

## ENHANCING COLLECTIVE CREATIVE DESIGN? AN EXPLORATORY STUDY BASED ON A DYNAMIC PERSONA IN A VIRTUAL ENVIRONMENT

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### ABSTRACT

*This paper describes an exploratory study to determine the influence of using a dynamic persona in a virtual environment on creative design activities. A pilot group composed of two professionals (a designer and an ergonomist) and a dynamic persona had to perform a creative task. We compared both their creative performance and group dynamic with those of 11 groups of three participants who performed the same task, in the same virtual environment, with the same communication modality (i.e., chat). Results tend to show slightly more ideas as well as higher originality of ideas in the dynamic persona group than in the other groups (without any persona). We also observed, in the dynamic persona condition, a satisfying quality of collaboration and level of empathy toward the dynamic persona.*

*Keywords: Design, Creativity, Personas, Virtual environment.*

### 1 INTRODUCTION

In order to stay competitive, companies must regularly bring out new products for users or consumers. However, it is always a challenge for companies - and designers - to come up with products that are both new and adapted to future users, whatever the area of design. Indeed, designers have to inject creativity into their design projects, while at the same time satisfying constraints pertaining to the object to be designed (Bonnardel, 2000, 2006). This is no easy task, and when design situations require particular creativity (e.g., contexts of so-called *prospective ergonomics*), the task of imagining and conceiving future products is made even harder for designers. First, we describe the characteristics and difficulties of creative design activities, in both individual and collective design situations (section 2). Second, we present a specific user-centred design method that we find particularly promising: the *personas* method (Bornet & Brangier, 2013), which enables designers to focus on archetypal *future users* of the product or service to be designed (section 3). This method is thought to favour both empathy and creativity among designers. However, studies so far have shown that the positive effect of the persona method mainly concerns the generation of solutions *adapted* to the situation at hand, with no obvious stimulating effect on designers' creativity (Bornet, 2014). Thus, our objective in the present study was to analyse the use and impact of a new kind of persona, which has the double particular feature of *being dynamic and to intervene in a virtual environment*. As the interactions between participants and the dynamic persona (an avatar) occur in this virtual environment (more precisely, *Second Life*), this should help to reduce the difficulties inherent to collective design activities, notably by allowing participants to remain anonymous. Especially, we argue that interactions with this kind of dynamic persona may have a positive effect on the evocation of creative ideas, with the dynamics associated with the persona enhancing participants' empathy. Therefore, in section 4, we first explain how we created both a traditional *static*

persona and a *dynamic persona* (an avatar played by the experimenter), and we present an exploratory study that allowed us to identify issues to address when creating such kind of dynamic personas. Then, we describe the number and originality of the creative ideas produced by two professionals (a designer and an ergonomist) who interacted with the dynamic persona through *Second Life*, and compare them with the ideas produced by 11 groups of participants who also interacted through *Second Life*, with the same communication modality (i.e. *chat*), but without any persona. In addition, we analyse the participants' level of empathy with the dynamic persona. In the final section (§5), we discuss these results in order to define future studies on the use of dynamic persona.

## **2 CREATIVE DESIGN SITUATIONS AND THEIR DIFFICULTIES**

The challenge associated with product design is to come up with design solutions and define products that are new, but which at the same time meet requirements and are adapted to future users and usages. This is an especially important challenge in the context of prospective ergonomics, where there are no explicit demands or clients. The whole point of prospective ergonomics is to create products that have not yet been identified (Brangier & Robert, 2014; Robert & Brangier, 2012). Therefore, designers have to detect existing user needs, anticipate future ones, and inject creativity into the design solutions they come up with. For several reasons, this appears to be a complex undertaking.

From a cognitive point of view, design activities can be regarded as problem-solving activities. One main characteristic of these problems is that they are *ill structured or ill defined* (Eastman, 1969; Simon, 1995), insofar as designers' mental representations are initially incomplete and imprecise. Only by going through the problem-solving process itself can designers complete their mental representations. Thus, the design problem-solving process has been described as being based on the coevolution of problem and solution spaces (Dorst & Cross, 2001). More specifically, Valkenburg and Dorst (1998) distinguish between framing the problem (exploring the design task) and framing the solution (developing solutions). Given that the personas method may enhance designers' ability to take into consideration and imagine future users' needs and usages, it should favour problem framing.

Furthermore, in non routine design contexts (designing new products or services), the design solution must be both *new* and *adapted* to the characteristics of the situation or context (e.g., future users and usages; Bonnardel, 2006, 2009). This double criterion matches the A-CM model (Bonnardel, 2000, 2006), which highlights the roles of two main cognitive processes: analogy and constraint management. According to this model, these two processes continuously interact during the design process, and also contribute to other cognitive processes, such as assessing solutions and considering other viewpoints. Analogy and constraint management may have contrasting effects, in line with the notion of divergent and convergent thinking. Analogy making may encourage designers to extend or open up their *search space* to new ideas, whereas constraint management allows designers to give focus to their search for ideas. Constraints also help designers to assess ideas or solutions, and thus to gradually delimit their search space, until they find a solution that is both new and adapted to the various constraints. In line with this description, the use of the personas method could encourage designers to

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consider constraints related to future users, and some of these constraints could also underlie analogies.

In the case of complex design situations, creative activities may occur in a social context, where designers interact with other stakeholders (Fischer, Giaccardi, Eden, Sugimoto, & Ye, 2005). In these *collective situations*, the design problem requires more knowledge than any single person can possess, and the relevant knowledge is often distributed across stakeholders. In a collaborative context, people approach the problem from different angles and with a variety of background knowledge, which may lead to the emergence of a wider range of perspectives (Milliken, Barel, & Kurstzberg, 2003). Thus, collaborative activities may have positive effects on creative design activities, as people adopting different viewpoints or perspectives can propose new ideas (Fischer et al., 2005; Milliken et al., 2003). However, although diversity can have positive effects on collective design activities, it can also lead to misunderstandings and other communication problems amongst group members (Nijstad, Diehl, & Stroebe, 2003). Thus, being creative in a group can be considered inherently more difficult, as collaboration processes are added to the design task. Negative effects can also be identified (see Hébert, 2012), such as production blocking, cognitive interference and/or fear of being judged and social inhibition. Production blocking can be related to the collaborative process of fluent turn-taking in verbal interactions: the deferred verbalization of an idea can result in its being forgotten or suppressed, and prevent the generation of further ideas (Nijstad et al., 2003). Cognitive interference occurs when the ideas generated by other group members interfere with an individual's own idea generation. In these cases, memory retrieval can be biased or blocked by the memories of others. Fear of being judged refers to the fact that people may fear negative assessments by the other group members (Nemeth & Nemeth-Brown, 2003; Nijstad et al., 2003). One consequence is that non common options or solutions are less likely to be expressed in a group than in an individual context (Nemeth & Nemeth-Brown, 2003).

In the analysis of collaborative design activities described in this paper, we reasoned that negative effects could be relatively limited, as the interactions would take place in a virtual environment. In this virtual environment (*Second Life*), the participants are represented by avatars, ensuring them relative anonymity. In addition, to avoid the possible influence of the participants' voices, the verbal interactions are based on a *chat* (or written) communication mode, which we expected to improve turn-taking.

### **3 THE 'PERSONAS' METHOD**

User-centred design methods can help designers understand users' expectations, needs and limitations, and take them into consideration during the design process (e.g., Norman & Draper, 1986). We hold the personas method to be particularly promising (Bornet & Brangier, 2013; Brangier, Bornet, Bastien, Michel, & Vivian, 2011; Grudin & Pruitt, 2002). This method is based on the creation and use of fictional users, or personas, who are usually associated with concrete representations comprising both textual descriptions and photos (Pruitt & Grudin, 2003). This method (or *interactive design technique*) was originally based on observations and reasoning by Cooper (1999), who noted that designers often have a vague and even contradictory sense of their intended

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users, and may base scenarios on people similar to themselves. This author therefore considered the notion of *user* to be too generic and confused to favour design that was genuinely centred on people's real needs. Products designed in this way are developed for an undefined or 'elastic user', according to Cooper (1999, p. 127). By contrast, personas are used precisely to personalize users, and constitute a means of enriching designers' mental representations of them. Furthermore, in line with previous descriptions of design activities, we consider that they encourage designers both to frame the design problem and to take constraints into account. Through the use of personas, designers can reflect on a product or service with a specific user in mind, with a typical face (shown in a photo), a distinctive name, and specific characteristics. According to Pruitt and Grudin (2003), personas are fictional people, who have names, likenesses, occupations, friends, and so forth. They are also characterized, for instance, by a specific age, gender, level of educational achievement, life stories, goals and tasks. In specific cases, personas can be played by team members and are, therefore, dependent on each participant's performance as actor.

The personas method is being used more and more frequently by ergonomists and certain designers, but based on an *assumption* of their benefits, rather than any empirical evidence. Only recently have several studies performed by Borner (2014) highlighted the benefits and limitations of using the persona method. In particular, she showed that while the use of personas does not lead to an increase in the number of ideas produced, these ideas are frequently relevant, and are therefore selected to deal with the problem at hand.

The effectiveness of the personas method seems to be based mainly on a process of empathy (Rind, 2007). Empathy can be defined as the ability to recognize other individuals' emotional responses (Decety, 2002). It can be selective, and some authors consider that participants less easily adopt the view of personas that sound far removed from them, be it with regard to culture or to personality. Nevertheless, complementary results obtained by Borner (2014) suggest that even personas that are very different from the designers can promote the generation of ideas. Therefore, in the exploratory study described below, we asked participants to fill in questionnaires probing the level of empathy they felt for the persona while performing the design task, and compared these data with their general level of empathy as a personality trait, independently of the design task.

### **4 USE OF 'DYNAMIC' PERSONA IN A VIRTUAL ENVIRONMENT**

With a view to contributing to creative design activities in collective situations, we performed an exploratory study inspired by the personas method, featuring a collaborative virtual environment and dynamic persona.

We chose to analyse design activities in a *collaborative virtual environment* because emerging technologies potentially offer worthwhile means of supporting creative work (Bonnardel & Zenasni, 2010; Burkhardt, & Lubart, 2010). In addition, the nature of interactions changes in a virtual environment (González-Ibáñez, Haseki, & Shah, 2013), and we reasoned that participants might be less subject to social inhibition in a situation where the stakeholders were represented by avatars, thus affording them relative anonymity.

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The method we developed and used was derived from the traditional personas method, but we chose to expose participants not to static but to *dynamic* personas. More specifically, we hypothesized that dynamic personas elicit greater empathy. Providing that certain conditions are respected when creating dynamic personas, in order to convey this positive feeling (see 4.1), we hypothesized that the use of dynamic persona favours both the production and selection of creative ideas.

In this exploratory study, we asked groups of participants to interact through *Second Life* in order to perform the same creative design task. Depending on the experimental condition, there were either two or three genuine participants. In the situation with the dynamic persona, the third participant was played by the experimenter (an *accomplice*), represented by an avatar. As the real participants were also represented by avatars in both conditions, we predicted that the dynamic persona would elicit empathy. This dynamic persona intervened in the discussion, expressing the sort of information (i.e., characteristics, preferences and points of view) that is provided in the descriptions associated with static (i.e., classic) personas. In the following section, given the complexity of creating a dynamic persona, we begin by setting out the issues we had to address. We then describe the exploratory study we conducted, and the results we obtained.

### **4.1 CREATION OF 'STATIC' AND 'DYNAMIC' PERSONAS**

In the present study, we created a single persona in two versions: static and dynamic. As the creative task consisted in designing future means of transport, we gave this persona the identity of a university student. His name was Kevin (a very common first name) and he was 21 years old. He was studying psychology, and had a detailed set of habits and hobbies. In addition, his main fear was to arrive late in class.

To create the *static* version of the persona, we used data we had gathered during discussions that had taken place among 32 groups of three students who had to tackle the same creative task in an earlier study. In addition, we conducted interviews with several students in order to gain additional information needed to flesh out the Kevin character. We also chose a photo for this persona, which was presented alongside the textual description of Kevin, and used to develop an avatar with similar features (see Fig. 1). This static version of the persona was not used in the present study but we still had to create it as a reference for the creation of the *dynamic* version of the persona. Moreover, we aim to compare influences of *static vs. dynamic* personas in further studies (see Bonnardel, Forens & Lefevre, 2015).

To create the *dynamic* version of the persona, we had to address issues related to the appearance of the persona, as well as to the content and formulation of its interventions during the creative design situation. First, we had to develop a specific avatar corresponding to the dynamic representation of the Kevin character. This proved more complex than simply using a photo! We reproduced the same physical features as those in the photo, but initially observed differences in the quality of the external representations. In the first version, the face of the avatar seemed more artificial, and we had to increase the textural quality and the number of polygons to achieve greater realism. This was very important, as the aesthetic quality and realism of personas undoubtedly has an

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impact on their pleasantness (Seyama & Nagayama, 2007) and on the empathy felt for them. Second, concerning the content of the dynamic persona's interventions in the creative design situation, we prepared a checklist that contained exactly the same items of information as the textual description of the static persona. Thus, the experimenter who played the role of Kevin was instructed to introduce all these listed items in the discussion. Third, in order to establish how these interventions were to be formulated, we gathered sentences that had been spontaneously expressed during the real discussions that took place between participants in the previous study featuring the same creative task. These were transcribed and reused by the experimenter to present information in the design situation.

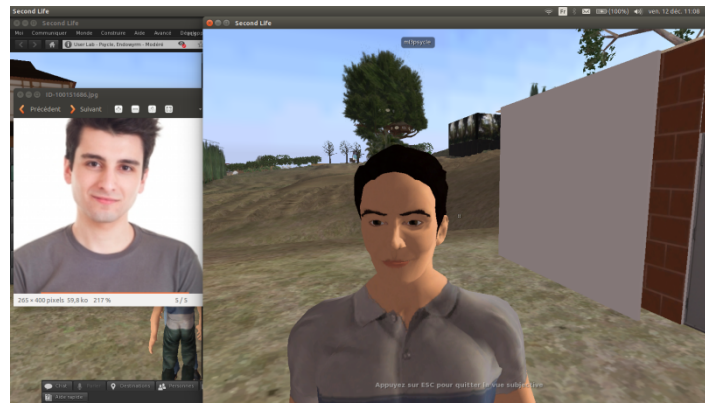


Figure 1: Example of static (left) and dynamic (right) persona

### **4.2 EXPLORATORY STUDY**

In the present exploratory study, part of a larger research project still underway, the aim was to compare the creative performance of a group made up of two professionals (a designer and an ergonomist) and a dynamic persona, with those of groups composed of three participants (three students) but no persona. All the groups performed the same creative task. Owing to the difficulty of recruiting professional participants, a single pilot group of professional participants interacted with a dynamic persona, and the data we gathered were set against results we had obtained from 11 groups of three participants who had to perform the same creative task using the same communication modality.

#### **4.2.1 Procedure**

Participants were placed in separate rooms, each with a computer running *Second Life*. They were asked to perform a creative task by generating creative ideas for reducing traffic jams in the city of Aix-en-Provence in southern France. This creative task was divided into two phases, in line with the classic brainstorming paradigm (Dennis & Williams, 2003; Paulus, Kohn, & Arditti, 2011). In the first, divergent thinking phase (25 min), participants had to generate as many ideas as they could, while in the second, convergent thinking phase (15 min), they had to select the best ideas and develop them. *Second Life's* built-in instant messaging service (or *chat* communication mode) was used to support the communication. Thus, only written communication was possible

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between participants. We also made a collaborative text editing interface available in the virtual environment, which allowed participants to note, organize, and develop ideas. As previously indicated, the persona avatar had a first name and, in order to put everyone on the same level, all the participants had avatars with their own names.

Once the creative task was over, participants in the dynamic persona condition were asked to complete a questionnaire about empathy: the Toronto Empathy Questionnaire (TEQ; Spreng, McKinnon, Mar, & Levine, 2009). This questionnaire was used to measure empathy as an emotional reaction to the encounter with the persona. In addition, participants had to answer complementary questions about empathy devised by Bornet (2014), based on three assertions:

- It's easy for me to put myself in Kevin's position,
- I understand Kevin,
- I can predict Kevin's reaction to a new situation.

Finally, a few days later, an e-mail was sent to these participants asking them to complete another empathy questionnaire: the Empathy Quotient (EQ; Baron-Cohen, 2004), which is used to assess empathy as a personality trait.

### 4.2.2 **Results**

After presenting quantitative results, concerning the number of ideas that were produced and their originality, we provide more qualitative results about the quality of collaboration within the group composed of a designer, an ergonomist and the dynamic persona. Finally, we set out the results on the participants' empathy for the dynamic persona.

#### — Fluidity and originality of the ideas

The ideas generated in the dynamic persona condition (C1), obtained during a single session, were compared with the ideas generated by 11 groups of three students (C2). All these participants tackled the same creative task, using the same communication modality (verbal interactions through written messages, *i.e.*, *chat*). Although there were only two real participants (besides the dynamic persona, who was played by the experimenter and who did not generate any ideas) in C1, compared with three in C2, they produced slightly *more ideas* (which corresponds to the fluency) with 18 ideas produced in C1 *versus* 15.45 in C2 ( $N_{C1} = 20$ ,  $M_{C2} = 15.45$ ,  $SD_{C2} = 3.33$ ).

To measure the *originality of the ideas*, as is the case in tests of divergent thinking, we calculated their mean statistical originality. This was done in two steps. First, we referred to results obtained in previous studies performed in similar conditions and featuring the same creative task. This allowed us to calculate the frequency of generation for each idea mentioned at least once by one of the groups (*i.e.*, idea originality). The originality of each idea ranged from 0.03 to 1, with an observed maximum of 0.84. Second, we calculated the harmonic mean of originality for the ideas generated by each group, obtaining the following results:  $N_{C1} = 0.82$  for the C1 group, and  $M_{C2} = 0.60$  ( $SD_{C2} = 0.06$ ) for the C2 groups. Thus, these analyses showed that the ideas proposed by the group in C1 were more original (0.82) than those proposed by the groups in C2 (0.60).

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### — Quality of collaboration

To determine the quality of collaboration for the group in C1, we analysed the overall communication that occurred within it, using an adaptation of the Quality of Collaboration Observation Grid devised by Burkhardt, Détienne, and Hébert (2010). This observation grid allowed us to determine an overall quality of collaboration (QoC) score on a scale of 0-80, as well as scores for each collaboration dimension (*i.e.*, fluidity of collaboration, support of mutual understanding, exchange of information to resolve the problem, argumentation and decision making, work processes and time management, and cooperative orientation). More specifically, we split the task duration into three 15-min phases (P1, P2 and P3), and applied the observation grid to each of the three phases. By so doing, we could analyse changes in QoC.

Results showed that QoC increased between P1 ( $Q_{P1} = 49$ ) and P2 ( $Q_{P2} = 64$ ), remaining relatively stable between P2 and P3 ( $Q_{P3} = 61$ ) – see Figure 2.

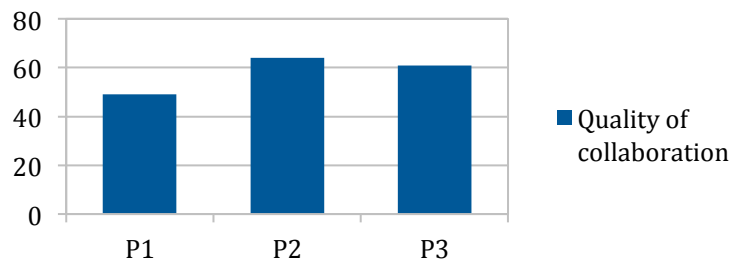


Figure 2: Changes in the quality of collaboration throughout the design activity.

The increase in QoC between P1 and P2 can be attributed to the construction of a common frame (Stumpf & McDonnell, 2002; Valkenburg & Dorst, 1998) for appraising the problem and defining ways of solving it. The mean score across the three phases tended to indicate a satisfying level of QoC ( $M = 58$ ,  $SD = 7.94$ ). Analysis of the QoC dimensions showed that scores were lower both for work processes and time management, and for cooperative orientation. The work processes and time management scores can be explained by the absence of time management in this group. The cooperative orientation scores can be explained by the monopolization of organizational decisions and use of the collaborative text-editing interface by a single group member. However, even if collaborative orientation was not optimal, the group scored highly on fluidity of collaboration, as none of the members monopolized the communication.

### — Participants' empathy

To measure empathy as an emotional reaction, we examined the participants' scores obtained just after the experimental task:

- scores on the TEQ empathy questionnaire, answered from Kevin's viewpoint ( $M = 0.55$ ,  $SD = 0.07$ );
- scores on the complementary questions devised by Bornet (2014) about empathy ( $M = 0.75$ ,  $SD = 0.07$ ).



Both these scores were higher than the EQ score ( $M = 0.39$ ,  $SD = 0.11$ ) corresponding to empathy as a personality trait, suggesting that participants experienced empathy for the dynamic persona.

## 5 DISCUSSION

In this exploratory study, we wanted to analyze the impact of using a dynamic persona on creative performance and quality of collaboration during creative design activities. Results were promising for several reasons. First, the group composed of a professional designer and professional ergonomist interacting with the dynamic persona produced slightly more ideas than the groups made up of three participants. Second, the ideas produced by this group, in the dynamic persona condition, were more original than those produced by the groups of three participants. Nevertheless, at this point, we cannot really state that the use of a dynamic persona has a genuinely positive impact on creative performances. Further experiments are needed to test the robustness of this impact and to analyze the variability induced by changing the population being tested (professionals vs. students).

Analysis of the quality of collaboration highlighted a lack of time management in the group with the dynamic persona, especially with regard to the two phases of divergent and convergent thinking. We clearly need to confirm this result on changes in the quality of collaboration with other groups of participants. It may well be that the work habits of professional creators are not directly compatible with this paradigm, in which case, we might consider removing these two phases in order to let them work more ecologically.

In this study, we told participants that Kevin was just another participant in the session, representing a transport user. In actual fact, he was what we call a *dynamic persona*, whose characteristics were similar to those of the *static persona* we had previously built. As the experimenter who played the role of this dynamic persona was told not to produce any ideas, Kevin may be perceived as non creative by the other participants. In addition, to limit his interventions to the items of information presented in the static persona, the experimenter had to elude questions from the other participants that were too specific. Thus, although the level of empathy for the dynamic persona was higher than the general level of empathy as a personality trait, we have yet to determine whether it would be more relevant to explicitly introduce Kevin as a persona (instead of an usual participant) with which the other participants could interact.

In the next study we intend to run, we plan to compare the impact of dynamic *versus* static personas on creative performance. The use of a static persona for a distant creative activity may seem non ecological at first glance, as the personas method was created for traditional teamwork. However, we can assume that this practice has already been implemented in a few companies, and could soon become more widespread. As far as we know, work organization is evolving quickly with the rise of digital communication, especially in creative activities involving players with distributed skills or who are in different locations. This new study will therefore have a twofold objective. First, we will analyse qualitative outcomes when a group uses a static persona for remote creative activities. Second, we will compare the impacts of static and dynamic personas both qualitatively and quantitatively.

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To conclude, introducing dynamic personas may represent the first step to bringing this technique to industry and businesses. For the time being, the persona is controlled by an experimenter, as this is the easiest way to achieve a satisfying human likeness in dynamic communication. However, building and maintaining this procedure is very complicated and demanding for a professional structure. However, if human likeness is not a central need, it would be possible to create conversational agents to play this role and provide the participants with information. This would be very useful in areas where professionals who are far apart from each other need to engage in creative activities together.

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