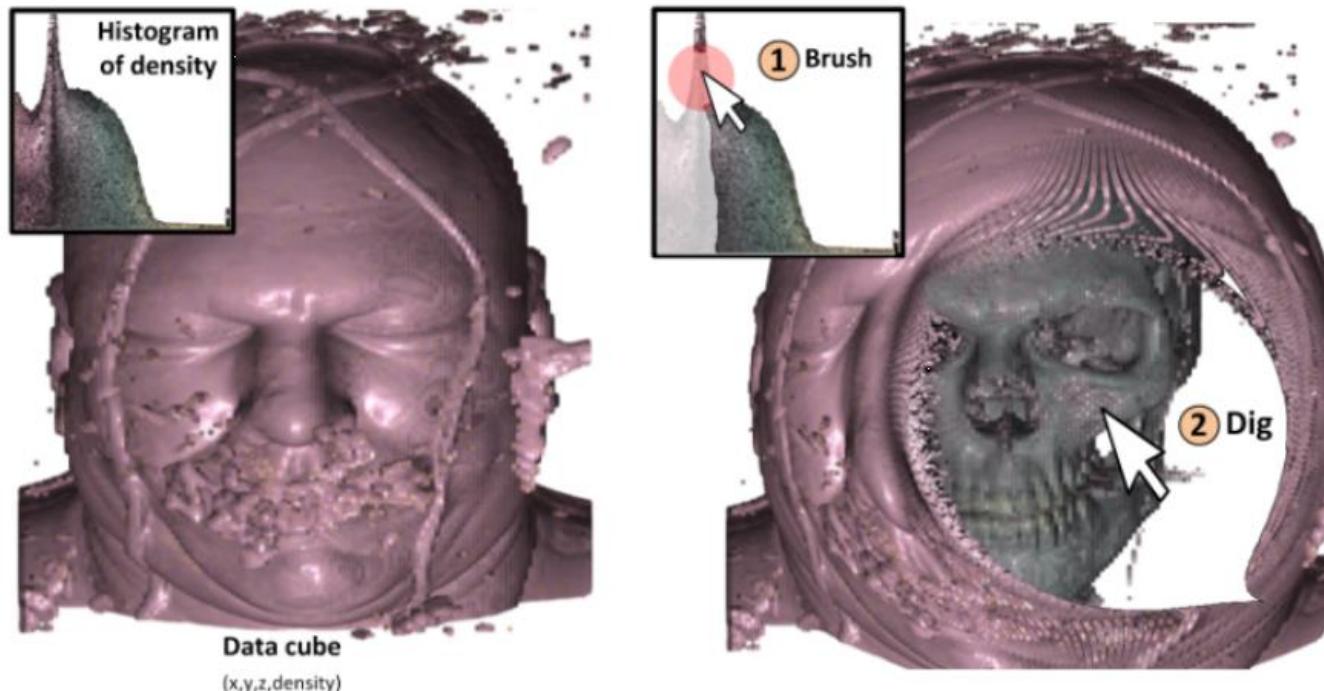
Christophe Hurter, Ozan Ersøy and Alexandru Telea. 2011. [pdf](#) [video](#) [exe](#)

MoleView: An Attribute and Structure-Based Semantic Lens for Large Element-Based Plots. *IEEE Transactions on Visualization and Computer Graphics* 17, 12 (December 2011), 2600-2609.

John Brosz, Miguel Nacenta, Ricky Pusch, Sheelagh Carpendale, and Christophe Hurter
Transmogrification: Casual Manipulation of Visualizations.
(UIST '13) In *Proceedings of the 26th annual ACM symposium on User interface software and technology*. ACM

Color Tunneling

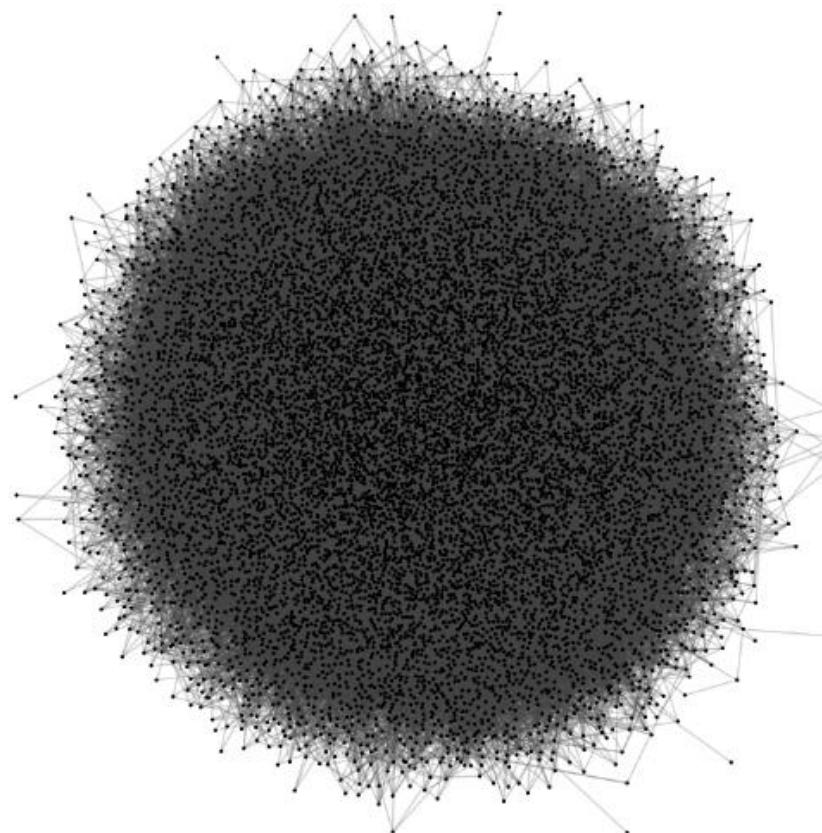
Pixel based visualization technique



C. Hurter, A. R. Taylor, S. Carpendale and A. Telea
Color Tunneling : Interactive Exploration and Selection in Volumetric Datasets
PacificVis 2014

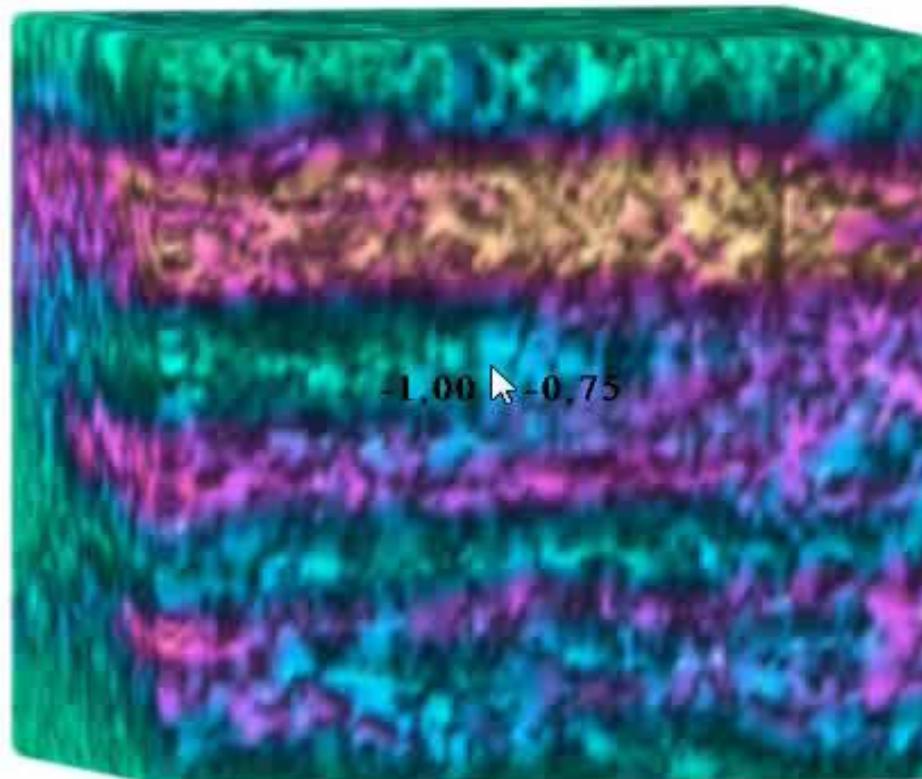
Research question

How to deal with large data set visualization
and data occlusion ?



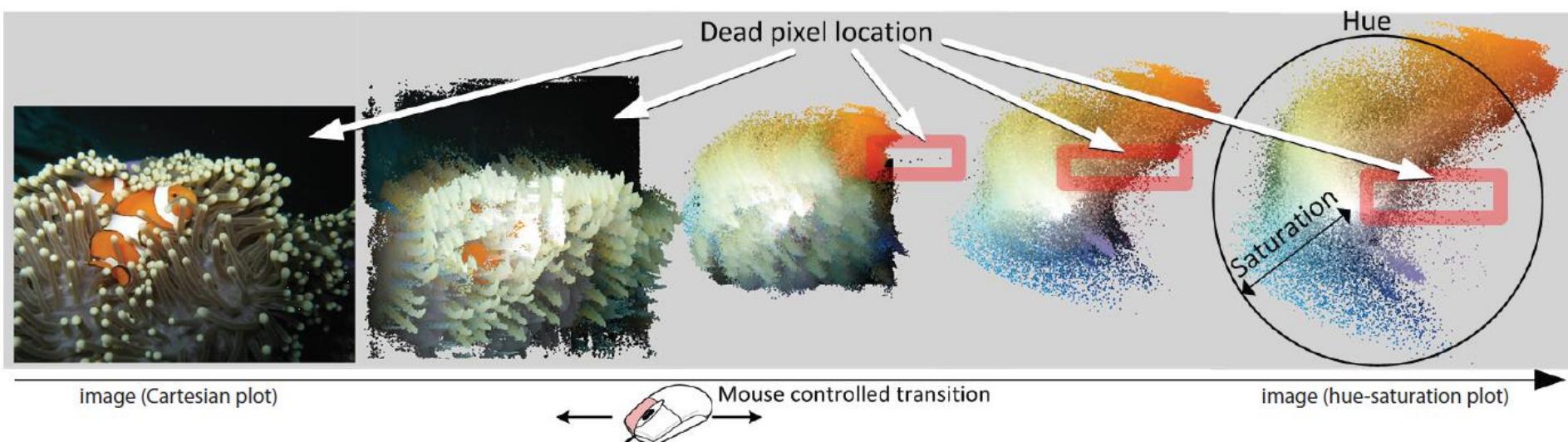
Method

We provide a set of **real-time** multi-dimensional data deformation techniques that aim to help users to easily **select, analyze, and eliminate spatial-and-data patterns.**

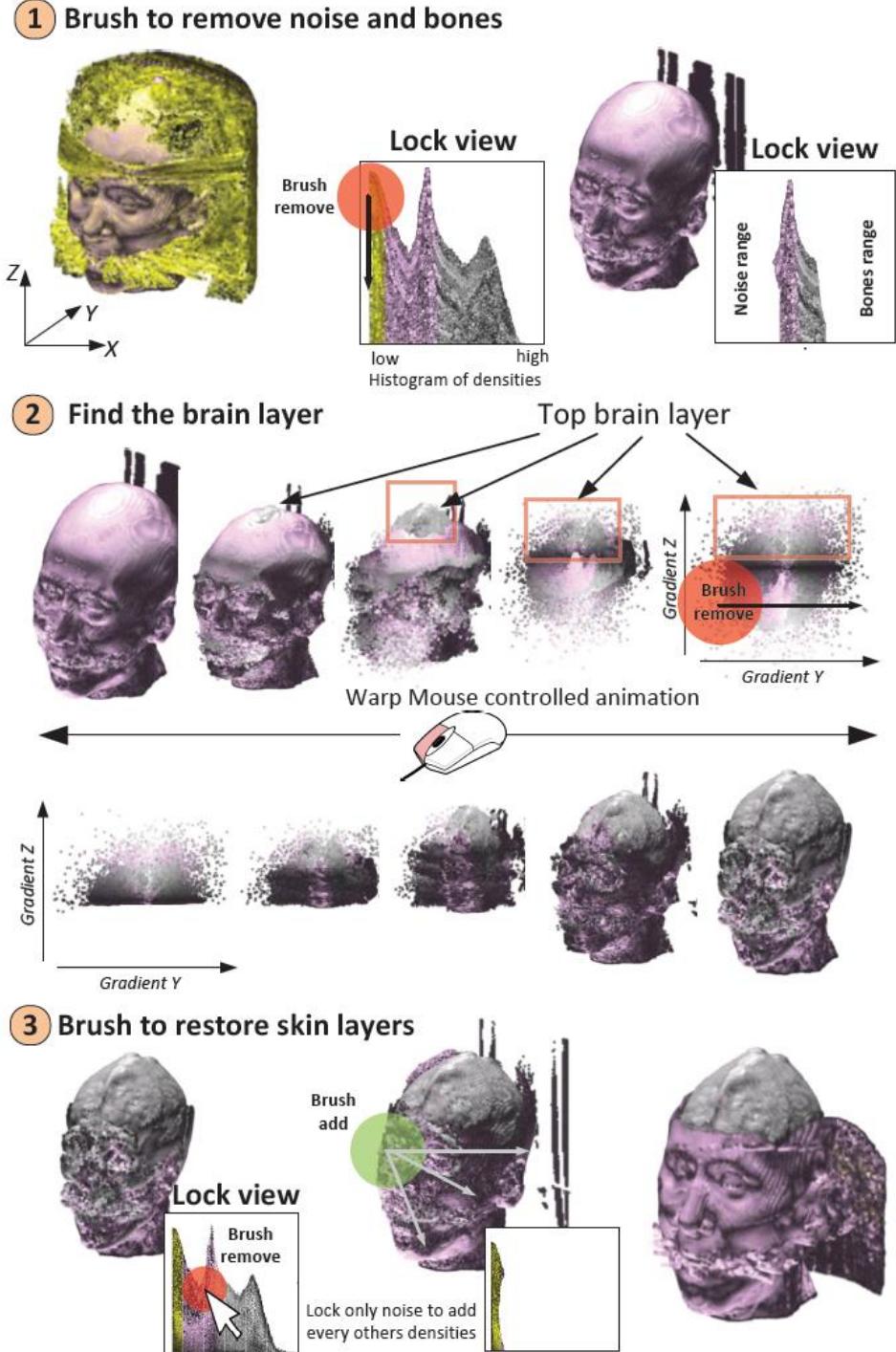


Contributions

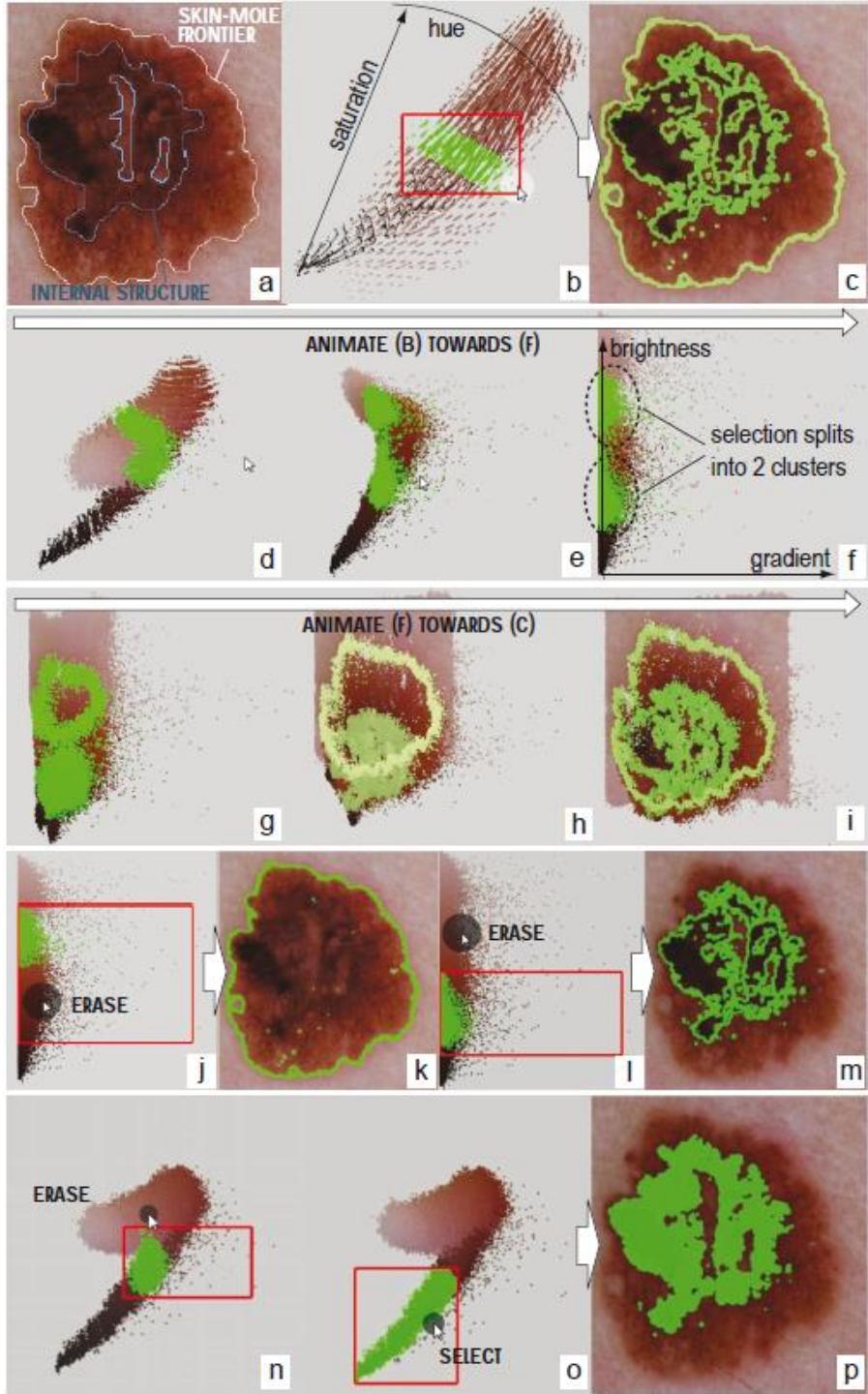
Animation as an efficient exploration tool



Use case 2: CT scan exploration



Use case 3: image segmentation

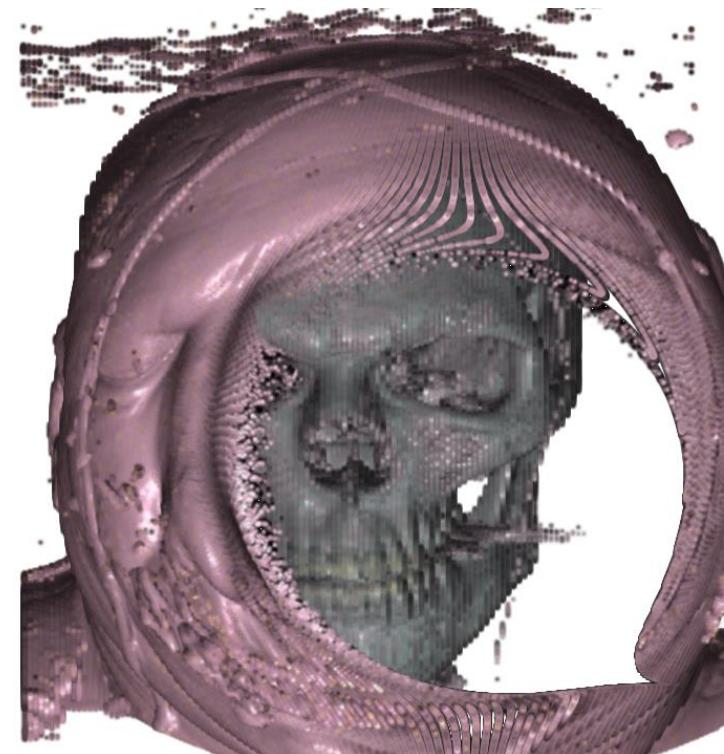
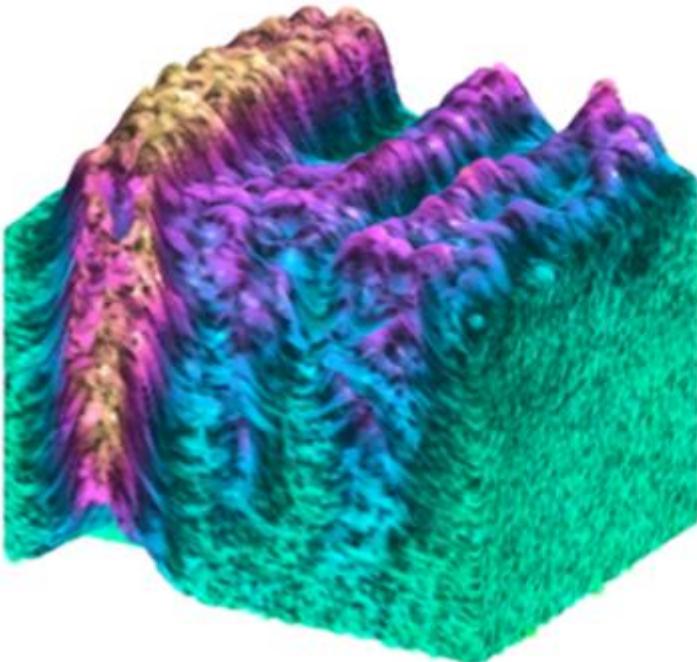


Contributions

GPGPU technique

Transform feedback :

GPU implementation able to handle over 10M displayed data points at a frame rate of 20 images per second on a modern graphic card.





Chapter Leader: Christophe Hurter

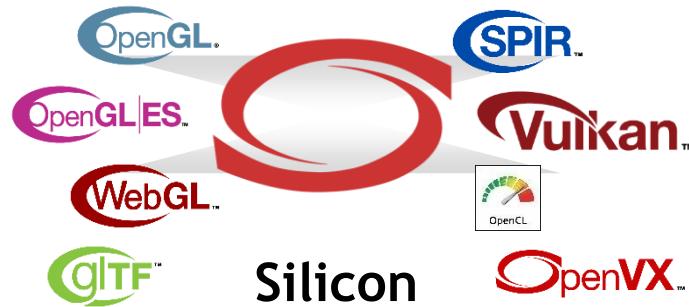
Email: christophe.hurter@enac.fr

<http://www.meetup.com/fr-FR/Khronos-Toulouse-Chapter/>

Khronos Mission



Software



Khronos is an Industry Consortium of over 100 companies creating royalty-free, **open standard APIs** to enable software to access hardware acceleration for **graphics, parallel compute and vision**

What's Khronos Chapter and how it works?

- **Khronos Chapter is:**
 - A local Khronos APIs related developer community;
 - A platform to communicate and share;
 - An opportunity to meet Khronos member companies and get the latest updates;
 - A chance to social with other developers.
- **How it works?**
 - The Chapter events will be held under the name of Khronos and get support from us;
 - A volunteering Chapter leader will drive the local chapter;
 - You may have meetup, demo, talk, competition, workshop and even cross-cities events.

Information

K H R O N O S
G R O U P™

- Mailing list IHM:

<https://wwwsecu.irit.fr/listes/subscribe/sigchi-toulouse>



- Meetup Khronos group:

<http://www.meetup.com/fr-FR/Khronos-Toulouse-Chapter/>

- Page perso:

<http://www.recherche.enac.fr/~hurter/>



Image-Based Visualization
*Interactive Multidimensional
Data Exploration*

Christophe Hurter

SYNTHESIS LECTURES ON VISUALIZATION

Christophe Hurter

**Image-Based Visualization: Interactive
Multidimensional Data Exploration.**
[Synthesis Lectures on Visualization](#), Morgan
& Claypool Publishers 2015

https://www.amazon.com/Image-Based-Visualization-Interactive-Multidimensional-Exploration/dp/1627057587?ie=UTF8&keywords=christophe%20hurter&qid=1454778663&ref=sr_1_1&sr=8-1