On the Notion of Value Object

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Abstract. It is increasingly recognized that business models offer an abstraction that is useful not only in the exploration of new business networks but also for the design and redesign of operational business processes. Among others, they can be used as input for a risk analysis that is crucial in cross-organizational business process design. However, the notion of value object is up till now not clearly defined. In this paper we investigate the notion of value, value objects and the activities involved when transferring value objects between business actors. We illustrate the proposed value object model by applying it on the well-known conference case.

1 Introduction

Meeting changing customer demands and creating new opportunities makes it necessary for businesses to constantly re-invent themselves. This is often done by changing the processes that produce the goods or services that an organization offers to the market. The changes may take many forms, e.g., the products offered may change, the ways in which the products are produced are changed, or the organization that produces the products may change.

There is an increased recognition that when creating models of new business processes or redefining old ones, the right point of departure in the analysis is not the business processes themselves but notions at a higher level of abstraction. The abstraction can be achieved by focusing on the essential communicative acts [3] rather then the specific message exchanges, on functional and non-functional goals rather than the way they are achieved [13], on commitments and obligations [7] rather than the way these are fulfilled, or on the business models behind a process. In this paper, the point of departure is one kind of business model, the e^3value model introduced by Gordijn [4]. A value model shows the exchanges of values that takes place, for instance, when actors trade goods and services for money. Value models have a special characteristic in that they are formulated declaratively with little or no concern for the order of activities taking place or other forms of dependencies.

When value models are used in the design of business processes, somehow a link must be made between the value model and the process model. A value model focuses

on high level and timeless objects like value objects, actors, and value exchanges. In contrast, a process model focuses on procedural details including messages and activities as well as control and data flow. So when moving from one type of model to the other, a significant ontological gap has to be bridged. A problem the arises specifically when using e^3value as a starting point is that the notion of value object in e^3value is defined in general terms only. This may be sufficient when the model is used in discussing business models, but we need to know more about the internal structure of value objects if we want to make the step to the design of operational processes.

The objective of our research is to find a rigorous way of identifying value objects in business models and to explore how these value objects can be used to derive process models in a systematic way. Results of this research will be useful for practitioners, that is, business process analysts and designers who currently lack abstraction mechanisms or, if they do use one like e^3value, lack a systematic way of producing executable process models (e.g. expressed in BPEL [14]). The theoretical relevance is that the research clarifies the relationships between different models used in business process design.

The second part of our research objective is addressed in a separate paper [11]. This paper contributes to the first part by addressing the following research questions:

- What is exactly a value object?
- What is the relationship between value object and value activities?

In the paper, we provide tentative answers to these questions, using the well-known conference example as test case. In section 2, we will introduce the notion of value models and our general approach. Section 3 provides answers to our main research questions. In section 4, our answers are applied to the test case, which raises some new questions, and we conclude with a summary and directions for future research.

2   Background

In this section, we first explain the main concepts from the e^3value model and then present our general framework for the transformation of value models to process models.

2.1   The e^3-*value* Model

e^3value [4] is a modeling approach that is originally aimed at supporting the explorations of new business networks. For these explorations, process details are not relevant. What is important is whether a collaboration can be set up that provides value to all participants. Recently, e^3value has also been applied for other purposes, such as business/IT alignment [12]. We briefly introduce the basic concepts. An *actor* is an economically independent entity and is often, but not necessarily, a legal entity. Examples: enterprises, end-consumers. A *value object* is something that is of economic value for at least one actor. Examples: cars, Internet access, stream of music. A *value port* is used by an actor to provide or receive value objects to or from other actors. A value port has a direction, in (e.g., receive goods) or out (e.g., make a

payment) indicating whether a value object flows into or out of the actor. A *value interface* consists of in and out ports that belong to the same actor. Value interfaces are used to model economic reciprocity. A *value exchange* is a pair of value ports of opposite directions belonging to different actors. It represents one or more potential trades of value objects between these value ports. A *value activity* is an operation that could be carried out in an economically profitable way for at least one actor.
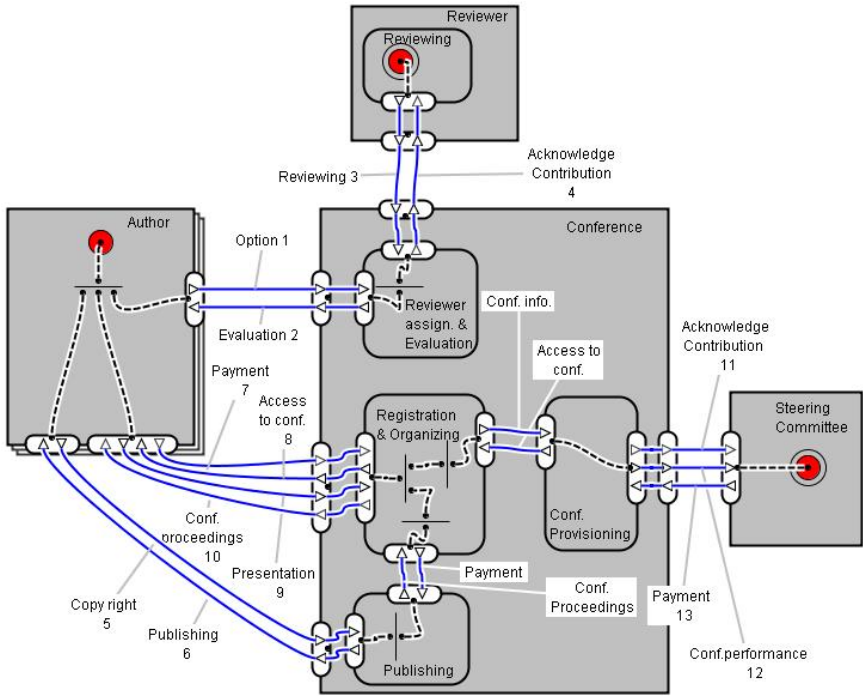

Fig. 1. e^3value model of the conference case

An example of an e^3value model for the well-known conference case is given in Fig. 1, where actors are shown by rectangles, value activities by rounded rectangles, value ports by triangles, value interfaces by oblong rectangles enclosing value ports, and value exchanges as lines between value ports with names of value objects as labels. For example, we see that the value object the reviewer offers is the reviewing – something valuable to both the Conference and the Author, and that she gets acknowledgement in return. The conference itself has several value activities, and corresponding value interfaces. First of all, this means that some value activities that are currently performed by the conference organization could be delegated to other parties as well. For example, the reviewing could be delegated completely to a PC, and the publishing to a commercial publisher. Secondly, the value interfaces could be opened separately to other actors. For example, the conference registration may not be limited to authors, but also to other participants.

2.2   From Value Model to Process Model

When constructing the process model, a number of design decisions have to be taken concerning the ordering and decomposition of activities. Process patterns can be used here to suggest possible transformations. We claim that the design decisions are based on three different aspects of a business case: resource management, communication design, and risk:

- *Resource management* aspect. This aspect concerns the physical flow of resources (logistics) and their capacity planning.
- *Communicative design*. This aspect concerns the coordination between customers and providers that is needed to initiate and complete value exchanges by means of communicative actions.
- *Risk* aspect. This aspect concerns risks that may result in value transactions not being completed or only partially completed, and the various ways to mitigate risks ([2][9]).

All three aspects have to be dealt with and influence the resulting process model. Although the aspects are not completely independent, it is useful to distinguish them. They provide a separation of concerns, thereby facilitating design and traceability of the process model. The approach is summarized in Fig. 2.
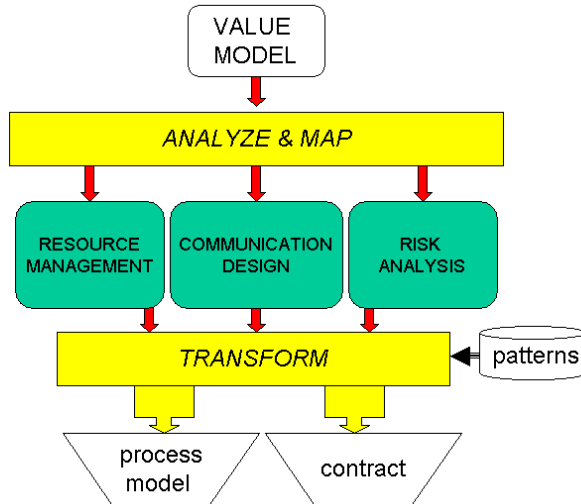

Fig. 2. From value model to process model

3   On the Notion of Value Object

There exists a huge body of knowledge in the area of economics regarding the concept of value. It is commonly defined as "The worth or desirability of something expressed as an amount of money" [15]. This something is often an asset or property

of someone. Some assets can quite easily be given a monetary value, e.g., cash and stock, whereas others, like intellectual property or brand value, are harder to measure. The definition highlights the quantitative aspect of value, which is of course quite important from a business perspective. However, it does not say anything about the subjective value experience nor about the internal structure of the value object. In economics, a categorization of what can be described as a tradable property (has a value) is the following list: a) personal property, e.g., cars or tools, b) real property, e.g., buildings or land, c) intangible property, e.g., patents or copyrights.

According to [4], a value object is "a service, a product, or even an experience which is of economic value for at least one of the actors involved". This definition makes clear that value objects are not restricted to goods or money exchanged, but it is rather open. In the work of Holbrook [6] to which Gordijn refers, the focus is on consumer value, and in this framework, *anything* can be of value, as consumer value is supposed to reside in the consumption *experience* rather than in the product or service itself. Consequently, Holbrook remains vague about the internal structure of value objects, but he does offer an interesting framework of consumer values, such as efficiency, aesthetics and status.

3.1   Towards a Value Object Model

We can learn something from the examples of value objects identified in Gordijn's examples such as the Free Internet Provider: "a fee", "internet access", "interconnection", "termination" and "termination possibility". In the contact ad example, we find the value objects: "submitted ad", "possible contact", and "read contact ad" [5]. We refer to the original work for the full description of these examples.

Products and money are obvious value object candidates, although we should realize that the value exchange should not be equated with the logistic transfer: basically, what one acquires when one buys a product is the *ownership* of the product. Ownership can be conceived as a bundle of rights, and other rights can be value objects as well. For example, when borrowing a book from a library, one gets the right to keep and read the book for a certain period of time, and on the Internet, one could acquire the right to use a certain piece of software for a limited number of users.

On the basis of examples like these, we may tentatively identify a value object with a certain right on some resource. A right of one party means obligations for the other party. The customer should be enabled to use the right. For example, a transfer of ownership of a product should be accompanied by a delivery of the product, or at least the customer should get the possibility to pick up the product somewhere. So we may define a value object as a certain right on some resource (of the provider) and the enabling to use that right (a working access route or means to exercise the right on the value object). This definition works not only for goods and money, but also for services mentioned above such as "internet access" (the right to send and receive data to and from Internet, where availability of the network is assumed), or "read ad" (the right to read a contact ad, typically including the right to contact the sender somehow).

We have found that this first definition works for many cases, but not for all. Think for example of services like hairdressing and transportation. What is characteristic of these cases is that some action is performed on an object belonging to the customer that adds value. I prefer myself with my hair cut, or prefer my kid being at school in

the morning. Let us call such an action a value transformation. In the Free Internet Example above, "termination" falls in this category: when the internet provider picks up the phone (terminates a call), he does something to the telephone network, owned by the telecompany, that increases its value to its owner, as he can charge costs to the caller. More precisely, the network becomes more valuable to consumers because they can use it now to connect to the Internet provider, and so access the Internet, and therefore it becomes more valuable to the telephone company since the marginal costs of a connection are very low. On the basis of examples like these, an alternative definition of value object is: "the value transformation of some object belonging to (or at least of interest to) the customer". Note that we assume a relationship between the customer and the object in question, and in most cases, including the ones above, this is a relationship of "belonging", but it can be more general. For example, "restoring my town" or even "reducing pollution of my planet" can be viewed as value transformations on things in which I have an interest (my town, my planet), and the fact that I value them can be inferred indirectly from the fact that I may be willing to donate money to a party like Greenpeace that claims to provide this value. To avoid confusion with the term "value object", we will use the term "value subject" for the thing whose value is increased by some transformation process.
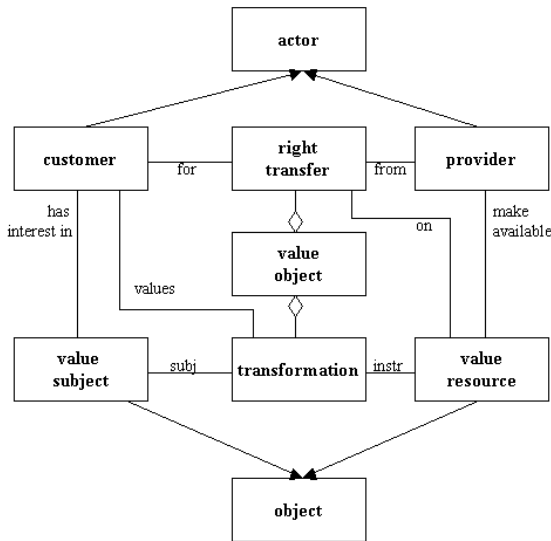

Fig. 3. Value object model

Note that in this second definition, the focus is on the value transformation of the value subject, but this does not exclude that some resource of the provider is involved as well. For example, the transportation service involves the use of a bus or some other vehicle, and the hairdressing service involves the use of a chair and the dedication of a hairdresser for a certain period of time. More generally, the value transformation of the value subject belonging to the customer often involves a right

(and the enabling thereof) on some resource owned by the provider. This suggests a unification of the two definitions. In this unified model, we distinguish both a resource and a value transformation in which the resource is instrumental. When the focus is on the resource, the value transformation is not explicit, but still it can be found in many cases. For example, one could say that the borrowed book is used for reading, to teach something, or provide pleasure. However, the value exchange, as economic event in this case, focuses on the resource provided, and leaves unspecified what the customer does with it.

Figure 3 summarizes our value object model. Provider P transfers a value object to customer C when P brings in a resource R for the purpose of a transformation of some subject S in which C has an interest such that the transformation has value for C. "Bringing in" the resource means that P transfers C some right on R and makes R available (enables C to execute the right). The value that C gets could be characterized further by Holbrook's value framework (e.g. status, aesthetic pleasure). Given this background, the value object can be defined as an aggregation of value transformation and the right transfer, where usually but not necessarily both are present.

3.2   Some Remarks on the Value Object Model

We analyze the value object model in some more detail by addressing a couple of issues.

An Experience is Not a Value
Customer and value subject are roles that may be filled by the same entity, such as in the hairdresser case. Similarly, the provider may be a resource himself. Note that the value that the customer gets of the value transformation should be distinguished conceptually from the experience of the value subject, even if the customer is the subject. For example, in the case of watching a movie the *value* could be the pleasure of having watched a good movie, and the experience consists of the emotions that the movie imposes (e.g. pity). The experience (as a special case of value transformation) provides value, but is not a value.

Value Exchange Implies Value Transformation
The value transformation in the centre of our value object model is not an isolated activity, but can be integrated with the value chains of both customer and provider. According to [8] the value chain is a chain of activities, which are the building blocks by which a firm creates a product valuable to its buyers. The resource made available by the provider is either made or bought; if it is made, the provider should perform one or more value transformations that depend on other resources. At the customer's side (either a firm or an individual consumer), the value subject may itself be a resource for another value transformation. For example, a consumer may acquire a hammer, besides other things, to ameliorate his house. Value subjects that are used to raise value somewhere else are called extrinsic value objects by Holbrook, as opposed to intrinsic ones. Note that our model allows us to link the value object directly to the *value activities* in the e^3value model. A value activity is defined as an operation that could be carried out in an economically profitable way for at least one actor. However, in the value model logic, economic profit is only possible if the activity has some value to some actor in the first place, so a value activity (disregarding for the moment the

possibility of allowing coordination activities to be value activities) will also be a value transformation, although not every value transformation is necessarily a value activity – it might be impossible to exploit it profitably. Below in section 4, we will argue that a value transformation model may be useful to complement the current e^3value model; the contribution of our current analysis of the value object is that it shows how value transfer and value activity are linked through the notion of value transformation.

In our model, it is not specified who performs the value transformation. In the hairdresser case, the provider, or one of the assistants, is the agent. In other cases, such as the borrowed book, the customer is the agent, as she is the one who does the reading. The more or less active contribution from the customer (Holbrook talks about active versus reactive value) is an interesting distinctive feature, but not so relevant for modeling the provider's responsibilities, as his involvement in the value transformation can be seen as an extension of "making resource available".

The transfer of ownership (goods, money) reappears in this model as a special case where subject and resource coincide: the resource provided by the provider is not only used but disappears as such, and it reappears as a value subject belonging to the customer. The value transfer as such is not a value transformation (it does not add value in the economic sense – note that supporting activities like transport can be value transformations, but the value transfer is not the physical transport). The question can be raised whether this case should be seen as a transfer of rights only, without a value transformation. An argument pro is that the customer can use the acquired resource in many unspecified ways (so it is hard to indicate what the value transformation is) and it falls out of the scope of the value transfer. An argument con is that in many cases, the resource has a specific goal, which sometimes is part of the value transfer or of the value proposition. An example of the former is when the customer buys clothes, these are for wearing (a value transformation of her body); if for some reason the value transformation does not succeed, this can be a reason for rolling back the value transaction – the customer returns the clothes. Examples of the latter are when phone companies sell phones with the slogan "be connected" or educational institutes sell a course with the slogan "improve yourself". So the preliminary answer that we want to give to the question is that the value transformation need not be included, but can be seen as part of the value object when this is deemed relevant.

Value Object is Not Value Proposition
The value object model can be used to analyze value objects, and gives a rather objective basis to the value object identification. However, we should keep in mind that the value proposition of a provider is a particular *view* offered on a value transfer, and hence may highlight certain elements, repress others, and even add elements, such as the indirect value the customer may get in a later stage. The value proposition is extremely important in marketing, but less informative for the design of the operational processes.

A Symbolic Value Object is Different from the Value Object It Points At
The transfer of ownership of symbolic objects needs some special attention. For example, if I buy a ticket for a football match, what is the value object I acquire? Is it the legitimate access to the match (as resource)? Or is it the ticket itself that I can use to get access to the match but that I could also profitably resell to others? Evidently,

there are many symbolic value objects (tickets, stamps, vouchers – also money itself). It is part of the choices to be made in the overall value model whether to introduce symbolic value objects or not. We propose the following rule: only when there is some unique (mostly physical) symbolic token of a transferable right – a right that is not bound to a specific agent but for which it holds that the legal *owner* of the token is the holder of the right, then this token *may* be treated as a value object in the same way as physical goods. So a football match ticket may be a value object, as is money, but an airline ticket is not (which may explain partly why airline tickets are disappearing nowadays). Whether it *should* be modeled as a value object is another question. If the token is only used for control purposes (like a cinema ticket), it is

3.3 A General Format of Value Object Description

Using our analysis of the value object, we propose to use the following general format for describing a value object. The value object is something the actor offers, so we always start with "A offers B"

> A offers B *that a value subject is transformed* (by means of giving B | including) the right to *use* a *value resource*

An alternative format is to focus on the customer's value. In that case, the sentence would be something like " For B it has value that <value transformation> (by means of getting | including) the right to <use value resource>". In the case of doubt about a value object, this alternative may be used as a test.

The difference between the two variants "by means of giving" and "including" has to do with the role of the value resource. If the value resource exists before the value transformation, then the first phrase is appropriate. It is also possible that the value resource is created during the value transformation, and in such a case the second phrase is appropriate.

When the formula is instantiated, *A* and *B* will be actors and *use* will express a certain way of using or having access to a resource, e.g., own, lend, read, and copy. This formula captures the two aspects of a value object, i.e., the resource an actor gets access to as well as the transformation of some value subject in which the actor has an interest. When only the transformation is of interest, the second half of the formula can be omitted, while the first part is omitted if only the transfer of resources is of interest (However, we recommend that this should be done only if the other part is really out of the scope). Some examples:

> A offers B *that his hair is cut*
> A offers B the right to *read a contact ad*
> A offers B *that he is entertained* by means of giving B the right to *access the entertainment park*

As we said in the above, the transfer of ownership is a special case. Using the format above, it would be expressed like:

> A offers B *that he can spend money* by means of giving B the right to *get that money from him*
> A offers B *that he uses product X* by means of giving B the right to *get that product X from him*

In some cases, the "use" of the product can be made more specific, as we argued above. However, we also allow a shorthand notation in case details are not deemed to be relevant:

A offers *B* <u>a *value resource*</u>

For example, "A offers B money", "A offers B product X". Note that this abbreviation should be used only when there is really transfer of ownership. It should not be used, for example, for the selling of digital goods, where the buyer only acquires a right to use a copy of the product; and not in the case A only has an intermediary role, like a broker that helps someone to buy a house which is not the broker's property.

4   Application and Discussion

In this section, we apply our value object analysis to a larger case, not for thorough validation but for illustration and to deepen our understanding. We also explore how to model the notions of value resource and value transformation graphically.

4.1   The Conference Case

As an illustration of our analysis of value objects, we have considered the well-known conference case. The e^3value model [4] for this example is shown in figure 1 in Section 2. The numbers in the list below correspond to the numbers on the labels in the e^3value model in Fig. 1.

1. The Author offers the Conference the right to consider publishing her paper
    > Value resource = paper
2. The Conference offers the Author <u>that her Paper is evaluated</u> including the right to read the evaluation report
    > Value resource = evaluation report
    > Value subject = paper
3. The Reviewer offers the Conference <u>that a Paper is reviewed by him</u> including the right to use the review report for evaluation and include it in the evaluation report
    > Value resource = review report
    > Value subject = paper
4. The Conference offers the Reviewer <u>that he is acknowledged for his Contribution</u>
    > Value subject = Reviewer
5. The Author offers the Conference the right to publish/copy her Paper
    > Value resource = paper
6. The Conference offers the Author <u>that her Paper is published in the Proceedings</u>
    > Value resource = paper
7. The Author offers the Conference Money
    > Value resource/subject = money
8. The Conference offers the Author the right to participate in the Conference Event
    > Value resource = conference event

9. The Author offers the Conference <u>that the conference program is augmented</u> by means of giving it the right to include the presentation of her paper
    Value resource = presentation
    Value subject = conference program
10. The Conference offers the Author a copy of the Proceedings
    Value resource/subject = copy of the proceedings
11. The Conference offers the Steering Committee <u>that it is acknowledged for its contribution</u> by means of the right to be mentioned in the proceedings
    Value resource = proceedings
    Value subject = Steering Committee
12. The Conference offers the Steering Committee <u>that its conference event is organized</u>
    Value subject = conference event
13. The Steering Committee offers the Conference Money
    Value resource/subject = money

The analysis that we give here is not necessarily the only right one. What we do claim is that our analysis and the format that we use makes the identification process more rigid. However, there is not one unique value model for all conferences. In some cases, the authors get paid for a presentation, whereas in other cases, they have to pay. The Steering Committee may provide financial resources, but it may also try to acquire them. Ultimately, it is not the designer but the stakeholders in the business collaboration who decide on what the value objects are.

Sentence 3 exemplifies a complex right: the Conference not only can use the review report for its evaluation of a paper, but also has the right to include it in the evaluation report, that is, to forward it to the author. Again, conferences may handle review reports in different ways, but our analysis forces the stakeholders to be explicit about the rights rather than posit an unqualified value object "review report". It is our claim that this is valuable for the business network negotiations and also when the value model is used as input for process design. Another interesting question raised by the initial analysis is: what are the resources that are used in the value transformation "organization of the conference event" (sentence 12)? In a further analysis, it may turn out that more parties need to be identfied, such as a conference hotel.

Sentence 4 and 11 exemplify the situation that an actor is also a value subject: the public acknowledgement of the Reviewer and Steering Committee, respectively, adds value to themselves.

4.2 Sourcing

The example of the conference case urges us to say something about the effect of sourcing. Sourcing, or delegation is present here in the form of reviewers performing some task on behalf of the Conference, and would be possible also for other value activities, like the publishing of the papers. Sourcing complicates the value object model because the provider may delegate some of his tasks to a third agent. In that case, the agent has a double orientation [10]: it offers value to the provider's customer, on behalf of the provider, and (thereby) provides value to the provider. To work out the effects of sourcing is beyond the scope of this paper; we limit ourselves to the remark that if necessary, the two value objects the agent provides should be distinguished carefully, and that the B in our format (the one for whom the value

object has value) is not necessarily the customer of A but may also be the customer of the agent's principal.

4.3   Modeling Value Transformations

Our analysis of the value object has revealed value resources, value subjects and value transformations - concepts are currently not in the e^3value model. Rather than overload this model, we propose that these concepts are dealt with in a complimentary model. Where the e^3value model focuses on value exchanges, and centers the model around the actors, the complimentary model should focus on value transformations, centering value resources and repressing the actors. A possible candidate for this model is the Activity Dependency Model described in [1] that aims at being half-way between value models and process models. Its purpose is to describe, on a high level, the activities needed for carrying out the value transfers. For that purpose, it includes coordination activities and assignment activities, among others, and flow dependencies. It highlights the activities, corresponding partly to value transformations, but it does not contain the objects on which these activities work. For a graphical representation of the value object sentences, the Activity Dependency Model is not appropriate

It would be possible to define a new graphical format for this purpose, but a more practical solution is to use a combination of standard UML diagrams. More in particular, we can use Class Diagrams for modeling the value resources and Activity Diagrams to model the life cycle of value resources in terms of the value transformations that they undergo. Figs. 4 and 5 contain the initial models for the conference case.
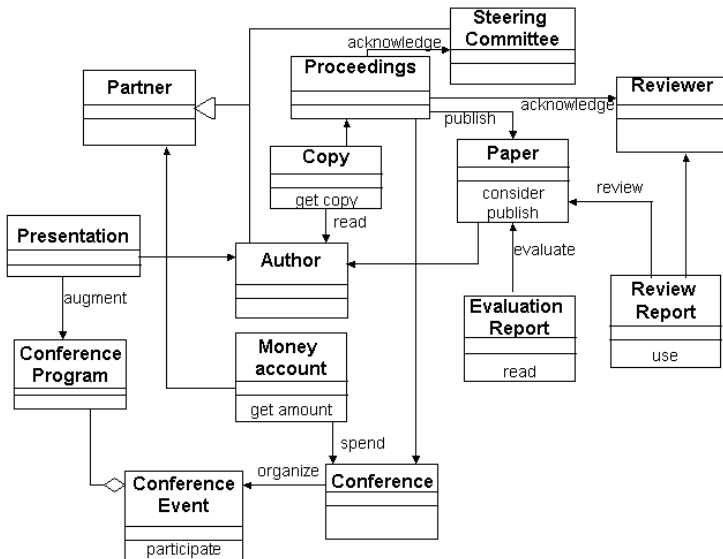

Fig. 4. Class diagram for the Value Resource Model of the conference case

In the class diagram, we include all value subjects and value resources (something can be a value subject in one value transformation and a value resource in another – to simplify, we propose to use the term Value Resource model). In the operation boxes, the operations found in "use rights" parts of the value object sentences are included. For example, in sentence 2 the right of reading the evaluation report is mentioned. If this right is provided to somebody, then it must also be enabled, that is, "read" must be an operation (method) of the class "evaluation report". The named associations should be interpreted as value subject/value resource relationships: that is, the resource plays a role in the named value transformations of the value subject. There are also unnamed associations for the relationship between an object and the actor that brings it in. All in all, the Value Resource Model integrates the information that is known about the value resources and presents it in a concise way.

The Value Resource Model can also be used for validation and further exploration. For example, in our conference example, there is the value transformation "acknowledge" for the subject "reviewer", but no resource was mentioned. In fig. 4, we have filled in this gap by allocating this job to the Proceedings. We have also included some aggregation relationships that were implicit in the sentences, and identified a superclass of author and Steering Committee. We have not added multiplicities yet, but this can also be useful (for example, can a paper have multiple authors?). If our goal is to transform the value model to a process model, the Value Resource Model is an important input for the resource management analysis that has to make choices on e.g. the logistics of papers, review reports, money etc.

In the example above, we have tried to be faithful to the sentences, in order to show that the value resource model is not a result of design but of analysis only. We made an exception with the class Money, as this would lead to a conflict with the OO assumption of identifiable discrete instances, and modeled it as Money account.

The activity diagram (Fig. 5) focuses on the value transformations per value subject. It allows the designer to order them and it may also have a heuristic value, for example, as it leads to the question what is the birth event of the object. In this case, it allows the designer to add the value transformation "write paper" that was not recognized

Fig. 5. Activity Diagram (object life cycle) for the Value Transformation Model of the value subject "Paper"

yet as a value transformation. The ordering of the value transformations is to be added by the designer, although some part can be derived from the value subject/value resource relationships. The Value Transformation Model might be useful for deriving flow dependencies in the Activity Dependency Model.

5   Concluding Remarks

The objective of this paper was to analyze the notion of value object, as it has been defined up till now in general terms only as "a goods, a service or even an experience that is of value". We have analyzed that in the case of goods, the value exchange is in fact a transfer of ownership. In the case of a service, we have defined this service more precisely as a value transformation on something (the value subject) that belongs to the customer or is of interest to him. In some cases, the provider only contributes to the value transformation indirectly by providing an access right to some value resource that plays a role in the value transformation. In our analysis, we distinguish value object from value experience (the value the customer gets from the value object). However, it is quite well possible that the customer is also the value subject and that the value transformation consists in offering him some experience.

Our analysis of the value object has brought us to the introduction of the notions of value resource and value subject as roles in a value transformation. We propose to add these concepts to the e^3value model ontology. We have also suggested to model these concepts graphically using UML class diagrams and activity diagrams.

The results of this paper might be useful for designers using the e^3value model as it allows them to define value objects in a more rigorous way. The additional models may also have heuristic value during the design. These suggestions need to be validated in practice of course, which is still to be done.

To achieve the research objective that we described in the introduction, our next step is to work on the mapping from value model to process model, via the three aspect analyses. Besides other things, this work will make clear whether the analysis of the value object presented in this paper is instrumental to the process model mapping or not.

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