

RETROSPECTIVE CODING OF THE UX DESIGN PROCESS FOR UX DESIGN ENHANCEMENT IN DESIGN AGENCIES

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ABSTRACT

User Experience is becoming an increasing centre of interest both in the academic and industrial worlds. Design agencies are no strangers to this phenomenon and are willing to shift from product-oriented design toward user experience design. However, their design process is often loose which may explain a lack of final UX quality or proof of quality, and does not allow to diagnose misuses and improvement opportunities due to a lack of UX formulation and traceability. We propose in this paper to retrospectively represent a design project and its specified, designed and validated UX, in the perspective to conduct a posterior collective diagnosis of UX design in a design agency. The proposed representation model is used to analyse one design project. Results show that only a few UX traces are found in the presented project, and that many dimensions are not considered (like perceptions or affects). Finally, we discuss the next steps of this tool's deployment to create a shared mental model of the design process among the design players.

Keywords: Design process, Process representation model, Experience design, Design practice

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1 INTRODUCTION

User experience (UX) is the subject of growing interest in both academia and industry, as shown by the increasing number of publications concerned (Roto et al., 2021), brands adverts or design agencies websites¹. Therefore, some companies are interested in transitioning to User Experience centred design.

In this article, we focus on small to medium-sized design agencies (from less than ten players to a few dozens) and how to help them shift to UX design. The design process is often quite loose in these agencies (Löfqvist, 2009). It includes only basic information such as the main milestones, light specifications and deliverables with no use of templated models of UX. Nothing wrong, as long as the produced results are satisfactory. The issue comes in when the results are not satisfactory enough (quality, cost or delay issues) or when the agencies' clients require to be sure that UX specifications are met. Then, shifting to User Experience centred design becomes challenging since, as only a few things are formalized, it is difficult to identify clear improvements opportunities.

To understand the present UX design process of the players and identify improvement opportunities, we need to create a shared mental model of the process' strengths and weaknesses among the players. This shared view is the first step for proposing improvements ideas and managing process changes, by allowing the players to become aware of their process' needs to shift to UX centred design. To create this shared mental model, one way is to retrospectively represent several projects to identify gaps within them and formulate general recommendations based on a representative sample of the players' projects. To do so, one way to create this retrospective representation and shared mental model is a graphical representation of the projects design processes. This brings up the question: How to graphically represent User Experience features within a design process?

In the scientific literature, we identified seven graphical representation models of design processes. However, none of them allows to represent UX features within a design process. We thus decided to create our own process representation model to highlight UX features. To do so, we need an UX model to provide a framework for representing UX. We thus reviewed fourteen UX models from the literature. As a UX framework for design process analysis, we selected the most complete and detailed model. Additionally, we established a list of requirements from the identified process representation models to graphically represent the most indispensable design process features.

To develop the proposed representation model, a case study was used as support. This case study is based on a French design and prototyping company, willing to improve user experience features within their design process. This company has a design team composed of about ten players and little formalized design processes. The proposed model was designed in parallel of this case study. Five past design projects have been analysed based on interviews, observations and documents. Graphical representations of these projects are using the proposed model, in order to build a shared mental model of the current design process and collectively elaborate improvement opportunities.

This article is made of four sections. First, a literature review goes through the existing graphical representation models of design processes and user experience models. Second, the method followed, as well as the proposed representation model are presented. We then focus on the case study, and illustrate the possibilities offered by this model to analyse and diagnose the consideration of user experience within a design process, based on an example. Finally, a discussion on the strengths and weaknesses of the tool is made, and perspectives on the deployment of the model as a stimulation tool to structure UX features are evoked.

¹ <https://www.priestmangoode.com/>

2 STATE OF THE ART

2.1 Graphical representation models of design processes

Many models exist to represent the design process. From a literature review on these models, we identified seven existing graphical representation models allowing to retrospectively represent the players' design process. Among these models, six come from the literature review (Bjarnason and Regnell, 2012; Elsen et al., 2010; Felson et al., 2013; Lespagnard et al., 2021; Macmillan et al., 2002; Rummeler and Brache, 1995), while the last one is a model used by one of the co-authors in lectures for summarizing how car dashboards are usually designed in automotive companies.

These models offer to represent different views on the design process. The swimlane diagram represents the orchestration of tasks between the players. Macmillan et al. (2002) represent the orchestration and time spent on each task along the main design phases. Felson et al. (2013) highlight the interactions between project players, as well as their involvement level during the different phases. Elsen et al. (2010) allow to represent the tools used by the players. Bjarnason and Regnell (2012) retrospectively compile project traces on a timeline to support the player's memory during agile projects retrospective. Lespagnard et al. (2021) represent several so-called *design aspects* during the main project phases, through decisions, influences between *aspects* and the evolution of the amount of work for each *aspect*. Finally, the model from one of the co-authors allows to represent the main phases of a design project, along with textual description of main tasks (players, tools, deliverables, decisions, general comments).

Together, these models cover thirteen variables of a design process: task, phases, temporality, players, tools, decisions, cost, value, intermediary objects, interactions, meetings, player's involvement and amount of work. However, none of these representation models allow to represent UX features. Thus, this is a gap we need to address to be able to represent user experience features within a designer's team design process. So, we decided to define a new process representation model.

To create a shared mental model between the players of UX features within their design process, we need to graphically represent the general shape of the process, in order to highlight UX within it. To draw this general shape, we need the players to remind what they did during the process and when, which intermediary objects they used to design and communicate, and how they worked together. To do so, we selected five out of the thirteen variables as the essential ones to represent a design process in our case: players (who), tasks (what the players did), temporality (when they did it), meetings (how did they work together) and intermediary objects.

2.2 User experience models: a framework to represent UX features

The next step to be able to represent user experience features within a design process is to define a reference frame for grounding UX within a theoretical foundation.

In the literature, several User Experience models exist. We identified fourteen of them but, for brevity in this paper, we summarize them around five main families. The first one describes UX as the processing of external stimuli through three emotional levels (Kremer and Lindemann, 2015; Norman, 2004). The second one explains UX as the perception of specific product attributes or qualities and the resulting effects on the user, such as emotions or behaviour for example (Desmet and Hekkert, 2007; Hassenzahl, 2005; Mahlke and Thüring, 2007; Pucillo and Cascini, 2014). The third one contains models emphasizing the temporal dimensions of the experiences, such as before/during and after interaction, and/or short and long term (Forlizzi and Ford, 2000; Pohlmeier et al., 2009; Von Saucken and Gomez, 2014). Models offering a synthetic view of UX from literature reviews constitute the fourth family (Berni and Borgianni, 2021; Ortiz Nicolás and Aurisicchio, 2011). Finally, the last family contains models centred on human (Bongard, 2013; Fokkinga et al., 2020; Peruzzini et al., 2017), from several points of view (psychologic, ergonomic, behavioural).

The wide variety of existing models thus offers several points of view to consider UX within a design process. To identify the most suitable model to represent UX features, we analysed the identified models along two criteria, their exhaustivity and detail level. As we do not know much about the

player's process and how they cover UX, our goal is to build the wider and most precise view as possible. Only two detailed models were identified, the model of [Bongard \(2013\)](#), and the model of [Peruzzini et al. \(2017\)](#). [Peruzzini et al. \(2017\)](#) model of UX is based on [Norman's \(2004\)](#) model of emotional design, but enriched with "ergonomic" metrics (for posture, occlusion, mental load, interaction and emotions). [Bongard \(2013\)](#) model of UX is constructed from a literature review, and builds on three elements: the human, the product and the context. Human and Product are both considered as "systems" and are composed by sensors (five senses for the human), a "processing unit" (cognition and affect for the human, abstract and concrete properties for the product), and responses (physiological, motivational and motor for the human).

[Peruzzini et al. \(2017\)](#) UX model is focused on specific user measurements, while [Bongard's \(2013\)](#) UX model offers a more general point of view on the human "working principles" and external factors (product and context). We thus chose to base our work on the model of [Bongard \(2013\)](#), as it proposes the most exhaustive and detailed view from the identified models. Moreover, it offers a detailed list of UX dimensions, which is quite convenient for our purpose.

2.3 Problem definition

From this literature review, we observed that several process representation models were existing. They cover several variables, but none allows to graphically represent UX features within a design process. However, as our goal is to create a shared mental model among the players of UX features within their design process, we need to be able to graphically represent UX features within a design process. To address this gap, we thus selected five out of the thirteen identified variables as the design process backbone to highlight UX features. Next, among the fourteen identified UX models, we selected [Bongard's model \(2013\)](#) as the most detailed and exhaustive.

Our model thus needs to represent the following variables: tasks, temporality, players, meetings and intermediary objects, as well as UX dimensions through the list proposed by [Bongard \(2013\)](#). This list encompasses the following categories. 1) Human: target user, sensory system, stable / event dependent cognition & affect, responses; 2) Product: product information (sector, type, name, function), functional property, feature, intended character, sensorial properties, structural properties / appearance, behaviour, production method / quality; 3) Context: cultural factors, situational factors, social factors. These categories are further divided in several dimensions. To build and deploy this representation model, a case study has been used as support.

To support this case study, we propose two hypotheses. First, the list of UX dimensions proposed by [Bongard \(2013\)](#) should allow to finely describe how UX is designed by the players during the process. Second, distinguishing specified UX (S), imagined UX (I) and evaluated UX (E) should allow to describe how UX is structured by the players during the process. These states are inspired from the three main steps of a creative/design process identified by [Bonnardel \(2009\)](#), namely "problem formulation, search for creative solutions and idea evaluation".

3 CASE STUDY

To design our graphical representation model, we used a case study as support. This case study first allowed to design the proposed representation model. Then it has been used as an example to illustrate how this representation model can be used to diagnose the UX features in a design agency's design process.

This case study focuses on a French design agency employing about 120 people, willing to improve user experience features within its design process. This company designs and prototypes transport and mobility systems at the 1:1 scale for major companies, among which are Stellantis, Dassault Aviation or Alstom. They thus offer several services, such as prototyping, designing, or both.

After an initial assessment, it appeared that they have no user experience specialist as well as no specific method, tool, or procedure to design UX. Some traces can be found (such as sketches for example), but they are hard to interpret outside their original context. To capture, represent and

analyse how they design user experience, we thus set up a method based on the analysis of five of their projects.

3.1 Method

3.1.1 Company and participants

This company is structured around three main teams: the industrial design team, responsible for the creation of new concepts; the engineering team, responsible for managing the concept's production; and the manufacturing team, responsible for building the concept's prototypes. In this study however, we focus on the design team, as they are the main responsible for the user experience aspects of a project.

This design team is composed of 12 players: a director, a project manager, four 3D modelers (including a manager), and six designers (including a manager and two Color&Trim designers). This team works mainly for industrial client. However, in some situations, the players can be involved in *internal* projects, whose objectives are to promote the company's know-how on specific subjects such as business class seats for example. All the players of the design team have been involved in this study. They have between 3 and 22 years of professional experience (avg. 10), and between 3 and 9 in the company (avg. 5). Most of them (7 out of 12) have a background in car design, three have a rather generalist background (architecture, transports), and two are specialized in airplane seats.

The team is constituted by five roles: designer, color&trim designer, architect, modeler and project manager. The project manager is responsible for managing the projects among the design team (quality, cost, time). The designers are responsible for defining the shape of the product to design (car, airplane seat). Color&Trim designers are responsible for defining colors and materials to dress the product shape. The architect (specialized in airplane seats) is responsible for the underlying structure of the seat (dimensions, construction, ...). Finally, modelers are responsible for modelling precisely the shape of the product to design in the numerical format (using 3D Modeling software).

3.1.2 Selected projects

To capture, represent and analyse how they design user experience, five projects have been selected. Three past projects and two work in progress projects have been selected among the most representative of the design team activities. We chose the projects from four variables: progress (finished / in progress), type (internal / external), domain (automobile, aeronautics, product), and creative freedom (the players can be more creative during internal projects). The five projects have thus been selected for their complementarity: two aeronautical projects, both internal (one business class seat - finished; one premium economy class seat - in progress), two automobile projects, both external (one campervan concept - finished; one light quadricycle - in progress), and one finished internal product project (Amenity kit concepts).

3.1.3 Representations development

To develop this new representation model and build the graphical representations (one per project), we followed a three-step iterative process. This iterative process is constituted by three phases. Figure 1 illustrates the interplay between these three phases.

1. **Data collection** (green in figure 1): To analyse these projects, three data collection methods have been deployed: past projects have been studied using semi-structured interviews, while "in progress" projects have been studied through *in situ* observations of the players. Documentary research allowed to complete the analysis for all projects. For the interviews and observations, notes have been taken using paper/pen. No recording system has been used. The gathered data set therefore consists of 27 interviews of 11 players, with an average duration of 50 minutes; 55h of observations from 25 sessions (mostly client meetings, but also a few collective ideation sessions), and many documents (planning, specification, sketches, presentations, etc.).
2. **Data processing** (red): The collected data have been processed in two phases. First, the data gathered are sorted to identify data describing the design process (who did what, etc.) and data describing the designed object (product, UX, ...). Second, to locate UX within a design process,

we assume that UX features will most likely emerge in the projects as "descriptions of the user point of view". These descriptions are basically statements or documents centred on the user. For example, "[the passenger] should not be disappointed by [the product]". Data describing the designed object is thus sorted to isolate descriptions of the user point of view (POV) from the other descriptions. POV descriptions are then classified depending on the UX state described (specified, imagined, evaluated). The datasets obtained (POV and others) are then coded by one of the authors following the list of dimensions established by Bongard (2013) to identify the dimensions considered by the players.

3. **Representation model** (blue): One representation for each project was then built from the gathered and processed data (design process data). The first iteration was based on the swimlane representation (Rummler and Brache, 1995), as it already covered most of our requirements. The representation model was then enriched and improved to cover the required functionalities. This process was repeated until the represented data is complete for each project, and the representation model covers the required functionalities with parsimony. Eight iterations were necessary. The five first have been made based on interview data (past projects) to represent the design process functionalities. One more has been made based on observations (in progress project), to ensure that all the studied projects could be represented. Finally, two iterations have been necessary to add the UX dimension to the design process representation.

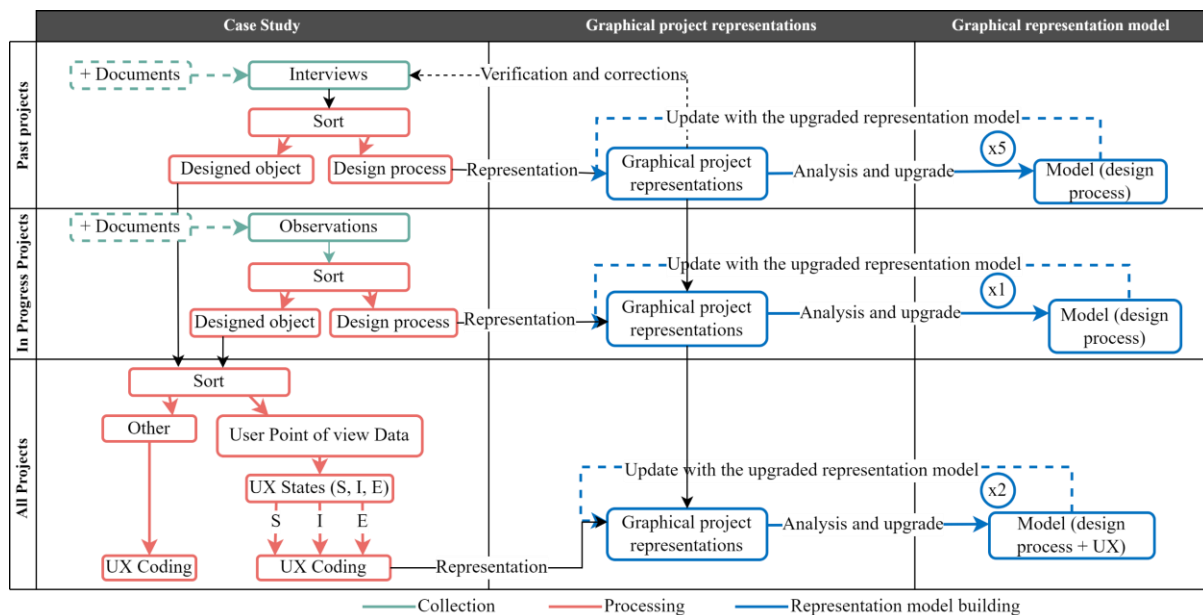


Figure 1 : General methodology followed during the case study.

3.2 The proposed representation model

The proposed model is structured upon three rows (Figure 2). The first row indicates the project's name (top row) and timeframe. The second row represents the project design process, ruled by the legend and symbology proposed in the third row.

This representation model is structured around three principles:

- A colour code indicates the player involved (costumer, design, architect, ...)
- Three types of rectangles allow to represent several aspects. The first type, coloured with the colour code, indicates a design task. Each design task is described by the involved player(s), the goal, and the Intermediary objects (IO) used. A symbol indicates if the IO has been found during the documentary research. The second type of rectangle, represented with a grey title background, indicate the different meetings, with the involved players, the goal, and the IO used as support. The last type represents the POV descriptions (white filled rectangle, with black contour), with either the statement, or the document identified. The source of the description is indicated by a link to the design task. The UX state of the description, as well as the main categories of dimension identified are also represented in the rectangle, along with the

temporality of the description (before, during, after usage, ...). We chose to represent UX categories instead of individual dimensions not to overload the representations (16 categories against 57 dimensions).

- A symbology allows to locate the main milestones in the project process, such as the beginning, the delivery, as well as the intermediate milestones and meetings. Three symbols also allow to identify the data source for IOs and POV descriptions (document, interview, observation).

To illustrate these principles, the next section focuses on the description and analysis of an excerpt from the graphic representation of the Campervan project.

4 THE CAMPERVAN PROJECT: AN EXAMPLE ON HOW TO USE THE REPRESENTATION MODEL TO ANALYSE UX FEATURES

The Campervan project is a project made with a car manufacturer. The industrial client ambitioned to develop a concept of a new kind of campervan, inspired from the hotel world. The goal of this project was to design the interior and exterior fittings of a campervan using an existing vehicle as a basis. In this article, we propose to go through the description and analysis of an excerpt of this project's graphical representation, to highlight how the proposed representation model can be used to analyse UX features within a design process. This excerpt has been built from the analysis of three interviews (total: about 490 words) and 8 documents: six presentations (total: 30 slides), and two written meeting reports (total: 816 words).

4.1 Graphical representation

Figure 2 represents the ideation phase of the campervan project. This phase goes from the client request to the last concept propositions before selection and development of one alternative.

This representation can be read as such. First, the client arrives with a request. This request, a document, is then detailed by the client to two designers of the team during the first meeting. The two designers then work on segmentation propositions to propose to the client, resulting in 3 concepts. These concepts are illustrated with a segmentation document (presentation) and a storyboard (several sketches linked together to illustrate a basic story - a kind of comics). These concepts are proposed to the client to select the most appropriate one. From now on, three designers are involved. Each one of them illustrates one concept through an ambiance, defined from the current trends using a moodboard (collages of images), and a theme (form, geometry, details) using sketches. During this step, the 3D modeler defined a simple 3D model of the vehicle for the designers to visualise the available space (footprint). The client (third meeting) selects one of these. Two designers then propose several variations of these themes. This first phase did last about one month (4 weeks).

In this phase of the project, we identified three POV descriptions (three slides) among the documents and interviews used to build the representation: the storyboard produced during the concept proposition task, and two concept illustration sketches. We describe the storyboard as an example. The storyboard shows human silhouettes (a woman and a man), interacting with a campervan (extending the bed, climbing on the roof, drinking, ...) in a mountain setting where the van stopped. This description is in the imagination state, as it is a proposition from the designers, not a request from the client, nor an evaluation of a proposition. This description considers the subject characteristics (user), the actions performed (responses), the features, behaviour, and appearance of the product, as well as the social and situational factors. It moreover describes the usage phase.

The next section shows how this representation can be analysed to identify UX features and formulate improvement opportunities.

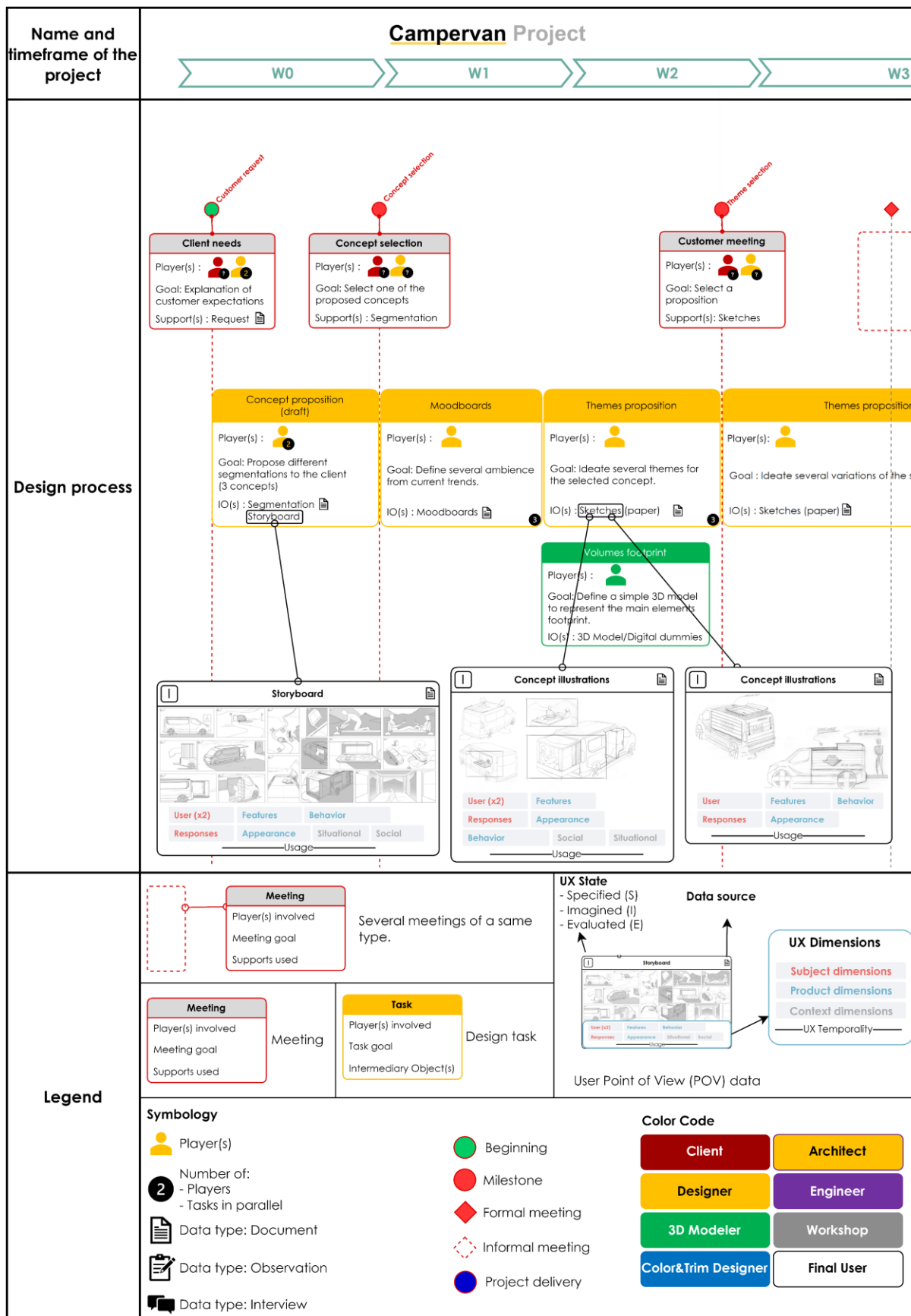


Figure 2: Excerpt of a design process graphical representation for the Campervan project

4.2 Analysis and results

First, this representation shows that UX is not much represented (3 slides among 30), nor discussed (0 descriptions among 1300 words). In terms of UX state, we can see that UX is imagined during the concept and themes propositions tasks (3/3 descriptions). However, we do not find any specified, nor evaluated UX descriptions. As a conclusion, trace of UX is rather weak in the studied phase. Thus, UX does not appear to be the project's main centre of interest. In terms of tools, the players are using tools such as sketches and storyboard to describe the user point of view, but we do not find any specialized UX tool.

In terms of UX dimensions, we assume to find at least each of the three main UX elements (user, product, context), described by one or more dimension categories. In practice, we found that all three identified descriptions consider the user and the product, however only 2/3 consider the usage context. In these descriptions, the subject is described through his responses, but not in terms of characteristics, sensory system, cognition or affects. The context (when considered) is described through situational and social dimensions, only missing cultural factors. The product is described with features, appearance and behavioral dimensions. Although missing some dimension categories, the product and context descriptions are satisfactory at these early design stages, as the main interaction categories are considered. For the subject descriptions however, the missing dimensions (characteristics, sensory system, cognition and affect), should at least be basically considered, as they are essential for UX.

As a conclusion, it appears that the players do not have the basic language to describe UX, as they miss some of the most important dimensions (such as affects for example). Moreover, they do not have specialized tools for UX, and do not appear to be centred on UX. However, their tools could be used to better specify, ideate or evaluate UX. We could for example imagine finding more detailed sketches of the product in the storyboards, with more detailed interactions with the users as the concept is refined. The storyboards could describe as well how the user feels, what he/she thinks or perceives during the interaction, like in comics speech bubbles for example. Moreover, sketches or storyboards could be used at the beginning of a project to draw a basic UX as a specification and could later be used as a reference for ideation and evaluation of UX propositions.

5 DISCUSSION AND CONCLUSION

In this article, we proposed a new representation model to represent the design process and code UX features within a designers' team. This model allows to represent several variables of the design process (players, tasks, intermediary objects, meetings), as well as the place of UX through three graphic principles and a list of UX dimensions (from [Bongard, 2013](#)). The proposed model allows to diagnose a given design process by identifying strengths and weaknesses in the UX features. We illustrated this capability on a case study, by focusing on one out of five studied projects. The resulting representation allowed to identify a low UX features in the process, along with a lack of an UX language and appropriate tools. Opportunities for improvement are thus to define such a language, along with tools and methods to enhance UX features.

Although only one project phase was presented, the five projects studied have also been analysed using the proposed model. These representations allowed to highlight the same needs for an UX language as well as more appropriate tools and methods for a more rigorous UX design. Moreover, they allowed to validate the hypothesis: [Bongard's \(2013\)](#) list of dimensions allowed to describe how UX is designed by the players, through the dimensions considered, while the UX states allowed to describe the evolution and structure of UX features during the design process.

In the next steps, some validation work is still required. First, the coding has been done by one of the authors alone. The robustness and repeatability of the coding should be validated by at least two more coders. Second, the proposed representation model will be tested in the context of the presented case study to validate two axes: 1) its ability to create a shared mental model of the design process among the design players, to ensure that everyone shares the needs of their design process to reach better UX features; and 2) The accuracy of the represented data for each project, as well as the parsimony and understandability of the representation model.

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