

techniques d'interaction avancées

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www.telecom-paristech.fr/~elc

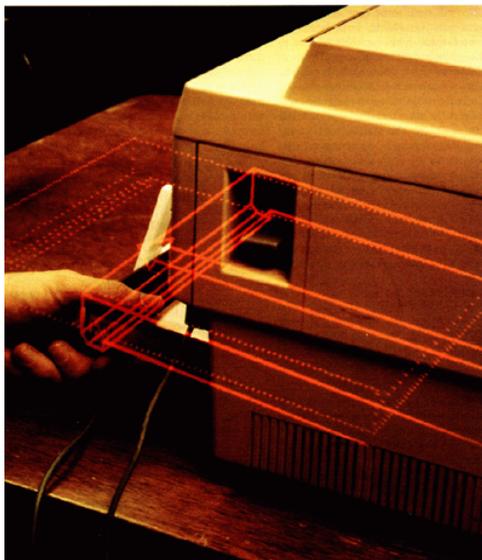
mars 2018

réalité augmentée

Augmentation du monde réel par des représentations virtuelles

Exemples

- aide à la réparation d'une photocopieuse
- annotation d'une scène réelle
- contrôle aérien, conduite automobile, etc.



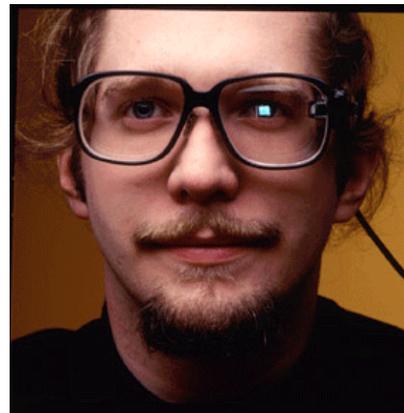
réalité augmentée

Cas d'usages et technologies

- smartphones
- lunettes (type Google Glass)
- vidéo- et pico- projecteurs
- virtual retinal display (expérimental)



Google Glass



Thad Starner



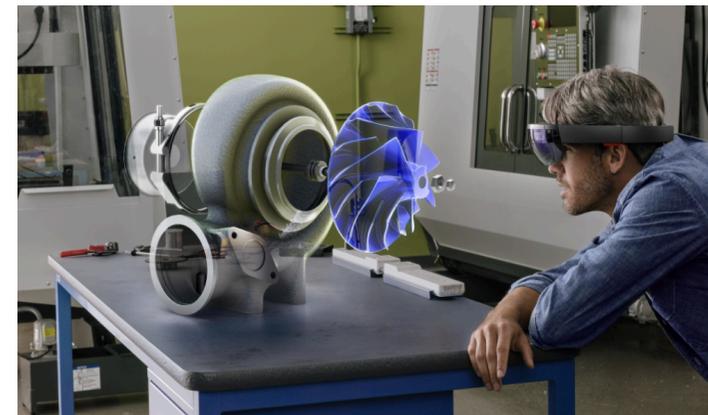
réalité mixte

L'utilisateur peut interagir avec les représentations virtuelles

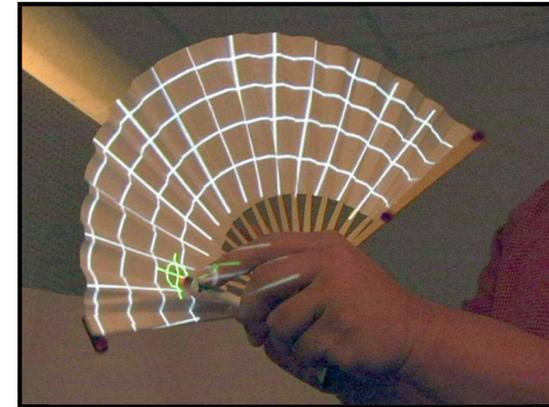
- mélange du monde physique et du monde virtuel
- frontière floue avec la **RA**
- lunettes semi-immersives (type HoloLens)



Note : différent de la **RV** où l'utilisateur est immergé dans un monde purement virtuel



projection et projection mapping



Foldable displays

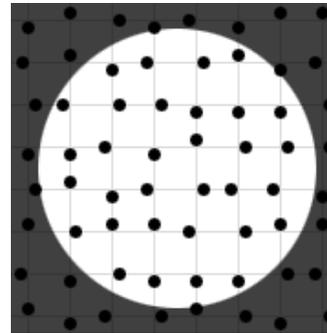
IllumiRoom

Microsoft Research

papier augmenté

Anoto

- couple papier / stylo numérique
- papier micro-tramé
- lien tangible / numérique



Penlight (Song et al.)

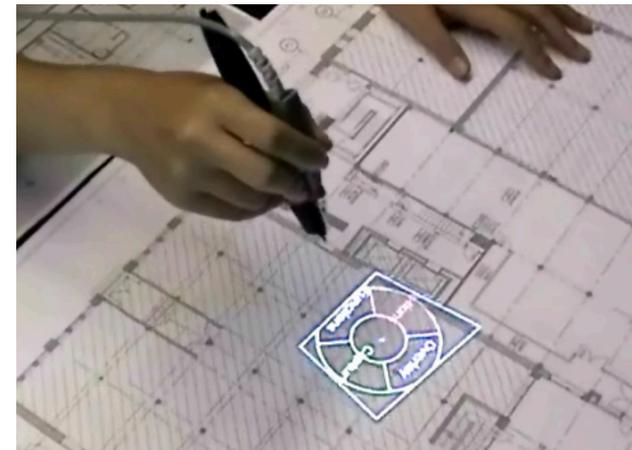
- picoprojection

Quickies (Mistry et al., MIT)

- post-its augmentés

Missing Link (Mckay et al., INRIA)

- le PDA sert de « lentille magique »



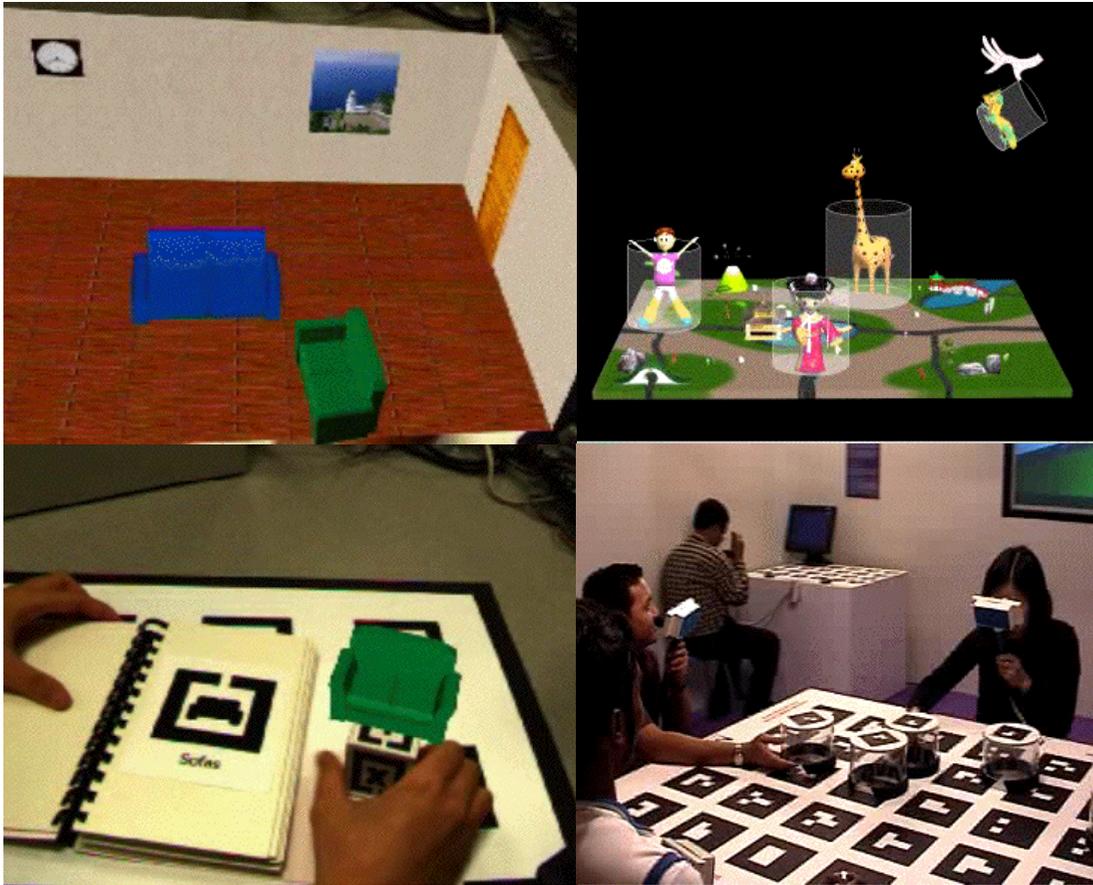
interfaces tangibles

Interaction avec l'information numérique via l'environnement physique

- Reactable
 - PERCH Retail
 - GaussBit
 - inFORM
 - ZeroN
- la souris peut-etre vue comme une interface tangible....



interfaces tangibles et réalité mixte



Marqueurs de Réalité Augmentée (RA)

- ARToolkit et dérivés
- MagicCube, MagicLand

interfaces tangibles, capteurs



Pinstripe
textiles interactifs



Synchronous gestures
(Hinckley – Microsoft R)



Scratch Input
(C. Harrison - CMU)



Stane
« grattage » de textures
(U.Glasgow.)

retour tactile

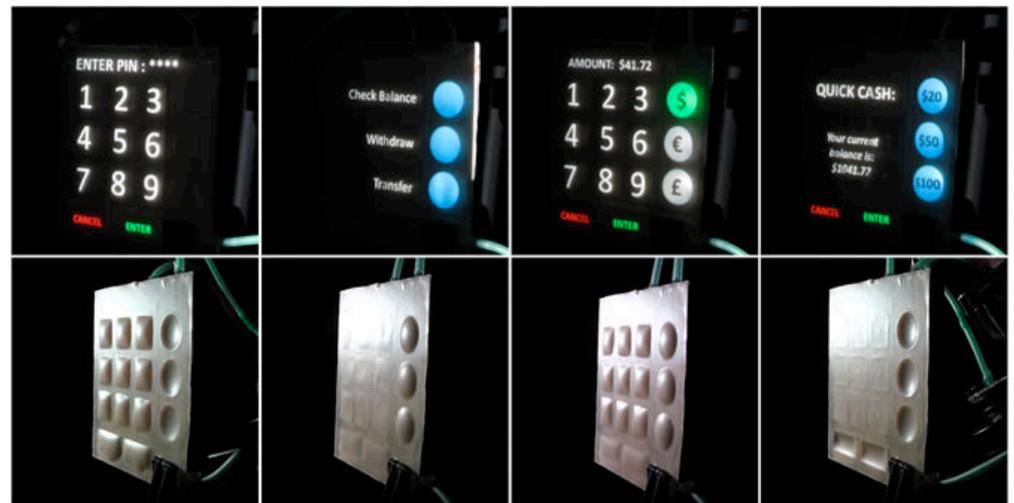


TeslaTouch

(Bau et al, Disney)

cf aussi Casiez et al.
(microvibrations)

Pneumatic Displays (Harrison et al, CMU)



shape changing interfaces

Morphees [Roudaut et al. 13]

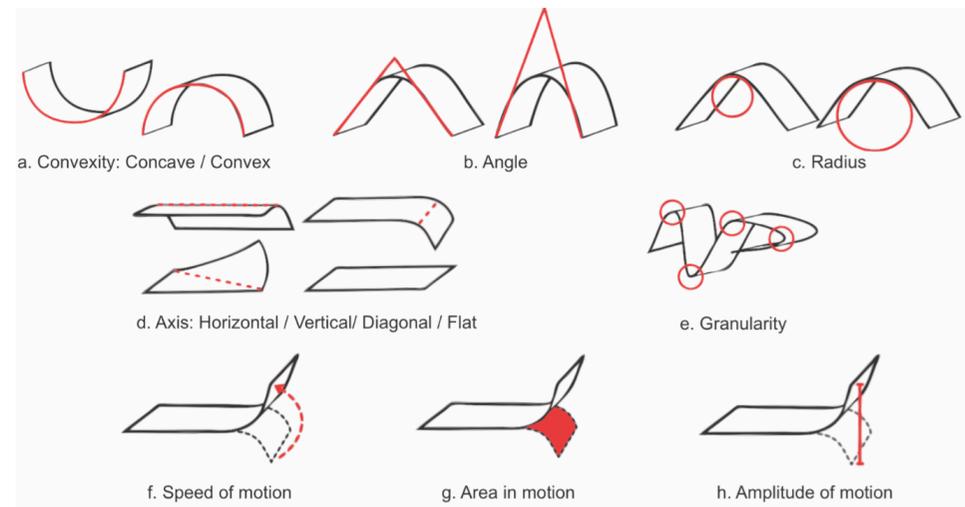
Shapes and emotions [Strohmeier et al. 16]

Haptic Edge [Jang et al. 16]



Design with Applications

Sungjune Jang et al., CHI, 2016 (accepted)



interaction robotisée

Living Desktop [Bailly et al. 16]

Zoids [Le Goc et al. 16]

Hand Development Kit [Sang Leigh et al.]

On Body Robots [Dementyev et al., 16]



nouveaux matériaux

Cillia [Ou et al. 16]

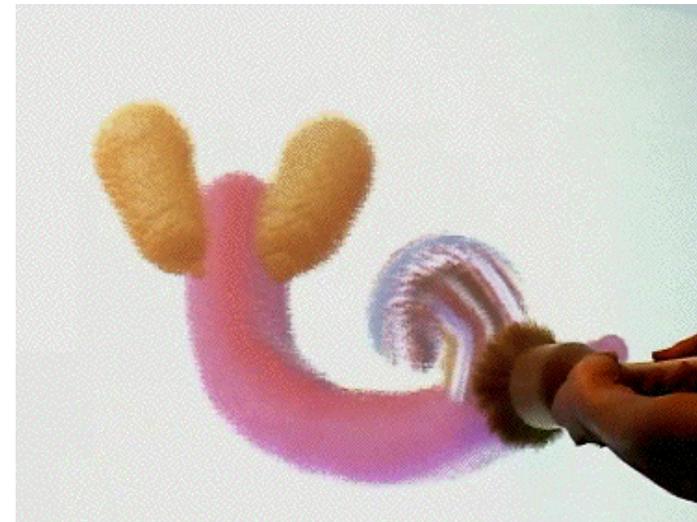
ExoSkin: On-Body Fabrication [Gannon et al. 16]



des dispositifs étonnants...



« **Ensemble** » : vêtements tangibles



IOBrush
MIT Media Lab

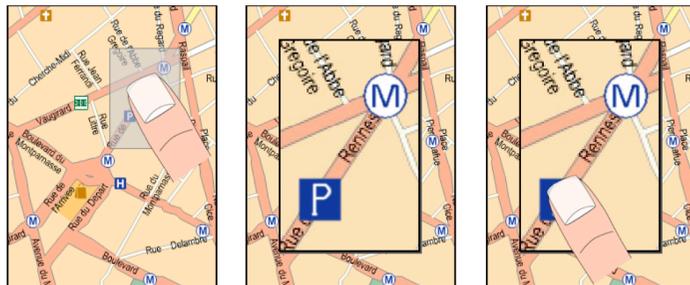
petits dispositifs

Fat Finger Problem

- occultation
- précision insuffisante

Techniques

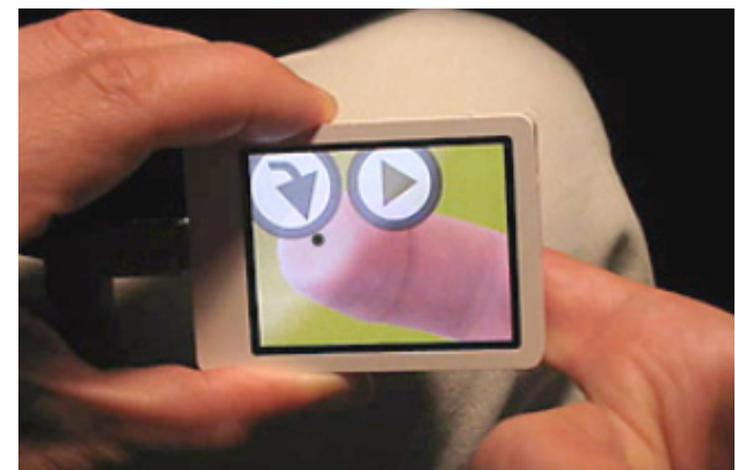
- Shift
- TapTap
- NanoTouch (back-of-device interaction)
- NailDisplay



A)

B)

C)

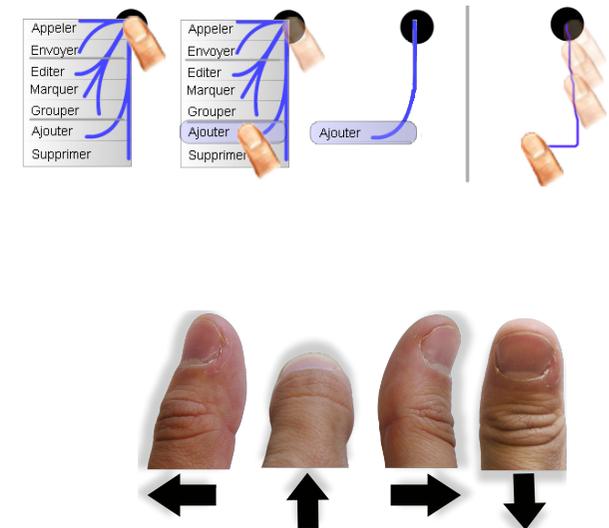
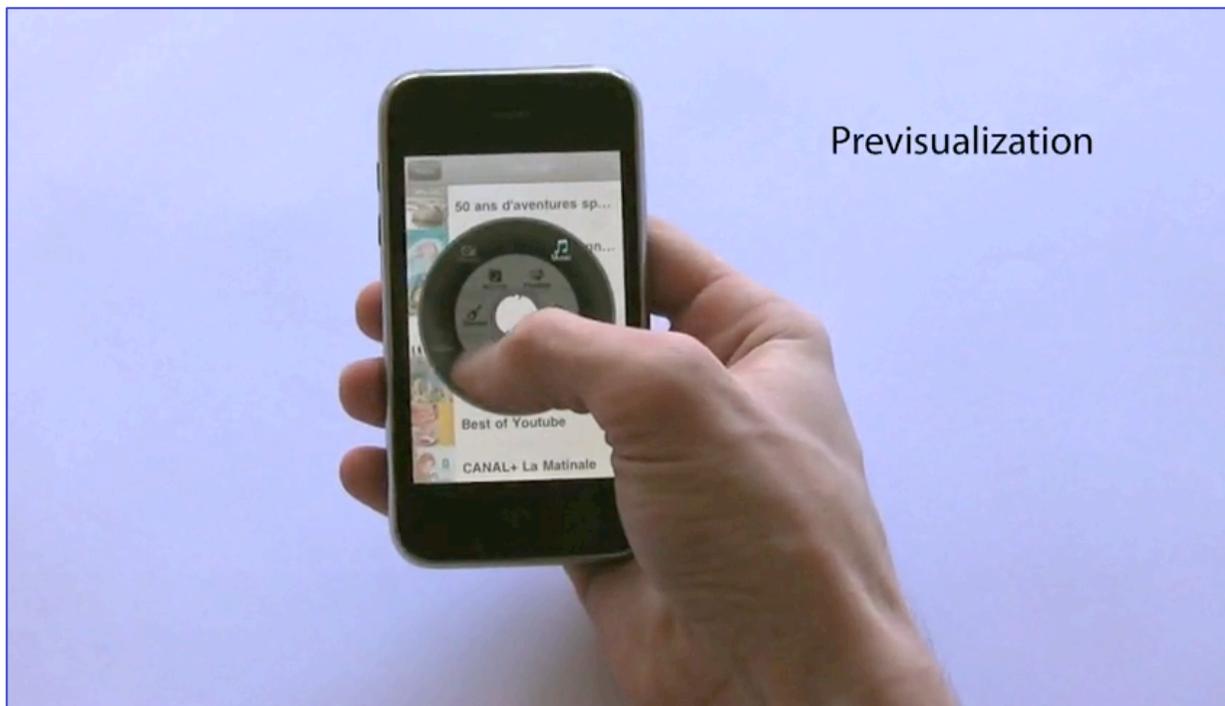
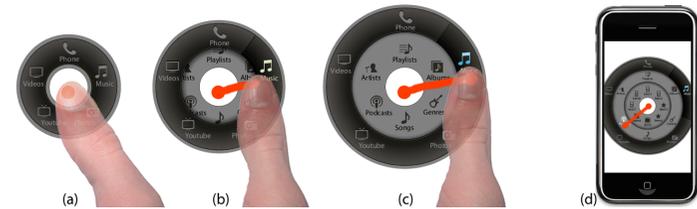


NanoTouch
(Baudisch et al.,
Microsoft Research)

gestes sur le dispositif

Menus gestuels

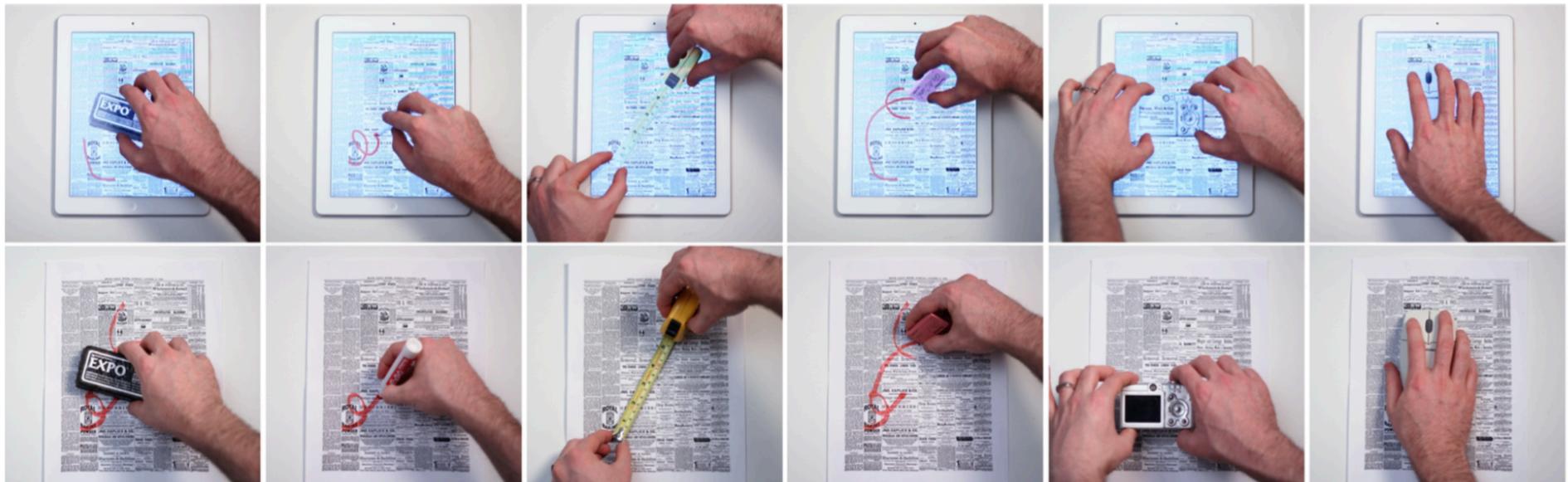
- **Wavelet menus** [Bailly et al. 2010]
- **MicroRolls** [Roudaut et al. 2008]



multitouch

FingerSense (Queexo)

TouchTools [Harrison et al. 14]



whiteboard eraser, marker, tape measure, rubber eraser, camera, mouse, magnifying glass.

gestes 3D

JerkTilts [Baglioni et al. 11]

- Avoid unintentional activation
- Auto-delimiting quick back-and-forth gestures



gestes autour du dispositif

Olsen: *"If I can fit my entire PC in a cubic inch, how will I interact with it?"*

Abracadabra [Harrison et al. 09]

- use of the (larger) space around a (very small) device
- magnets



Abracadabra

Nenya [Ashbrook et al., 11]

- micro-interactions with a ring

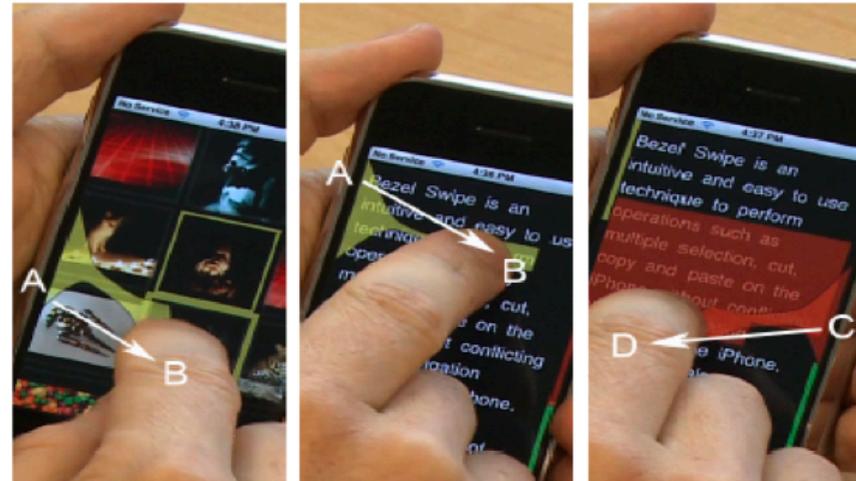


Nenya

bezels

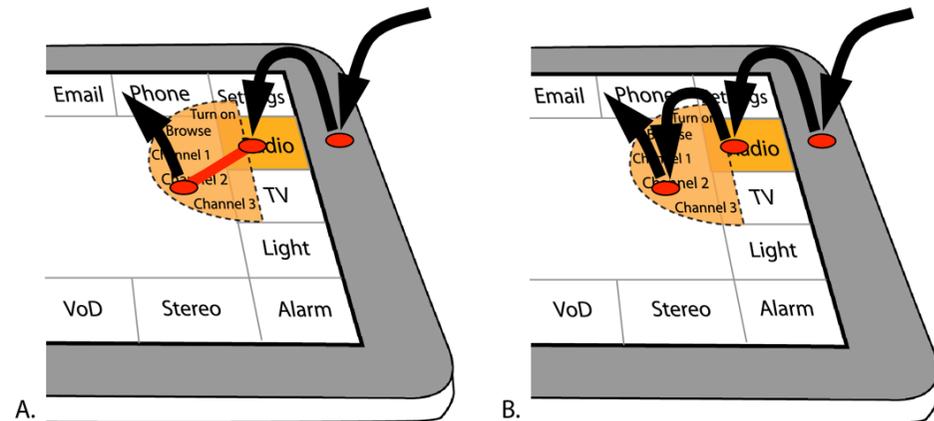
BezelSwipe [Roth et al. 09]

- gestures start from the bezels



BezelTap [Serrano et al. 13]

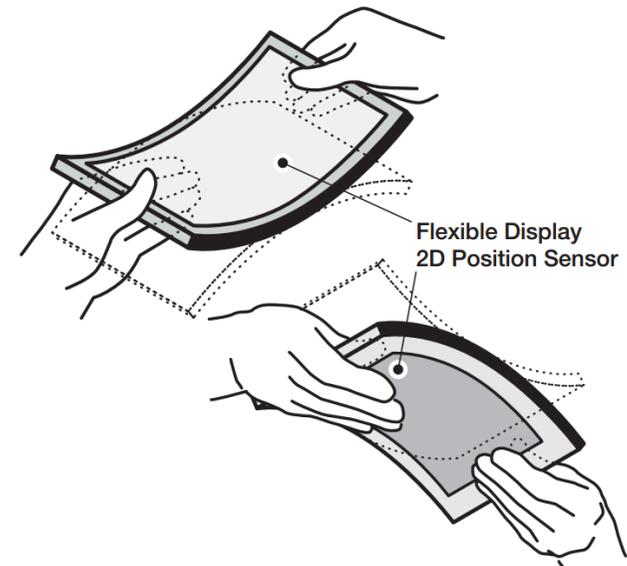
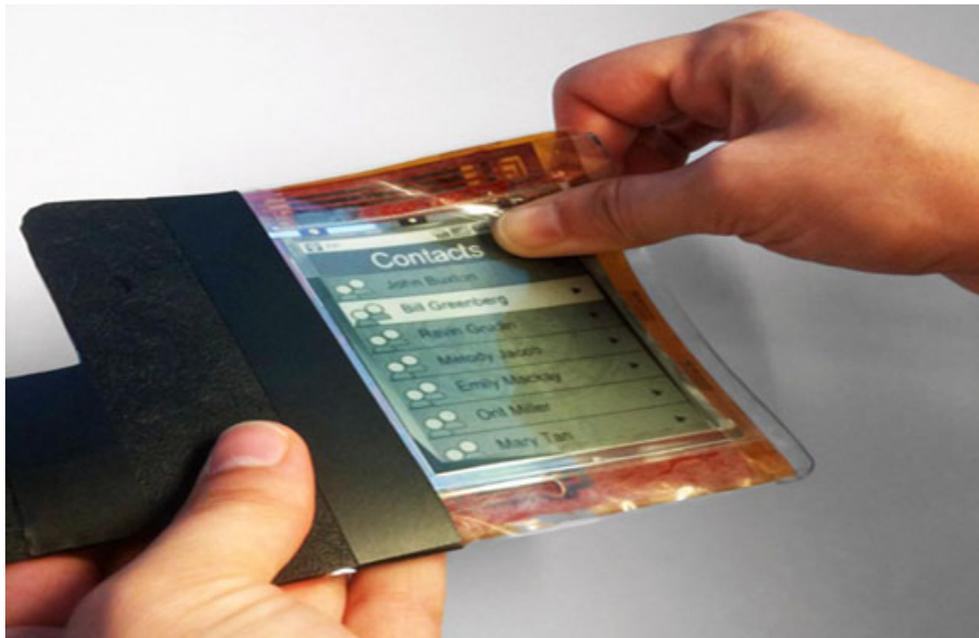
- accelerometer : **tap on the bezel** + tap or slide on the screen
- always active even in idle mode



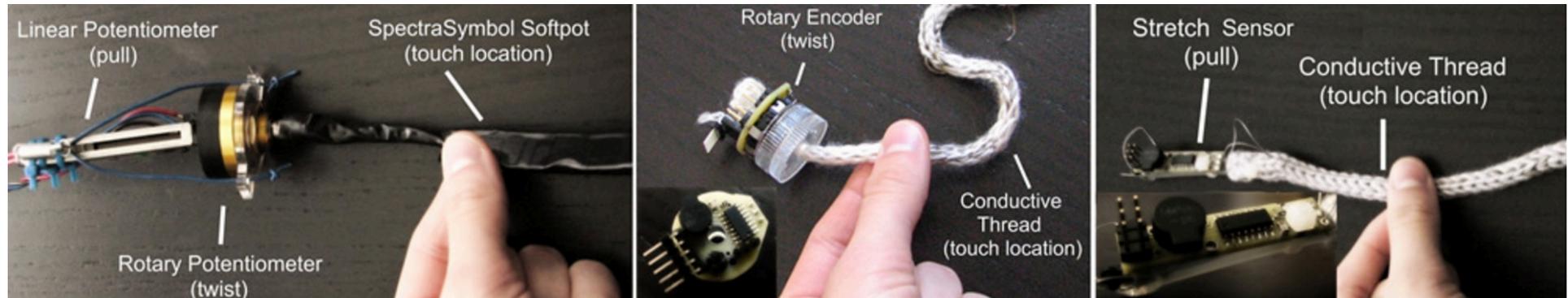
bending the tablet

Gummi [Schwesig et al. 04]

PaperPhone [Lahey et al. 11]



gestures elsewhere



CordInput
(Schwarz et al 10)

gestes sur le corps

Skinput [Harrison et al. 10]

Skintrack [Zhang et al. 16]

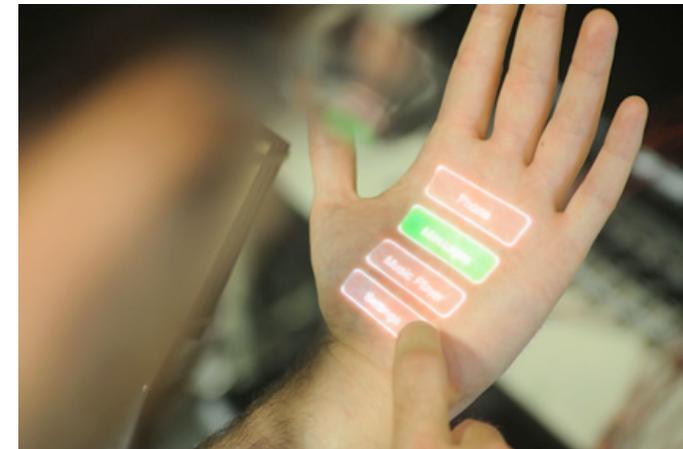
FingerIO [Nandakumar et al. 16]

iSkin [Weigel et al. 15]

Body-centric Design Space [Wagner et al. 13]



MULTIPLE DISCRETE BUTTONS



iSkin

Flexible, Stretchable and Visually customizable
On-Body Touch Sensing for Mobile Computing



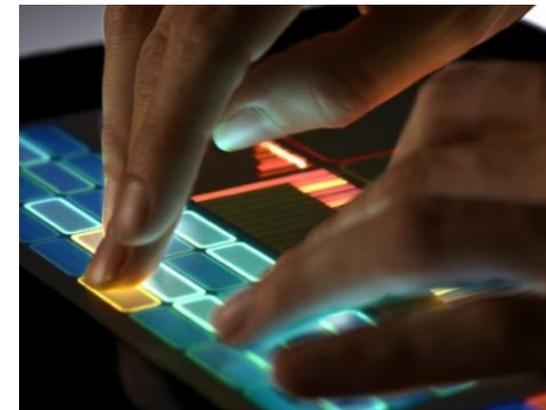
grands écrans



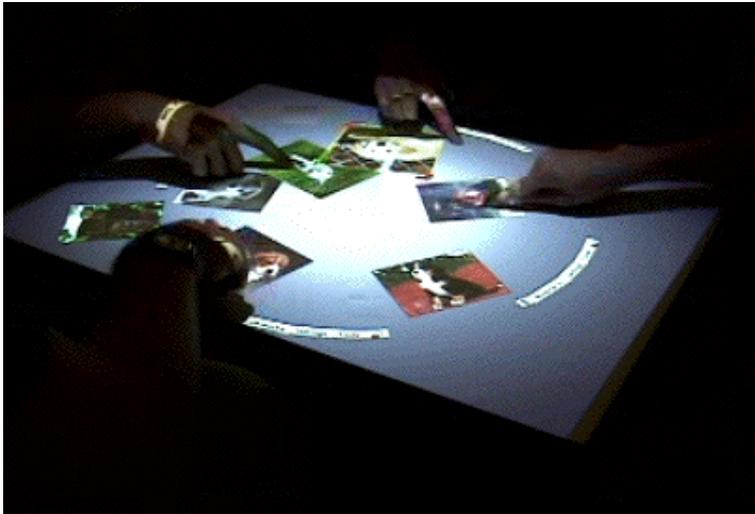
FTIR

Frustrated Total Internal Reflexion

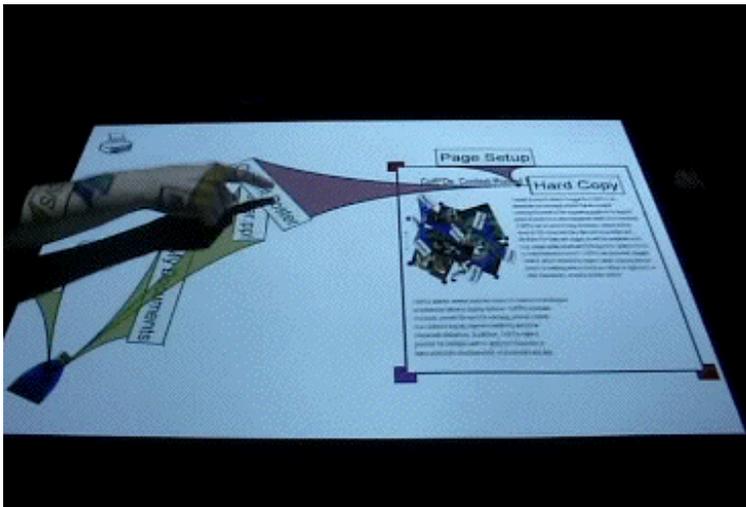
Jeff Han (NIU / Perceptive Pixels)



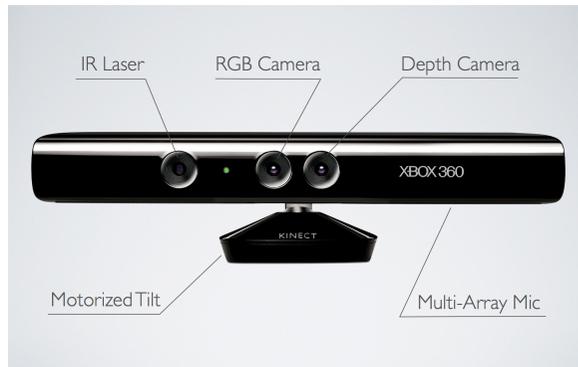
groupware, tables augmentées



DiamondSpin Java Toolkit
MERL tabletop



interaction 3D



Problématiques

- techno : analyse d'images / vision
- facteurs humains :
ergonomie (fatigue), acceptabilité,
vocabulaire, usages sociaux



interaction avec l'environnement

QR Codes or Visual Codes

Visual Code Widgets [Rohs 2004]

- camera phone as “see-through tool”

Sweep, Point and Shoot [Ballagas et al. 2005]

- the phone controls the screen



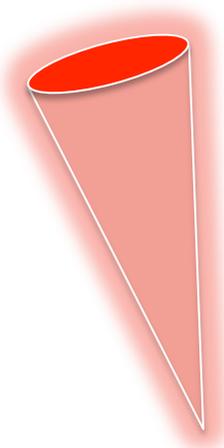
Pointer dans l'environnement



[Delamare, Coutrix, Nigay 13]



Alternative



Ray-Casting is
difficult to improve in
the physical world

Volume-based pointing
& disambiguation step

interaction proxémique

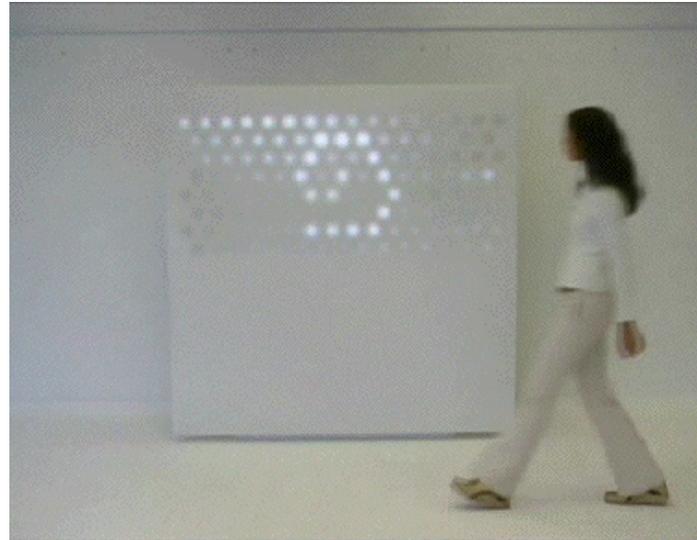
Continuously revealing more information while approaching the display



Proxemic interaction



interaction ambiante



Ambient Agoras

in-visible urban information



visualisation

The screenshot shows the homepage of the 'visual complexity' website. At the top, there is a navigation bar with links for Home, About, VC Book, Stats, Blog, Books, Links, and Contact. On the right side of the navigation bar, there are options to subscribe to latest projects via RSS and email, and social media icons for Twitter, Facebook, and LinkedIn. Below the navigation bar, the website logo 'visual complexity' is displayed on the left, and a search bar for the VC database is on the right. The main content area is divided into several sections: 'Latest Projects:' which features a grid of 24 thumbnail images of various network visualizations; 'Indexing 772 projects' which includes a 'Filter by:' dropdown menu set to 'SUBJECT' and a list of categories with their respective project counts (e.g., Art (62), Biology (52), Business Networks (29), etc.); a 'Buy now' button for the book 'visual complexity Mapping Patterns of Information'; a 'visual complexity aStore' banner; and a footer note about saving money using OldNavy Coupons.

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

Représentation temporelles

Gapminder

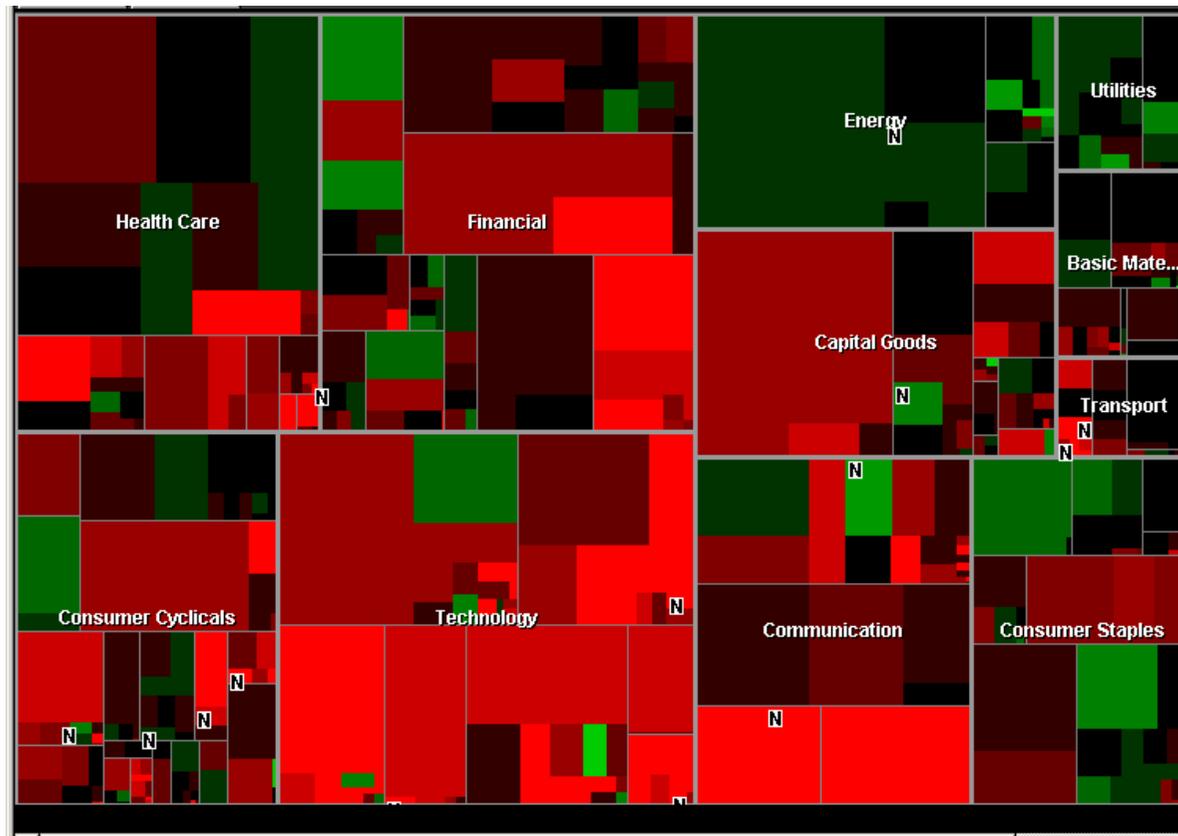


<http://www.gapminder.org>

<http://www.gapminder.org>

TreeMaps

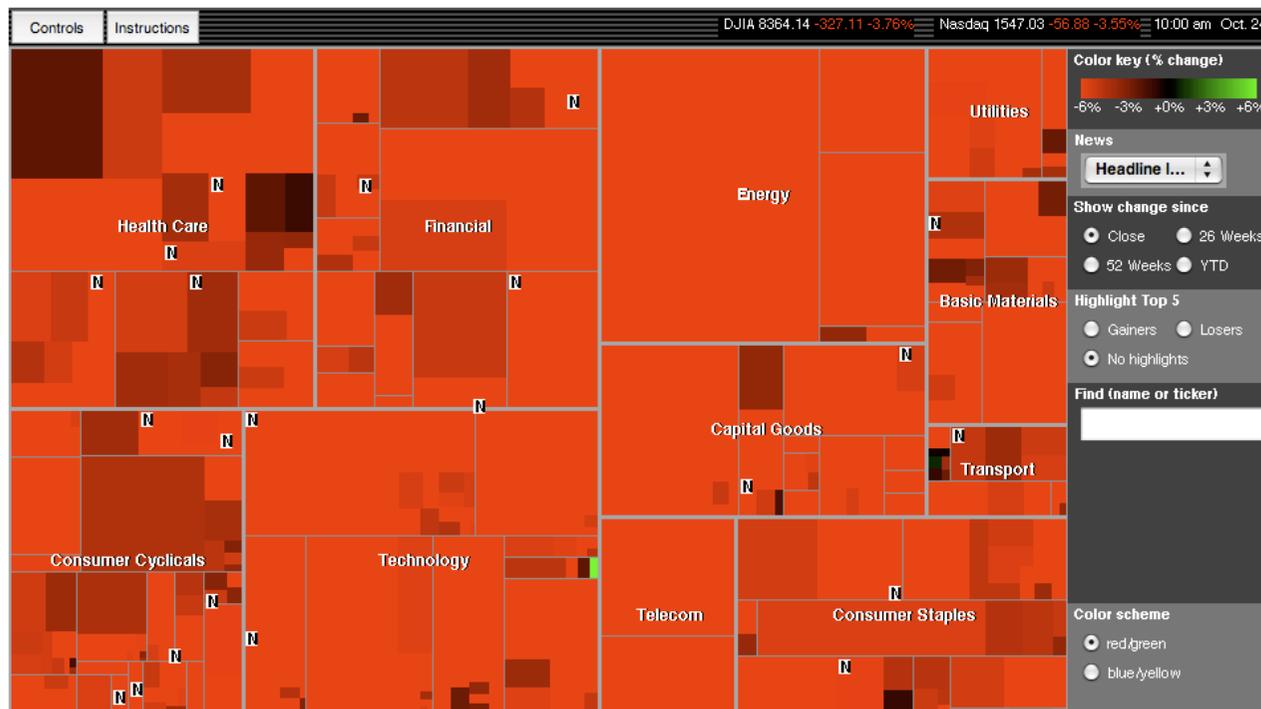
TreeMaps (Shneiderman et al.)



Map of the Market: <http://www.smartmoney.com/marketmap/>

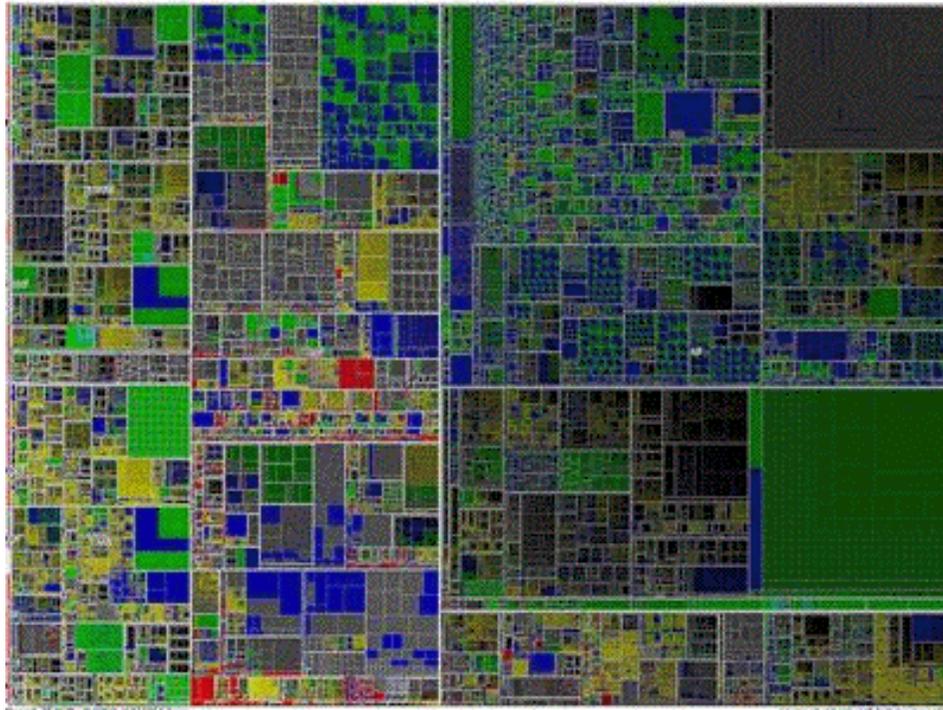
TreeMaps

Map of the Market

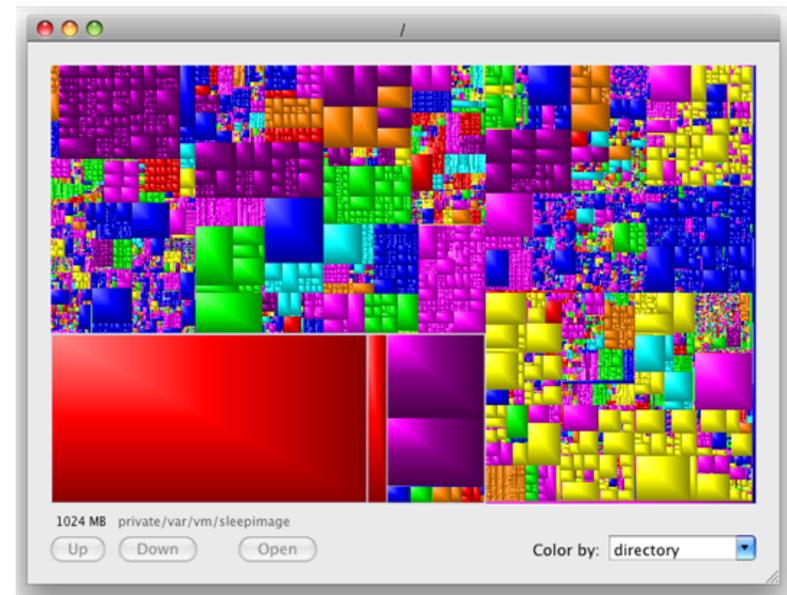


24 octobre 2008

TreeMaps



MillionViz (JD. Fekete)



Grand Perspective

Métaphores 3D

Task Gallery

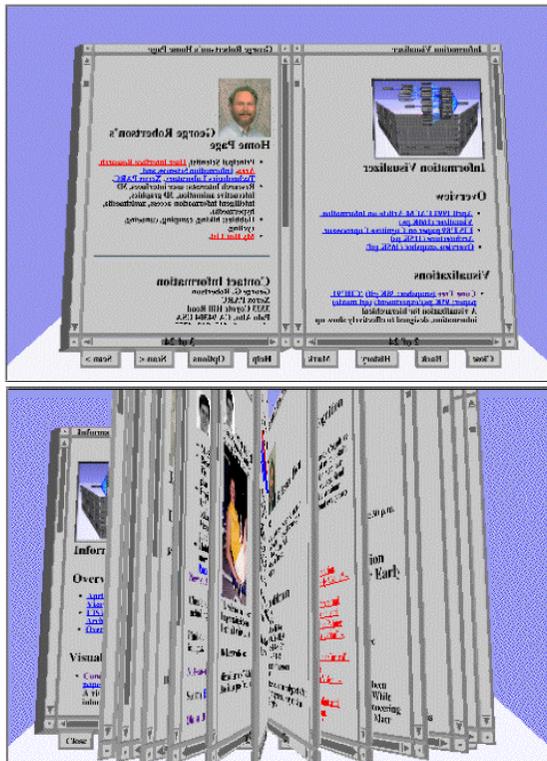
Web Book

Time Machine

Time Machine
Apple



WebBook
Xerox Parc



Robertson et al
Microsoft Research



Data Mountains

Alternative aux bookmarks hiérarchiques

Représentation pseudo 3D (plan incliné)

Interaction 2D (mapping y / z)

Exploite :

- mémoire spatiale (et des gestes)
- mémoire des objets
cf. Arts de mémoire

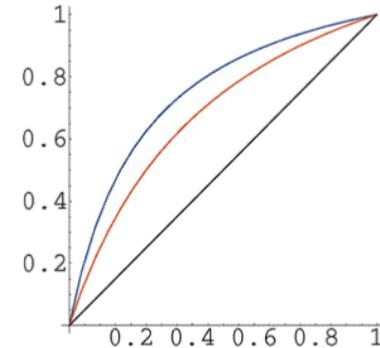


Robertson, Czerwinski, et al.
Microsoft Research

Fish eye géométrique

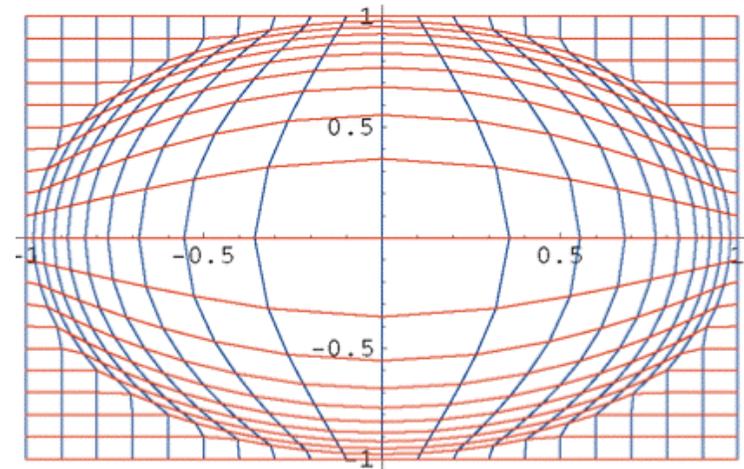
Approche

- déformation bi-dimensionnelle non linéaire continue
- imite l'effet des objectifs à très courte focale (fish eye, oeil de poisson)
- continuité spatiale de la représentation
- nombreuses variantes



Exemple de fonction

- Sarkar et Brown
 - $G(x) = (d+1) x / (d x+1)$
 - d : facteur de distorsion

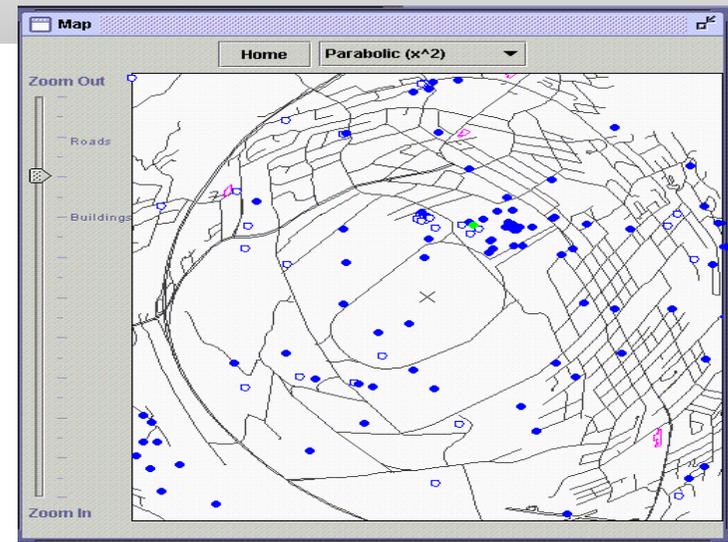


Fish eyes

Exemples

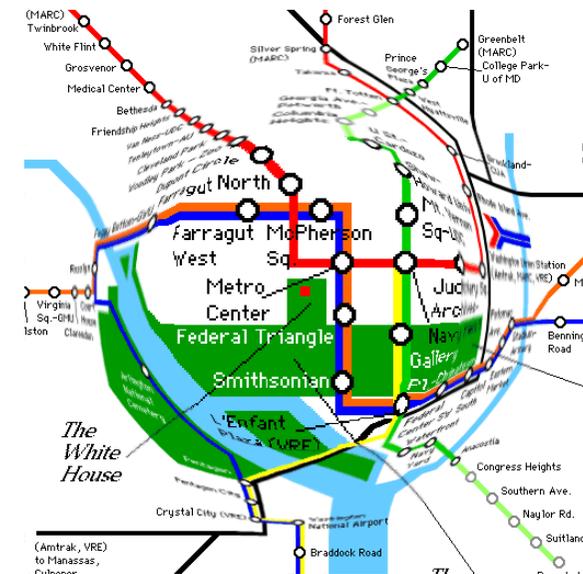
Moosburg (Schafer)

Transformation linéaire/non linéaire
contrainte à un domaine spatial
Keahey, Robertson, 1996



Inconvénient des fish eyes

- manque de lisibilité dans la zone de distorsion
- plus ou moins brutale selon technique
- texte particulièrement illisible



Vues hyperboliques

Approche

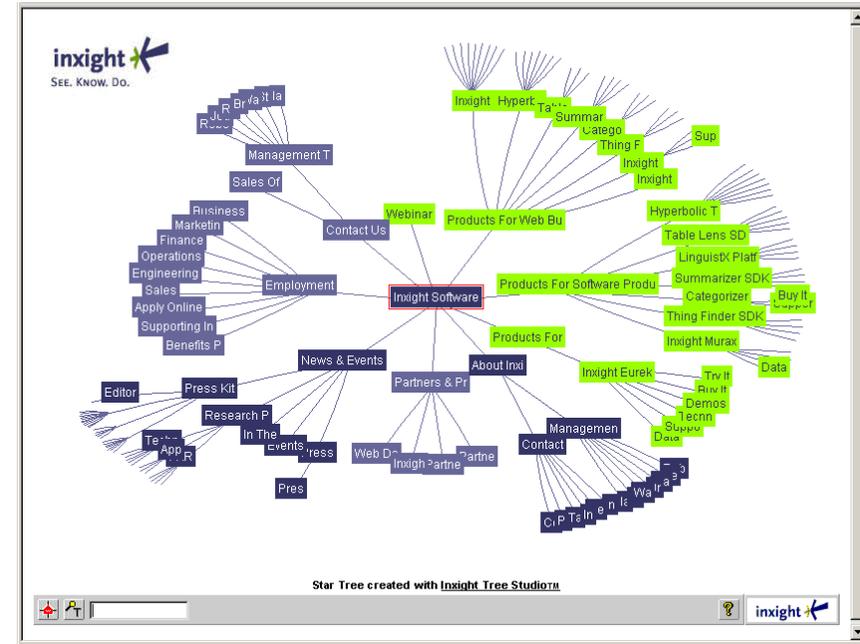
- effet ressemblant au fish eye
- pour représenter des arbres

Géométrie hyperbolique

- géométrie non euclidienne (« 5e postulat » non vérifié)
- mapping entre l'espace hyperbolique et l'espace euclidien (modèles de Poincaré ou de Klein)

Principe

- disposer l'arbre dans le plan hyperbolique
- puis mapping sur un disque

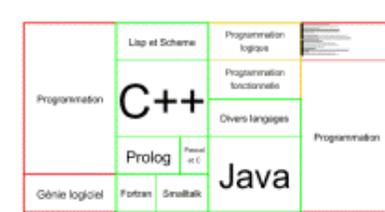
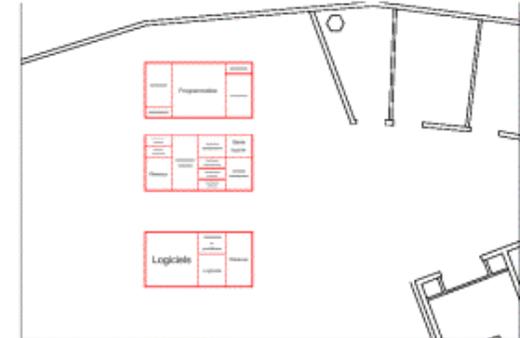


Lamping et al
(cf. également Munzer)

Zoom sémantique

Approche

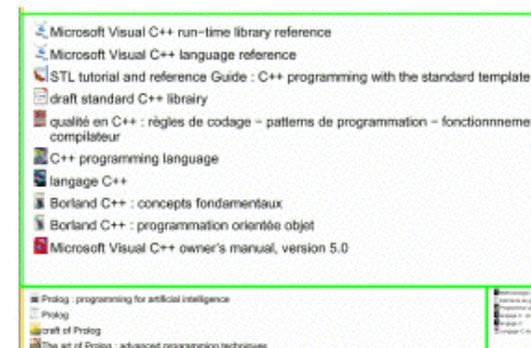
- zoom géométrique **et** logique
- la représentation change en fonction du niveau de zoom
 - **donc** du degré d'intérêt de l'utilisateur
- le zoom devient une **technique de navigation** dans un espace 2+1D
 - 3e D = niveau de détail



Principe

- **multiplexage temporel** + fish eye logique
- (pas du focus+context à proprement parler)

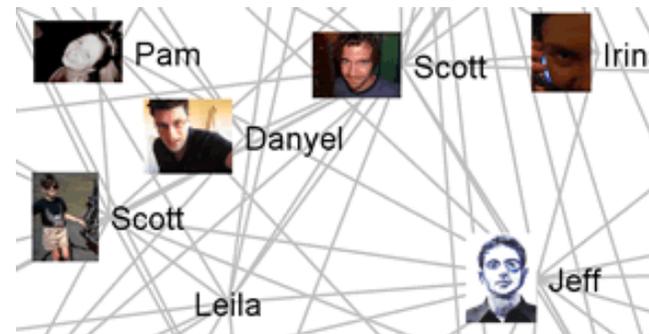
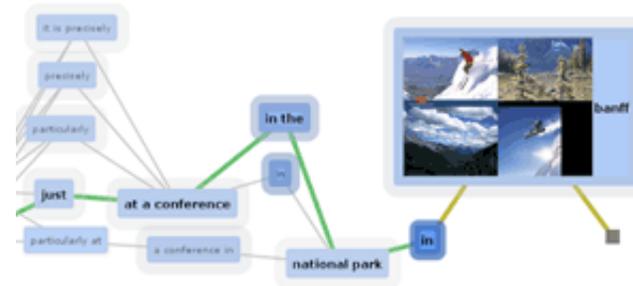
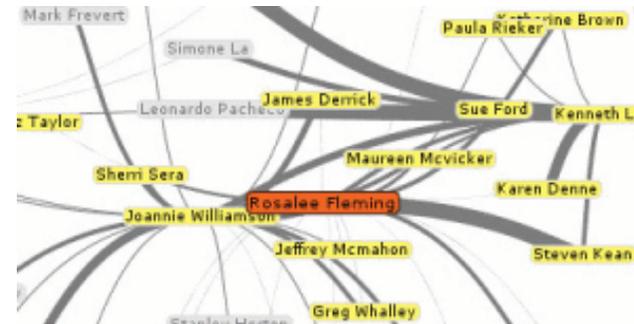
Zomit (Pook, Lecolinet)



Démo Treeviz

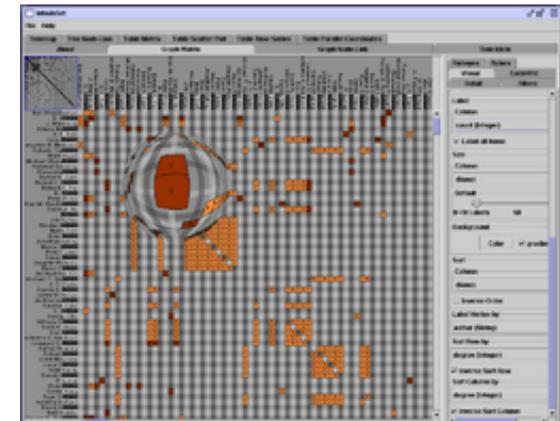
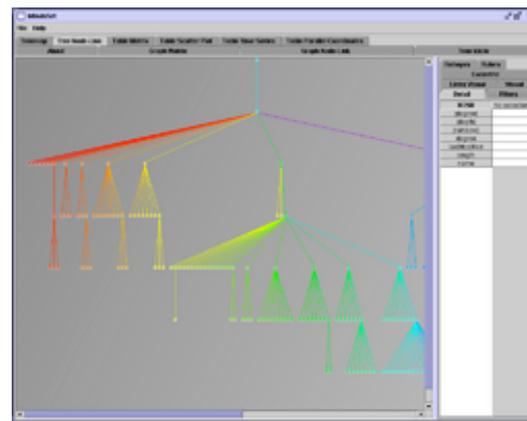
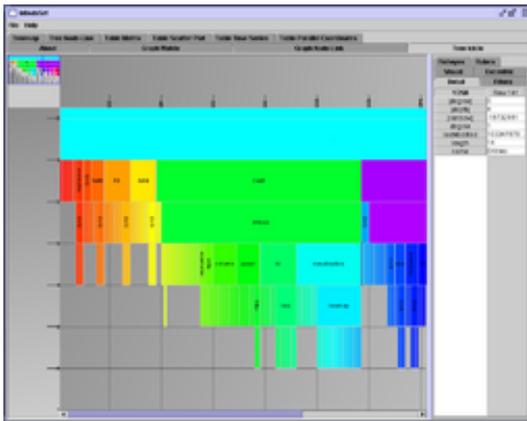
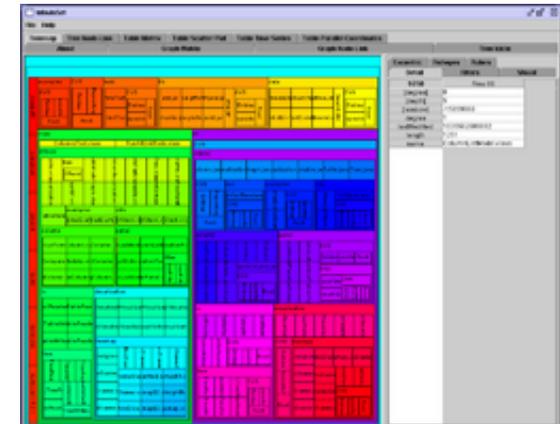
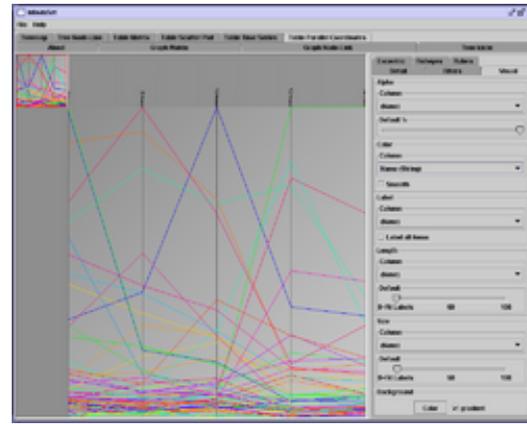
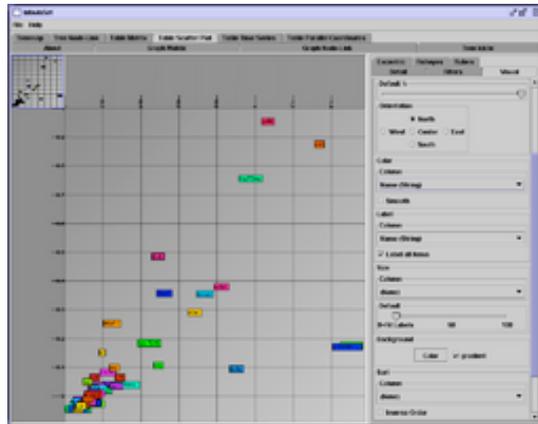
Toolkits pour la visualisation

Prefuse (Heer et al.)



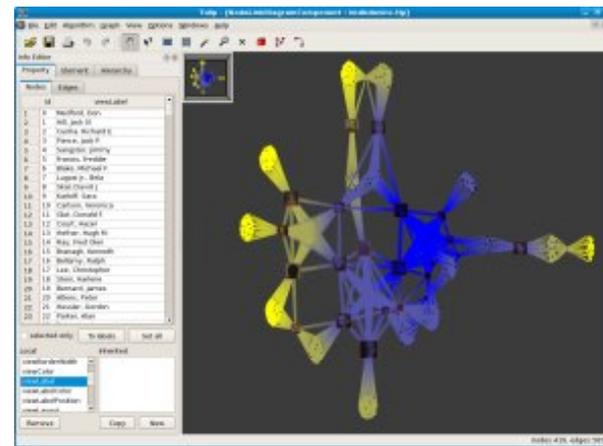
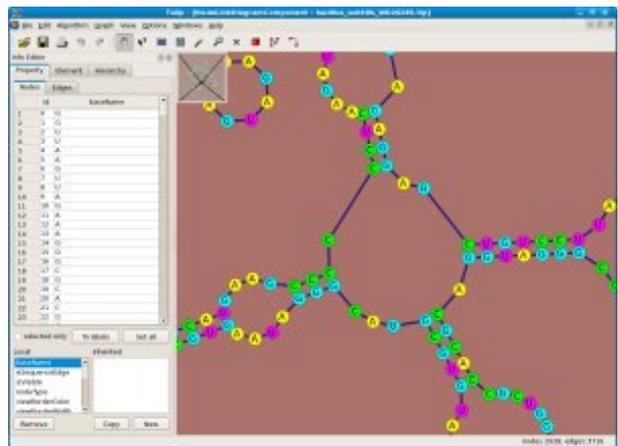
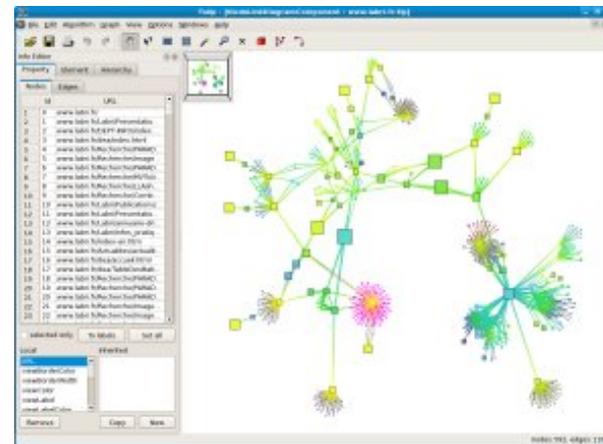
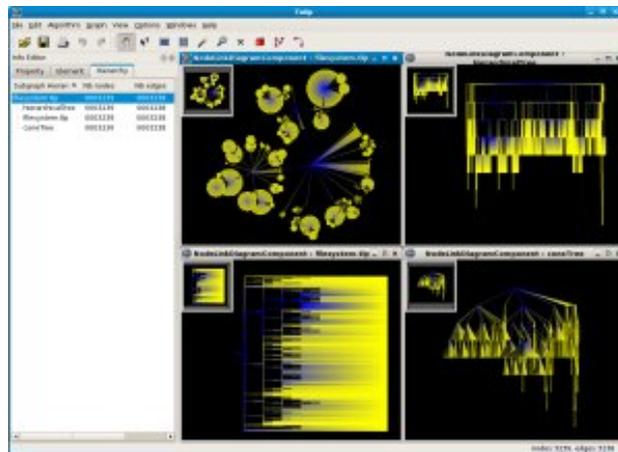
Toolkits pour la visualisation

Infovis Toolkit (J-D. Fekete, INRIA)



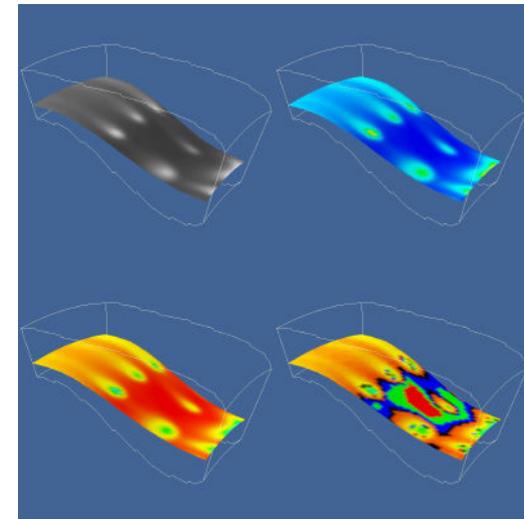
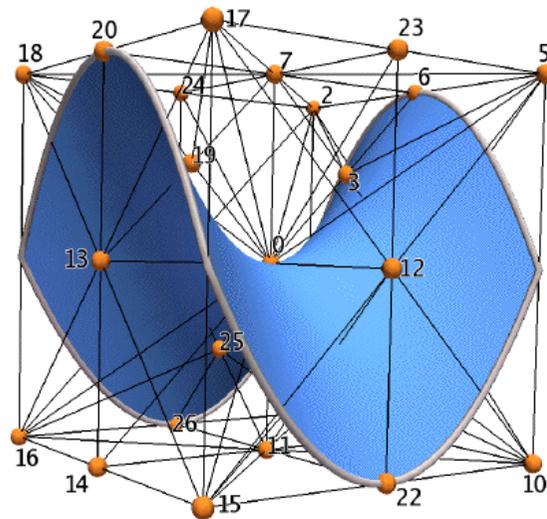
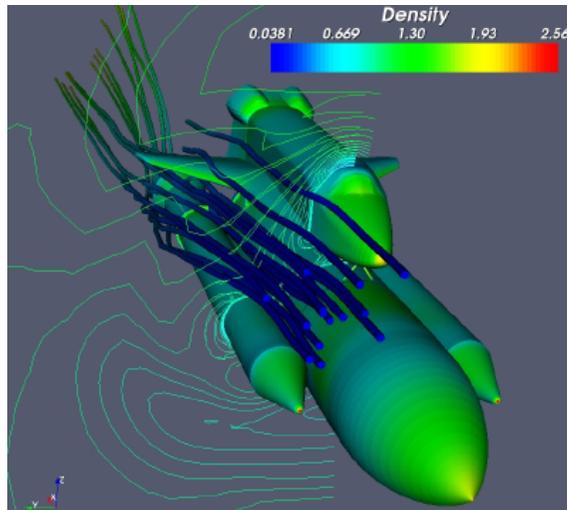
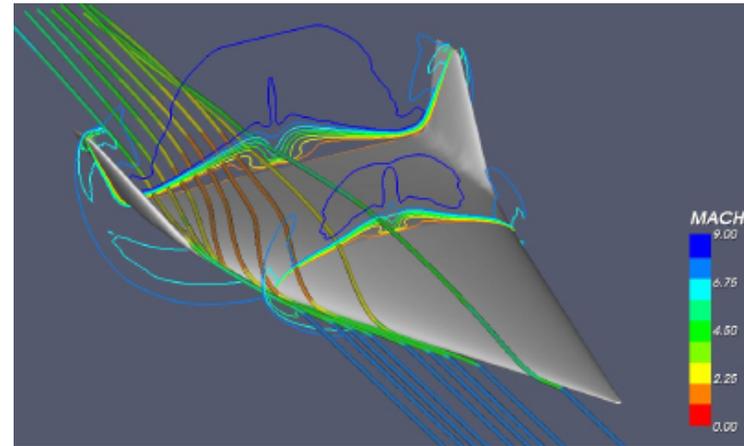
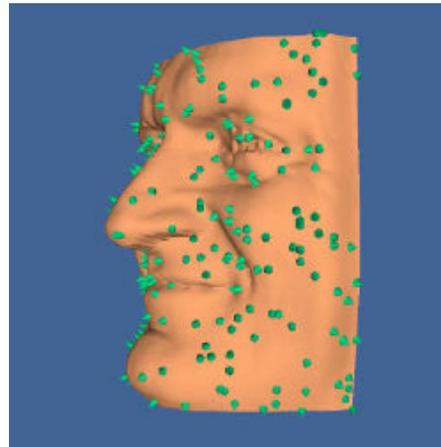
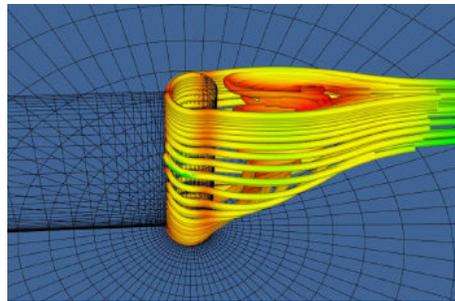
Toolkits pour la visualisation

Tulip (D. Auber, Labri)



Toolkits pour la visualisation

VTK



Quelques références

Livres, articles, tutoriels

- Readings in Information Visualization, *Card, Mackinlay, Shneiderman*
- The display of quantitative data, *Tufte*
- Sémiologie graphique, *Bertin*
- Information Visualization: Perception for Design, *Colin Ware*
- Graph Visualization and Navigation in Information Visualization : A Survey, *Herman, Melançon, Marshall*, IEEE trans on visualization and computer graphics
- Visualisation interactive d'information, *M.Hascoët, M.Beaudouin-Lafon*, revue I3 (en ligne sur le Web)

Web

- Google en entrant les noms indiqués sur les transparents de ces cours ...
www.infres.enst.fr/~elc -> zomit
- otal.umd.edu./Olive
- people.cs.vt.edu/~north/infoviz/
- graphics.stanford.edu/courses/cs348c-96-fall/resources.html
- www.sims.berkeley.edu/courses/is247/s98/lectures.html
- www.limsi.fr/Individu/jacquemi/IRI-TR/menu-visu.html