

A Data Workflow Approach for Pedagogical Sensitization to the BIM Concept

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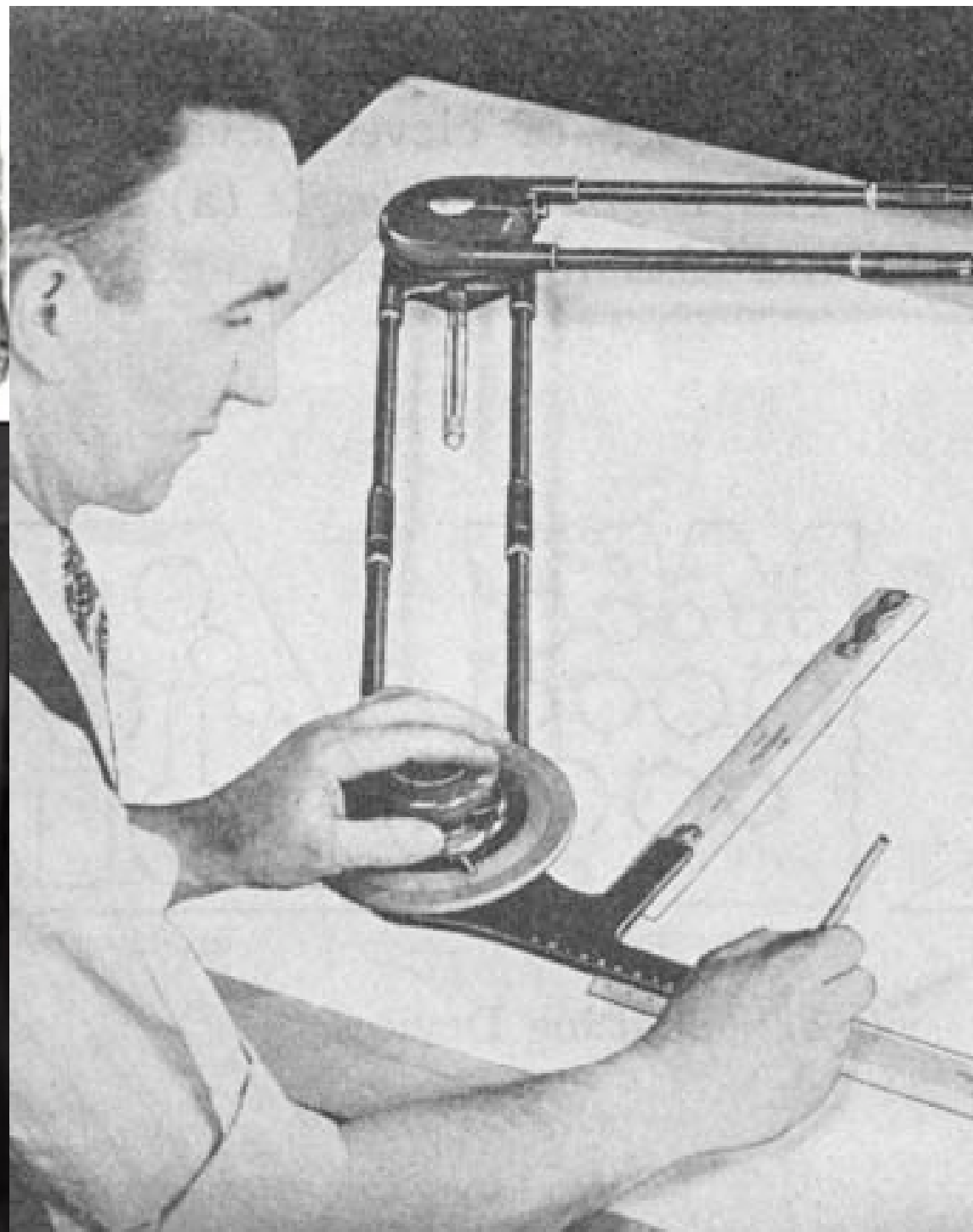
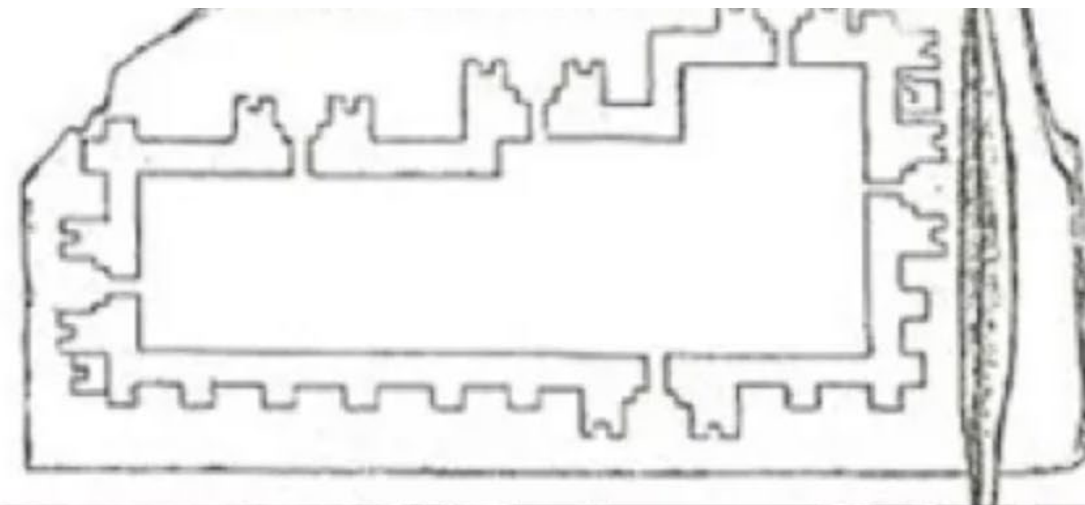
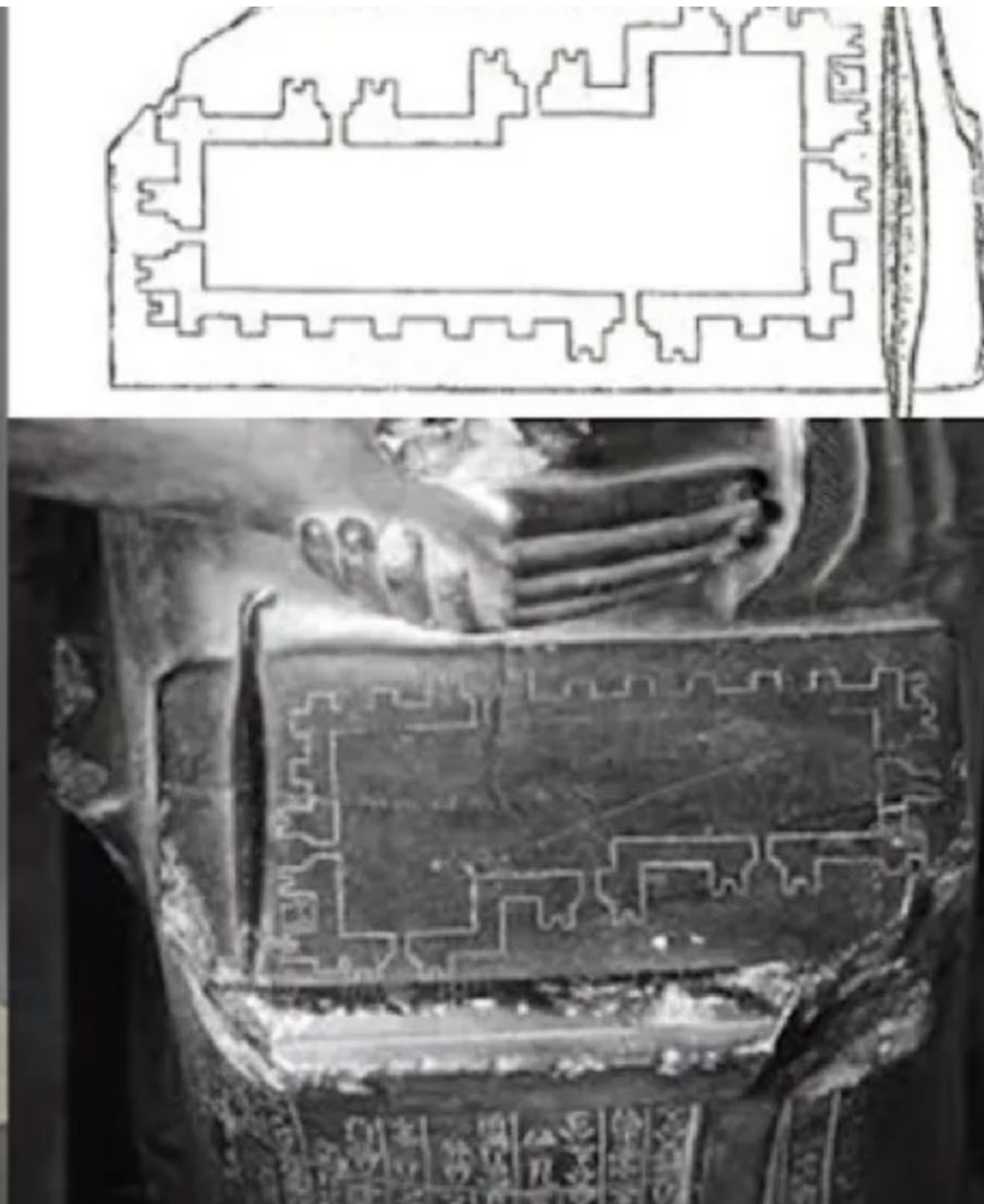


Research Context

Research Context

From CAD to semantic modeling

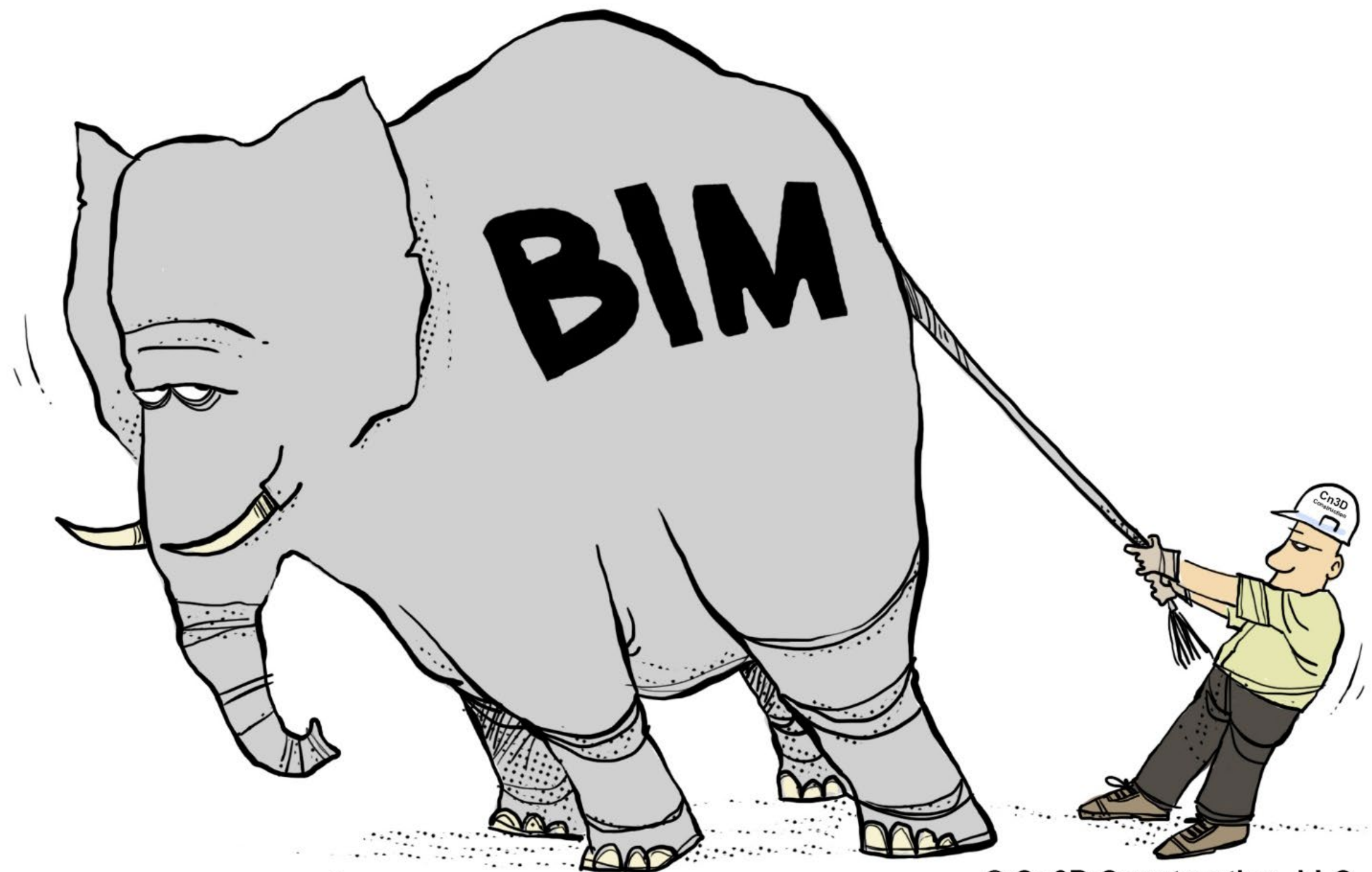
- History of architectural practice : different representation tools but the same rules
- Difficulties to implement semantic dimension using conventional processes



Research Context

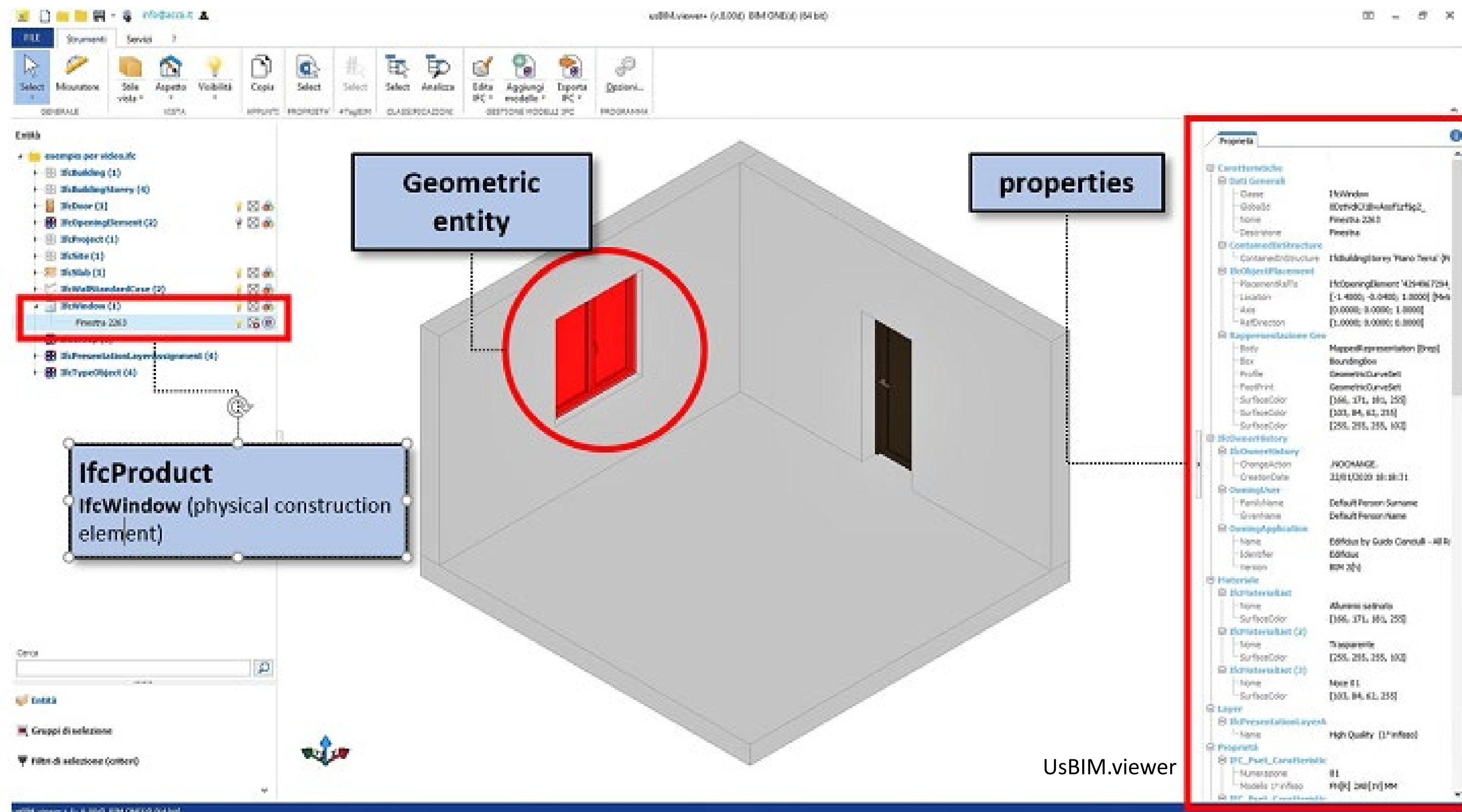
Introduction to BIM methodologies

- BIM = Black Box
- BIM activities \neq Architectural design activities



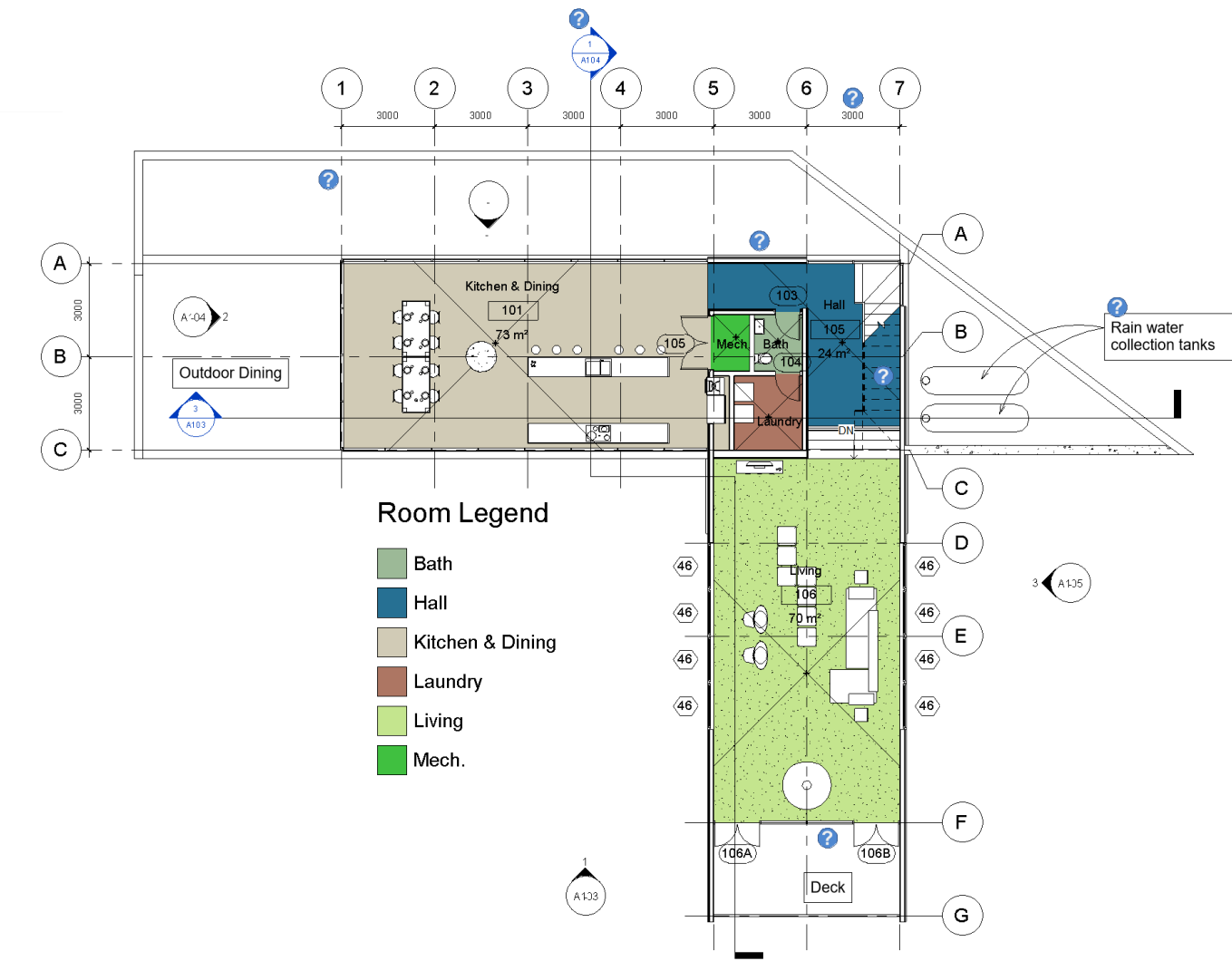
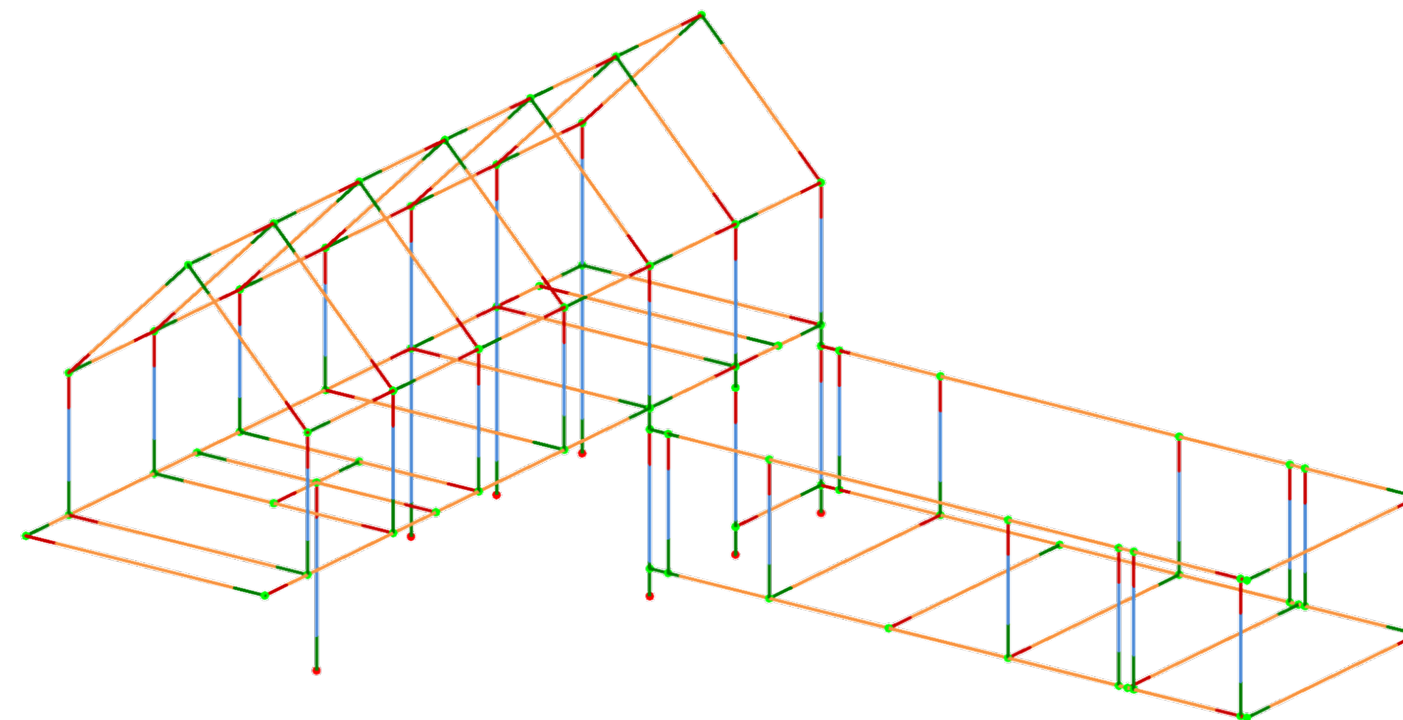
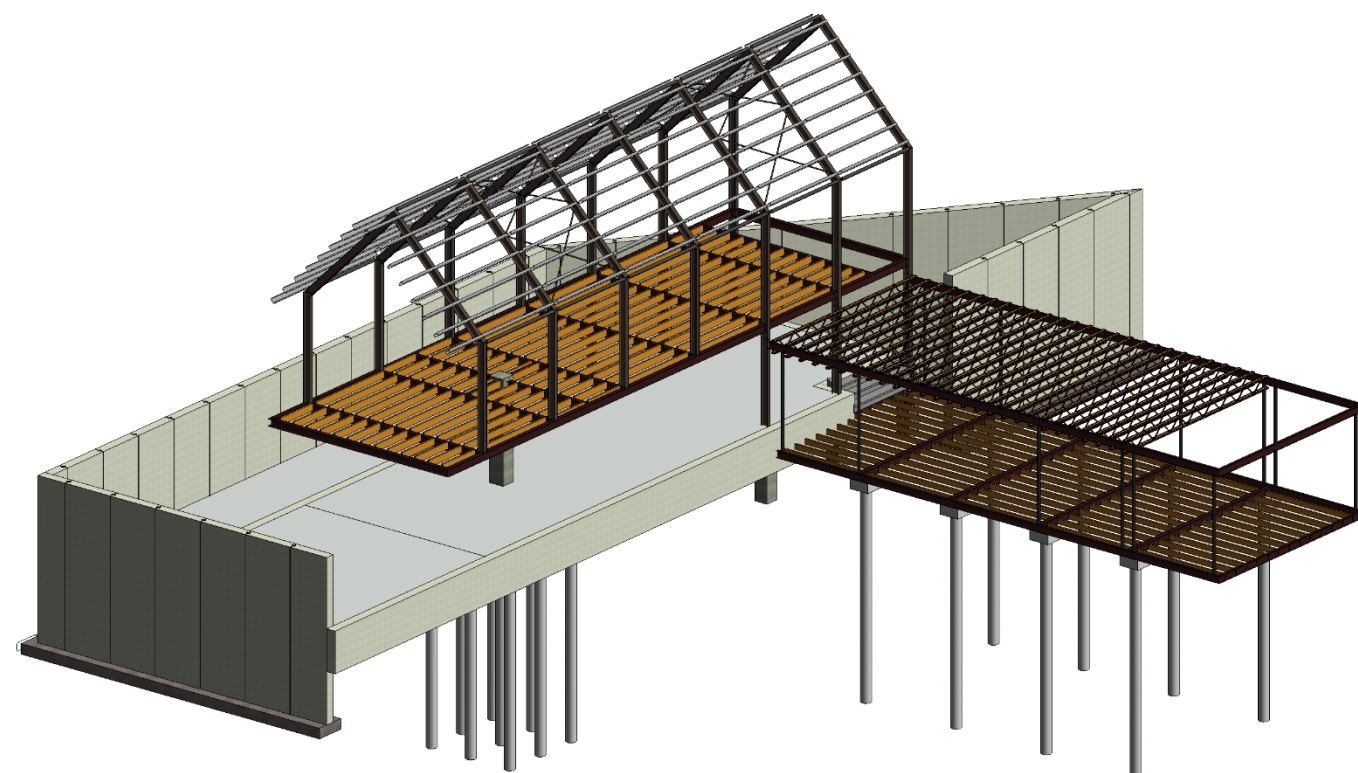
Research Challenges

- Make semantic dimension (structure) more reliable (visible) during modeling process
- Propose a simple and accessible tool for students to manage semantic model structure.



Research Challenges

- Show to students that semantic dimension is an asset.



Element ID	Type	Surface	Largeur	Longueur	Hauteur non contrainte
2	Custom Parameter	Autre	Cotes	Construction	Cotes
3	MEN_10cm	16.325	0.1	5.45	3.3
4	MEN_10cm	15.5	0.1	5.6	3.3
5	MEN_10cm	10.22	0.1	3.85	3.3
6	MEN_10cm	4.445	0.1	2.1	3.3
7	MEN_10cm	10.22	0.1	3.85	3.3
8	MEN_10cm	4.445	0.1	2.1	3.3
9	MEN_10cm	12.78	0.1	3.85	3.55
10	MEN_10cm	8.99	0.1	3.2	3.55
11	MEN_20cm	6.375	0.2	1.7	4.25
12	MEN_20cm	28.475	0.2	6.6	4.25
13	MEN_20cm	6.375	0.2	1.7	4.25
14	MEN_20cm	11.475	0.2	2.6	4.25
15	MEN_20cm	26.55685535	0.2	12.7461216	2.1



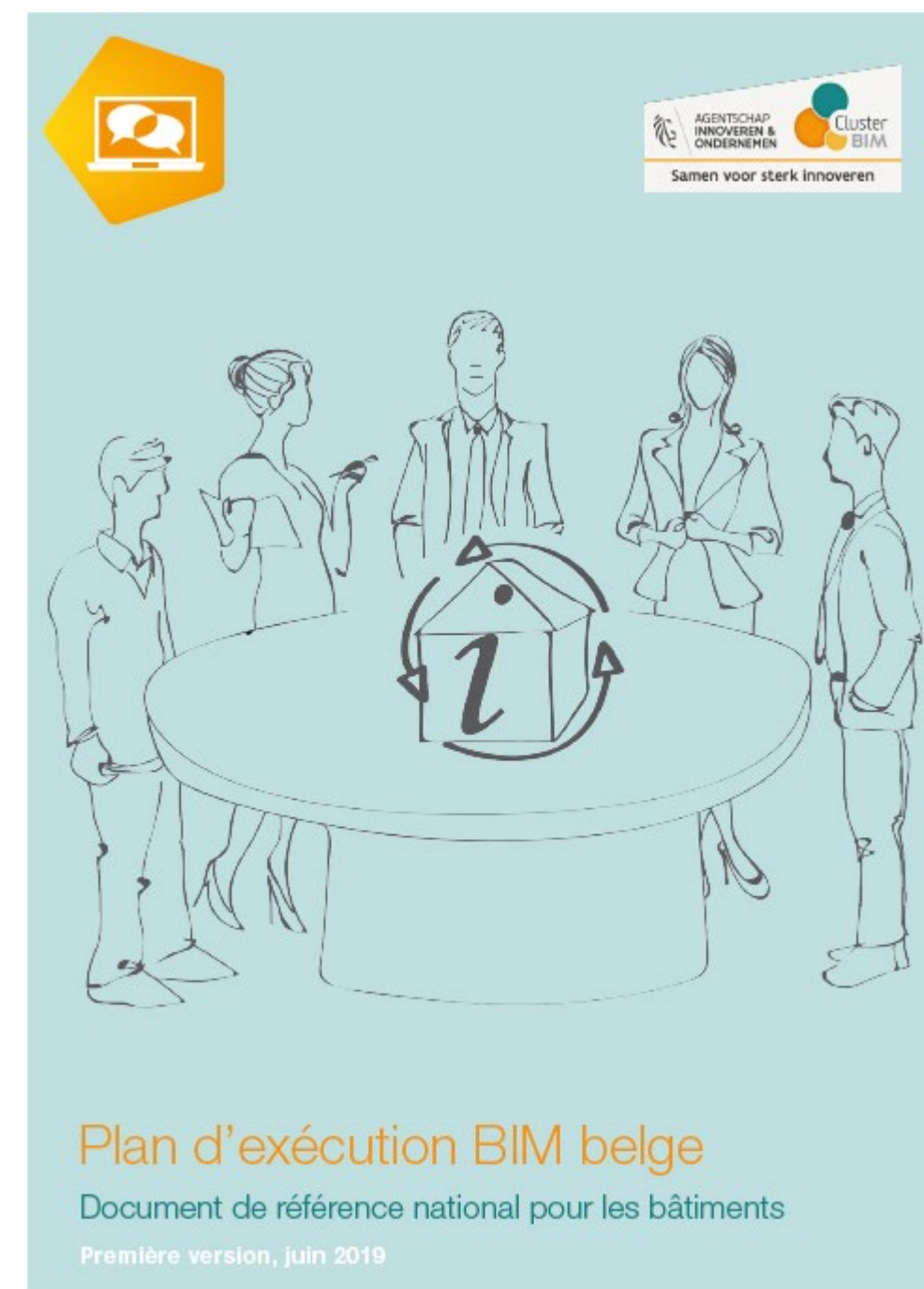
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[CoordinationView V2.0]','2;1');
FILE_NAME('0001','2021-03-06T12:09:22','(',')','The EXPRESS
Data Manager Version 5.02.0100.07 : 28 Aug 2013','21.1.20.44 -
Exporter 21.2.0.0 - Interface alternative d'export
21.2.0.0','');
FILE_SCHEMA('IFC2X3');
ENDSEC;

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#5= IFCAPPLICATION(#1,'2021','Autodesk Revit 2021
(FRA)','Revit');
#6= IFCARTESIANPOINT((0.,0.,0.));
#10= IFCARTESIANPOINT((0.,0.));
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#14= IFCDIRECTION((-1.,0.,0.));
#16= IFCDIRECTION((0.,1.,0.));
#18= IFCDIRECTION((0.,-1.,0.));
#20= IFCDIRECTION((0.,0.,1.));
#22= IFCDIRECTION((0.,0.,-1.));
#24= IFCDIRECTION((1.,0.));
#26= IFCDIRECTION((-1.,0.));
    
```


Research Challenges

- Flattening the BIM concept
- Assimilate BIM methodologies and make them more reliable



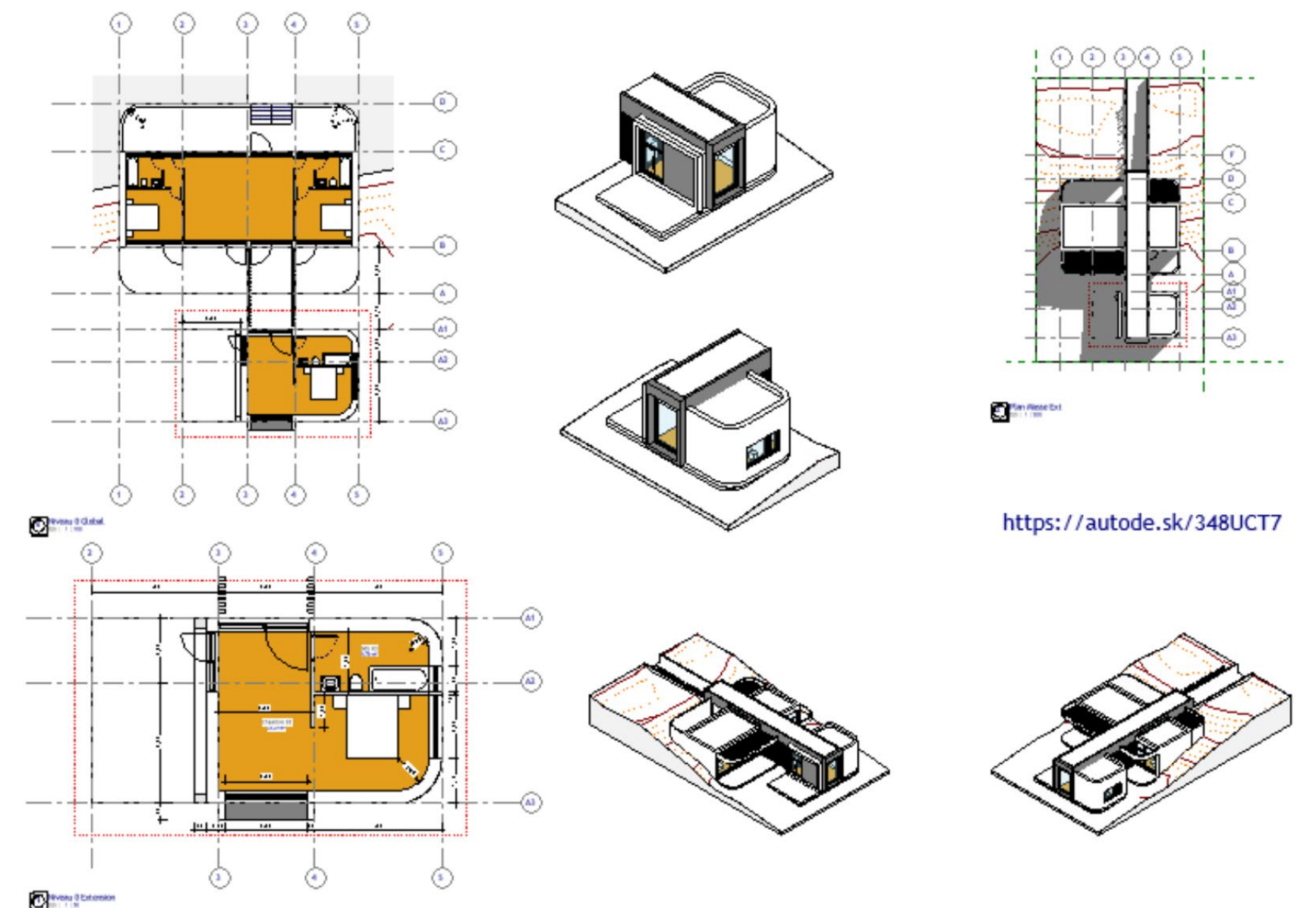
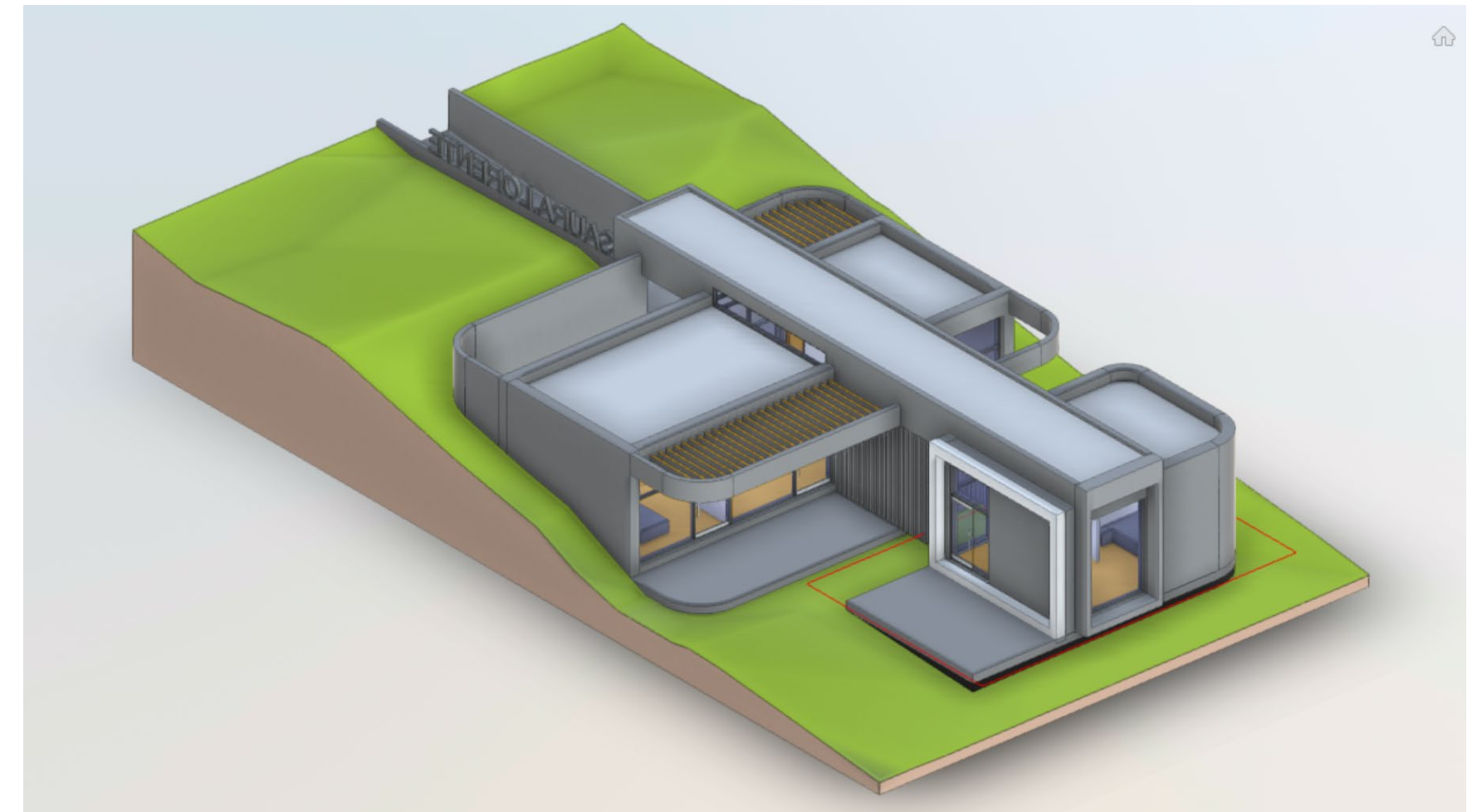


Semantic Modeling

Semantic Modeling

Previous experiences of semantic modeling results (from students' job evaluations and surveys)

- The complexity to understand what is a “model” or “data” for architecture bachelor students
- Model is often resumed to its 3D representation
- The difficulty to understand the link between model's objects and the hierarchy between them during modeling activities
- The use of complex semantic modeling tool to generate unstructured 3D geometric models (representations)



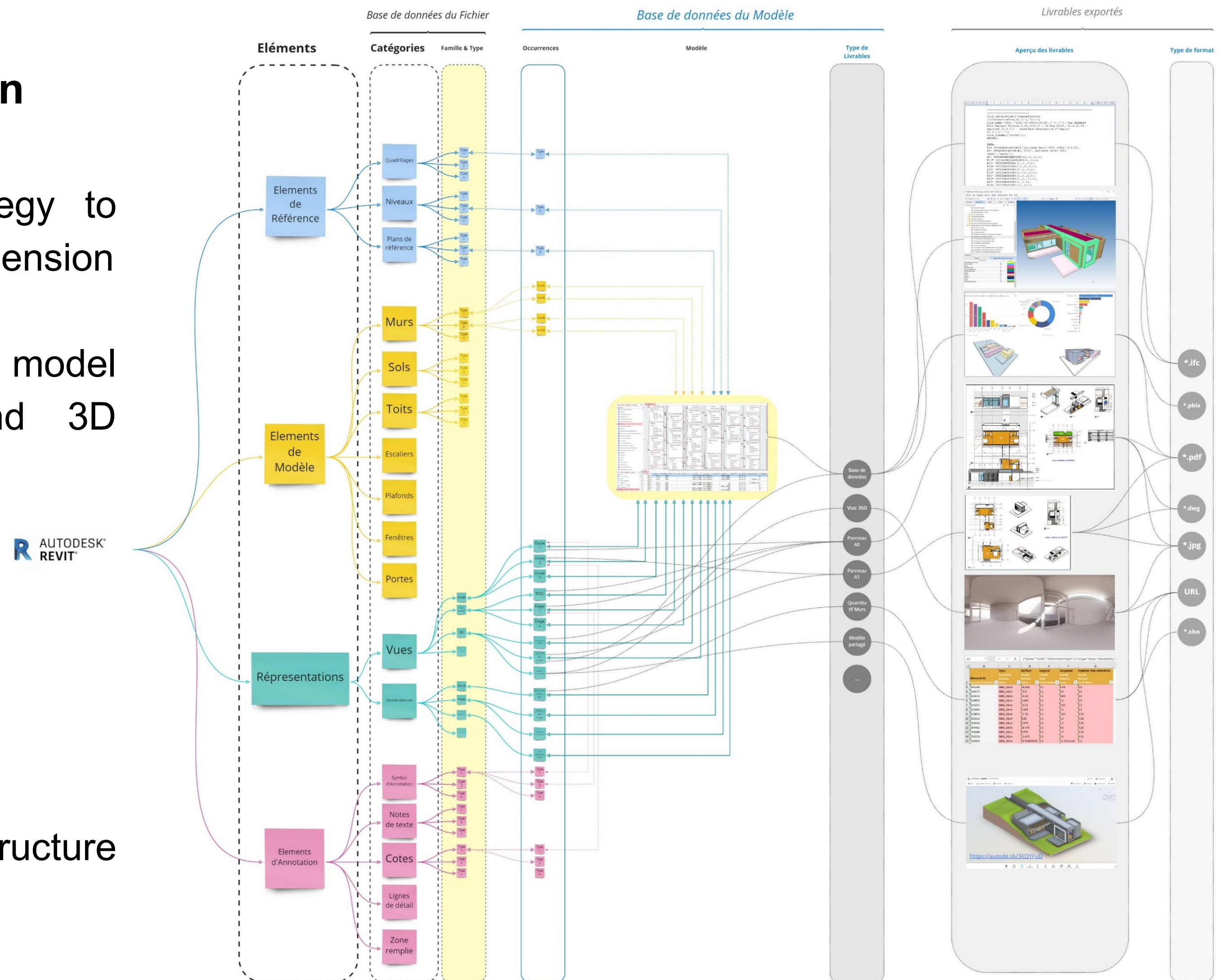
Semantic Modeling

Semantic dimension integration

- Propose a graph base strategy to initiate students to semantic dimension
- Focus on data managed by the model and not generated 2D and 3D representations :

Elements;
Categories;
Types;
Instances;
Links...

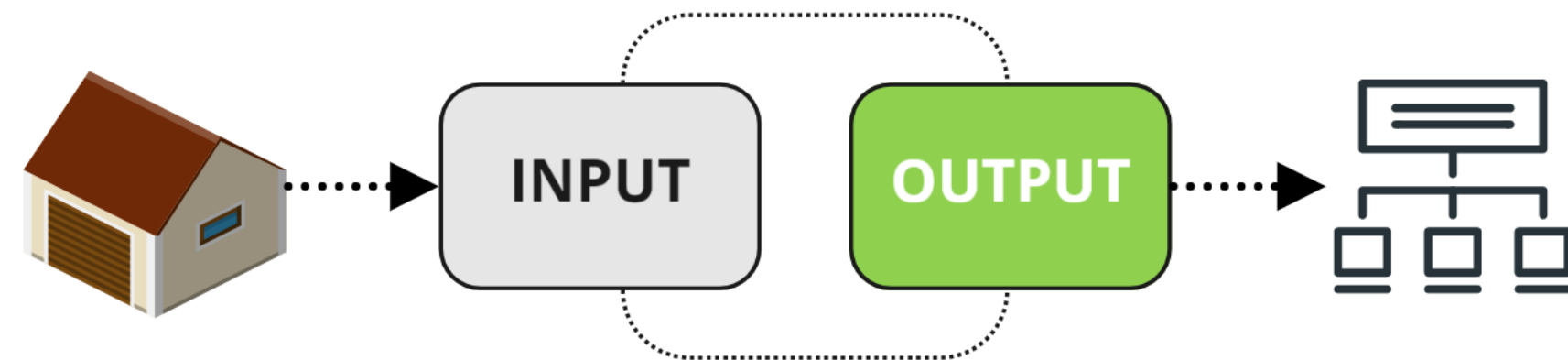
- Create links between model structure and tool interface.



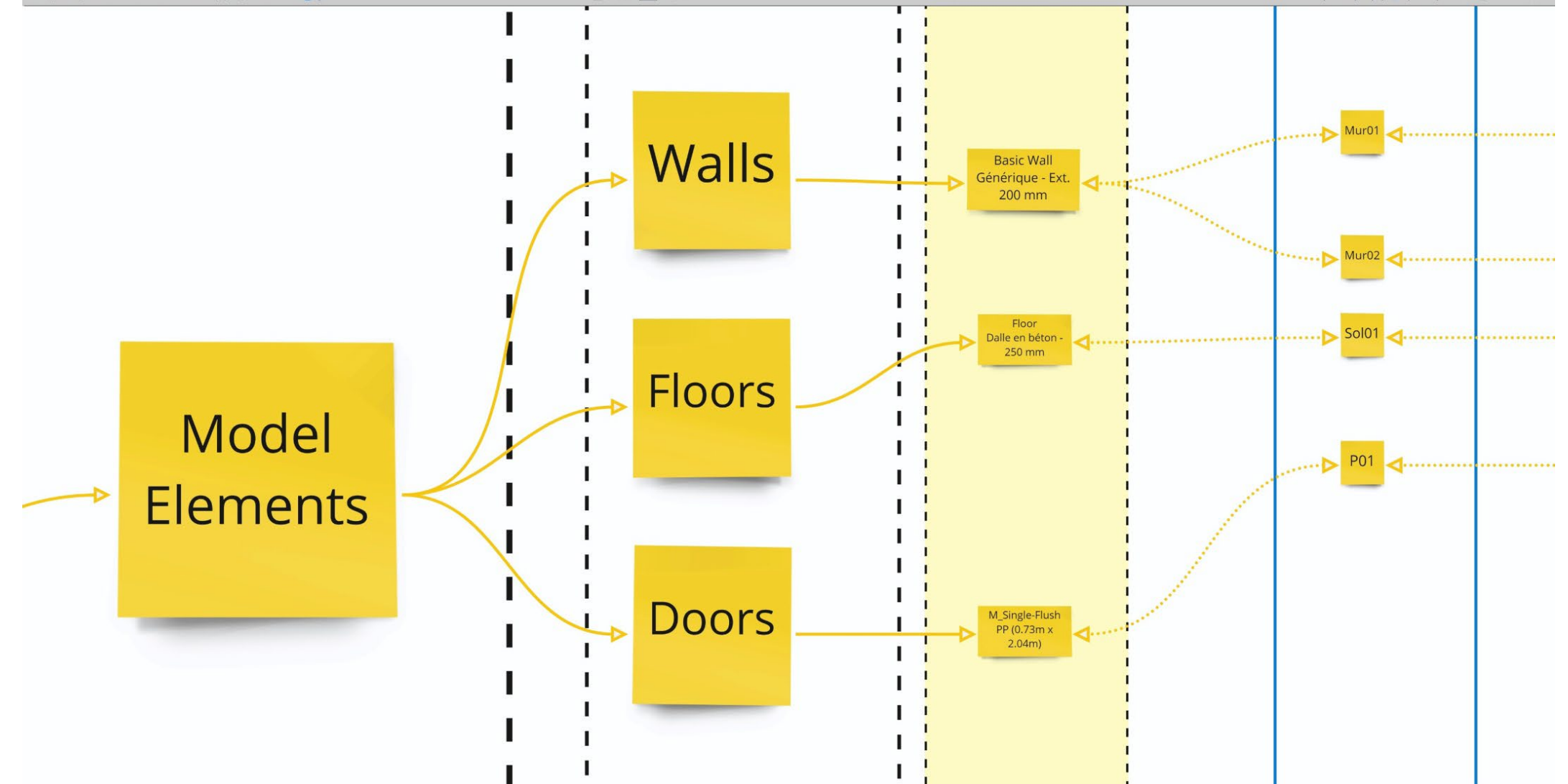
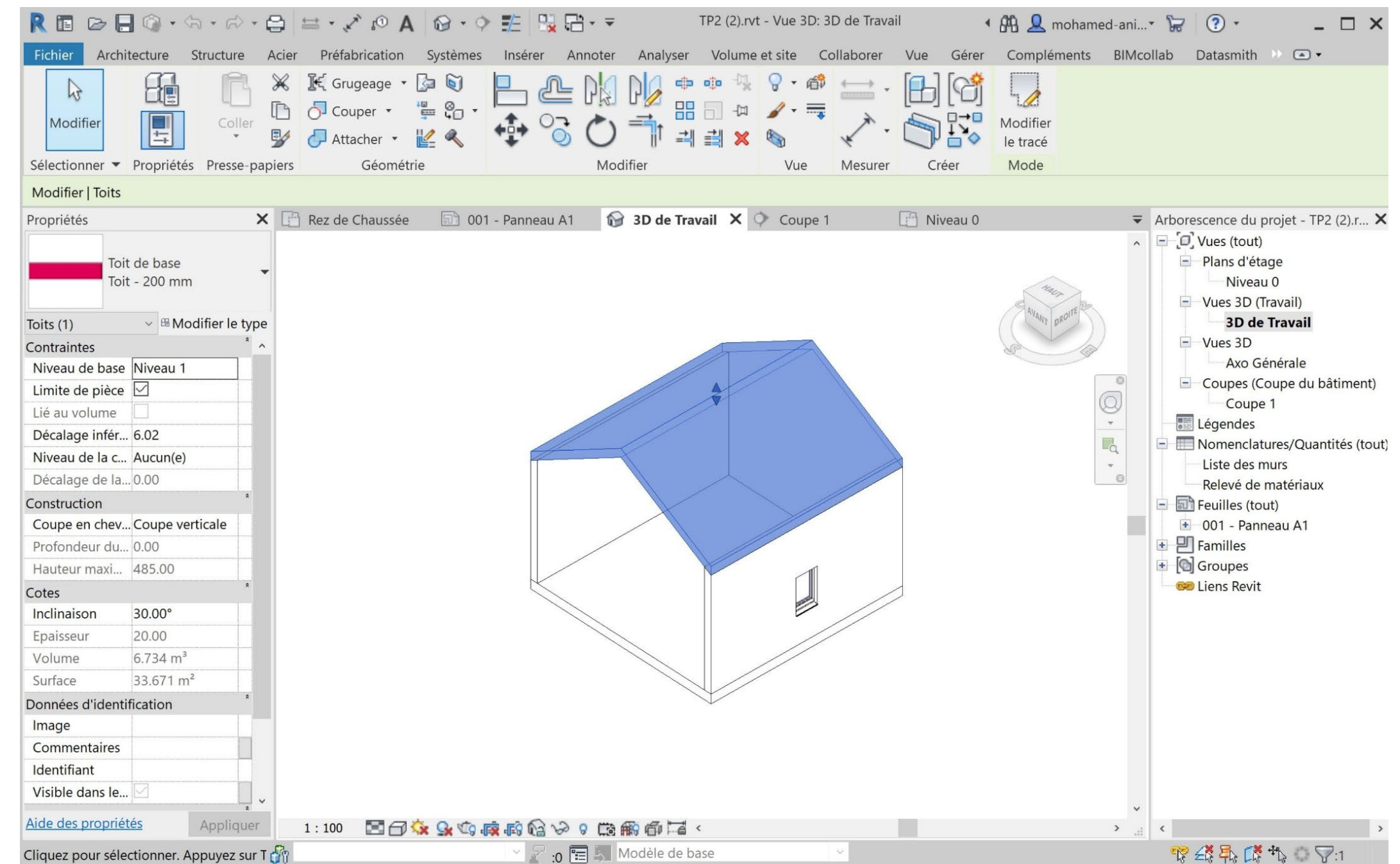
Semantic Modeling

Semantic dimension integration

- Starting the pedagogical process by a reverse engineering (analyze) exercise :



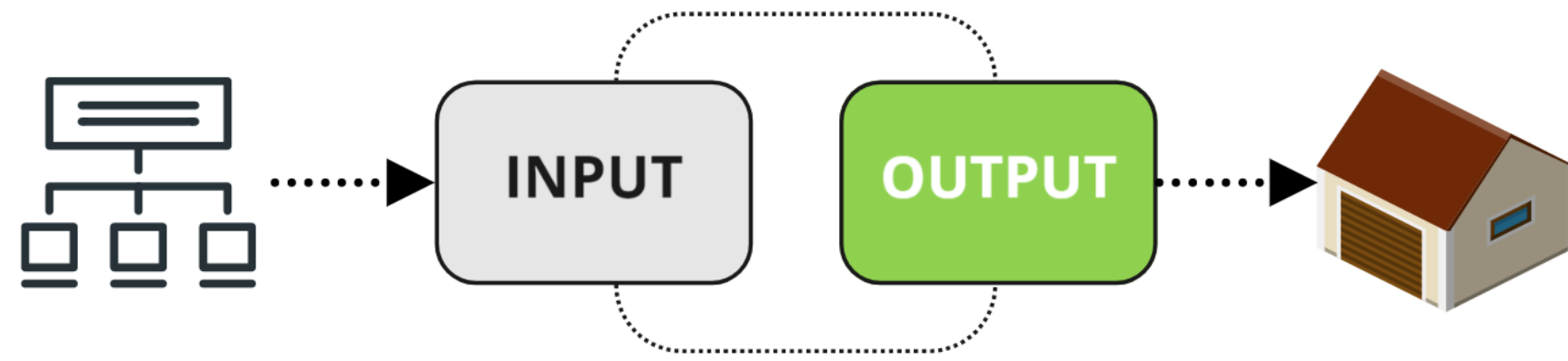
- Activity : fill in the graph with information from the Revit model



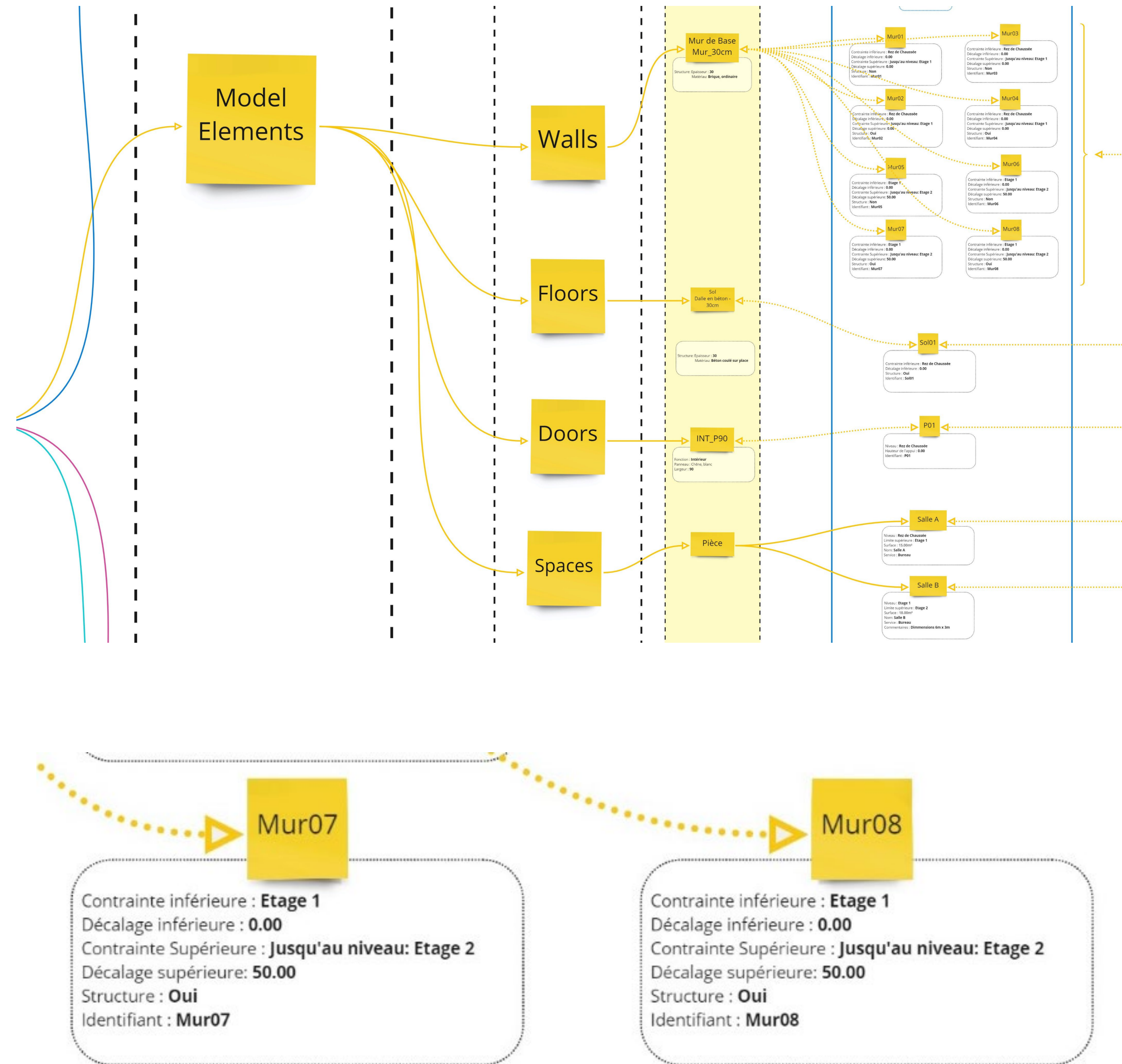
Semantic Modeling

Semantic dimension integration

- Ending the process by a modeling activity from a graph (not 2D/3D representation)



- Activity : Create a Revit Model from the graph information.



Semantic Modeling

Outcomes



- An interesting integration level of graph representation for modeling activities
 - A better assimilation of the concept of data in semantic modeling activities
 - A better consideration of model concept as a database and not only a 3D representation
- Lack of comprehension of relationships between model elements
 - Lack of self-verification activities (quality tests) of the model reliability during modeling process



Semantic assimilation in BIM process

Semantic assimilation in BIM process

Previous experiences

(from job evaluations and surveys)

- Shortage of BIM modeling skills
- Non-equitable tasks in the collaborative process
- Difficulty in understanding modeling objectives
- Problems in translating them to models uses and activities

Présentation de l'équipe BIMSTAR



Adrien DORMAL

BIM Modeleur



Martin BOUTE

BIM Modeleur



Arnaud PIZZIGA

BIM Modeleur



Olivier HONG

BIM Modeleur



Mathieu BUIRETTE

BIM Modeleur



Martin HEUSE

BIM Coordinateur



Clarence GERBOIN

BIM Manager



Precillia MUSUNGAYI

BIM Manager



Celaleddin SARIKAYA

BIM Manager

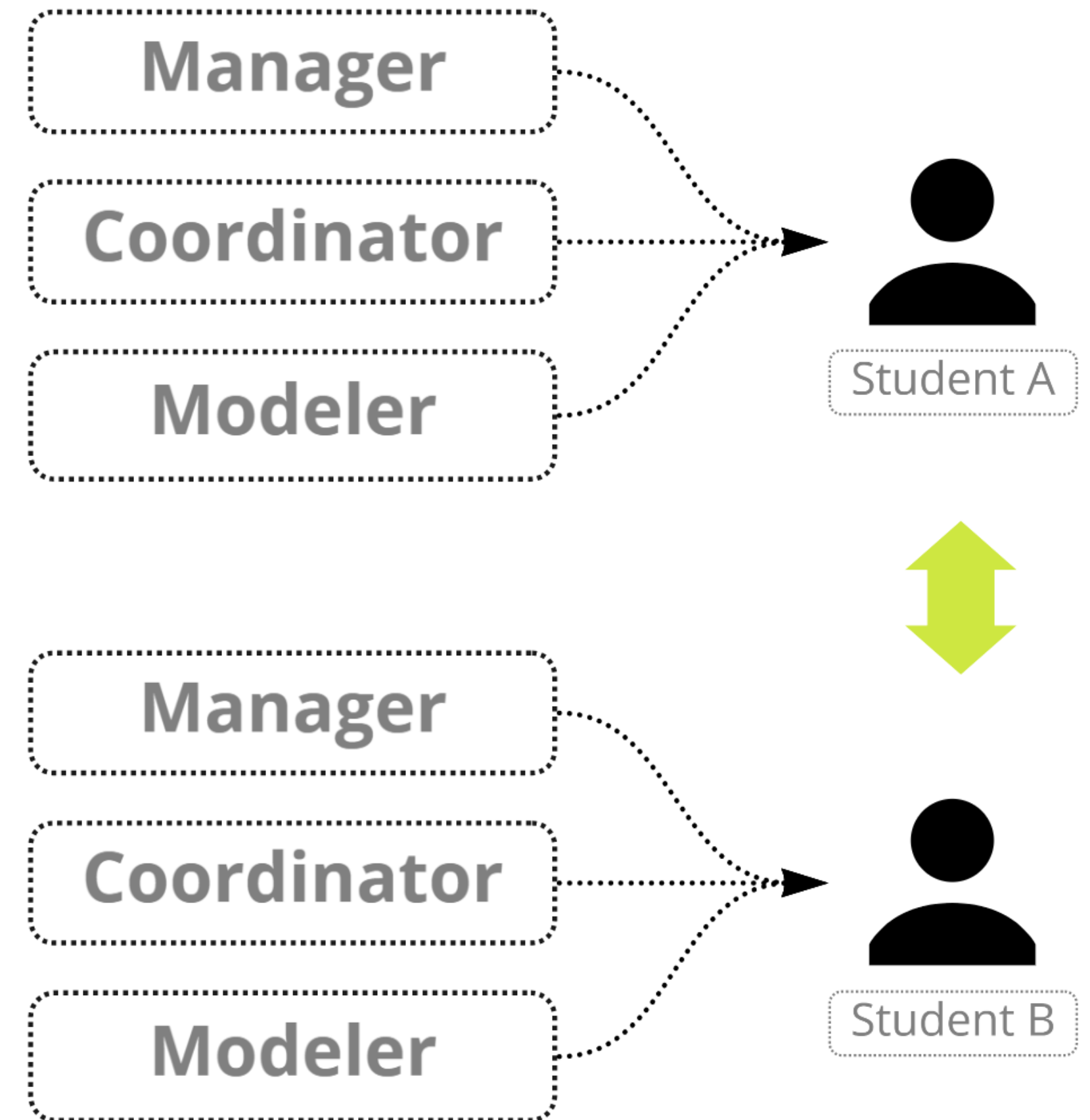
Semantic assimilation in BIM process

Experience goals

- Enhance students' participation in all tasks of the BIM collaborative process
- Allow students to validate skills in BIM modeling and collaboration

Experience process

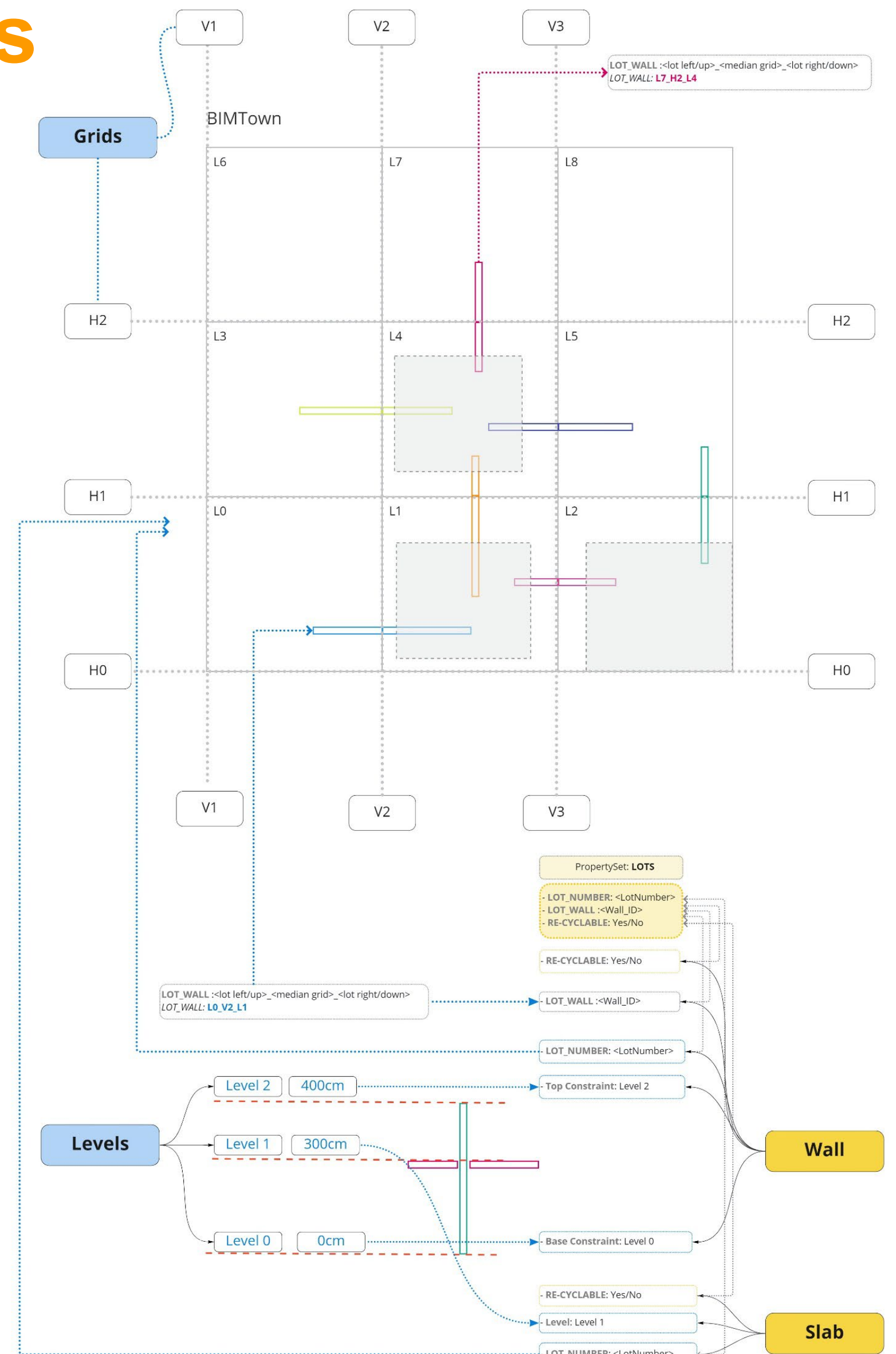
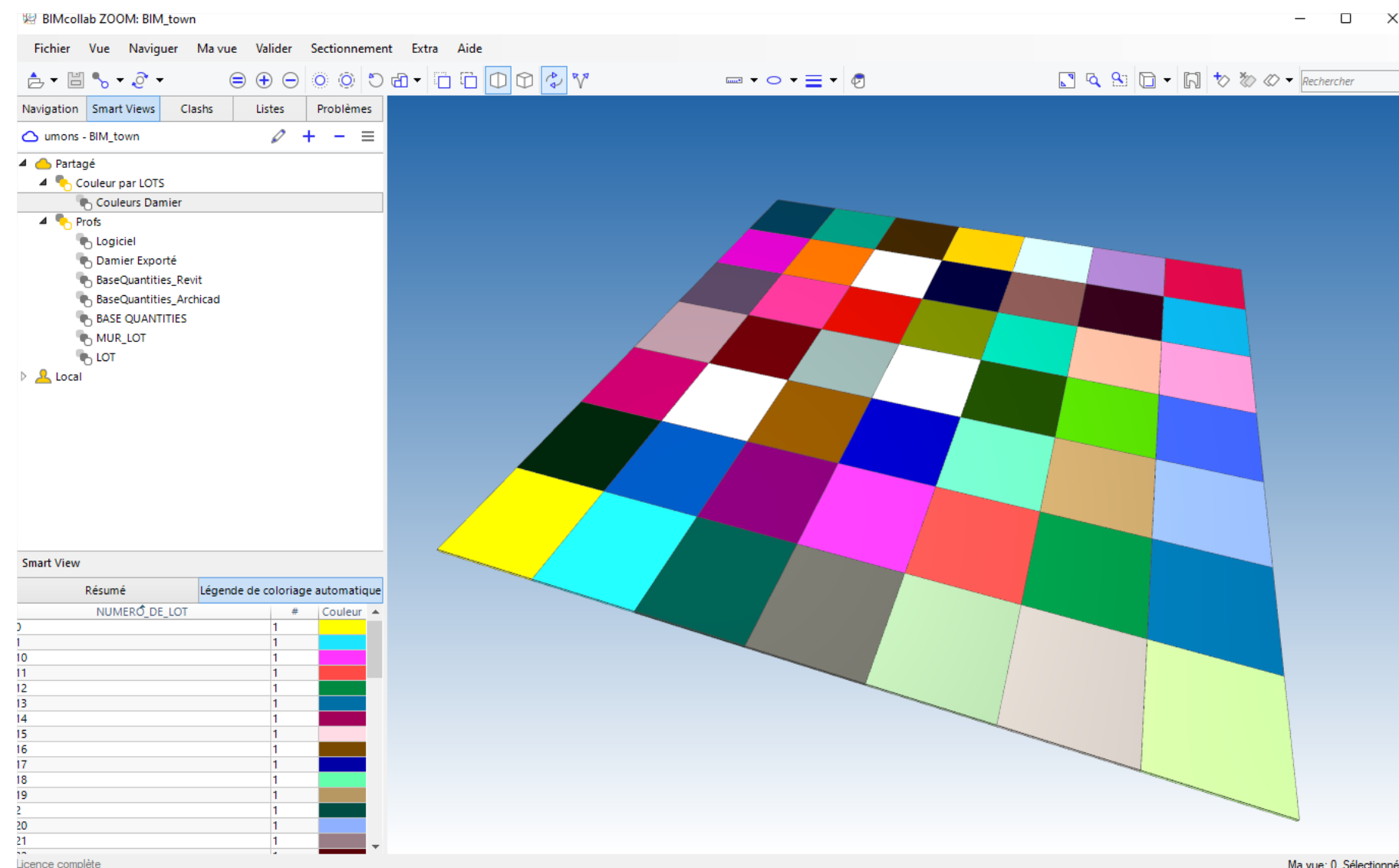
- Gamification of the pedagogical experience
- Create a set of rules that force students to collaborate and verify the quality of their models.



Semantic assimilation in BIM process

BIMTown : the game rules

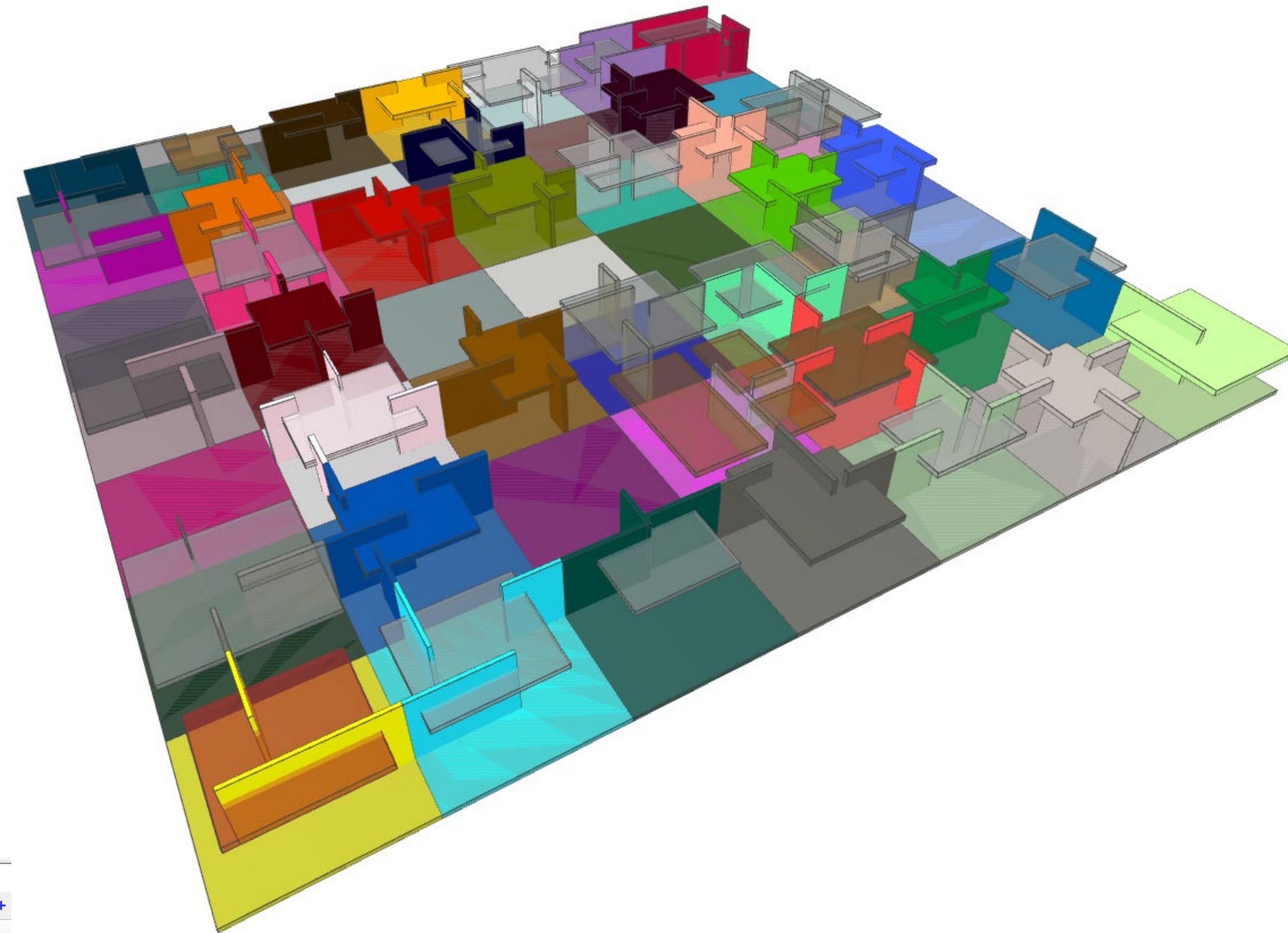
- A virtual Town with 49 parcels shared in an IFC model
- Students should create walls and slabs respecting a naming convention and properties set.
- Students should collaborate with parcel neighbors to respect the rules.



Semantic assimilation on BIM process

BIMTown : the game results

- A virtual town with 49 parcels integrating shared slabs and walls
- The use of smart views functions to verify models' quality and respect of the game rules



The screenshot displays the BIM software interface with a navigation pane on the left and a smart view configuration window at the bottom. The navigation pane shows a tree structure with 'BIM_town' at the top, followed by 'Couleurs Damier', 'Profs', 'Logiciel', 'Damier Exporté', 'BaseQuantities_Revit', 'BaseQuantities_Archicad', 'BASE QUANTITIES', 'MUR_LOT', and 'LOT'. Under 'Local', there are 'Smart view basics', 'Smart view advanced', and 'Visualisation exemples'. The 'Smart View' section is active, showing a 'Résumé' tab and a 'Légende de coloriage automatique' table. The 'Modifier le smart view' window is open, showing a table with columns for 'Type d'élément', 'Propriété', 'Opérateur', 'Valeur', and 'Action'. The table contains the following data:

Type d'élément	Propriété	Opérateur	Valeur	Action
Wall	None			Ajouter
Slab	None			Ajouter
Building Element Part	None			Ajouter
Any element	NetSideArea	Est défini		Appliquer une couleur
Any element	NetArea	Est défini		Appliquer une couleur

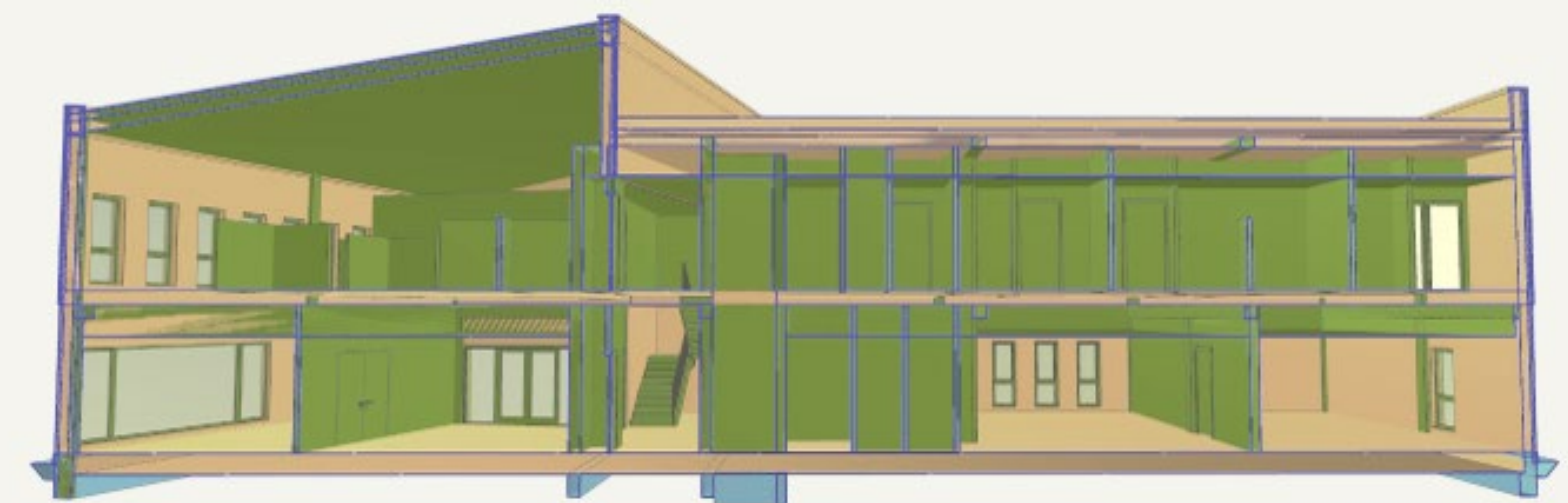
Semantic assimilation in BIM process

BIMTown impact on BIM modeling activities

- Create a semantic model of an existing building
- The generated model should integrate 2 major goals.

Cycle de vie et circularité des matériaux

Démontable



Recyclable



Création des smartviews

Vérification des paramètres

Méthode :

Création de smartviews

- Vue 1: Coloration automatique
- Vérification des entrées // critères
- Vue 2 : Entrée manuelle d'un dégradé cohérent

+ Mêmes outils que vu précédemment.

Type d'élément	Propriété	Opérateur	Valeur	Action
Any élément	None			Ajouter
Any élément	RECYCLABLE	Est défini		Coloriage automatique

Propriété	Valeur
RECYCLABLE	119
APRES TRAITEMENT	227
EN L'ETAT	31
INDEFINI	

Type d'élément	Propriété	Opérateur	Valeur	Action
Any élément	None			Ajouter
Any élément	RECYCLABLE	Est	EN L'ETAT	Appliquer une couleur
Any élément	RECYCLABLE	Est	APRES TRAITEMENT	Appliquer une couleur
Any élément	RECYCLABLE	Est	NON	Appliquer une couleur
Any élément	RECYCLABLE	Est	INDEFINI	Appliquer une couleur
Any élément	ZONAGE	Est défini		Retirer

Critères :

- Listes des matériaux et des paramètres correctes // convention
- Nomenclatures
- Oublis
- Bonne application

Conformité des paramètres.



Semantic assimilation in BIM process



- Enhance collaboration during the BIM modeling process
- A better assimilation of BIM goals



- Weakness in translation of BIM goals to uses and activities
- The need of more gamification (create different levels, challenges and bonuses, etc.).



Limits and Conclusions

Limits and conclusions

- The feedbacks from the experiments identified limitations and weaknesses that will be improved during the next sessions.
- There is a clear difference between software learning and model data structure
- Consider semantic dimension as an import layer in architectural models
- Simplify the BIM concept in order to make it more accessible to architectural educational practices
- Create pedagogical use cases to experiment BIM process using non-professional contexts.

Thank you for your attention !

Moitas grazas! Muito obrigado! Muchas gracias!

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