

CREATIVITY IN VIRTUAL DESIGN TEAMS

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1. Introduction

Creativity constitutes one of the most significant skills needed throughout the product development process [MacGregor and Torre-Coronas 2007]. In the design literature, creativity is seen as associated with the outcome (hence, creative product), the individual (i.e. the designer) and the process (i.e. creative process). It has also been argued that teams may be more creative compared to the individual in isolation and this is why teamwork is often the vehicle employed by companies seeking to enhance creativity [Stempfle and Badke-Schaub 2002]. Creativity has been researched within a wide range of contexts, thus constituting a multifaceted and widely explored topic. Some have also stressed the importance the organizational environment plays in enhancing a team's or an individual's creativity [Andriopoulos 2001].

With the advent and increased use of virtual media, however, the design environment has inevitably evolved to a virtual, less structured, and characterized by flattened hierarchies milieu, which brings with it new opportunities and challenges. The term Virtual Team (VT) has become popular in the last decade and refers to collections of dispersed individuals who – within an organizational context and with a defined objective – get together via technology-enabled communication channels [Jarvenpaa and Leidner 1999]. Virtual Design Teams (VDTs) are, by extension, such teams whose objective is to carry out a design(-related) activity. These teams are also referred to as globally distributed/dispersed, technology-enabled, or simply global teams. Considering the above, the emergence of this new working environment calls for re-thinking of the well-tested and -examined practices, applicable to the traditional, physically collocated design environment in order to support and enhance creativity.

The aim of this paper is to conduct an exploratory review on creativity and virtuality in an effort to identify the gaps in the literature and extract directions for future research in the field. The review covers creativity and virtuality in general and in the design context insofar as they have been discussed. Due to the limitations of this paper (i.e. length), the focus of the creativity review is team creativity, virtual teams, and design teams; these are more thoroughly discussed, though the individual and organizational levels are also briefly explored. The paper starts by introducing creativity, as researchers from different disciplines have discussed it, while it then goes into the design and virtuality literatures and focuses on teams. In the penultimate section (section 5), a discussion is initiated, which attempts to situate creativity in the VDT context, while a research agenda for enhancing and supporting creativity in VDTs is presented (Figure 4).

2. Creativity

One of the most cited authors that have researched creativity from a management perspective is Amabile (1988) who refers to creativity as “*the production of novel and useful ideas*”. As she puts it, creativity is about novel products, services and processes, yet differs from innovation, as the latter involves implementing creative ideas by the individual/team/organization [Amabile 1996]. In the

organizational literature, [Shalley and Gilson 2004], in an effort to label and discuss leadership as a contributing factor to enhancing creativity, make the distinction among the factors associated with creativity, as follows: *individual*, *job* (job characteristics, role expectations and roles, sufficient resources, rewards, supervisory support, external evaluation of work), *team* (social context, group composition), and *organizational* (climate, human resource practices). Accordingly, creativity itself has been looked at at three different levels: the *individual*, the *team*, and the *organizational*; this classification of creativity is the one most widely accepted in the field and therefore this study also explores creativity at these three levels, instead of focusing on other dimensions (such as *job*) as mentioned above. Kallio and Blomberg (2009) also agree with this distinction. Their model (figure 1), though produced to situate organizational creativity within the general discourse on creativity and innovation, helps us understand the three levels of creativity, and also how they influence one another. Interestingly enough, SME (small and medium sized enterprises) seem to focus on individual creativity, as do firms in the financial sector, while large firms on the other hand, as well as organizations in the marketing and sales sector, place more emphasis on organizational creativity [Bharadwaj and Menon 2000]. In design, however, teams are seen as very important, since they represent “*groups of individuals that work together in order to accomplish problems they cannot solve on their own*” [Stempfle and Badke-Schaub 2002]. The present section is structured by discussing the variables that affect creativity at these three different levels, whilst in its last subsection (2.4) paradoxes which have been encountered in managing creativity are discussed.

2.1 Individual Creativity

Amabile (1988) argues that individual creativity provides the basis for organizational creativity and innovation. Individual creativity is closely associated with *divergent thinking*, or else the ability to produce a plethora of different ideas as opposed to a single answer, which might be the outcome of *linear- or convergent-thinking* [Thompson 2003]. It has also been seen as dependant upon *intelligence*, *motivation to innovate*, and *creative skills* [Amabile 1998]. *Fluency*, *flexibility*, *originality*, and *elaboration* are also found to enhance divergent thinking, and thereby individual creativity [Torrance 1974]. In addition to these cognitive abilities, individual creativity has been also associated with *personal traits*. Though it is sometimes seen as inherent, the literature suggests that creativity can be taught [Hokanson 2007]. For example, an experiment using the verbal Torrance Test of Creative Thinking (TTCT), a very widely used standardized test of creativity and divergent thinking [Hokanson 2007; Torrance 1974], posited significant differences in exhibiting creative behaviours in comparing students who attended a creativity class and students who did not [Hokanson 2007].

2.2 Team Creativity

Team creativity, which can also be phrased as group creativity, is undeniably influenced by individual creativity of its team members (as also shown in figure 1). It is however also influenced by additional variables, such as team interaction and group characteristics, as it is hereafter discussed. Team interaction for example can lead to more and better ideas [West 1990], while Csikszentmihalyi (1996) even argues that creativity happens not by individuals in isolation, but through interaction. This is because teams are about combining and integrating input from multiple individuals and by so doing create new knowledge and insights, given effective communication is established; the aforementioned authors argue also that the more a team interacts the more likely for an idea to cross-fertilize, which enhances the activity of idea generation in general. Nemiro (2002) also stresses that creativity is not an individual trait, but the outcome of interpersonal interplay within a specific structure. Thus, given the importance of team creativity, Woodman et al. (1993) introduced *group composition*, *group characteristics* and *group processes* as variables affecting creativity at the team level, and following on from this, Ocker (2005) summarized in a well-presented model the team characteristics, which along with the individual characteristics and social influences affect the team interaction and – by extension – the creative team performance.

The team also plays an important role in determining the social influences that affect individual creativity [Woodman et al. 1993]. Successful and creative teamwork relies heavily on the

heterogeneity and diversity (group composition) [Amabile 1998; Woodman et al. 1993]; these are linked to the feelings of trust and belongingness for the team members, which are also highlighted as variables that affect team creativity [Andriopoulos 2001; Woodman et al. 1993]. Those authors have also stressed the importance of leadership in enhancing creativity within a team, which means that the effectiveness and creativity of a team is dependant not only on individual- and team-related factors, but also on organizational factors [Kallio and Blomberg 2009].

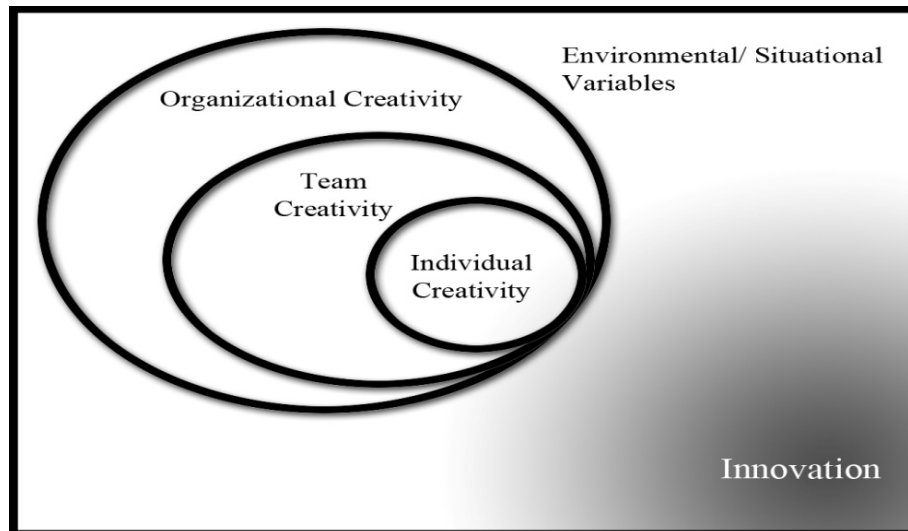


Figure 1. Framework of creativity [after Kallio and Blomberg 2009]

2.3 Organizational Creativity

In investigating organizational creativity, researchers have put in additional dimensions. Organizational creativity is viewed in the literature as the interface between *individual characteristics* (e.g. personal competencies), *group characteristics* (e.g. group dynamics), and *organizational characteristics* (e.g. climate) [Paulus 2000]. Isaksen and Lauer (2002), for instance, outline the following variables in reviewing the literature on how climate influences creativity: *challenge and Involvement, freedom, trust and openness, idea time, playfulness and humour, conflict, idea support, debate, and risk-taking*, while Andriopoulos (2001) in a broader picture synopsised the five major organizational variables that can enhance creativity, as follows: *organizational climate, leadership style, organizational culture, resources and skills, and structure and systems of an organization*. Drawing on Andriopoulos's study, Kallio and Blomberg (2009) added more variables that affect organizational creativity. They argue in their review that the same variables can have a positive or negative effect upon creativity, depending on the attributes of each variable as well as upon environmental/situational influences. For example, in two different organizational climates, the same leadership style could have opposite effects on creativity.

It is important to understand the context within which creativity is studied, as this can determine which creative outcomes can be measured [Mumford et al. 2002; Shalley and Gilson 2004]. The variables that describe the context might include *capabilities, pressures, resources, and socio-technical systems*. [Csikszentmilyai 1996]. Given the context, creativity can be measured not only by the individual and/or the team, but also by stakeholders outside of the team, that is the manager or the customer (e.g. regarding products). Amabile (1996, 1998) also refers to context as a critical factor for creativity, although she does not offer a definition for it. This is why several researchers have identified such contextual factors (e.g. enhancers and inhibitors) as areas for future research. Nonetheless, it is widely acknowledged that organizations which provide the tools, environment and context suitable for creativity to flourish, enjoy greater benefits from creative employees [Andriopoulos 2001]. Another common view among researchers is that expenses for creativity should be seen as an investment, as they result in increased turnover. Innately creative people alone are not sufficient for team and/or organizational creativity to flourish.

2.4 Paradoxes in Creativity

It seems that organizations do not always deal with creativity with success. Andriopoulos (2003), for example, uncovered six paradoxes in managing creativity in three highly creative organizations (table 1), which basically lie in the opposing inherent tendencies between the employee himself/herself and the three organizations studied. Andriopoulos, in his research, labelled these paradoxes, however they have not been investigated in much depth, nor have they been rationalized. Lewis (2000) encourages future researchers to rationalize the paradox, develop a framework that can foster creativity, and interpret anomalies that occur in organizations, or as she puts it, to develop “*understandings more in tune with the paradoxical nature of individuals, groups and organizational life*”. This paper focuses at the team level. VTs will be discussed in the following sections in more detail; these bring diverse manpower together, which means that Paradoxes 3 and 4 (table 1) are likely to be of importance for VDTs, because they present an antiphesis between the diversity of the individuals and the cohesion of the team.

Table 1. 6 Paradoxes in Managing Creativity [Andriopoulos 2003]

Paradox 1	Support employees' passions, but achieve financial goals
Paradox 2	Challenge employees, but build their confidence
Paradox 3	Encourage personal initiative, but maintain a shared vision
Paradox 4	Encourage diversity, but build cohesive work teams
Paradox 5	Learn from the past, but seek new areas of knowledge
Paradox 6	Take incremental risks, but break new grounds

3. Design Teams

The most general description of the design process is “*a human activity, involving communication and creative thought among a group of participants*” [Gennari and Reddy 2000]. According to this description, both teamwork and creativity are seen as inherent elements of design. This view highlights the collaborative nature of design. Similarly, Valkenburg (2000) argues that design projects have become more complex and can no longer be accomplished by individual designers; rather, the new competitive environment requires designers to break down their projects into parallel activities, which has led to concurrent engineering and raises new challenges (e.g. team building) [Valkenburg 2000].

Teamwork in design has increased because of the advanced complexity of the products, services and systems being designed. This points towards the potential of a team to overcome more difficult problems and be more creative than an individual by himself/herself. By introducing the *goal space* (which is quite rigid in design) and the *solution space* (which is quite large considering that more than one solutions might emerge), and by clarifying that often in design solutions are first produced and then evaluated as per the goals, Stempfe and Badke-Schaub (2002) propose the following four operations: *generation, exploration, comparison, selection*, as a means of overcoming design problems.

Along with the four operations presented above, Stempfe and Badke-Schaub (2002) introduced two different types of action often taken in design teams, *content* and *process*. As they argue, these two constructs have been also termed as *task-work* and *team-work*, respectively, by past authors. Based on this, they developed a framework depicting the steps to be taken throughout the so-called *content* and *process*, which are associated with the four aforementioned operations, shown in figure 2 below. Such

models of the design process are needed in order to identify what could be measured as creative output from VDTs.

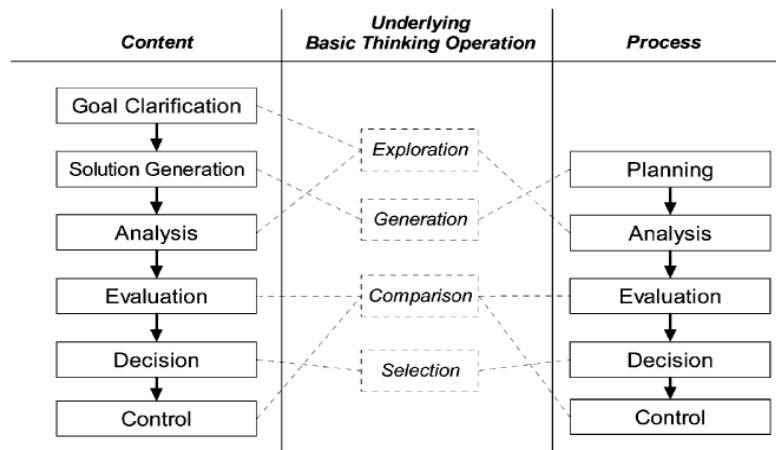


Figure 2. Generic step model of design team activities [Stempfe and Badke-Schaub 2002]

Global Design Teams (GDTs) is a recently developed term that describes “a group of individuals who constantly pursue (design) objectives while based at distance work sites” [Monalisa et al. 2008], or “a team in which members work for the same company on a specific design function and are geographically dispersed, culturally diverse, and share responsibility for producing deliverables within time and resource constraints” [Monalisa et al. 2008]. The forenamed authors argue that such teams, although they are assembled to overcome design problems and be creative and effective, often fail to achieve their goals. This however corroborates Akin’s (1979) view that compartmentalization of the design process (as for example figure 2 suggests) is in essence unrealistic. Interestingly, Monalisa et al. (2008) argue that such failures are owed to *technological*, *organizational* and/or *personal* reasons. In addition to that, they outline a number of challenges encountered in the GDTs they investigated: these are: *trust*, *communication*, *cultural difference*, and *time zone difference*. Trust, for example, is seen as a prerequisite for successful team communication. Trust is critical in helping the team overcome any problems [Monalisa et al. 2008].

Overall, design teams have emerged due to the complexity of contemporary design projects, since a collection of individuals is more likely to offer the range of expertise required for advanced design problems, compared to an individual designer in isolation. From the literature review, it becomes evident that some companies have designers who are located in different geographical areas, and they form this way, GDTs, which are not always successful [Monalisa et al. 2008]. GDTs are a type of VT, which are discussed more thoroughly in the following section.

4. Virtual Teams

With Computer-Mediated Communication (CMC) being the primary platform for interaction and collaboration in VTs, new opportunities and challenges are brought about. Producing deliverables across different locations, work cycles, and cultures, while collaborating via electronic media in view of an organizational task enables working remotely [Gray and Igarria 1996; Palmer and Speier 1998]. VTs can cut down on travel expenses and reduce redundancies [Kayworth and Leidner 2000]. The extant Information Systems (IS) literature agrees that hierarchical organizational structures and traditional and well-established management practices may not be appropriate in such a virtual workplace [Chamakiotis and Panteli 2010; Duncan 2009]. Virtuality, in general, has been researched from a management perspective, yet a gap in the literature, as to how it influences practical organizational processes, such as design, remains non-researched.

A virtual organization is defined as “a flexible network of independent entities linked by information technology to share skills, knowledge and access to others’ expertise in non-traditional ways: a form of cooperation involving companies, institutions and/or individuals delivering a product or service on

the basis of a common business understanding. The units participate in the collaboration and present themselves as a unified organization” [Pang 2001]. VTs, correspondingly, represent the collection of skilful human capital [Bell and Kozlowski 2002], which is physically, organizationally and/or time-separated, whilst facilitated through CMC in view of an organizational objective [e.g. Jarvenpaa and Leidner 1999]. It is for these unparalleled characteristics (e.g. geographical separation), why some researchers have used the words *dispersed* or *distributed* to name VTs. It is also not uncommon that researchers refer to them as Global Virtual Teams (GVTs), emphasizing that their members are located in different countries and are thus culturally diverse [Jarvenpaa and Leidner 1999]. There are different types of VTs, varying in the media they use, their purpose, their degree of dispersion, and their level of continuity, as outlined in Figure 3. The model has been adopted from Panteli (2004) and shows that not all VTs are the same and that some are more or less diverse, global and temporary than others. The level of continuity refers to the fact that some VTs may have been initiated for a very specific objective, upon completion of which are disassembled, while other VTs might be permanent working on a series of different projects. The degree of dispersion concerns the locality the VTs are taking place, which can be national or global (hence, GVTs). VTs’ relation to the firm/organization might also vary, as in the literature both inter- and intra-organizational VTs have been investigated, comprising respectively members of one or two/multiple organizations. Further, VTs can be synchronous (using advanced technologies e.g. video-conferencing) or asynchronous (e.g. email) in which case they rely completely upon CMC, while in some cases VT members do conduct periodical face-to-face (F2F) meetings. [Panteli 2004]. As a result, each different type of VTs might require different type of trust among its members, or different leadership style [Chamakiotis and Panteli 2010; Panteli 2004].

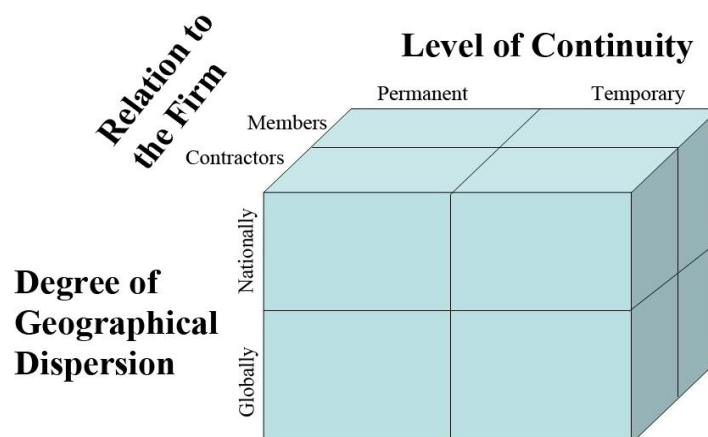


Figure 3. Typology of Virtual Teams [Panteli 2004]

Nonetheless, Information and Communication Technologies (ICTs) develop quicker than does the culture of managing the *virtual* in organizations [Duncan 2009], which raises new problems (e.g. miscommunication), and makes research in the field pivotal. It is therefore within the context of VTs, and in consideration of the numerous challenges the *virtual* brings about, that has led to current research on several subtopics, including: **trust**, **conflict**, **leadership**, **identity**, **cultural diversity**, and **knowledge management**. Trust for instance is an issue that has received substantial attention within this context and has been recognized as one of the core variables that foster VT dynamics and can help therefore VTs to achieve their goals [e.g. Jarvenpaa and Leidner 1998]. Leadership, or e-leadership as it can be also found, has likewise been discussed substantially and is seen as substantially different to leadership as in the collocated environment (e.g. centred leadership). E-leadership can be shared, rotating, shifting, distributed or *polycephalous* [e.g. Chamakiotis and Panteli 2010; Lipnack and Stamps 2000].

Creativity is another issue which is central to team efficacy and effectiveness, but it has been scantily investigated in VTs. Nemiro however is one of the few academics who have conducted substantial empirical work in this very particular area, of creativity in VTs. Based on her investigations using case

studies and interviews with various VT actors, she comes to state that since routine work is nowadays automated in most organizations, creative work is to be done by VTs, and hence a new area of research, that of creativity in VTs, has emerged [Nemiro 2007]. It follows therefore that creativity is not only a prerequisite for VTs' successful functioning, but it is also an objective; VTs' role may be to conduct creative work, and this is certainly the case for VDTs. In response to this, Ocker (2005) identified a number of enhancers and inhibitors of creativity in asynchronous VTs using graduate students within an academic setting (table 2). Though it would be beyond the scope of this paper to discuss all the enhancers/inhibitors of Ocker's study, it is noteworthy to refer to some of them. For instance, as Ocker puts it, "every team experienced some frustration due to technical woes", and this resulted in the team not achieving consensus. Hence, *technical problems* in some of these asynchronous VTs prevented the teams from reaching a conclusion and/or being creative, which would not necessarily be the case in a collocated environment. Similarly, Ocker found that *stimulating colleagues* enhanced creativity, and since VTs by their very nature can bring together more diverse human capital, the potential for more creative teams exists; and this may deliver particular benefits to design practice.

Table 2. Enhancers and Inhibitors of Creativity in VTs [Ocker 2005]

Enhancers	Inhibitors
Stimulating colleagues	Dominance
Variety of social influences	Domain knowledge
Setting the example	External reward
Collaborative climate	Time pressure
Surface and reduce equivocality	Downward norm setting
	Structured approach
	Technical problems
	Lack of shared understanding
	Non-stimulating team members

MacGregor and Torres-Coronas (2007) presented an edited book titled "Higher Creativity for Virtual Teams" a collection of studies centred on how creativity can be fostered within the context of VTs. The authors included the term *virtual* when referring to, as previously explained, geographically distributed teamwork, but some authors used the words *spatial*, *distributed* and *dispersed* to describe such teams. Most of the studies presented in the collection draw from VDTs, namely VTs whose task involved (a) design activity(/ies), which included the design of products, services and/or systems. The book provides great insights into creativity in VDTs, e.g. by suggesting ways to overcome conflict in virtual teamwork, and thus be creative. The collection also brings to light certain gaps in the literature that still need to be bridged. Though a specific research agenda is proposed in the next session, some gaps in the research which have been acknowledged amongst the different authors include:

- to systematically test virtual practices applicable to the traditional working environment
- to collect evidence for which types of activities are suitable for virtual teamwork, and
- to define the boundaries within which team creativity is feasible.

5. Exploring Creativity and Virtuality in the Design Context

Having reviewed the extant literature on creativity, virtuality, and design, this section brings these areas together in an effort to (a) position the knowledge gaps and (b) set the boundaries for future research. A model is therefore developed, which provides the reader with a synopsis of the variables associated with creativity in VDTs as per the literature herewith reviewed. In the model some specific issues related to each variable are mentioned; however, not all of these have been investigated in the

VDT context. In 5.1 the model is presented by discussing the variables affecting VDT creativity and pinpointing the knowledge gaps. In 5.2 a research agenda is developed based on the model (figure 4).

5.1 Variables affecting VDT Creativity

The model presented here draws on multiple studies carried out by various researchers and represents an extended version of Ocker's (2005) work, which shows how individual and team characteristics lead to team interaction and thus creative performance. What differentiates it from Ocker's model is that it has been adjusted to the VDT context. Hence, in this updated version of the same model, individual and team characteristics appear to influence each other, and this interaction influences the design task. This interaction along with the social influences and the attributes of the design task leads to team creativity and, by extension, to the creative design output. Whilst under individual characteristics are personal traits and cognition (as discussed in section 2.1), team characteristics include not only team composition and structure, but also atmosphere (climate) and leadership style, which trace back to the organizational level of creativity, discussed in section 2.3 and which are also linked to the social influences.

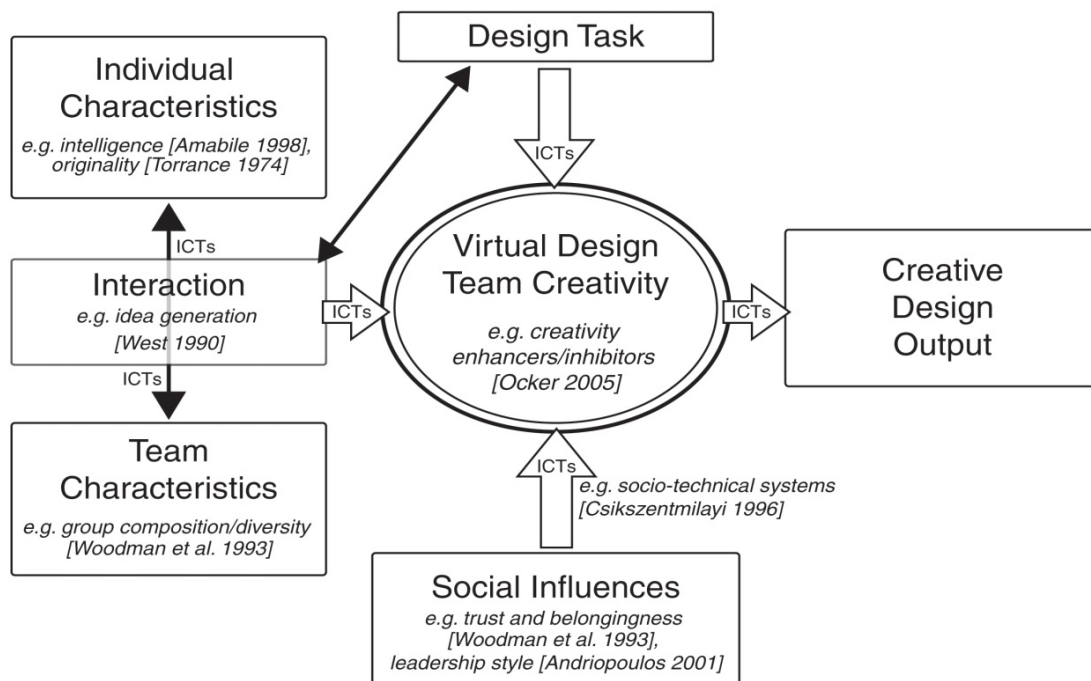


Figure 4. Variables affecting VDT Creativity

ICTs have also been embodied in the model, as these play a prominent role in the VDT context and inevitably influence the rest of the depicted variables (individual characteristics, interaction, etc.). ICTs are also related to the concept of socio-technical systems [Csikszentmilyai 1996]. However, in this model not all variables associated with VDT creativity are cited below each of the different variables, but examples that have seen some focus are listed instead (e.g. creativity enhancers/inhibitors [Ocker 2005]). It becomes clear though that there is no information as to which types of design tasks and which stages of the design process are most appropriate to be conducted in a VDT environment. In a similar manner, the creativity of the design output is ambiguous, as no specific studies have measured it adequately. Another limitation of the model is that it ignores the degree of physical dispersion, level of continuity and the rest of the factors discussed in section 4 and figure 3 in particular. It does however provide a general framework that may lead the future researcher towards specific issues under each of the variables (e.g. leadership) in specific types of VDTs (which might vary in continuity, level of dispersion, etc.).

5.2 Directions for future research

All in all, literature on VDTs has examined a limited number of issues, while design teams present a likewise limited body of knowledge in these issues. Trust, nevertheless, represents an issue that has dominated the VT discourse and, not surprisingly, has also been discussed in the context of VDTs. Using Panteli's (2004) typology of different VTs varying in continuity, relation to the firm and dispersion (figure 3), future research might seek to examine different types of trust needed for different types of VDTs. The research agenda for VDTs might also include exploring topics such as: (a) measuring the creative output as opposed to creativity in its own right; (b) empirically validating that industry-based VDTs factually come to fail (current studies make this assertion yet lack evidence); and (c) testing whether the variables shown in figure 4 are likewise important in the VDT context. Examples of some of the research questions might be: (a) whether establishing trust and connection is important in exhibiting creativity within a VDT; (b) which stages of the design process are more appropriate to be carried out virtually; (c) what problems typically occur at different stages of the design process for teams conducting a virtual design process; (d) how do these problems later impact the creative output from that stage; (e) what tools/approaches can help overcome these problems and enhance the creative output from VDT's through various stages of the design process.

6. Conclusion

This cross-disciplinary literature review aimed at exploring creativity and VTs within the design context in order to set the research boundaries and pinpoint the knowledge gaps. This paper presents a literature study centred on the team level (hence, Creativity in VDTs) and contributes to the body of knowledge in the field of design by presenting a model which synthesizes the variables associated with creativity in VDTs (figure 4) and by elucidating some of the issues to be discussed by the future researcher. This study may not be conclusive, as the field is developing rapidly; nonetheless, it does provide a considerable research agenda (section 5.2) for researchers looking at the topic of Creativity in VDTs.

References

- Akin, O., "Exploration of the design process", *Design methods and theories*, Vol.13, No.3-4, 1979, pp. 115-119.
- Amabile, T. M., "A model of creativity and innovation in organizations", In B. M. Staw & L. L. Cummings (Ed.), *Research in Organizational Behavior* (10, pp. 123-167), Greenwich, CT: JAI Press, 1988.
- Amabile, T. M., "Creativity in context", Boulder, CO: Westview Press, 1996.
- Amabile, T. M., "How to kill creativity", *Harvard Business Review*, Vol.76, No.(5), 1998, pp 77-87.
- Andriopoulos, C., "Determinants of organisational creativity: a literature review", *Management Decision*, Vol.39, No.10, 2001, pp 834-841.
- Andriopoulos, C., "Six paradoxes in managing creativity: An embracing act", *Long range planning*, Vol.36, No.4, 2003, pp 375-388.
- Bell, B. and Kozlowski, S., "A typology of virtual teams: Implications for effective leadership", *Group & Organization Management*, Vol.27, No.1, 2002, pp 14.
- Bharadwaj, S. and Menon, A., "Making innovation happen in organizations: individual creativity mechanisms, organizational creativity mechanisms or both?", *Journal of Product Innovation Management*, Vol.17, No.6, 2000, pp 424-434.
- Chamakiotis, P. and Panteli, N., "E-Leadership Styles for Global Virtual Teams", In P. Yoong (Ed), *Leadership in the Digital Enterprise: Issues and Challenges*, (11, pp. 143-161), Hershey, PA: Business Science Reference, 2010.
- Csikszentmihalyi, M., "Creativity: Flow and the Psychology of Discovery and Invention", New York, NY: HarperCollins Publishers, 1996.
- Duncan, E., "Cultural and Social Inhibitors to the Adoption of Virtuality in the Workplace", *Proceedings of IFIP W.G. 9.5: Virtuality and Society International Workshop, Images of Virtuality, Conceptualizations and Applications in Everyday Life*, Athens, Greece, 2009.
- Hokanson, B., "By measure: creativity in design", *Industry & Higher Education*, 2007, pp 353-359.
- Gennari, J.H. and Reddy, M., "Participatory Design and an Eligibility Screen Tool. Proc.", *Proceedings of the AMIA Annual Fall Symposium*, pp. 290—294, 2000.
- Gray, P. and Ignaria, M., "The Virtual Society", *ORMS Today*, 1996, pp 44-48.

- Isaksen, S. and Lauer, K., "The climate for creativity and change in teams", *Creativity and Innovation Management*, Vol.11, No.1, 2002, pp 74-86.
- Jarvenpaa, S. L., & Leidner, D. E., "Communication and trust in global virtual teams", *Organization Science*, Vol.10, No.6, 1999, pp 791-815.
- Kallio, T. J. and Blomberg, A., "Organizational Creativity in Academic Journals: A Literature Review", 25th EGOS Colloquium: Passion for Creativity and Innovation: Energizing the study of organizations and organizing, Sub-theme 34: Organizational creativity: the overlooked, understudied, and much missed, Barcelona, Spain, 2009.
- Kayworth, T. and Leidner, D., "The global virtual manager: a prescription for success", *European Management Journal*, Vol.18, No.2, 2000, pp 183-194.
- Lewis, M., "Exploring paradox: Toward a more comprehensive guide", *The Academy of Management Review*, Vol.25, No.4, 2000, pp 760-776.
- Lipnack, J. and Stamps, J., "Virtual Teams: People Working Across Boundaries with Technology", New York, NY: John Wiley & Sons, 2000.
- MacGregor, S. & Torres-Coronas, T., "Higher Creativity for Virtual Teams: developing platforms for co-creation", Hershey, PA: Premier Reference Source, 2007.
- Monalisa, M., Daim, T., Mirani, F., Dash, P., Khamis, R. and Bhusari, V., "Managing Global Design Teams", *Research-Technology Management*, Vol.51, No.4, 2008, pp 48-59.
- Mumford, M. D., Scott, G. M., Gaddis, B. and Strange, J. M., "Leading creative people: Orchestrating expertise and relationships", *The Leadership Quarterly*, Vol.13, 2002, pp 705-750.
- Nemiro, J., "The creative process in virtual teams", *Communication Research Journal*, Vol.14, No.1, 2002, pp 69-83.
- Nemiro, J., "The Building Blocks for Creativity in Virtual Teams", In S. P. MacGregor & T. Torres-Coronas (Ed), *Higher Creativity for Virtual Teams: developing platforms for co-creation* (5, pp. 98-121), Hershey, PA: Premier Reference Source, 2007.
- Ocker, R., "Influences on creativity in asynchronous virtual teams: a qualitative analysis of experimental teams", *IEEE Transactions on Professional Communication*, Vol.48, No.1, 2005, pp 22-39.
- Palmer, J. W. and Speicher, C., "Teams: Virtualness and Media Choice", *Proceedings of HICSS*, 4, 1998.
- Pang, L., "Understanding virtual organizations", *Information Systems Control Journal*, Vol.6, No.1, 2001.
- Panteli, N., "Situating Trust within Virtual Teams". In S. Reddy (Ed), "Virtual Teams: Contemporary Insights", pp20-40, ICFAI University Press, Hyderabad, India, 2004.
- Paulus, P., "Groups, teams, and creativity: The creative potential of idea-generating groups", *Applied psychology*, Vol.49, No.2, 2000, pp 237-262.
- Shalley, C. E. and Gilson, L. L., "What leaders need to know: A review of social and contextual factors that can foster or hinder creativity", *The Leadership Quarterly*. Vol.15, 2004, pp 33-53.
- Stempfle, J. and Badke-Schaub, P., "Thinking in design teams-an analysis of team communication", *Design Studies*, Vol.23, No.5, 2002, pp 473-496.
- Thompson, L., "Improving the creativity of organizational work groups", *Academy of Management Executive*, Vol.17, No.1, 2003, pp 96-109.
- Torrance, E. P., "Torrance Tests of Creative Thinking, Verbal Edition", Scholastic Testing Services, 1974.
- Valkenburg, R. C., "The reflective practice in product design teams", *Industrial Engineering Design*, Delft University of Technology, 2000.
- West, M. A., "The Social Psychology of Innovation in Groups", In M. A. West & J. L. Farr (Ed), *Innovation and Creativity at work*, Chichester: Wiley and Sons, 1990.
- Woodman, R. W., Sawyer, J. E. and Griffin, R. W., "Toward a theory of organizational creativity", *Academy of Management Review*, Vol.18, No.2, 1993, pp 293-321.

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