DESIGN, VIRTUAL REALITY AND PEIRCEAN PHENOMENOLOGY

Jean-Marc Orliaguet

Chalmers Medialab, Chalmers University of Technology, 41296 Göteborg, Sweden

ABSTRACT

We suggest an approach to design using virtual reality based on phenomenology, considering the case of both ordinary and semiotic phenomena. Phenomenology considers all objects present to the mind as 'forms' or 'relational structures' (Marty, 1990). Semiotics studies all possible forms of relations that can connect two objects, when one serves as a representation of the other. As a consequence of defining the reality of an object, either virtual or not, as the agreement by a community on an objective and unique structure associated with that object, we can consider the design activity as a dialectic process aiming at instituting objective community-shared structures and the necessary connections between those structures.

1. INTRODUCTION

Design using virtual reality (VR) combines many kinds of experiences apparently belonging to very different categories. Indeed, an ideal form of design occurs when the *mental* object of a designer, externalized in a *material* object, either virtual or not, corresponds to the one of the end-user. A product of design establishes therefore a connection between the realm of ideas and the object world, but to experience the *idea* of an object — either virtual or not — is obviously very different from experiencing the object itself. Yet, the design act combines those two different kinds of experiences, and the combination in itself constitutes a third kind of experience.

Our knowledge and experience of virtual objects is so different in a way from a casual everyday experience of 'real' objects that the term 'virtual environments' (VE) was invented, without any quite definite understanding however of what is meant by 'virtual' that would place virtual objects in a category so separate from the category of real-world objects that all 'virtual' experiences would necessitate theories and methods especially invented for that purpose. In any case, a theory focusing on the design process using VR has in one way or another to overcome all the dualisms setting in opposition *virtuality* and *reality*, *mental* and *material*, while avoiding the dangers of reductionism.

Does design using virtual reality necessitate a new theory? On the contrary, we will try to convince the reader that such a theory exists already in the science of phenomenology and semiotics invented by nineteenth-century philosopher C.S. Peirce, and especially in its formalized version (Marty, 1990, 1992). Phenomenology is primarily concerned with describing the direct and immediate experience of what is present to consciousness, refraining from any form of judgment or presupposition on the nature of the experience itself. Peirce defined the phenomenon — or 'phaneron' in his own terms, — as "a proper name to denote the total content of any one consciousness (…), the sum of all we have in mind in any way whatever, regardless of its cognitive value" (Peirce, 1998a, p. 362). Semiotics, based on phenomenology, is the study of how an object can be substituted for another, i.e. when one collective total of objects present to the mind stands for another collective total of objects. The one directly experienced is a representation of the other.

Sartre (1994, p.11) began his essay of phenomenological ontology by commenting on the progress that modern thinking had achieved in overcoming "embarrassing dualisms" by reducing existents, i.e. real objects, to the series of their appearances (the phenomena). Thus by treating objects as appearances, we overcome the duality between 'virtual' and 'real objects'. The 'virtual' partakes in the phenomenon and acquires the same status as any 'real object'. Both terms are not synonymous however. There would be no reason otherwise to study the design process in the particular case of VR; such a theory could be derived directly from any general design theory, so we need to define 'virtual' and 'real' more precisely in order to show their conceptual differences.

The other "embarrassing dualism" that we mentioned earlier was that one of abstract ideas and concrete existents. Here again, the duality is not as strict as it seems when considered from a phenomenological perspective. Every object that can possibly be present to the mind is not restricted to such concrete things as tables, chairs or lines of pixels on a computer screen. Everyone has done the experience of having the presence in consciousness of

general ideas, concepts, or abstract forms, in a manner similar to the experience of concrete objects. Both general ideas and existents are thus objects of study for phenomenology and semiotics.

However, before laying down conceptual bases for any design methodology, we need to ask ourselves the question of which, of ideas or existents, predates the other: do ideas originate from existents, or do existents originate from ideas? Functionalism offers an easy solution to the problem. Functionalist principles assert that the form of a concrete object is determined by the function that object is meant to fulfill (Michl, 1995). This approach is well adapted for VR design, provided that the function of every object involved has previously been defined. Since many virtual environments often strive to emulate real-world conditions, it is often the case that the form of a virtual object ought to follow from the function of the real-world object from which it is derived. But we see that the functionalist approach is essentially reductionist because it implicitly assumes that every virtual object somehow is the derivative of an already existing real-world object. We must consider the possibility that neither ideas nor existents should have any absolute precedence over the other, which is to say that if the function a thing is not entirely given from the beginning, it must be dialectically constructed.

2. DEFINITIONS AND METHODOLOGY

The elements of a phenomenon are classified on the basis of their form or structure rather than on the basis of their substance (Peirce, 1998a). Our approach consists in establishing a formal connection between the design process, that produces forms and VR technology that provides the actual 'substrate' into which these forms are embodied. Our theoretical and epistemological bases are the formalization of phenomenology and semiotics done after the works of philosopher C.S. Peirce by R. Marty (1990, 1992). But we may first ask, what is meant by 'real' and what is meant by 'virtual'?

2.1 The reality of the ‘virtual’

Conceptually speaking, the term 'virtual' cannot be the opposite of 'real', or the expression 'virtual reality' would be a contradiction in terms.

What is then 'real'? For Peirce (1992) the 'real' is definitely linked to the notion of 'truth': 'Reality' is known at the term of an inquiry aimed at settling a final agreement: “The opinion which is fated to be ultimately agreed to by all who investigate, is what we mean by the truth, and the object represented in this opinion is the real. That is the way I would explain reality” (p.139), or: “'Real' is a word invented in the thirteenth century to signify having Properties, i.e. characters sufficing to identify their subject, and possessing these whether they be anywise attributed to it by any single man or group of men, or not” (1998b, p.434).

And what is 'virtual'? Stemming from Peirce's definition of the term (Baldwin, 1902): “A virtual X (where X is a common noun) is something, not an X, which has the efficiency (virtus) of an X”, it is clear that virtual things are virtual not for being unreal but because, they, according to efficiency requirements, fulfill the same function as the actual things that they are substituted for, and this is known *a posteriori*. Imaginary things, on the other hand, like all untested hypotheses are *a priori* 'unreal', existing in the mind only, considered 'untrue' because their existence is dependent, at any given stage of knowledge, on individual minds only. Hence, a virtual thing will be real insofar as it is a true representation of a real thing. But a true representation is more than a graphically accurate representation: the photograph of a piano will never make a virtual piano insofar as a photograph is incapable of playing sounds. The truth of a piano — or the essence of a piano — no matter how large a community agreeing on a final opinion may be defined is clearly to play music. What differentiates something true from something untrue is the existence of essential features or "characters independent of what anybody may think them to be", that any given community of experiencers in some way or another has agreed upon. This posits reality as a social construction where ideas and objects acquire stability through the adherence of the entire community to objective aspects belonging to the structure of objects.

2.2 The essential structure of a virtual object

Insofar as a real thing is defined as having qualities independent of what anybody in particular may think of them, and because, in the same manner, the very way in which those qualities are organized also constitutes a character particular to that thing, it is not just qualities taken separately, but the collective total of qualities and the stability of their structural arrangement that is real. This means that there is in the perceptual configuration of every real object of experience a structure shared by all the members of a community. In Marty’s formalization of phenomenology, this common structure is unique; it is named in reference to the Husserlian notion of 'eidos' (Greek: idea, form): the eidetic structure of that object. The eidetic structure of a perceived object is included in every appearance of that object,

and in a converse manner, a condition for that object to be present to the mind is that the mind should form its eidetic structure (1990, 1992). The perceptual configuration of an object of experience is described formally by a relational structure incorporating the eidetic structure of the object present to consciousness. While some aspects of this particular structure may in practice be absent from the sensuous field experience, it is often an inference of a psychological nature that in some way or another fills the missing elements by combining elements of 'external' perception with elements of 'internal' perception. W. James (1981, p.747) concisely summed it up this way: "whilst part of what we perceive comes through our senses from the object before us, another part (and it may be the larger part) always comes (…) out of our own head." But in any case it is the *result* of this inference, in the form of a collective total of things present to the mind at the instant of perception, — and not the inference in itself —, that concerns phenomenology.

What is present to designer's or the user's mind is an object, which formally speaking is a relational structure in which the eidetic structure of the object in included. The designer's task would in principle consist in incorporating into the perceptual form of the concrete object of design the eidetic structure corresponding to the object of his conception. The concrete object formed in this way will be a representation of the mental object conceived by the designer. Now because the essential character of a virtual object is to have the efficiency of the actual object that it is supposed to represent, the eidetic structure of any virtual object needs to incorporate at least the function of the represented object, which we summarize by saying that a virtual object has in essence the function of the object that it represents.

2.3 VR Design and functionalism

What is 'function'? The function of an object is the idea expressing the essential purpose for which that object is designed. 'Form' refers to a structural arrangement, a set of relations according to which the qualities of a any given existing object is organized: i.e. how it must be put together in order to be what it is, which means that the function of an object is potentially contained in the form of that object, but not the opposite. Indeed, if form could be deduced from function, with the implication that there would be such a thing as a function existing prior to form (Michl, 1995), nothing more would be required, in order to design virtual environments, than to identify the function of every object and run a sequence of pre-programmed functionalist precepts.

This approach is highly reductionist, because if 'function' is a first that determines form, then design using virtual reality is fated to simply reproduce or emulate the function of real-world objects, which renders impossible the task of explaining how a new function may arise in a virtual environment before arising in the 'real' world. We see that, by placing function absolutely prior to form, functionalist philosophy applied to virtual reality eventually poses more questions than it answers.

2.4 Dialectic of design

After rejecting the idea that there should be a pre-established function associated with every object, we are led to consider the design activity as a dialectic process where form and function participate as two polarities. The ideal object of the designer posited as universal is the first positive moment of the dialectic. The second and negative moment corresponds the phase of implementation where the idea of the object is confronted with technical limitations of VR technology and has to overcome the resistance to change of the community. A synthesis of both the positive and negative moments in the form of an object of design, combines the abstract idea of an object and its concrete material realization.

In practice, designers tend to create mental objects or 'models' by modifying the structure of an already existing object. If modifications are made on unessential aspects of it, function will be preserved, but if the modifications pertain to eidetic (i.e. essential) structures and provided that the changes are accepted on a community level, it is literally *new* objects and eventually new connections between these objects that are instituted. The design activity can then be regarded as the dialectic process of institution of structures and relations between these structures on the scale of a community (Marty, 1994).

Since there are two kinds of phenomena: those associated with previously memorized experiences (i.e. semiotic phenomena'), and those not associated (i.e. 'ordinary' phenomena) (Marty, 1990, pp. 15-16), the design activity is for 'ordinary' phenomena a process of institution of new *eidetic structures*, and for semiotic phenomena it is a process of institution of *new relations* between these structures.

3. APPLICATION AND RESULTS

3.1 Designing for 'ordinary' phenomena.

'Ordinary' phenomena are, by definition, not associated with memorized experiences. They involve the direct experience of objects in themselves. Nothing is present to the mind that is absent from the realm of direct perception — either internally or externally. The eidetic structure of every object appearing is therefore immediately present in the phenomenon. Hence, designing for ordinary phenomena means for the designer to focus on identifying the eidetic structure of every object that he is working with. It also means to focus on technologies that can generate immediate types of experiences (3D-displays, surround sound systems, force-feedback devices, etc). The feeling of 'presence' in virtual environments is an instance of this, or the sensation of directly experiencing objects in three dimensions, or the immediate sense of feedback that one experiences with haptic or force-feedback devices, as well as the compulsive idea that forces us to mentally connect things together as if they were connected already, e.g. images and sound. Such experiences can neither be represented without losing their character of immediacy, nor can they be described in simple terms. They must therefore be experienced directly for what they are in themselves.

Now, the total of all immediate experiences of an object contributes to the taking of a habit, the habit of immediately experiencing the object, for the individual as well as for the rest of the community. The dialectic process leading to the formation of eidetic structures is based on the opposition that arises between the particular form of experience of an object by an individual and the experience of the same object by the rest of the community. The level of reality, or 'realness' of an object is a function of the stability of the eidetic structure associated with that object, so the chances of succeeding in modifying that particular structure on the scale of a community are determined by the resistance of the community that may either accept the changes or simply discard them. Hence the designer continuously faces two alternatives: either to preserve the essential (eidetic) structure of that object or to modify some of its aspects while running the risk of failing to communicate the object altogether.

This particular phase in the design process is determined by the technological limitations of the technology. This was particularly the case in the eighties when the rendering power of computers was limited to displaying wire-frame objects. Not surprisingly, objects were designed so as to contain the essential aspects of the object meant to be present to the mind of the user. Wire-frame display techniques were already adequate because they could render most features of the eidetic structure of objects, i.e. vertices and connections between vertices. Yet if too little of the eidetic structure of an object is presented to the end-user, the designer runs the risk of creating ambiguous objects that may be perceived in many very different ways, thereby losing total control on the design process. On the other hand, an excess of realism can never guarantee that an object will not be ambiguously perceived, if by 'realism' is meant to focus on all aspects of an object without making any distinction between what is essential and what is not.

Research themes in relation with the study of 'ordinary' phenomena cover issues of physical presence in VE, immersion, augmented reality, enhanced virtual vision, the use of perspective, perceptual or haptic illusions, etc.

3.2 Designing for semiotic phenomena

By definition, semiotic phenomena are associated with the experience of memorized objects. They involve a) the direct experience of an object of perception, b) the experience of another object that has been memorized, usually absent from the direct field of perception and c) the experience of the mediation linking those two experiences. The object that is directly present to the mind is a *sign* of the object present by mediation, and the connection between them is the *signification,* or *interpretant* of the sign. Designing for semiotic phenomena is very similar to designing for ordinary phenomena, except that, apart from the eidetic structures of objects, it is also the connections between those structures that need to be identified by the designer. A condition, for a law, a rule, or a concept, and more generally for any form of communication within a community to have any efficient effect, is that every individual has assimilated the connections linking the eidetic structures the objects involved, and by 'objects', we mean not only existents but also qualities and general ideas. The designer's task is more complex than in the case of ordinary phenomena. The 'encoding phase' consists in selecting an object whose eidetic structure is at least partially contained or connected by social convention to the eidetic structure of the mental object that he tries to convey. For the end-user, the corresponding 'decoding phase' consists in reconstructing the eidetic structure of the mental object conceived by the designer, by assembling together perceptual structures gathered from previous memorized

experiences and connected with the structure of the directly experienced object (nothing is communicable that has not somehow, at least in a partial way, been experienced directly). A condition to succeed for instance in representing the feeling of a three-dimensional object using only two dimensions, is that the experience of seeing in three dimensions has occurred at least once.

The question of how phenomena are formally connected and how community members modify these connections in practice is beyond the scope of this article. But to give an idea, possible research themes in relation with the study of semiotic phenomena are for examples issues of communication and collaboration in virtual environments, the study of social presence in VE as opposed to simply physical presence, the use of metaphors, metonymies in VR, and more generally just any form of representation.

4. CONCLUSION

We cannot claim to have given here more than an overview of Peirce's phenomenology and theory of signs, and the general lines after which we think that it can be applied to design using virtual reality. It is particularly pertinent to the issue that when the level of reality subjectively experienced is a function of the stability of a construction involving the work of community whose members have agreed on some objective structures, then the distinction between real and virtual need not imply that virtual environments should necessarily be derived from 'real' environments. With the expansion of networks and the possibility of reaching towards wider communities, virtual worlds acquire a reality that is determined in the first place by the size of the community but also by the level of agreement between all of its members. To create virtual experiences is therefore an important aspect of the problem, but to understand how these experiences are formally organized and connected together is even more important.

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