Exploring complex service design: Understanding the Diamonds of Context

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ABSTRACT

Purpose – The paper aims to describe the way of mind model creation in service design. The second target is to describe how the different mind models, coming from different domains can be united and understood in situation of solving complex service with practical examples in Smart City domain.
Design/Methodology/approach – The paper will show the limitations of current modeling tools. Using Service Science and System thinking we will show the main ideas of complex mind modelling and introduce the model of individual mind modelling. Following the idea of multidisciplinarity, the second part of the paper proposes how to combine different mind models with the emphasis of understanding different contexts and the shared value within (value-in-context). The proposed approaches will be validated by practical examples from the Smart City domain, and smart mobility particurarly.
Findings – The paper proposes a new approach to understand complex services and provides the systematic way of how to combine the different domains to find optimal multidisciplinary solution, represented by complex service design.
Research limitations/implications – The model proposed by the paper is mostly theoretically oriented and more practical approaches will be developed. We expect to obtain more insights to prove the value of the model in practice.
Practical implications – The problem of understanding the opinions and problems cross more than one discipline is critical in complex service design. By establishing of common vocabulary that will be understood by all members of the team, we can avoid the issues of misunderstanding and wasting of resources.
Originality/value – The paper shows practical implications of Service Dominant Logic, Service Science, as well as Network and Systems Theory by providing an effective application of methodological framework to understand complex service problems. Both theoretical and practical contributions can be used in multidisciplinary teams to understand the key problem and improve the service design.
Key words: Service Dominant Logic; Service Science; Network and Systems Theory; multidisciplinarity, complex services design, transdisciplinary teams.

Paper type – Conceptual paper

1. Introduction

In 2010, the approach of Context Sensitive Modelling was introduced (Stanicek, Winkler 2010). The model showed the possibility to model complex services, using a multidimensional lens, based on different contexts. Even the idea was described properly; we think that the importance of this approach was not fully appreciated in service domain.
In this paper we focused on the service provision by decomposing of the participating items, analyzing their position in the service and categorizing them. The key factor in this part of the service analysis is to understand the position of every involved object. If we see for example a car, then is it about the mobility, or is it about the sharing or something different? Are there any other relationships with other objects? Do those relationships affect other objects or even services? Are some relations more important?
To answer those questions, we need to know, how to analyze the situation and model the process of service provision in a stated context. First, we need to know how to decompose each object and how to understand its role. To prove this concept, we use the examples from Smart City domain. Smart City (or better to say Smart Community) is a very complex environment. The service and its value

(as the value-in-context) cannot be easily evaluated and analyzed. The modeling tool we suggest and describe in this paper should have the power to do so.
The rest of the paper is organized as follows; section 2 is discussing the Context Sensitive Modelling, based on the Context Sensitive Modelling, section 3 investigates more on the concept of value-in-context in the context of Smart City. Then section 4 describes the application of the Context Sensitive Modelling. From the application, Section 5 discusses the implication of the model. Finally, Section 6 concludes the paper.

2. Context Sensitive Modelling

Conceptual modeling can be described as the process of conceptual understanding and rendering the modeled part of reality. The modeler tries to find out which objects of interest the system should keep and provide. The conceptual model should be independent of the intended implementation and intelligible for users (Duzi, 2001).
By the conceptual modeling, we need to create a unique way how to understand the reality, in our case the provision of the service. The main contribution of the authors leads to the fact they separated the process of "knowing the world" into two parts:

1. How do we model the reality in our mind
2. How those "mind models" can meet in the real discussion

In the first case, the authors (Stanicek, Winkler, 2010) are answering the question of what does it mean "to pay attention"? Our senses are recognizing hundreds, maybe thousands object every second and still – we pay attention only to some of them. More precisely, we pay attention to the objects and their connections (relations) with another object if we find them interesting. For example – we ignore car on the street far away, but a car on the road just in front of us we perceive. First, important insight is we need to see not only the objects but also (or more) the relations among them. That means we perceive the only car driving on the street because it could be dangerous for us. The car parking on the same street does not represent any danger for us.
The unique combination of objects and their relations enables us to categorize any object we see. Only by this, we can distinguish different sets of objects properties. In our mind, we are continuously moving the objects with their relationships to the different categories, depending on the particular situation.
It is clear there are not the only static distribution of object with their relationships to the categories. Objects can perform actions, affects other objects they are related to and change their statuses. This ability is so-called operations. But what kind of operation can the particular object do? Does it depend on the objects or the specific set of relationships? It is related to the category the object belongs in our mind model.
To complete the model we need to be able to distinguish when we can use specific operation. Not only if it is allowed (for example by law), but if it is even possible, if we have met all conditions (we have all necessary objects needed to perform a specific operation. Therefore rules must be defined by connection (relation) with all necessary objects.
The described model is drowned in figure 1. The R-edges are representing the mention – use principle, applied in this model. Using R-edges, we can move category, operation, rule or connection to the "middle" of the diamond as object and think about it as the part of our other model (mentioning). If we want to use it again, we move it back to their place.
P-edge is representing the projection – specific relations between the objects that are defining their category and rules for operation. This definition is represented by edge 01 and 02.
The category defines the ability to perform one or more operations (where one operation can be performed in several categories) – this is a meaning of edge 02. And operations can be restricted (or allowed) by several rules – edge 04.

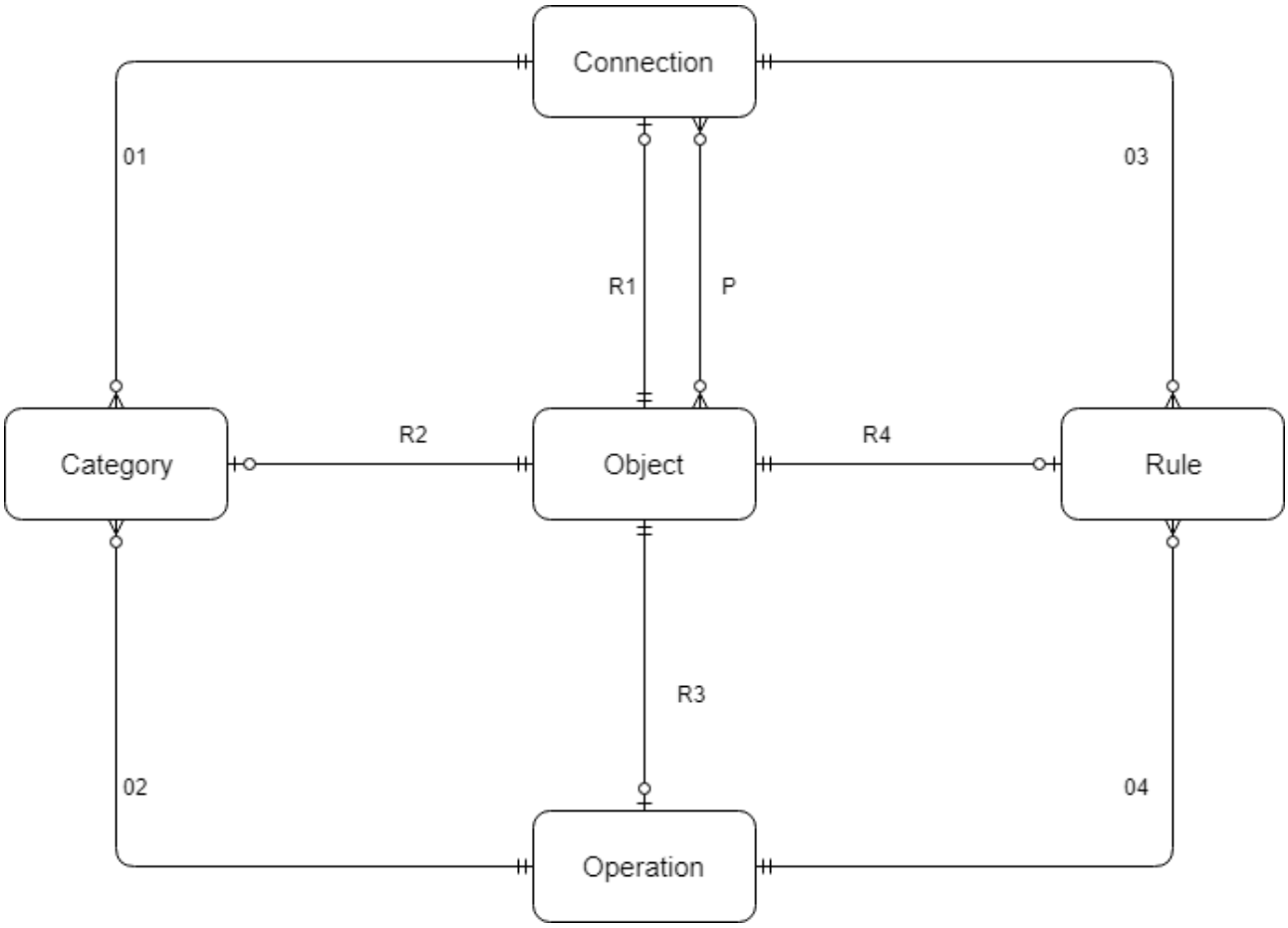

Figure 1 - Diamond See (Stanicek, Winkler 2010)

This approach is always used when we need to design any service. We explore the object the service is related with and put them into specific categories, define operations and rules according to their role in the service.

We need to highlight that we are speaking about mind model – how do we model everything inside our mind when we think about specific objects or set of objects. There is no uncertainty or misunderstandings. But what to do in a situation when we need to interact with other people? How to compare our mind model with others? We find that categorization of objects and other consequences are different. Does it mean our mind model is better than others? No, this means just the fact we see our objects in our specific context and the others are doing the same. What we exactly need is to do the next step – find the tool that enables to unify all mind models into the one.

This diamond, so-called "Recognize" is describing the process of attention distribution (Stanicek, 2009). Item in this model corresponds to the Object in the See model. CI-connection is representing the level of certainty that the Item belongs to specific Category, where the certainty level can have values from interval <-1,1>, where -1 means Item for sure does not belong into the Category, one means that Item belongs for sure into the category and 0 means we cannot decide.

The value of certainty depends on the context we currently are (as motivated in the section after). Context is defined as a set of manifestations – where manifestations are elementary beliefs that are related to the specific piece of reality. For example – in the context of Law the car is defined as "a motor vehicle is a non-rail vehicle powered by its engine and trolleybus." But in the context of e-mobility is important if the car has an electric engine or common fuel engine. Therefore the Context is defining sets of Categories to be used when one Category can exist in more Contexts and vice versa.

The whole picture of the Diamond Recognize is on Fig. 2

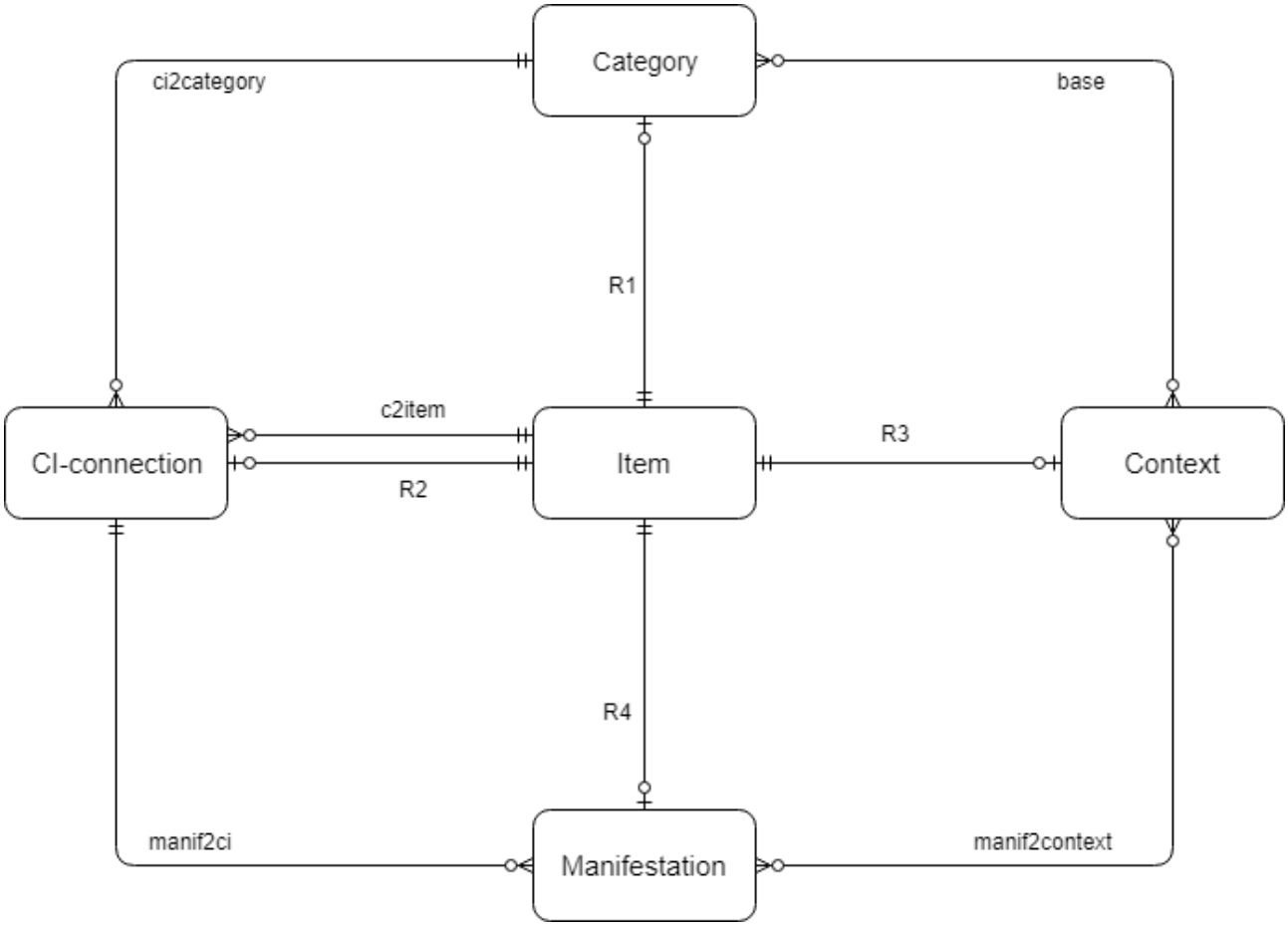

Figure 2 - Diamond Recognize (Stanicek, 2009)

The main role of this diamond is to support service design and service analysis. To be able to list the components of the service, we first need to identify all important and related contexts and describe all manifestations of all objects (items) we find as important for particular service.
Usage of both diamonds together enables to understand the role of each object(item) in all contexts and be able to design service with overlap to all related contexts.

3. From value-in-context in the context of Smart City

3.1 Nudges from Literature

Currently, conceptualizations on value-in-context (Chandler and Vargo, 2011) highlight an important dimension in understanding value co-creation processes, because they framed exchange, service, and resources in light of actors' perspectives (Vargo and Lusch, 2016).
Recent advances in Service Research led to better framework interactions of users with the servicescape in which a service is experienced and they benefit directly from the active participation in the co-creative processes of value (Wieland et al., 2012); further, value has been reinterpreted as value-in-context, because it is contingent on the integration of resources and its context specifics (Vargo et al., 2008); contextual value does not exclude the existence of an exchange or use of the resources integrated by actors in their interactions (Vargo and Lusch, 2016).
The relevance of context emerges as a fundamental dimension in the study of markets and value co-creation processes particularly (Peñaloza and Venkatesh, 2006; AarikkaStenroos and Jaakkola, 2012; Yi and Gong, 2013); in a context subjectively perceived, indeed, users should be stimulated in the constant multi-directional, multi-form and multipart collaboration for the development of systemic

interactions participating, the convergence of individual goals, the stable resources exchange release (Polese et al., 2018).
Context can be explored at multiple levels, as the showed model fullfils, from micro-dyadic exchanges to macro-ecosystems and depends on the resources available for actors and the institutional logic they adopt to interpret the potential value of the resources (Taillard et al., 2016). Thus, since contexts are continually re-shaped by actors' interactions, just as intended before, the time and space of value co-creation become interesting when companies' performance and competitiveness in the ecosystem are being evaluated (Löbler and Hahn, 2013).
The challenge still open is to identify the customer value (Eggert et al., 2018) as something co-created in a context, different from some others situations and conditions that can occur over time, as they are perceived personally from users (Polese et al., 2016; Carrubbo et al., 2018). New evolution and expanded models can help in the understanding of dynamics in a defined pathway. This is so intriguing for lots of application field, just like market shaping, destination management, supply-chains development, public services management (just like smart traffic, smart mobility, smart cars), service design in smart service systems (as Smart Cities are) and so on.

3.2 A smart pathway dealt with

Specifically, Smart Service Systems (SSS), as they are deeply focused by several service scientists, call for a strong engagement to include and involve the costumer in collaborative actions able to improve business performances and increase the perception of value-in-use after any exchange (Ballantyne and Varey 2006) by transforming a potential value proposition to the so-called effective value (Barile et al, 2018). Then, in order to meet the customers' expectation, every SSS works to better fit with their needs and wants (Carrubbo et al., 2017); moreover, dynamic interactions between actors operating in the same context (just a SSS could be intended like) and influencing each other (consciously or not) are exploited to catch a common final goal (Polese et al., 2017a).
The decision maker has the mission of continuously analyzing the evolving conditions of the specific context (as subjectively perceived and interpreted), trying, as far as possible, to prevent and avoid negative contingencies (Polese et al., 2016). Using change and adaptation, SSS decision-making passes through a continuous learning process of re-organization of the owned knowledge (Barile et al., 2016). The socio-economic context may contribute to facilitate or hinder system conditions (Gronroos, 2008) leading to the development of the users' potential contribution (e.g., awareness of their rights and expectations, self-determination and sense of responsibility) and, consequently, facilitate or hinder the integration of resources as an opportunity to further promote processes of value co-creation (Polese et al, 2017b), just as car users in the case-study. As highlighted in Service mainstream, the user through participation may broaden and transform his/her resources into skills that can be positively activated while resource integration takes place and ensure that the potential compatibility among the actors who operate in the same context (Wieland et al., 2012).

3.3 Smart Cities as SSS

The context of Smart Cities is highly complex and brings several challenges to the realization of the principles identified in a logic of Smart Service Systems (Walletzky et al., 2017). ICT services employed in the Smart City context should not be treated side by side to other Smart City services. It is much more appropriate to consider them as the supportive layer in the Smart City architecture that the higher-level Smart City services are built upon (Walletzky et al., 2017).
Any Smart City, as SSS, could be considered as an open system that establishes relationships (for exchanging flows of energy, resources, commodities and information), not only with the sub-systems, which contains and manages, but with supra-systems also in which it is included (Hall and Fagen, 1956; Hannan and Freeman, 1977). As the world is becoming smarter (Maglio et al., 2009), Smart Cities must be people-centric, information-driven, and e-oriented to adapt and mutually satisfy any participant involved within the same service eco-system, while the community should encourage and cultivate people to collaborate and innovate (Qiu et al., 2007). With respect to the attitude to respond

to specific needs of the market or to create new ones, the skill to understand the needs (by rightly interpreting critical information, Napoletano and Carrubbo, 2010) is an intermediate solution that is most likely effective in terms of sustainability of SSS (Iandolo et al, 2018). These are basic elements for a co-creative interface (Carrubbo et al., 2017), and we can see that in the following sections.
Smart Cities appear today as resource integrators, socially constructed and knowledge-based, as demonstrated in che case below. System traits of SSS, and the Smart Cities, aligned with the vision all business organization wants to rely on (Polese et al., 2018). Of course, among actors, customers play a key role, since they demand a personalized product/service, high-speed reactions, and high levels of service quality; despite customer relevance, SSS has to deal with every other actor's behavior, who's expectations needs and actions (as in the described car usage), directly affect the system's development and future configurations (Barile and Polese, 2010).

4. Modeling of Smart City Services

In a smart city, smart mobility is one of the most important areas. To improve the traffic situation and reduce car emission in the city, car-sharing has been advocated in many smart cities. Considering that the Amsterdam municipality plan to improve the smart mobility service by car-sharing. One of the car sharing platforms is the WEGO platform (https://wegocarsharing.com/en/) in Amsterdam that enables owners and drivers to manage car renting. This platform also launched an app for companies to save cost and invest in sustainable mobility. People or companies can benefit from smart mobility by lowering the cost of vehicle ownership and obtain extra income.
In this scenario, we first need to identify all necessary object to be used and explore their relations. We can reduce the objects to:

- Car = object to be used in the sharing process
- Mobile phone = object to be used to manage the sharing
- Parking place = object to park the car

Now we can define several categories from the customer perspective:

- Car in connection with Mobile phone = Car available for sharing
- Car in connection with Parking place = Available car

Each of those connections also defines several rules, for example:

- The only Car in connection with Parking place can be rented
- The only Car in connection with a Mobile phone can be used

And finally, we can define operations for selected categories, like:

- Car available for sharing can:
    - Accept customer
    - Refuse customer
    - Switch into maintenance mode
- Available car can:
    - Accept customer
    - Refuse customer

But this is only one perspective. We can see the perspective of the service provider or service developer, where the names of objects might be the same, but the relations with other objects can be different. For example, software developer who will design the application for car sharing will take the car as a virtual object in a programming language. The person, responsible for charging stations, will take the car as an object, performing completely different operations than a customer in our example.
As the first step, we obtain many "See" diamonds, depending on the fact what connections and relationships each stakeholder finds interesting. The role of "Recognize" diamond is to enable all stakeholders to understand the perspectives of others – under the same or different context. Our example can work under the context of Smart City. The using of Recognize is on Fig. 3

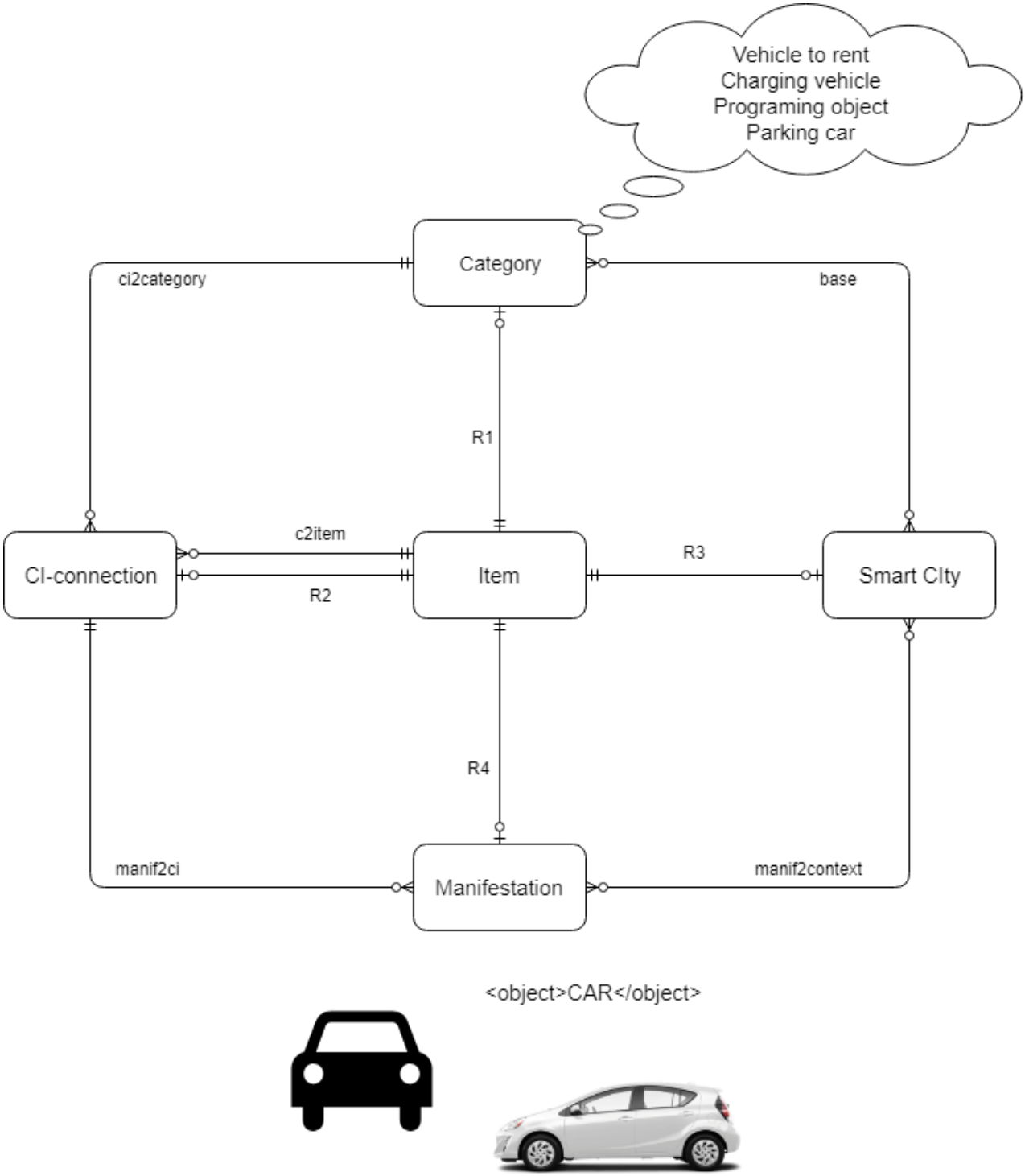

Figure 3 - Usage of Recognize (authors elaboration)

Manifestation is the key for understanding about what design of object we mean. CI-connection than represents the sets of certainty vectors. When we recognize the pictogram  , we can say with certainty of 0,8 we are speaking about the service model, where this pictogram is manifested.
But we can also have different context – for example transport modeling, where we are using exactly the same manifestation, related with the same item.

5. Discussion

In this paper, we focused on the analysis of the process of how the service parts should be analyzed for the best value comes. To understand what objects are participation in services, to know their relations with other objects is the first step to understand the complexity of service.

Especially in the domain of Smart City, we need to have a detailed overview of the objects we are interacting with. But the second problem is represented by the context when the same object can interact with different objects or can be used in another way.

When we are designing a new service that can be used in more than one context, we always need to keep in mind the interconnection of the contexts. Change in one context (Smart City) can affect another context (transportation management).

The presented model is showing how to prepare the first steps of the service analysis, decompose the objects related to the service and get an overview of the all-important contexts.

In this scenario of the smart mobility in the smart city, the Item object in Figure 3 can be city municipality. The municipality in the smart city may have different manifestations; for example, IT companies will provide app development service to the municipality. The common target between the municipality and IT company is to realize the car sharing for smart mobility in the city. To the IT company, the municipality is a service user; however, when the municipality provides the smart mobility services to citizens and tourists, the municipality becomes a service provider. Likewise, the item also can be IT company, to the municipality, IT company is a service provider when IT company would like to deploy their app into the cloud, IT company becomes a user of the cloud services from the cloud service provider. That means, to define the category of the item, we need to use the CI-connection, this component can be used to decide how confident an item belongs to a certain category. In the above example, the municipality has different manifestation such as service provider and service user. How to define the role or category of the municipality depends on the CI-connection. In this component, it specifies how to categorize the municipality into one category or different categories in different contexts. Likewise, to define if the IT company is a service provider or a service consumer, it will depend on the context, because there can be different context, the CI-connection can be dynamically used to decide the item will probably belong to which category. We could further identify the values along with the service design. For example, a municipality and IT company can co-create value in the smart mobility context. A municipality can generate value-in-context by applying the car-sharing app in a smart city. The IT company can have a value proposition in terms of revenues. The different value views can be further identified in another unit model in the process.

6. Conclusion

In this paper, we focused on decomposing of objects while designing service. Understanding of all contexts, influenced by the service, seems to be one of the key factors to share value. The fact one object can be manifested in multiple contexts seems to be underestimated in service design.

Many stakeholders in the cities tend to design all objects just to be used in one context, but it is not true in all cases. For example, lamps can be used not only for lighting but also for monitoring activities on the streets and could be an important part of the city security system.

For future research, it is necessary to aim to multi-contextual services, while the domain of Smart City seems to ideal for such research. Understanding the multi-contextual overlaps and how the service (via object participating on it) can affect the final value-in-context and how the changes in object manifestation in one context could affect value in other context seem to be a great topic for the research.

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