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# MULTIDISCIPLINARY CONVERGENCE ABOUT "PRODUCT-USE" COUPLE: INTERMEDIARY OBJECT'S STRUCTURE

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## ABSTRACT
Companies call for collaborative work practices and user-centered design approaches to consider use value and user experiences into product design process as a way to propose innovative products to the market. Indeed, collaborative work is especially needed in the convergent phases of design process. However, the actors in the design team have different viewpoints making it difficult to curry out the convergence between them. So, intermediary objects (IOs) are used as supports of the social interactions and communication. However, IOs are loosely defined, loosely structured. They are viewed as just the product model and even sometimes confused with the technologies that support them. Thus, the aim of this paper is to introduce the concept and the roles of IOs and to propose framework to define a structure for these objects. Based on a case study in virtual environment, the framework proposes that IO is the result of seven interdependent models: product model, product use model, interaction model, support tools model, rules and instructions model, evaluation model and convergence situation model. This framework could be used as a base for designing and choosing the IO.

*Keywords: collaborative design, design for ergonomics, design process, multidisciplinary convergence, intermediary objects.*

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# 1 INTRODUCTION

Nowadays, innovation is a key driver to improve competitiveness and business performance in industrial companies. This innovation could be achieved by considering use value into product design process. Indeed, there is no common definition of product use by researchers. However, we believe that the product use is the result of interaction between three elements: the user, the product and the context in which the user interacts with the product and with other users. Moreover, in accordance with Vallette et al. (2003), we adopt a global and multidisciplinary approach to product use. Thus, the assessment of product use is a common topic among different actors (stakeholders) like physical ergonomist, cognitive ergonomist, sociologist, marketing responsible, designers, product testers, etc. Furthermore, this list of actors could also include the users themselves as experts of their experiences (Sanders and Stappers, 2008).

We assume that the product use is defined throughout the design of the product. In other words, we consider that the design process is a co-designing process of the "product-use" couple and in which the definition of the product and the definition of its use are depending on each other. As a result, different actors drawing from a range of disciplines have to collaborate together during the design process to define the "product-use" couple. In a collaborative and multidisciplinary approach, these actors work together interdependently to achieve a greater goal than is possible for each one to accomplish alone. This collaborative work is mainly achieved during successive iterative convergent phases of the design process. Convergence is considered as an activity that relies on exchanges between different actors concerning several design alternatives in order to reach a satisfying joint decision based on collective rationality. However, these actors of the design process have different intentions, backgrounds and circumstances making it difficult to carry out the convergence between them. To support multidisciplinary convergence, Intermediary Objects (IOs) are used as external representations and mediators that facilitate the social interactions between heterogeneous social worlds (Boujut and Laureillard, 2002). However, the IOs are loosely defined and loosely structured. They are always viewed as just the product models and confused with the technologies and the tools used to support them. Other aspects of the IOs like the interaction, product use, instructions, etc. are neglected during the definition of these IOs.

The aim of this paper is to introduce the concept and the roles of IOs and to propose a framework to define a structure for these objects. This framework could be used as a base for designing and choosing the IOs in the context of multidisciplinary convergence about "product-use" couple. In the first part, we present a literature review about multidisciplinary convergence and the notion of IOs. A case study of a hydrogen vehicle design project is presented in the second part of the present paper. More precisely, we present a convergence step between 4 actors: ergonomist, 2 mechanical designers and industrial designer about the vehicle's cockpit design in virtual reality platform. Based on this case study and the literature review, a framework of seven models is presented to define the Intermediary Object (IO). We believe that IO is such a system that contains several interdependent models. Indeed, our viewpoint is that IOs and the different models in these objects have to be designed according to the convergence situation and the relations between these different models.

# 2 BACKGROUND

## 2.1 Multidisciplinary convergence

The overall product design process is convergent, but it contains phases of both divergence and convergence (Cross, 2008). For instance, in the conceptual design stage, while the objective of divergent phases is to generate several ideas and solutions to solve the design problem, the objective of convergent phases is to reduce the number of proposed solutions and to lead to one detailed solution.

Convergent phases are considered as phases of exchanges and argumentation between different actors concerning several design alternatives in order to reach a satisfying joint decision. During these phases, the actors transmit, communicate, propose, criticize and share ideas like they are in a kind of debate. Each actor has his/her own viewpoint based on his/her constraints, objectives and experiences. These viewpoints have a dynamic nature. They evolve during convergence phases through social interactions and communications between actors who are trying to reach a joint decision (Lu et al., 2007). Moreover, Détienne et al. (2005) introduced the concept of viewpoint as an individual mental representation characterized by a certain combination of constraints, and it is strongly influenced by

domain area or discipline knowledge. They analyzed the dynamic nature of viewpoints through the argumentation process. The notion of integrated-viewpoint is presented as the representation constructed through the argumentation process of the team and it is shared among designers whatever their discipline. Other works introduce the concept of mental model. Each actor in the design team has his/her own mental model as a simplified representation of a current situation. More precisely, he/she perceives a current reality based on his/her prior experiences, background knowledge, and aims (Badke-Scaub et al., 2012). Similarly, the notion of frame is also presented by other works. They are underlying structures of belief, perception and appreciation (Hey et al., 2007).

As mentioned above, actors into product design process have different viewpoints, mental models or frames (in this work, we will adopt the notion of viewpoint as defined by Détienne et al. (2005)). Furthermore, divergence between these actors' viewpoints may be larger in multidisciplinary teams where multiple backgrounds, conflicting objectives and constraints exist. However, our assumption is that convergence between the different actors into product design process can be built up through social interactions around Intermediary Objects (IOs) which will be presented later.

In accordance with the framing process proposed by Hey et al. (2007), the convergence process starts with making the individual implicit viewpoints more explicit by externalization. Once viewpoints made explicit, a confrontation and exchange between the actors are done about their viewpoints. As a result, the conflicts between the different viewpoints will be made salient. After that, the conflicts will be negotiated and the knowledge derived from the different viewpoints will be combined to attain a shared viewpoint. We propose placing the IOs in the center of the convergence process as supports of the social interactions as shown in Figure 1.

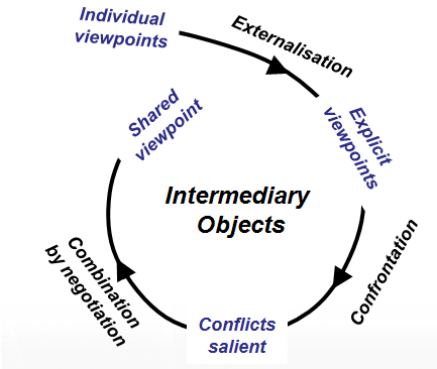


*Figure 1. Convergence process as a social interaction around intermediary objects adapted from Hey et al. (2007)*

After presenting the convergence process around the IOs, we present three levels of convergence in which the convergence process could be occurred (Figure 2):

- The first level is the convergence about the problem formulation: formulating the problem of design is necessary to subsequent ideas generation into design process. A well-defined problem is half solved. A good strategy to define a problem is to consider it from multiple viewpoints that may reflect the interests of different actors. Unfortunately, design problem is often ill-defined problem or ill-structured problem. The objectives are vague and many constraints and criteria are unknown. The problem context is often complex and poorly understood. Convergence between multidisciplinary actors in this level is a real challenge.
- The second level is about the design alternatives: The different alternatives need to converge on one choice of design that satisfies the different actors. For instance, selecting a concept at the conceptual design stage is a complex collective task that has to be done between all the actors. Sometimes, we need to combine tow concepts to obtain a third concept that gathers the qualities of the tow last concepts.
- The last level is about the evaluation of the design. In this level, after the selected concept is developed, the actors need to evaluate it depending on their qualitative and quantitative constraints.

We think that these different levels of convergence could be achieved in the all convergence phases into product design process and sometimes are happening depending on each other. For instance, the convergence about the problem formulation can be done in the all convergence phases into product

design process; this because the design problem is often ill-defined problem depending on the solution. So, it evolves with the solution during design process and it requires convergence among the different actors throughout the design process. However, some convergence phases are marked by certain level of convergence like the convergence about the design problem formulation in the fuzzy front end of the design process, while the convergence about the alternatives is the hallmark of the conceptual design phase in the design process. Additionally, these levels are put in hierarchical order; it is clear that convergence in the higher levels is more important and has more impact on the product design than lower levels (Figure 2).

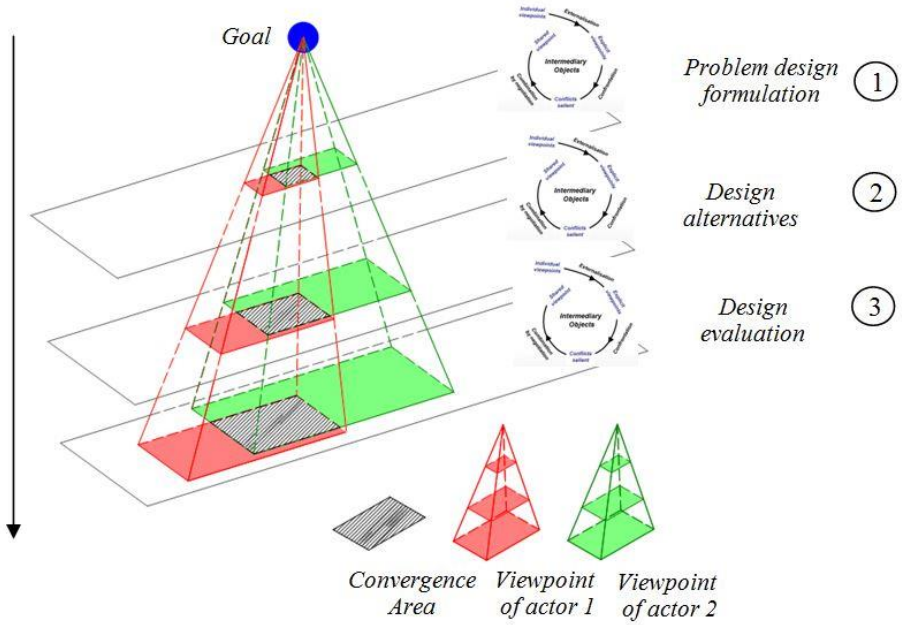


*Figure 2. Levels of convergence into product design process adapted from Lu et al. (2007)*

The study of the convergence about the "product-use" couple between the different actors of the design process will permit to better considering use value during the design process. In this context, the IOs play crucial roles. More precisely, they enable social interaction and dialogue between the actors and help them to externalize, confront and negotiate their viewpoints to arrive a shared viewpoint. In the next part, the notion and the roles of IOs will be presented.

## 2.2 Intermediary objects (IOs)

The notion of IO has been appeared in sociology by Vinck and Jeantet (1995); it referred to every object that circulates between the members of a social network. Subsequently, this notion was used into product design studies like ethnographic analysis. In this context, IOs include all artifacts, whether physical (mock-ups, sketches, etc.) or virtual (CAD models, etc.) produced by the actors during design process (Boujut and Laureillard, 2002). They represent a part or the whole product's identity. Furthermore, they represent the actors who created them by including their intentions, viewpoints, objectives and their ways of working or thinking. These artifacts are all kind of externalizations which constitute the traces of design activities carried out by the actors. Vinck (2009) indicated that IOs are shaped, developed and manipulated through social interactions between actors. In other words, they are materialized representations of actors' viewpoints and their evolutions into product design process. So, IOs make the cognitive implicit frames of actors explicit and they contribute to the construction of a compromise and a shared ground between the different actors. That is to say, IOs act as mediator into product design.

More interestingly, Star and Griesemer (1989) introduced the notion of boundary objects. These objects are located at the intersection between different heterogeneous social worlds. They maintain coherence across these worlds. In the context of participatory ergonomics, Broberg et al. (2011) identified eight characteristics of boundary objects. For instance, they have to be objects- in-the making and built-in affordances. However, the notion of IOs is often confused with the notion of boundary objects. Vinck (2009) indicated that IOs don't necessarily have the characteristics of boundary objects. In some cases, IOs contribute to the articulation between heterogeneous social

worlds. IO becomes boundary objects if they are equipped with a common structure between these different worlds (Vinck, 2009).
However, this paper will adopt the notion of intermediary objects (IOs) which referred to any object that circulates between the actors of design process. These objects are various and depending on the convergence situation as we will see later. Moreover, although the important role of these IOs in convergent phases, they are loosely defined and loosely structured. We suppose that it is useful to investigate a structure for these IOs later. So, this paper investigates some questions like: which IOs can be used for the convergence about "product-use" couple? How can we define these objects for this context? And what is the structure of these objects? The next section reports some empirical findings from a synchronous (same time) and co-located (same location) convergence step of an automotive design project in which objects played an important role. This case study will help us to clarify the proposed structure of the IOs later.

# 3 VIRTUAL MOCK-UP IN A CONVERGENCE PHASE: CASE STUDY

## 3.1 Context of the study

This presented case is a convergence review of an automotive design project (MobyPost). This project is an ongoing project that aims at developing a whole system combining a carbon neutral vehicle with a novel technology based on a solar hydrogen fuel cell system. MobyPost is conducted by nine partners; one of them is our laboratory (IRTES-SeT). The aim of our laboratory is to develop a vehicle adapted to some specific needs of the postmen (i.e. considering ergonomics aspects) with the respect to other functions of the vehicle (i.e. considering mechanical and esthetic aspects). The objective of the project review presented in this part was to attain a convergence about the design of the vehicle's cockpit and the vehicle's powertrain accessibility. This project review is a convergence step about "product-use" couple. The actors who participate in this project review were one ergonomist, 2 mechanical designers and one industrial designer. Indeed, ergonomics constraints play a critical role in the current vehicle design. For instance, one of the major constraints concerns the fact that postmen get in and get out of their vehicle about 350 times per day.

## 3.2 Procedure

During this project review, the actors used a virtual reality (VR) platform composed of 3 active stereoscopic screens (Figure 3-A). To manipulate and to interact with VR mock-up in Virtual Environment (VE) during project review, Wii (Nintendo®) Remote Controller is used. An Ethernet network is implemented between virtual reality system and a sketching pen tablet (Figure 3-B). A remote monoscopic screen of the immersed actor's viewpoints is used. This remote view allows non-immersed actors who are out of the VR platform to obtain a non-distorted view of the immersed actor's viewpoint (Figure 3-C). VR software (Virtools) is used to develop VR applications on the VR platform. To sketch on the captured photos by the pen tablet, Autodesk SketchBook Designer software is used as user interface.
Some actors involved in this study had no previous experience with the VR project review and the manipulation of the VR mock-up. So, a familiarization phase was conducted. By the end of this phase every actor has to know how to: 1) turn the VR mock-up and change its scale to check some details; 2) turn around the VR mock-up and even enter it; 3) use a ray to indicate or to select some parts of the vehicle; 4) hide and display the vehicle's mock-up to compare it with the mock-up of another vehicle existing in the market. 5) Hide and display a virtual human in the vehicle, the reach zones and the vision zones; 6) take a photo of their viewpoint (like snapshots) in the virtual environment (VE) figure 4; 7) sketching and annotating their captured viewpoint on the sketching pen tablet figure 5; 8) hide and display sketched and annotated viewpoint in the VE. Moreover, a VR facilitator was in the disposal of the actors to help them when they had questions during the project review.
Each actor's contribution was colored differently (using a specific color on the pen tablet). This enabled to follow the traces done by every actor. Moreover, 2 roles were defined for actors in the VE:

- The first role is the role of immersed actor. In this role, the actor leads the interaction with VR mock-up in the VE and he can visualize VR mock-up in relief. He can also capture his own viewpoint in the VE and then sketch and annotate his/her intentions on the pen tablet.
- The second role is the role of non-immersed actor. In this role, the actor discusses and communicates with the immersed actor and with the other non-immersed actors. Sometimes, he

can be near the immersed actor on VR platform (with quite distorted viewpoint) or he can also visualize the immersed actor's viewpoint on the monoscopic screen. He can participate in sketching and annotating the captured viewpoint.

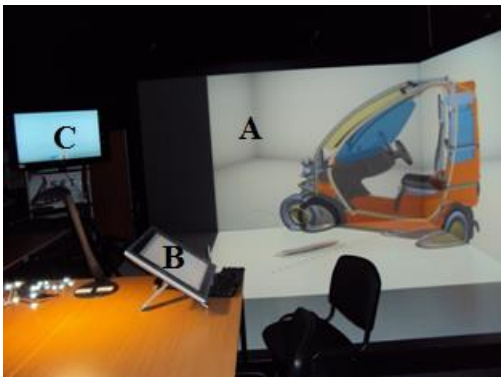


*Figure 3. Tools used during the project review: (A) VR platform. (B) Sketching pen tablet. (C) Monoscopic screen.*

The change between the roles of these actors has to take place in a dynamic way. Every actor can take the role of immersed actor when he wants. The project review was recorded by two video recorders. Following the project review, semi-structured interviews were conducted with the various actors who participate in the study.

*Figure 4. The ergonomist visualizes the vehicle with the virtual human (left). The ergonomist takes a snapshot to his viewpoint (right).*

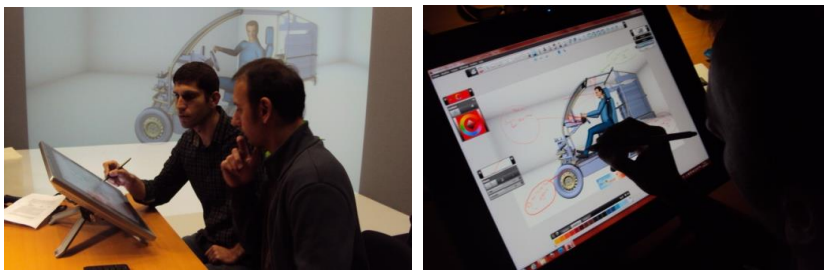

*Figure 5. The ergonomist explains his idea by sketching on the captured viewpoint on the pen tablet.*

The proposed tools allowed the ergonomist to visualize the vehicle on the real scale. He had the possibility to validate the dimensions of the different parts of the cockpit by displaying the virtual human, the reach zones and the vision zones. He could also take the place of the driver on a physical seat in VE for testing the ease of ingress and egress out of the vehicle. It was possible to expect the use of the future vehicle by experiencing the gestures and postures of the driver on VR platform like touching virtual mailbox in the VE. These tools allowed the mechanical designers to validate some mechanical specifications (e.g. the possibility of fabrication of some parts of the vehicle). It helped them to argue and to clarify their design choices to the other actors. By sketching and annotating the captured viewpoint, they could illustrate some ideas to other actors. The industrial designer was very satisfied with the access to his traditional techniques which is 2D sketching. As the ergonomist, VR provided him the perception of the real dimensions of the vehicle. He evaluated the vehicle's esthetic aspects. The discussion and experiencing the gests of the postman on the vehicle's ergonomic design

by the designers convinced them the importance of some dimensions like vehicle's floor width to facilitate getting in and getting out the vehicle.
In fact, the convergence between the actors in this project review took place in different levels. We can find here the convergence about the problem formulation. For instance, one mechanical designer wanted to know if the ergonomists and the Post need doors for the vehicle on which depends the design of the vehicle's frame. He indicated that the proposed solutions to facilitate getting in and getting out the vehicle make it difficult to put doors for the vehicle. He asked the ergonomists to prioritize their choices. We can also find the convergence about the design alternatives. The actors had to choose between different ideas proposed and sketched by the industrial designer on the tablet. Moreover, the convergence about the design evaluation could be clearly highlighted. The ergonomist took the place of the driver to evaluate his gests according to his constraints. The IOs played important roles in this project review. More precisely, the social interactions (externalization, argumentation, confrontation, negotiation, etc.) in this project review were extremely depending on the IOs. Based on this case study, the next section will investigate and discuss a global structure of the IO in the context of the convergence about "product-use" couple.

# 4 DISCUSSION: INTERMEDIARY OBJECTS STRUCTURE

The observation study and the literature review show us that the notion of the IOs is confused with the technologies and the tools used to present and to interact with them. Moreover, most of the studies deal with the IOs as just the product model. However, our experiences show us that product model is just one of several aspects when we are dealing with the IO. This approach was presented also by Wang (2002) in the definition of the virtual prototype. More preciously, Wang indicated that a complete virtual prototype should include three types of models: A 3D solid model, human-product interaction model and perspective test related model. However, we think it is necessary first to introduce a global structure to define the IO in the context of the convergence about "product-use" couple. This structure could be applied for all the IOs and not only for the virtual prototype. We propose that an IO could be the result of the articulation and the interdependence between seven interrelated models. While, the first two models are related to the representation of the product, its environment and its use; the other models are related to the interaction and the selection of the IO (Figure 6). These seven models are:

- **Product Model:** This model consists of any representation of a part or the whole product's identity (e.g. parts, functions, form, materials, constraints, kinematics, assembly, etc.). This model couldn't just be for our product being designed, it could be also for the other products existing in the market. For instance, in our convergence case, the VR mock-up of the vehicle is a product model (converted CAD model). It represents the form, some parts and some functions of the vehicle. We find also the VR mock-up of the other existing vehicle to compare it with our vehicle's mock-up. However, the nature of the product model is divers. It could be physical, numerical, 2D, 3D, mixed, etc.
- **Product Use Model:** This model includes any representation related to the product use or the users (e.g. scenario, persona, human activities, human mannequin, simulation, etc.). It defines how the users interact with the product and the different objects related to its use. Additionally, it could also define the physical or the social environment in which the users interact with the product or with each other. For instance, on the virtual reality platform, the product use model consists of the possibility to perform the gests of the postmen in vehicle's cockpit like trying to access the mailboxes. The objects related to the use are the mailboxes, virtual letters, etc. Like the product model, the product use model has different natures; it could be physical, numerical, 2D, 3D, mixed, etc.
- **Interaction Model:** this model defines how the actors of the design process will interact with the product model and the product use model during the convergence phases. This interaction could be done to modify the product model or the product use model, to test some functions of the product model, to perform some use scenarios in the product use model, etc. The interaction can be achieved in 2D like sketching and annotating some drawings of the product, in 3D like modifying the product model and performing use scenario in the virtual environment, etc. For instance, in our case study, the actor perform the gests of the postman trying to access to the mailboxes in the virtual environment. The mailboxes change the colors when the actor touching them. Furthermore, actors turn and changing the scale of the product model or take snapshots of

their viewpoint in VE. Interaction model is often defined depending on the actor's needs and what they want to do with the intermediary object.

- **Support Tools Model:** this model defines the different tools and technologies needed to present the product model and product use model and to interact with them. The examples are divers here: the virtual reality platform, pen tablet, papers, computer, mouse, etc. They could also be programs like CAD programs, virtual reality simulation program, virtual human program, etc.
- **Rules and Instructions Model:** the IOs need rules and instructions for using or modifying them. To turn the product model in the virtual environment, the actor should press the button (a) in the Wii remote controller on the platform; to change the scale, he should press the button (b); just one actor could be immersed in the virtual environment in the same time, the other actors could watch the immersed actor's viewpoint by the monoscopic screen. However, the rules and instructions model is sometimes so complicated that the actors need a support person. Broberg et al. (2011) called him a facilitator who supervise and help the actors to do the good use of the IO.
- **Evaluation model:** this model includes the different methods and tools used to evaluate the different aspects of the product model and the product use model. The method and tools could be specific to one discipline or could be common between different disciplines. For instance, the ergonomist could use accessibility and visibility zones on the virtual reality platform. They could use virtual rule to measure some dimensions of the product model. Indeed, this model is related to the quantitative and the qualitative constraints of each actor.
- **Convergence Situation Model:** it is the model on which depend the choice of the other models and consequentially the IO. We want to explain this model in more details. The idea here is that an IO is a situation convergence depending; it is designed to be used just for a specific convergence situation. So, we have to detail the notion of the convergence situation. A convergence situation could be defined by:
  - **The participating actors:** The disciplines of the participating actors, their roles, tools and methods during the convergence phases define and influence the choice of the different models of the intermediary objects. The appropriate object for the convergence between two mechanical designers is different from the appropriate object for the convergence between an ergonomist and mechanical designer. CAD drawings could be a valuable object for the two mechanical designers; but they are a less useful for the ergonomist. Additionally, the number of these actors in the convergence phase has to be taken in the consideration. For instance, due to the technical limits of the virtual reality platform in the last case, one actor could be immersed in the virtual environment with correct viewpoints. The other actors should watch the immersed actor's viewpoint thanks to the monoscopic screen. Other aspects should be considered are the level of actor's familiarization with the different technologies, the informality between the actors, the actors' preferences, etc.
  - **Convergence objectives:** This means actors' specific objectives and needs during the convergence phase, what they want and need to do during the convergence phase. For instance, in our case study, the actors needed to arrive to a common decision about the design of vehicle's cockpit. More precisely, they wanted to simulate the gests of the postmen in the vehicle and to test the pertinence of the proposed solutions, to validate the vision zones, to compare the two vehicles' cockpits, etc.
  - **The convergence style (timing and location):** the convergence style can be defined depending on the time and the location conditions in which the different actors interact. Germani et al. (2012) identified four styles by different times and spaces combinations: Synchronous and co-located (e.g. informal face-to-face meetings), synchronous and remote (e.g. videoconference meeting between different sites), asynchronous and co-located (e.g. routine design activity in the same company), and finally asynchronous and remote (e.g. routine design activity of a team involving multiple companies at different geographical locations).
  - **Design process stages:** Some IOs are more appropriate for certain stages of the design process than other stages. So, the definition of the intermediary object changes if we are in concept design, concept development, embodiment design or detail design.
  - **Convergence level:** We defined obviously several levels of the design convergence: Convergence about the problem formulation, convergence about the alternatives, and

convergence about the evaluation. The choices of the models of the IO are related to whether the convergence is more oriented to problem formulation, alternatives selection or evaluation.

- **Product type:** The type and the nature of the product is sometimes a crucial factor to identify the choice of the different models of the IO. A product could be an airplane, a workstation, a machine, a program, or a mass consumption product. For instance, some products have high value of the industrial design. So, they require a high fidelity IO to evaluate the product's form in some convergence phases.
- **Context of the project:** the context of the project could include the enterprise's size. Sometimes, small enterprises do not have sufficient resources or available technologies to choose some choices for the different models of the IO. Other enterprises have time limits and constraints that could affect their choices. Moreover, this context may include the type of the project whether it is an optimization project, innovation project, etc. For instance, vehicle project presented in this paper is conducted by nine partners; one of them is our laboratory which possesses a virtual reality platform.

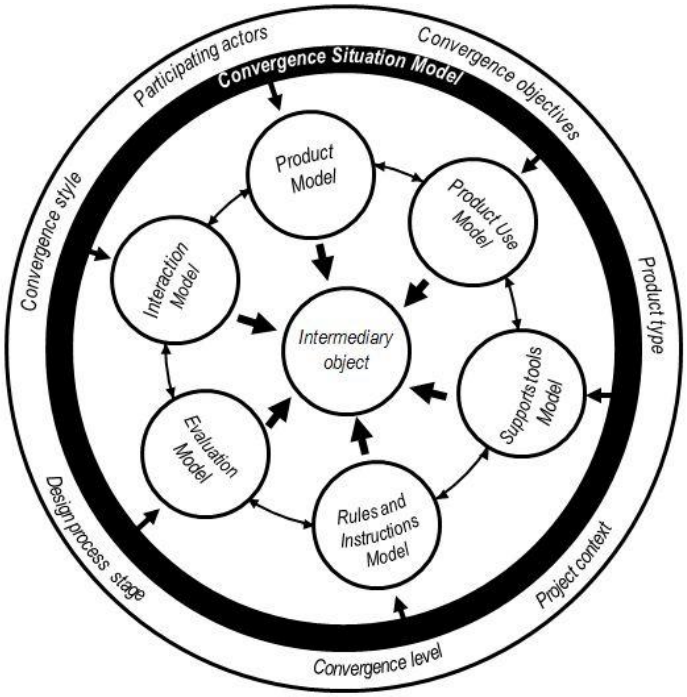


*Figure 6. Structure of the intermediary objects for the convergence about "product-use" couple*

Actually, depending on the convergence situation model, the intermediary object could be more dominated either by the product model or by the product use model. While the CAD drawings are an intermediary objects based principally on the product model, scenarios are more based on the product use model. Moreover, the intermediary object doesn't necessarily include all these models. For instance, a physical mock-up doesn't necessarily need a rules and instructions model or support technology to visualize or interact with it. The combination between the seven models gives us large variety of the intermediary objects. Indeed, the case study showed us that the virtual reality technology is a very interesting technology for the convergence about "product-use" couple. More precisely, it offers the possibility and the malleability to support a large variety of product models, product use models, interaction models and evaluation models according to the needs and the convergence situation model. In this context, Bennes et al. (2012) have been proposed ASAP methodology to help and guide VR developers in the development of virtual reality applications and tools. We think that there is no an IO that could be used for all the convergence situations. IO has to be selected or designed according to the convergence situation. Indeed, the quality of the IO is defined depending on the coherence between the different models, especially between the convergence situation model and the other models.

## 5 CONCLUSION

The aim of this research was to introduce the notion of multidisciplinary convergence about "product-use" couple as a way to innovate into product design process. Different levels of this convergence were defined. Moreover, this paper investigated the role of the intermediary objects (IOs) as the center of the social interactions between the actors engaged in the convergent phases. To this end, a case study of an automotive design project was presented. This case study showed us the crucial role of the IOs during convergent phases. However, we indicated that IOs are less defined and less structured. So, this paper proposed a first structure of the IOs in the context of the convergence about "product-use" couple. Indeed, an IO could be defined by seven models: product model, product use model, interaction model, support tools model, rules and instructions model, evaluation model and convergence situation model. The convergence situation model could be defined by several elements: participating actors, convergence objectives, convergence style, design process stage, convergence level, product type and the context of the project. We think that the choice and the design of the IO are depending on the convergence situation. This first structure could be used as a base to understand and to choose the IOs. We discussed also the advantages of the virtual reality due to its malleability to support a large variety of product models, product use models, interaction models and evaluation models according to the needs and the convergence situation model.

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