



UMR 5205 CNRS

2D, 3D, 4D, ... Interfaces avec le territoire

Gilles Gesquière

Laboratoire d'InfoRmatique en Image et Systèmes d'information

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INSA

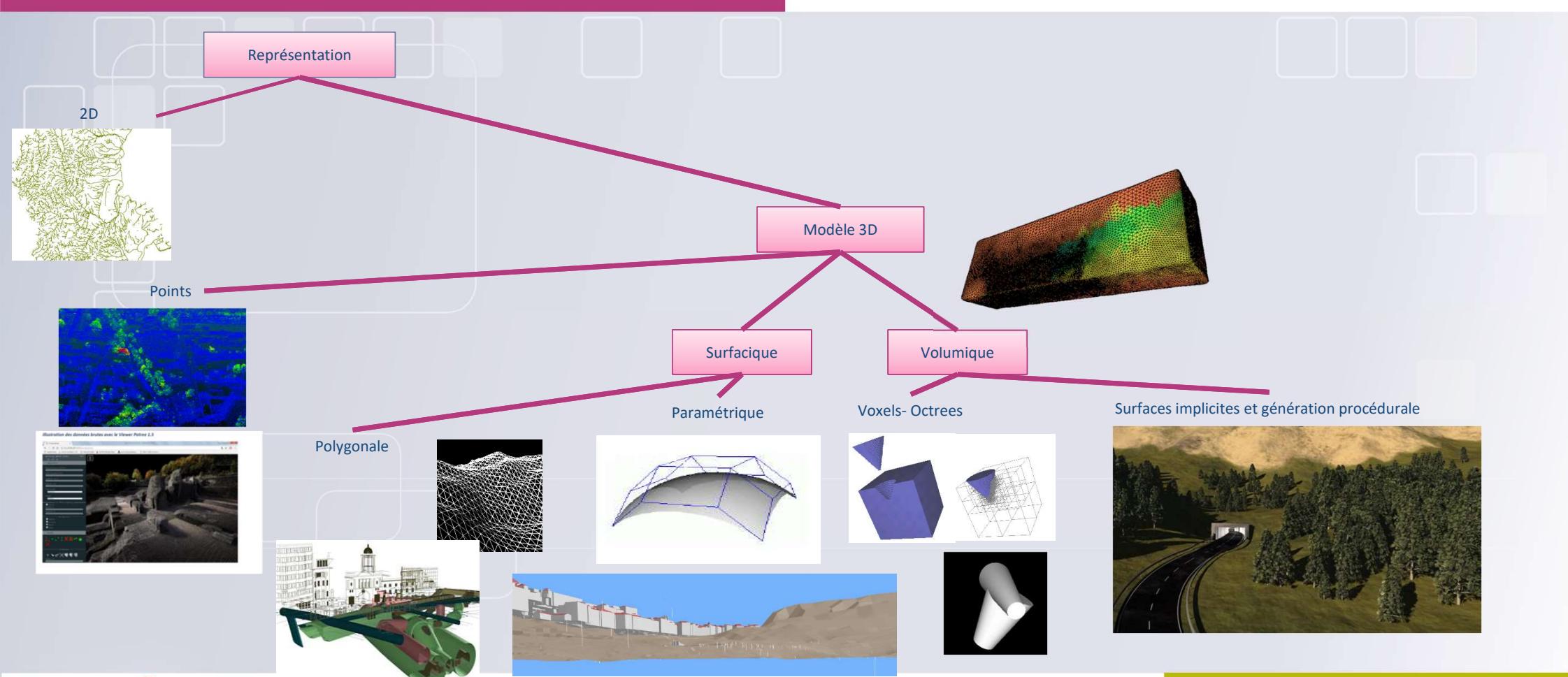


Gilles Gesquière- Courte bio



- Professeur à l'Université Lumière Lyon 2- France – Chercheur au LIRIS UMR CNRS 5205
- Brève orientation de la recherche
 - Sciences des données (avec un accent sur les données 3D)
 - Représentations et dynamiques de la ville
 - Échange de données, interopérabilité, normalisation (travaux au sein de l'OGC et de l'ISO TC/211)
- 2022 : Co-porteur du Programme PEPR VDBI (Programmes de Recherche Prioritaires et Equipements de la Stratégie Nationale d'Accélération « Solutions pour la ville durable et les bâtiments innovants »)
- 2016-2023 : Directeur du LabEx IMU (cluster français de laboratoires travaillant sur les Mondes Urbains)
 - <http://imu.universite-lyon.fr/>
- Responsable du projet de recherche Vcity au LIRIS
 - <https://projet.liris.cnrs.fr/vcity/>
- Leader de la plateforme logicielle UD-SV
 - <https://github.com/VCityTeam/UD-SV/>

Géométries 2D et 3D...



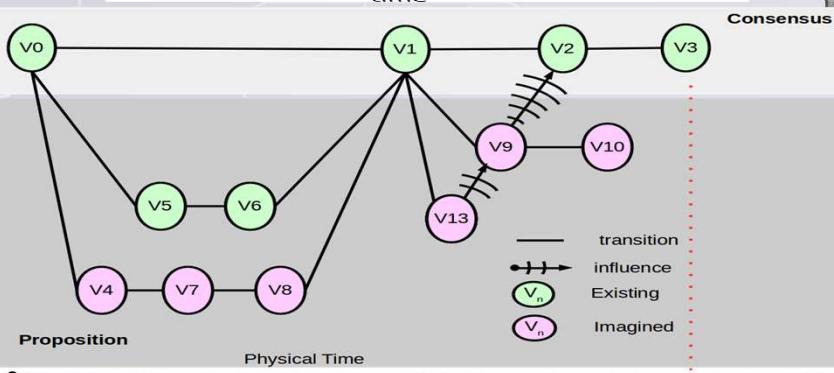
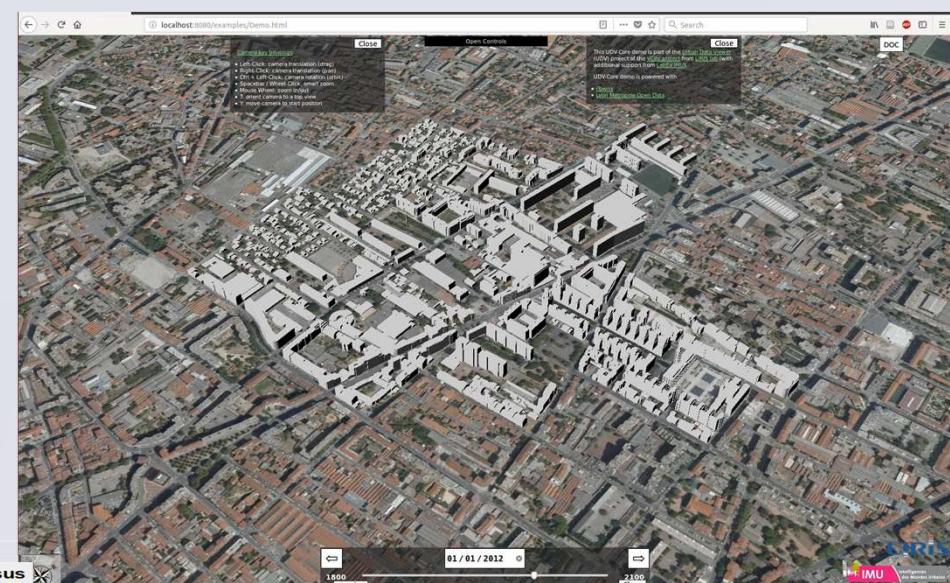
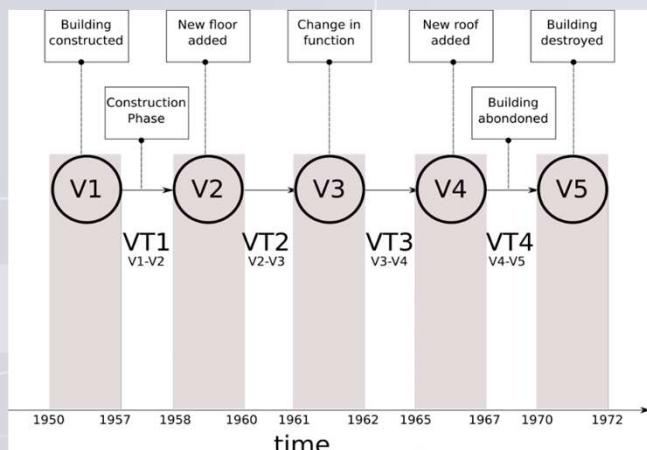
De la 3D vers la 4D : Visualisation et navigation 4D



De la 3D vers la 4D : Cycle de vie de la ville

Evolution de la ville au cours du temps

- Villes concurrentes
- Apporter des informations justificatives aux changements

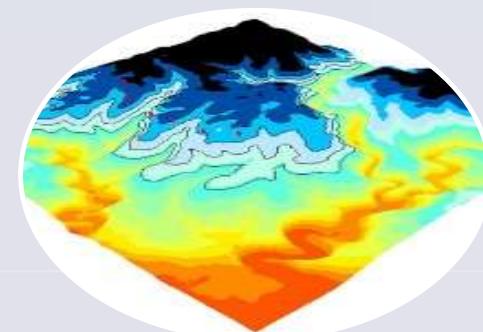
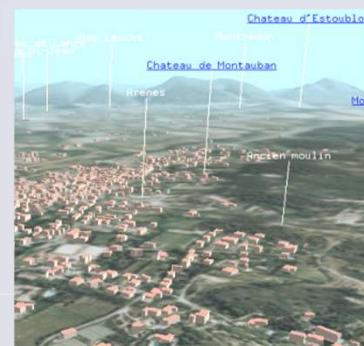


- Morel et al 2014, Chaturvedi et al 2016, Périnaud et al 2015, Samuel et al 2018
- Standard CityGML 3.0
- Samuel et al 2020
- Puget 2023, 2024

Géométrie + temps et sémantique

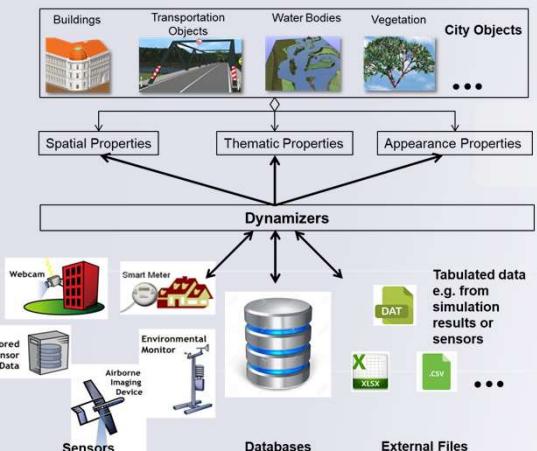
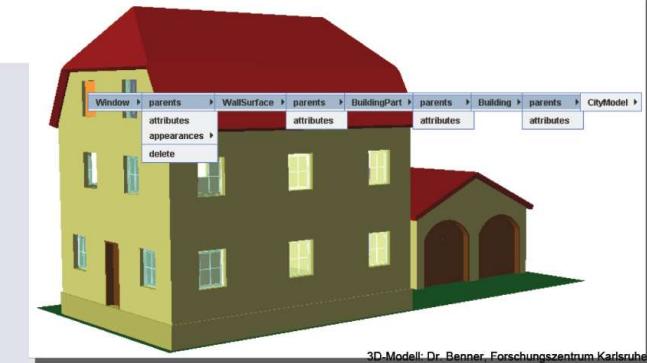
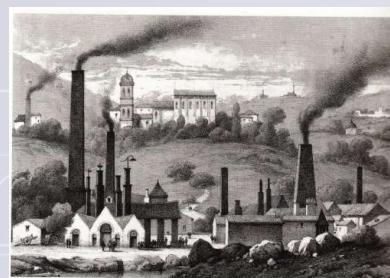
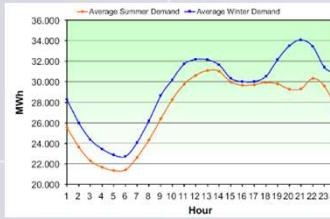
■ Place importante pour la sémantique

- Réseau routier
- Mailles et nœuds, et mesures physiques liées (température, ...)



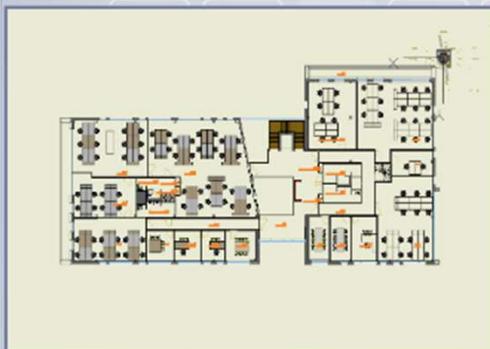
Géométrie + temps + sémantique et Objets composés, mais aussi liés à d'autres ressources

- Quels objets ?
- Quelle hiérarchie entre objets ?
- Liens entre les objets ?
- Informations liées à ces objets ?



Extrait K. Chaturvedi, Dynamizer, 2018

Multireprésentation d'un même espace



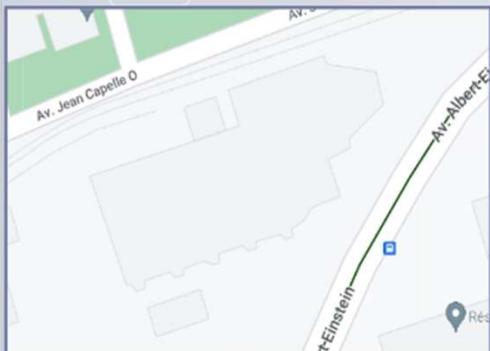
Plan 2D DWG



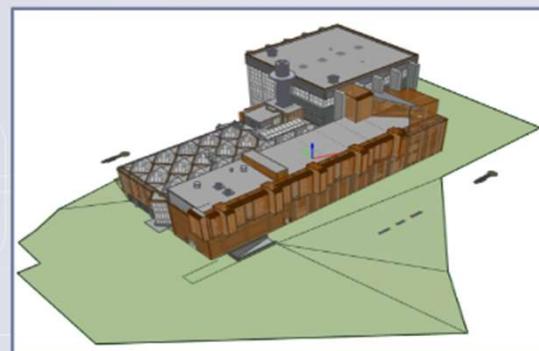
Géométrie 3D CityGML



Multimédia



Géométrie 2D Google Map



Géométrie 3D IFC

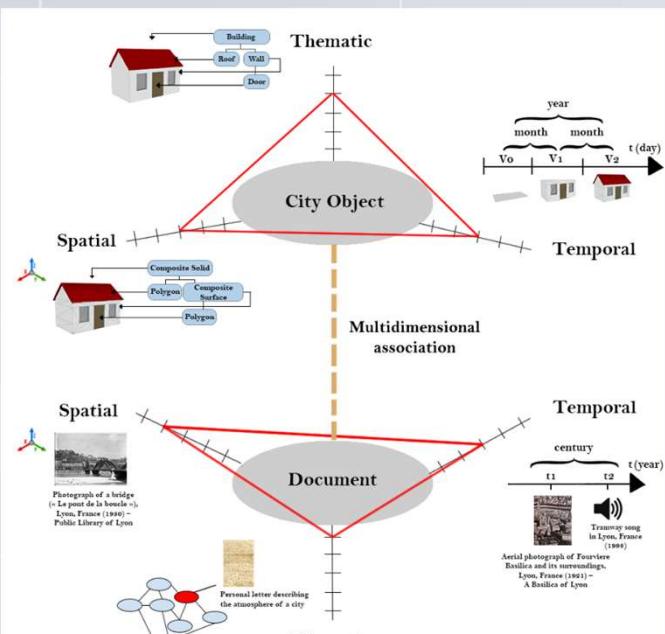
Element Specific	
FileName	ifc_doua.ifc
Guid	0AhY_q3Qr4ZgkcnSHCY\$2
IfcEntity	IfcProject
LongName	Nom du projet
Name	Numéro du projet
Phase	Etat du projet
File Header	
Description	ViewDefinition [CoordinationView_V2.0]
Implementation Level	2;1
Originating System	20160225_1515(x64) - Exporter 17.0.416
Preprocessor Version	The EXPRESS Data Manager Version 5.02.0
Schema Identifiers	IFC2X3
Time Stamp	2018-12-05T12:45:06

Données Sémantiques IFC

4D+ et multi-échelle : Continuum BIM-GIS



4D+ média



Travaux de Jaillot, Rigolle 2021

<https://projet.liris.cnrs.fr/vcity/>

Modalités d'intégration des données dans un même contexte

The screenshot illustrates the UD-Viz interface, which integrates document navigation, geolocated 3D city objects, and document inspection.

Document - Navigator: Navigate in **n** documents

Geolocated 3D city objects: Navigate in **n** city objects

Document - Inspector: Navigate in **one document** and in its links

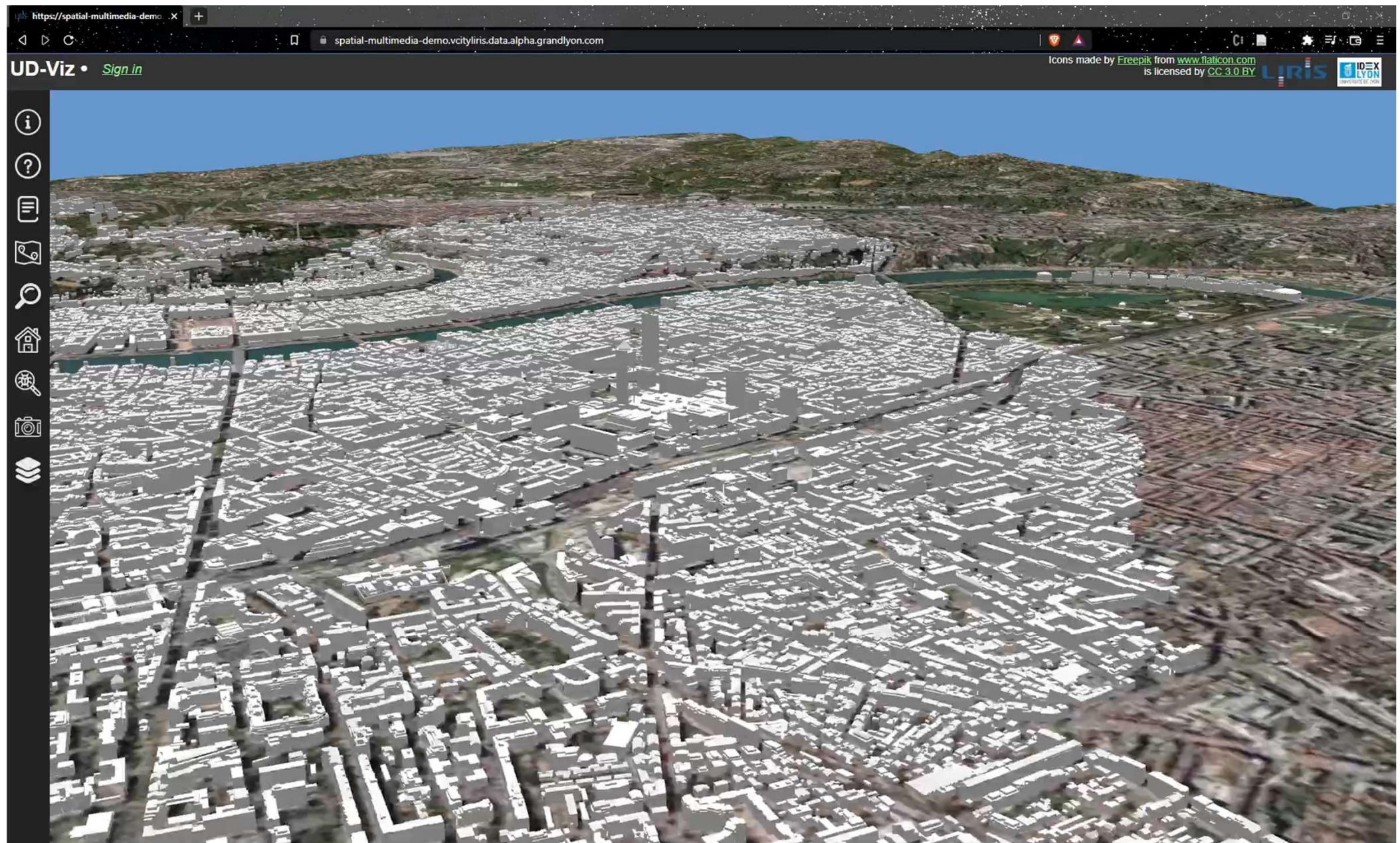
City objects: Navigate in **one city object** and in its links

City object links

Document links

The interface features a central 3D city model of Lyon. On the left, the "Document - Navigator" sidebar lists 16 documents, including historical photographs and aerial views. Below it, the "City Objects" sidebar shows selected attributes and a list of 3 linked documents. A red box highlights the "3 linked documents(s)" section. Red arrows point from this section to the "City object links" label and the "Document links" label at the bottom.

The right side displays the "Document - Inspector" window for a specific document titled "Photographie réfectoire des hospitalières". It shows a thumbnail of the photograph, details about the photo (date, publication date, source), and a "Document Links" section. A red box highlights the "Document Links" section, and a red arrow points from it to the "Document links" label at the bottom.

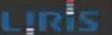


https://spatial-multimedia-demo... X

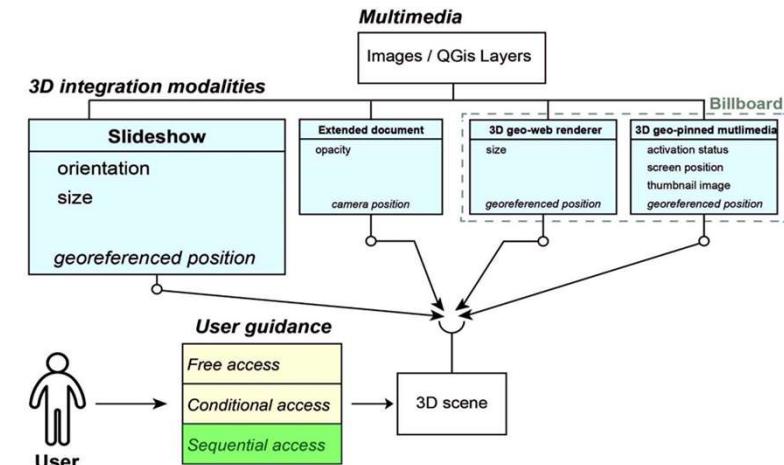
spatial-multimedia-demo.vcityliris.data.alpha.grandlyon.com

UD-Viz • [Sign in](#)

Icons made by [Freepik](#) from [www.flaticon.com](#)
is licensed by CC 3.0 BY

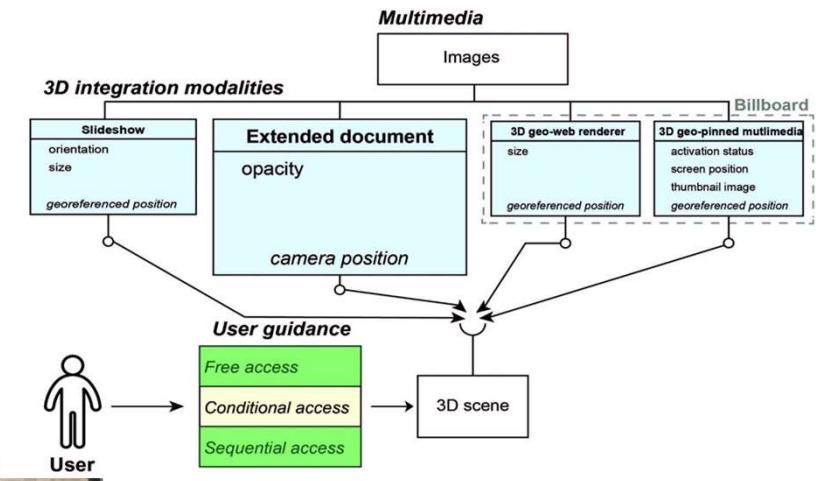
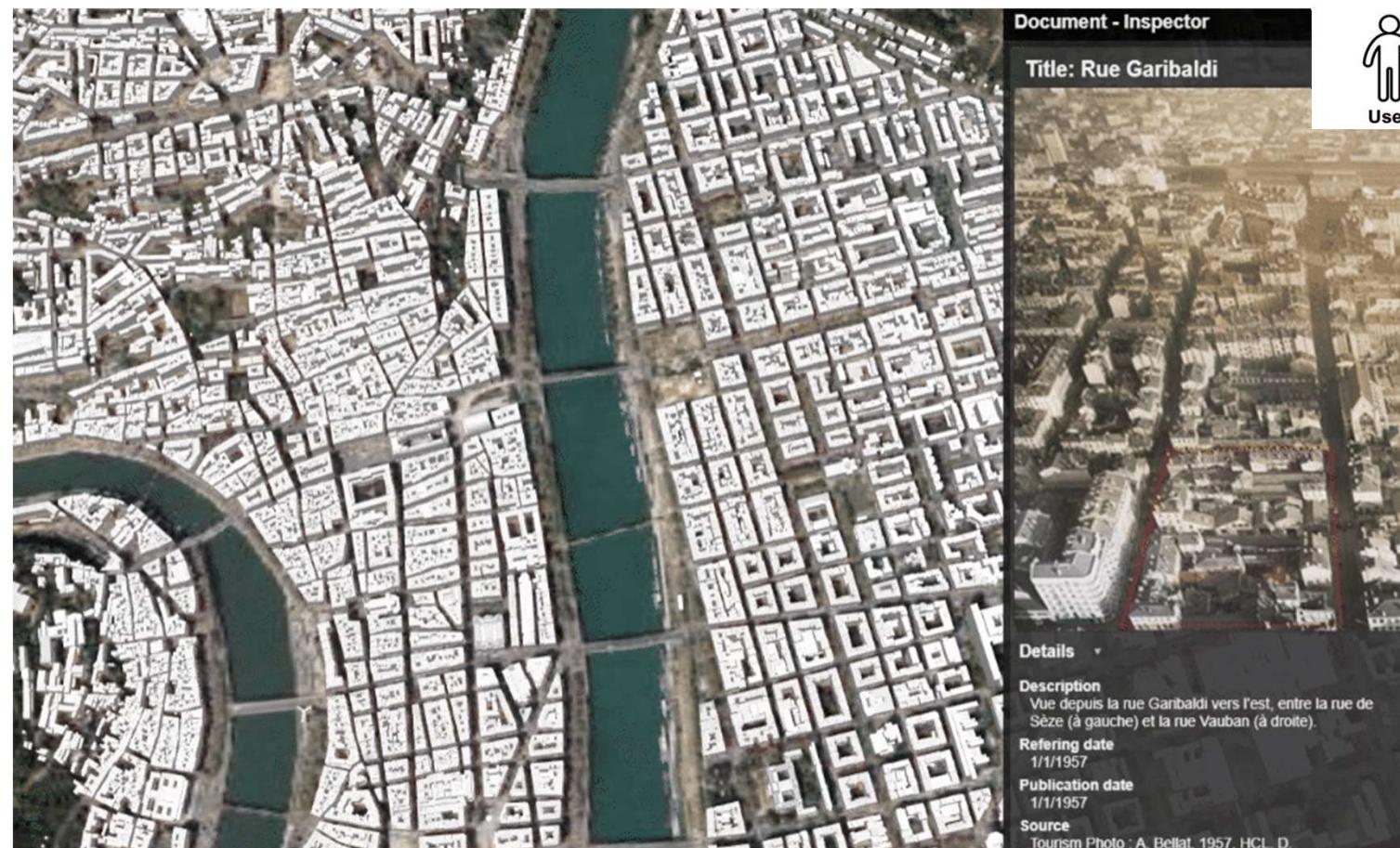


Providing contents or devices to un



“Derrière les fumées”: web documentaire interactif sur le territoire de la vallée de la chimie (Lyon) C. Gautier

Extended document

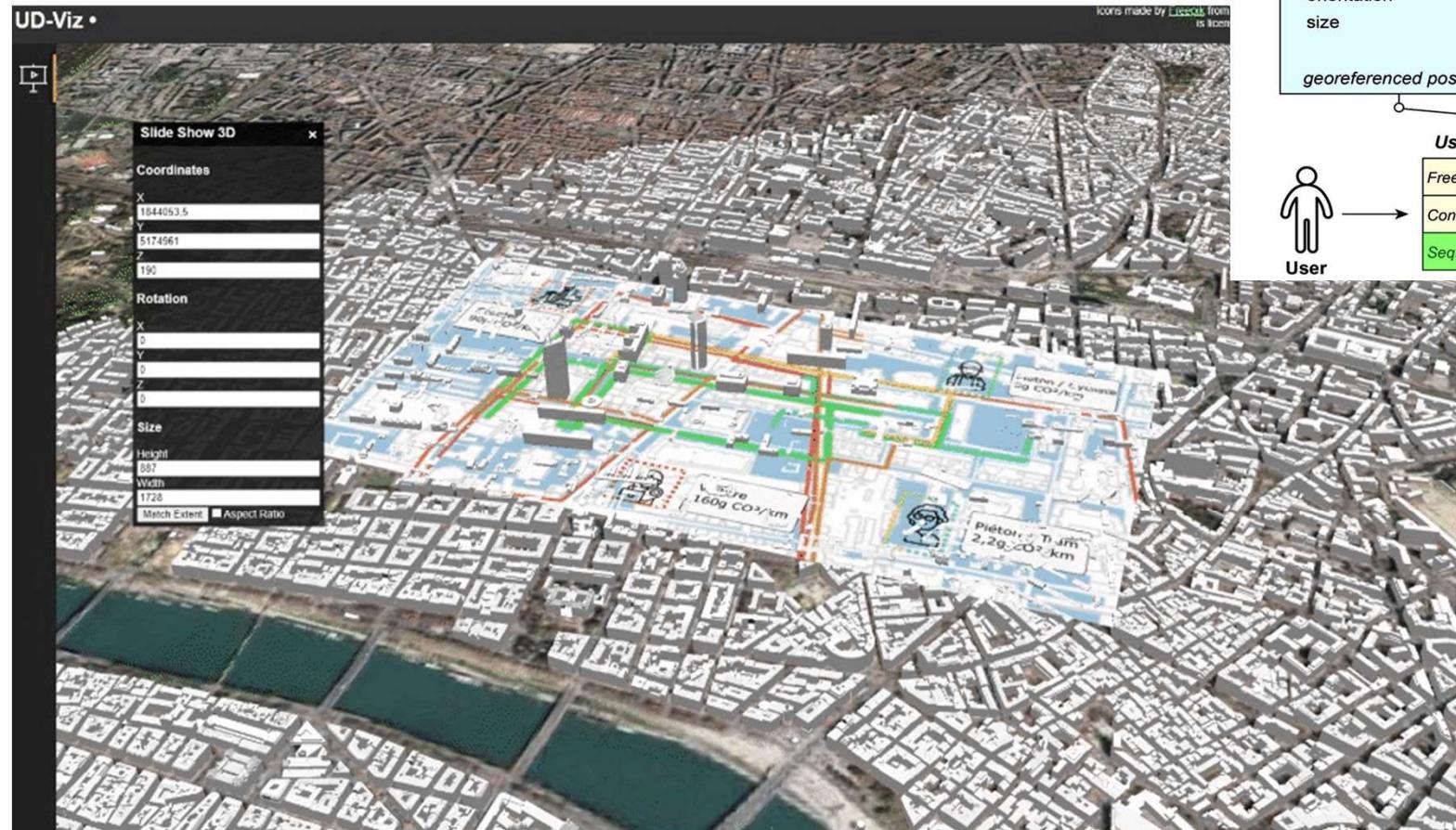


Multimedias: Pictures

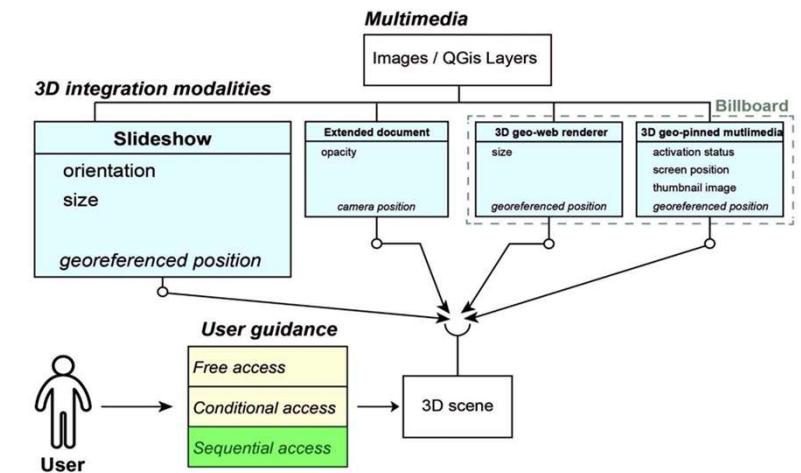
This makes it possible to compare the geometry of the buildings with the current state and the archive images

Enhancing by a guided tour that gives a logical flow of documents

SlideShow



C. Gautier



Multimedias: Pictures

Qgis layers (2D carto) can be integrated in the SlideShow

Guided Tour – Démonstration



L'avènement de la grosse mécanique

Dans un contexte de fragilisation de la filière de l'acier en raison de l'assèchement des commandes ferroviaires, une grande part du tissu se reconvertis dans la grosse mécanique dans l'entre-deux-guerres, notamment dans les années qui suivent la crise de 1929.

Les *Fonderies et Forges de l'Horme* sont représentatives de cette évolution. Elles ferment en 1929 pour être aussitôt racheté par les **Acieries du Nord**, un important groupe français de mécanique générale. Entre 500 et 600 personnes travaillent dans les ateliers de l'Horme désormais spécialisés dans la maintenance mécanique du matériel roulant de la compagnie de chemin de fer PLM puis au sortir de la seconde guerre mondiale dans la **production de tracteurs et machines agricoles**. L'établissement intègre alors le groupe Richier spécialisé dans les machines agricoles et de travaux publics.

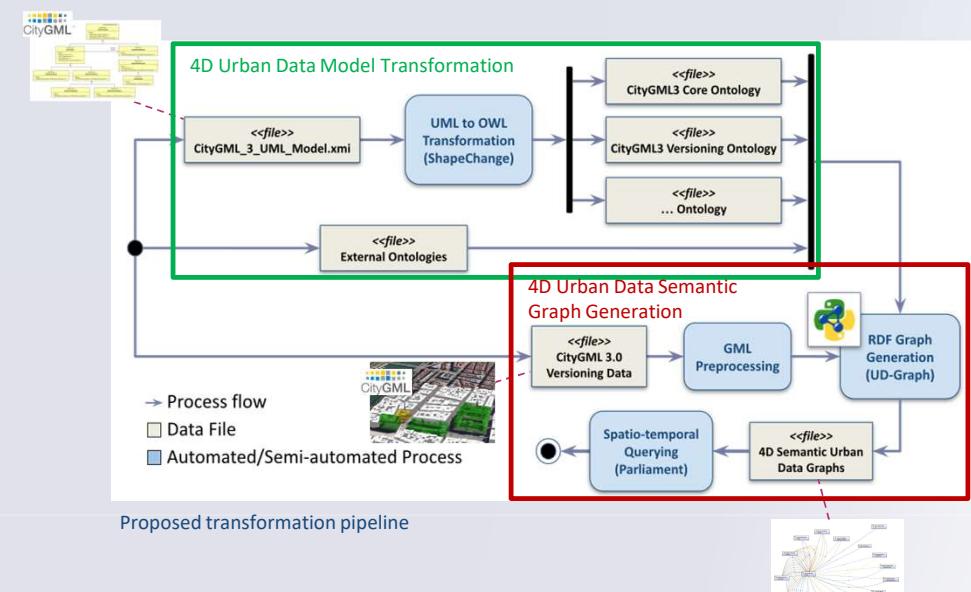


Travaux de C. Périnaud et L. Marnat

Geometry, but also semantic...

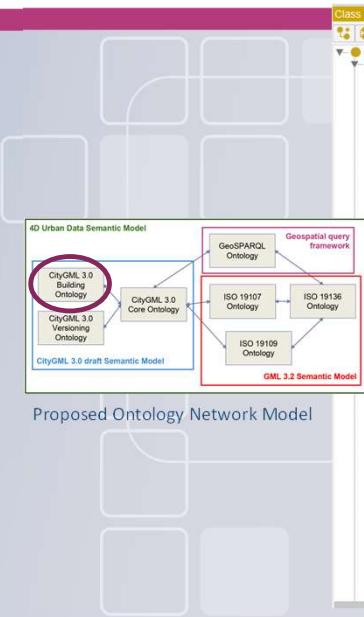
Proposition : limiting loss of data : based on a model centric transformation of data.

- 4D urban data model transformation
 - UML to OWL (Web Ontology Language) based on ISO19150-2
- Generation of a semantic graph
 - RDF
 - Possible fusion with other graph and adding global queries

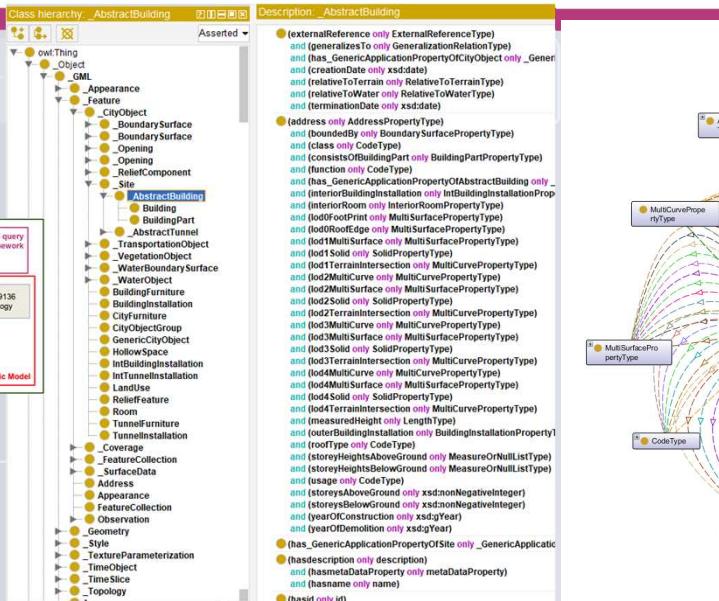


Travaux de D. Vinasco et V. Jaillot

Data integration



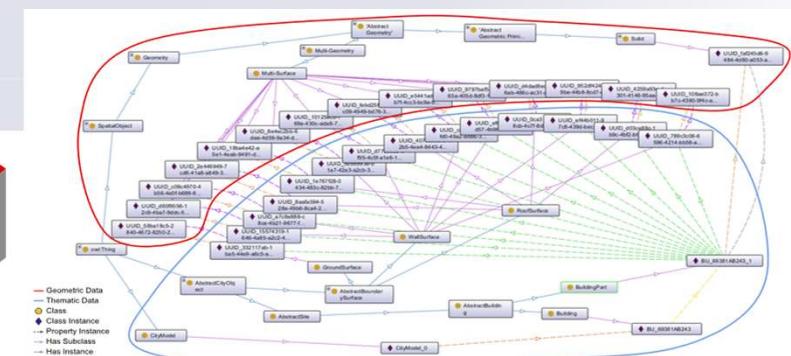
Visualization of CityGML 2.0 Building module: AbstractBuilding class and related properties with Protégé²



Visualization of CityGML 2.0 Building module: AbstractBuilding class and related classes with OntoGraph¹

1. <https://protegewiki.stanford.edu/wiki/OntoGraf>
 2. <https://protege.stanford.edu/>

Travaux de D. Vinasco





UMR 5205 CNRS

Enrichir le territoire par croisement de données

Laboratoire d'InfoRmatique en Image et Systèmes d'information



INSA



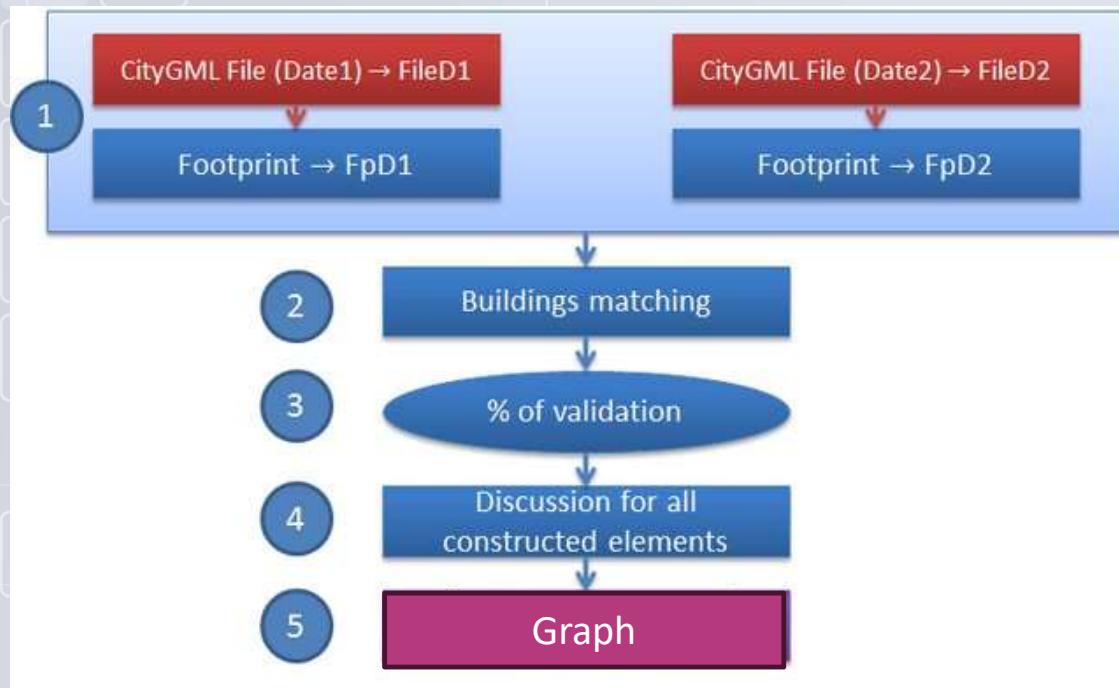
UNIVERSITÉ
LUMIÈRE
LYON 2

G. Gesquière



Détection de changements

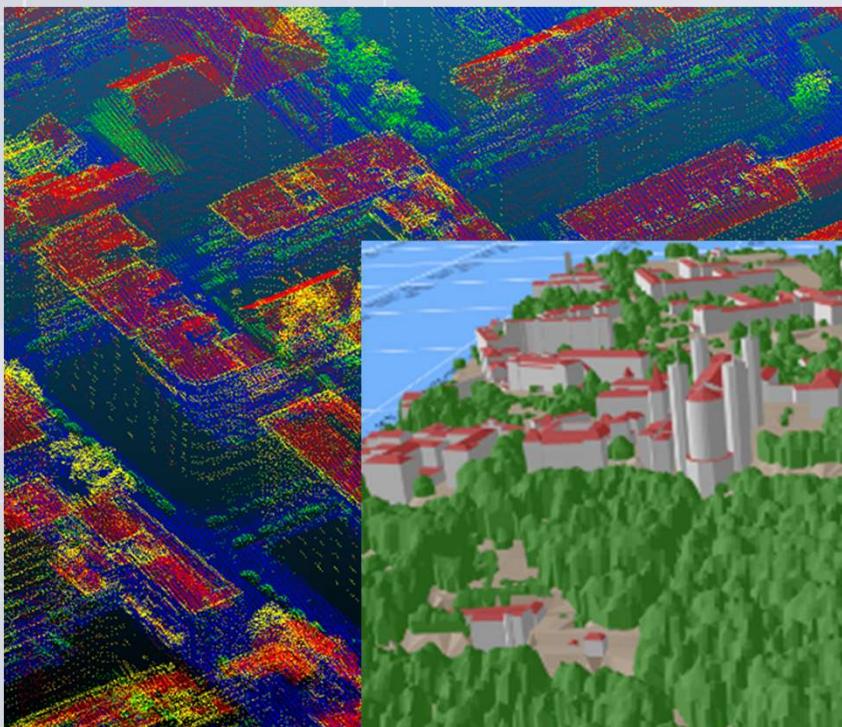
A partir de millésimes



Travaux de F. Pedrinis, E. Boix

Créer de nouvelles données 2D/ 3D

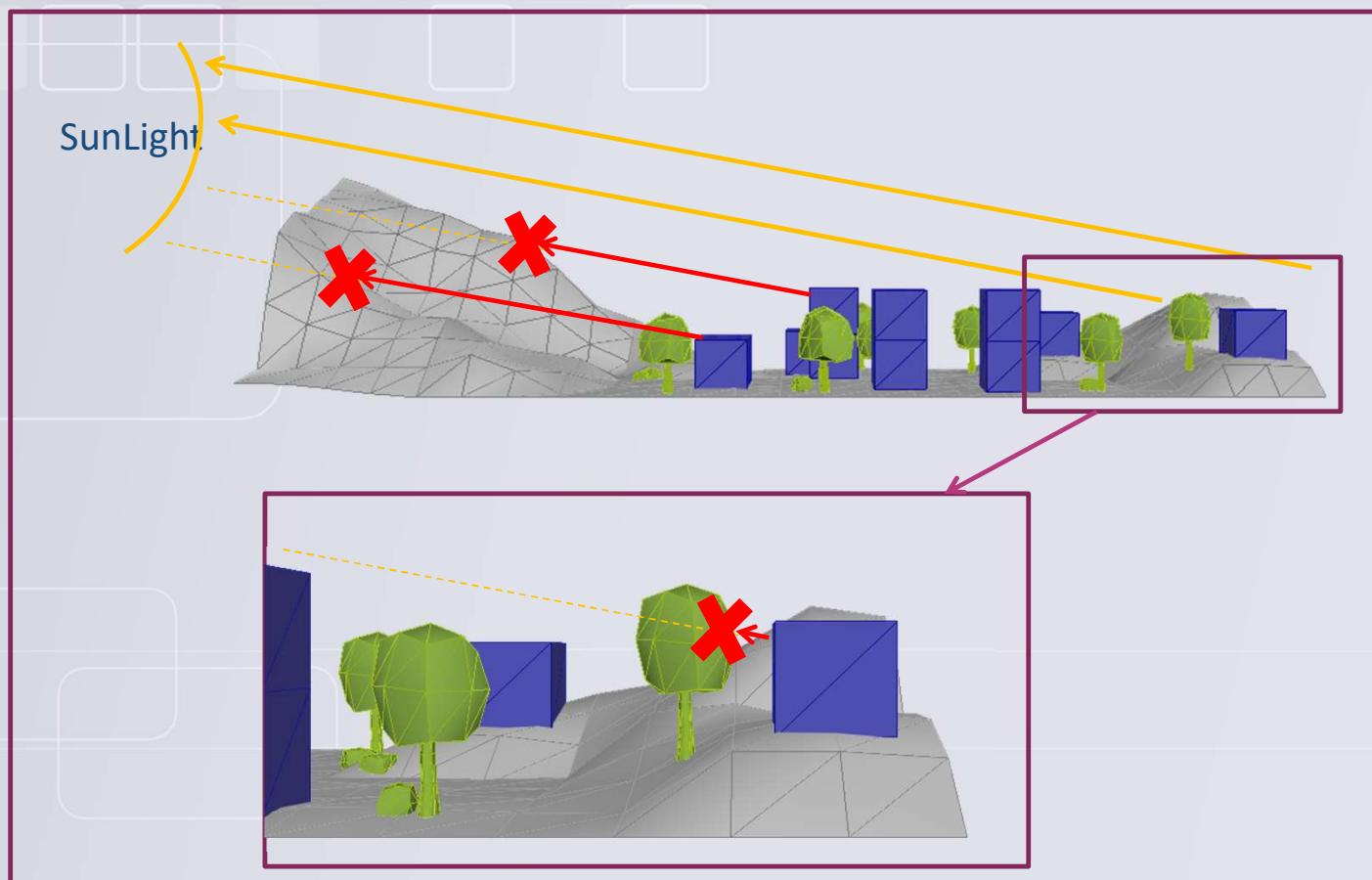
3D aerial point clouds.



Infrared orthophographies (IRC).

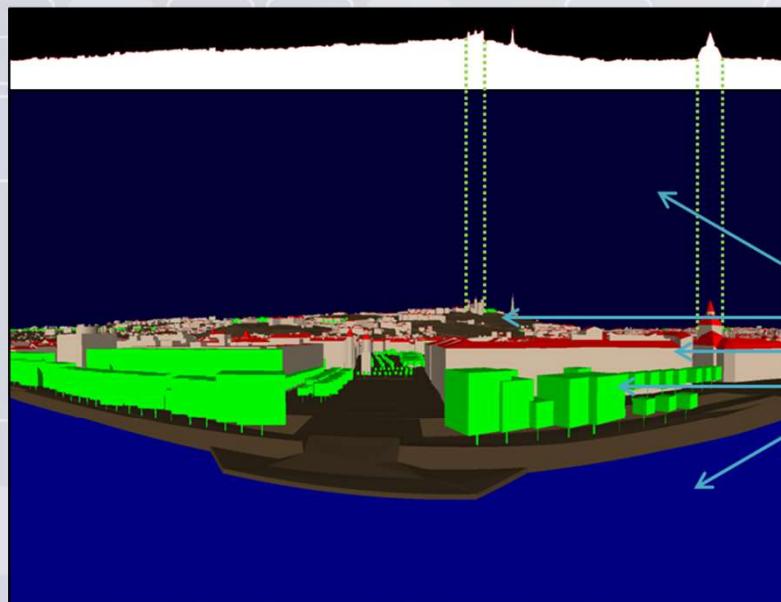


Simulation de l'ombre et du soleil à grande échelle



Travaux V. Jaillot, F. Pedrinis

Simulation de champs de vision/composition de la vue

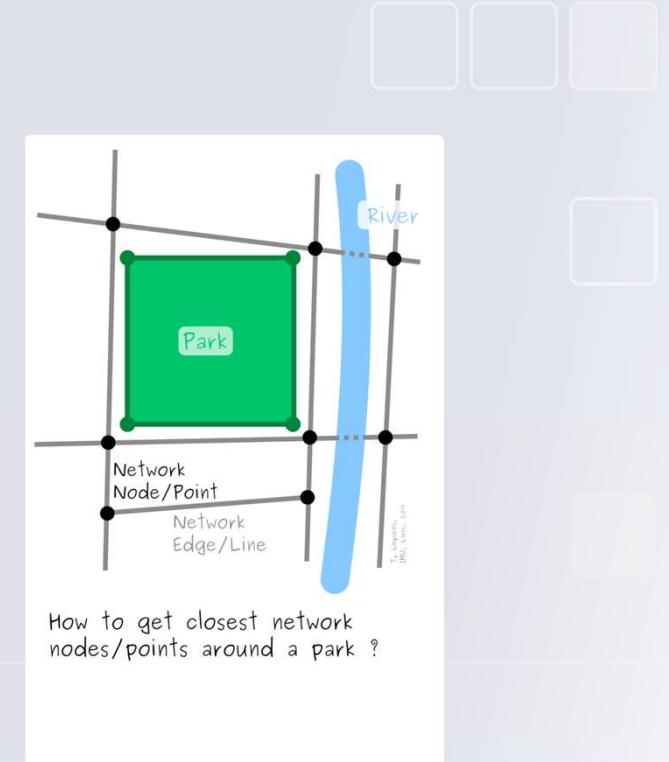
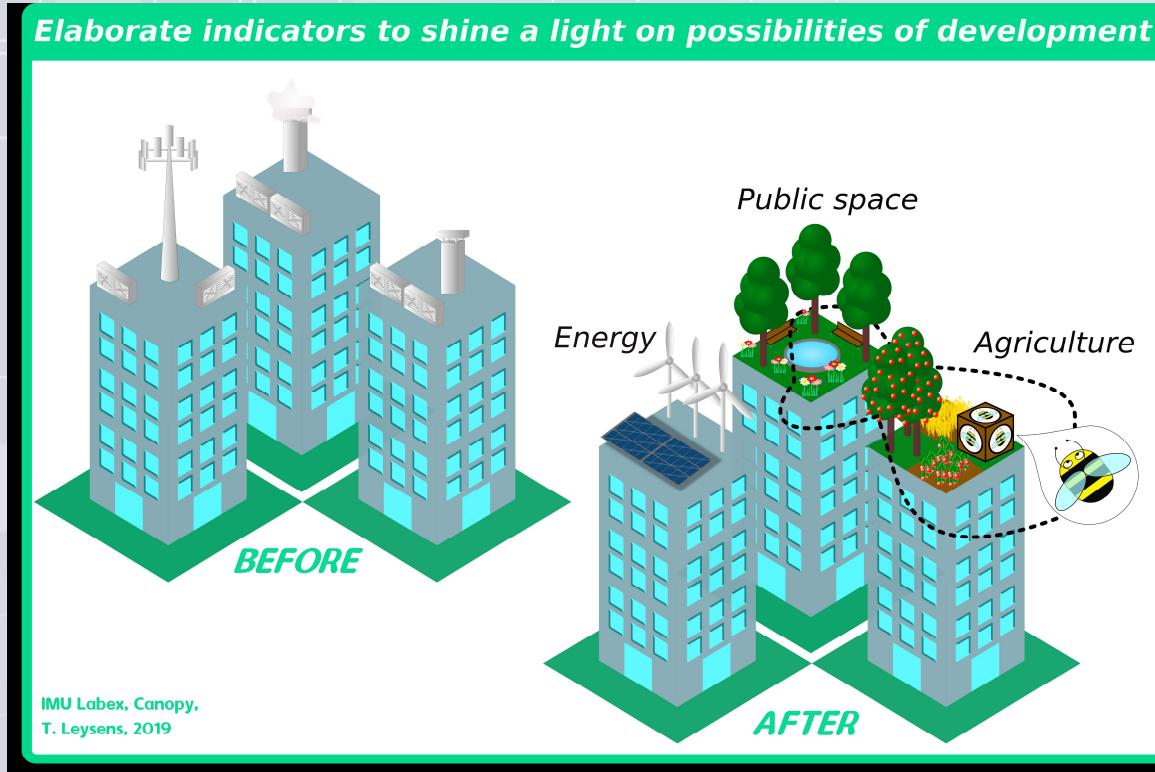


Data Layer	% of occupation in the view
Sky	44.71
Ground	12.16
Buildings	27.98
Vegetation	7.91
Water	7.23

Travaux F. Pedrinis

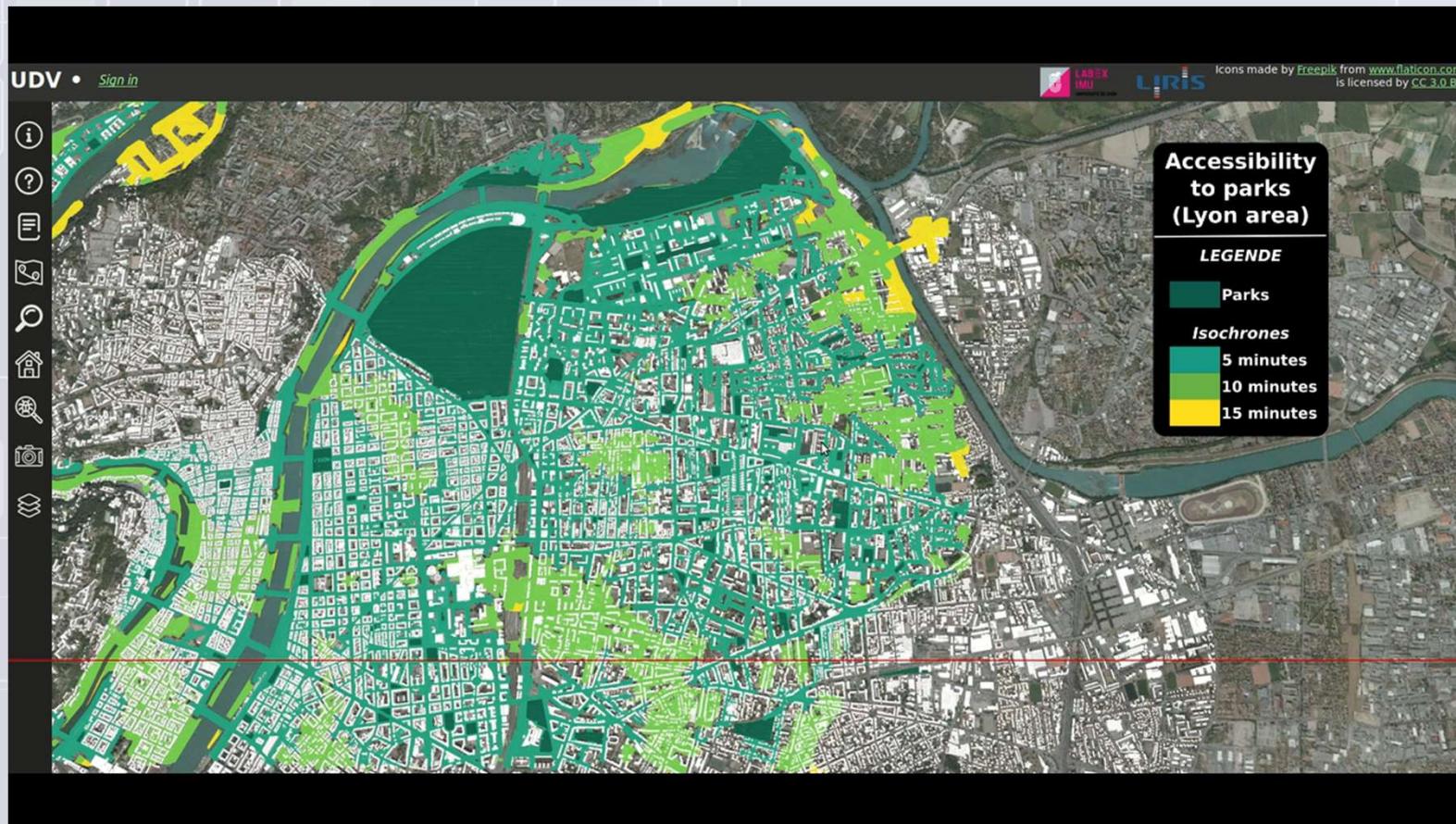


Simulation d'utilisations possibles pour des zones non utilisées



Travaux de T. Leyssens

Simulating new vegetation areas and eco-systems

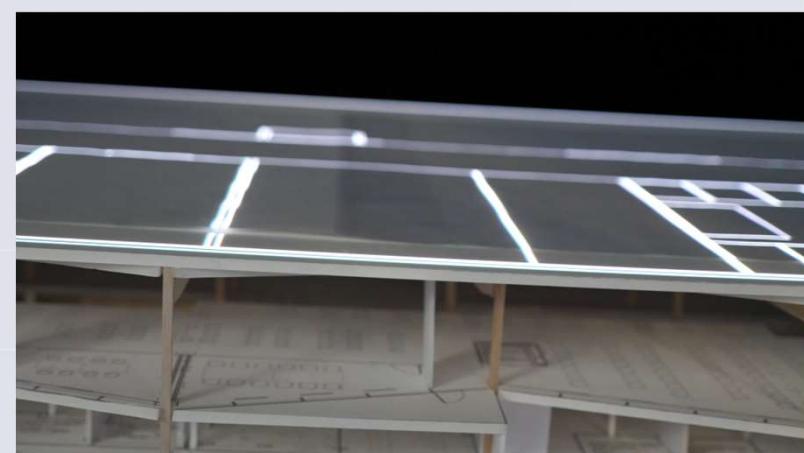
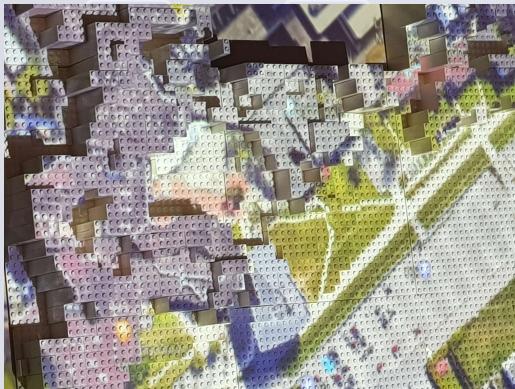


Providing contents or devices to understand

- Semaine de l'anthropocène 2022:
 - À quoi rêvent les maquettes ?
 - Étudiant : Urbaniste /
Informaticien /
Géomaticien



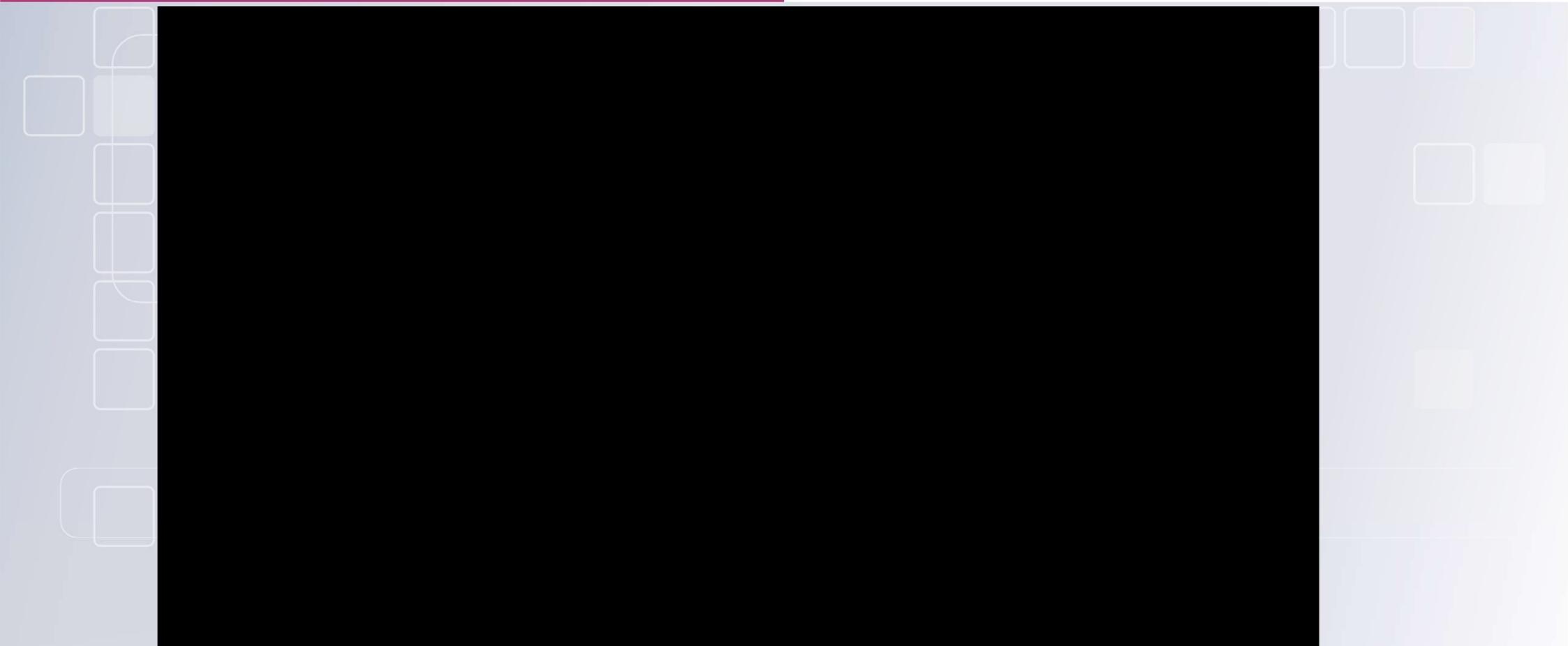
Mixing different contents



Travaux d'A. Grignard (modèles multi-agents et maquette)

M. Livebardon, V. Machado, C. Gautier, L. Marnat (Maquette)

Maquette augmentée par la donnée pour la médiation



Providing contents or devices to understand

Projet GUIDE

■ Cible : Les étudiants

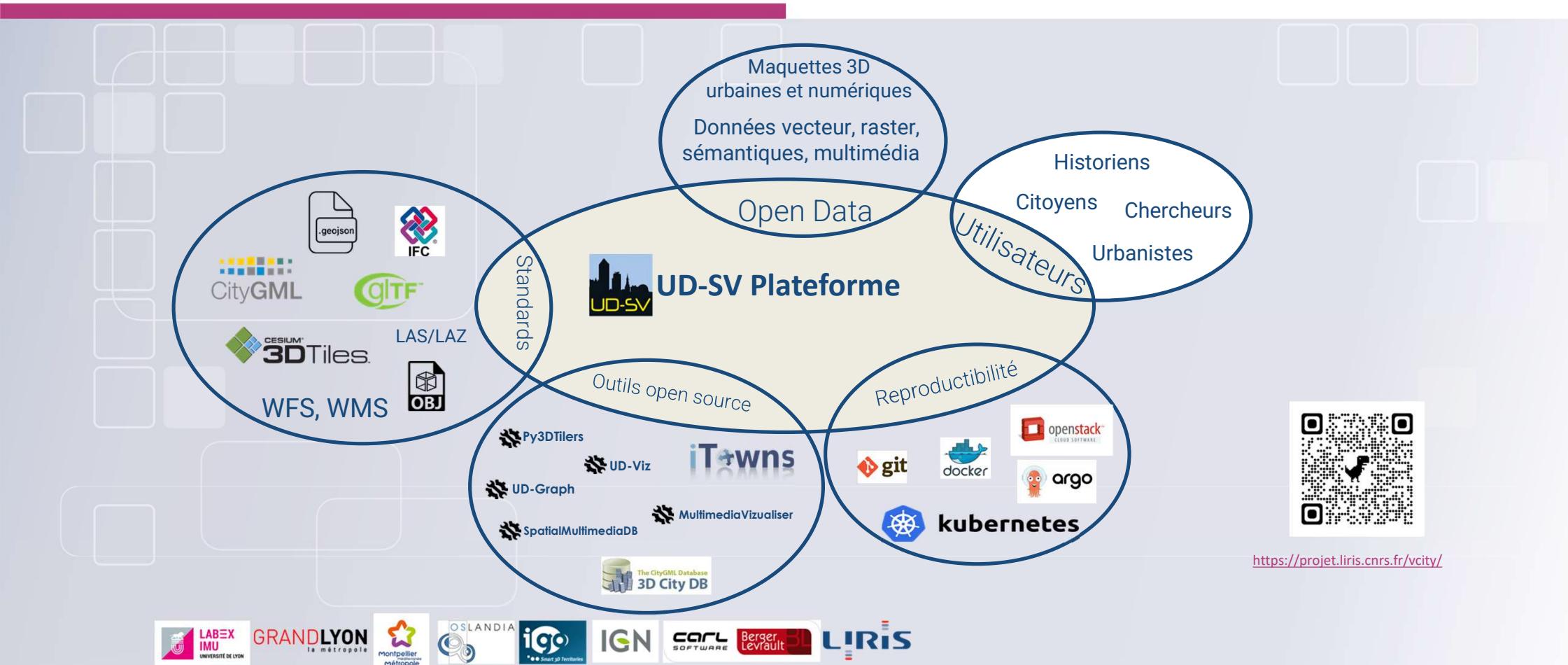
■ Données : Modèle 3D
du campus de Bron

■ Composants : UD-Viz

■ Enrichir les données
grâce à des modalités
dédiées



Constructing an eco-system



Code, données comme patrimoine

Economie générale du projet de recherche Vcity

Phase 1

- De la veille à l'idée ...
- ...Prototyper / résultats ...
- ... à l'écriture de l'article

Phase 2

- Robustification du code et mise à disposition sur la plateforme (en fonction de la PI)
- Mise en exemple avec éléments de réplicabilité
- Mise en place d'une démonstration sur l'espace vitrine

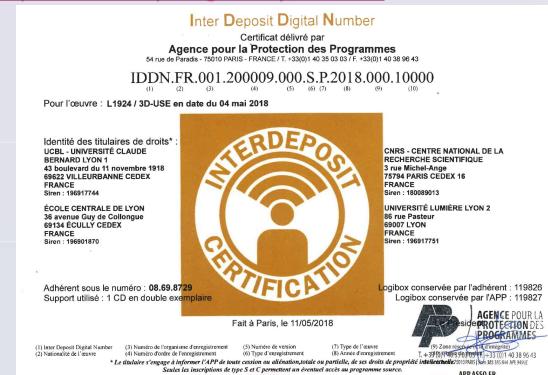
Au niveau technique needs, Design Note (partie privée) :
<https://github.com/VCityTeam/VCity>

Mise sous HAL + Site projet

Documentation sur la partie publique :
<https://github.com/VCityTeam/UD-SV/>

Documents d'installation + accès aux jeux de données utilisés : <https://github.com/VCityTeam/UD-Viz>
<https://datasets.liris.cnrs.fr/>

Espace démonstration : <https://ud-viz.vcityliris.data.alpha.grandlyon.com/>



Retrouver les informations sur les projets et publications

- Démo
 - Membres
 - Projets
 - Code
 - ...
- <https://projet.liris.cnrs.fr/vcity/>

The screenshot shows a web browser window with the URL projet.liris.cnrs.fr/vcity/ in the address bar. The page itself has a dark background and features the LIRIS logo at the top. Below it, the title "Virtual City Project" is displayed. The page is organized into several sections with links:

- General**: Project description, Our Team, Contact, About.
- Research topics**: Versioning of city models, Measuring the city, Enhancing 3D city models, Documents and 3D city models, nD visualization of digital twins.
- News**: Publications, Developed tools, Partnership projects, Demos.

On the right side of the page, there is a large heading "Virtual City Project" followed by the date "Fri, Jun 9, 2023". Below this, a section titled "Example of 3D Visualization of Lyon" contains a detailed paragraph about the project's research focus on geometric modeling and data science, mentioning various disciplines like astrophysicists and geographers. It also discusses the development of new data processing algorithms and the use of 3D data over time to understand urban dynamics. The text concludes by noting the involvement in consortia like the Open Geospatial Consortium (OGC) to create new standards. At the bottom, there is a note about scientific bottlenecks and two bullet points discussing data aggregation and city evolution.

Virtual City Project
Fri, Jun 9, 2023

Example of 3D Visualization of Lyon

Vcity Team's research activity is anchored in the field of geometric modeling and data science, with an approach that has often led us to collaborate with various disciplines (astrophysicists, paleoanthropologists, historians, urban planners, geographers, etc.). In recent years, our project has therefore focused on modes of representation and the dynamics of the city. This theme, anchored between geometric modeling and geomatics, leads us to propose new data processing algorithms, to allow a better understanding of the territory, but also of its evolutions. The data is geometric (generally 3D) and has related semantics and topology. It often refers to the time and space in which it will evolve (rapidly with sensor data, but also over long periods of time with the evolution of city buildings, for example). The processes that we propose to consider are based on spatio-temporal, but also thematic dimensions and should allow promoting the exchange of data in an interoperable way. The standardization processes in which we are involved, for example within consortia such as the Open Geospatial Consortium (OGC), enable the creation of new standards.

The use of these data leads us to look at several scientific bottlenecks:

- Agglomeration of data:** The first issue concerns the agglomeration of heterogeneous data to fulfill the demands of experts. In our research, we are positioned in the context of interoperability based on norms and standards. We participate in the creation of standards of the [Open Geospatial Consortium \(OGC\)](#) and [ISO TC/211](#). In our work, we often look at 3D data but we also follow the development of the standard concerning, for example, sensors, coverages, or vector data.
- City Evolution:** This second aspect has already been covered for many years in 2D but

Publications

The screenshot shows a web browser window with the URL projet.liris.cnrs.fr/vcity/research/publications/. The page has a dark header with the LIRIS logo and a sidebar on the left containing links for General, Research topics, News, and Contact. The main content area is titled "List of VCity publications" and lists publications by year, with a detailed list for 2024.

List of VCity publications

2024

- Diego Vinasco-Alvarez, John Samuel, Sylvie Servigne, Gilles Gesqui  re. Towards an Automated Transformation of an nD Urban Data Model to a Computational Ontology Network: From UML to OWL, From CityGML 3.0 to "CityOWL". ISPRS Annals of the Photogrammetry, Remote Sensing and Spatial Information Sciences, 2024, X-4/W4-2024, 231-238. <https://doi.org/10.5194/isprs-annals-X-4-W4-2024-231-2024>. (hal-04600398)
- Clement Colin, Diego Vinasco-Alvarez, John Samuel, Sylvie Servigne, Christophe Bortolaso, et al.. A model-driven methodology for integrating heterogeneous 3D geospatial urban entities. 27th AGILE Conference 2024, Jun 2024, Glasgow, United Kingdom. pp.1-11, (10.5194/agile-giss-5-3-2024). (hal-04602040)
- Diego Vinasco-Alvarez, John Samuel, Sylvie Servigne, Gilles Gesqui  re. Model driven transformation of CityGML towards CityOWL: from a 3D urban data model to a computational ontology. Geoinformations-systeme 2024, Mar 2024, Munich, Germany. Pp. 38-40. (hal-04602014)
- Mathieu Livebardon, Valentin Machado, John Samuel, Didier Chanfray, Jean-Yves Toussaint, et al.. IMUV: A Digital Twin for Mediation to Discover and Exchange on Territories. ISPRS Annals of the Photogrammetry, Remote Sensing and Spatial Information Sciences, 2024, X-4/W4-2024, pp.107-114. (10.5194/isprs-annals-X-4-W4-2024-107-2024). (hal-04604514)
- PDF : Ana  s Guillem, John Samuel, Gilles Gesqui  re, Livio De Luca, Violette Abergel. Let the fallen voussoirs of Notre-Dame de Paris speak: Scientific Narration and 3D Visualization of Virtual Reconstruction Hypotheses and Reasoning. Semantic Methods for Events and Stories (SEMMES) Workshop at ESWC 2024, May 2024, Hersonissos, Greece. (hal-04614354)

[Back to Top]

2023

- Cl  ment Colin, Corentin Gautier, Diego Vinasco-Alvarez, Johanna Delanoy, Gilles Gesqui  re, et al.. UD-SV : Plateforme d'exploration de donn  es urbaines    n-dimensions – Espace, Temps, Th  matiques. M@ppemonde, 2023, 135, (10.4000/mappemonde.8265). (hal-04071143)
- PDF : Corentin Gautier, J. Delanoy, Gilles Gesqui  re. Representation of urban geometry evolution through space-time cube. 27 International Conference Information Visualisation, GraphicsLink, Jul 2023, Tampere (Finlande), France. pp.414-419, (10.1109/IV60283.2023.00079). (hal-04200467)
- PDF : Jey PUGET GIL, Emmanuel Coquery, John Samuel, Gilles Gesqui  re. Versionnement de graphe pour des donn  es urbaines    volutives. BDA 2023, Oct 2023, Montpellier, France. (hal-04257528)

- 2024
- 2023
- 2022
- 2021
- 2020
- 2019
- 2018
- 2017
- 2016
- 2015
- 2014
- 2013
- 2012

Membres de l'équipe

← → ⌂ projet.liris.cnrs.fr/vcity/general/team/ ⌂ 🔍 ☆ ⌂ ⌂ ⌂ ⌂ ⌂

Liens

LiRIS
Virtual City Project

General

- Project description
- Our Team
- Contact
- About

Research topics

- Versioning of city models
- Measuring the city
- Enhancing 3D city models
- Documents and 3D city models
- nD visualization of digital twins

News

- Publications
- Developed tools
- Partnership projects
- Demos

VCity Team Members

Fri, Jun 9, 2023

Staff members

- Gilles GESQUIERE : Professor, Head of Vcity project (VCity member since 2013)
- Sylvie SERVIGNE : Associate Professor (VCity member since 2014)
- John SAMUEL : Associate Professor (VCity member since 2017; previously post doctoral researcher)
- Johanna DELANOVY : Associate Professor (VCity member since 2021)
- Thibault DUPONT: Associate Professor (VCity member since May 2022)
- Eric BOIX : CNRS Engineer (VCity member since December 2015)

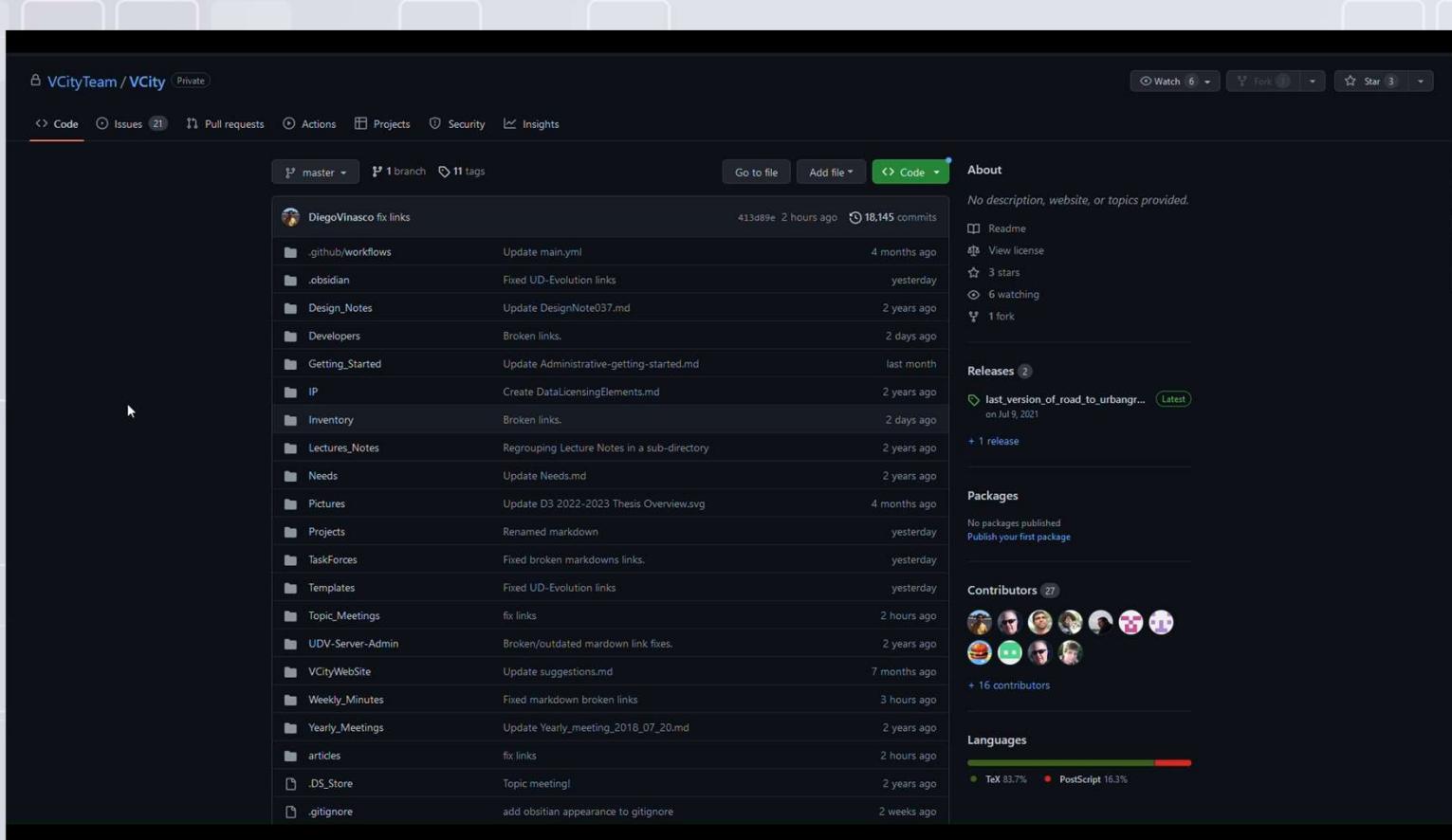
Trainee/students members

- Do not hesitate to contact us

Post-doctoral, Doctoral and Engineer positions

- Jey PUGET GIL: Doctoral position (January 3, 2023 - January 2, 2026) Research topic: Urban Knowledge Hub for Evolving Cities
- Corentin GAUTIER: Doctoral position (November, 2022 - September, 2025) Research topic: Dynamic, virtual and tangible representations of the city (effort part of the TIGA Project)
- Lorenzo MARNAT : Engineer (November 2021- December 31, 2024) Research topic: Management of 2D and 3D geospatial data for building 3D scenes (effort part of the TIGA Project)
- Mathieu LIVEBARDON : Engineer (December 1, 2021- December 31, 2024) Topic: Gamification context for new 3D collective animation

Navigation in knowledge



J. Puget-Gil, J. Samuel, E. Cocquière, G. Gesqui  re