

Cyril Lacheze - Marina Gasnier

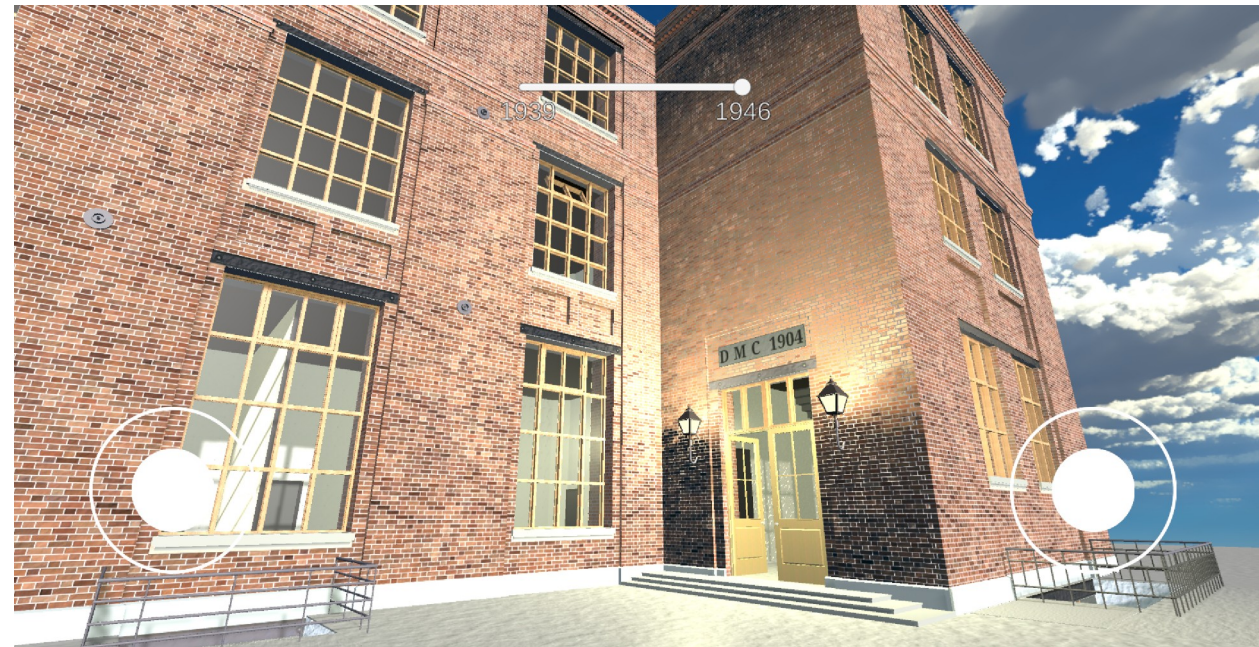
Training engineering students through a digital humanities project Techn'hom Time Machine

Belfort-Montbéliard
Technology University
(France)



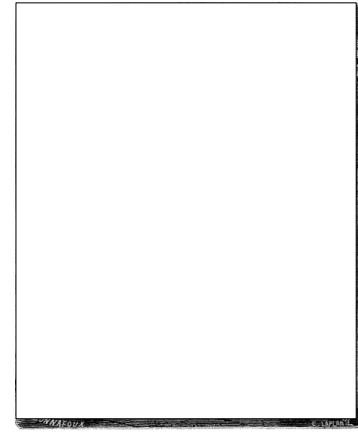
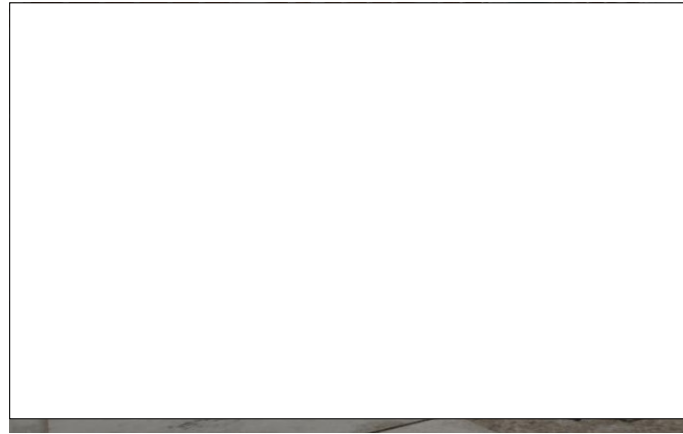
FEMTO-ST

National Research
Agency (ANR) Project
Lab In Virtuo

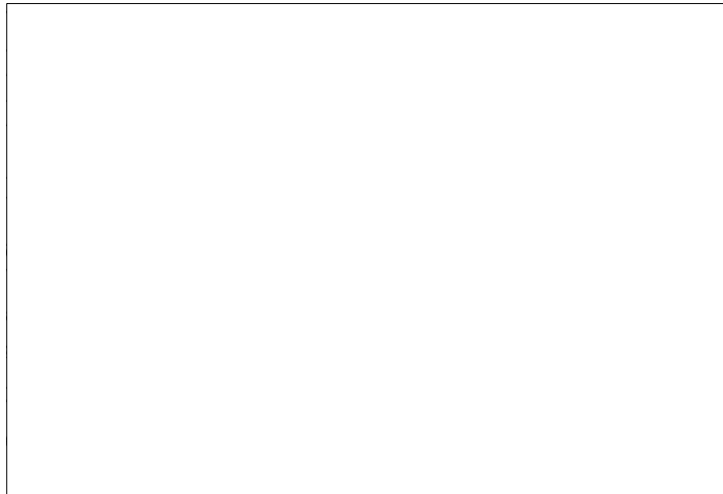


Goals – *Lab in Virtuo*

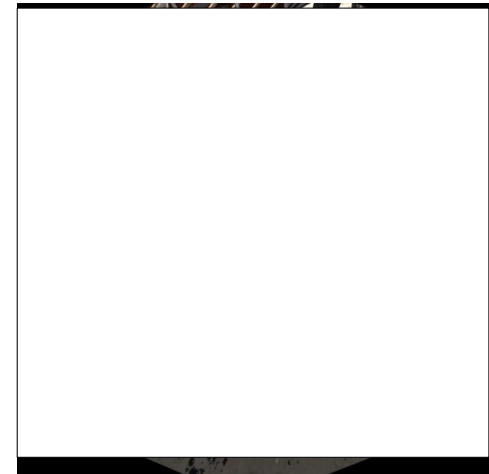
- 1/ Study industrial sites and their activity, evolving over time
- 2/ Model the activities
- 3/ Reconstruct the site in 3D
- 4/ Integrate everything into a participatory virtual environment:
 - for mediation
 - for research



Brest iron works

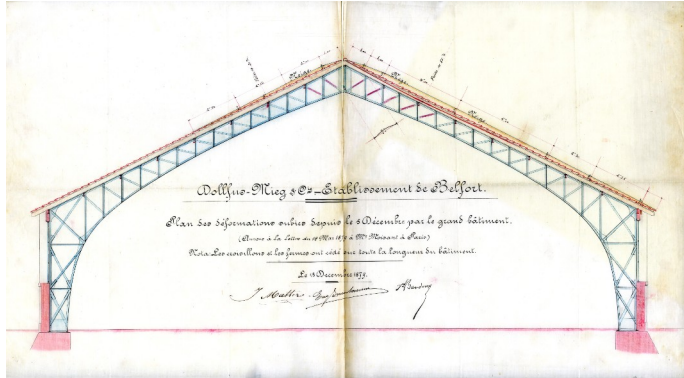


Ontology example

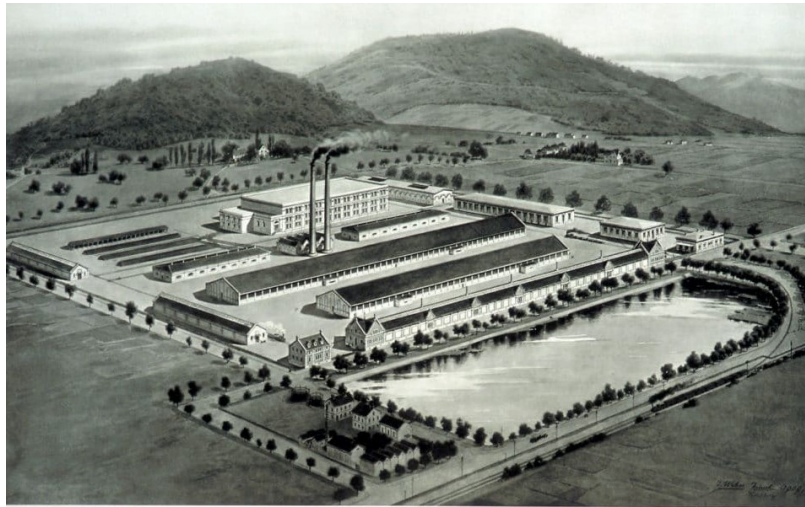


The DMC spinning mill

Current DMC thread

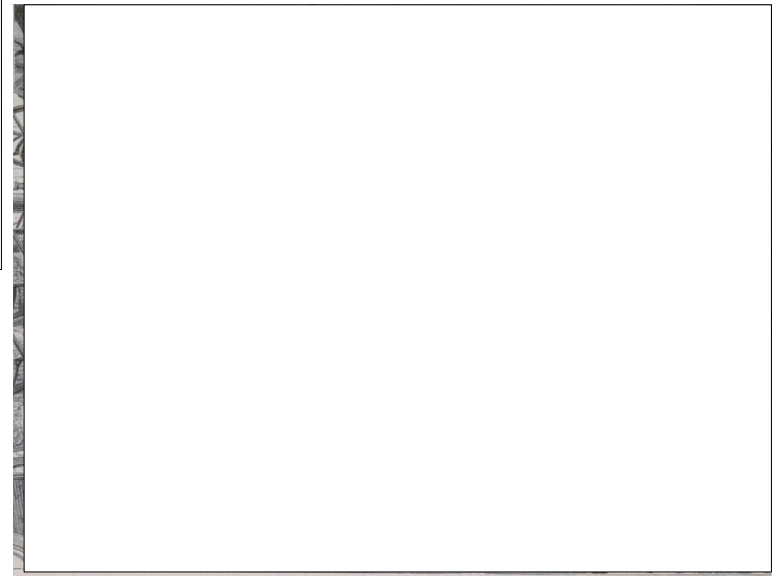


Source examples (Framing plan from 1879, Mulhouse municipal archives, Moisant correspondence ; De Prat, *Nouveau Manuel complet de Filature*, 1914)

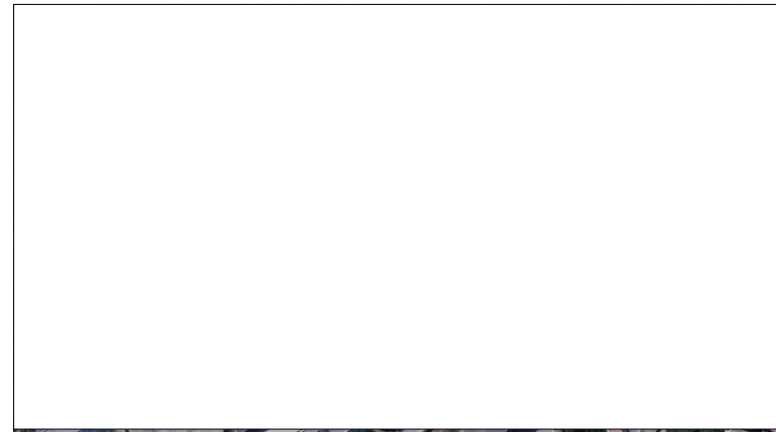


DMC spinning mill in 1909, established 1879 (DMC advertising, 1909, Mulhouse municipal archives)

Techn'hom – in the background, ALSTOM (Google Earth)



Spinning mill in 1889 (Barclay, Heilmann wool combing machines room, 1889)

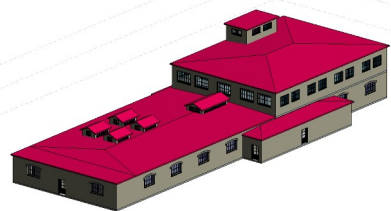


Students participation in the project (40)

Axis	Year	Nb of student(s)	Task, element to be modeled
1. Machine modeling Total : 16 students	2019	1	Twisting machine – modeling
	2020	5	Twisting machine – animation ; unwinding machine
	2023	3	Carding machine – modeling, animation ; tools, furniture and cotton
	2024 (ongoing)	7	Spinning machines (x4) ; combing machine (x2) ; tools and furniture
2. Building modeling Total : 12 students	2019	3	Twisting buildings (x2)
	2020	1	Electric transformer
	2022	1	Spinning building
	2023	1	Dyeing building
	2024 (ongoing)	6	Whitening, finishing, annex buildings ; offices ; cotton and wood storages ; boiler room
3. Data model – Knowledge engineering Total : 6 students	2020	2	Relational database ; data generation (photo analysis)
	2022	1	User interface
	2023	2	Ontology and RDF base ; instantiation of ontology (walls)
	2024 (ongoing)	1	Instantiation of ontology (sources)
4. Integration into Unity Total : 6 students	2021	1	Building test (electric transformer)
	2022	1	Building + machine test (twisting machine + spinning building)
	2023	1	Garages
	2024 (ongoing)	3	Carding machines (x2) ; twisting machines



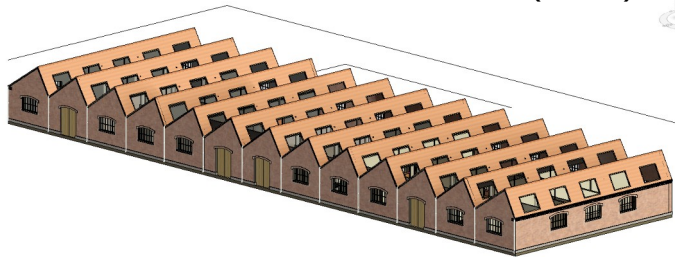
Building 5 – Spinning (1904)



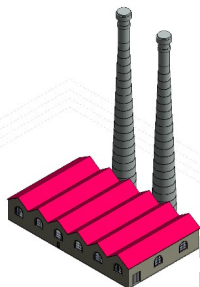
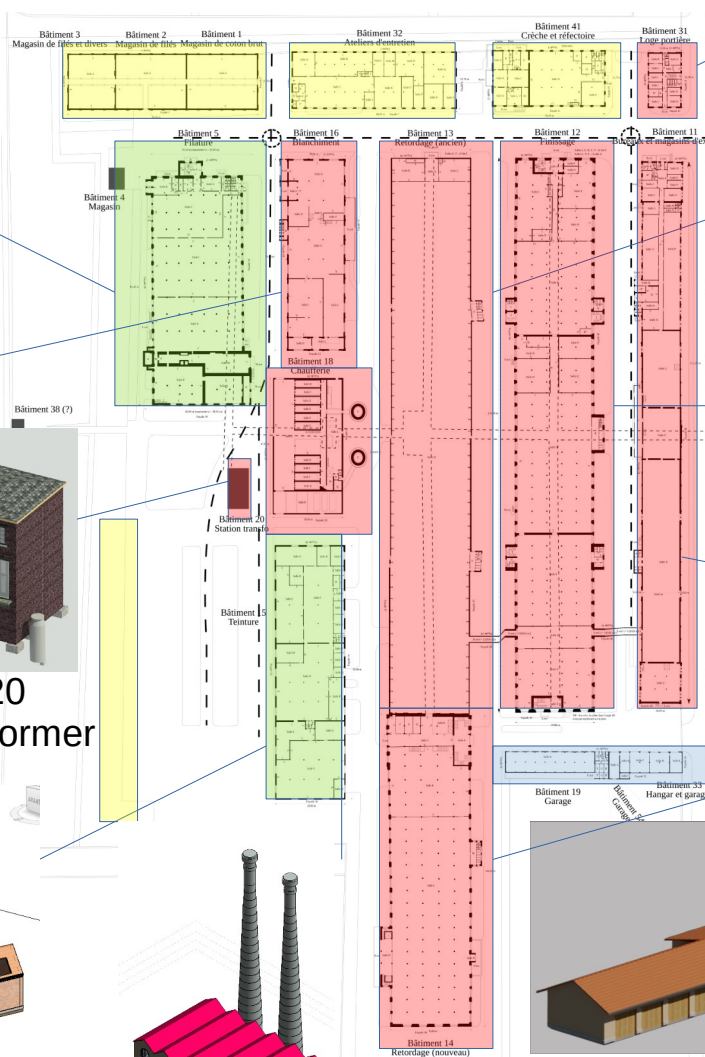
Building 12
Whitening
(1879)



Building 20
Electric transformer
(1948)



Building 15 – Dyeing (1904, expansion 1939)



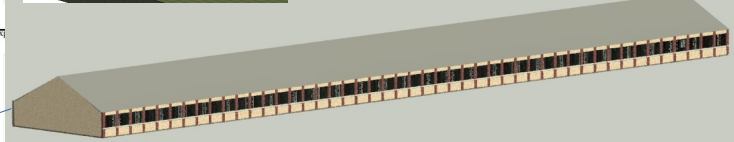
Building 18
Boiler room (1879)



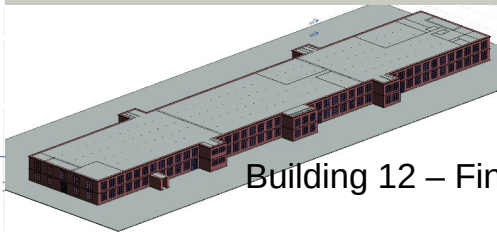
Building 19, 33 & 54 – Garages
(1879, expansion 1946)



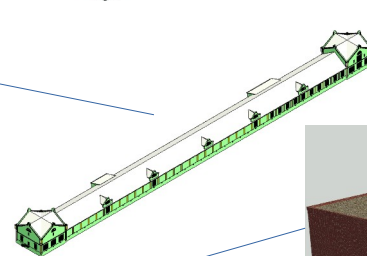
Building 31
Keeper's lodge (1954)



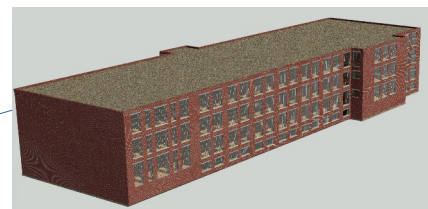
Building 13 – Twisting (1879)



Building 12 – Finishing (v.1910)



Building 11 –
Offices (1879)

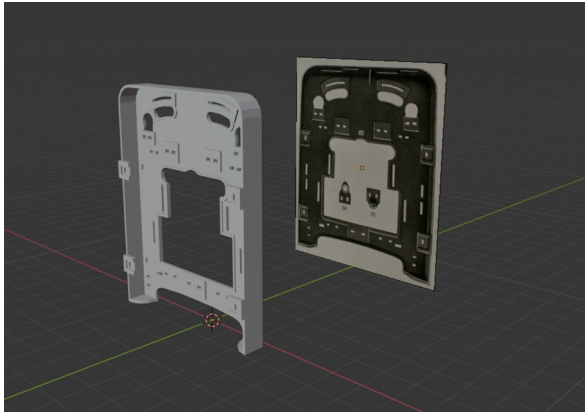


Building 14 – Expansion
of twisting (1928)

Machines modeling

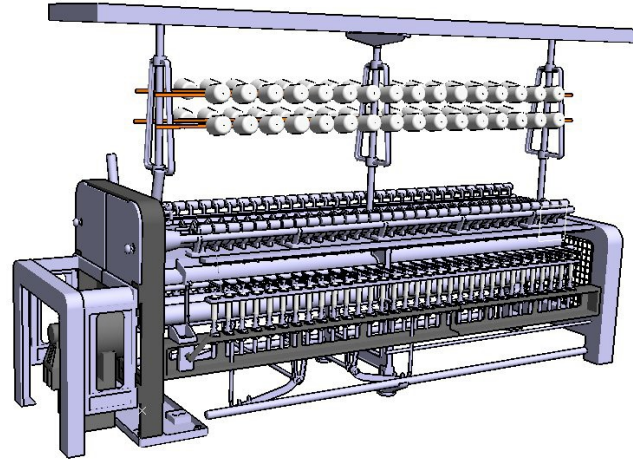
Twisting machine

Work 1 – Machine modeling (2019)
→ Blender



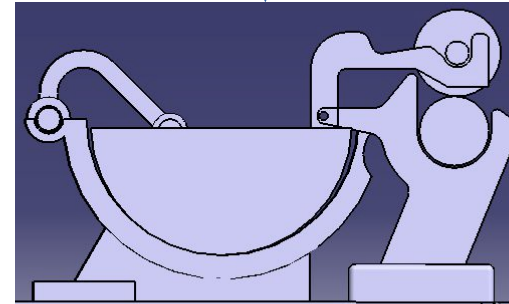
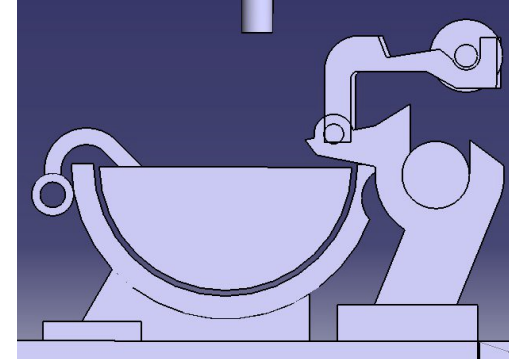
?

Work 2 – Machine animation
(2020) → Catia



Integration of the mechanism

→ Question about porting to Unity ?



- "Models optimization rather than accuracy"
- "parts very close to the base material from a visual point of view but absolutely not reliable from a measurement point of view"
- "very realistic side"
- "drop consistency"

Machines modeling

Visual and optimization

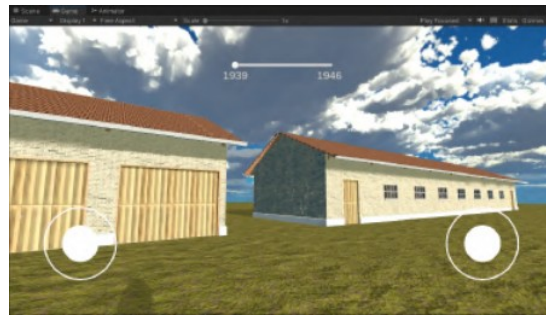
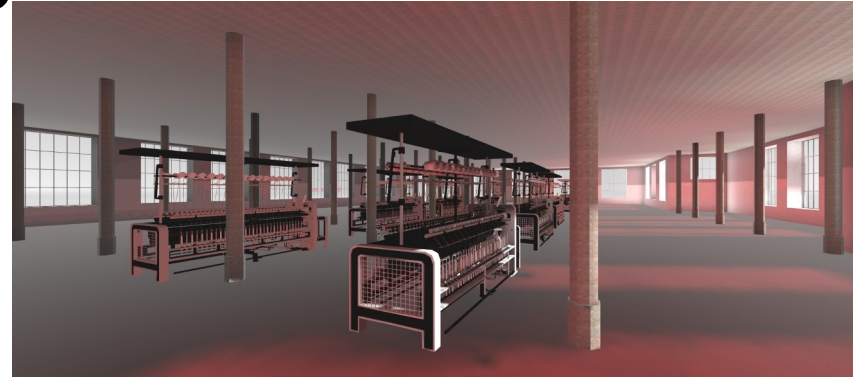
Spool (2020) → Catia + Keyshot

(Mulhouse municipal archives)

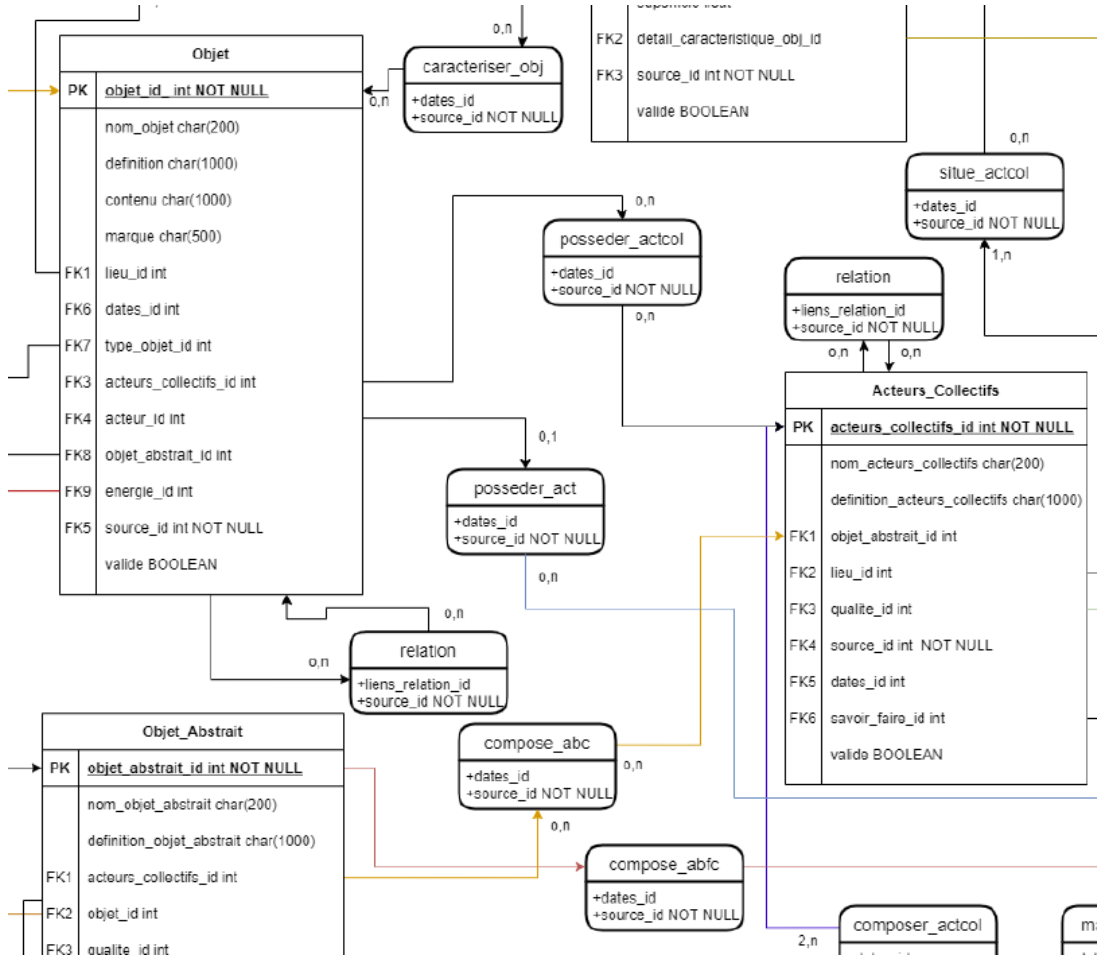


Unity :

- Integration of twisting machines in the building (2022)
- Interactions (2023)



What data model ?



Version 1 : Relational database (2020)

- a historical database implies “a certain complexity in its design”

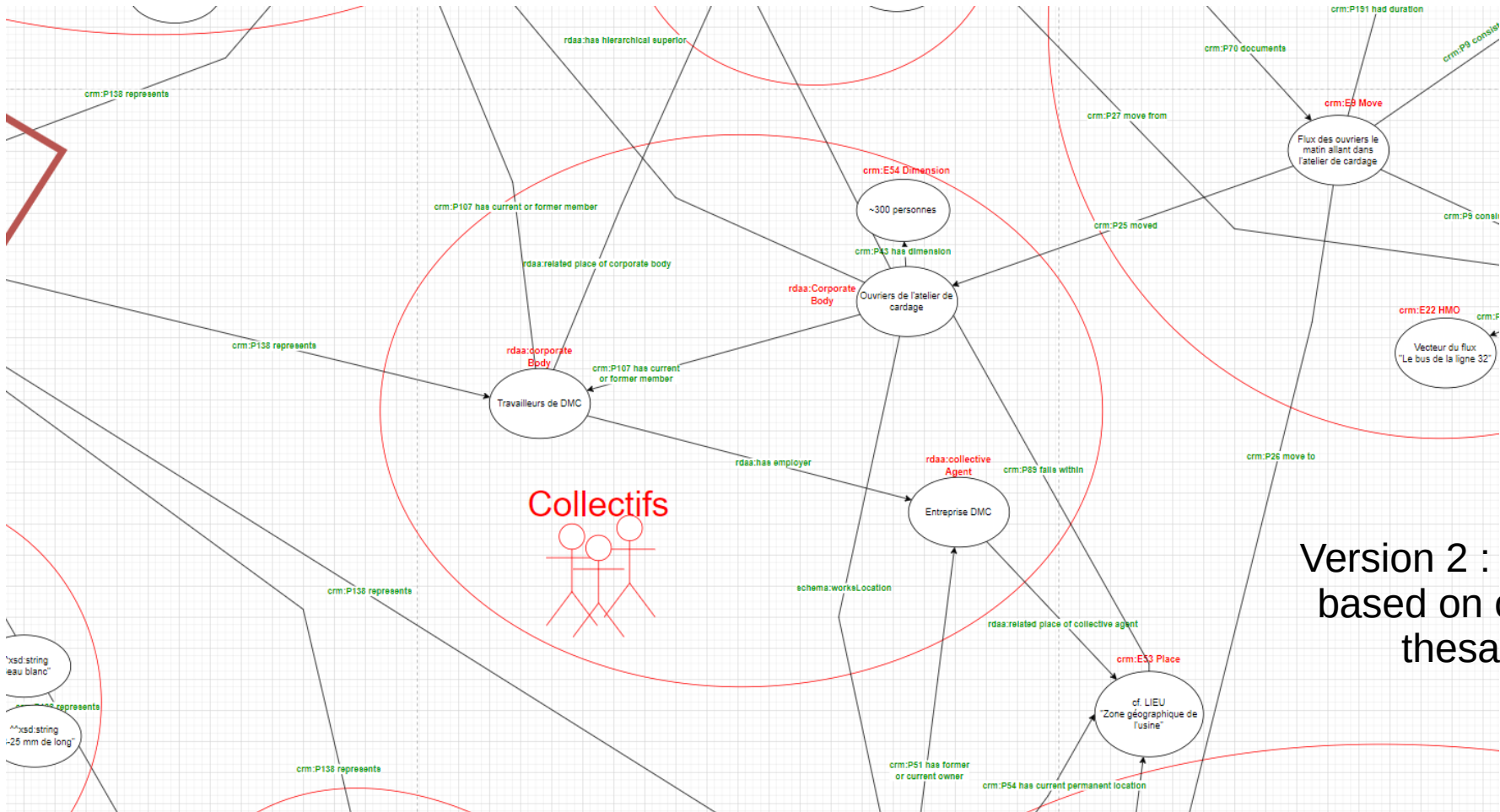
- “The “Abstract_Object” table is, in my opinion, the most difficult to understand.”

- table allowing to specify types of links between actors, which “gives additional depth to the model (...) by having information on the relationship between the different resources”

→ Perception of the lack of adequacy of a relational database with a social system

→ Interest of an RDF base

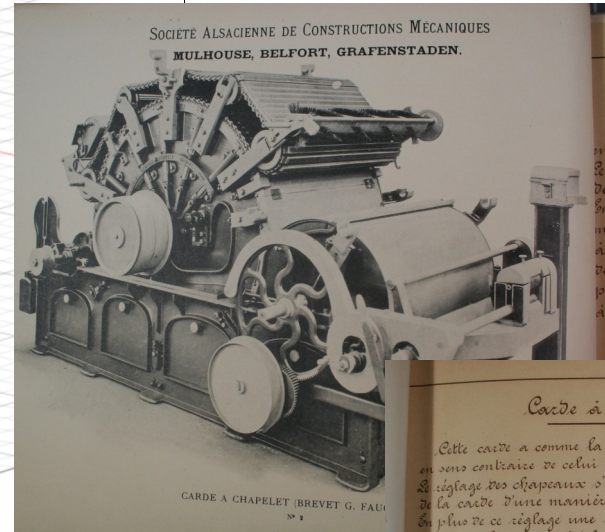
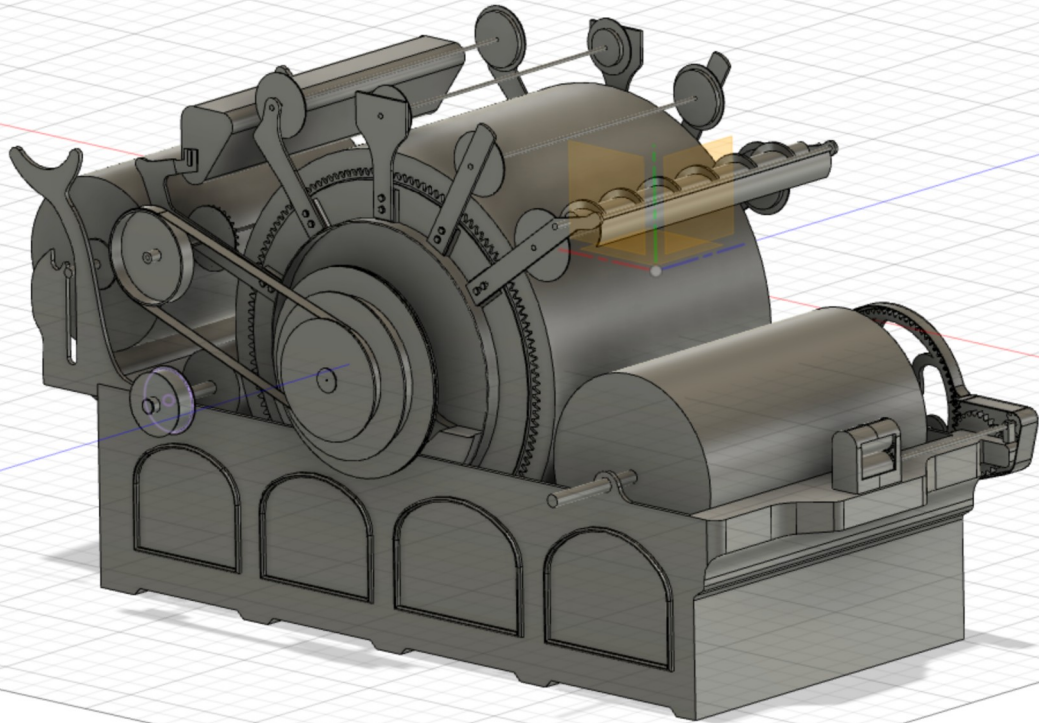
What data model ?



Version 2 : RDF database, based on ontologies and thesauri (2023)

Discovering human and social sciences

Students feedback



Mulhouse municipal
archives

Cardé à Chapelet (Système G. Fauguet. Brevet S.A.D.R.)

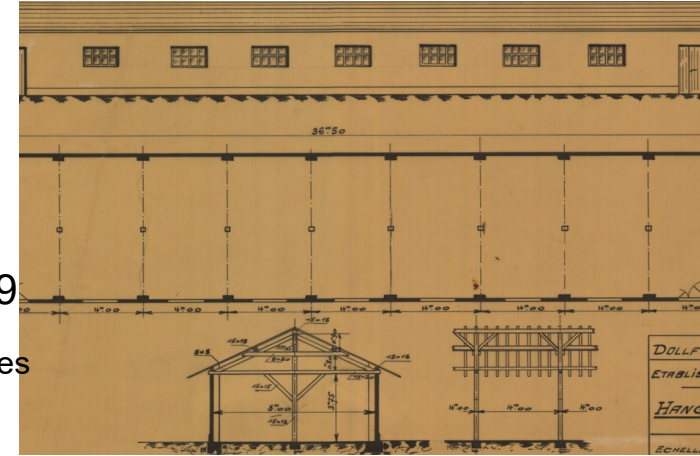
Cette carte a comme la précédente la marche de translation des chapeaux en sens contraire de celui du grand tambour.
Le réglage des chapeaux s'opère également en un seul point de chaque côté de la carte d'une manière mathématique.
En plus de ce réglage une disposition spéciale permet de varier le rapprochement des chapeaux à tel ou tel point de leur travail et de leur faire suivre à volonté les déplacements du grand tambour causés par celui de son axe. De sorte qu'une fois ce réglage spécial opéré, la simple manœuvre, en un seul point, permette de régler tous les chapeaux de la même quantité, par rapport à la nouvelle position donnée par l'usage au grand tambour.

Discovering human and social sciences

Students feedback

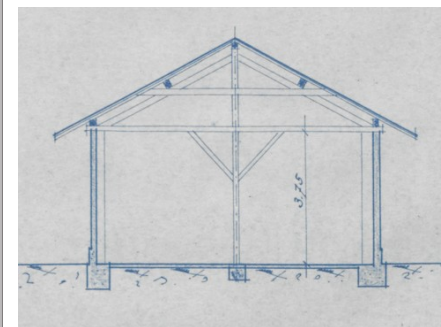
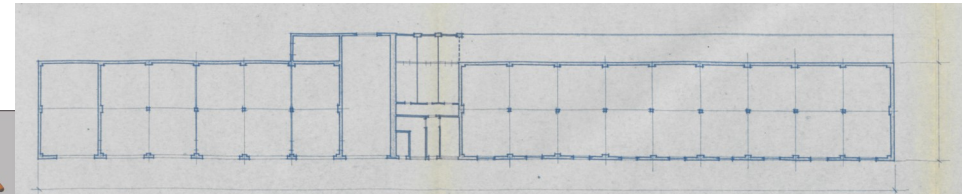


Mulhouse municipal archives



1939

1959



Utilisation actuelle : Hangar - Garage autos et bicyclettes

Composé d'un rez-de-chaussée.

Construit : Fondations en béton
Mur en élévation en briques avec enduit teinté
Soubassement saillant enduit au ciment

Sur l'ensemble : Charpente en sapin
Couverture en tuiles mécaniques
Sous-face plâtrée pour le bâtiment 33
Plafond pour le bâtiment 54
Charpente libre pour le bâtiment 19

Sol : en béton bouchardé

Baies : Châssis fer - vitrage au verre clair
Linteaux en béton armé
Appuis en ciment
Portes cochères en bois à rainures et languettes
et barres et écharpes.



Students feedback

Discovering human and social sciences

Some immediately relevant sources

"The [manufacturer's] catalogue was a bit like our gold mine of information. It contains more than 500 numbered, named and illustrated parts."

VS.

most other sources

"at my disposal several thousand pages of text", giving "access to many documents but little precision"

Historical documents "do not provide as much information as we had hoped"

"The lack of information was cruel"

No *blueprint*...

the modeled machine "remains much more complex than that of the diagram, not allowing the direct connection and understanding of each part"

... or architect's plan

It is necessary to "make measurements on the plan to approximate some of the distances"

Students feedback

Discovering human and social sciences

→ Awareness of the “historical narrative” We cannot “exactly reproduce past reality”

→ Workflow in human and social sciences

"note the importance of reading all the archives and not just a few because errors may be present"

“difficulty of exploiting numerous bibliographic resources”; pleasure of “learning to read in archives”

"This type of task requires a patience and a methodology that are completely different from what we are used to doing. The difficulty or even the impossibility of finding the desired information has taught us to put ourselves in the shoes of a historian who must at certain times make hypotheses in order to continue his work. We are exposed to this type of situation in our studies but much less frequently and in a more binary way."

→ Interest of a concrete case study

“Working on concrete cases helped us understand how to articulate several standard ontologies and thus develop a strategy to combine them effectively into a coherent whole. This approach also allowed us to better understand the advantages and limitations of each ontology and to make informed decisions on how to use them.”

Students feedback

Solutions found

→ Additional sources

- original documents in archive
- old movies found on the Internet
- “observations made on site by observing the building from the outside, which allowed us to be better visualize the plans”

Contact with former workers, and with physical reality:

"allowed us to take a step back from the project. In addition, we understood a lot of things about the steps before and after the twisting"

(during COVID) Not being able to "go and see the machine in real life particularly hampered our understanding of the mechanisms. If our project is taken up again, we strongly recommend going to see it to take photos of the real mechanisms in order to be able to correct our approximations that were made in the complex part of the machine."

"It was both a very interesting and very enjoyable moment. Being able to see with our own eyes the machine that we are trying to reproduce on a computer was a very enriching experience"

"Being able to visualize in real life a machine that we have been modeling for several months is truly incredible"

Students feedback

Project management

→ Project management independently

- "the most important project I have had to carry out"
- "I learned the management" of the organization
- "allowed me to find my own rhythm and manage my production"
- "learned to manage a project in my free time"
- "learned to work efficiently and manage projects independently", with "perseverance"

→ Developing working methods

- "a lot of backtracking"
- "need to do a lot of research to use the right method to work correctly"
- "a time to understand the documents, research on software features as well as a considerable investment"
- "a first professional experience that I reached the end of thanks to a significant amount of effort (...) The experience gained during the internship is immense"

→ Being part of a bigger project (importance of communication!)

- A lack of "direct contact [between one group and the next] makes the task more difficult", because there is a risk that one group "will waste [...] time understanding what the other group had already understood"
- Interest in organizing "a video conference between the old and new groups" and that "each group gathers important documents in a separate file" when passing the project.
- Advice given to future students at the end of a report, about searching in digitized historical documents: "use and abuse the keyword search (Ctrl+F) in the documents. This will save you a lot of time in your targeted research"

Thank you for your attention

"I discovered technologies that I didn't even know existed. The concept of ontology has greatly changed my vision of information science: the desire to link and structure data on the Internet is something that had already interested me before doing my internship, but only the solution to this problem still eluded me"

"I met people who were passionate about this field and who gave me even more the desire to increase my general and historical culture"

An "atypical project in which history and engineering complement each other to achieve a common goal",
"participating in this reconstruction provides a small satisfaction of making a contribution"