TIMAEUS: Three-dimensional Illuminated Media Augmented Sculptures

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1. Introduction

In this paper, we discuss the background, inspiration and current state of Timaeus, a digital art studio environment that enables the creation of personalised 3-dimensional sculptures built with expanding and interconnected volumes of atomic blocks.

Timaeus sculptures can be customised with media, e.g, pictures, videos and music which are overlaid or seeded in the sculpture. Media can represent memories or more generally facts, including live internet feeds that can be used to create artistic narratives in space. Such facts are embedded in the sculpture and can be experienced in different ways with the capability of zooming in and out, rotating, viewing from different angles, and applying sounds and soundtracks. Sculptures are hollow and translucent. They can be illuminated, and the space that they enclose can be viewed internally. TIMAEUS incorporates generative components. Features of images, videos or music can be algorithmically extracted and used to modify the shape or movement of a perpetually mutating or dancing sculpture where these media have been applied.

We are currently designing a study in art therapy of dementia patients where Timaeus will be applied. One hypothesis is that artistic memory sculptures can both aid reminiscence and create a much needed sense of well-being. Reviewing one's life in an artistic manner may help to place fragments in perspective as well as work out gaps and conflicts. This could nurture feelings of relaxation through artistic creation and of stronger more coherent self. Timaeus was inspired by the homonymous Platonic dialogue and its geometric, atomic cosmogony and cosmology.

Figure 1 shows a relief created in Timaeus in a style which is reminiscent of sumptuous Byzantine silk fabrics and which, we hope, connects this paper to the Byzantine art for which Ravenna, where the conference takes place, is renowned.

Figure 1. Tribute to the Byzantine art of Ravenna – a relief created in Timaeus

In section two we provide relevant background on digital and generative art and its applications to art therapy in particular reminiscence and dementia. In section three, we highlight the potential for generative art. In section four we discuss the inspiration and state of Timaeus, and finally in section five, we draw conclusions and discuss further work.

2. Digital and Generative Art & Therapy

Groysman reminds us of the original meaning of “téchnē” (τέχνη), the Greek word for art, which was used to refer to both art and technology at the time [1]. It is well established that for ancient Greeks, the expression, imagination, creation, aesthetics, beauty, thought and emotions which are integral to “téchnē” “were not confined to

"fine arts". But is this connection between technology and art relevant in today's technological age, and how?

Jones notes that computers were a liberator technology for artists, in the same way as video and television had been before [2]. One recent strand of digital art has become known as generative art. Monro [3] cites Philip Galanter's widely circulated definition of generative art as "any art practice where the artist uses a system, such as a set of natural language rules, a computer program, a machine, or other procedural invention, which is then set into motion with some degree of autonomy contributing to or resulting in a completed work of art" and notes that computers, or even machines, do not have to be imperatively present in the creation of generative art.

In this paper, we focus on the potential of digital and generative art for art therapy, through the implementation of an art studio that enables therapeutic expression within the creation of personalized, customisable and generative sculptures. One particular application of this is the creation of "memory sculptures" for reminiscence in the context of art therapy of dementia patients.

Multimedia

Conventional and digital media and multimedia, are generally present in art and reminiscence therapy systems and they appear as an essential element of this approach. As an example, Tony et al. report Hellen Bonny's Guided Imagery and Music method, in the 1970s, aimed for self-development work where music may be selected and images may be used for building a metaphorical dialogue with the therapist [4]; or the inherent presence of media in the Antunes definition of reminiscence therapy for dementia, in "the use of life events, photos, music and other supports" to remember the past and promote dialogue [5].

Several authors report on the benefits of the use of multimedia, e.g. on helping to engage patients and improve communication. Elements such as texts, photos, videos, music and songs, possible to use in the work of day-care settings, can provide entertainment and recreational experiences; they can be used as a vehicle for reminiscence conversations [6]. Alm et al. report that staff enjoy more pleasant caregiving experiences [6] and Peterson describes patients creating digital images and movies, with the advantage of unnecessarily getting "messy during their art therapy treatment" [7]. In addition, Carswell et al. report enhancements in wellbeing and brain stimulation [8], and Blandford et al. explain that high satisfaction with the use of multimedia in reminiscence results in "strong tendency towards repeated use" [9]. Noticeably, it is also reported that there is a strong preference for personal, in contrast with generally themed materials [9].

Lazar et al. assert that "access to rich and engaging multimedia reminiscence materials", helps the clients to "participate in social interactions and take ownership of conversations, and that there is also a resulting reduction of barriers due to motor deficits" [10]. Antunes makes a comprehensive listing of several existing applications of multimedia in the context of dementia: like multimedia biographies, where the caregivers collect materials that are then continuously displayed in a device at the

client's home; or Portrait, purposed for nursing homes and day care centres; and computer-assisted reminiscence therapy, with personal photographs, and photographs taken from public places known to the patient and playlists of songs they can relate to, where the carers noticed that the clients had increased focused time, in comparison with non-digital media; or the use of YouTube in group therapy sessions, where caregivers can set playlists that will work as reminiscing triggers, and where the patient's enjoyment was visible; and Friendcrafting Memories, a web application with an interface resembling a bookshelf where the patients can choose to open themed books about people, places, and interests; or Friendsourcing and Remember-Me, that use the functionalities of social networks to collect reminiscence materials; and even the use of virtual reality, providing immersive experiences that transport the client to familiar places [5].

Taking into account the differences between dynamic and static media, Blandford et al. state that "dynamic media, like video, can provide more context than static media, such as photos" [9]. Media can also be linear or non-linear. Linear media, like a song or a movie, has a beginning and a point of completion. Non-linear media incorporates continuity within the possibly endless complexity and can also be beneficial in art therapy.

A multimedia-game synthesis

One area little explored in the area of therapy is that of "games". It is important to look at games as they can provide a very rich non-linear multimedia interactive experience. Games also introduce advanced computerized functionalities such as cinematics, physics, and artificial intelligence. It is therefore plausible to consider that digital games might add value to the digital approach to reminiscence and art therapy. There are indeed a few examples of the use of digital games in this therapeutic context. Alm et al., for instance, mention the creation of computer game prototypes, developed in consultation with patients and carers, where there was no competitive element, nor finishing point, and that did not rely on memory for successful play, nevertheless resulting to a joyful and engaging experience for players [6].

Further Gamification

This leads us to the topic of gamification, to the definition of its meaning, and to the understanding of why and how it is used. Mesárošová and Hernández observe that the concept of gamification was introduced in 2002 by Nick Pelling, a game designer [11]. A way of thinking that involves the application of concepts of computer games in social contexts, taking the dynamics of games and implementing them in real life, converting tedious tasks in playful activities and, in general, application of game mechanics to any situation, idea or project [11]. Gamification includes current research that involves games and health is growing. ShapiI et al. observe that, for instance, in cognitive rehabilitation, there is great heterogeneity of impairments to address and cost-effective ways for game creation are desirable [12].

The answer to the question of why gamification is relevant may be reduced to the ideas of fun and usefulness. For instance, software vendors have adopted it to

increase customer engagement [13]. Research in gamified training, illustrated by examples such as medical serious games, has been applied to surgery and infection prevention and to increase dexterity [14]. Also in Odontology and Nursing, in areas such as diagnostics, decision-making, treatment protocols and risk and pain management [15]. Moreover, and importantly for this research, gamification is being applied to Medicine and Psychology therapies, because it may have the potential to address "difficulties associated with sustained engagement in behaviour change strategies". Psychologists may use well-established tasks to train specific cognitive abilities, benefiting from the transformation of routine tasks into playful activities [14]. As another example, Ricciardi and De Paolis report the use of several physical rehabilitation serious games, that were perceived by the patients as a credible training approach [15].

Overall, there seems to be an interesting potential for computer games to become a compelling medium to create engagement in healthier lifestyles, and in learning and teaching [13]. In mental health, Agmon et al. provide some evidence that suggests positive impacts on depressive symptoms, cognitive performance and mental health related quality of life [16].

3. Towards a generative-game synthesis?

Generative cinema, generative photography or painting provide good examples of possibilities that are realised when jumping from one simpler to a more complex medium that incorporates a degree of autonomy. This observation has led us to consider that digital games for art therapy could be greater than just non-linear media, and more than an interactive multimedia synthesis. By thinking about the general architecture of Timaeus, we considered the possibility of generative art components in gamification of art therapy.

The possibility for a generative art synthetic game emanates from the diversity of its organics. Modern digital games, from the view of a game engine, provide real-time functionalities in varied domains: real-time graphics and sound that can be enriched with generative algorithms; generative poetry can take the shape of generative game narratives; music, text, voice, cinematics, 2D and 3D imagery and shapes, etc. The digital game has the potential to be a synthesis of a vast panoply of generative art forms. Such forms could be integrated, unified. Pushing it to the limit, even mechanical generative systems can be reproduced within a game through its physics engine, inputs, and outputs such as screens, printing, and 3D printing. However in this synthesis new generative forms may also emerge, that are not necessarily a mere sum of the previous. This is the case of new forms of generative sculpting/design that are addressed in this paper. Such is the case of generative time, flow, and control – through the game's AI engine – and also of an overall Generative Play.

Play and Art Therapy

This concept of Generative Play reconnects us with Generative Art Therapy. Whilst discussing contemporary art, Sweeney emphasized the pivotal meaning of Play in deriving pleasure from Art, making a mention to Plato who considered that pleasure

”does no good or ill” itself but it is important and conditioned to do good by other factors such as virtue and practical wisdom [17]. This sense of Play is also present in Hayes look into the role of the creative arts in dementia care. Hayes reminds us that “when we play we do not question the validity of what we do or make”, hence resulting in a joyful experience for patients and the staff [18]. This, in turn, can have a therapeutic effect especially if contextualised properly. Play is important in this kind of therapy that is person-centred in quality experiences [18]. Killic focuses on the delicate nuances that might exist between play and game, by noting that the obtrusiveness of rules of the latter might invalidate the first [19], which seems a wise and important consideration in the design of serious games.

4. TIMAEUS Art Studio

Inspiration from Plato

The Platonic dialogue of Timaeus has inspired the conception of the homonymous art studio. The dialogue develops a geometric cosmogony in which the world, much like the mosaics of Ravenna, is composed of atoms which in the dialogue are considered to be shaped as the five perfect solids discovered by Plato. Apart from its literary value and an example of dialectic argumentation, the dialogue provides extraordinary insight into later scientific discoveries in the field of chemistry and biology which have discovered harmonious, often geometrically perfect, structures in the fabric of matter. Note that the system that we develop effectively aims to construct memory worlds from atomic units and entities.

Timaeus also contains the original reference to the myth of Atlantis, the lost city or lost continent depending on which narrative one reads out of the many stories created in centuries of literary speculation that followed Plato. The myth makes a relevant connection to the loss of memory and therefore the topics of reminiscence and dementia that we wish to address. Moving beyond this obvious connection, modern psychological and neuroscientific theorie*s* suggest that memories are continually reconstructed on the fly as opposed to being recalled. This is precisely what happened in the case of the myths surrounding Atlantis, but it is also how memories are recreated in an artistic fashion within the Timaeus art studio.

Creation of artefacts, moments, memory sculptures

Timaeus as an art studio is envisioned to be a digital game for art therapy, providing an interactive audio-visual experience for generatively augmented expression and creativity that can be used for reminiscence and life review with dementia patients, care staff, and artists.

The Platonic inspiration provides an opportunity for bringing a philosophical dimension to the project with links to geometry. The game should provide, with simple interactions designed to address problematics such as loss of sight and dexterity, an imaginative environment for the generatively augmented expression of ideas, memories, and thoughts, through the creation of sculptures collated with sounds, images, videos and other media, and illuminated. Despite its unique technological advances on the links drawn with art and therapy, the underlying action

of creating reminiscing artefacts is an established therapeutic methodology, including in digital form, in reminiscence therapy for dementia, and is well documented in Thiry's doctoral thesis [20]. This is a work that was focused on a specific type of reminiscing, described as "a process that may involve many 'turns' and that produces a personal legacy artefact".

Thiry observes that artefacts may be scrapbooks, memoirs, oral histories, photographs, newspapers, letters [20]. In a functional view, artefacts may be created to remember or to share and be remembered or just "because it is pleasurable in and of itself" [20]. To remember traveling, for instance, in that moment or in the future, or to share with a grandson a personal journey, stories and knowledge the patient feels that should be preserved for younger generations [20]. In terms of therapy practice, Thiry reports that "artefacts have emerged as an important aspect of reminiscences with older adults" and that despite "HCI researchers have explored a variety of different approaches to the creation and use of personal legacy artefacts" however "very little attention has been directed to how personal legacy artefacts might be created and authored" [20].

In terms of patients' requirements regarding technological approaches to the creation of personal legacy artefacts, Thiry mentions the desires expressed by the users of the greatest simplicity possible, in the software, and also a preoccupation with the possibility that the technologies might later become obsolete and their legacy lost [20]. This information is very valuable for this research because it strengthens a justification for possibly including 3D printing of the memory sculptures in the workflow.

Besides looking into Thiry's work in what concerns digital reminiscence and artefact creation, the research task of Timaeus also looks into the artfulness of such artefacts and the creative experience and joy that is more related to art therapy. Here, another strong inspiration and reference is the work of ArtCare in bringing workshops of non-computerised reminiscence "using poetry, art, music and handling objects" into the interior of hospitals, to "inspire staff, patients and visitors" [21]. This research considers doing precisely this, but in a technological, and possibly ubiquitous way. In the same line with Cognitive Dynamics work of combining reminiscence activities and art therapy "to validate Alzheimer's patients in their current state, helping to honour their life stories, restore and preserve their sense of self", improving the patients' communication and expression, concentration, attention and ease of care [22].

The above is the current stage on experiments with the creation of a software that enables innovative ways of producing art, namely handmade therapeutic generative art, through a system in the form of a touch-based game that facilitates the augmented expression through the creation of transparent 3D sculptures, drawing, texturization, illumination and semantics and may help to reflect the patients thoughts and facilitate reminiscence and life review exercises. The present features of TIMAEUS are:

- Moment/Memory Sculptures
- Painting

- Sculpting
- Multimedia 3D Collage (picture, audio, video, illumination)
- Control of variables for generative art exploration

The studio is already in a developed state. Figure 2 displays an example of a memory sculpture created in Timaeus. A colourful painting by abstract artist Roberto Bono (http://www.arteutile.net/) is covering the surface of the sculpture, Hanging within and on the boundary of the curved space there are personal images forming an internally illuminated 3D collage that can be navigated both internally and externally.

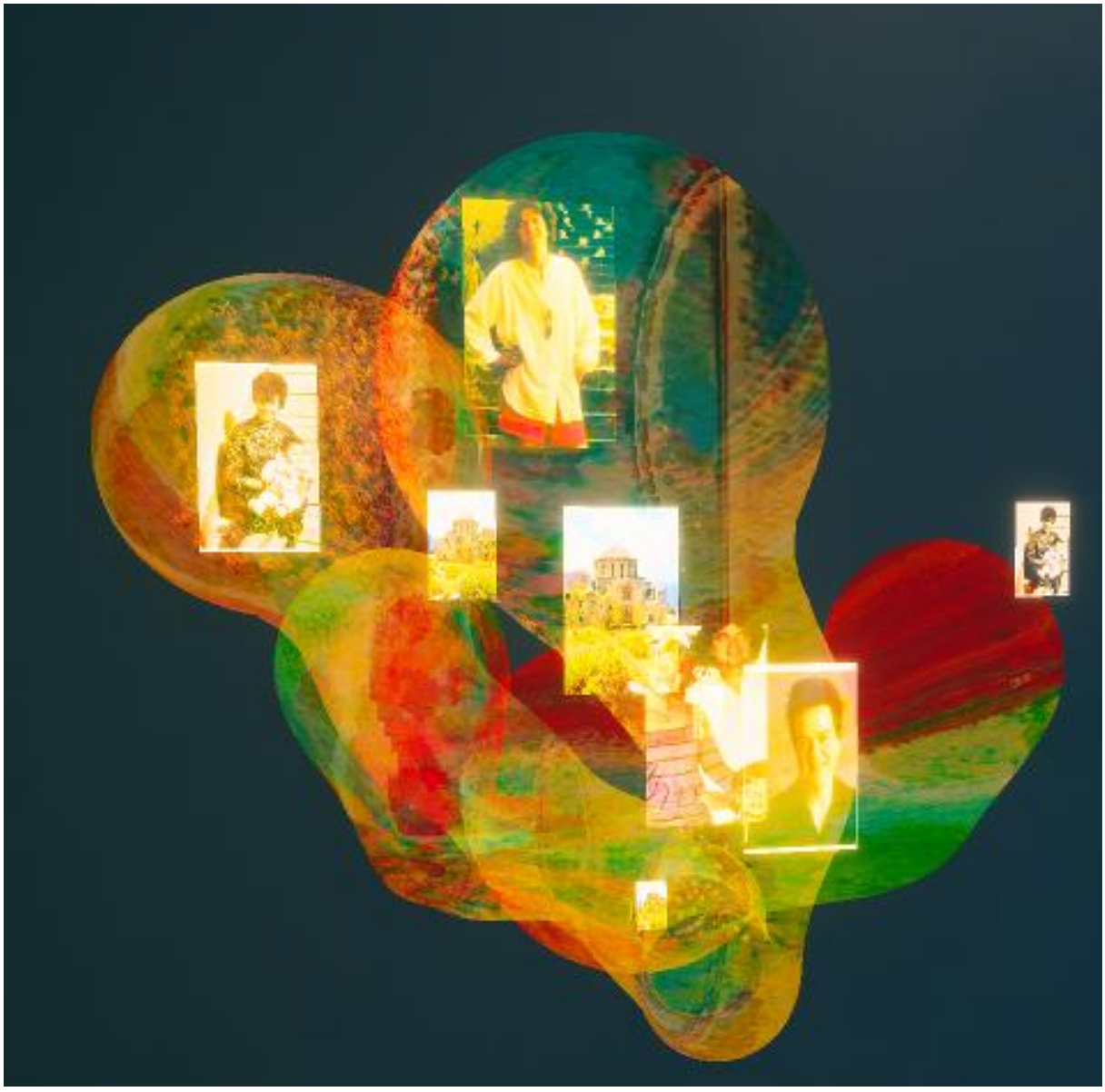

Figure 2. Memory sculpture created in Timaeus

Dancing Sculptures

As an exercise on the many possibilities for generativeness we have picked music as an example of input that can be processed to then create a generative effect on a sculpture under design. This processing, done via Fast Fourier Transformations (FFT), results in a dynamic sculpture that has a constant, editable shape, which also floats in the air as a result of sine and cosine fluctuations of surface shape that correspond to the results of the FFT. By enabling this function, the player creates a sculpture that can be constant but that at the same time reconfigures itself to the variations of the frequencies of the music. While sculpting, the shape comes back, and then it floats again, so there is a perceived sensation of dancing with the sculpture.

Thinking in terms of complexity, and in a parallel with Soddu's New Naturality, the sculpture is fed with an "always differing flow of information" [23], in this case, derived from the soundtrack, that then is dependent on the player's interaction. Still in that parallel, possibly more interesting sculptures could be achieved if, instead of simple surface sine and cosines, more complex design decisions were made regarding the shape. As to emergence, the dynamic feeling of "dancing with the sculpture" emerges from this generative exercise.

5. Future Work

Timaeus is already at the stage where case studies are being put in place. However, work is needed to improve the efficacy of this art studio and the work it intends to support.

Firstly, the current user experience design is further being developed in collaboration with domain experts in the field of dementia. We are currently considering including interaction possibilities such as natural input and language so that we can maximize the therapeutic applicability of Timaeus.

Secondly. Timaeus opens the possibility to provide augmentation in creation, in a way that, inabilities to draw, paint, and sculpt, or limitations such as the loss of dexterity may be surpassed, in an overall beneficial and expressive experience. This involves concepts such as cognitive amplification, augmentation or prosthesis. Augmenting in disability is a challenge transversal to assistive technologies for the elderly, considering that "computers may have the potential to augment human cognitive processes in ways that could be beneficial" [6]. Peterson reported that "a computer's ability to capture and amplify even the smallest movement made art therapy treatment available to those with limited mobility" [7] and Astell notes that an important goal when developing technologies for people with dementia should be in building on, maximising and extending retained abilities and mitigating the natural cognitive limitations [24]. Very relevant for this study, Sauer mentions how important that opportunities for creative expression are for those with dementia, who might have seen the erosion of other abilities of self-expression and mastery eroded [25].

Finally, we are working with experts, therapists, staff, and patients in memory clinics, to address safety and compliance with medical regulations.

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