



Social and Technological Transformation of Farming Systems: Diverging and Converging Pathways

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Workshop 4.3: ICT to help on participatory approaches for the agroecological transition of agriculture

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Agroecological transition of agriculture requires implementing new farming practices (from low-diversity- to high-diversity-based), developing new local social networks either for farmers' community to share knowledge and experience or selling agricultural products (local markets). Participatory approaches are particularly well suited to support stakeholders in designing and implementing this transition. ICT may facilitate the construction of an agroecological transition at local level:

1. Store and Record information: exchanges and discussions during workshops allowing traceability of exchanges and choices, information and data used during the workshops; thematic maps (eg farming systems and environmental issues within the territory), directory of innovative farmers, discussion forums or territory slides; how to store design elements proposed by actors with respect to their possible conflictual views on the knowledge and on the territory;
2. Show and Visualize data: present and future vision of the territory, interactively viewing of the content of knowledge bases, visualization of the dynamics and exchange networks at workshops, modelling choices, system analysis dashboards, innovative visualization tools such as 3D telescopes to give the feeling of being on the ground;
3. Structure and Equip participatory processes: access to participatory methods, toolkits to facilitate discussions during participative workshops for modelling and scripting (repositories, intermediate objects, potential physical exchanges between players, tools diagnostics, agricultural or regional projects, computer graphics simulations, method of socio-economic scenarios of changes), educational materials, modalities and achievements of a participatory workshop, serious games based on low- and high-diversity based agroecologisation, virtual meetings;
4. Share and Spread knowledge: internally at workshops or more broadly, synchronously or asynchronously, direct exchanges between innovators, popularise the results of observatories;
5. Create new knowledge: from the mixing of diverse information sources - experimental knowledge, scientific knowledge, knowledge from farmers - we explore how participatory methods can be used 1) with "strong" "knowledge formalisation techniques (ontologies, unified modelling language, etc.) or 2) with "weak" semi-formal techniques (multi-viewpoints knowledge organisation systems, social semantic web, federated Wiki).

The workshop debated the technical possibilities and how they are used by researchers and stakeholders during participatory meetings.

Viewpoints-based method and tools in territorial participatory design

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Abstract : As a part of the Tatabox project exploring ways to define and locally experiment 'transition to Territorial AgroEcological System' (tTAES), researchers and rural stakeholders (policymakers and farmers) organised territorial participatory design workshops (TPD). Such TPD are especially challenging since actors projecting their activity into the future confront many viewpoints or controversial dimensions (farming systems, natural resources, food-chain, etc.). To facilitate multi-viewpoints TPD, we propose a multi-ViewPoints model for both organisation and knowledge purposes. It allows for adequate organisation of TPD activities and agendas; it also supports knowledge sharing, capitalising, annotating and category-building with respect to the plurality of semantics of the TPD actors. It is presently experienced by rural actors in face-to-face meetings using classical maps and paper devices. In this paper we demonstrate and propose guidelines for Viewpoint-based software tools supporting meeting recording, annotation, information retrieval and cross-viewpoints visualisation throughout the TPD process.

Keywords: Viewpoints, knowledge management, participatory design, collaborative work, territory, software tools

Introduction

Consensus rarely exists in territorial participatory design (TPD) shared knowledge building, and even less so in agro-ecological TPD. It appears that discussing face-to-face, in 'oral culture' organisations enhanced with 'low tech' devices (paper maps, post-its and annotation walls, audio recording) is a good way to achieve an efficient tTAES design work. But 'Viewpoints', as organisational and semiotic artifacts, can be introduced explicitly into such an organisation of face-to-face TPD meetings. Taking the agro-ecological design as an example, this paper presents how they can take place in a concrete TPD organisational device.

Since such an approach can be successfully experienced without ICT tools, as we observed it, we also propose to study it in more depth and transpose it to a viewpoints-based ICT infrastructure, adapted to TPD workshops. The paper presents some guidelines we follow in the design process of Viewpoints-based ICT tools that support TPD activity.

The software modules that we are presently testing or developing have not only to complete face to face oral and paper devices, but also to reinforce the autonomy of concurrent viewpoints and categories and to make the knowledge more precise (facilitating

a bottom-up categories-making process separately within each Viewpoint), without weighing down the design with unnecessary formality. These tools could also reduce the costs of TPD cycles which are very time-consuming, both for animators and participants.

Related research

Especially in agro-ecology, the participatory design (Berthet, 2015) has territorial issues needing especially multi-viewpoints confrontation (Pipek et al., 2000). To facilitate multi-viewpoints TPD it is necessary to make more explicit how a Viewpoint can be defined in the particular context of a sequence of TPD workshops. In some regards it can be seen as an organisation artifact (Teulier et al., 2000, 2004), or a coordination mechanism (Schmidt et al., 1996), including also communication and knowledge aspects. Explicit ViewPoint is here considered as a potentially fruitful notion to document the participatory activity we are considering.

Territorial decisions in territorial design can use TPD focus groups, serious game support and roles gaming (De Olde et al., 2014 ; Martin et al., 2011). In our hypothesis, viewpoints are of major interest for these approaches because they help both to structure TPD activity (free or imposed group forming, agenda of discussions alternating groups with and without Viewpoint...) and to structure TPD knowledge issues (for knowledge sharing and capitalising, annotations, category building) while respecting the plurality of semantics of the TPD participants. Viewpoints confrontations were studied, for example in scientists' work (Bowker & Star, 2000; Felder, 2010).

Like scientists' teams working in an interdisciplinary manner on complex phenomena, designers in TPD contexts can hardly convoke in a unique "panoramic" overview all events, proposals, disciplinary interpretations, categories, possible consequences, etc., involved in the design situation. They rather experience and know the situation as a conjunction of concurrent views on the situation, resulting in a controversial, dynamic and unknowable configuration of viewpoints.

In the scientific and technological domains areas directly interested in cooperation and collaborative knowledge engineering, the notion of Point of View has been studied by many scholars (Bowker et al., 1994; Dourish, 2000; Simone et al., 2001). Viewpoints have been considered in design activities to organise annotations on artifacts in mechanical design (Boujut et al., 2003; Guibert et al., 2009). In participatory workshops, useful knowledge emerges from situated activity where actors' practical experience is influenced by several semantic grids coming from dominant viewpoints. Faced with "strong semantics", "weak semantics" find it difficult to establish their own language and categories, as analysed by (Bowker, 2010) and (Bowker & Star, 2000) noting how classification (of diseases, of death/birth instant criteria, etc.) can become a pure power exercise profiting to actors, dictating or influencing their language or their categories. It could lead to the weakening or exclusion of certain stakeholders.

Territorial Participatory Design has been studied in rural areas. Analysing several cases, like the ecological restoration of Grand-Lieu Lake, Teulier and Hubert (2004) use the notion of multiple "words of interest". They notice that stakeholders sharing common territory with

various viewpoints are both independent and interdependent, *'with social positions usually very unequal and may be associated with the knowledge they hold or apply'*. Therefore knowledge is here a key point. Figuring out, naming and building the items into categories, represents a major type of knowledge and major stakes in Collaborative Knowledge Engineering. Knowledge structured by viewpoints has been studied in Knowledge Engineering (Dourish, 2000; Benel et al., 2009; Cahier et al., 2013) especially for categorising, naming domain items and relying them. A name, a category or a set of categories can be relevant in some of the worlds of action existing on a territory, but not for all. So as we will see below, TPD organisation and agenda have to insure that the naming and categorising of things can be “isolated” in Viewpoints, as cooperation artifacts. Viewpoints aim to consider the others’ perspective, establishing equality or symmetry even when social status differ. They are a means whereby stakeholders can dynamically question and change their own representations on a regular basis.

Illustrating Viewpoints in agro-ecology TPDs

Context of the experiments

To reduce the impact of agriculture on environment and human health, energy crisis and climate change, agroecology has to be designed with “weak” approaches opposable to “strong” ones. The second way promotes a stronger ecologisation of agriculture by reducing inputs (fertilisers, pesticide, energy...) and using ecosystem services at the field, farm and landscape levels. It requires changing deeply the management of farming systems, natural resources and food-chain while dealing with a wide range of environmental and societal changes. To support them, agricultural actors and interdisciplinary teams of researchers require new methodology, where agricultural stakeholders develop vision(s) of the desirable ‘transition to Territorial AgroEcological System’ (tTAES) applied to concrete and local agricultural systems.

“Tatabox”¹ is a french R&D project exploring ways to define and locally test tTAES approaches. In a part of this project, in 2015 and 2016, rural stakeholders (policymakers, farmers) are working in TPD workshops focused on the Aveyron region (located in the south of France).

In these participatory workshops, participants have to make an inventory and to examine a large amount of ideas, problems, solutions, themes, things of the world, etc., by discussing and referring to two critical sets of issues:

- *not-precisely geolocated topics and items* : these topics and items can be for example grouped into categories so as to be situated onto non-geographic maps (e.g. topic maps)

¹ *“Territorial Agroecological Transition in Action”: a tool-Box for designing and implementing a transition to a territorial agroecological system in agriculture”. ANR project (2014-2018) led by INRA Toulouse (National Institute of Agronomy) - <http://www6.inra.fr/tatabox>*

- *more precisely geolocated topics and items* : they can be situated *both* on geographic maps *and* on non-geographic maps.

For this reason, in the field experiments presented below (see Figures 4 & 6) we shared the wall or table annotation panels in two parts, respectively dedicated to geolocated vs non-geolocated items and annotations.

General Method

In our approach in the agroecological TPDs field, a Viewpoint is a construct which has a conventional label (for example: the “Natural Resources”; the “Cooperative”; the “AgriFood Chain”). It can refer conventionally (as a network “node”) to particular people, places, semiotic attributes (colour), dates and documents participating to its use. The name of the Viewpoint can refer to a business, an opinion, a representative object, etc. Under its label, a given Viewpoint is an agglomerate, taking historical consistency in the context of a peculiar TPD sequence. It can be described more precisely with various keywords (for example, in the right part of Figure 1: archetypal actors’ jobs, communities, cultures and goals) helping stakeholders to understand, nourish and endorse the Viewpoint.

In the project Viewpoints were used to organise finer grain stages of “workshops by Viewpoints” alternated with “multi-Viewpoints workshops”, because in design activity it is important to consider both the independence of viewpoints (leading to make each Viewpoint more explicit) and their interdependence (because the design is relied to given map and territory). In design of rural territory relevant Viewpoints are especially numerous and imbricated. Based on this general model, several detailed organisations are possible (see for example the two following sections). Each Viewpoint is a “container” to store language elements, topics, categories and interpretations within the Viewpoint. So the Viewpoint is an artifact organising both TPD activity and knowledge.

A preparatory role play exercise with Viewpoints

First we designed a exploratory experiment², whose one goal was to verify hypotheses or intuitions concerning Viewpoints:

- (i) Roleplay based on Viewpoints can provide an efficient scaffolding to stakeholders’ positioning practices, favouring a less influenced collection of ideas, and making the design more contrasted, active and detailed equally in all perspectives;
- (ii) Places and displacements [8], spatialized artifacts with semiotic attributes [18] are very important issues in participatory activities. If Viewpoints are associated with “protected places and times”, assigning a fixed place to each Viewpoint (its participants, maps and annotations they each build) completed by circulation rules and semiotic parameters (e.g. colours of annotation) makes the inter-Viewpoints confrontation more productive.

² Conducted in February 2015 during 1h30 with 28 participants (scientists of the Tatabox project) in INRA Toulouse

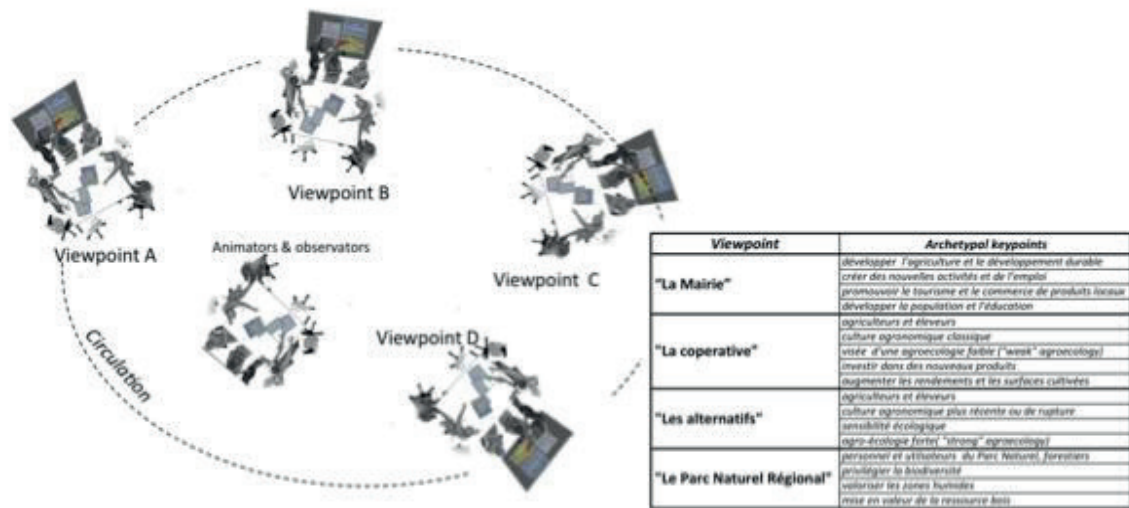


Figure 1. The device and the four Viewpoints in the roleplay exercise (February 2015)

To verify this hypotheses, 4 “mono-Viewpoint” teams (of about 7 people) were constituted from pre-established lists. These teams were disposed in a large room at distant places (Figure 1) so as to make overhearing between them impossible or difficult to perform. Each team could use a table (with documents and post-its) and a vertical panel. The panel (Figure 2) was divided into two zones for annotations with and without map. For each team a different colour for post-it and pencils was imposed. In this experiment the circulation rules within the common room were changing in the course of time:

- (i) The circulation between Viewpoint was forbidden in the first 30 minutes, to give time for each Viewpoint to acquire an identity and make propositions for the territory.
- (ii) Then, at t0+30 minutes, a Viewpoint team could send 1 or 2 “spys” in order to observe the annotations in other places and report to their own group. Spys were not allowed to speak during their trip, but each group could write (and ask the spys to throw) written messages (questions, annotations....) to other groups.
- (iii) Then, at t0+60minutes, all Viewpoint members could walk around, observing three rules: to remain silent (only written communication), to keep a kernel meeting in their camp (to not dilute, read or react to incoming messages) and equilibrate activity of receiving and emitting messages.

Specific colours for post-its and for direct writings on panels allow identification of their origin, e.g. a yellow message from “La Mairie” answers to an annotation on the “La Cooperative” map (Figure 2a).

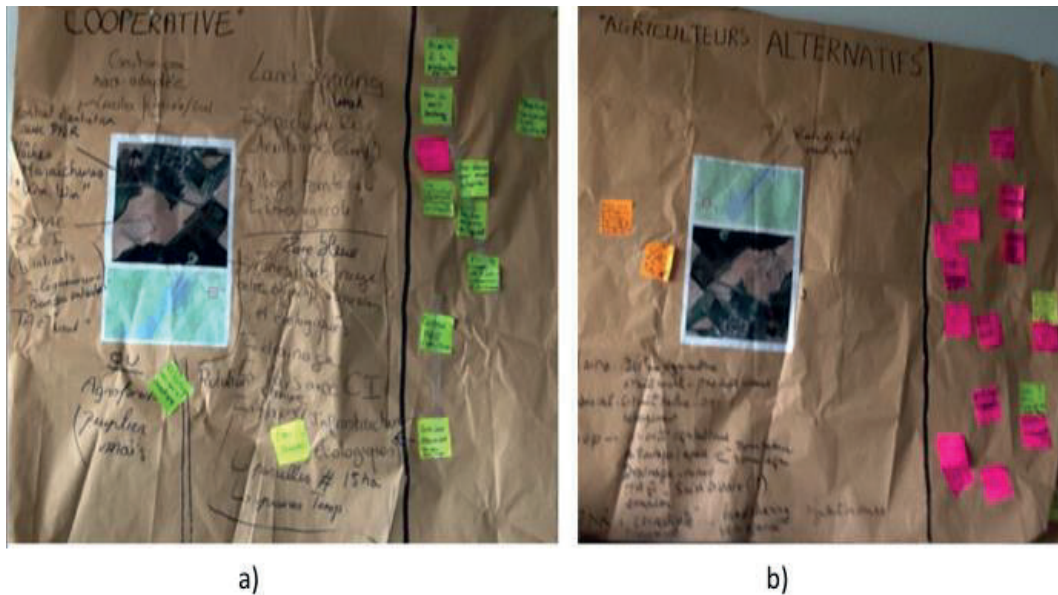


Figure 2. Wall trace of 2 “Viewpoint places”: a) “Coopérative”; b) “Alternatifs”.

Participatory workshop with Viewpoints

This workshop took place during a full day (13/11/2015), with 15 rural participants and a strong animation / observation team (10 people). A device was used with three Viewpoints (“Agricultural production”, “Transformation/Consommation” and “Natural resources”). This day was part of a sequence of meetings with the same stakeholders’ group (starting in April 2015, continuing in 2016³). The device for the day prescribed several working stages (Figure 3):

- 1) *Morning*: alternate plenary session and short parallel sessions (without Viewpoints), resulting in a shared list of 5 transverse “main issues” to be explored in the afternoon ;
- 2) *Early afternoon*: three separated focus groups “by Viewpoint” were formed, in three different rooms (participants were assigned to one group according to a predefined list). The 5 “main issues” were crossed with dominant subcategories of the Viewpoint : e.g. “water”, “biodiversity” or “soil” were subcategories of the “Natural resources” Viewpoint. At the end of this session (2-4h pm), wall panels with post-its mapping by issues and by Viewpoint topics were photographed and duplicated ;
- 3) *End of afternoon*: the members of the precedent groups were re-mixed into “cross-Viewpoints” focus groups (two Viewpoint by two Viewpoint). The second viewpoint wall panel previously photographed was displayed onto a screen nearby

³ The present paper does not report all results of this very rich series of TPD experiments (it will be made soon in more details by complementary papers from other scientists involved). We only focus in this article on the Viewpoint model and its contribution to the TPD device (both at organisation and knowledge levels) with classical paper support and possibly towards future ICT support. In addition to the multi-Viewpoints issue, many methodological ideas and innovations contributing to the TPD success were brought by other researchers involved. Thanks especially to J.E.Bergez, E. Galvez, O.Therond, M.Taverne, G.Martin, A.Gonclavez, J. Ryschawy and M.Willaume.

the first one (the original, on paper) in order to confront the two Viewpoints' knowledge, categories, arguments and annotations. In this way participants were able to compare and discuss the two sets of annotations written in the two "mono-Viewpoint" groups during the previous stage.

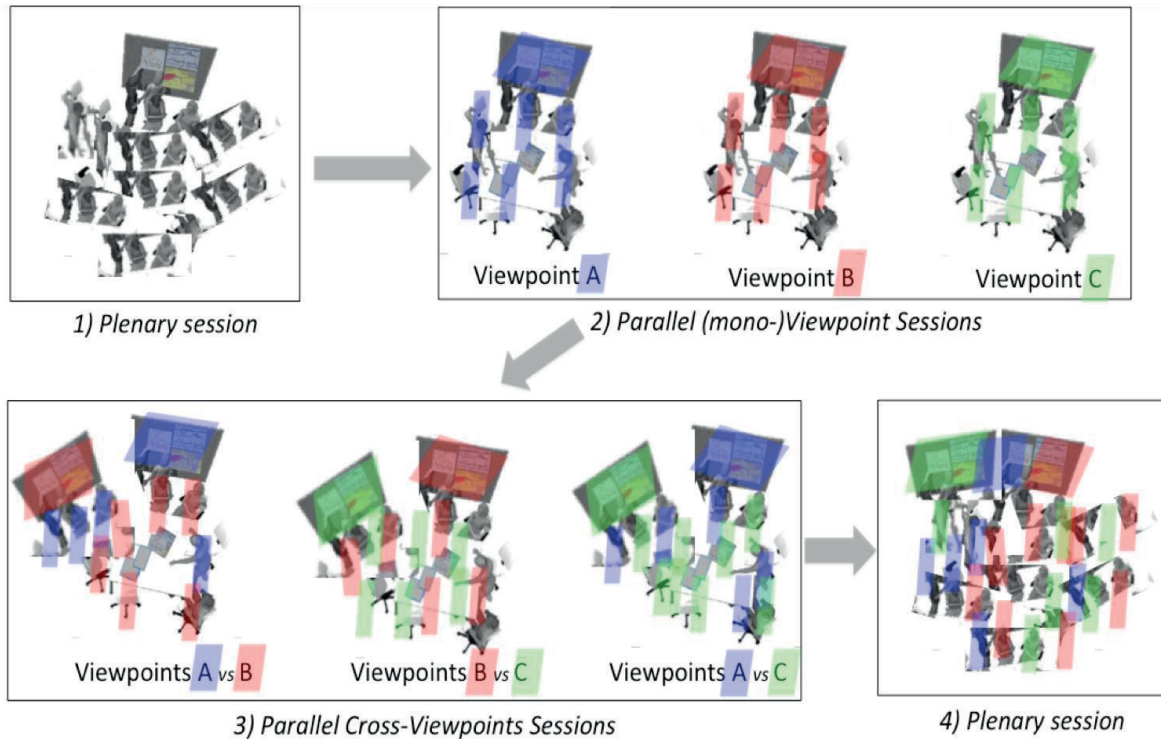


Figure 3. TPD device (13/11/2015) structured by Viewpoints : a 2h session of 3 "mono-Viewpoint" groups was followed by a 1h one of 3 "bi-Viewpoints" groups

When new ideas or discussions occurred during cross-Viewpoints confrontation, the paper panel was typically overloaded (Figure 4) by *green* post-its in case of agreement or minor remarks, and by *red* ones in case of disagreement or design dissension (design "clashes").

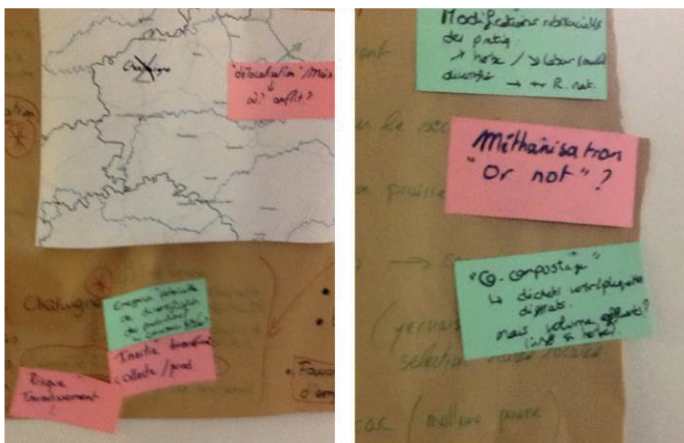


Figure 4. Annotation of "agreements" and "dissensions" during "cross-viewpoints" session

Lessons learned and implication for ICT implementation

The results of these field experiments, both using the socio-technical Viewpoints model proposed put into evidence that :

- (i) The positions of the different stakeholders are more clearly detailed when based on a system with Viewpoints. Even though paper was used as a support the way to design new agroecological models step by step by viewpoint stimulate interest, participation and codesign of participants.
- (ii) The TPD seems to be made easier during stages devoted to confrontation between Viewpoints. Discussion is fostered (between small groups or by peer-to-peer exchanges) when the device allows circulation of participants and cross-visualisation of written annotations in Viewpoints.
- (iii) Comparing with stages without Viewpoints, theming and category-building were more coherent, more fine-grained and less laborious in stages with Viewpoints.
- (iv) Viewpoints-based devices and spatial circulation favour strategies or micro-alliances between stakeholders with dissimilar viewpoints, concerning ideas or territory issues.

Globally these positive results allowed us to sketch reflection, mock-ups, and tool selection, to propose some ICT functions implementing the model in computerised TPD collective practices.

The agro-ecological TPD Viewpoints-based device presented above was a face-to-face one, only supported by paper. In a further stage, it may be interesting to propose a similar Viewpoints-based device, but supported (partially or completely) by ICT tools. Such computerised tools could allow both face-to-face and remote participation and accept more numerous designers. They could also reduce the costs of TPD cycles which are very time-consuming for animators and participants. By using the Viewpoint model and by learning from the lessons of its experiment, ICT tools should improve pertinence, granularity and all advantages noticed above. Naturally the Viewpoint-based computerised tools that we propose in order to accompany the TPD activity have to be designed to preserve the wealth of face-to-face discussion and knowledge sharing, not weighing down the TPD activity with unnecessary formality (Shipman et al., 1999).

Consensus rarely exists in TPD, and more rarely in agro-ecological TPD. In contrast, Decision Support Systems (DSS) or sophisticated Knowledge Engineering systems (such as Semantic Web systems based on domain “ontology”) are too formal systems, far from stakeholders’ practices (Bowker, 2010). They encourage a top-down categories-making and are far from stakeholders’ practices, especially when they defend conflicting perspectives.

We now are preparing a set of practical and simple computerised functions using Viewpoints, to propose them to actors and evaluate with them their usability in future TPD workshops. Below we give just two examples :

(i) MM-Report⁴ completes the *audio* recording of meetings by indexing the audio content with coloured marks and tags for time, speakers' names, categories, design rationale topics. In the long records of the meetings (many hours), it helps actors in retrieving oral fragments and tagging them.

(ii) Lasuli (Bénel et al., 2011) and Cassandre (Lejeune et al., 2011) are two Web-based associated tools⁵ for qualitative analysis and co-working on the *written* text (transcribed from the previous audio records). As shown in (Figure 5b), fragments can be selected, highlighted and associated with categories in Viewpoints. That way TPD actors can quickly retrieve what was said during the meetings. This tool allows cross-readings of annotated TPD verbatims, with categories organised by Viewpoints.

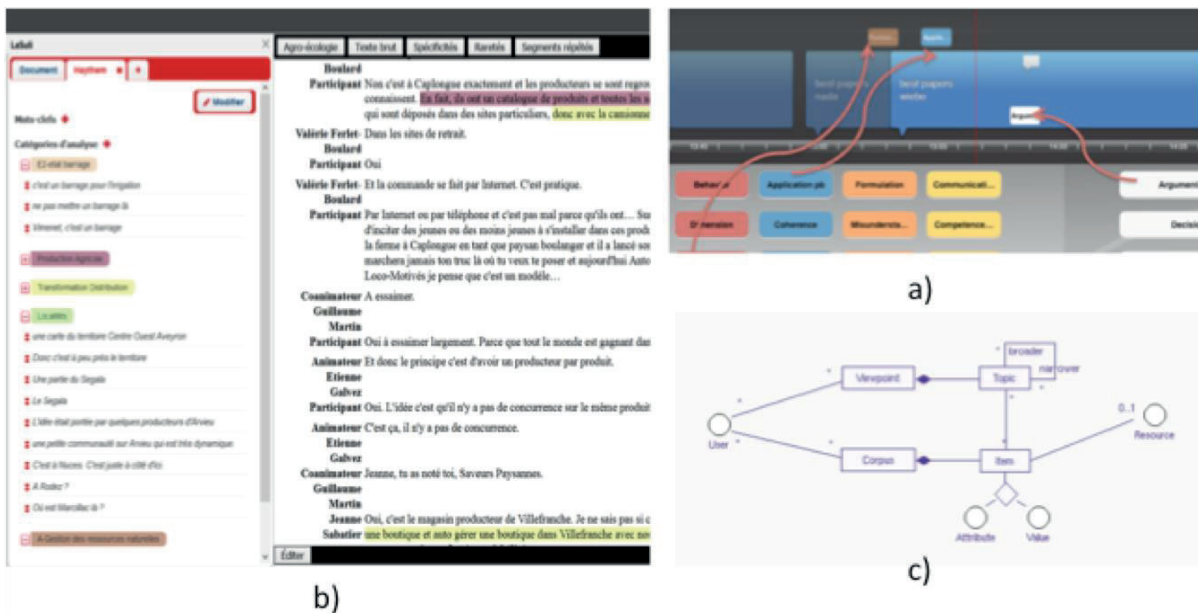


Figure 5. Some tools proposed to support Viewpoints in TPD activity: a) MM-Report (Matta et al., 2013); b) Cassandre (Lejeune et al., 2011 + Lasuli (Benel et al., 2011); c) Hypertopic model including Viewpoints (Zhou et al., 2006).

To demonstrate these tools to TPD participants the same set of colours was used for MM-Report Categories and for Lasuli Viewpoints (Figure 5b: highlighting of fragments on the left, colouring of categories on the right margin). Cassandre and Lasuli use the technical protocol 'Hypertopic' (Zhou et al., 2006). (reminded in Figure 5c) precisely designed to implement multiple Viewpoints organising Knowledge on items. We presently use this protocol as an infrastructure to integrate existing or future tools and prototypes favouring Viewpoints use in TPD distant meeting.

⁴ MM-Record and MM-Report are two complementary free IOS Apps (running on iPad and iPhone) developed by UTT for recording, hearing and tagging audio records of design meetings.

⁵ Open-source tools (see <http://hypertopic.org/>)

Conclusion

In the TPD workshops, Viewpoints allowed a more successful design by the considered stakeholder. Not surprisingly it appears that discussing face-to-face is the best way to achieve an efficient tTAES design work. The more efficient solution we recommend is to use Viewpoints to optimise the interaction in the oral culture patterns, just reinforcing them (cautiously) by selected spatial solutions and by a touch of written culture: co-writing paper supports, symbolic and iconic artifacts such as coloured Viewpoints.

Now what about the ways to use ICT in the next phases of the mentioned TPD ? Although the spectacular inflation of sophisticated tools offered by advanced ICT and Knowledge Engineering for managing domain Knowledge or discussing at distance, for the agro-ecology TPD we are faced with (in complete agreement with the Tatabox project staff), we continue to feel that the best way is the face-to-face “artisanal’ discussions we have described, completed by symbolic/ iconic artefacts. Such a position could seem strange in 2015, in our era of ICT-based “New Collective Intelligence”. In fact, stating that oral culture does remain the fundamental medium for conflict management in TPD, does not prevent experimentation with new ways to apply ICT technology to it. This technological attempt, for which we gave a brief sketch in the final section above, is to provide a socio-semantic infrastructure supported by Viewpoints (Cahier et al., 2013) for actors’ interaction. The oral discussion in face-to-face stays as a grounding principle, but its device is reinforced by artifacts combining paper and digital tools. A stake is to provide symbolic, spatial and semiotic distinctive language elements, such as explicit Viewpoints, to better organise the discussion work and its traces.

In TPD workshops it should make it possible to take into account higher complexity, finer description of conflicts and higher granularity of knowledge, resulting in better tuning of human interaction, better engagement and better participation. Given these precautions, the ‘New Collective Intelligence’ could have some effect on territorial participatory design.

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