

Is Knowledge Emerging in the Secrecy of our Digital Collections?

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Abstract — Object-oriented computer science was created to simulate our activities of placing objects in identified and labeled class structures. As we know, its success was immediate. Recently, an innovative trend appeared. It is characterized by the mobilization of object-oriented computer science for the organization of our collections which are considered like heaps of objects waiting to be classified in ad-hoc classes that could be created at the same time. Undeniably, *collecting* is an older activity than *classifying*, in so far as it allows the useful experimentation of the concepts of extension (in the case of a spatiotemporal, even temporary and ephemeral arrangement) and of intension in the idea of an abstract order of similarities. We always put together a collection of *something*, which makes it impossible to typify the activity regardless of the objects, and which therefore disturbs the modeler's customary practices.

I. EXPERIENCING A SUCCESSION OF SITUATIONS AS OPERA SPECTATOR

One goes to the opera to throw oneself in the shiver of a lasting and incredulous experience, stretched between metaphysical solitude and subjective dissolution, with the certainty of maintaining one's social position.

"A drama performed without the possibility of direct participation" is basically the essence of opera. And the pole of metaphysical solitude is contained entirely in the possibility that "the drama of another does not concern me." Indeed, what is being performed there, without me, could easily leave me indifferent. One could perhaps claim that the work does not work, then taking the effect away from the subject. In extreme cases, when the work or the artist as the person responsible for this dysfunction is booed, the audience will even create a location where they can manifest their unanimous disapproval, giving social graces to disappointment.

Often, indifference to otherness makes the nagging question "who am I?" stand out, complimenting the corresponding method of "accessing the contents of the order, know thyself". The frustrated spectator returns to introspection as the only way to access knowledge, barely distracted by the fleeting vanity of sharing this bitter account with others. What then is left to address otherness? As for the dual extremity, that of subjective dissolution, it is germinating in the account of the possibility of being affected by fiction. This is the passion that numerous opera fans know, those who live the explosion of feelings and the reduction of emotions without bothering to discern where "it is obvious" in a contemporary way. In a best-case scenario, spectators know that introspection is not the only way to arrive at "know thyself"; but, there is another way: through the concern of another's drama. The audience they make up

then becomes a discreet place to share an inexpressible secret, like the way the director Ingmar Bergman did at the beginning of his film, *The Magic Flute*. Then, "know thyself" is interwoven with otherness to the point where it becomes "know yourself as you could never know yourself without the means of fiction." It is rare that the dissolution in imagined otherness should lead to a passionate dependency or to solipsism to the point that the spectator loses the fever of the performance.

In this way, a bit like the "time" of a journey which imposes itself as something other than simply moving through space, the strange effect of the "ipso facto" of the drama of another strikes the opera audience, mysteriously imposing itself as a way of knowing oneself.

Following the example of the journey, a live performance can be experienced as a sequence of situations. However, the spectator experiences the sequences that "make motives" (citing the vocabulary used by Jean-François Peyret [11], during his intervention in the symposium on writing time and interaction organized by IRCAM – June 13 & 14, 2006).

II. ENVISAGING THE PERFORMANCE THROUGH THE LENS OF COLLECTIONS

But is it a question of preconceiving these motives or do they appear when the work is performed? In the field of musical creation, Bernard Sève [17] distinguishes two distinct systems of synthesis: *organic systems* (where an element does not exist prior to the structure), and *composed systems* (created by submitting an additive ensemble to a principle of organization external to the diverse material to be organized, but logical nonetheless). He then goes on and cites Schloezer's Paradoxical Theorem: if music were an organic whole felt as such, that alone would not suffice to distinguish it from a chaotic system and that is why it is necessary for it to be composed – to satisfy both the intellect and perception.

According to Jean-François Peyret there are two different approaches to theater: one based on a system of composition and another that is organic. These two systems allow movement from one to the other, just like in musical composition. The first approach brings together what he calls preconceived 'fables,' whereas the second uses what we call open forms. The latter are of particular interest as they appear after the event of their writing, by condensation of what 'makes a motive' of what continues, allowing us to collect one more time the work retrospectively. Using other methods, a live performance could be close to a collection. Before delving deeper into our ideas on these two approaches to theater, we could make a detour through the passion-filled world of collectors and collections.

A. The Strange Status of Collections

1) The Fascination of Artists for Different Systems of Collecting

Artists have always been sensitive to the rebellious nature of collections, and have demonstrated this in their own way. Were Walter Benjamin [2] Gérard Wajcman [19], and others [14][18] able to sketch a different portrait of collections that strangely contrasts with painting as we define it?

Here, for example, is the analysis of Gérard Wajcman (*Catalogue for the inaugural exhibit of the Maison Rouge*) on the status of excess in a collection:

"Excess in a collection does not mean disordered accumulation; it is a fundamental principle: for a collection to exist as such-in the collector's eyes – the number of objects must exceed the physical possibilities of exposing and storing the entire collection at home. Therefore, someone who lives in a studio can have a collection: it is only necessary for him to have at least one work he cannot hang in his studio. That is why the reserve is an integral part of collections. Excess also applies to the capacity of memorization: for the collection to exist, it is necessary for the collector not to be able to remember all the works he owns.... In fact, the number of objects he owns must be so important that it becomes too important, so that the collector can forget one of them or leave a part of his collection outside of his home. To say it differently, for a collection to exist, the collector must not have full control over his collection any more.

Certainly thinking of Gertrude Stein (*Collection*), Gérard Wajcman goes on saying, *"If nobody ever looks at a collection, it is because the collection is not a whole made up of works but a vague series of unique objects, a work + a work + a work..."*

The collection, as opposed to formal ontology, seems to appear to be a metastable balance resulting from the dynamic tension between structures that are categorical and others that are unique. Contrary to what is organic, the collection only exists for each of its parts (like the flock in the Gospel according to Saint Matthew) and, in contrast to the whole, it does not exist as a normalizing and equalizing unity.

The dominant theme in the donation of a collection (its reception by a visitor or the collector himself, be it during the act of acquisition or even of re-collecting) is the paradox of the impossibility of a donation as a coherent whole except in the simplistic system of management. From this point of view even a jumble of objects can be seen as a coherent whole: scattered objects become a part of the jumble using the logic of *being different* before later becoming similar in that they are all different, thus forming what Jean-Claude Milner calls the paradoxical class.

2) Digital Collections: Between Order and Disorder

Object-oriented computer science was created to simulate our tasks of classifying objects in identified and labeled structures [10], [8], [1]. Its success was, as we know, immediate.

Recently, an innovative trend is mobilizing computer objects for the organization of our collections, considered like a group of objects waiting to be organized in ad hoc categories that must be created simultaneously [8][16].

Collections seem to be closer to classificatory order than disorder – no matter if they appear to be a stack, a heap, an assembly, a hodgepodge, or any other sort of jumble – they always seem to aspire to a system of classification, even if it remains temporarily incomplete and unfinished. Wasn't the scholar's cabinet of curiosities the ultimate destination for collections that then fell into a system of classification through a procedure of categorization and finally of sorting? Regarding stamp collections (as another example), aren't they waiting for their categories to be completed through the achievement of series that have been *started*?

Therefore, in a certain sense, it was inevitable that one ended up comparing collections to classes because in several ways, they seem to be pale imitations. Nevertheless, something resists this comparison, and in some ways collections remain slyly rebellious to the idea of classification. This is how they come to be pushed together with singularities – sharing with them a strange magic spell to definitively escape any attempt at classification (see the examples of journeys, opera, of Don Juan-ism, and of the evangelistic flock [15]).

3) The Traditional Ontologies of Theater

Let us return to the artistic world of performances and look in detail at the traditional approach to theater that favors the system of composed systems. Faced with diverse human experiences, the playwright composes the unity¹. The director's work is the development of organic systems – he invents a structure of understanding that one can exhibit – a way to understand the reading of the text. This gives rise to ideas that spawn the staging of a scene.

The director begins by establishing an overall ontology for the play. Characters are described in terms of type (the perfect example in a light comedy would be husband, wife, and lover) and they are presented as instances¹: we learn their names and situations at the beginning of the play. In the *Fourberies de Scapin* by Molière, Géronte is an example of the "old man" type. A playwright's ontology can also be structured by typical situations. Characters and situations are not imagined as unique entities, but as specific cases in a larger model.

Throughout the play there are several possibilities for variations of these instances. The audience discovers through the plot that this or that character is different from what they originally believed, although he remains in the category of a conventional model. An old man stays an old man, even if the example varies. In baroque theater the question of a character's permanency as a characteristic is asked; in *Le Bourgeois Gentilhomme*, Molière raises the question of the possibility of radically transforming his Monsieur Jourdain. In the same manner, *Don Juan* by Tirso de la Molina (1630) is based on a theological debate on human nature: can man change by abjuring his errors just before he dies? The question lies in knowing if the

¹ *Instance* is a term currently used by computer scientists. Instancing generalizes an operation used by mathematicians that affects a numeric value to a variable. To be concrete, computer scientists instance abstract classes, thus declaring that such or such an entity is a specific case in a class that is linked to other classes through general and/or formal hierarchies. The entire system make up what we sometimes call an *ontology* (an ontology can also describe areas of knowledge of the world that are often used in artificial intelligence), sometimes an *object design* (an object design is made up of graphs designed to create computer programs through simple instancing of key parameters).

ontology can resist possible extreme variations in instancing. It is therefore the director's organic logic that must adapt to that of the author, responsible for a composed system via writing. The success of a performance is often linked with the perception of the (sometimes artificial) harmony between the principles of the composed and the organic. This procession of situations displays preconceived motives, structures, and forms that contribute to collections.

But we must now consider another possible approach, one that would favor the organic over the composed in theater. Here are some examples of this approach.

B. Designing a Performance as an Open-Collection Form

1) Improvising in Order to Find a Temporal Solution

Jean-François Peyret describes² his theatrical creation work this way:

"Theater is traditionally an art of space, of expanse. It involves taking a temporal object – the text – and stretching it out in space. We call this directing. Our way of doing theater goes the other direction, confronts an entirely different situation. What are the particulars of this experience? On the one hand, a space, a stage designer, and a technological and musical system with which the actors have to interact, and on the other hand, a textual score, literary materials. Through incessant experimentation and successive improvisations the actors try on the elements of this score under our leadership by playing with the technical constraints. This is how the text – and therefore the play – is written. It must be understood that the text does not exist before the performance; it is produced through the work carried out in the theater. The length of the texts is the touchstone. Writing a play is therefore a matter of time. It is just about finding time, meaning, finding the right time."

Resolutely approaching this work as organic, with the constraint of improvisation and the initial premise of a stage-oriented system, this text shows how the director lays down the conditions for the possibility of an open form. The actors are seen as "agents" (as the term is used in computer science) who collectively take part in what specialists call a "constraint-programming optimization engine." The result, the solution that is found, can be compared to the hanging of a painting as described earlier by Gérard Wajcman: from the excess of the open-form a particular solution appears, putting temporal and theatrical elements in relationship, and refusing to clarify the ontology of traditional theatrical productions. So, from the spectator's viewpoint, the performance is perceived like a visit in a collection of temporal objects.

2) *La Traversée de la nuit*, by Geneviève de Gaulle-Anthonioz

This type of open-form approach is not reserved just for improvisation. It can also be used for pre-written texts, the production setting is a scene that makes formal dramatic relationships bland, allowing motives to emerge. The computer, not seen as a calculator but as a partner in a rich actor-machine dialogue, becomes a production tool in an attempt to escape specification *a priori* by placing the emphasis on multimodal interaction. This approach

balances the composed and the organic better than Peyret's, and is still closer to the organic, filtering the text through an emerging production.

This is the research carried out for the inter-media play *La Traversée de la nuit*³ by Geneviève de Gaulle-Anthonioz about her imprisonment in a cell, in the Ravensbrück concentration camp, at the end of WWII. *La Traversée de la nuit* is the story of a memory: in 60 pages Geneviève de Gaulle-Anthonioz tells of a unique experience lived more than 50 years ago. Bringing together the theater and this text – which wasn't written as a play – gives perspective *and* depth to the sharing of a memory. The author shares, more than 50 years after the painful events of the war, memories from different times in her life (childhood, adolescence, her resistance during the war, deportation) that overlap and affect each other.

Pulling together these ideas, an interactive multimedia system that features a narrator and a Noh dancer was used in this performance. A huge screen, with its monumental presence, physically defines the stage and opens the visual scene to the audience. The metaphoric space reacts at the same time progressively and with tension, like an autonomous background. It is the space in which the characters' thoughts play out – always in motion, a symbol of life, a hypnotic and receptive breathing membrane.

The screen – a metaphor for the moments that pass through an imagined space – lets thoughts appear and be reabsorbed. Images are created here from a neutral video "cloth," modified into a rhythm which is almost imperceptible to the human eye: frames of images animated by movements, circulations, superimpositions that are spontaneously generated on the screen based on the particular emotional states detected in the narrator's voice.

The text orchestrates the performance through direct and interactive processing of the actress' voice. In this way the words of the author, of her memories of an initiation, are delivered. Words lead images, converting each "moment" of life into a process of transforming, mutating, and constructing her being. The immediate influence of her voice is transmitted simultaneously by the screen and consequently acquires additional reach and persistence in the form of temporal depth.

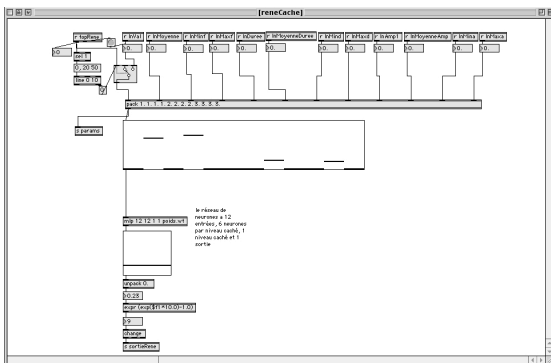
In this work, events are deliberately made less prominent through a staging that is not overly controlled and specified by variations of events at the heart of the ontology of each character and the situations, but by a sliding of the situation controlled by the situation itself. *La Traversée de la nuit* was adapted to this kind of approach, as the stage design was based on the psychological states of the character, and not on the illustration of situations. The sudden emergence of emotions as visual elements on the screen, visible to all – on and off stage – could influence both the actress' ranting and the dancer's choreography. These elements contribute to the feedback loop because the two actresses on stage make up the two aspects – aware and unaware – of a single character, keeping with the traditions found in Noh theater; the

² Presentation during the symposium *Écritures du temps et de l'interaction* organized by IRCAM, June 13 – 14, 2006.

³ *La Traversée de la nuit*, by Geneviève de Gaulle-Anthonioz, director: Christine Zeppenfeld, multimedia design: Alain Bonardi and Nathalie Dazin, image creation: Julien Piedpremier, music: Stéphane Grémaud, actress: Valérie Le Louédec, dancer: Magali Bruneau. Performed in November 2003 at the Centre des Arts d'Enghien-les-Bains.

computer continuously senses the narrator's emotional states.

The multimedia real-time system put in place⁴ is made up of a network of neurons⁵ designed to recognize emotions in the actress' voice and outputs through a multi-agent⁶ system that generates the images projected on the screen. The network of neurons was tested under supervision for several months with a list of emotional states the actress would be confronted with during the reading of the text. The voice input is processed sentence by sentence, each one leading to a calculation of a vector of twelve components: four of them concern the pronunciation of vowels (formants); four of them represent the characteristic of the voice and therefore the pronunciation of the consonants; the four final parameters concern the prosody (the intonation of the voice in a sentence). For each vector presented in input, the network of neurons provides a "recognized" emotional state.



Putting in place a network of neurons in *La Traversée de la nuit* allowing the recognition of emotional states in an actor's voice. At the top, the twelve voice excerpt descriptors. At the bottom, the recognized emotional state (source: Alain Bonardi).

Multi-agent systems allow the real-time generation of images projected at the back of the stage. The agents are like dynamic poster hangers, assembling images that are constantly renewed.

Each agent has its own simple psychological model of (positive or negative) sensitivity that reacts to emotional states in the network of neurons depending on the text. The result, depending on what is indicated by the network of neurons, and depending on the level of sensitivity, is a mood that conditions their "will" to accomplish the tasks at hand. Multi-agent modeling was designed this way:

The agents work together toward the goal of optimizing a utility function for the image (different for each passage from the text).

The agents are coordinated in reaching this common goal in relation to an emotional state recognized by the network of neurons by a compensation mechanism: those who are "in a very good mood" (a high positive value) grant a little of their fervor to those who are in a very negative mood.

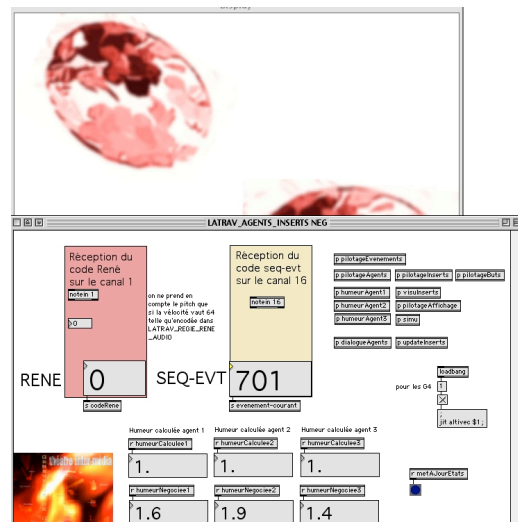
⁴ Developed using a platform for signal processing in real-time Max/MSP/Jitter. Website: <http://www.cycling74.com>

⁵ cf. technical glossary.

⁶ *Ibidem*.

The agents communicate among themselves, two by two, at fixed periods by transmitting their respective moods to each other.

The agents' environment is made up of emotional states recognized by the network of neurons--indicators that show where events of specific values are found--and of its observance of the overall image.



The multi-agent system in *La traversée de la nuit*. In the background, two autonomous agents carry fragments of images. In the foreground, a part of the pilot screen (source: Alain Bonardi).

The screen in the background lets the audience see the retention of the actress' voice, breaking away from the linear and markovien quality of interactions by giving a permanent dimension to a particular media: the voice, a vector of different emotions⁷. In this way, a collection of interactions (micro-form) is embedded in the play like a collection of animated images (macro-form).

III. HOW DO COMPUTER SCIENTISTS TREAT COLLECTIONS?

Undoubtedly impressed by artists and philosophers who considered the strange status of collections, "object-oriented" computer program designers realized that the modeling of collections of objects would rely on hybrid computer objects that combine characteristics coming from the private world (where we encounter objects) and characteristics from activities in which the collected objects engage.

A. A Conservative and Attractive Approach

The approach chosen to characterize a collection is often parsimonious and consists in overdetermining the private referencing of the collected objects through a minimal description detailing the collective activity's context, even overrating the *becoming-classification* of the collection.

This practice presents the advantage of not fundamentally opposing the modeling of objects, but does not always live up to the collectors' high standards. This is how François Pachet (Pachet, 2003) describes a curious phenomenon to which he was subjected. As a user of indexing tools for music, he ended up not listening to the

⁷ We mean that these emotions constantly slide from one to the other.

music he downloaded; he was so concentrated on the organization of his collections that this activity stealthily replaced listening. Quite by accident, it was discovered that his music listening system had been unplugged for a long time without it affecting his zeal for indexing whatsoever.

Here it is important to distinguish between figural and non-figural collections. This subtle distinction, introduced in the 1970s by Piaget and his research teams of child psychologists (Piaget & Inhelder, 1980), brings more light to the situation. There are collections that we can label as figural because their arrangement takes into account the implications of spatial configurations, considered in parallel with the typical concerns of the meaning of the classes.

According to Piaget, *"The characteristic of a collection as opposed to a class is that it only exists through the assembly of its elements in space and therefore ceases to exist as a collection when the sub-collections are dissociated. The result is that when the sub-collections are brought together in the $A + A'$ form, the subject unites the ensemble together in the $B = A + A'$ form. However when the sub-collections are dissociated, either in space or in thought, the subject no longer unites the whole collection and is therefore unable to carry out the operation $A = B - A'$."*

Curiously, here we see the opposite of what was previously exposed: the stack, heap, jumble, and other hodgepodes that only exist in the privacy of a shared space now reside with slightly different collections when the classes are situated in another state, different by nature from the organizational systems based on space.

In their work, *La genèse des structures logiques élémentaires* (lit: *The Genesis of Basic Logical Structures*) Jean Piaget and Bärbel Inhelder (Piaget & Inhelder, 1980) make a more precise distinction between figural and non-figural collections, which are still called classifications or categorical collections. For these authors, a classification has two different types of characteristics or relationships, both necessary, and satisfactory for its making (page 25, 1980):

1. The qualities common to its members and those of the class it belongs to, as well as the specific differences that distinguish its own members from the members of other classes (comprehension);
2. The relationship of a part to the whole (membership and inclusion) determined by the quantifiers "all," "some" and "none" applied to the members of the class in question and to other members in the class they belong to, defined as extensions of that class.

For example, cats have several characteristics shared with all cats, others that belong to them individually, and others that can be found in other animals as well. However, using these characteristics to define a class does not bring into play any references or relationships to a spatial configuration. Cats can be grouped together or spread randomly without changing the qualities (1) and (2) in this class. Undoubtedly, the inclusion relations defined in (2) could provide a topological – and therefore spatial – structure, but it is by first using isomorphism that one is able to create a relation between the algebraic structure of the possible series and certain topological structures of envelopment without the interference of a

space that is not necessary for a complete description of the class.

B. Figural versus Non-Figural Collections

On the contrary, Piaget speaks of "figural collections" when the placement in space is carried out according to spatial configurations that have meaning from the viewpoints of the characteristics (1) and (2). *"In a word, a figural collection would be made up of a figure in accordance with the connections between its elements as they are, while non-figural collections and classes would be free of any figure, including the cases when they are symbolized by figures and despite the fact that they can result in an isomorphism with topological structures."*

What is listening to music on-line if it is not building up a collection – certainly sometimes a transient and ephemeral one, but always *figural* in the unique way it was made under the fragile condition of continuation – that depends on the temporal figure of its use in time (Pédaque, 2006), (Rousseaux, 2005)?

Figural collections adapt poorly to their assimilation into non-figural collections or classes; however, according to Piaget, collections are destined to become classes in the same way as subjects will grow psychologically so as to improve their cognitive capacity to classify. Still referring to Piaget, the major theme of figural collections is a radical *indifferentiation* that makes them recalcitrant to traditional modeling. Let us observe how he decodes the experimental situation of a child who is making a figural collection in *La genèse des structures logiques élémentaires* (page 51):

"While the child is certainly capable – once he has reached the Sensory-Motor Stage – of successive assimilations that form resemblances, when these assimilations begin there can nonetheless exist a sliding from resemblance to relatedness, creating the principle of broader similarities originating from the geometric form of the whole, or from the empiric unity. But, above all, as these assimilations are only successive, nothing yet allows the subject to quantify his results and assign them an extension by gathering together simultaneously as a 'whole' the elements that they apply to. The problem is therefore creating a substratum that can be used as an extension of this understanding brought about through successive assimilations. Attempting to construct a collection that corresponds to his successive assimilations, but without having acquired all the tools necessary to translate these assimilations into 'whole' or 'some' that guarantee the regulation of the corresponding extensions, the subject sometimes proceeds from understanding to extension, sometimes from extension to understanding and not according to a principle of univocal and reciprocal correspondence, but through a simple lack of differentiation and through indifferenciation that prolongs, but also considerably reinforces the resemblance and proximity already at work from the beginning of the assimilations.

Sometimes the child places 'the same' with the same, and here understanding determines extension, as will be the case for later logical classification. However, sometimes the child adds an element to finalize the collection he began in the direction of its growing extension, and it is precisely this extension that establishes understanding. This establishment can thus present itself

in two distinct, but equivalent manners: either it is the geometric form of a collection in which an element is joined with others as a part of a group without there being a precise resemblance among the element, or there is a group of random objects and one element will be chosen to complete the others so as to make a coherent whole, so that, this time, resemblance is forgotten in favor of an empirical convention taken from past experiences in the subject's life. In both cases, only the form of the collection provides its conditions and therefore it is this physical and autonomous extension that establishes comprehension."

This distinction between different collections sheds light on the two approaches to theater that we have raised: the preconceived "fables" that are seen by the audience as non-figural walk-on parts, and the open forms which are figural.

IV. WE ARE ALL COLLECTORS

In everyday life, we are often faced with collections, even when we are far from imagining that that is what we are doing. This does not concern only the collector of works of art (paintings, for example), the viewer at an exhibition, and even the shipping agent responsible for moving the collection to its next location. Collections are far more present in our everyday lives than we think.

As a matter of fact, in the expanding field of tools to assist performance, numerous existing computer applications help us in our constituent relationships to collections⁸: music devotees looking for works using an interactive search tool, students drawing up a document browsing on the web looking for inspiration, engineers interacting with colleagues – all are forming collections.

But why let the primacy of the collection spread to the collected objects themselves? Ordinarily, a collection is understood to be a *collection of something*, and these objects are thought to have pre-existed the collection, to have value in themselves, apart from the group. Let us be clear; in affirming the primacy of the collection over the collected objects, the question does not simply lie in offering a lexical amendment to talk about collections where one normally talks of sets, classes, groups, categories, masses of objects. What we want to demonstrate by introducing the idea of a collection *being at the origin of the idea of things* is that its promotion at the foundation of our categorical and conceptual systems makes it possible to truly reexamine a number of our cognitive activities, and therefore to better target the adequacy of our computer tools that assist us in these activities.

In fact, we always act, live, and imagine in a given perspective, in a given set of circumstances that are limited and defined, like a journey by train or a performance at the opera. Of course, these circumstances are not fixed and evolve in correlation with the choices we make. Still, there is the element of *always-already* for any given set of circumstances, a staging, a project, a plan, an intent that defines our interest in and our relation to things.

And this is the reason why our interpretation activities are *always-already* involved in their continuation and their survival, and only acquire meaning in the horizon and

⁸ Interesting arguments have been made by Pachet [8] concerning this question.

perspective of the attempts that preceded them. This is how we can feel strong emotions at the opera, counting on the intermission and the end of the performance to extract ourselves from the fictive situations that we found so moving – even if certain of them left indelible marks on our future emotions.

In short, what I hear in a certain piece of music is a part of a project and has inherited the previous motivated-management and directed projects. It is in this precise case that the current piece enters the collection of pieces already heard, and completes the collection like a flexible whole (Deleuze, 2003).

In a way, listening to music is like collecting works, like the traveler who travels through situations that "make motives"⁹.

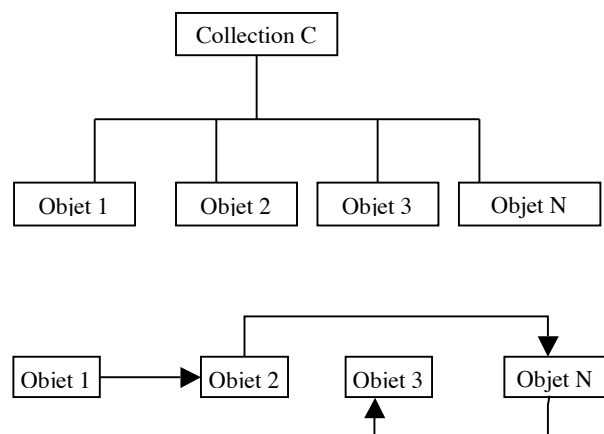
V. TOWARD A COLLECTION-ORIENTED FORMALISM

A. Are Our Tools Adapted to the Collections That Live With Us?

If collections are so important in our lives as performers, the question of location that our intelligent tools brings up becomes an interesting one.

Let us go back to the example of the art collection; we can use the example of a collection of paintings to be clearer. In a computerized system, this COLLECTION is often considered like a gathering of art works, approachable through a semantic tree-structure that places the emphasis on the ART_OBJECT category. When we model the system, we usually draw up a model structured on a three-fold relationship:

1. Each work is declared to be A_PART_OF the said COLLECTION;
2. Each work inherits certain characteristics of the COLLECTION as a whole, for example, the name of its owner;
3. HANGING the COLLECTION is a way of ordering the works – an ordered graph that sequences the collection.



⁹ Sometimes the two approaches come together as in Modest Moussorgski's famous *Tableaux d'une exposition* for piano.

Furthermore, procedures link works of art to a collection, like the evaluation of the global monetary value of the collection, or even its artistic descriptions.

This kind of model is appropriate to describe the work of someone transporting the works, a person who is writing a catalogue for an exhibit, or even maybe a banker who looks after the collector's affairs. In other words, the management of the collection could be appropriately describable in this model. Here, three categories are sufficient: ART_OBJECT, HANGING, and COLLECTION. The ART_OBJECTS are both PART of the COLLECTION and a SUB-CLASS of this entity.

But does a collection only operate through its system of management? Certainly not. The collector, just like the art lover who comes to see the collection, does not see a collection as a group of objects. First, because an art object, the unique work that one is looking at, always hides other objects in the collection. An object hides whatever it does not show. In its phenomenological system, the collection permanently distinguishes itself from its management system. Here, my encounter with a work of art is always unique, and the collection in the background promises both the continuation/reproduction of the experience and its end. I can enter the world of the work and know that I can leave it.

The collection also manifests itself in the particular way it is hung, in the same way as an organized journey. In the situation of a visit – or for the collector about to acquire a work, it is a graph of precedence that best defines the collection, each confrontation with a work leading to a distinct step, even if the work is re-visited (Deleuze, 1968).

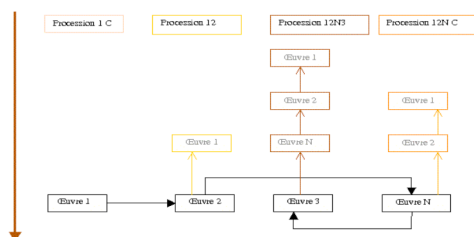
Therefore, two distinct figures in the same collection – or rather two systems of donations that we can easily distinguish – are at work:

- A management system, marked by the figure of the art object;
- A phenomenological system, marked by the figure of the performance's journey and the donation, which is always unique, through a work.

Neither of these two systems can be spontaneously reduced to the other; one must note this irreducibility to imagine the collection as a category with two original dimensions.

B. Modeling the "Phenomenological" System of Collections

Here, the management system and its entities ART_OBJECT, HANGING, and COLLECTION are no longer applicable. They are replaced by the categories WORK_OF_ART, PROCESSION, and VISITATION.



Of course, WORK_OF_ART resides conditionally in ART_OBJECT, but also in PROCESSION, which is the current path of the journey of VISITATION, which is in turn conditionally part of HANGING. Regarding what we suggest calling VISITATION, it consists of a PROCESSION that has been declared complete (even if the art objects were never seen). The question of the end is important and is of course conditioned by the COLLECTION and the HANGING, but also by decisions that concern the visitor only.

Therefore, numerous systems of context become apparent: a context connected to PROCESSION, a context connected to VISITATION, and another one connected to the ARTISTIC_LIFE of the visitor.

C. Toward Axiomatic Collections

1) Industrial Context

Computerized tools that help us search for information are more and more effective technically, and their spectacular acceptance by the general public shows us that this field will continue to play a key role in closing the gap between computer users and non-users.

To increase chances of success, current efforts of R&D are concentrated on the diversification of competitive offers and the improvement of tools (recall rate, precision rate, noise, silence, etc.) that reference the products that seduce users, such as the search engine Google™.

However, can the market still welcome new international players? Isn't it already saturated with strong competitors that are ready to do anything to prevent the entry of these new players? It is likely that only truly innovative products can slip past the major players and become established.

2) Research Program Proposal

In this prospect, we have drawn up a proposition for a research program that hypothetically results in an innovative differential investment in material to assist searches for information that could promote a new strategic international offer.

Hypothesis 1 (strategic refocusing of the activity of information searches):

Assisted searches for information could benefit from a presentation as a modest tool palette that is offered as a part of an environment that anyone could spontaneously identify as a metaphorical invitation to take part in an activity that has been known and practiced since the beginning of time. In other words, we suggest that the search be hidden behind a generic activity.

Hypothesis 2 (identifying an activity that encompasses information searches):

This *original* location that would spontaneously speak to everyone, and facilitate the use of our search tools to reduce the user/non-user technology gap exists. It only awaits its computer metaphor; it is a place for creation, inhabited by the transformation of our masses/stacks/jumbles/hodgepodes into intermediate, metastable configurations that are temporary and malleable. One works there through successive and exploratory refinements, continually attracted and stimulated by the asymptotic perspective of classifying by category, but without being able to find a definite solution. The emblematic form of these intermediate configurations is the *figural collection*, using the precise definition given

by Piaget. In everyday language, one simply speaks of *putting together a collection* of something.

Hypothesis 3 (interactive computer-science):

As long as we understand what a figural collection is and which tools will give it its *fundamental characteristic of lack of differentiation* are, and as long as we have the proper search tools integrated in the perspective of a creative aid for the creation of figural collections, the design/production of a computerized environment for assisted creation/browsing of figural collections is perfectly imaginable. It is even striking to note that every time an environment for assisted searches is put on the market, it is successful. It is possible to interpret this success in terms of how easily users "find themselves" and "continue to be interested," are involved in putting together (possibly ephemeral) collections to the point that at the time of the creation of the collection there is also a certain desire and definition of the users' satisfaction. Other criteria beyond the quality of the technical tools used are still to be discovered and need to be specified to qualify the appropriation of these environments by users. Even projects that address "man-tool interaction," "the adaptability of tools to man," or "understanding the context" do not look into the issues at the heart of the problems, as they are not yet able to give the exact reason for the interactive/adaptive/contextualization need. GoogleTM never reveals its internal search model to its users, but offers them *spatial* propositions in the form of *ordered lists/pages* that are means of expression for the similarity/contiguity competition, necessary for the creation of figural collections. Didn't a big part of the success of the first office automation tools come from their unexpected performance? We must now go further than the experimentation stage, which leads to too many failures, to seriously create a theme for the open question.

Hypothesis 4 (methodological approach):

The radical lack of differentiation between relatedness and aspectual resemblance that characterizes figural collection leaves a unique field of expression open to the collector, but at the same time prevents any systematic approach that would deny the indestructible order of the nature of the collected objects on the collection's progress. It would also be vain to want to constitute an environment to assist the creation of figural collections in any way other than one based on applicative cases. *Making a collection of something* can not be imagined as a simple instancing of a generic figure of *making a collection (without an object)*, and it is not by trying to think/imagine a significant variety of projects on computer-assisted digital information searches in an environment that would be favorable to the creative constitution of figural collections that an innovative system can be created.

The innovation consists of a family of new computer environments that produce the metaphor for a very old activity, at the same time general, cross-cultural and still dependent on the nature of the objects it aims at organizing: the creative constitution of a figural collection. We suggest encouraging the placement of innovative products that stimulate the creative building-up of figural collections on the market. An offer for this type of environment will represent a decisive asset to enter the extremely competitive world of the international information search market. These new environments will facilitate the appropriation and diffusion of information

search tools and will thus contribute to narrowing the technology gap.

To complement these hypotheses, we have begun to work on an axiomatic system for collections that should open the door for computer modeling, simulation, and understanding of collections as for example the new *Musée des art premiers* in Paris whose architecture and catalogue do not show any apparent classification. The major points that we would like to emphasize are:

- The existence of places to exhibit and store (one of the two at least not being empty); the definition of an exhibit space through the spatiotemporal hanging of the works;
- The notion of a catalogue, necessarily limited to what is exhibited;
- The lack of differentiation between the two systems of journey/creation of collections: resemblance *versus* relatedness.

VI. CONCLUSION

A. *A Collection is Always a Collection of Something*

Husserl said that conscience is always conscience of *something*, indicating by that that conscience always *pre-dates* the subject and the object, that conscience *puts them together* in the process. There are no subjects and objects already put together that meet in the world to fill out a journal of experiences (the subject) and perhaps adapt to each other by induction.

In the same fashion, we could say that a collection is always a collection of something, and that the original location of the categorization is the activity of collecting, implacably mixing abstraction and spatiotemporal arrangements, producing as many correlations as metastable categories.

Above all, the modeling of digital collections that we are working on should not succumb to the generic nature of digital files by producing systems of collections that would have their own worth, regardless of their contents.

B. *A Metaphor for Categorization*

Therefore, *putting together* a collection could be seen as a hypothesis to operate under a metaphoric system of the cognitive concept of categorization. One of the functions of a metaphor is to summarize and to present a group of complex cognitive and semantic structures. The heuristic aspect in the metaphor for *putting together* a collection is to permit the conceptualization of the complex processes that a cognitive agent concretely puts to work when putting together a class and its categorization, before knowing what one wants to classify. *Putting together* a collection in this sense is an interesting metaphor. It partakes of abductive reasoning.

The current models for information search are too formal. And in practice, when searching for information, experimentation is a part of the activity, not due to the limits of technology, but because the searcher does not know all the parameters of the class he wants to create. He has hints, but these change as he sees the results of his search. The procedure is dynamic, but not totally random. And this is where the metaphor for the collection is interesting.

The collector's experimentation is always carried out by placing objects in temporary and metastable space/time. Here, the intension of the future category has an extensive figure in space/time. And this system of extension (the figure) gives as many ideas as it does constraint. What is remarkable is that when we collect something, we always have the choice between two systems of constraints, irreducible one to the other, with an inalienable freedom between the two, which is the one to choose at any time between the two systems.

If Piaget asks a child to place a cube that represents a bird on its side when several other cubes with plants on their sides *have already been placed in a certain way so that there is almost a whole square with only one cube missing in a corner to create a perfect geometric shape*, the child places the bird-cube so that the square is completed without worrying about regrouping a bird and plants. But if Piaget asks the same child to place the same bird-cube with the *same plant-cubes not organized into any noticeable shape*, the child would be more reticent about placing the bird-cube with the plant-cubes. If the abstraction/placement option is radical and inalienable (or *non-differentiated* to use Piaget's term), it is not less prescriptible by the environment. When Y puts together a collection of X (or when we go to see Y's collection – all this being in fact the same thing) he works between the two concurrent systems.

This is the same when a user mobilizes formal computerized tools to assist in categorization. Everyone (and, above all, the designers of these tools) thinks that the user is coming closer to the formal domain, but it is not so. On the contrary, the user enlists the formal productions of the tool in a cycle of the collection that lets him mediatize/refine his desire, and therefore orient it in time/precision/satisfaction. The best proof is that Google™ has not divulged how it finds the propositions given following a request, but gives instead an *ordered list* to the user who now has the choice between abstract similarities and relatedness.

In other words, satisfactory computer environments already assist in the activity of collecting, even if we do not know how to reproduce this success. When we speak of man-machine *interaction*, *adaptability* or other notions, we are not precise enough – we do not reach the point of a whole description, creating an artificial *lack of differentiation* for similarity/relatedness, the only possible freedom for experimentation so that we can categorize.

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