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Design thinking and urban planning projects: Towards new climatic services for climate change adaptation?

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1. Introduction

The purpose of the Adaptatio research project was to suggest a novel methodology to take into consideration the issue of adaptation to climate change (ACC) during the design process of urban planning projects (cf. Colombert et al, 2015). It is necessary to think adaptation and mitigation in a conjunctive way and upstream, notably, of the design process of urban planning projects. This suggested methodology is based on the development of a novel and simple tool to assess mainly energy but also water consumptions of an urban planning project following different climatic scenarios. In addition, another objective of Adaptatio was to realize an exploratory research on the possibility to create a new organization of the reflection framework with the active participation of all concerned stakeholders participating in an urban planning project in order to get them involved into the innovation process. The project also questioned the possibility of involving a new type of stakeholder: the designer, the work of whom should facilitate the cooperation done on an urban project integrating the question of ACC during the design process, with insights from the design thinking theory.

Thus in this presentation the main characteristics of the design thinking theory will be introduced as well as the points in common with urban planning approaches. Then, the methodology set up for Adaptatio brainstorming workshops will be developed and their main outcomes will be highlighted. Last, some first prescriptions on how to apply design thinking theory into urban planning will be proposed.

2. Design thinking: main characteristics and steps

Design Thinking (DT) definitions can be vague, unclear, or even contradictory. Yet, we can cite the widely known definition of Tim Brown, CEO of IDEO, who together with the Design School of Stanford, the first School specialized in DT, have contributed to the identification of its main theoretical aspects. According to Tim Brown (www.ideo.com): "Design thinking is a human-centered approach to innovation that draws from the designer's toolkit to integrate the needs of people, the possibilities of technology, and the requirements for business success". Following this definition, with the Design Thinking, innovation lies at the overlapping of desirability ("human": capacity to respond to an identified need), feasibility ("technical": capacity to innovate using existing technologies) and viability ("business": capacity to formulate a realistic business model) (Carron, 2013). Thus, to achieve innovation "you need to be one part humanist, one part technologist, one part capitalist" (Patniak, 2009).

DT process mobilizes important human resource means (interdisciplinary groups, clients/end users, etc.), involved from the earliest project development phases, a participatory methodology (Marchal, 2013) referred as co-design (Leboeuf, 2013). Co-design embeds empathy, since it becomes a matter of sharing and ethical investment of different actors loyal to the future clients and to their team (Body, 2013). Co-design also calls to get off beaten tracks by mobilizing capacities like intuition and idea construction based on emotional and functional criteria, hence, make an abductive reasoning (Brown 2010). According to (Kortzfleisch et al. 2013), wicked problems are justifying the iterative, stepwise process of DT; they are ill-formulated, can provide confusing information, and exhibit complex interdependences thus linear techniques will not be suited.

Second, DT, having as a starting point the objective to reach or the component to design, differs from the solution-focused thinking where the problem is the starting point (C. Nigel, 1982). Indeed, DT, while focusing on the present and the future, explores simultaneously the parameters of the question and the solutions. This feature reveals that DT can be used in order to handle "wicked problems" (Vial, 2010) related to novel socioeconomic and

environmental challenges (climate change, natural risks, social injustice etc.) that cannot be treated with solution-focused thinking.

Finally, DT Definitions emphasize the importance of visual expression of ideas notably though drawing. Drawing is also seen as a memory aid allowing to see both, the 'big picture' and minute details, and thus help comprehension, make creative connections and encourage collective emulation (Lisicki, 2013, Brown, 2010, MJV Tecnologia e Innovacao, 2011, Leverenz, 2014).

According to Tim Brown, the DT application process has 3 fundamental steps; inspiration, ideation and implementation. During the inspiration phase, the aim is to focus on the individual's needs. The aim is to fully develop the "human" dimension of the project to be designed. Within the second phase of ideation, previously gathered data are translated into ideas. This phase represents a continuous learning which is realized through visualization, experimentation and prototyping. Error is culturally accepted in order to encourage the formulation of an even better idea. Within the ultimate phase called implementation, the aim is to follow the path that leads the "product" to the market. The most promising ideas generated before are transformed into concrete action plans defined in order to achieve a long term reliable result. Defined solutions are tested many times on the field in order to assess whether they match endusers needs.

Within this process, Designers competences are revised (Dym et al. 2005). First, designers have to have the ability to tolerate ambiguity that emerges when design is viewed as inquiry or as an iterative loop of divergent-convergent thinking. Second, they need to maintain the big picture while including at the same time systems thinking and systems design. In addition, designers have to handle uncertainty and still make decisions and think as part of the team in a social process. Last, they must think and communicate in the several design languages (verbal or textual statements, graphical representations, mathematical or analytical models, numbers etc.).

Yet, (Bjogvinsoon, et al. 2012) state that DT may seem like "good old" participatory design, yet with a better articulated and appealing rhetoric. DT and its application procedure have some weaknesses. Indeed, project's evolution rate relies on the number of iterations that need to be realized and on the mobilization of stakeholders revealing important time and budget needs. In addition, following (Elsen et Cornet, 2012), the most noticeable DT applications that are identified are related to mercantile ends, labeling thus DT as a commercial niche and not as an empathic process. Concerning mutlidisciplinarity, a great number of participants from different horizons and disciplines can be gathered, calling yet for patience. Last, participants can have hard time to see a problem and a solution being co-developed and during the process, various "enemies" can intervene and stop the creative production like fear or resistance (Goldschmidt et al. 2013).

3. Design thinking and urban planning

Following the definition provided by (Merlin et Choay, 2010), urban planning is defined as the science, art and/or technique of spatial organization of human settlements. Thus, the urban project is found at the crossroad of three spheres, architecture (knowhow), public sector (decision making), industry (project management) (Seitz and Terrin, 2003), reminding the feasibility, desirability, and viability spheres of DT.

In addition, since the French decentralization law initiated in the 80s which inspired the assessment of the interactions between the urban fabric and uses based on social criteria (Verpraet, 2005), the development of an expertise related to mediation and coordination was launched (Seitz, 2003). This "mediation urbanism" was materialized through the relation between the project team, the social groups, the institutions and the clients, highlighting the double focus on expertise and mediation, the involvement of all the concerned actors, and the empathy towards the client. Thus, existing procedures like architects/urban planners consultations are characterized by aspects comparable with the ones of DT like; the use of visual representations in order to produce spatialised propositions and assist decision making, the organization of debates between stakeholders, local population etc. in order to gather feedbacks and suggestions, the organisation of workshops in order to gather data and transform them into prototypes. We identify thus the iterative thinking, the continuous 'learning by doing' and the emphatic dimension empowered by the DT.

Nowadays, urban projects stakeholders experiment various novel collaborative procedures in order to satisfy the perpetual quest for innovation. Yet, very few examples of DT application into urban planning can be found. (Kusumarini et al. 2012) for instance study how the entrance and circulation facilities of 15 shopping centers' public facilities, can be best designed following the universal design approach, in the City of Surabaya. Following DT theory, they are applying the principles of exploration (empathy towards the visitor, documentation), identification (problem definition, synthesis), ideation (alternative solution designs), visualization (models, drawing sketches), evaluation (solutions assessment) and persuasion (presentation, feedback for perfection).

4. Adaptatio methodology

Within the frame of Adaptatio project the Consortium initiated two workshops (WS) in May and June 2014. The aim was to settle a collaborative thinking process and exchange with urban practitioners on the question of ACC and its integration at the very local level of urban planning projects design (perceptions, obstacles, challenges, etc.). For this purpose, the urban project of Tolbiac Chevaleret, localized in the 13th District in the South of Paris, was studied. Overall, 8 practitioners were present in the May's workshop and 7 practitioners in the June's workshop. During both workshops 9 members of the Consortium were present. Their profiles were quite

diversified (civil-engineers, engineers-architects, engineers-designers, engineers-economists, town planners, public scientists, etc.).

4.1 Workshop n°1

The 1st WS started with a presentation of the actions of the City of Paris related to ACC, followed by a presentation on the Adaptatio project aims and objectives. The presentations were followed by a brief overview of the content of the two workshops and notably on the focus of this first WS on CC and urban programming.

The Consortium then realized a quiz with 6 questions related to CC. It was underlined to the participants that questions were vague on purpose, in order to launch the debate and encourage spontaneity. The questions were the following: “What is Climate change?”, “When Climate Change will occur?”, “What are the impacts of Climate Change on water?”’ “What are the impacts of Climate Change on energy consumption (supply and demand)?”, “What are the impacts of Climate Change on design and construction costs?”, “Is climate a major concern for your profession?”.

The quiz was followed by a presentation on CC made by the Consortium to let participants confront their ideas to experts’ opinion. Meanwhile, the Consortium was elaborating cartographies (i.e. mapping of ideas) on A0 paper sheets based on participants’ answers, by grouping answers with the same themes. Cartographies were used as a basis in order to launch the debate.

After a short brake, the WS was concentrated on the urban programming question following the same organization as the quiz i.e. questions followed by a brainstorming. The aim was to identify and understand the key components of the urban programming of the Parisian urban projects and notably the Tolbiac Chevaleret project. The Consortium presented some “golden rules” helpful to follow in order to hold a fruitful brainstorming, notably being positive and spontaneous, never criticize other participants’ answers, provide as many answers as possible, bounce back to stimulate responses, depersonalize and provide also answers not directly related to Tolbiac Chevaleret. Questions related to Tolbiac Chevaleret urban programming were focused on 5 themes: “presentation of the activities of each participant”, “ways that the climate issue is considered within their respective professional frameworks”, “changes that would happen in the practice of their respective professions in 2050, based on the presentation previously done on CC”, “barriers that may hinder the integration of the CC impacts in their respective professions”, “CC impacts that may influence their respective decisions”. As done for the quiz, participants were filling post-its (one color per question), used during a short break to elaborate a new cartography.

4.2 Workshop n°2

The second WS was opened with a presentation of the Adaptatio Consortium and a reminder of the first workshop’s objectives and main outcomes. Participants were then asked to express their observations on the first WS’s experience. Questions were formulated quite spontaneously by the Consortium following the subjects raised by the participants. Adaptatio project’s main objectives and research approach were also reminded and the 2nd WS objectives and contents (ACC solutions and their assessment) were presented.

The Consortium then initiated a brainstorming session recalling the “golden rules”. The session was based on 8 questions related to programming options that can be foreseen for the ACC of the Tolbiac Chevaleret sector: “To which type of data would you be sensitive?”, “What options can we envisage in order to improve urban comfort?”, “What options can we envisage in order to improve buildings indoor comfort ?”, “What options can we envisage in order to improve buildings thermal quality?”, “What is the role of water within the 2050 urban environment ?”, “What are the storage and retention means for drinking water and non-drinking water?”, “How far are you willing to go concerning plants integration ?”, “Towards which type of urban planning are we moving?”. As for the previous sessions, invited professionals were asked to provide one idea per post it expressed in the form of short sentences. A short break followed giving the Consortium the necessary time to prepare a cartography based on participants’ responses.

The next part was dedicated to adaptation options assessment. For that purpose, a presentation was realized on the content of the 5th IPCC report volumes on climate’s physical sciences, CC mitigation, impacts and ACC. After that, the Consortium realized a presentation on the CC impacts on, water and energy consumption and urban comfort, and associated costs, for different CC and urban morphology scenarios, assessed within the Adaptatio project for Tolbiac Chevaleret over 2050-2100. Three modeling approaches were followed by the Consortium and presented during the WS.

First, Clim’Elioth model, used to assess CC impacts on energy consumption and energy focused solutions for various CC scenarios at the building scale, was presented. Then, ENVI-met software, used for the water consumption (for the watering of the outdoor vegetation) and the urban comfort assessment over the district scale for various CC and urban morphology scenarios, was presented. Afterwards, the Consortium focused on the price forecasting, notably the prices of crude oil, natural gas, electricity with a special focus on urban energy networks in Paris (CPCU: heat and Climespace: chilled water), and the prices of non-drinking water. A review of various economic decision making methods were also presented in order to highlight the chosen one, namely cost efficiency analysis, for the project. The Consortium presented also the ‘Adaptatio toolbox’, a set of excel spreadsheets created in order to gather all the computations realized by the Consortium and present them in a “user friendly” manner. Participants were asked to give their feedback on these presentations.

Next, various existing ACC case studies in France and abroad were presented (water utilization, vegetation, natural ventilation etc) which either adapt based on past experiences (examples from Iran) or on future projections (examples from UK). The last part of the WS was dedicated to gather participants' feedbacks on the contents of the two WS, the deployed methodologies and organization.

4.3 Results of the workshop n°1

This first WS experience helped us gather some useful ideas. First, it reveals to be necessary to involve upstream all the participants in a balanced manner, giving them time to express their viewpoints thus avoid having some invited people taking time ownership, help properly conduce the meeting and continuously stimulate a rich exchange. This can be also achieved by a fair balance between time dedicated to presentations and to exchanges with a need to integrate each presentation within a debate rationale. Furthermore, our first WS revealed that it is necessary to keep a minimum downtime between the different sequences, since some sequences like cartographies preparation were lengthy.

Concerning the quiz dedicated to CC, the experience was overall positive. Indeed, participants were spontaneous, a great number of ideas were expressed, post it management by the Consortium was efficient, and time management between questions was good. Nevertheless, the two post-it colors for the positive (green) and negative (red) ideas related to CC, proved to be inefficient. Participants felt lost or did not paid attention to the distinction. This problem distorted up to a certain level Consortium's understanding during the elaboration of the cartographies. Thus, it seemed more convenient to use only one post it color per question to facilitate their handling and have a more meaningful visual effect. Furthermore, the "rule" to express one short sentence idea per post it was overall not straightforward. Indeed, participants were multiplying the amount of information over one post it. Thus, it seems necessary to ask invited professionals to provide short answers through simple sentences or key words, in order to have more forceful ideas and facilitate cartographies' elaboration.

Interesting ideas were gathered during the 1st WS. CC is seen as 'borderless', as a 'challenge', that will cause 'floods', 'heatwaves' and 'pollution', and that will necessitate more 'studies' and conduce to increased 'demands' and 'costs'. Yet, some positive ideas were raised like the fact that CC can be an 'innovation opportunity', can conduce to the development of 'new energy sources' and if it is 'anticipated' there will not be 'any additional costs'. Overall, the main ideas were that CC can be seen over all the scales, calls for a growing awareness, and consists in water resources scarcity leading to inequities. CC will also lead to increasing energy demands which will necessitate housing design revision. According to participants, CC is an issue considered within the professions, giving the inspiration to revise the working methods, yet, that needs to be mainstreamed. Last, participants seemed to focus the thinking on the districts without mentioning the building scale, addressed the uncertainty issue and the idea about a tolerable climate. In addition, they have expressed the need to have a concrete vision, to have a guideline/toolkit and somehow some arbitration will need to be done.

The second brainstorming on urban programming was a bit more laborious. Answers provided were quite long, hence, it was difficult to elaborate the cartographies. Participants' were less spontaneous and were exchanging less in comparison with the quiz on CC. Yet, the question on the CC impacts that can make practitioners take into consideration into their decisions CC, seemed to draw their attention. Participants were encouraged to exchange before and while they were providing their answers. Meanwhile, the Consortium was able to annotate the key messages in the form of short sentences on post its which were more proper to use for the cartographies. This exercise seemed to help maintaining a dynamic dialogue with the active participation of participants.

4.4 Results of the workshop n°2

After the various introductory presentations, a discussion was launched with the invited experts on the outcomes of the first WS presented above. After the presentation of the 8 questions and a short break necessary for the cartographies elaboration, the debate was launched.

Some general observations were drawn. First, speaking time management was more efficient than during the 1st WS. Despite this extra attention, it was still difficult to stimulate to a greater extent participants who were less spontaneous and had a smaller involvement and fewer reactions than during the 1st WS. Yet, participant's stimulation needs to be undertaken with caution since group's spontaneity momentum must not be disrupted and participants must not be inhibited. Furthermore, it must be also stressed that presentations followed successively one another since, following the WS's plan, there was no discussion time left systematically after each WS sequence. The result is that the 2nd break was less optimally managed and the forthcoming debate was concluded earlier, since participants had the feeling to be "swamped" in the numerous computations' information. This extra discussion time could be useful in order to let participants express on the spot their viewpoints, perceptions, feelings etc., thus have less measured and distant answers. Concerning post it colors, following the WS1 experience, this time there was only one post it color per question. Another improvement that we were able to notice was that participants also present during the first WS, have better applied the "golden rules" providing one idea short answers per post it.

Responses to the 8 questions were related to regulation and numbers. Regarding the urban comfort improvement options, various themes emerged like colors, albedo, frustrations related to silence, shadowing, air circulation, buildings forms and orientations. For the internal comfort improvement solutions, answers seemed to mainly converge towards the theme of natural ventilation and all the technical occultation apparatus, as well as on

the optimal orientation to capture the natural light and on programming. Regarding the buildings thermal quality improvement solutions, answers overall focused on renewable energy production and subsurface exploitation, as well as the importance to avoid over insulation and the non-revenues generation issue. For the possible water utilization in 2050, participants' answers unanimously agreed that water utilization can contribute to fight against urban heat island, adding that options like soft mobility and urban bathing areas can contribute too. On the means to store drinking and non-drinking water, the themes that were identified were green roofs, underground disposal-groundwater, wastewater discharge collection and humid zones, water recycling and waterproofing suppression. The issue of participants' willingness to integrate plants species, raised also some reactions, like the experiences realized for biodiversity purposes in France with trees embodied within tubes in front of buildings' facades raising tree care concerns, as well as green roofs, plants management alternatives and smooth vegetation integration. Regarding the novel urban planning paradigms, it came forth that a focus is needed on present, notably technological, solutions, on the modification of the current economic model, and on the social aspects consideration.

The last part was dedicated to participants' feedbacks on the WS's content and organization. Participants raised various concerns like the fact that we cannot continue constructing as we did in the past, and that habitats typologies need to be analyzed to develop adaptation strategies based on existing know-how. Other participants stressed that they were expecting to see some guidelines among Adaptatio outcomes notably ACC solutions for the Tolbiac Chevaleret project, and asked some further explanations on the robustness of the developed decision support tools. The cost concern was also raised and notably the fact that, according to participants, global or annual costs can be more easily taken into consideration compared to net present values. Participants also highlighted that the city and its morphologic parameters need to be projected in 50 years not only the climate, and that climate is already integrated within cities design. Yet, participants highlighted that making a choice between the 'intelligent" traditional architecture and the modern architecture that favors air conditioning, represents a challenge. Last, participants emphasized the paradigm shift from the traditional know-how thinking towards a performance challenge thinking seeking for high technicity and bill reduction.

4.5 . Design Thinking Theory into Adaptatio project Workshops

During the WSs we have mobilized, in a rather unconscious way, tools suggested by DT. First, we have used responses' cartographies, comparable with the DT's 'conceptual cards' and 'concept maps' tools (Stickdorn et al. 2010). Indeed, gathered answers during quizzes were grouped following their proximity or affinity to identify the main thematic areas and launch exchanges one them. Furthermore, in order to understand the positioning of the invited professionals within the urban programming sector and the connections between them, the Consortium created diagrams comparable to 'actors' cartographies' (Stickdorn et al. 2010).

Moreover, the Consortium had put into place brainstorming sessions. Following animation needs, one or more Consortium members were ensuring the facilitator(s) role, to remind the "golden rules", foster dialogue, maintain exchanges dynamics and help maintain group's concentration on the subject. Despite the 2nd WS identified shortcomings, due to brainstorming and response cartographies exchanges were more animated since participants were more unbridled compared to WS1.

The way that notably the first WS took place, was quite close to the DT 'generative sessions' (Stickdorn et al. 2010). Indeed, participants did not explicitly expressed themselves on their experiences, yet they spoke about their knowledge and perceptions related to CC and urban programming. Furthermore, the structure of the first WS with the two quizzes is somewhat the structure followed by the 'co creation workshops' (Stickdorn et al. 2010), with the various information gathered on participants knowledge, the presentation of the main ideas stemming from their answers etc. The only difference was our WS did not have a creative/innovative aim since our purpose was to set up an exploratory frame letting participants understand Adaptatio's context and aims with no prototyping phase thereafter. By contrast, the second WS did not have this co-creation structure since time was mainly taken by Adaptatio approaches and adaptation options, with participants having more a passive role which is quite far from the unbridled dialogue set free by any hierarchy positioning advocated by DT.

5. Conclusion: Design thinking and urban planning?

As it can be seen, DT Theory and urban planning show similarities notably when it comes to the participatory meetings/workshops. Thus, we could state that urban planning stakeholders are "doing Design thinking" without having explicitly the attention "to do" DT (P. Thiebaut, 2012).

Thus, some prescriptions can be made. According to (D. Patniak, 2009, Brown 2010), the project team has to concentrate the possibly maximum skills/ capabilities over a minimum number of actors with multi-competent profiles, to mobilize mediation and technical capabilities, to unlock team creativity and reveal value. Thus, the project team ought to gather at least one town planner, a member with a technical profile and at least one member with a social sciences background.

Attention must be also drawn on the number of experts associated following the size of the project. Indeed, if the number is too large, information loss may be significant and 'resistance' or 'fear' may arise. It seems thus necessary to have a reasonable number of participants to improve the chances to have a relaxed and recreational frame. The limited number can help also focus on particular themes and go further in the project development, if necessary by multiplying the number of thematic workshops. Participation of users/inhabitants must be envisaged

with caution, since they can be mainly focused on their personnel interest, yet without preventing from the importance of their unique experience on the project. These data can be gathered through different DT tools like the 'typical characters'.

Last, concerning the Designer issue, it seems that it is not necessary to redirect the research towards the definition of a new profession within urban planning. Indeed, architects and town planners have already made the effort to add to their technical competences, mediation capabilities. Therefore, they can easily adopt tools and methods from the DT theory while keeping the coordination approach suggested by the professions of Assistant Project Manager-Assistant in General Contractor and Environmental Consultant. In this manner, we can acknowledge the term "Designer-Mediator" as suggested by the project BIMBY (http://bimby.fr/content/) who would accumulate leadership, communication and technical competences.

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