TASK ANALYSIS MAKES IS METHODOLOGIES OBJECT ORIENTED

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Key Words: Object oriented analysis, task analysis, realist ontology, SSM, behaviour

Abstract
This paper proposes that the shift of ontological assumptions in systems analysis from the realist world to the socially constructing one could facilitate the smooth transition of object oriented analysis from a static view to a dynamic one in which object behaviour becomes a key to analysis. In order to realize the OOA of a dynamic view, this paper also proposes the integration of OOA with task analysis/human computer interface which has developed independently from structured analysis and OOA. TA/HCI could further bring the nature of object orientation to the OOA field by introducing SSM's subjective inquiry.

Introduction

There are a wide variety of object oriented analysis approaches. Most of them support the idea of a fountain model or spiral model, but are still based on thinking of traditional established structured analysis which is primarily based on realist ontology. This variety of OOA approaches has been spreading over the range from one deeply rooted in realist ontology to one liberated from it. The basic source of objects and their relations still tends to be problem domain analysis that is fundamentally static, although the basic idea of object orientation accepts the dynamic behaviour of objects.

Firstly, this paper discusses that the shift of ontological assumptions in systems analysis from realist to socially constructing is sporadically emerging in papers and books. Secondly, this paper proposes that the shift of ontological assumptions in systems analysis could facilitate the smooth transition of OOA from a static view to a dynamic one in which object behaviour is a key to analysis. In order to realize the OOA of a dynamic view, this paper also proposes the integration of OOA with task analysis/human computer interface which has developed independently from structured analysis and OOA, and finally discusses that TA/HCI has inherently subjective nature and SSM's subjective inquiry could make TA/HCI more practical for OOA.

The ontological assumption of OOA

Object-oriented models are one that in a sense maps a socially constructed subjective world and even further gradually evolves. In other words, object oriented models are to grow and are not necessarily a sole mapping of the real world from the perspective of realist ontology. This ontological assumption of OOA has begun to appear sporadically in a few papers and books as mentioned below.

Firstly, in contrast to a waterfall model in structured analysis, a fountain model or spiral model is the basic idea of OOA. This model means that analysts do not have to get all at the outset but rather can reveal the behaviour of systems and their environment gradually through implementation.

Booch (1994, p.232) describes the situation in object orientation as follows: We find that the process that leads to the successful construction of object orientation architectures tends to be both iterative and incremental. Such a process is iterative in the sense that it involves the successive refinement of an object orientation architecture, from which we apply the experience and results of each release to the next iteration of analysis and design. The process is incremental in the sense that each pass through an analysis/design/evolution cycle leads us to gradually refine our strategic and tactical decisions, ultimately converging upon a solution that meets the end user's real (and usually unstated) requirements, and yet is simple, reliable, and adaptable.

Iteration and incrementalism imply that models will grow and be refined as socially shared understanding of systems between people. In other words, they mean the actions of the analysis and design and the perception of the systems and environments interact with and influence each other over time to bring the changing systems of real existence.

Secondly, there is some burgeoning of a departure from realist ontology in OOA. Vidgen and Wood (1995) analyzed the text of OOA books and indicated that objective thinking and subjective thinking are present in the text at the same time. They argue that the issue is not whether to be objective or subjective but that one implies the other and that any method that is based upon one of these ontological positions must accept and cater for the other. The same situation is also suggested in the field of a data-centered approach (Lewis, 1993).

These justify the departure from the sole dependence on the real world and implies that object orientated models also map a socially-constructed subjective world and evolves through social interaction over time.

The ontological assumption of OOA leads to structuration theory by Giddens (1984). He describes the relationship between agents (analysts, designers and users) and structures (the perception of the world) as follows: The constitution of agents and structures are not two independently given sets of phenomena, a dualism, but represent a duality. According to the notion of the duality of structure, the structural properties of social systems are both medium and outcome of the practices they recursively organize.

Structuration theory suggests the target for modeling can not be the world of objective existence independent from people but that of subjective existence in people involved. In contrast to realist, “socially constructing” is used in this paper to emphasize the shared understanding of the world and time dimension.

The shift of OOA approaches

There can be found two approaches in OOA. Booch (1994, pp.155-156) describes them as: 'A number of methodologyists have proposed various sources of classes and objects, derived from the requirements of the problem domain. We call these approaches classical because they derive primarily from the principles of classical categorization. Whereas these classical approaches focus upon tangible things in the problem domain, another school of thought in OOA focuses upon dynamic behaviour as the primary sources of classes and objects. These approaches are more akin to conceptual clustering: we form classes based upon groups of objects that exhibit similar behaviour.'

Here, we call the former approach static-view/functional and the latter dynamic-view/behavioural. Socially constructing ontology we have just described can be an enabler of the shift from a static-view/functional approach to a dynamic-view/ behavioural one in OOA.

Graham (1995, p.277) says that all existing object-oriented design and most OOA methods make the assumption that a written requirements specification is available at the outset. It means that most of existing methods which favor a static-view/functional approach are based on realist ontology that requirements exit to be defined and are stable.

The object-oriented technology has been recognized for many years, but the methodology of OOA is not matured. Existing OOA methods have not yet proved to be a radical change to analysis (Ramachandran and Taylor, 1994). This suggests that analysis is still constrained by realist ontology that waterfall model has been based on, although object orientation facilitates social constructing ontology. It is time for analysts to shift from static to dynamic, and this shift is made possible by the changes of espoused ontology .

Then, why is the shift necessary and possible? Firstly, data and functions internal to each object are too narrow and detail in the early phase of analysis. Object orientation has an encapsulation feature that makes the internal specification possible to be made in the later phase. We must emphasize that analysis focuses upon behaviour, not form (Booch, p.252). 'We can characterize the behaviour of an object by considering the services that it provides to other objects…. This view forces us to concentrate upon the outside view of an object…' (ibid, p.43). …the purpose of analysis is to provide a model of system's behaviour (ibid, p.252). All these show the need for the shift from a static-view/functional approach to a dynamic-view/behavioural one.

Secondly, the required behaviour of systems as a server is to be derived from the behaviour of users as a client. Graham (1995, p.320) says that a business can be regarded as an object communicating with other objects in the external environment it inhabits; customers, suppliers, regulators, and so on. The process of these business objects are implemented by objects within the business, including human actors and the tools used to support their activities. The similar approach is also described by Winter, Brown and Checkland (1995) in a similar way like that information systems as a serving system (server) has to be derived from the human activity system as a served system (client). It

means OOA must start from the behaviour of actors.

Lastly, the behaviour of objects is a social construct which gradually evolves over time through interaction between human objects and between human objects and supporting objects. Behaviour among human or organizational objects or between human objects and supporting objects is socially created and accepted among people involved in the domain. In other words, behaviour is not an entity in the sense of realist ontology. Some aspect of behaviour as socially accepted constructs such as contracts is also mentioned by a practitioner as follows:

'The outside view of each object defines a contract upon which other objects may depend, and which in turn must be carried out by the inside view of the object itself (often in collaboration with other objects). This contract thus establishes all the assumptions a client object may make about the behaviour of a server object.' (Booch, p.43)

Although the object-oriented approach has been recognized for many years, the methodology of OOA is far from mature (Wang, 1995). Now, behaviour becomes a key to OOA as mentioned above. Once OOA accepts socially constructing ontology, the shift from a static-view/functional approach to a dynamic-view/behavioural one should take a smooth transition, and OOA could be matured.

How to create behaviour

The dynamic-view/behavioural approach could be partly found in a use case driven approach by Jacobson, Christerson, Jonsson and Overgaard (1992). The followings are some excerpts from their book:

This model uses actors to represent roles the users can play, and use cases to represent what the users should be able to do with the system (ibid, p.157). Each use case constitutes a complete course of events initiated by an actor and it specifies the interaction that takes place between an actor and the system (ibid, p.159). The reason that we have identified actors initially is that they will be the major tool for finding the use cases (ibid, p.59).

The different versions of use case in different names can be found recently in a few OOA approaches. Although there are descriptions as to how to find actors and objects from use cases by text analysis, there is hardly anything as to how to build use cases. Therefore, it is thought in the object-oriented field that the articulation of use cases or behaviour still remains an art.

TA helps OOA create behaviour

Task analysis or its equivalent, Human Computer Interface, which has developed independently from structured analysis (SA) and OOA has potential to provide a more concrete method to behaviour analysis which still remains an art in the object-oriented field.

Benyon (1992a) says: TA is concerned with how people actually perform tasks. It has arisen out of work in ergonomics, psychology and software engineering, but surprisingly has not had much call on its cousin in computer systems development, namely SA. Since the current focus of many TA exercises is concerned with the interactive use of computers, SA should have some contribution to make.

This situation is also applied to OOA with a few exceptions. Even in the use case approach of Jacobson et al. (1992), there is neither mention nor reference to TA. However, it is also true that a practitioner and a researcher are recognizing the importance of TA in OOA. For example, 'TA is central to HCI practice. I now believe it should be central to OOA tool.' (Graham, 1995, p.101) But Graham's SOMA methodology is so relatively new that it is not accepted as a major one in the object orientation field.

As there are a wide variety of OOA methods, there are also a wide variety of TA methods, such as Hierarchical Task Analysis (Shepherd, 1989), GOMS (Card et al., 1983) and Task Knowledge Structure (Johnson, 1992). There can be found a brief description of each methods in papers (Benyon, 1992a; Whitefield and Hill, 1994; Wang, 1995). Those approaches are very diverse because of those different assumptions. However, there can also be found some similarities among them.

Here we just have a brief list of the major outputs or products of TA mainly based on Whitefield and Hill (1994) because of a space limit.

• Behaviour

The TA product must identify the behaviour that an IWS carries out in performing its tasks. Here, IWS stands for an interactive work system which includes users, software and hardware. A task is a set of IWS behaviour directed towards a task goal. 'A task is a set of behaviours undertaken by an agent assuming a role to change a system's state to some goal state' (Graham, 1995, p.99).

• Task goals

The product should identify the IWS's goals in performing work. A task goal is a desired state and a task is the means of reaching it. Messages are sent in order to achieve goals. The needs to achieve these goals lead to the need to perform tasks

• Decomposition

The tasks of an IWS are complex enough to require decomposition into their components parts.

Although no standard or major TA methods have emerged yet, the possibility that TA makes some contribution to OOA in the analysis of behaviour has to be tapped.

SSM makes TA more practical for OOA

Although rich knowledge has accumulated around TA/HCI, there is still true that no common practices or major methods have emerged in them. The problem is related to the subjective nature of behaviour. It is mentioned by a few researchers as follows:

Sutcliffe and McDermott (1991) argues that task design in its fullest sense involves job

design which aims to match task demands to the operator's abilities and to provide interesting and satisfying jobs. However, task design is problematic because of the subjective nature of interest and satisfaction.

Benyon (1992b) argues that agents are intentional autonomous systems in that they have beliefs and desires and can formulate their own goals. …We can define a 'goal' (or external task) as a state of the environment or of the agent which is preferred by that agent to the current state. …Goals are thus constrained by the agent's weltanshuuug.

These implies that subjective inquiry of the world is still rare even in TA. Soft Systems Methodology (Checkland, 1984) has a great possibility to enrich this subjective inquiry in TA to describe behaviour. SSM can help an actor/agent reveal a specific Weltanshuuug, derive a conceptual model and then make a subjective inquiry of the real world with it. SSM promotes never ending learning cycles which are inherently required in a spiral model or fountain model of object orientation.

A SSM conceptual model as a human activity system leads to human behaviour to reach a specific state of a served/client system to achieve a goal, and then in turn leads to the required behaviour of objects within the serving/server system. The learning cycle of SSM brings, to the perception of people, emerging and changing behaviour, which in turn gradually change object behaviour in information systems as serving/server systems.

Conclusion

This paper has proposed that the shift of ontological assumptions in systems analysis from the realist world to the socially constructing world could facilitate the smooth transition of OOA from a static view to a dynamic one, in which object behaviour is a key to analysis. The OOA of a dynamic view could use the profound results of the research and practices in TA/HCI. The linkage of OOA and TA/HCI could be materialized by the use of SSM's subjective inquiry.

As structuration theory of Giddens (1984) suggests there is a duality in organizations, the perception of the organization and information systems and the actions of the analysis and design can interact with each other over time and influence each other to build changing information systems under an object oriented systems architecture. To achieve this ultimate forecast, the three islands of thinking (OOA, TA, SSM) now have to be reconsidered for cooperation.

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