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EXPLORING THE IMPACT OF USERS' PARTICIPATION TO CREATIVE WORKSHOPS FOR NEW MOBILITY SOLUTIONS

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ABSTRACT

User participation in design or innovation projects is nowadays highly recommended in various domains. The main motivation is that their participation enables developing products that fit well users' needs and then that are more easily accepted by customers. Especially in the context of creative design, i.e. when expected solutions should be both novel and appropriate, studies have observed that several factors can impact the solutions' level of creativity, such as the quality of collaboration between experts and users. This study aims at determining the effect of user participation in creative workshops with designers, focusing on three aspects: the level of creativity of the final solution, the quality of the creative process and the quality of collaboration. The study has been conducted in the context of a real project whose objective was to find new solutions for transportation services in a given geographical area. The ultimate goal is to identify facilitators and barriers in the collaboration between users and experts, in order to provide optimal tools to support the contribution of every stakeholder and then to achieve highly creative solutions. The method was as follows. Eight creative workshops were organized. In five of these workshops, experts in transportation and mobility had to collaborate with employees of the area who were considered as users. In the three other workshops, experts collaborated with each other without any participation of users. All the workshops were audio and video recorded, in order to analyse both the creative and the collaborative processes.

Keywords: Creative design, collaboration, user participation.

1 INTRODUCTION

Innovation in transportation and mobility has become an environmental challenge supported by the European Union, whose goal is to reduce carbon dioxide emissions by 60%. One of the main specificity of the transportation domain is that innovation is the concern of a wide range of stakeholders, like automotive and infrastructure industries, territories or transportation operators. If today, the need of collaboration between these stakeholders is acknowledged, the best way to involve citizens and transportation users in innovation projects remains to be studied.

For many decades, more and more industries and territories try to develop user participation in innovation projects, at different stages of the projects and using different methods. However, until now, no research has evaluated the impact of user participation to projects of innovation, in terms of the quality of the final solution resulting from these projects.

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In this research, we study whether the participation of users in creative workshops contributes or not to improve the level of creativity of the final solution, as well as the quality of the creative process and the quality of the collaboration between the participants in the workshops.

2 RELEVANT WORK: COLLABORATIVE CREATIVE DESIGN AND USER PARTICIPATION

2.1 COLLABORATIVE CREATIVE DESIGN

Although creativity and design have been approached in different ways, these two concepts share many similarities. First, they consist of producing a work that is novel, or different from previous products, and that is useful, achieving some goal (Lubart, 1994; Simon, 1995). Second, activities in creativity or in design, may be classified in three categories (see Bonnardel, 2009):

— activities dedicated to define the goals that have to be achieved (problem definition),
— activities dedicated to produce ideas to meet this goal (solution generation or divergence)
— and activities dedicated to evaluate and select the most relevant ideas (solution evaluation or convergence).

One of the main differences between research on creativity and research on design is how the collaboration between participants within the creative process has been considered. In creativity, many studies attempted to compare individual and collective production of ideas, or to evaluate the effect of the team size, according to the number of produced ideas (see e.g. the review by Goldenberg & Wiley, 2011). In design, studies rather considered the process in its entirety and highlighted collaborative processes which have an important impact on a successful design: communication processes, task-related processes, coordination processes and motivation processes (Burkhardt et al., 2009).

Although they differ in their methodologies, these studies concur on the fact that in collaborative creative design, the quality of the final solution is jointly influenced by the individual contribution of each participant and by the quality of the collaboration between participants.

2.2 IMPACT OF USER PARTICIPATION TO CREATIVE DESIGN

Many studies tried to evaluate the impact of user participation on many aspects of the creative design process. Concerning the quality of ideas produced by users in the ideation phases, users produce more creative ideas than professional developers when they are previously educated with creative techniques (Kristensson et al., 2002) or when they are unaware of the technical constraints of the product to be design (Kristensson et al., 2010). Also, users produce more creative ideas when they have the opportunity to experience freely a new technology in everyday life during one week than when they can only experience it during half an hour in a laboratory (Decotter, 2013).

Other kind of studies focused on the collaborative aspects between users and experts, and more specifically on barriers to successful collaboration. Participation of users to co-design meetings may be weakened by divergences with experts in terms of knowledge, perceived roles and interests (Cahour,

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2002). A tendency of participants to reject every alternative option to the current solution, due to a general will to avoid disagreement and maintain progressivity has been observed in participatory design meetings (Heinemann et al., 2012). Differences between users and experts in the ability to think for solutions in a horizon greater than 10 years have also been found (Buur & Matthews, 2008; Richard et al., 2014).

3 RESEARCH QUESTION

These results allowed us to hypothesize that collaborative creative design processes may be different whether they involve users or not. First, ideas produced by users differ in quality from ideas produced by experts. Second, the quality of the collaboration between users and experts may be from lower than the collaboration between experts, and the quality of the final solution may be influenced by these collaborative aspects.

In the experiment we conducted, we aim to answer three main questions:

 — Do users produce ideas that differ in quality from experts, in ideation stages?
 — Is the collaboration in groups mixing users and experts lower in quality than in groups with only experts?
 — Are solutions resulting from creative processes involving users different in quality that solutions resulting from processes not involving users?

4 METHOD

Our experiment was conducted as part of a real project, initiated by the Institut VEDECOM. The creative workshops of this project aimed at finding new solutions of transportation services for the employees of Satory, a district of Versailles (France).

4.1 PARTICIPANTS

Eight teams consisting of three to six individuals participated to the co-design workshops, with a total of 34 participants, including representatives of local authorities and representatives of industrial and academic partners of the Institut VEDECOM. Five of these teams included employees from companies located in Satory (Mixed condition), and the three other teams did not include employees (Experts condition). Employees of Satory were identified as "users" as they travel to and from Satory on a daily basis.

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GROUP #	TYPE	SIZE	COMPOSITION
1	Mixed	5	2 experts, 3 users
2	Experts	3	3 experts
3	Mixed	4	2 experts, 2 users
4	Mixed	6	2 experts, 4 users
5	Experts	4	4 experts
6	Mixed	4	1 expert, 3 users
7	Mixed	5	3 experts, 2 users
8	Experts	3	3 experts

Table 1. Characteristics (type, size and composition) of the eight teams

4.2 PROCEDURE

Each meeting was planned to last four hours, and was constituted of four main stages.

4.2.1 *Introduction*

First, participants were informed about the context and the objectives of the workshop. Then they made crossed presentations: participants formed pairs and had to get information from their partner in order to introduce him to the rest of the team. This exercise was implemented in order to reinforce the cohesion of the team.

After, participants were presented the results of the mobility survey intended for employees in Satory. This survey aimed at examining mobility habits of the employees (origin, destination, travel times, etc.) and difficulties they encounter in their everyday mobility.

Finally the participants were introduced the challenge of the creative workshop: "How to improve the transportation service in Satory?". Two criteria had been introduced: the solution had to be novel in Satory, and it had to be adapted to the needs of both employees and inhabitants of Satory. It was also specified that the solution may be complementary to an already-existing solution.

4.2.2 *Divergence*

Participants were given 30 minutes to generate as many ideas as possible in response to the challenge. They had to write their ideas on a post-it (one post-it per idea) and give the post-it to the facilitator who read the post-it aloud and placed it on the central board. The idea-generation phase was divided into three subphases:

1. A 10-minute phase during which participants generated freely their ideas (called "freewheeling").

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2. A 10-minute phase during which participants received some pictures and tried to associate these pictures to ideas in response to the challenge (called "picturetelling").
3. A 10-minute phase during which participants wrote negative ideas (i.e. ideas of worst-case scenarios) on post-its and threw them on the ground, so that other participants take these post-its back and reformulate the negative ideas into positive ideas (called "reverse brainstorming").

4.2.3 *Convergence*

Collectively, participants got back all ideas collected from the divergence phase and distributed them into four categories:

— Green ideas (*Very short-term*): Very easy to implement, no major change needed
— Blue ideas (*Short-term*): Feasible at the horizon of a few months, which present an improvement of what currently exists
— Yellow ideas (*Mid-term*): Feasible at the horizon of a few years, bringing a major change
— Red ideas (*Long-term*): Not feasible with current technologies, but maybe feasible in a few decades

Once all ideas had been categorized, participants selected collectively a category. Inside the selected category, they distributed the ideas based on a thematic classification, then selected a theme. Inside the selected theme, they choose one post-it (or one set of post-its) that constituted the final solution.

4.2.4 *Drafting the solution poster*

Participants edited collectively their "solution poster" which had to be composed of the following items:

— A title to describe the solution
— The insight: The need or the problem to which the solution is responding
— A description of the solution (material elements)
— The benefits of this solution, for the users and for the territory
— A claim
— Keywords
— Graphic illustrations of the solutions (drawings, sketches, pictures)

At the end of the drafting phase, participants completed a questionnaire of teamwork assessment.

4.3 DATA COLLECTION

All the workshops were audio and video recorded in their entirety. The poster containing the final solution was collected, as were the posters containing the post-its classified in time-horizon categories.

4.3.1 *Quality of the process*

For each workshop, we were able to extract:

— The number of ideas generated by the whole group
— The number of ideas generated by each participant

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— The number of ideas of each category (very-short-term, short-term, mid-term, long-term) generated by each participant

4.3.2 *Quality of collaboration*

The quality of the collaboration of each team was assessed based on an adaptation of the QC method (i.e. Quality of Collaboration, Burkhardt et al, 2009). For each workshop, two excerpts from the convergence phase have been extracted: the first excerpt was the categorization of the first ten post-its, the second excerpt was the categorization of the last ten post-its. For each of the twenty post-its, the quality of the collaboration was assessed by answering as objectively as possible to the following questions. The keyword in italics is the name of the criterion associated with the question.

— Are the turns of speech not interrupted by other participants? (*Fluency*)
— Are all the participants focused on the same object? (*Focus of attention*)
— Do the participants refer to the rules of categorization? (*Understanding of rules*)
— Do the participants bring clarification or ask questions about the content of the post-it? (*Understanding of content*)
— Do participants suggest any alternative option to the first proposition? (*Alternatives*)
— Is there any digression? (*Coherence of ideas*)
— Is there at least one argument used to justify the category in which the post-it has been classified? (*Arguments*)
— Do all the participants agree explicitly to the choice of the category? (*Agreement*)
— Do a majority of participants participated verbally in the discussion? (*Equilibrium of contribution*)
— Are all participants focused on the task? (*Involvement*)

Each positive answer to these questions was rated 1 and each negative answer was rated 0, without any alternative score. In this way, each group obtained a score out of 20 for each dimension concerning collaboration, and a total "QC score" out of 200.

4.3.3 *Quality of the solutions*

At this time, the final solutions have not been assessed by experts yet. The final solutions will be examined qualitatively.

5 RESULTS

5.1 QUALITY OF THE PROCESS

Regarding the number of ideas generated by each participant, no significant effect of the type of participant (User vs. Expert) was found. However, participants in Mixed groups generated more ideas than participants in Experts groups (11.79 vs.9.60, $F_{(1,32)}$=2.085, p = 0,158) but the difference was not significant.

Regarding the number of ideas of each category generated by the participants, participants in Mixed groups generated more very short-term ideas (3.33 vs 2.20, $F_{(1,32)}$=2.119, p = 0,155) and more short-term ideas (4.13 vs 2.90, $F_{(1,32)}$=2.362, p = 0,134) than participants in Experts groups but again, the

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difference was not significant. No difference was observed for mid-term and long-term ideas.

5.2 QUALITY OF COLLABORATION

Both conditions (Experts vs Mixed) were compared based on each dimension of collaboration according to a Wilcoxon signed-rank test for independent samples. Mean scores are reported on the following table:

DIMENSION	MIXED (5 GROUPS)	EXPERTS (3 GROUPS)	W	P
Fluency	11.00	12.00	9	0,763
Focus of attention	17.00	19.67	11.5	0,253
Understanding of rules	9.40	11.33	8.5	0,881
Understanding of content	8.20	11.33	11	0.365
Alternatives	7.40	9.33	11.5	0,291
Coherence of ideas	17.60	17.67	7.5	1,000
Arguments	11.40	13.00	11	0,362
Agreement	13.80	17.00	12	0,250
Equilibrium of contribution	13.00	16.00	12	0,219
Involvement	18.60	19.67	9	0,733
Overall collaboration	127.40	147.00	13	0,143

Table 2. Comparison of Mixed and Experts conditions according to 10 dimensions of collaboration and overall collaboration

Even if there were no significant differences (probably due to the low number of groups in each condition), we observed a slightly better collaboration for experts groups.

However, the fact that experts groups generally had less members than mixed groups suggested that this difference of quality of collaboration could be an effect of the group-size. We distributed the 8 groups according to a new variable: Size of the group. Groups with 3 or 4 participants were assigned as "Small groups" and groups with 5 or 6 participants were assigned as "Large groups". The same comparisons were made:

DIMENSION	SMALL (5 GROUPS)	LARGE (3 GROUPS)	W	P

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Fluency	10.80	12.33	10.5	0,451
Focus of attention	19.60	15.33	2	0,103
Understanding of rules	12.20	6.67	1	0,072
Understanding of content	11.00	6.67	3.5	0,291
Alternatives	8.80	7.00	4	0,365
Coherence of ideas	17.60	17.67	7	1,000
Arguments	12.60	11.00	5	0,544
Agreement	17.20	11.33	0	0,036 *
Equilibrium of contribution	16.60	10.00	0.5	0,046 *
Involvement	19.80	17.67	3	0,172
Overall collaboration	146.20	115.67	0	0,036 *

Table 3. Comparison of small and large groups according to 10 dimensions of collaboration and overall collaboration

Size of the groups appeared to have a strong effect on the quality of collaboration. Small groups (i.e. groups with 3-4 participants) collaborated with higher quality than large groups (i.e. groups with 5-6 participants). This difference is also significant for the following dimensions: explicit agreement and equilibrium of contributions, as well as overall collaboration.

5.3 QUALITY OF THE SOLUTIONS

Five of the eight groups selected the final solution in the "short-term" category, i.e. a solution which is feasible in a few months. The three other groups selected the final solution on the "mid-term" category, i.e. a solution which is feasible in a few years. Among these three groups which selected a mid-term solution, two groups were experts groups, and the last group was a mixed group with, interestingly, a majority of experts.

6 DISCUSSION

Although conducted on a small number of groups, this experiment provides some interesting results. First, it appeared that groups involving users generated slightly more ideas than experts groups. This difference may be explained by the number of short-term ideas which is higher in mixed groups. It is worth noting that in the area studied in this project, mobility problems are so numerous that the need of a fast implementation of solutions is very important, that explains the predominance of short-term ideas. If they focus more on long-term ideas when they are not collaborating with users, experts tend to focus more on short-term ideas when they are collaborating with users. The presence of users within design projects tend to guide the reflexion of experts during the stage of divergence, as a "signal" of an emergency for short-term ideas.

The results of our study tend to confirm previous results according to which users have more difficulties thinking over the long-term time framework than

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experts (Buur & Matthews, 2008; Richard et al., 2014). However, contrary to these studies which seem to explain this difference by a difference of cognitive skills between users and experts, we would rather explain this difference by an emergency of users to have "quick solutions" whereas experts are less concerned with this emergency.

Regarding the quality of collaboration, we have not found differences between mixed groups and experts groups. However, we found a significant effect of group-size: groups of 3 or 4 participants showed better collaboration than groups of 5 or 6 participants, especially on two dimensions of the collaboration that are fundamental for the decision process: explicit expression of an agreement, and equilibrium of contributions. However, a qualitative observation of the workshops showed a lower feeling of cohesion and group dynamics for groups of 3 participants. Based on this, we could determine the ideal number of participants as 4, at least for decision making.

Finally, results concerning final solutions seem to parallel those for the stage of divergence: while experts groups produced long-term solutions (i.e. available in 5-10 years), mixed groups produced more short-term solutions (i.e. available in 1-2 years). An important feature of mixed groups was the numerical superiority of users compared to experts. Further studies should focus on groups containing as many users as experts.

7 CONCLUSION

In innovation processes for transportation systems, the importance given by users to the emergence of original solutions is superseded by a strong need for easy-to-implement solutions. The creative process is then influenced by this goal and the solutions produced from this processes are often too little original. Further studies focusing on the factors of users' motivations to search for original solutions should be beneficial. It must also be noted that the experiment has been conducted on a small number of groups, and that a study with a larger sample has to be conducted.

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