

Leading the Creative Process: The Case of Virtual Product Design

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Introduction

Virtual project teams (VPTs) have become an increasingly popular form of project organisation (Holtgrewe, 2014; Yeow, 2014). They emerged as a response to a highly competitive global business arena, wherein organisations are expected to capitalise on global expertise, cross-cultural collaboration, and time differences (Cascio, 2000). As such, VPTs are expected to bring together the best talent regardless of location. This ability adds diversity to VPT membership and has been seen as an opportunity for creativity (Schmidt *et al.*, 2001; Shachaf, 2008). Several empirical studies exist that show that VPTs are set up in order to promote creativity, such as for example to develop new and novel product designs (e.g. Schmidt *et al.*, 2001; Nemiro, 2002; Chamakiotis *et al.*, 2013), while, more recently, Gilson *et al.* (2015) have asserted that creativity in VPTs deserves further research. What is lacking in the current literature is an understanding of the role of VPT leaders in supporting creativity. With product design being an important aspect of virtual projects, in this paper, we aim to explore the role of leadership in the creative process that takes place within VPTs.

Creativity has been examined in traditional, face-to-face (F2F) settings from both an individual (e.g. Amabile, 1983) and an organisational perspective (e.g. Amabile, 1988; Andriopoulos, 2001). Within the context of VPTs, researchers have looked at factors influencing creativity (Ocker, 2005; Chang, 2011; Chamakiotis *et al.*, 2013) as well as the stages of the creative process (i.e. idea generation, development, finalisation/closure, and evaluation; Nemiro, 2002). Design, which we use here as an empirical context, is largely seen as an example of the creative process (e.g. Howard *et al.*, 2008; Forest and Faucheux, 2011). Given that designers are expected to generate creative outputs, and that their work is increasingly accomplished virtually, we focus on the phases of the virtual design process to study how one can lead for creativity within this context. Mumford *et al.* (2002) argue that as teams become more multidisciplinary, as is the case with VPTs, leading for creativity becomes more challenging than in collocated teams. We thus contribute to the literature by analysing the roles of appointed and emergent leaders within each phase of the creative process in the VPT context.

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We took the case of an Industry-Academia collaboration which involved dispersed participants from two global companies and four academic institutions spread across four European countries. Six VPTs of a total of 49 members were formed and worked virtually towards their assigned design tasks for five months. Our approach involved individual and focus group interviews throughout the creative process, as well as observations and review of other materials (e.g. project documentation and project reviews) as complementary methods.

In what follows, we discuss how VPTs are led and what we know about creativity within this context. Following, we present our case study and the ways in which we collected and analysed our data. We then use the different phases of the product design process and discuss how creativity and leadership played out within each phase. Finally, we discuss how our findings contribute to theory and outline our study's limitations and implications for theory and practice.

Leading Virtual Project Teams

Scholars agree that an embedded characteristic of VPTs is that of discontinuities, especially geography and time, but also work, cultural and organisational aspects which can potentially disrupt team cohesion (Chudoba *et al.*, 2005; Watson-Manheim *et al.*, 2012). Similarly, due to their technology-mediated nature, VPTs lack embodied indications of emotion, such as facial expressions, which can thwart VPT trust (e.g. Baralou and McInnes, 2013) and consequently collaboration. VPT leadership has therefore begun to gain attention among researchers and practitioners with an interest in improving VPT collaborations (e.g. Johnson *et al.*, 2015).

Three dominant themes have been studied so far: First, researchers have shown an interest in the characteristics of successful VPT leaders. Experimental studies have shown that within online groups transformational leadership behaviour tends to have more positive effects on team performance and levels of satisfaction than the transactional form (Balthazard *et al.*, 2009; Purvanova and Bono, 2009; Ruggieri, 2009). Second, numerous studies have elicited that successful leaders emerge from the interactions that occur within the online group or community (e.g. Yoo and Alavi, 2004; Carte *et al.*, 2006). These authors suggest that for a member to become a leader, s/he should actively participate in several activities within the team, make contributions to discussions and encourage other members to collaborate. The frequency with which VPT leaders (Jarvenpaa and Leidner, 1999; Kayworth and Leidner, 2000; Yoo and Alavi, 2004; Huffaker, 2010) communicate with their team members has been seen as an indication of effective leadership. Third, studies have examined VPT leadership across the different stages of the VPT lifecycle and have identified specific behaviours that need to be adopted. For example, Zander *et al.*

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(2013) identify three key VPT project stages—welcoming phase, working phase and wrapping-up phase—and within each phase present specific actions and behaviours that an effective leader should adopt in order to improve team performance.

Creativity in Collocated and Virtual Project Teams

The literature on creativity in traditional, physically collocated settings is rich, with researchers examining the creative process (e.g. Koestler, 1964; Lubart, 2001); the creative person (e.g. Guilford, 1950); the creative product (e.g. Richards, 1999); and the role/press of the environment (i.e. the social/organisational influences; Smolensky and Kleiner, 1995); or the 4Ps (process, person, product, press) of creativity, as these have been phrased (Richards, 1999). As a topic, creativity has attracted multidisciplinary attention in the literature from the fields of software design (e.g. Warr and O'Neill, 2005), product design (e.g. Howard *et al.*, 2008), management (e.g. Amabile, 1983) and psychology (e.g. Guilford, 1950), among others. The literature also points to different types of creativity. For instance, design scholars emphasise 'conceptual creativity' as a critical type of creativity necessary early on in the creative process (Howard *et al.*, 2008; Snider *et al.*, 2013). However, Unsworth's (2001) developed a typology of creativity, based on two dimensions: motivation (volunteered vs. required) and problem definition (discovered vs. specified). She identified four types of creativity: expected (i.e. required solutions to discovered problems), proactive (i.e. volunteered solutions to discovered problems), responsive (e.g. required solutions to specified problems) and contributory (volunteered solutions to specified problems).

The early literature focused on the role of the individual, arguing that it is largely cognitive abilities (e.g. ability to synthesise), personality traits (e.g. originality in thinking; Guilford, 1950, Torrance, 1974), relevant knowledge and personal motivation (Amabile, 1988) that lead to creative behaviour. Researchers have also examined group and organisational factors, such as leadership, team diversity, organisational culture, and technology, which are seen as associated with the creative process (Bharadwaj and Menon, 2000; Andriopoulos, 2001; Mumford *et al.*, 2002; Amabile *et al.*, 2004; Fagan, 2004; Chen, 2006; Pearsall *et al.*, 2008; Magadley and Birdi, 2009). This literature places emphasis on creative leadership which has been closely related to transformational leadership (e.g. Rickards and Moger, 2000). Mumford *et al.* (2007) argue that leading for creativity requires specific capacities (e.g. social skills) and capabilities (e.g. ability to define problems), while Sternberg *et al.* (2003) posit three behaviours of creative leaders: accepting existing practices, challenging existing practices, and synthesising existing practices.

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Despite this wealth of studies on creativity in the traditional literature, creativity in the VPT context is scant (Gilson *et al.*, 2015). For instance, Ocker (2005) offers a set of enhancers (e.g. stimulating members) of and inhibitors (e.g. dominance) to VPT creativity in a study of asynchronous VPTs in a university setting. In a similar vein, Chang (2011) discusses how anonymity and structure affect creativity in VPTs, while Chamakiotis *et al.* (2013) explain how individual-, team- and technology-related factors influence creativity in VPTs. Kratzer *et al.* (2006) argue that the higher the variance of geographical dispersion and computer mediation, the more creative the VPT performance in terms of generation of ideas, application, and methods. Research is also available on the effects of member demographic variations on VPT creativity (Martins and Shalley, 2011); and brainstorming in VPTs (Dzindolet *et al.*, 2012). What is more, Nemiro (2002) identifies the following four stages of the creative process in VPTs: idea generation, development, finalisation/closure, and evaluation. She moreover finds that idea generation is best accomplished in a F2F setting, whereas the development and finalisation in technology-mediated environments. The creative process in VPTs has two distinguishing factors that make it different to the creative process in traditional teams: increased archival capabilities and access to a widened creative pool of participants (Nemiro, 2002).

Research Gap and Research Question

It follows that although these factors are important, we do not know how they play out as the creative process evolves. Therefore, with an increasing number of projects seeking creativity and being organised virtually (Schmidt *et al.* 2001; Shachaf, 2008; Yeow, 2014)—and given that leadership is strongly associated with the creativity (e.g. Amabile *et al.*, 2004)—we take the position in this paper that leadership and its impact on creativity should be examined within the VPT creative process. Thus, we seek to address the following research question:

How can leadership be exercised to support the different stages of the creative process within the VPT context?

Delta: An Industry-Academia Collaboration for Creative Designs

A case study approach was selected in view of our research question, allowing us to gain in-depth understanding of a single setting by adopting multiple data collection methods. We took the case of an Industry-Academia collaborative project, Delta (a pseudonym), which involved two global companies and four academic institutions. Delta was set up with the aim of promoting creative product designs in a dispersed team environment, which would then lead to commercialisation of selected prototypes (as reported later, four prototypes were selected for commercialisation).

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Delta involved a mixture of (a) professionals from the two companies and (b) academics and students with some work experience (through placements or prior employment) from the four institutions. The two companies are global manufacturers of home appliances and sanitary ware products, keen on working with academic institutions in order to capitalise on students' creativity and produce marketable prototypes. Students chose to join Delta on a voluntary basis in order to enhance their portfolios and benefit from gaining project management experience in a global setting.

In 2010, six VPTs were formed, each with 7-8 culturally and organisationally diverse mechanical engineers (MEs) and industrial designers (IDs), dispersed across four European countries (see Table 1 for participants' details).

Table 1 to be inserted here.

The project was broken down to four phases which collectively entailed the product design process: market research, conceptual design, design finalisation, and final workshop. Delta organisers agreed with scholars in the field of product design (e.g. Howard *et al.*, 2008) that the product design process constitutes an example of a creative process. Thus, in what follows we will be using these phases, which correspond to those of the creative process as identified in the literature, to address our research question. Upon completion of each phase, the two companies reviewed progress and provided feedback.

Each team had a designated, appointed, coach. The coach was an experienced academic or professional with prior experience in the organisation of virtual, company-sponsored projects. The coaches' role was to guide the teams, but with minimum input whilst encouraging autonomy, creativity and learning among team members:

"We are like an 'overlooker', of the whole project. So we see how they are going; looking at monitoring their emails and stuff; and if you think that they're going a little bit off track, then just try to bring them back [...] but without having lot of input" (Ronald, coach, team F).

Of the six VPTs, three were tasked with designing a kitchen utensil for the adult male consumer, and the other three with a house cleaning system. According to the project agreement, selected outputs would be commercially exploited by the two companies. The teams worked virtually for five months between February and June (Phases 1-3 of the project) and met in a F2F environment during the last week (Phase 4 of the project). In Phases 1-3, VPT members employed the following information and

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communication technologies (ICTs) to work with their geographically dispersed teammates: a video-conferencing system (VCS), Huddle, Skype, and email. The VCS sessions, though essential, were limited to two one-hour-long sessions per week for each team.

Data Collection and Analysis

In this section, we describe the methods adopted to collect data: focus groups and individual interviews (primary methods), observations and review of project documentation and project reviews (complementary methods; see Table 2).

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We aimed to interview as many participants as possible in order to get a rich picture of the VPTs under study. Data collection began with the completion of Phase 1 of the design process. Initially two focus groups were organised with coaches and members and aimed to gain insight on the level of creativity experienced in this phase. On completion of Phases 2 and 3, individual interviews were conducted with both members and coaches in an effort to follow up on issues that had emerged in the focus groups and to gather the participants' views as the project happened and to understand creativity and leadership behaviours that came into play in each phase. In Phase 4, individual interviews were conducted with coaches who were also able to evaluate how their VPTs performed overall. Most members were interviewed in focus groups with their teammates, but there were also a few that were interviewed individually. Focus groups were at that stage preferred because we wanted to capture the VPTs' collective voices at that last stage. The participants who had not been interviewed previously were also asked to reflect on the earlier phases of the project, while those who had been interviewed at the end of each phase were asked follow-up questions in Phase 4.

Interviews and focus groups were broken down into the following sections, each involving a different set of open-ended questions: (a) background information of the participant(s) (this section appeared the first time each participant was interviewed); (b) summary of what happened during the present phase and how it related to the previous phase, when appropriate, and discussion of the virtual aspects of the work carried out; (c) creativity (here, the participants shared their experiences around the creativity of each phase); and (d) leadership and management issues. Some of the questions were: 'do you have any examples of team creativity during this phase?',

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'how did the leader influence creativity in this phase?' and 'what do you think was the role of virtuality for creativity?'

Focus groups and individual interviews constituted the primary data collection method. They were semi-structured and were conducted via a video-link or, where appropriate, F2F. These were recorded and later on transcribed. The ensuing data were then inserted into QSR NVivo 10, a software program for qualitative data organisation. Our coding process was influenced by Braun and Clarke's (2006) approach to thematic analysis. We initially organised our data per phase of the design process and distinguished between coaches and members. We conducted top-down thematic coding using 'creativity' and 'leadership' as our umbrella (top-level) codes for each phase, and we then identified themes relevant to our umbrella codes. Example themes include 'emergent leadership', 'heterogeneity', and 'shared leadership'. This was an iterative process until the final themes had emerged.

We also conducted non-participant observations during Phases 1, 2 and 4, mainly for familiarisation purposes and for improving understanding of the Delta context. Thus, these methods played a complementary role to the interview dataset. A VCS session was observed in Phase 1 for introduction to the teams as well as for familiarisation purposes with the ICTs used. In Phase 2, another VCS session was observed as well as a review process that involved the teams and the companies. Phase 4, in which the VPTs worked in a F2F environment, was observed in person throughout (one week-long) as the participants were putting together and finalising their designs. Photographic evidence was also collected during Phase 4, though this cannot be shared for reasons of confidentiality.

Finally, we reviewed relevant project documentation to improve understanding of the Delta context overall (i.e. general guidelines, information on Delta and the companies involved, design briefs and aims) and to understand the levels of creativity attained as the design process evolved (i.e. reviews and evaluation forms on completion of each phase).

Observation and other data gathered from the above documents were also inserted into NVivo and coded using the process outlined earlier.

Findings

In what follows, we present the aims and expectations of each phase, followed by an analysis of creativity and leadership behaviours found in our dataset. As mentioned in the earlier section, Phases 1-3 were completely virtual, whilst Phase 4 was based on F2F communication.

Phase 1: Market Research

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At the beginning of Phase 1, all randomly selected members met virtually using VCS. Phase 1 was organised and managed virtually and the teams relied on different ICTs for their collaboration. Phase 1 was focused on market research and the development of functional requirements for their designs:

“The general idea [of phase 1] is to ...get the research done on the company, so you understand the company; and basically create the general idea of the product. The end result of this should be the vision, and the design problem on which [team members] are going to continue on later” (Miro, coach, team C).

The challenges of virtual work became evident early on:

“Communication is difficult. [...] VCS is one of the difficulties. Skype and all these things make it easier for us but virtual interaction as in you don’t literally have a person in front of you so if you really want to get a point across you can’t really do it” (Abhishek, member, team A).

Despite the artificial character of these ICTs, there was consensus among both coaches and members that the outcomes of this phase played a key role in the extent of creativity that would emerge at the following stages:

“We did a survey which showed that a lot of people would prefer to pay extra money for an environmentally friendly product. So we decided to design a whole new system. We took this decision because in 50 years the [house cleaning] system had not changed at all, there had to be done something about it” (Nace, coach, team D).

During this phase, and as members were unfamiliar with each other, the coaches took initiatives to break the ice, promote trust, and provide direction and structure of team activities. Despite taking on these leadership roles, there was a shared understanding among coaches and members that the coaches should not play a central role in the team activities:

“After the first two or three, maybe four, meetings our coach did not have a very active role, I don’t think. Not crucial” (Gael, member, team E).

Therefore, rather than assuming a dominant leadership role during the design process, the coaches encouraged their teams to be autonomous in a way that would promote learning and which would enhance the teams’ levels of responsibility and creativity:

“They manage their own group, they are in charge of the whole group dynamics themselves; so we don’t really tell them, we don’t even choose [...] for us it’s just a matter of telling them if they’re doing something bad [...] give them advice and it’s up to them to decide what they want to do with that advice” (Ronald, coach, team F).

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It follows that in Phase 1, the assigned leaders played a key role in helping their team members to focus on the expected tasks as well as to undertake responsibility for doing so themselves. Creativity here was found to be inhibited by ICT characteristics.

Phase 2: Conceptual Design

In Phase 2, *“the aim [was] to propose a technical concept, which is proven to be fulfilling the needs, marketable, solves the design problem, meets the requirements of the different stakeholders, etc.”* (Kristof, coach, team A).

Company members highlighted that this phase was all about creativity and that the morphological chart was recommended to the teams as a way to unleash their creative potential:

“This is THE creative phase of the design process. In this phase the functional requirements, that were developed at the end of the fuzzy front end, are operationalised using one of the creativity methods. We propose the method of the morphological chart” (Delta document extract).

Expectations with regards to creativity at this stage peaked, as the teams had to maximise the quantity of ideas so that they could have a pool to select from at the next stage. The main challenge was to think outside the box and to come up with a concept that will have the potential to work.

There was consensus among coaches and companies that all teams developed highly creative ideas that can lead to new, marketable products. The coaches were seen as facilitating the creative process in these cases:

“I think it’s a good thing that the coach is just giving guidance but doesn’t have a leading role at all. It would be say, okay, you’re going wrong this way, because I think this, but it’s my opinion, and maybe you are forgetting this. So that was really good that the coach is not interfering in the power dispute” (Jorge, member, team C).

The coaches encouraged their teams to have leaders, either by having one person lead the team throughout the different phases or by adopting a shared leadership approach:

“It’s important to have a coordinator if you don’t want to call him a leader. And if the person is doing pretty well, then I think s/he should be given the chance. Because what I propose is that instead of having one leader for the whole project, that we have one leader for the first phase, one for the second, or you have one leader for the first phase and if everyone is happy with him/her then s/he can be the leader for the rest or for the second phase” (Ronald, coach, team F).

As a result, the case of emergent leadership was posited in some teams:

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"[...] in Phase 2, there were a couple of members who have been very active and you can actually see the emails coming out, I mean being sent every day about progress, what needs to be done and what has to be done. You know, these kind of things. So at least some of them are trying to coordinate the whole thing. But in a way it's quite good. Because we need someone at least to do that" (Petar, coach, team B).

Looking more closely at the individuals who emerged as leaders in this phase, it became clear that IDs were those who drove the creative process within this phase, and put a lot of effort in even training others on how to be creative in their attempt to be as creative as they could be:

"Yes, here the creativity really kicked in. And I would say that the IDs were the ones leading with the creativity. They brought a lot of new tools that the engineers are not familiar with [...] Most of the solutions were driven by the initial design. So how do we want it to look? And then when we know how we want it to look; how are we actually going to achieve that from taking place" (Miro, coach, team C).

Accordingly, Phase 2 of the project showed evidence of conceptual creativity (e.g. Howard *et al.*, 2008). The coaches were found to facilitate this process whilst leadership was also exercised by discipline-specific members; the IDs in particular. In this phase, therefore, the effects of different disciplines started to become evident.

Phase 3: Design Finalisation

Phase 3 was focused on detailed aspects of design. First, the teams were tasked with the production of computer-aided design (CAD) models and then with prototyping towards the end of the phase. The expectations in this phase were high and the teams had to show an in-depth understanding of the mechanics of their products by providing optimal solutions.

The teams in Phase 3 were largely guided by the companies' feedback from the previous phase, which made them narrow down their priorities:

"Concept 2 seems to be very interesting as there is a lot of creativity and the idea seems quite innovative. From Concept 2 the idea of having a little generator which again goes into a charger that charges a battery can increase the complexity of the design, so can you think of any other methods of fulfilling the power supply?" (2nd project review extract for team F).

Although the teams were not expected to be creative in terms of generating concept-related ideas, they had to show responsive creativity for problem-solving purposes, as problems occurred while teams were moving from CAD models to prototypes.

"So the creativity maybe was more before [Phase 2], but still I think you have to have a fair amount of creativity to actually put everything together [...] We are now at the

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point that we are going to face many problems and be creative to seek solutions, let's say 'I can make this but it might weigh 20 kilograms, which is not good'. After that point there will again be no room for creativity, after the problems are solved" (Miro, coach, team C).

Here, coaches continued to play a supportive role by guiding the teams to identify better solutions to the emerged problems:

"He gave us a few ideas and pointers.... in one of our [VCS] meetings, he pointed out things about the blades being exposed and how you could have a better solution that would allow us to protect the blades so a person using it wouldn't cut themselves" (Abhishek, member, team A).

However, the coaches' input was limited and participants viewed coaches as 'outside assistants' in this phase. Further, a significant amount of leadership was exercised from within. For instance, Val took the liberty to email everyone in his team and beyond to let them know about an emergent problem and inquire about possible solutions with coaches and others in the company involved until the problem was solved. Similarly, Kevin, who had emerged as a leader in his team earlier, retained his emergent leadership position in view of the general absence of a formally assigned leader within his team. In the quote below, Kevin explains that his emergence and tenure as a leader was driven by a felt need, by his team, for someone who would be responsible for the team's communications between the VCS sessions:

"I don't know that the others didn't really know how to deal with leadership. So I just stepped in. [The previous leader] didn't try to keep in touch in between the conferences. It's also very important to stay in touch during the week on Skype and then by other means, so you really know what others are doing. So I just did that instead of them and, after Phase 2, we didn't try and find a team leader from [Country B]. I just stayed as a team leader. But everyone was fine; we didn't actually discuss any of this, because it just worked like that" (Kevin, member, team D).

What, however, became more evident in this phase was a clear shift in leadership from IDs to MEs. Following the IDs' leadership in the previous phase, in Phase 3, the MEs in the project took over and started to model up the mechanical aspects of the agreed concepts:

"The first two phases [1&2] were mostly oriented towards design engineers, because it was to do with using, you know, market research and modelling and aesthetics and how you'd have a concept with good aesthetics to present and all that. In Phase 3, our leader shifted towards engineering and hence that would mean that okay, now [the members] that were concentrating on those aspects of physical aspects of the concepts would now say okay no this is it. You [the MEs] take over. That is what happening at the moment" (Abhishek, member, team A).

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Similarly to Phase 2, in this phase it is evident that leadership is exercised by a discipline-specific group (this time, the MEs) and not by any single individual. Here, creativity is responsive in nature (Unsworth, 2001), and coaches appear to be sidelined within this phase with members taking on leadership responsibility themselves.

Phase 4: Final Workshop

The aim of Phase 4 was for each team to assemble and present their prototypes to their corporate sponsors. This took place in a collocated environment in Country C, which gave team members the opportunity to meet for the first time F2F. This phase lasted for one week (previous phases lasted for one month) and members and coaches worked on Phase 4 intensively on a full-time basis, as opposed to the previous phases, in which they all had other commitments as well.

Everyone showed enthusiasm about finally being able to work in a F2F manner as well as socialise with their teammates:

“Because it’s not the same in the internet, you know just how they can... how the person feels... it is different when you speak to a person and you don’t see, you know, his face, his reactions to different stuff; and these first three phases were only, you know, just work. We didn’t have fun. Here in Ljubljana, we also go out; speak; get drinks together; so it’s more fun” (Laban, member, team E).

The coaches’ expectations for creativity were low in this phase:

“There’s no space for significant creativity [in Phase 4]; they just have to assemble the prototype and to solve the problems that they hadn’t considered before” (Petar, coach, team B).

However, members considered that Phase 4 was a creative one. This was largely due to the fact that the members from different disciplines came together F2F. In working in this cross-disciplinary approach, unanticipated problems emerged, thus creativity here was responsive too, in that the teams had to resolve problems which were unexpectedly brought to light:

“This last phase was also creative because a lot of problems just emerged, like immediately the problem that we couldn’t actually think of before, because they were part of some other stuff, so we came up to these problems and they required a lot of creativity to, you know, to solve them” (Pablo, member, team B).

Given that in this phase the teams were expected to both assemble the prototypes and also to prepare their final presentations, a co-leadership style became evident, whereby two or more individuals would take the lead simultaneously as a way for working on the different tasks to be done. What we found is that MEs took the lead

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in addressing issues of mechanical nature and IDs in dealing with the aesthetics and also in putting the final presentations together:

“As mechanical guys, we took care of the prototype building work, working on moulds, electrical components and basically making a prototype we had decided to work on. The designers mainly worked on the stall, the poster and publicity material/posters/leaflets to exhibit on the final day [...] they took responsibility for all the design” (Zagor, member, team C).

With most of the work done by the teams, the coaches' role in Phase 4 was to coordinate some of the different activities performed by the teams. At the end of Phase 4, the companies were pleased with the outcomes. They recognised that, overall, the design outputs were highly creative and decided that four (out of the six presented) prototypes would be developed further. As a company assessor put it,

“It [was] one of the most successful years, as 4 prototypes are actually being developed further and will be patented in the near future” (F2F observation extract).

Overall, Phase 4 shows evidence of shared leadership where members from different disciplines take on leadership roles simultaneously for different parts of the task at hand; we call this co-leadership. The coaches do not appear to play any role in this phase.

Discussion

Our study examined how leadership can support creativity at the different stages of the creative process in VPTs. In doing so, we expand research in the areas of creativity, leadership and VPTs. Extant literature has been limited to factors influencing creativity in predominantly mono-cultural, asynchronous VPTs in educational environments (e.g. Ocker, 2005; Chang, 2011), neglecting how these factors play out as the project evolves. Even though the different phases of the creative process in VPTs have been recognised (Nemiro, 2002), no previous study has looked at how creativity develops or how it can be supported within these different phases. Findings revealed that creativity was evident in all phases and that it took different forms, varying from new ideas for novel products and modifications to existing (tried and tested) products in the marketplace (Phases 1 and 2) through to creativity in terms of how the selected ideas were presented, and also the responsive creativity required to solve unanticipated problems (Phases 3 and 4). These findings highlight the heterogeneous character of creativity in virtual work, arguing that creativity is not a one-off activity, but rather a phenomenon which is constantly present and equally important as the product design process evolves, and which comes in diverse shapes within the various phases of the process. These findings add to the different types of creativity identified in the literature, for example, by explaining where Unsworth's (2001) responsive

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creativity is positioned in the creative process, whilst also informing the literature on design creativity which argues that very little is known about creative behaviour in the later stages of the design process (Howard *et al.*, 2008; Snider *et al.*, 2013).

VPTs are characterised by discontinuities (Chudoba *et al.*, 2005; Manheim-Watson *et al.*, 2012) due to their team members' diversity and dispersion. These were challenges that were experienced by the VPTs in our study where non-F2F communication took place during the first three phases of the project. Though, early on, participants voiced concerns that it would be harder to be creative while working virtually, they managed to develop creativity and meet the project requirements. This was formally confirmed by the assessment carried out by the company assessors. Central to this were the different ICTs used for different creative purpose, as well as the role played by the leaders.

On one hand, synchronous ICTs (e.g. VCS) were seen as an opportunity for creativity at the team level, as this was the only time the teams could formally come together in Phases 1-3. Asynchronous ICTs (e.g. Huddle) were also found to enhance creativity as they enabled members to be creative irrespective of others' availability. However, ICTs were also found to constrain creative behaviour regardless of their level of synchronicity, predominantly due to their artificiality which inhibited creativity. On the other hand, it was shown that, when managed properly, creativity could flourish in the virtual environment. Two types of leaders were evident. In the first group, there were those that were formally appointed at the start of the project and those that emerged during the project. In the first group, we position the coaches who had prior experience in working with similar projects. They acted as facilitators and their contribution as leaders was paramount in the first phase of the process by motivating and guiding their teams. Though they remained present throughout the project, they became less active in the team activities as the project evolved.

In the second group of leaders, we identify those that emerged from within the teams during the various phases. Within this group, two primary skills were found to dominate these leaders' behaviour: on the one hand, organisational skills became important for promoting coordination, team communication and assigning roles or setting deadlines. On the other hand, technical skills became essential for creativity development. In the study, Phase 2 was led by the IDs who, due to their training, were more familiar with creativity techniques and therefore acted as leaders for that phase. Through their expertise and enthusiasm, they actively participated in the team activities, guiding and also training others on how to maximise their creativity and meet specific goals. Phase 3 saw MEs emerge as leaders; they took over from the IDs, as the priority for the teams in that phase was to solve problems of mechanical nature. Following from this shared leadership model, whereby leadership positions were found to shift from phase to phase, we also posited a co-leadership model whereby

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two or more members from each team acted as leaders simultaneously. This was the case in Phase 4, whereby MEs and IDs were found to co-lead, with the former being responsible for modelling up the mechanical aspects of the prototypes and the latter finalising the actual shapes. It is our position that this co-leadership approach was an effective one because, by this phase, the members were well aware of each other's capabilities and were more comfortable in splitting the work up to different subgroups.

Accordingly, our study furthers existing literature by corroborating the supportive role of leadership for creativity (e.g. Amabile *et al.*, 2004) and by explaining how creative leadership (Mumford *et al.*, 2007; Rickards and Moger, 2000; Sternberg *et al.* 2003) can take place in the virtual environment. For instance, Mumford *et al.* (2007) discuss the capacities and capabilities that are generally useful to leaders who support creativity. Our study adds to these discussions by unpacking the specific skills that matter for each phase of the creative process in VPTs. The skills we have unpacked here were: facilitation, organisational and technical skills. We also add to the literature on emergent (e.g. Carte *et al.*, 2006; Yoo and Alavi, 2004) and shared (Hoch and Kozlowski, 2014) leadership in VPTs by revealing that different leaders might emerge at the different phases of the process (i.e. shared leadership) or within the same phase (i.e. co-leadership). Our findings add to Hoch and Kozlowski's (2014) study by explaining how shared leadership can be exercised to enhance creativity in the virtual environment, highlighting that different leadership behaviours are necessary in order for the different expectations in terms of creativity in each phase to be accommodated in the VPT creative process. In other words, our study reveals that rather than the individual themselves, it is the different leadership skills that matter. These skills can be exercised by different individuals, or even groups of individuals, as it was the case in our study. As the creative process evolves, leadership is a heterogeneous activity which, like creativity, takes different forms during the course of the creative process.

Our study advances understanding in a number of fields, including scholars in the fields of leadership, creativity, and VPTs as well as practitioners and managers working in those areas. Though context-specific, our study has value for other types of teams in which leading for creativity is important, including project teams (Yeow, 2014), teams in the creative industry, in design, and in new product development (Rickards and Moger, 2000), as well as in online environments different to VPTs, in which leadership matters, e.g. in online communities, in which leadership behaviour remains largely unexplored (Panteli, 2016).

Limitations and Implications

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Reflecting on the study, its limitations should be acknowledged. First, the single case study approach in the context selected here as well as in the product design industry may mean that the creative process may be dissimilar in other contexts or industries. Also, interviewing as a research method has limitations, for example, of memory bias. Likewise, the VPTs under study had minimal temporal dispersion given all members were Europe-based. Furthermore, the study did not examine whether creativity would have been different if the product design process took place in a collocated setting throughout. Future research could address these and other issues, through comparative studies between virtual and collocated creative processes, additional studies in other contexts, industries, and other types of creative teams and online environments, as well as studies of VPTs with significant temporal dispersion. Researchers could also adopt research methods (e.g. quantitative) which could lead to statistically generalisable results.

Finally, organisations increasingly rely on dispersed teams for their activities, be they product designs (e.g. Schmidt *et al.*, 2001) or of any other project-based character (e.g. Yeow, 2014), and therefore our findings have practical significance. To emerge as a leader who supports creativity in a VPT setting, one has to be able to recognise the different types of creativity necessary at the different phases of the process, and have relevant expertise and ability to guide and train others accordingly. It is important that leadership be shared in a way that each phase of the creative process is led (or co-led) by those who have the required knowledge. Thus, VPTs offer managers an opportunity to capitalise on a pool of heterogeneous members who can contribute different types of creativity. Given these different types, managers should be open and allow for leaders to emerge, who will accommodate the different creativity-related needs that are expected within the different phases.

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References

- Amabile, T.M. (1983), 'The social psychology of creativity: A componential conceptualization', *Journal of Personality and Social Psychology* 45, 2, 357-376.
- Amabile, T.M. (1988), 'A model of creativity and innovation in organizations', *Research in Organizational Behavior* 10, 1, 123-167.
- Amabile, T.M., E.A. Schatzel, G.B. Moneta and S.J. Kramer (2004), 'Leader behaviors and the work environment for creativity: Perceived leader support', *The Leadership Quarterly* 15, 1, 5-32.

Leading the Creative Process: The Case of Virtual Product Design

- Andriopoulos, C. (2001), 'Determinants of Organisational Creativity: A Literature Review', *Management Decision* 39, 10, 834-841.
- Balthazard, P.A., D.A. Waldman and J.E. Warren (2009), 'Predictors of the emergence of transformational leadership in virtual decision teams', *The Leadership Quarterly* 20, 5, 651-663.
- Baralou, E. and P. McInnes (2013), 'Emotions and the spatialisation of social relations in text-based computer-mediated communication', *New Technology, Work and Employment* 28, 2, 160-175.
- Bell, B.S. and S.W.J. Kozlowski (2002), 'A Typology of Virtual Teams: Implications for Effective Leadership', *Group & Organization Management* 27, 1, 14-49.
- Bharadwaj, S. and A. Menon (2000), 'Making innovation happen in organizations: Individual creativity mechanisms, Organizational creativity mechanisms or both?', *Journal of Product Innovation Management* 17, 6, 424-434.
- Braun, V. and V. Clarke (2006). 'Using thematic analysis in psychology', *Qualitative Research in Psychology* 3, 2, 77-101.
- Carte, T.A., L. Chidambaram and A. Becker (2006), 'Emergent leadership in self-managed virtual teams', *Group Decision and Negotiation* 15, 4, 323-343.
- Cascio, W.F. (2000), 'Managing a Virtual Workplace', *The Academy of Management Executive (1993)* 14, 3, 81-90.
- Chamakiotis, P., E.A. Dekoninck and N. Panteli (2013), 'Factors Influencing Creativity in Virtual Design Teams: An Interplay between Technology, Teams and Individuals', *Creativity and Innovation Management* 22, 3, 265-279.
- Chang, C.M. (2011), 'New organizational designs for promoting creativity: A case study of virtual teams with anonymity and structured interactions', *Journal of Engineering and Technology Management* 28, 4, 268-282.
- Chen, M.H. (2006), 'Understanding the benefits and detriments of conflict on team creativity process', *Creativity and Innovation Management* 15, 1, 105-116.
- Chudoba, K.M., E. Wynn, M. Lu and M.B. Watson-Manheim (2005), 'How virtual are we? Measuring virtuality in a global organization', *Information Systems Journal* 15, 279-306.
- Dzindolet, M.T., P.B. Paulus and C. Glazer (2012), 'Brainstorming in Virtual Teams', in C. Silva (eds), *Online Research Methods in Urban and Planning Studies: Design and Outcomes* (Hershey, PA: IGI Global), pp. 138-156.
- Fagan, M.H. (2004), 'The influence of creative style and climate on software development team creativity: An exploratory study', *Journal of Computer Information Systems* 44, 3, 73-80.
- Forest, J. and M. Faucheux (2011), 'Stimulating Creative Rationality to Stimulate Innovation', *Creativity and Innovation Management* 20, 3, 207-212.

Leading the Creative Process: The Case of Virtual Product Design

- Gilson, L.L., M.T. Maynard, N.C. Jones Young, M. Vartiainen and M. Hakonen (2015), 'Virtual Teams Research: 10 Years, 10 Themes, and 10 Opportunities', *Journal of Management* 41, 5, 1313-1337.
- Guilford, J.P. (1950), 'Creativity', *American Psychologist* 5, 9, 444-454.
- Hoch, J.E. and S.W.J. Kozlowski (2014), 'Leading virtual teams: Hierarchical leadership, structural supports, and shared team leadership', *Journal of Applied Psychology* 99, 3, 390-403.
- Holtgrewe, U. (2014), 'New new technologies: The future and the present of work in Information and Communication Technology', *New Technology, Work and Employment* 29, 1, 9-24.
- Howard, T.J., S.J. Culley and E.A. Dekoninck (2008), 'Describing the creative design process by the integration of engineering design and cognitive psychology literature', *Design Studies* 29, 2, 160-180.
- Huffaker, D. (2010), 'Dimensions of leadership and social influence in online communities', *Human Communication Research* 36, 4, 593-617.
- Jarvenpaa, S.L. and D.E. Leidner (1999), 'Communication and trust in global virtual teams', *Organization Science* 10, 6, 791-815.
- Johnson, S.L., H. Safadi, H. and S. Faraj, S. (2015), 'The Emergence of Online Community Leadership', *Information Systems Research* 26, 1, 165-187.
- Kayworth, T. and D. Leidner, (2000), 'The Global Virtual Manager: A Prescription for Success', *European Management Journal* 18, 2, 183-194.
- Koestler, A. (1964), *The act of creation* (London, UK: Hutchinson).
- Kratzer, J., R.T.A.J. Leenders and J.M.L. Van Engelen (2006), 'Managing creative team performance in virtual environments: an empirical study in 44 R&D teams', *Technovation* 26, 1, 42-49.
- Lubart, T.I. (2001), 'Models of the creative process: Past, present and future', *Creativity Research Journal* 13, 3, 295-308.
- Magadley, W. and K. Birdi (2009), 'Innovation labs: an examination into the use of physical spaces to enhance organizational creativity', *Creativity and Innovation Management* 18, 4, 315-325.
- Martins, L.L. and C.E. Shalley (2011), 'Creativity in virtual work: effects of demographic differences', *Small Group Research* 42, 5, 536-561.
- Mumford, M.D., G.M. Scott, B. Gaddis, and J.M. Strange (2002), 'Leading creative people: Orchestrating expertise and relationships', *The Leadership Quarterly* 13, 6, 705-750.
- Mumford, M.D., S.T. Hunter, D.L. Eubanks, K.E. Bedell and S.T. Murphy (2007), 'Developing leaders for creative efforts: A domain-based approach to leadership development', *Human Resource Management Review*, 17, 4, 402-417.

Leading the Creative Process: The Case of Virtual Product Design

- Nemiro, J.E. (2002), 'The Creative Process in Virtual Teams', *Creativity Research Journal* 14, 1, 69-83.
- Ocker, R.J. (2005), 'Influences on Creativity in Asynchronous Virtual Teams: A Qualitative Analysis of Experimental Teams', *IEEE Transactions on Professional Communication* 48, 1, 22-39.
- Panteli, N. (2016), 'On leaders' presence: interactions and influences within online communities', *Behaviour & Information Technology* 35, 6, 490-499.
- Pearsall, M.J., A.P.J. Ellis and J.M. Evans (2008), 'Unlocking the effects of gender faultlines on team creativity: Is activation the key?' *Journal of Applied Psychology* 93, 1, 225-234.
- Purvanova, R.K. and J.E. Bono (2009), 'Transformational leadership in context: Face-to-face and virtual teams', *The Leadership Quarterly* 20, 3, 343-357.
- Richards, R. (1999), 'Four Ps of creativity', in M.A. Runco and S.R. Pritzker (eds), *Encyclopedia of Creativity* (New York, NY: Academic Press), 733-742.
- Rickards, T. and Moger, S. (2000), 'Creative leadership processes in project team development: An alternative to Tuckman's Stage Model', *British Journal of Management* 11, 4, 273-283.
- Ruggieri, S. (2009), 'Leadership in virtual teams: A comparison of transformational and transactional leaders', *Social Behavior and Personality: an international journal* 37, 8, 1017-1021.
- Smolensky, E.D. and B.H. Kleiner (1995), 'How to train people to think more creatively', *Management Development Review* 8, 6, 28-33.
- Schmidt, J.B., M.M. Montoya-Weiss and A.P. Massey (2001), 'New Product Development Decision-Making Effectiveness: Comparing Individuals, Face-To-Face Teams, and Virtual Teams', *Decision sciences* 32, 4, 575-600.
- Shachaf, P. (2008), 'Cultural diversity and information and communication technology impacts on global virtual teams: An exploratory study', *Information & Management* 45, 2, 131-142.
- Snider, C.M., S.J. Culley and E.A. Dekoninck (2013), 'Analysing creative behaviour in the later stage design process', *Design Studies* 34, 5, 543-574.
- Sternberg, R.J., J.C. Kaufman and J.E. Pretz (2003), 'A propulsion model of creative leadership', *The Leadership Quarterly* 14, 4, 455-473.
- Torrance, E.P. (1974), *Torrance Tests of Creative Thinking*. Scholastic Testing Service (Lexington, KY: Ginn).
- Unsworth, K. (2001), 'Unpacking creativity', *Academy of Management Review* 26, 2, 289-297.
- Warr, A. and E. O'Neill (2005), 'Understanding design as a social creative process', in Proceedings of the 5th Conference on Creativity and Cognition, London, UK (New York, NY: ACM), 119-127.

Leading the Creative Process: The Case of Virtual Product Design

- Watson-Manheim, M.B., K.M. Chudoba and K. Crowston (2012), 'Perceived discontinuities and constructed continuities in virtual work', *Information Systems Journal* 22, 1, 29-52.
- Yeow, J. (2014), 'Boundary management in an ICT-enabled project-based organising context', *New Technology, Work and Employment* 29, 3, 237-252.
- Yoo, Y. and M. Alavi (2004), 'Emergent leadership in virtual teams: what do emergent leaders do?', *Information and Organization* 14, 1, 27-58.
- Zander, L., P. Zetting and K. Mäkelä (2013), 'Leading global virtual teams to success', *Organizational Dynamics* 42, 3, 228-237.

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Table 1. The participating VPTs

	Team A	Team B	Team C	Team D	Team E	Team F
Assigned task	Kitchen utensil for males	Kitchen utensil for males	Kitchen utensil for males	House cleaning system	House cleaning system	House cleaning system
Coaches' location	Country A	Country B	Country C	Country D	Country B	Country C
Members' gender	6 male 2 female	8 male 1 female	6 male 2 female	7 male 1 female	6 male 2 female	6 male 2 female
Native languages spoken	Croatian, Hindi, Hungarian, Slovene	Croatian, Hungarian, Slovene	Croatian, Hungarian, Slovene, Spanish	Croatian, Hungarian, Slovene	Croatian, Hungarian, Persian, Slovene	Croatian, Hindi, Hungarian, Slovene
Members' geographical dispersion**	3-1-1-3	3-2-0-4	2-1-2-3	2-2-0-4	2-2-1-3	2-1-2-3
Members' age group	20-30	20-50	20-25	20-30	20-30	20-30
Members' disciplines	5 MEs*** 3 IDs****	6 MEs 3 IDs	5 MEs 3 IDs	6 MEs 2 IDs	5 MEs 3 IDs	5 MEs 3 IDs
Team Size	8 members	9 members	8 members	8 members	8 members	8 members

*Members in this table include coaches

** Country A – Country B – Country C – Country D

MEs = mechanical engineers, *IDs = industrial designers

Table 2. Data collection

		Phases of the product design process			
		Phase 1: Market research	Phase 2: Conceptual design	Phase 3: Design finalisation	Phase 4: Final workshop
Data collection methods	Interviews (individual/ focus groups)	2 coaches 4 members	3 coaches 3 members	2 coaches 3 members	3 coaches 22 members
	Observations	Observations of VCS sessions	Observations of VCS sessions	N/A	Week-long direct observations
	Review of materials/ documents	Project outline materials Phase 1 project reviews	Phase 2 project reviews	Phase 3 project reviews	Final evaluation forms