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Creative Expression in Virtual Worlds: Imitation, Imagination and Individualized Collaboration

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In press: [*Psychology of Aesthetics, Creativity, and the Arts*](#). This article has not yet been published.

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Posted April 29, 2009.

Author note: The authors thank Nanci Burke, Rosanna Guadagno, Lisa Neal and Paul Paulus for their input on various aspects of this project. Address correspondence to Thomas B. Ward,

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Abstract

Internet use has increased dramatically in the past two decades, including the use of 3D virtual environments in which individuals represent themselves via avatars and can develop and share creative content within those worlds. We examine the content of virtual worlds with particular attention to tools that allow expressing individuality, objects that appear to imitate real world content, as well as those that break from real world constraints. We also introduce the construct of *individualized collaboration*. Unlike face-to-face group activities in real world settings, in which the ambient conditions are largely the same for all participants, virtual worlds have properties that make it possible, in principle, for individuals to personalize their experience even while interacting with others in collaborative groups. Virtual worlds provide an opportunity to ask traditional questions about creativity in a new context, but also introduce a range of new questions that can lead to new insights and understandings about creativity in general.

Creative Expression in Virtual Worlds: Imitation, Imagination and Individualized Collaboration

In 2008, an avatar controlled by one of the authors in the virtual world known as Second Life® examined artwork on the ceiling of the Sistine Chapel, walked through a 3D representation of the village depicted in Van Gogh's *Starry Night*, changed from an ordinary human shape to a tentacled alien and back again, flew and hovered unaided by mechanical devices, teleported to and from numerous locations, danced a tango and a salsa, sat on several versions of seemingly ordinary chairs, but also meditated on a cloud, attended a staged reading of Shakespeare's *Twelfth Night*, listened to a live performance of a Mendelssohn violin concerto as well as several varieties of recorded music, attended lectures on topics concerned with science, technology and business, and pilot tested group problem solving exercises. Aside from minor tweaks to appearance and self-description in a profile, the avatar has largely been a consumer rather than producer of creative products, appreciating the myriad objects, scripts, and other content that make Second Life, like other virtual worlds, a compelling environment. All of the activities took place over a relatively short period of time and attest to the remarkable potential of expressing and experiencing creativity at multiple levels in this user-generated virtual environment.

It is the ways in which creativity can be expressed, and sometimes limited in virtual worlds that are the focus of this paper. As an organizing framework, we use the distinctions between mini-c, little c, Pro-c and Big C creativity (e.g., Beghetto & Kaufman, 2007; Kaufman & Beghetto, 2009) that have enriched the field's understanding that creativity, though potentially manifest in most people, is exhibited at multiple levels from simple personal understandings and expression to complex scientific, technical and artistic advances that challenge our basic assumptions. We will examine the potential for mini-c expression of individuality as well little c

and Big C creative contributions. We will also examine the structuring of imagination (see e.g., Ward, 1994) that is evident in virtual worlds through intentional and possibly unintentional imitation of real world objects, as well as flights of imagination in the virtual environment that represent movements away from that structuring. We will also consider the prospects for enhanced group creativity through a capability uniquely available in virtual worlds, termed *individualized collaboration*.

Internet Access and the Opportunity for Creative Expression

There is little doubt that the internet has radically influenced the ways in which individuals around the world communicate, represent themselves, share ideas and otherwise interact with one another. According to statistics compiled by Internet World Stats (2008), the number of internet users grew from 16 million in December 1995 to over 1.4 billion in March 2008. The same source shows a projected number of internet users of over 1.6 billion by 2010, a remarkable hundred-fold growth in only 15 years.

Aside from the stunning growth in internet use, another striking indicator of interactivity is the proliferation of applications that provide users with a multitude of ways to project themselves and their ideas to the rest of the connected world. These include popular social networking tools, such as Facebook, MySpace, Youtube, and Flickr, not to mention more highly focused applications, such as ravelry.com, a site at which users can share images and descriptions of their knitting projects with other equally avid knitters. As a perspective on the ubiquity of some of these applications, as of April 2008, both Facebook and MySpace were reported to have approximately 115 million monthly users (Arrington, 2008).

3D Virtual Worlds

The trend toward internet applications that afford opportunities for creative expression

has extended most recently to the proliferation 3D multi-user virtual environments (MUVES), such as Second Life, ActiveWorlds, There, Kaneva and others. In at least some of these MUVES, users can represent themselves as mobile 3D avatars of human or other form, navigate by walking or flying, create their own virtual content, including clothing, buildings and furnishings, interact in multiple ways with the avatars of other individuals via text and audio messaging, work together in collaborative virtual spaces, share objects, present content “inworld” through other applications, such as Power Point, and manipulate the same content. In short, 3D MUVES allow users to produce and consume creative content, both individually and collaboratively, and the present paper considers virtual creative content using examples from Second Life.

Second Life is a particularly good choice for examining forms of virtual creative expression. A statement on its home page describes it as a “3D virtual world imagined and created by its residents” (<http://secondlife.com>). It has an extensive set of tools and support structures to facilitate content creation, an astonishing range of creative content, and it is accessible to any individual with a computer and reasonably fast internet connection. Although not nearly at the level of widgets, such as Facebook, 3D MUVES have seen their own explosive growth. Currently more than 1.2 million logins are recorded in Second Life in a given 60 day period, and concurrency (the number of users logged in simultaneously) has grown from an average of about 6,000 in August 2006 (Lang, 2007) to a peak of more than 86,000 in March 2009.

A Word about Levels of Creativity

It has long been recognized that creativity is not a monolithic entity. Instead there are clearly degrees, domains and directions of creative contributions (e.g., Csikszentmihalyi, 1996;

1998; Kaufman & Baer, 2005; Sternberg, 1999). One distinction for example, is between little c or everyday creativity and Big C or eminent creativity. The boundaries between little c and Big C creativity may be fuzzy, and it may not always be clear whether a given product is an instance of little c or Big C, but the constructs nevertheless capture the idea that products may vary in their impact. A commonality across little c and Big C, however, is that for both types, a product exists that knowledgeable individuals would deem to be novel and appropriate in a given domain.

A recent extension of the little c versus Big C distinction is the addition of the construct of mini-c (Beghetto & Kaufman, 2007). Inspired by Runco's (1996) notion of personal creativity, mini-c captures the idea that even very young individuals and those without a large amount of domain knowledge construct personal understandings of the world, and that the proclivities that lead to those constructions can be, with appropriate experiences and feedback over time, precursors of little c or even Big C creative productivity. Extending these ideas still farther, Kaufman and Beghetto (2009) have proposed the Four C model of creativity, which introduces a Pro-c as a level between the everyday, possibly avocational applications of little-c and the eminence of Big C creativity. Those engaged in Pro-c creativity have developed the knowledge, skills and motivation to make creative advances in a chosen profession, though their creative products do not generally reach the revolutionary level of Big C eminent contributors.

As described by Beghetto and Kaufman (2007), even little c creativity may require considerable domain knowledge, so that young children or individuals just learning about a topic are unlikely to generate products that others would consider to be creative. Yet their approaches and their initial efforts nevertheless reflect their personal understanding of the challenges and problems that they confront. A particularly pertinent example used by Beghetto and Kaufman is

that a student just learning HTML programming might not produce a website that would be deemed by experts to be “new.” But it might reflect personal understandings of what websites should be. Put in the context of virtual worlds such as Second Life, because editing, building and scripting tools are available to anyone who can access that world, it may be a perfect environment for investigating that most nascent form of creativity termed mini-c. The personal understandings that characterize mini-c creativity might, for example, be reflected in the ways in which individuals new to that environment use editing tools to modify the appearance of their avatars, clothing, or dwellings. In addition, because there exist ample opportunities to develop knowledge and skills relevant to producing creative content in virtual worlds, it is also possible to examine manifestations of creativity that could be deemed as reaching the level of little c. We describe both of these levels in the sections that follow.

Avatars and a World of Possibilities for Individuality

When signing up for an account, residents of Second Life can pick from a small range of male and female human-shaped avatars the particular one that will serve as their initial shape. The starting avatars also have what may be described as standard-issue clothing. Once inworld, however, residents can personalize their avatars in a host of ways, and those ways of crafting one’s inworld representation may be a good example of mini-c creativity (e.g., Beghetto & Kaufman, 2007). That is, people can alter the appearance of their avatars in a way consistent with their understandings of the virtual world, their role in that world and what they would like to derive from participation in it. They might want to, for example, make their avatar as close as possible to their own real world appearance or more in line with some idealized self. Unless they have extensive programming skills or other virtual world experience, however, they are unlikely to be able to achieve even little c creativity in their initial efforts.

A tool for personalizing the self that is readily available to all residents is the edit menu.¹ By selecting edit > appearance, residents are able to interact with a panel that gives them a variety of options for changing the appearance of their torso, head, face, appendages, hair, clothing and accessories (e.g., jewelry) among other attributes. They can also import images from outside Second Life to apply as textures to their clothing (e.g., for t-shirt logos), though skill and experimentation would be needed to achieve aesthetically pleasing or otherwise desired outcomes.

The use of the edit menu also allows a mini-c personalization of one's virtual world beyond the physical appearance of the avatar. By selecting edit > profile, residents can enter self descriptions, favorite quotes, interests, desires to interact (or not) with others in particular ways, or any other information they deem relevant. Because other residents can see the person's profile by clicking on their avatar, the profile can serve almost as a traveling personal ad. It can be a creative outlet for the representation of the self.

The internet in general, and virtual worlds in particular, provide a vehicle through which people represent themselves and interact with others (Turkle, 1995), and the ways in which they do so has been of great interest to social and personality psychologists (Bargh, McKenna & Fitzsimons, 2002; McKenna & Bargh, 2000). From the standpoint of creativity research, the processes by which individuals move from the default representations available on entry to a world to the types of personalized avatars that reflect their own goals and understandings are of great interest and can provide a window on the phenomenon of mini-c creativity. Research should focus on the types of changes individuals make to their avatars and how those changes relate to their personal understandings as well as to individual differences such as non-conformity and need for individuality among other traits. Because modified versions can be

saved readily, it would be relatively easy to preserve a record of an individual's progression in self representation and relate that to changes in their interpretations and goals.

Transition to little c or Pro-c Potential

The edit menu allows a personalization of one's own virtual representation without requiring extensive programming knowledge or skills. However, there are also a variety of sources by which individuals can develop expertise that may extend their potential for making creative contributions. These include books (e.g., Rymaszewski, Au, Wallace, Winters, Ondrejka, & Batstone-Cunningham, 2007; Weber, Rufer-Bach, & Platel, 2008), tips (e.g., Second Life Video Tutorials, 2008), distribution lists (e.g., SL Educators, 2008) and inworld classes in building and scripting (e.g., Academy of Second Learning, 2008)². Through acquisition of skills, individuals may be able to transition from novices capable of mini-c personalization to skilled producers of content for sale to others, which can be characterized as little c creativity. To amplify this point, Beghetto and Kaufman (2007) used the example of learning to play a song on a musical instrument for one's own satisfaction (mini-c) versus developing the talent to "perform for an interested public" (little c). Analogously, in the virtual world we can distinguish between modifying one's appearance and profile to satisfy one's own goals (mini-c), acquiring the capacity to produce content of sufficient quality that it would be of interest for purchase or use by others (little c), and adopting the professional identity of producing virtual content as a way of making a living (Pro-c). Thus, virtual worlds hold at least some potential as venues for studying transitions from mini-c to little c creativity. Interviews with producers of the virtual content sold in those environments could provide retrospective accounts of their own creative development, but longitudinal studies of individuals as they progress from mini-c personalization to the capacity for generating little c content could provide

a window on creative transitions. Again, because products can be saved in a person's inventory, a continuous record of creative progress can be preserved easily for later coding.

By purchasing avatars and clothing, residents can alter their mode of representing themselves in ways that go beyond limits imposed by their own capabilities, and those purchases can be characterized theoretically as an interface between the mini-c of residents' personal understandings and the little c of the skilled individuals who craft the products. Numerous shops sell the products of creators who have produced avatar shapes (the overall avatar form) that are beautifully crafted, if sometimes exaggerated, representations of human form, and avatar "skins" (the surface appearance of the avatar) that are photorealistic and contain exquisite levels of body and facial detail. Likewise, other shops market hair, clothing, jewelry, tattoos and other adornments. These products can be seen as re-creative rather than truly original, but they are rendered artistically, in ways that are aesthetically pleasing, and for the clothing at least, there are designers who develop lines of apparel in the virtual world in much the same way as do real world fashion designers, who would presumably be identified as producers of creative products. In addition, some of the created items have novel features particular to Second Life, such as the "bling" of jewelry and shoes that causes them to appear to shimmer or sparkle, but that can be turned off to reduce the load on the sim in which the avatar is present.

There are several additional senses in which mini-c creativity manifests itself in Second Life. One is the ways in which it is possible to personalize one's environment. Residents can purchase or rent land, and can build structures and decorate them inside and out with artwork, furniture, plants and a wide variety of objects and textures. In effect, they can make a "home" for themselves in the virtual world, and the ways in which they personalize that home can be as much a reflection of their personal creativity as the ways in which they personalize their real

world homes.

As with personalizing avatars, edit menus allow residents to implement modifications of their environments on their own, or they can purchase ready made objects or even enlist the help of highly skilled architects, builders and scripters directly. Again, as in the case of avatar form and attire, if the quality manifest in the design and construction of buildings is sufficient that others are willing to purchase them, then it is reasonable to characterize them as at least little c, if not Pro-c creative products in much the same way as the products of architects, furniture designers, landscapers and others in the real world are considered little c or Pro-c creative.

An interaction of levels

The virtual world activities described in this section are not so very different from real world activities in that they represent the operation of economies in which goods and services are produced, bought and sold (Castronova, 2002; 2005). More directly pertinent to creativity is the fact that the dynamic of purchasing includes an interaction of the personal understandings of purchasers and the creative products made available by suppliers that either fit or clash with those understandings. More broadly, the mini-c construct is new enough that all of its implications have not been examined, but we suggest that one implication is that creativity theorists should consider, not just different levels of creativity as independent entities, but rather interactions across levels. To extend this point, the notion of scientific revolutions includes the idea of an interaction between incremental, normal science and more radical, revolutionary science. In normal science, advances are made within a paradigm until enough anomalous findings build up that a period of crisis and revolutionary science ensues which can result in the rejection of the paradigm in favor of a new one, which in turn can set the stage for new incremental advances within the new paradigm (Kuhn, 1962). By the same token there may be

merit in considering how mini-c personal understandings and little c and Pro-c creative production interact with one another to determine the flow of product development and purchase. In the section on individualized collaboration we consider how personalization of avatars and inworld experience might interact with the type of little c creativity that occurs in collaborative group problem solving settings.

Imitation:

Intentional Builds: Recreations of Real World Structures (with Some Twists)

One class of little c or Pro-c creative products in Second Life is sites that portray well-known real world landmarks and attractions, such as cathedrals and monuments. We refer to this type of creative contribution as *imitative recreation*. Being 3-dimensional, these builds allow visitors to walk through them as avatars without having to physically travel to them in the real world. They accurately represent the structures being depicted, but also have features unique to virtual worlds.

A question to be considered in relation to these imitative recreations is whether and to what extent they constitute at least little c creative products. They are constructed from *prims*, basic geometric building blocks, which users must shape and combine, and to which they must apply images or textures to achieve the appropriate surface appearance for the object. In effect the builds are virtual scale models of what they are created to represent. Thus, they are recreations rather than purely original works. However, just as Audubon's detailed, realistic paintings of birds, Monet's series of paintings of the Rouen Cathedral, or photographs in a coffee table book about Notre Dame can be considered to be creative products, so too can virtual recreations of real world entities. As with paintings and photographs, virtual recreations may be rendered artistically and with technical precision or poorly, giving users either an aesthetically

pleasing experience or one that is less satisfying. In addition, the imitative recreations include features that make use of the unique building and scripting capabilities that are available in Second Life, but are, in principle, impossible in the real world. Thus, they go beyond simple imitation. Whether such builds would be better characterized as little-c or Pro-c may depend on whether the creators are skilled individuals who develop them out of the enjoyment or challenge, without necessarily doing so as part of their profession, or professional media artists who make a living with their technical knowledge and skills (Kaufman & Beghetto, 2009).

An excellent example of an imitative build is the portrayal of the Sistine Chapel (Sistine Chapel, 2007) on the Vassar campus in Second Life. The virtual structure is built to scale, and the floor, walls and ceiling depict the tile, tapestries, paintings and other features that are part of the real structure. Avatars can walk through the site and examine all its aspects in fundamentally the same way as their controllers might actually walk through the real site.

The Sistine build also contains novel properties available in Second Life. Unlike the limitations of gravity inherent in the real world, Second Life has controls that allow flying and hovering. Visitors to the virtual Sistine Chapel could fly up to the ceiling and hover there to closely examine the paintings. Alternatively, because of the moving camera feature of Second Life, they could stand in one place and use their cameras to pan and zoom to various locations in the structure to make detailed observations. The site also contains scripting that forces avatars to agree to a code of conduct before entering the build. Those who do not do so on their first visit are ejected and teleported elsewhere. The removal script makes use of the “eject from parcel” feature available in Second Life, a feature that, of course, could not be implemented in the same way in the real world. Thus, like other aesthetically pleasing imitative builds in Second Life, the Sistine Chapel is creative in the sense that it is artistically rendered and also in the sense that it

contains novel and useful properties that are not inherent (or even possible) in the real world structure that it seeks to portray.

Another example of imitative recreation is the Vietnam Veterans Memorial Wall (The Wall, 2008; <http://www.thewallsl.com/index.html>), a faithful reproduction of the actual memorial in Washington, DC, including the names of the 58, 223 veterans killed or missing. Although it is imitative, the virtual memorial is, like the Sistine Chapel site, skillfully rendered, creating at least the possibility that visitors might experience the emotions that would be evoked by actually traveling to the real memorial. Moreover, it is also creative in the sense that it incorporates novel features that are possible in virtual worlds, but not the real world. There are directories, for example, that allow visitors to type the name of an individual and then teleport instantaneously to the exact location on the wall where the name is listed. On arrival at the appropriate panel, an indicator above it identifies the exact row on which the name appears. Typing the name in the directory also brings up a dialog box that allows visitors to select from a menu of items, such as a white rose or an American flag to “leave” in memory of the individual. Clicking an item results in the object being placed at the base of the panel on which the name appears.

Second Life also contains a wide range of other imitative recreative builds, but two additional ones are worth noting because they incorporate features that reveal some of the creative potential of that world. The first is a recreation of the Globe Theatre (Globe Theatre, 2008, SL Globe Theatre, 2008). It is accurately based on historical information about the original theatre that is believed to have existed in Shakespeare’s time. In addition, aside from the standard Second Life options of walking, flying or panning throughout the building, visitors can be attend productions of one of Shakespeare’s plays performed by avatar actors from the SL

Shakespeare Company wearing costumes designed by members of the group, and they can visit a gift shop to purchase period costumes if they want to dress their own avatar that way. The build also includes scripting that automatically shifts the avatar's camera position to the stage when they click to sit on one of the seats in the audience so that, in effect, there is not a bad seat in the house. Finally audience members can click to acquire and wear a heads up display (HUD) that will provide subtitles of the dialogue in any of several languages, including English, French, German, Spanish, Italian and Portuguese. Thus, the Second Life Globe Theatre helps to illustrate a range of creative expression in the virtual world, including an imitative recreation of a real world landmark, performance of creative literary content, avatar and costume design, and incorporation of novel features uniquely possible in virtual worlds.

Another imitative recreation of note is the Basilica of Saint Francis of Assisi (Assisi SL, 2008). It is a meticulously crafted rendition of the church, including the beautifully detailed internal architecture and artworks, as well as the grounds immediately surrounding the church. But we focus on it here because it also incorporates special features of Second Life. Visitors can purchase and wear a HUD that records the avatar's position so that they can know where they are in the build and receive audio, pictorial and textual information about what they are seeing on their visit. The HUD is a virtual version of the sort of devices used in real life museums (Bartneck, Masuoka, Takahashi, & Fukaya, 2007), but with the added element of being automatically keyed to the visitor's location in the build and presenting information specific to that location.

Imitative recreations in virtual worlds allow a look at an aspect of creativity that deserves additional study, namely how proficient creators use technical skills they have acquired along with an aesthetic sense to craft products that will be generally appreciated by audiences.

Interviews with the creators of current content as well as prospective studies looking at the steps used in developing new builds would be of great interest. In addition, because the number of unique visitors to a virtual site is easily recorded, it would be possible to relate aspects of the process and product to the popularity, and by extension perceived creative worth, of the construction. What considerations are most predictive of success? How does the balance of faithful recreation versus incorporation of novel features relate to visitors' appreciation of the site? Are there cultural determinants of what properties of the original entities can and cannot be modified (see e.g., Lubart, 1999)?

Cultural Exposure and Creativity

Our focus has been on little c creative products, but it is also worth noting a potential effect of those products, particularly the builds considered in this section. A recent paper by Leung, Maddux, Galinsky and Chiu (2008) documents that multicultural exposure can enhance creative functioning, and in particular can help people bring to mind ideas that might not otherwise have occurred to them. There may be geographic, health-related, financial or other constraints that would limit an individual's ability to physically travel to a given location, such as the Basilica of Saint Francis of Assisi, but a huge and growing number of internet users can now virtually travel there to learn about its history, the details of its construction, the art and other treasures contained in it and so forth. Whether or not the immersive experience of walking within a 3D representation of the space, much as a tourist would walk through the real structure, would lead to a richer understanding of the culture that produced it than simply reading about it or seeing it on a standard 2D website is an open empirical question, but certainly stands as a potential positive consequence of the creative build.

In addition, because anyone anywhere with a computer and internet connection can enter

the virtual world, there exist ample opportunities for informal cultural learning. Avatars can encounter others whose controllers come from a multitude of countries and cultures who speak a huge range of languages. With openness to those experiences, a key ingredient in deriving creative benefits from multicultural experiences (e.g., Leung et al., 2008), the virtual world could thus conceivably be a stimulant to people's real world creativity.

Non-imitative Builds with Real World Referents:

So far we have considered the mimic of personal representation in the virtual world and the little c of producing imitative recreations of real world entities and objects for sale. Another type of creativity shown in virtual worlds is the construction of large scale builds that do not imitate any particular real world structures, but instead are only *conceptual imitations* of the kinds of things found in the real world.

The memorial to the victims of the mass murder that took place on the Virginia Tech campus on April 16, 2007 (VT Memorial, 2008) is an example of a creative build that was designed and constructed, not to imitate a real world landmark, but rather to stand on its own merits. It is beautifully rendered and emotionally evocative. There is a central area bordered by plaques depicting the faces of the 32 students and professors who were killed that day. The plaques also include scripting that takes visitors who click on them to websites that open within Second Life that contain details on the lives of those individuals. A particularly moving feature is a blank plaque that represents the perpetrator, along with encouragement to visitors to reflect on what they can do to reach out to others. Adjacent to the plaques is an area with walkways that are lined with trees that appear to shed pinkish flowers as though they were softly weeping for the victims. Thus the VT Memorial build is a novel entity that achieves an aesthetic and emotional

result by making use of programming features that are particular to the virtual world in which it was constructed.

As with imitative recreations, the processes involved in conceptual imitation are of great interest to an understanding of creativity more generally. How do the creators go from a personal vision to the development of the product? To what extent do they employ analogical thinking in mapping the properties of actual conceptually related products onto their new creations?

We should note that the builds mentioned in this section are just a small fraction of the creative content in Second Life. By focusing on them it is not our intent to characterize the whole of Second Life. It is an extensive world full of types of locations too numerous to mention, but including everything from modern cities to renaissance villages complete with castles and settings for jousting, as well as parks, beaches, mountains and forests, to name just a few, and a range of activities including skiing, skating, surfing, sailing and hang gliding among many others. Nor is it our intent to create a kind of travelogue of endorsement of that particular virtual world. We simply wish to identify some salient examples of different type of virtual creative products.

Imagination: Structure versus Escape from Limiting Assumptions

Structured Imagination

Whereas the imitation of some real world content (e.g., the Sistine Chapel) may be intentional, there may also be a mimicking of real world content that occurs as an inadvertent result of basic cognitive principles. That is, when people develop new ideas for objects within known conceptual domains, their creations typically tend to be heavily structured by the properties of existing objects within those domains, a phenomenon labeled *structured imagination* (Ward, 1994). For example, when asked to imagine what animals might be like on

other planets, even though the creatures could assume an infinite variety of forms, the majority of research participants generate drawings of creatures that closely resemble typical Earth animals and possess ordinary properties, such as legs, eyes and bilateral symmetry (Ward, 1994), and they do so even when given instructions to make their creations different from standard animals on Earth (Ward & Sifonis, 1997). Similarly, if people are shown examples of novel items purportedly created by other participants (e.g., imaginary animals that all have four legs, two antennae, and a tail), they tend to incorporate properties of those examples into their own new ideas, even when instructed to avoid doing so (Jansson & Smith, 1991; Marsh, Landau, & Hicks, 1996; Marsh, Ward, & Landau, 1999; Smith, Ward, & Schumacher, 1993). This structuring of imagination, either by long-term existing knowledge or by recently encountered information, has been attributed to people following a path-of-least resistance in which they begin the task of developing novel products by retrieving specific, highly accessible domain instances (e.g., dogs in the case of the animal domain), and projecting their properties onto the new creation (see, e.g., Ward, 1994, Ward, Wilkenfeld, Sifonis, Dodds, & Saunders, 2002)).

Structured imagination is a robust phenomenon observed across a wide range of conceptual domains, including fruit, tools, coins, faces and words, among others (e.g., Bredart, Ward, & Marczewski, 1998; Rubin & Kontis, 1983; Ward et al., 2002) and across different populations, including young children, science fiction writers, and design engineers (Cacciari, Levorato, & Cicogna, 1997; Jansson & Smith, 1991; Karmiloff-Smith, 1990; Ward, 1994). It also appears to be inadvertent in that it is not strongly influenced by instructions. Thus it would not be surprising to see the same phenomenon occurring with the products in virtual worlds. Individuals enter virtual worlds with stored representations of concepts based on their real world experiences, and it is reasonable to expect that those concepts will influence their initial

construction of avatar identity via mini-c, as well as the generation of products by little c creators.

We do not present a content analysis here, but it is clear from casual observation during travel in Second Life that the form of objects contained there mimics the form of objects in the real world. For example, the vast majority of buildings, even those not intended to mimic specific, well-known landmarks, are fundamentally similar to ordinary real world structures, possessing four walls and a roof. Likewise, furniture is utterly ordinary, including chairs, tables, desks, sofas and other basic entities with standard legs, seats and other surfaces (see also the products available for purchase at <http://xstreetsl.com>).

Interestingly, without the use of specific scripts to make it otherwise, it never rains or snows in Second Life, nor is the programming set to make avatars get sunburns from too much exposure, so that a roof for protection from those elements is certainly not necessary. Nor is it strictly necessary for virtual furniture to possess the basic features of real world furniture. For example, there is no compelling reason for chairs in Second Life to have legs, the point being that they could just as well appear to float unsupported in the air. For that matter, there is no reason in principle why avatars would need to sit at all on furniture whether of ordinary or unusual form.

We should note that furniture in Second Life differs from real world furniture in that instances of the former contain scripts that cause avatars to adopt particular poses when the avatars click on them. However, as with the appearance of the objects themselves, the poses are largely ordinary, such as sitting, reclining or meditating cross-legged, rather than, for example standing on one's head or balancing on just one finger, even though there is no reason such scripts could not be developed. Thus, structured imagination extends to actions as well as to

objects in virtual worlds.

In spite of the fact that real world constraints need not apply to objects and actions in virtual worlds, one reason for the extensive mimicking of real world properties may be that fundamental psychological principles and expectations apply in virtual settings. For example, principles of interpersonal distance, such as the fact that male-male dyads maintain more distance than female-female dyads apply in Second Life as they do in the real world (Yee, Bailensen, Urbanek, Chang, & Megert, 2006). The creators of content in virtual worlds may intuitively grasp the idea that many residents will prefer ordinary, familiar seeming objects to wildly unusual ones, at least for day-to-day concerns, such as furnishing their houses. But research is needed, in the form of interviews with creators to begin to understand the reasons for mimicking real world properties in virtual worlds, where, at least in principle, such mimicking is not necessary. In addition, controlled studies, in which skilled producers of creative content are asked to generate new products for specific purposes would allow a more controlled look at the processes of creation, the ways in which existing real world concepts structure virtual imagination, and the ways in which knowledge can guide and constrain creativity.

Escaping Limiting Assumptions

Although much created content in Second Life mimics the properties of related content in real life, there are clear departures from structured imagination. For example, although the initial avatar choices available to Second Life residents are of human form, a multitude of other forms are possible. To illustrate this point, at the shop, World's Greatest Smile, Shop, Playground (2008) one can purchase anything from a comically friendly-looking dinosaur type avatar that is the virtual equivalent of 50 meters tall to a 1 cm flattened creature, somewhat like a starfish but with four tentacle-like legs and two large eyes. But the creations also break the assumption that

an avatar should have any standard appendages or senses, or even necessarily be animate, with a range of avatars such as pulsating crystals, amorphous shapes that turn inside out, a set of rings that move and change color, and simple geometric forms. These forms depart radically from the kind of constraints regarding senses, appendages and symmetry that structure the imagination of the majority of individuals given the task of envisioning novel life forms (e.g., Ward, 1994).

Art in Second Life also contains instances of structured imagination as well as escape from limiting assumptions. Some sculptures, for example, are simply the virtual equivalent of statues and other 3D forms in real life. Others, however, incorporate dynamic properties made possible by scripts that can be written to cause them to hover unsupported, rotate, change shape or color, or change over time in other ways. Some sculpture is even immersive in that avatars can not only view it from outside, they can walk through it.

In the real world, although painters often try to convey information about depth or distance in their works, they generally do so on flat, two-dimensional surfaces. Mimicking that feature, much art in Second Life relies on a 2D form that is suitable, for example, for decorating the walls of the types of ordinary buildings already described. However, the virtual world also contains examples of creative products that break from that limitation even while depicting well known 2D paintings. At the sim called Virtual Starry Night (2008), for example, there was a platform that held a relatively ordinary, seemingly 2D copy of Van Gogh's famous *Starry Night* painting. However, the platform also overlooked an enormous 3D representation of the painting, including the village depicted in it. The stars hung suspended in 3D above the village. From the platform visitors could teleport to the village. There they could walk around virtually within the painting, a strikingly creative extension of Van Gogh's original work that made optimal use of the unique property of 3D navigation in virtual spaces. The sim also contained an apparently

ordinary museum displaying other works by Van Gogh, but again with the interesting twist that some of them were represented in three dimensions so that visitors could walk through them, sit on the furniture in them and otherwise have their avatars be inside the paintings. The opportunity to learn about the works by wandering within 3D representations of them provides a kind of learning experience unmatched by anything in the real world. The site no longer exists in Second Life, but a video that captures some aspects of the 3D representation is still available (http://www.youtube.com/watch?v=KSb1gVFtQPA&feature=channel_page). Interesting research questions can be asked about the extent to which providing opportunities for 3D exploration of otherwise 2D paintings can enrich non-artists' appreciation of art as well as art students' capacities for producing technically proficient and creative works. Does the additional perspective provided by that third dimension, being able to see how the depicted elements relate to one another in that plane, improve artists' creative visual thinking about objects and how to depict them?

Other variations in virtual worlds challenge assumptions about the typical aspects of buildings. Although many buildings are placed on the surface of the "land," others are placed at distances as much as the equivalent of several hundred meters above the surface. One can literally build a castle in the virtual clouds. Also, although most buildings are set to be in scale with the size of ordinary human forms, others, such as Greenie's House Rezzable (2008) are enormous with respect to humans, so that visitors with ordinary human avatar forms can have the experience of navigating through a house from the perspective of a creature as small as a mouse or smaller.

Some sims incorporate multiple unusual properties. Inspire Space Park (2008) nearly defies description (see <http://www.flickr.com/photos/bettinatizzy/2716275106/> for a screen shot,

or http://www.youtube.com/watch?v=V_Gn0GEMgc for a video of the sim). In teleporting there, one lands on what seems to be an enormous flat gray stone platform that hangs in the air surrounded by clouds. In every direction are floating objects, some large, some small. Some of the objects resemble planets or moons and slowly rotate. Some are smaller irregularly shaped rocks. In addition, there are regular chairs as well as blue lounge chairs that hang in the air unsupported. There are also poses unlike the standard ones that cause individuals to sit or recline on surfaces such as chairs. The “orbital sleep” pose, for example, puts one’s avatar in a horizontal position, floating slowly amid the objects in the sim. Likewise there are meditation poses that cause one’s avatar to float in a cross-legged pose rotating in all directions. In the next section we consider the possible impact of exposure to these types of unusual experiences.

Individuals, Groups and Individualized Collaboration

By virtue of the fact that they are MUVES, virtual worlds such as Second Life can support the creative functioning of groups. This role is especially important given the fact that the employees of so many corporations are increasingly geographically dispersed and come together only virtually. Just as one example, 50 percent of Sun Microsystems’ workforce is located offsite on any given workday (MPK20, 2008). As a solution, Sun developed MPK20 where their employees can come together virtually to work in groups of various sizes and share applications.

Virtual worlds can support group functioning in groups as small as three or four for simple brainstorming, and as large as hundreds for conferences. At the large group end of the spectrum was the Second Life Best Practices in Education: Teaching, Learning and Research 2007 International Conference (SLBPE, 2007), which took place entirely within Second Life over a 24 hour period on May 25, 2007. The conference included 30 inworld presentations, and

more than 1,000 individuals registered to attend. Another example of a large scale collaborative creative project in Second Life is Studio Wikitecture (Liveblogging MetaverseU, 2008; Wikitecture's Progress, 2008), through which dozens of architects produced architectural plans for a health clinic and telecommunications facility for one of the poorest regions in Nepal.

Supportive Characteristics

Confluence models (e.g., Sternberg & Lubart, 1995) argue that the environments in which people function must be considered in explaining creativity, and here we discuss how the characteristics of virtual environments can encourage and support creative thinking in individuals as well as creative productivity in virtual groups. One potentially facilitative characteristic can be labeled "possibilities." As noted in previous sections, virtual worlds contain events and objects that are possible in those worlds, but impossible in the real world. For example, programming exists that makes it possible to hover unsupported in space, "fly" around environments without any need for a vehicle, teleport nearly instantaneously to other locations, build homes in the sky, radically alter the size and shape of an avatar, and represent oneself in nearly any imaginable form from human to animal to mechanical or inanimate. In addition, "possibility" is an individual construct in that people's avatars can execute actions that may be possible for others but not for them in the real world. For example, people who are without the use of their legs in the real world can nevertheless have their avatars dance in a virtual world (Crichton, 2007). Conversely, those who are able-bodied in real life can experience disability, thus potentially increasing their awareness of physical barriers.

Seeing possibilities and new perspectives may enable individuals to generate or discover novel solutions that were previously blocked by implicit assumptions. The conformity effect described earlier, in which people inadvertently copy ordinary properties of presented examples

in developing their own creative products (e.g., Smith et al., 1993) also extends to unusual properties. People will mimic or incorporate unusual or “incomprehensible” properties of examples (e.g., Ishibashi & Okada, 2007; Landau & Lehr, 2004), thereby increasing the prospects for the novelty of their creations with respect to the base domain. Thus, there is reason to believe that exposure to the impossible possibilities of virtual worlds could have a facilitative effect on individuals’ creative idea generation. Empirical research should be targeted at understanding how and under what conditions such exposure can facilitate creative production. Is bizarreness enough to spark the production of creative ideas or must the bizarreness relate in conceptually meaningful ways to the problem at hand?

From a group creativity perspective, exposure to the possibilities uniquely afforded by virtual worlds may also encourage adherence to one of the key principles of brainstorming, namely, to engage in freewheeling thought and make suggestions that may seem impractical or infeasible (Osborn, 1957). The extent to which it does so should be the focus of future empirical work.

A second potentially facilitative characteristic of virtual worlds is that they can be accessed from anywhere in the world using ordinary computers with internet connections, meaning that individuals with common interests but from diverse geographical regions and cultural perspectives have an opportunity of having their avatars come together in groups, unconstrained by financial, physical or geographic concerns. Anecdotal and experimental evidence supports the idea that combining concepts is an important aspect of creative functioning, and that combining discrepant concepts can increase creative possibilities (Estes & Ward, 2002; Mobley, Doares, & Mumford, 1992; Mumford, Baughman, Maher, Costanza, & Supinski, 1995; Rothenberg, 1979; Wilkenfeld & Ward, 2001), and the potential benefits of

combining diverse perspectives has been extended to creative group functioning in applied settings (Heath & Heath, 2007). Diversity is not always beneficial to group functioning (see e.g., van Knippenberg & Schippers, 2007), but to the extent that the creative productivity of groups is facilitated by the diversity of their members, the opportunity for interactions with diverse others in virtual worlds stands as a potential benefit.

In addition to any immediate effects of “impossible possibilities” or group diversity on problem solving, it is useful to consider longer term effects as well. Given that the process of structuring imagination is influenced by the concepts formed over time in the individual’s environment, unusual or diverse experiences in a virtual environment may provide a unique opportunity to develop one’s new raw materials to feed the creative process. The culture of Second Life as a user created environment is a dynamic amalgamation of global cultures and diverse demographic influences. It may be that, with continued immersion into a virtual world a person’s representations constructed in real life are challenged. Interactions with other Second Life citizens and their cultural views and evolving creative products may gradually transform the controller and shift the orientation away from their own culturally singular, real life based norms, thereby introducing mental variations that result in tangible (or virtual) products (see Kujundzic, nd for a related point regarding real life creativity). To amplify this point, Sawyer (2007) argues that significant innovations do not result from a single conversation, but with sparks gathering together over time, resulting from an invisible collaborative web, with insights that emerge when one is alone being traceable to previous collaborations. These “collaborations” may be considered in a virtual world context as a chance meeting between two or more avatars (synchronous experience), and then extended to a chance event such as stumbling upon a creative product in a virtual environment (asynchronous experience).

A third property of 3D worlds that may contribute to their usefulness in supporting the creative functioning of groups is that the mere existence of other visible avatars may facilitate a sense of presence, the feeling of actually being in the environment, which in turn may be associated with more engagement in the task. Although, different researchers have different conceptions of presence (see Biocca, Harms, & Burgoon, 2003), case studies and experimental work have shown that individuals have a greater sense of presence when other avatars are in the same space, and even when the other is a computer generated embodied conversation agent (Gerhardt, Moore, & Hobbs, 2005). Although other technologies that support group interaction (e.g., Elluminate) have presence awareness features, such as a list of other participants who are logged in, the salient visual representation of avatars in 3D worlds may give them an edge in producing a sense of presence

A fourth important characteristic of 3D worlds is the ways in which they may support and encourage extra-work activities. Members of groups that are geographically close enough to meet face-to-face have opportunities to interact with other group members outside of the work context, during chance encounters, shared meals, and social events. Such opportunities are clearly reduced in virtual organizations, but the objects and locations in virtual worlds provide opportunities for those types of interactions. There are scripted objects that cause avatars to simulate consuming foods and beverages, thus creating an opportunity for avatars to “eat” and “drink” together. There are also cafes with tables and chairs, ballrooms with scripted dance floors, and other publicly accessible venues that support social interactions among avatars. Avatars can go to live concerts and plays together, and can dance together to live or recorded music. In addition, because individuals and groups can own land, buildings and scripted objects (e.g., dance floors), they can create regular social events that are open only to members of their

particular groups. Trust in virtual organizations, especially early in their formation is encouraged by communication patterns that include sharing of personal information (Jarvenpaa & Leidner, 1998). Thus, to the extent that group members participate in these extra-work activities, they may be expected to exchange information beyond that which is specific to work, and thus develop more trust in other members. In turn, trust may be expected to reduce inhibitions about sharing ideas, particularly unusual ones, with others in the group (e.g., West, 2003).

A final aspect of MUVES to be considered here is the ways in which they allow individuals to manipulate their own experience of a group activity, that is, the way their mini c personalization may interact with the little c possible in group problem solving. Users can easily modify the way they present themselves to the group. Aside from the types of avatar modifications already described, they could, in principle, make alterations in appearance to create salient visual markers of adopting alternate modes of thought, such as wearing an avatar like a noted creative genius if they wanted to try to “think like” that individual, or adopting different “hats” in De Bono’s six hats approach and so forth. There are self-help books that purport to provide ways to boost creative potential by helping people to, for example, think like Einstein or invent like Edison (e.g., Gelb & Caldicott, 2007; Thorpe, 2000), as well as more academically oriented analyses that provide insights into the minds of eminent individuals (e.g., Friedel, Israel, & Finn, 1987; Gruber, 1981). Self-representation in virtual worlds holds the potential for taking the modeling of such individuals to another level by allowing residents to don avatars that resemble them. Whether doing so would lead to any measurable improvement in creative problem solving is an as yet unanswered empirical question, but we mention it here as an example of the kinds of new questions virtual worlds open up.

More interestingly, beyond manipulating how one appears to the group, individuals can manipulate how they experience the group. Unlike face-to-face situations in which all individuals work in the same room with the same ambient conditions, individuals can personalize their conditions while collaborating in virtual environments. In effect they have a wider range of environmental expression available to them than in real world, face-to-face settings, even while functioning in groups at work on little c creative brainstorming. And the personalization goes beyond simply being able to sit at home in the real world in one's favorite chair wearing one's favorite pajamas and slippers. Personalization extends into the virtual space itself and to the user's experience of that space. In Second Life, for example, it is possible for individuals to change the appearance of the environment on their screen from morning to noon to midnight at will, so that some group participants could choose one and others another if they felt more comfortable that way. It is also possible to separately adjust the volume of ambient sounds (e.g., the crackling of virtual fireplaces), any music or other media in the environment as well as the voice chat of other group participants. Because the view on one's screen is determined by the position of one's "camera," it is also possible for individuals to separately choose to focus close up on another avatar or an object being discussed, draw back to look at the larger group, or even pan away to look at surroundings rather than what is happening in the immediate environment. Because the text chat continues to scroll on the user's screen regardless of where they pan, the user can still follow and contribute to the group conversation even while, for example, relaxing to the view of sunset through the trees far away from the virtual room where the meeting is being held. The point here is not that any one of these or other possible variations would necessarily be adopted or have an influence on the outcome of a group activity, but rather that, more generally, virtual environments allow a personalization of group experience that is either not possible or at

the very least more difficult to implement in face-to-face situations. That is, virtual environments raise the possibility of what can be termed *individualized collaboration*. To extend this point, an extensive literature exists on the properties that influence group performance, but as in all published psychological research there is variability around mean differences across conditions. Our contention is that, at least some of the variability is attributable to the fact that environmental manipulations that are beneficial to some participants may in fact be detrimental to others due to individual differences not accounted for in the studies. By allowing individuals to personalize their virtual experience, virtual worlds hold the potential for better matching their optimal conditions.

As collaborative creative activities occur more and more in virtual settings, the construct of individualized collaboration will become increasingly relevant, and methods of assessing creative problem solving in groups will need to include measures of how people personalize their group contributions and the effect that such individualized collaboration has on the quantity and quality of ideas produced.

Our conjecture is that individualized collaboration will have a facilitative effect on group creativity because it can allow each individual to maximize his or her own unique capacity for making a contribution. However, it is also possible that individualization could have a disruptive effect on group dynamics and cohesive group functioning. Only a series of empirical studies can provide the answer. A research agenda would include studies of the extent to which individuals naturally tend to use the properties of virtual worlds to personalize their group participation, and the extent to which such tendencies relate to other individual differences, such as non-conformity and the need for individual expression. In addition, studies need to examine the extent to which such individualization either increases or decreases group creative productivity. Finally, studies

would need to address the issue that individualized collaboration might be more or less facilitative or disruptive depending on the nature of the problem being confronted and the stage of problem solving in which the group finds itself. For example, might greater individualization be more helpful in ill defined problems or in early stages of problem finding than in well defined problems or in later stages where honing in on a consensus solution may be more relevant?

Summary

The proliferation of internet applications in general, and 3D virtual worlds in particular provides an ever increasing range of possibilities for creative expression. Among these are the mini-c personalization of avatar appearance, profile content, living environment, and ambient conditions (e.g., morning versus night), as well as the little c production of objects (e.g., clothing, jewelry, furniture, buildings, plants, vehicles) for sale to or use by others. Virtual worlds also provide a venue for performance creativity in the form of plays, dance and music. Whether any examples of Big C creativity exist is debatable, but virtual worlds do contain “impossible” possibilities as well as objects and actions that radically violate real world assumptions. Finally, virtual worlds allow interactions among levels of creativity as when individuals personalize their experience of or participation in group level little c creative activities.

Virtual worlds provide a vehicle for asking traditional questions about creativity in a new context, such as questions about the links between psychometrically measured creativity or personality traits and a tendency to develop products that would be deemed by others to be creative. But they also open new questions. How do the personal understandings of mini-c creativity play out in the development of people’s self-representations in virtual worlds? How do individuals transition from the ability to express themselves in mini-c ways to being able to produce little-c content that others will use or purchase? How do mini-c understandings and little

c productivity combine to structure the economies of virtual worlds? What are the technical skills and aesthetic sensibilities that combine to yield imitative recreations and conceptual imitations? How and why does structured imagination manifest itself in virtual worlds that, at least in principle, do not have the same constraints as the real world? Can exposure to the possibilities of virtual worlds lead to richer understandings or art and other creative products and to the development of more creative problem solving? To what extent do individuals avail themselves of the opportunities for individualization in virtual worlds and to what extent does that facilitate or disrupt creative group problem solving? These other questions constitute an important research agenda sparked by the proliferation of virtual worlds.

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Footnotes

¹ A companion website, <http://creativityforyou.com/slimages.html>, shows a screen capture of the edit > appearance menu along with some examples of variations to the body and face shape. The variations are not intended to depict aesthetically pleasing avatars, but simply to show how anyone could use the edit menu to produce variations in a starting avatar. The website also shows examples of some of the other Second Life contents mentioned in the paper as well as links to additional images.

² A conventional method of specifying locations in Second Life is by way of a slurls, hyperlinks that allows users login directly to that site or teleport to it if they are already inworld. For citation purposes, we treat them as documents and include entries in the References section, rather than as whole websites with the address listed in the body of the paper.