

New ideas for browsing our digital collections

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Abstract

Recently, a new trend centered on object-oriented computer science has become apparent. This trend is characterized by the mobilization of computer objects for the organization of *collections* of objects, considered like a group of objects waiting to be managed ad hoc by class, which now must be created in parallel. Often, the approach implicitly chosen to characterize a collection is parsimonious and consists of over determining the organization of private reference of the objects collected using a minimal description of a collective activity's context, even if it means presuming to become a classification of the aforementioned collection. But to succeed, it is necessary to distinguish figural from non-figural collections. This subtle distinction, first made by Piaget and his teams of child-psychology researchers in the 1970s, brings the situation to an interesting light.

Keywords: music retrieval, cognitive modeling, collection, figural collection, class, Piaget, lack of differentiation between the resemblance and the contiguity.

1. The strange status of collections

Object-oriented computer science was invented to assist the task of classifying objects in a structure where different classes are distinguished ([13, 4, 1]).

As we all know, this innovation became quickly an important success.

1.1. Collections, between order and disorder

Recently, a new trend has become apparent. This trend is characterized by the mobilization of computer objects for the organization of *collections*, considered like a group of objects waiting to be managed ad hoc by class, which now must be created in parallel ([11, 16, 14]).

Because our collections seem to be nearer to order than disorder, attempting to assimilate them in classes is not so surprising. At least, collections look like they are

waiting for their completion within a classification order, with the aim of turning into canonic achieved structures made of objects and classes. But something is also resisting that assimilation, as artists and philosophers have always noticed.

1.2. Artists' fascination for collection regimes

As a matter of fact, artists and philosophers have been always fascinated by the rebellion of collections against categorical order ([2, 8, 6, 19]).

Let us mention for example Gérard Wajcman's analysis on the status of excess in collections (*Catalogue de l'exposition inaugurale de la Maison rouge*): "Excess in a collection does not mean disorganised accumulation. There is a founding principle: for a collection to be so – even in the eyes of the collector – the number of works needs to exceed the material capacities of displaying and stocking the entire collection at home. Someone living in a studio apartment may very well have a collection: he will only need to not be able to display at least one work in his apartment. It is for this reason that the reserve is one full part of collections. Excess can also apply to memorising abilities: for a collection to be so, the collector should be incapable of remembering all the pieces he possesses (...). In fact, he either needs to have enough pieces to reach the "too many" and to "forget" he had this or that one, or needs to be compelled to leave some outside his place. To put it in a nutshell, what makes a collection is that the collector should not have total power over his collection".

The process of extending a collection is potentially infinite, even if the collection is necessarily undetermined, *temporarily* finished. Practically speaking, a collection ceases to exist as something other than a commonplace correlate whenever the collector loses interest in its extension: he then stops reiterating the acquiring gesture and/or the reconstitution of the collection in an intimate dwelling comes to an end. Both acts have the same essence: in order to keep the collection in an intimate sphere, the collector re-generates the collection, working on his very logic of growth, yet unaware of it. Re-production balances the collection's heavy trends and facilitates new links among the pieces, hence setting up new similarities that will eventually influence the acquiring logic. Strangely enough, desire becomes knotted to difference. Objects enter the collection via the *being different* predicate; they only become similar later on, as being different is what they have in common, hence setting up what Jean-Claude Milner calls a paradoxical class.

"A private collector's scene is not his apartment but the whole world. It is important to stress that the major part of his collection is not to be found at his place, his collection is yet to come, still scattered all over the world. Any gallery or fair represents the possibility of chancing on his collection yet to come." ([8])

2. Computer scientists and collections

Undoubtedly sensitized by those who have long considered the strange condition of collections, object-oriented software designers understood that computer mod-

eling of object collections needed the support of heterogeneous computer objects, combining private characteristics – which the objects collected are usually referred to – with characteristics that come from the activities in which these objects are collectively committed.

2.1. A parsimonious so seductive approach

Often, the approach implicitly chosen to characterize a collection is parsimonious and consists of overdetermining the organization of private reference of the objects collected using a minimal description of a collective activity's context, even if it means presuming to become a classification of the aforementioned collection.

Force is to note that this practice that, it is true, has the unquestionable advantage of not fundamentally opposing the modeling of objects, result in computerized applications that do not always live up to collectors' expectations. François Pachet, for example, explains in [12] how amazed he was to discover himself so compulsively downloading and indexing music that he was not even listening to music he collected anymore.

This is what is necessary to distinguish figural from non-figural collections. This subtle distinction, first made by Piaget and his teams of child-psychology researchers in the 1970s, brings the situation to an interesting light. If it is certain that (non-figural) collections that adapt well to the aforementioned parsimonious approach exist it is because they are freed from all intrications with their spatialization and in that they are already close to the classification (of which they can only envy the formal completeness). There are also collections called figural because their position is determined according to spatial configurations that tend to recommend their significance jointly with typical considerations for the meaning of the classifications.

2.2. Collections versus classes

Curiously, the affinities between classes, collections, singularities and disorders like stack, mass, troop, jumble and other hodgepodes (the last disorders, like collections, cannot exist without a common significant space) have now changed their polarities: classes are definitely different from organizational spatial-based regimes like collections and other “disorders”, which now appear to only differ from some degree.

More accurately Jean Piaget and Bärbel Inhelder propose, in their book *La genèse des structures logiques élémentaires*, to distinguish *figural* collections from *non-figural* ones.

They begin by recalling that a class requires only two categories of relations to be constituted:

- common qualities to its members and to those of its class, and specific differences that distinguish its own members from other classes ones (comprehension);

- relations part-whole (belongings and inclusions) determined by “all”, “some” and “no one” quantifiers, applied to members of the considered class and to members of classes whose it belongs, qualified as extensions of the class.

For example, cats share in common several qualities owned by all the cats, some of them being specific and some others belonging also to other animals. But no consideration about space ever enters into such a definition: cats may be grouped or not in the space without any change concerning their class definition.

On the other hand, Piaget then defines *figural collections* through the introduction of meaning linked to spatial disposal, referred to (1) or (2) properties: a figural collection is a figure because of the spatial links between its elements, when non-figural collections and classes are figure-independent.

2.3. Figural versus non-figural collections

It is these figural collections that allow object-oriented computer-science – pushed by the growing demands of society connected to searching digital data on-line, interactive navigation in multimedia contents, or searching for information using multiple sources – to promise effective modeling more and more frequently ([17, 15]). Indeed, what is listening to music on-line if it is not amassing a collection, sometimes fleeting and ephemeral, but always figural in the unique way it was built up, on the fragile condition of continuation, that depends on the temporal figure of its unfurling in time?

However, we have understood, figural collections adapt rather poorly to their assimilation in non-figural collections or classes (although, according to Piaget, they are destined to become classes, even if the subjects will grow psychologically, increasing their cognitive capabilities to be classified). It is because figural collections are marked by a *radical lack of differentiation*, that pushes them out of the classical modelling field.

To be convinced, let us look at the way the great Swiss psychologist explained the experimental situation of the child that makes up a figural collection ([5], page 51 of the 1980 French edition):

“The child sometimes goes from assimilation to accommodation, sometimes from accommodation to assimilation, and not according to a principle of correspondence that is absolute and reciprocal, but by simple lack of differentiation, and by a lack of differentiation which prolongs, but considerably reinforces, that of similarity and proximity already at work on the first assimilations. Indeed, a child sometimes places ‘the same’ with the same, and here assimilation determines the accommodation, as will be the case for future logical classifications; but occasionally, the child adds an element to the collection that he has already started in its basic form, meaning its burgeoning accommodation and in this case, it is the accommodation that establishes the assimilation. This establishment can present itself in two different, but equivalent, manners. It is either the geometric shape of a collection and an element is added to others with that group’s shape as a goal, without there necessarily being a specific resemblance between the elements; or,

it is random objects and an element is chosen to be added to the others in the aim of creating a coherent sum in such a way that this time, the resemblance is forgotten in favor of an empirical suitability, the outcome of the subjects' previous experiences. In both cases, only the general shape of the collection provides its conditions and in this way, it is this physical accommodation and autonomy that determine the assimilation".

3. A case study: our proper research process

Designers of computerized systems that assist in the creation of collections, initially distracted by the growing importance of figural collections in their professional world and surprised by the resistant character of these once exotic entities when faced with parsimonious "object" modeling, reacting sometimes energetically, getting by as best they can.

3.1. Towards a creative lack of differentiation

Designers of computerized systems that assist in the creation of collections, initially distracted by the growing importance of figural collections in their professional world and surprised by the resistant character of these once exotic entities when faced with parsimonious "object" modeling, reacting sometimes energetically, getting by as best they can.

They understand that collections will play a large part in the knowledge economy (contrary to Piaget, I think that some of our collections are not predestined classes and in their current state make up an irreducible figure, just as certain figural collections in their current state are finalized knowledge figures). But everyone does not react with the same happiness. Many persist and persevere; others put forward constructions that can be considered more or less tautological; others look to work around the obstacle. Clever is he who looks at the general situation; clever is he who is able to generalize modeling of a specific lesson learned or of an ingenious realization ([10, 7]).

But there is at least one interesting path that should undoubtedly be explored on a broad scale and that is likely to associate different efforts: that of systems that help in the creation of figural collections that make available and equip a productive, and creative *lack of differentiation* between the resemblance and the contiguity.

By looking back at the major projects that centered on an interactive computerized assistance for the creation of figural collections that we have worked on in the past twenty years in the music field (*Le Musicologue*, *Virtualis*, *CUIDADO*, *SemanticHiFi*), we can not deny that we have followed an intellectual path that led to figural collections from classes, in passing by non-figural collections and the unusual. It is this path, characterized by a *lack of differentiation*, that we would now like to offer to the concurrence of other researchers, convinced that this gesture

will in no way deteriorate the fascinating potential of differentiation found in the core of this subject.

3.2. Le Musicologue

With *Le Musicologue*, a musical collection that has taken the shape of an educational program: the corpus of works chosen creates the curriculum for a student faced with a musical dictation exercise. Although it seems that the student is free in his choice of works, he must be assisted by a computer system that therefore narrows the possibilities to a subspace according to pertinence, assessed in terms of the student's latest performances and the dynamic rules that are supposed to bring his specific situation closer to the group of occurrences already met. So, the future of the collection (corpus/ curriculum) depends on the current state of a situation (one part of the results), but also on the assistant's educational experience.

When the product was tested on a large scale, we felt the need to show the student the possibility of choosing a work to study beyond the system's supposed limits of pertinence; this is what we offered during a trial version of the product. However, this version was abandoned, never put on the market; the fledgling system lost its capabilities for generalization and machine-learning and quickly moved towards a combinatorial casuistry that was impracticable and ineffective.

The lack of differentiation that imbues the systems based on formal logic proves quickly fatal when that lack of differentiation does not spontaneously assume a logical form.

3.3. Virtualis

When the *Virtualis* environment was used, for example, in the interactive operatic work *La traversée de la nuit*, the collection starts to take the shape of a parade of interactions, in the sense that we see a performance like a series of short plays linked together, the connection between them could be the subject of a dynamic setting recommend by the situation in progress ([9]).

The difficulty therefore lies in granting to these processions and/or singular interactions – which are not just simple particularities connected to a catalogue of general forms already envisioned by the performance's creator. In *La traversée de la nuit*, the vast background displays motives influenced by the interactive play between the Nô dancer's movements and the narrator in the ballet in real-time without the audience knowing that the performance of this artificial actor is synchronized via a network of neurons that analyze the emotions heard in the narrator's voice, the stage interaction finally places the voiced emotion in space.

But the systemization of this type of localized effect remains a difficult and, of course, paradoxical problem. The lack of differentiation always demands more space in order to express the openness it brings, completely devoted to the differential system that characterize and devour it.

3.4. The MusicBrowser by Sony-CSL

With the *MusicBrowser* developed by Sony-CSL ([12]) as a part of the European research projects coordinated by IRCAM CUIDADO and SEMANTICHIFI and achieved by a consortium of partners, the person who wants to hear more music can browse through the use of strange descriptive spaces, without ever even considering the fact that he is being confronted with one of the darkest mysteries of listening to music.

Having fun and finding what you are looking for do not equate understanding! The *MusicBrowser* offers three types of tools to assist browsing musical contents and it is the first indetermination that stimulates the user's curiosity: what to favor when looking for other types of music that I like, editorial tools, acoustic tools, or cultural tools? And why forbid the classification that comes from other the experiences of other users and/or specialized communities, or even leaving it to chance?

One of the *MusicBrowser's* designer's biases is the idea of favoring the users' idiosyncratic collection over the formal preservation of sound during the description. In giving up on following logic in detriment of history, the software deserves its success but lets indetermination take command, which tends to make it loose steam. Indetermination never feels better than when it exceeds the limit it set for itself.

4. Similarities, collections and cosmic game

The notion of similarity is currently very fashionable among computer scientists, who are convinced that computational similarities are the only keys for accessing content-based processing and then for bridging the semantic gap between low-level features (or content descriptors) and the richness of musical collections.

4.1. Current similarity fashion

These similarities are characterized by formal categorization and logical consistency, because computer scientists are used to being constrained by the very fact they have to run their programs on Turing machines. And those similarities more or less rely on preset knowledge organized throughout ontology-like structures.

But similarities alone cannot fill the semantic gap because they put the accent on resemblance-based synthesis and forget contiguity-based ones, so they cannot offer efficient tools for expressing creative and still imprecise pre-synthesis that correspond to the deeper desire of the user.

Computer scientists have to play the cosmic game ([3]), putting forward strategies and interactive metaphors to link together resemblance (similarities) and contiguity (spatialization and continuation).

4.2. Piaget's oracle

According to Piaget, a collection cannot exist but by gathering its elements in a space, and consequently stop existing as a collection when its under-collections are dissociated: when the under-collections are gathered ($A + A'$), we consider them as the whole $B = A + A'$. But when the under-collections are dissociated, in space or in idea, we do not link them anymore to the global initial collection and we cannot even imagine the $A = B - A'$ operation.

“No one can ever look at “one collection” since it is not a whole work but an infinite series of singular objects, a piece + a piece + a piece, etc.” ([8])

Using collections allows the collector to get out of the current preset formal synthesis so to describe some still undifferentiated idea or desire. Thus, by opening to some hybrid synthesis and preparing new formal or informal, figural or non-figural organizations, collections allow the users to play a more equilibrate part within the cosmic game.

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