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Collective decision-making with 4D BIM: identification of synchronous collaborative practices and natural user interactions

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1/ 4D COLLAB RESEARCH PROJECT

This thesis is a part of ANR4DCollab international research project [1]. Fig. 1 resumes related to the project research steps. The project aims to:

- propose an efficient set of **BIM/4D collaboration tools**;
- increase the **quality of human-computer interactions** with digital decision support;
- bring new scientific, professional, educational values.

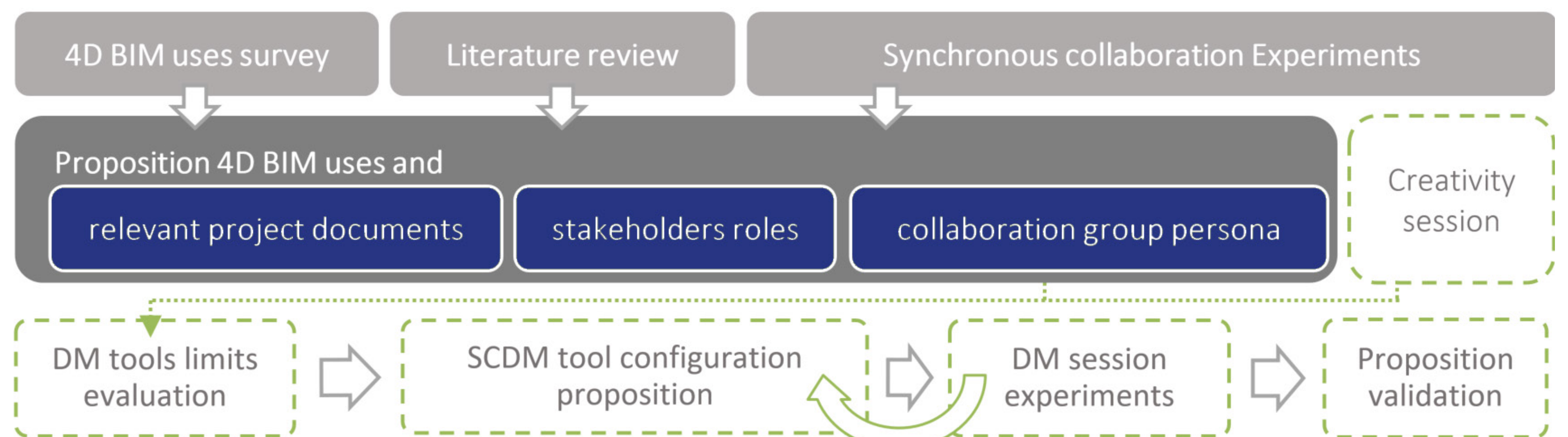


Figure 1 - Summary of methodology steps for decision-making support proposition [3]

2/ 4D BIM USES & PROJECT PHASES

4D (3D+time) BIM major benefits: information accessibility; clear visualization- all actors access 3D model & attached schedule and analysis. Guerriero et al. [2] propose 4D BIM uses. Their introduction and implementation by project phases and with a corresponding LOD is summarized in Fig2. 4D BIM main **value is perceived as a visualization**, however **other potential uses** have not yet been put in a common practice. All of them involve stakeholders' expertise and collaboration.

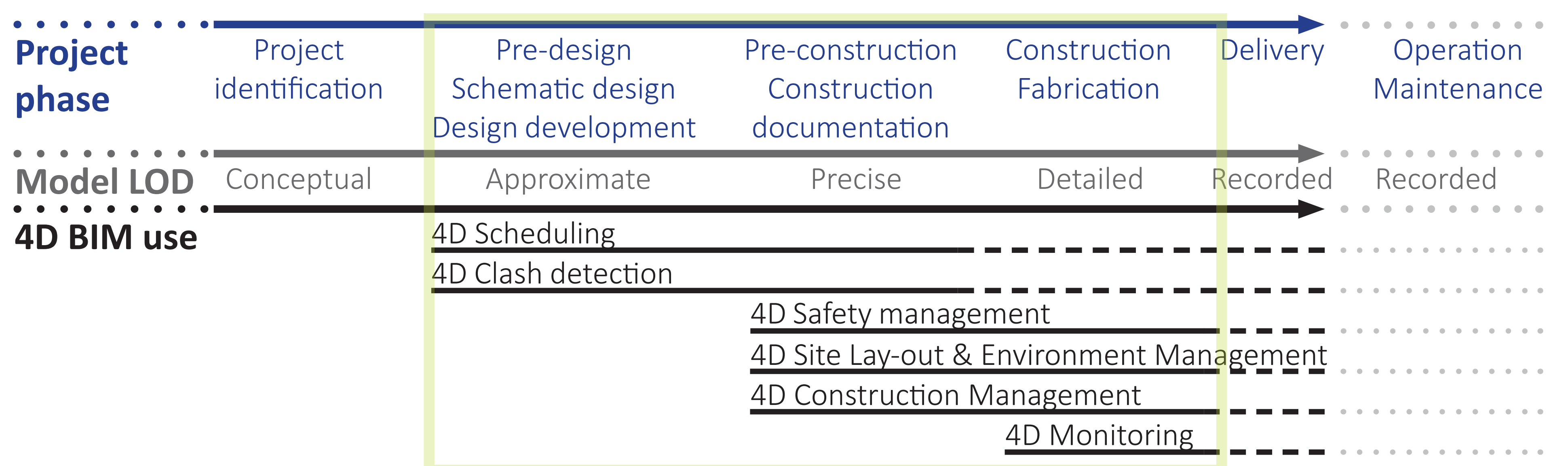


Figure 2 - Project phases and model LOD with 4D BIM use potential introduction [4]

3/ MULTI-USER SUPPORTS

There is no fully collaborative solution for a synchronous collaboration. 4D model interactions are mostly single-user targeted, **thus the multi-user aspect** is an important feature to be developed. An ease of access and low appropriation time with a tool is offered by natural user interfaces (NUI), we propose to **implement a multi-touch collaborative table and wall within a NUI** as session equipment (Fig.a,b). NUI fosters the convergence of 4D uses with project documents. The use of the table with the 4D software (Fig.2c) reveals new values for AEC project decision-making. The thesis research objective **aims for a democratization of the 4D simulations** of AEC projects usage and **develop an easy access** to these practices for the future actors.

4/ Collaboration personas approach

BIM allows the team to use the entire set of **collective knowledge, skills and competencies** as parts of collective intelligence, which is the key feature for digital project management. In order **to describe a project group collective activity**, we propose a collaboration persona (CP) approach [6], which is derived from the original user persona method, also called Individual Persona. CP describes a new type of persona which focuses on **group goals and needs, instead of personal needs**, and includes collaborative work aspects (Fig.2d).

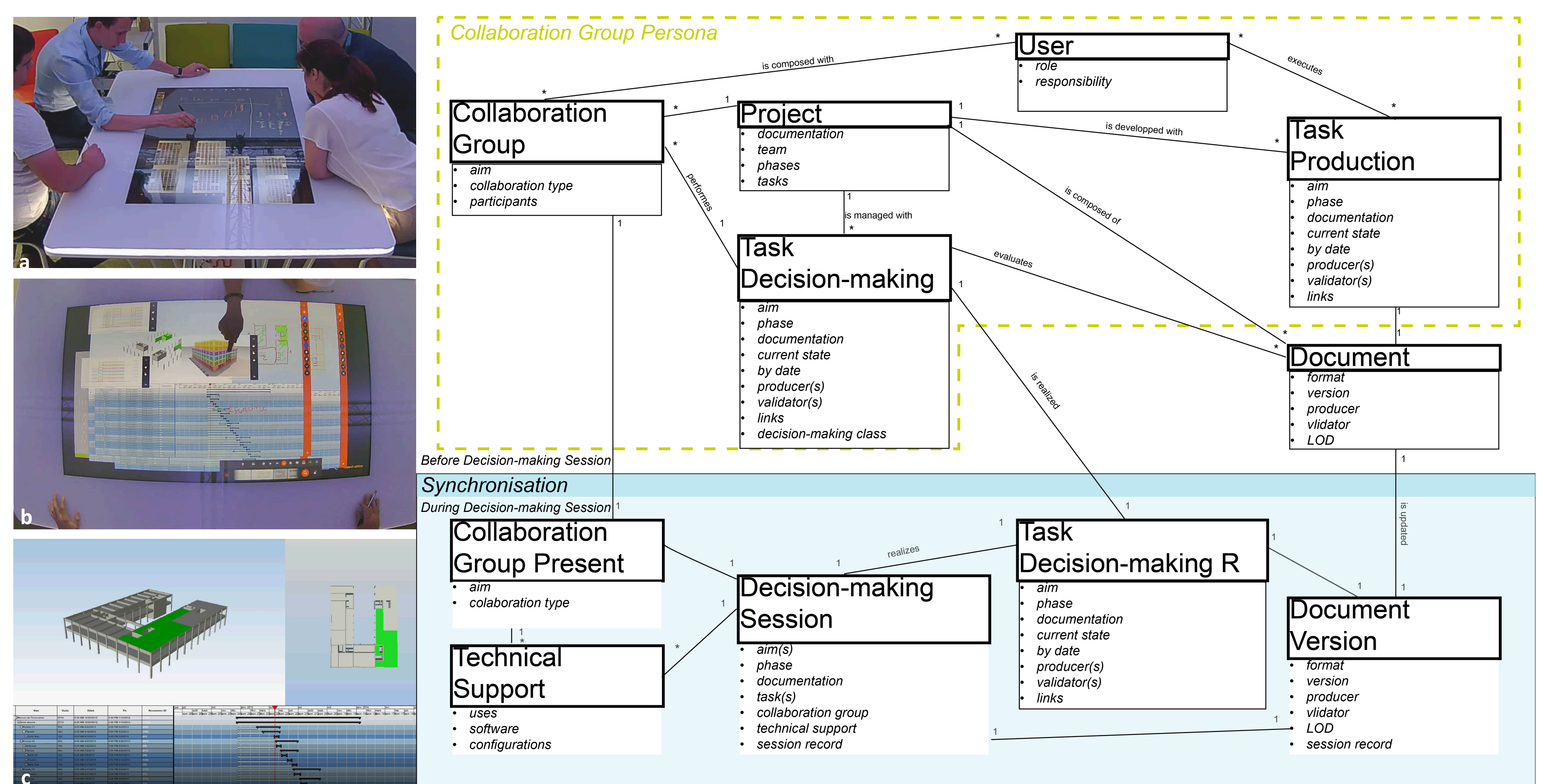


Figure 2 - Experiment session with AEC professionals: a. Decision-making with 4D on a touch table Meetiim & Shariing [5] collaboration and natural interactions environment; b. Project documents visualisation and 2D «sketch» annotations of 4D model; c. 4D model of concrete structure construction logics; d. Synchronisation for decision making session of collaboration persona and project documents

5/ Designing a collaboration support for 4D

The design of a new support will consider different actor roles throughout the collaboration process, and adapt the interface and to collaboration scenarios and 4D BIM use-cases. The design is focused on: 1. providing users with a simple 4D simulations interactions 2. creating semi-automated digital feedback on collective decision-making.

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