

University of Dundee

## A Roadmap for Therapeutic Computational Creativity

Pease, Alison; Ackerman, Margareta; Pease, Nic; McFadden, Bernadette

*Published in:*

Proceedings of the 13th International Conference on Computational Creativity, ICCC 2022

*Publication date:*

2022

*Licence:*

CC BY

*Document Version*

Publisher's PDF, also known as Version of record

[Link to publication in Discovery Research Portal](#)

*Citation for published version (APA):*

Pease, A., Ackerman, M., Pease, N., & McFadden, B. (2022). A Roadmap for Therapeutic Computational Creativity. In M. M. Hedblom, A. A. Kantosalo, R. Confalonieri, O. Kutz, & T. Veale (Eds.), *Proceedings of the 13th International Conference on Computational Creativity, ICCC 2022* (pp. 261-270). (Proceedings of the 13th International Conference on Computational Creativity, ICCC 2022). Association for Computational Creativity (ACC). [https://computationalcreativity.net/iccc22/wp-content/uploads/2022/08/ICCC22\\_proceedings.pdf](https://computationalcreativity.net/iccc22/wp-content/uploads/2022/08/ICCC22_proceedings.pdf)

### General rights

Copyright and moral rights for the publications made accessible in Discovery Research Portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

### Take down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

# A Roadmap for Therapeutic Computational Creativity

Alison Pease<sup>1</sup>, Margareta Ackerman<sup>2</sup>, Nic Pease<sup>3</sup>, Bernadette McFadden<sup>4</sup>

<sup>1</sup> School of Science and Engineering, University of Dundee, UK

<sup>2</sup> Department of Computer Science and Engineering, Santa Clara University, CA, USA

<sup>3</sup> Independent Psychotherapist, Cork, Ireland

<sup>4</sup> Bernadette McFadden Addiction Counselling-Member of Addiction Counsellors Ireland, Cork, Ireland

## Abstract

Recent years have seen a budding interest in therapeutic applications of creative machines, spanning both autonomous systems and agents that enrich the human creative process. This paper takes a deep dive into therapeutic modalities through the lens of computational creativity and explores opportunities in this exciting emerging domain. In addition to bringing to light to how computational creativity can interface with mental health and wellness, the current paper brings attention to the potential risks and pitfalls of bringing creative machines into the therapeutic context. We hope that this work, conducted in collaboration between CC researchers and practising psychotherapists, will help pave the way forward to responsible and effective applications of computational creativity to therapeutic domains.

Therapeutic Computational Creativity (TCC) is an emerging sub-domain of computational creativity that studies creative systems that promote well-being. More ambitiously, such systems can support or even improve mental health. The aims of TCC are wide reaching, spanning from casual wellness applications to improve mood, to the potential to be incorporated into treatment of conditions such as depression, anxiety, bereavement and trauma.

While Therapeutic Computational Creativity is still in its infancy, there are several works that have already begun paving the way for this new domain. (Cheatley, Moncur, and Pease 2019) posited design considerations for CC systems intended to operate in a therapeutic context. Focusing on bereavement, they identified ten design recommendations for creative systems aiming to assist in the therapeutic process. These include requiring users to participate in the creation process, allowing private and collaborative creation, and being secure and private. One of the challenges identified in (Cheatley, Moncur, and Pease 2019) is to encourage people who may not think of themselves as creative to engage in a creative process. Co-creative systems can be applied in a therapeutic context to overcome this challenge. Their creative abilities offset or even eliminate the need for any artistic expertise on the part of the bereaved and as such extend creative self-expression and the benefits of art therapy.

Building on the above work, Cheatley, Ackerman, Pease and Moncur (Cheatley et al. 2022) studied the impact of

using co-creative songwriting system ALYSIA in a bereavement context. ALYSIA allows users to easily create songs by offering an interactive process for the creation of original lyrics and melodies. The system generates original ideas line by line, allowing the user to select from the system's generations, make edits, or enter their own melodic or lyrical material as they see fit.<sup>1</sup> The bereavement study (Cheatley et al. 2022) asked participants who have recent lost a loved one to write a song about the deceased by utilising the co-creative ALYSIA system.

Using a combination of quantitative and qualitative analytical methods, and utilising the Warwick-Edinburgh Mental Well-Being Scale (WEMWBS) (Tennant et al. 2007), it was found that ALYSIA has promise as a therapeutic modality for bereavement. ALYSIA was helpful in enabling bereaved individuals, particularly those under 30 years of age, to express their feelings. Participants reported that using the co-creative system not only supported their self-expression, but also helped them to identify feelings that they were not previously aware of, as well as accept the reality of their loss, reminisce, and continue bonds with the deceased – all of which have been found to be beneficial for bereaved individuals in the process of adapting to and overcoming their bereavement and grief.

Several other computational creativity projects considered the potential of CC systems to assist in therapeutic contexts. For instance, (Adolfsson et al. 2019) utilised a light weight biofeedback technology, Muse<sup>2</sup>, to assess mental state (through the measurement of alpha waves) and create audiovisual experiences that simultaneously reflect the user's mental state back to them, as well as help them to achieve a calmer state. (Goldstein and Vainauskas 2019) utilised the same neurofeedback technology integrated with Impro-Visor (Keller and others 2012) to explore neurofeedback-driven music creation, which reflects the user's mental state, as well as offering the potential to allow people with limited mobility to express themselves through music.

Another related area in CC concerns casual creators

---

<sup>1</sup>ALYSIA was offered as a commercial product back in 2019 by WaveAI, and was based in part on the work of Ackerman and Loker (Ackerman and Loker 2017)

<sup>2</sup><https://choosemuse.com/>

(Compton and Mateas 2015). Casual creators centre on the autotelic aspects of the creativity process, that is, the inherent pleasure of the creative act rather than any potential benefit of the resulting product. Further, casual creators make it easy to engage in creative acts by having the systems take on much of the creative onus, allowing users to create pleasing artefacts often with minimal effort (see (Petrovskaya, Deterding, and Colton 2020) for a variety of examples).

We believe that casual creators have a role to play in TCC, representing a class of systems that may have value for mental wellness by offering readily accessible, enjoyable creative experiences. On the other hand, it is important to emphasise that the aims of TCC extend beyond casual creators, allowing for systems that require more substantial effort on the part of the user (such as in the bereavement study utilising ALYSIA (Cheatley et al. 2022)), as well as permitting for greater emphasis on the resultant artefact (which can play a role in the healing process, as identified by (Cheatley, Moncur, and Pease 2019)).

TCC can be viewed as part of a broader effort to discover new, creative ways to support mental health and wellness, including utilising modalities such as virtual reality (Emmelkamp and Meyerbröcker 2021) and video games (Fernández-Aranda et al. 2012) for therapeutic purposes. This effort extends to commercial applications, where several products interface between mental wellness and creative machines. These firms include Endel<sup>3</sup> and Brain.fm<sup>4</sup>, which offer personalised generative music and soundscapes designed to aid users in reaching desired mental states, such as focus, relaxation, or sleep. There are also a variety of AI-driven solutions for mental health support, such as Wysa<sup>5</sup> and Woebot<sup>6</sup>, typically focusing on chatbot technology. However, these are outside the scope of the current work since they do not integrate autonomous creativity or co-creative methodology.

In ICC 2021, CC Researcher Margareta Ackerman and Research Psychologist Galen Buckwalter led the first tutorial on TCC<sup>7</sup>. The event discussed the potential of this field, focusing on the therapeutic potential of creative self-expression that can be enabled through co-creative systems. The tutorial also included a hands-on session where attendees experienced a light therapeutic process through the use of creative machines, in particular, utilising co-creative lyrics system, LyricStudio<sup>8</sup> to write poetry about their experience with the COVID-19 pandemic. Several participants expressed surprise at the quality of the poems that they were able to create in a short amount of time. Poems were subsequently shared with the group. We hope that the current work will encourage future work and community events on therapeutic applications of CC.

In the remainder of the paper we take a deep dive into therapeutic modalities and approaches through the lens of

computational creativity. We firstly consider what makes creative arts therapy work, and then describe and contrast two main approaches: psychotherapy and occupational therapy. We draw particular focus to the concept of the ‘third hand’, a technique which we propose will be especially relevant to TCC. We then look at therapists’ attitudes to the use of technology in their practice, before describing three case studies in which previous generations of creativity software were used in art therapy. After briefly outlining implications of this work for TCC researchers, we then consolidate our work into eight concrete recommendations for TCC researchers: these are intended to provide a roadmap to this emerging area. We conclude with further work and reflections on TCC as playing a potentially significant role in future mental health support and therapy.

## Creative arts therapy

Many cultures hold that art making and creative activity can be therapeutic in that they promote healing, wellness, eudaimonic well-being, flourishing and happiness (Stuckey and Nobel 2010; Conner, DeYoung, and Silvia 2018; Lomas 2016). Our creativity can help us to construct our identities, as well as narratives that give meaning to our lives and meet deep existential and spiritual needs. (Lomas 2016) found that all four major arts modalities – music, visual arts, movement-based creative expression, and expressive writing – are associated with sensemaking (enabling people to comprehend existence and find meaning in it), enriching experience (facilitating new or elevated emotional states), aesthetic appreciation (enjoying beauty or skills), entertainment (having pleasure and fun), and bonding (connecting with others through art).

The positive power of creativity has been recognised within clinical fields, and is used in art therapy to help clients to process difficult feelings, uncover and come to terms with traumatic past experiences, and bring about changes in thinking and behaviour. While *therapeutic* art, or art *as* therapy, is done in unstructured, informal, unmediated, everyday environments, *art therapy* harnesses the power of creativity in very specific ways, usually under the guidance of a trained therapist.

There is a wide spectrum of therapies: these range from a focus on the core personality and questions around the structure of the self, where it comes from, and how it can be changed (psychotherapy approaches); to those which focus on finding meaningful activities for a person, given situational issues in the here and now (occupational therapy approaches).

## Psychotherapy

In psychotherapy the relationship between client and therapist is core to the healing process: it is this relationship, this connection between two people, that heals (Clarkson 2003). Here, art can provide a means of communication between them, a way of entering into a dialogue, often to express unconscious feelings or trauma that goes beyond words. The role of the therapist is to hold the space and bear witness. Healing happens when a client feels listened to and understood (Rogers 1977; Clarkson 2003). Three characteristics

<sup>3</sup><https://endel.io/>

<sup>4</sup><https://www.brain.fm/>

<sup>5</sup><https://www.wysa.io/>

<sup>6</sup><https://woebothealth.com/>

<sup>7</sup><https://computationalcreativity.net/iccc21/therapeutic-cc/>

<sup>8</sup><https://lyricstudio.net/>

of the therapist in particular therefore form the core part of the therapeutic relationship: congruence (authenticity), unconditional positive regard and accurate empathic understanding (Rogers 1977).

Creativity can also be a form of play which can help people to access early childhood states and memories, sometimes helping them to 'reset' if trauma has occurred as a child. Here, as when children engage in creative play, it is the process, the sensory experiences and the sharing with other people, that is important, rather than a finished artefact. The goal here is to invoke a healing experience, rather than a product with artistic merit.

Psychotherapy can also take place in group settings, and here, the whole group hold the space and bear witness. For instance, people might meditate for a while – a private space within a shared space – and then be encouraged to take some clay and "just play around with it", without rational thought or judgements, and see what happens. Once people feel they have finished, the group will go around the room and people will show their piece and explain what it means to them and perhaps what they think it expresses. Afterwards each person can take their piece home with them, or scrunch it up into a ball of clay and leave it.

Integrative psychotherapy consists of combining techniques and therapeutic approaches according to the client and the situation (Norcross, R., and Goldfried 2019). This is based on the idea that there is no one true way, that the therapist needs to find a new language for each client and find what works in the moment. The skill of the therapist here lies in not only knowing a variety of techniques, but being able to select the most appropriate one for a given context.

## Occupational therapy

Occupational therapy (OT) has a different approach to the role of creativity. As its name suggests, occupation plays a central role in the therapeutic process, with the goal being to improve health and well-being by enabling an individual to engage in meaningful activities. Here, occupations are viewed as a basic human need, and if people's situations, such as illness or mental health issues, hinder their ability to engage in their usual pursuits, then new patterns of occupation are required: for instance, OT was originally developed to help soldiers who were injured during World War I. It is in these times in a person's life that creative occupations may offer an alternative means of engaging in a meaningful occupation and contribute to health and well-being (Law, Steinwender, and Leclair 1998).

In a series of papers, Reynolds shows how artistic occupations such as needlecraft, textile arts and visual art-making can provide people living with depression, chronic illness, or cancer with a source of positive identity, even when they have not engaged regularly in art in their earlier adult lives (*e.g.* (Reynolds 2003)). She found that artistic occupations can help people to reconnect with their previous, pre-illness self; restore a sense of one's own expertise, status and self-esteem; develop a positive sense of personal growth; and provide a socially validated identity. These can help people to meet new challenges and manage their condition.

OT has its roots in arts and crafts participation, which is thought to have many benefits, including increased self-expression and perceived control, a sense of self and of purpose, skills for occupational participation, establishing daily routines and transforming a client's experience of illness (Bathje 2012; Perruzza and Kinsella 2010). Here the product is an object of value in its own right (Hussey, Sabonis-Chafee, and O'Brien 2007; Perrin 2001), in contrast to the psychotherapy context in which the main role of creative artefacts is to communicate between conscious and unconscious, or between therapist and client. Thus, in OT, the development of the necessary skills to produce an artefact and a sense of the quality of an artefact are integral to people's therapeutic experience. Perrin describes the potential of the art or craft product to do two things:

- "To anchor us in the reality of the here and now. 'I did this. It is a tangible expression of who I am and what I do. No matter how depressed, disordered or disabled I might be, this is a reflection of the fact that I do exist and I still have the capacity to make a mark on the world around me.'
- To use the external (hands and objects) to influence the internal (thoughts and emotions)."

(Perrin 2001, p. 130).

Arts and crafts activities are seen as a way into creative thinking, with creativity understood more widely to include skills such as adaptation, innovation, change, first insight, going with the flow, and risk taking (Schmid 2004).

## The concept of the Third Hand

Kramer coined the term 'third hand' as a metaphor to describe part of the job of an art therapist (Kramer 1986). This is a "hand that helps the creative process along without being intrusive, without distorting meaning or imposing pictorial ideas or preferences alien to the client" (Kramer 2000, p. 48). This might be at a purely functional level, such as a therapist providing a paintbrush, or at a more personal and artistic level, such as providing appropriate choices of colour for a client, suggesting a topic or modifications to an artwork, implementing changes themselves, or doing 'hand on hand' painting with a client. This is seen to be useful in a variety of situations; principally when the therapist is sure that they know what the client is trying, and unable, to express. Kramer warns that the therapist (often an artist in their own right) must be careful to work within the style of the client: "They must cultivate an area of artistic competence distinct from their own artistic struggles and predicaments, a conflict free sphere wherein technical skill, pictorial imagination, ingenuity and capacity to improvise are employed solely for empathic service to others." (*Ibid.*, p 48).

When done well, the addition of a 'third hand' can lead to cooperative and supportive interactions between the art therapist and client, and can trigger turning points; in the development of a particular artwork, in how a client feels about their artwork, and in how a client develops personally and emotionally. When done poorly, it can be seen as over-helping or taking over, which can lead to disempowerment of a client and lack of therapeutic progress and trust.

## **The use of computers in art therapy**

Dialogue around the use of technology by art therapists has been ongoing for more than 35 years, since Weinberg's study in 1985 on the potential of rehabilitative computer art therapy for people who are suddenly disabled (Weinberg 1985). Those in favour of the idea urge their colleagues to keep up with and be open to new artmaking materials, as well as pointing to successful studies of computer art therapy such as those described below (see also (Hartwich and Brandecker 1997; Thong 2007; Weinberg 1985; Peterson, Stovall, and Elkins 2005)). Kapitan expresses this as follows:

"To participate as artists in techno-digital culture, we must broaden our definitions of art materials and contexts across a wide spectrum: from traditional "low tech" forms that offer refuge from the digital world to interactive art events and virtual forms that stimulate playful, subversive, and symbolic communications with their audiences. Art therapists must be willing to move beyond historically validated media and offer our work in new contexts." (Kapitan 2007, p. 51)

In 1987 Canter argues that "art therapists are challenged to use state-of-the-art technology to positively reinforce art therapy techniques" (Canter 1987, p. 17); and Thong similarly states: "In order to take art therapy into future generations, we must be open to new areas of image making and new creative tools." (Thong 2007, p. 52). Hartwich and Brandecker suggest that "Prejudice against the computer comes more from therapists than patients" (Hartwich and Brandecker 1997, p 372). All warn that failure to adapt to artistic-technological innovations could lead to the profession of art therapy becoming extraneous or anachronistic.

Those against the idea point to practicalities such as cost and unfamiliarity on the part of the therapist (Peterson, Stovall, and Elkins 2005), as well as deeper concerns about their therapeutic value (Gerity et al. 1996; Asawa 2009; Gerity 2001; Kapitan 2007). One concern is that technology may inhibit or prevent the unconscious expression which a therapist sometimes seeks in creative activity, by offering suggestions which are easy to select but may not reflect unconscious feelings. A second concern is that the human to human connection is central in therapy and creative software cannot play a role in that. Thirdly, the therapist may be trying to foster a state of child-like play in a client, via primitive movement, sensations and tactile experiences, and again technology may well inhibit rather than encourage this state. Gerity, for instance, warns about over-exposure to the "seductive environment" of virtual reality and popular digital cultures. She champions the importance and power of safe, quiet, transitional spaces, such as a pottery room, healing garden, and inter-generational puppet-making workshop (Gerity 2001). Here the natural rhythm of creative work can flourish, including perhaps a stage of chaos or boredom which an artist sometimes moves through before finding "flow" (Csikszentmihalyi 1975). There is a danger that digital technologies, on the other hand, trap a person into endless superficial passive consumption, preventing us from finding our creative rhythm, accessing our inner environment or feeling real in the world. It is worth bearing in mind

that Gerity's criticisms here were written in 2001: today's digital culture is a changed landscape, although with many of the issues that she feared. While much of it is designed to hold the users' attention for as long as possible, responsible design could evade at least some of these issues.

It is important to note here that the dialogue (and case studies below) is almost entirely around a techno-digital art culture which is assumed to exist independently of art therapy; tools created independently, which therapists learn how to use, adapt to their purposes and then offer to their clients. Asawa points this out: "Art therapists, as well, are rarely consulted in the process of creating software designed for the flexibility and intuitive processes that they value." (Asawa 2009, p 59). Co-creative systems, on the other hand, often follow user-centred design methodologies, which include the user in all aspects of the development of a system to enhance and complement a person's creative process.

## **Case studies of creativity software for art therapy**

### **Computational Art Therapy for clients with impulsive or destructive personalities**

(Canter 1987) conducted a three month study in which clients with emotional and learning disabilities and impulsive or destructive personalities were given the opportunity to use computational as well as conventional art therapy, including programs for drawing (MacPaint), music (MusicWorks) and animation (VideoWorks). She found that many selected the computational tools and continued to engage with them after completing the programme. Benefits included increased attention span; development of visual and musical expression in clients who normally could not express themselves verbally and were unfamiliar with music; and development of self confidence, creativity and communicative skills. Clients felt more in control of their environment, showed enhanced creative problem solving skills, and flourished in a conflict-free atmosphere with the metaphor of friendly user and teacher. She highlighted the importance of an easy undo feature, which provided an environment in which clients could experiment safely, knowing that they can undo a move without any consequences. This allowed clients to "easily make quick changes without conflict, embarrassment or frustration." (Canter 1987, p. 25) Furthermore, the fact that it worked in real-time meant that clients can instantly hear or see their partially completed piece, which she felt was beneficial. Overall she found that the use of state-of-the-art technological tools for art therapy provided new kinds of creative learning experiences and positive interpersonal communication and helped to build self esteem and trust in the art therapist and exemplified positive changes in clients' behaviour.

(Parker-Bell 1999) highlights the same advantages as Canter found: the undo feature, and the success amongst learning disabled youth in particular to learn how to use the software, and subsequent increased self-esteem due to their achievements. Writing in 1999, she also emphasises the importance of familiarity: "art therapy clients may be more familiar with the computer than any other art tool besides

the pencil. At times we may need to bridge any gaps in art familiarity by starting with the client's home base - the computer." (*Ibid.* p 180) and advocates integrating computer use into clinical practice. She does identify some limitations; describing feeling a "tremendous hunger for the tactile stimulation and physical generation of energy that traditional artmaking can provide." after long sessions on the computer (*Ibid.* p 184), and suggests that traditional art materials be combined with computer art (for instance, scanning a hand-drawn pencil sketch and adding colour on the computer). Another limitation she found was a lack of diversity in some of the software programs; for instance the version of the Flying Colors program that she used had no racial or age variety in available figures; all being blond and blue-eyed Caucasians within a single adult age range. She recommends that therapists consider style, level, functions, and content of a program when matching it to a client.

### **Rehabilitative computer art therapy for suddenly disabled people**

Occasionally, computers may be the only art tool suitable for some physically challenged people. For instance, (Ranger 1996) advocated using computer art therapy with children who had severe cerebral palsy. Because of spasms and minimal motor control, these children were unable to use traditional materials to express and communicate their thoughts and feelings. Weinberg looked at the potential of rehabilitative computer art therapy for suddenly physically disabled patients, including quadriplegics, cerebral vascular accident patients and brain trauma patients (Weinberg 1985). She found that because deep psychological illness was rare in this patient group, psycho-educational art therapy or art as therapy were more appropriate than psychotherapy, since the focus was on patients' current problems of coping, adapting and building self-esteem. The hardest people to engage were patients who were accomplished artists prior to their quadriplegia: this group struggled with their inability to maintain their artistic standard, resulting in anger, frustration and withdrawal.

She found that certain aspects of computer art were particularly beneficial. The main feature was that the computer could undertake the manual parts of art that patients were now no longer able to do, leaving mental work such as aesthetic judgements for the patients. Further features included adjusting speed and pace of the computer to enable those with quadriplegia to work at a slower rate; bright colours and movements on the computer, which stimulated perception and helped to hold attention span; patients' ability to make a lot of progress over a short period of time, allowing for shorter sessions which was useful for patients learning to live with problems such as incontinence; and capability to store work in progress. She also highlighted that computer art can help therapists to monitor stroke patients' progress, in terms of cognitive abilities, spontaneity, creativity, perception and problem solving skills.

Weinberg describes rehabilitative computer art therapy for quadriplegic, stroke and brain trauma patients as having the potential to help patients to adapt, cope, value and build upon their remaining strengths by having successful

art experiences; to increase self-esteem, motivation, autonomy and control; to help to maintain orientation and memory; stimulate exploration and creativity and provide an outlet for expressing negative emotions; to prevent isolation by providing socialisation through non-verbal communication; and to provide patients with a temporary escape from the awareness of physical and mental pain by channelling attention into creative activity. She concludes that "Rehabilitative computer art therapy, by offering an unusually novel and rapid approach to successful art experiences, has the unique power and advantage to elicit disabled patients' curiosity and motivation to build upon their residual strengths." (Weinberg 1985, p 72).

### **Computational Art Therapy for children in hospital**

(Thong 2007) writes about her experiences in helping to establish a hospital computer art program. She concludes after two years that children who were proficient with traditional art materials demonstrated the same level of creativity with computer art. A further, perhaps even more striking finding, was that using computer art enabled her to engage children who were "defended against" traditional art expressions, providing "adaptive solutions to a patient's problems in the actualisation of his creative intentions" (Rubin 1984, p. 9), in (Thong 2007, p. 53).

She argues that those who have explored digital media have found computer art beneficial, and believes that computer art should be added to an art therapist's toolbox of media, and used in appropriate settings. To illustrate how digital art can be used as a therapeutic intervention, she describes five case studies of hospitalised adolescents, using programs such as Photoshop, Magic Mouse's Flying Colors, and Hapttek's People Putty. Benefits include helping people to find their voice and to self-advocate by producing computer artwork they feel sufficiently happy with to share, thereby opening up conversations with therapist, doctors, nurses, guests, and other patients; helping to draw patients out of their solitude and find social connections; finding ways to remember and express happier times; giving people a feeling of control over their hospitalisation; and providing space where anger leading to behavioural problems can be safely expressed and explored.

Thong discusses the importance of empowering clients through choice; both of creative media, and of elements within a software program, and argues that "Based on the cases illustrated throughout this article, the expressive potential of computer art is unmistakably therapeutic." (Thong 2007, p 58).

### **Implications for Therapeutic Computational Creativity**

Many art therapists are actively seeking to keep their work current by engaging with new art technologies. Those who have used previous generations of creative software have found it to have therapeutic value, particularly with certain client populations, such as young people or suddenly disabled people. Furthermore, techniques such as the 'third

hand' which were developed for human-to-human settings have a natural analogue in CC systems. This all points to TCC being an exciting and worthwhile application of CC and suggests specific, promising directions. However, we must also listen to those who urge caution. A computer cannot authentically bear witness, listen to and understand a person's pain. It cannot "hold space". There may be a pale imitation of this, or a behaviour that "fools" people into feeling listened to or understood (as ELIZA famously demonstrated (Weizenbaum 1966); also see (Abd-alrazaq et al. 2019) for an overview of chatbots in mental health), but that is necessarily different to the human to human connection that is sought and used in therapy. This precious connection must be cherished and protected. The therapeutic relationship between client and therapist is widely acknowledged to be a cornerstone of therapy (Clarkson 2003), and it seems far fetched to imagine that this deeply human bond could ever be replaced by a machine.

Nevertheless, computers may be able to have therapeutic value in ways different from a human therapist. The distinction between therapy and therapeutic is crucial here. A healing process may take multiple forms, and a person who has been through trauma might benefit from both therapy and therapeutic endeavours. Computers can certainly assist with the latter, and CC systems in particular have a role to play, in enhancing our creative process and making us more creative beings.

In order to provide a solid foundation for the emerging discipline of TCC, we need to add our voice to the dialogue on the use of computers in art therapy. We believe that the way forward is via cross-disciplinary engagement and collaboration. The landscape of creative software has significantly changed since the case studies into computer art therapy described above. The CC community now have over 20 years experience in thinking about theoretical issues such as the role of framing, explanation and dialogue (Llano et al. 2020), or what authenticity means in the context of creative computers (Colton, Pease, and Saunders 2018); in building co-creative systems which are designed to enhance a user's creative flow (Jordanous 2016), and to operate within hybrid human-machine creative teams (Yannakakis, Liapis, and Alexopoulos 2014); in evaluating creative and co-creative systems (Karimi et al. 2018; Kantosalo, Toivanen, and Toivonen 2015) and in methodologies for all of the above (Bray and Bown 2016).

Engaging with art therapists who advocate keeping up with state-of-the-art technologies for artmaking will help to make them aware of the collective body of work in CC, potentially to adopt new technologies, and to influence further directions and opportunities. Equally important, engaging with therapists who have theoretical concerns about incorporating computers into their practice will enable us to identify limitations and provide an essential note of caution.

### **Recommendations for Therapeutic Computational Creativity**

For TCC to flourish, proceed along ethical lines, and achieve take-up, we will need to construct a framework within which

to operate, including definitions, methodology, evaluation criteria, ethical guidelines, outreach and so on. In these early stages, a complete framework would be premature; it is more timely to outline recommendations as a roadmap for how to proceed. In addition to arising from the work just described, the following recommendations have emerged via a series of discussions between the four co-authors of this paper. Inline with our own recommendations, we are a mixed group of two CC researchers and two psychotherapists (one of whom embraced the idea of TCC as a new healing modality, with the other being considerably more wary about the idea, emphasising the importance of human connection in his own therapeutic practice). Recommendations 1-4 require us to recognise the inter-disciplinarity of the subject and to work closely with therapists and mental health professionals; 5-6 concern moral imperatives which should be embedded into the work at all stages; and 7-8 concern methodological recommendations.

#### **Recommendation 1: Collaborate with mental health professionals**

Working with art therapists will provide grounding and inspiration for the development of creative systems that stand to have substantial impact for mental health and wellness. Mental health professionals with other specialities – for instance, Cognitive Behavioural Therapy or Psychodynamics – can also offer insight into the therapeutic process that may inspire TCC systems.

Another critical motivation to engage with mental health professionals involves learning from their theoretical concerns about incorporating computers into their practice, in order to unpick these. Some may be based on false assumptions about what computers can or cannot do or pertain to state-of-the-art only; however, we expect that some theoretical concerns will go beyond these and address deep and inherent limitations.

#### **Recommendation 2: Design software which is underpinned by work in art therapy**

There is a wealth of research on art therapy and why it works. Disregarding this literature would lead at best to wasted time and resources, and at worst to ineffective, irrelevant or dangerous solutions. Techniques such as the 'third hand' are a natural fit for TCC and we can learn from therapists' experiences about how and when to use this. While this technique seems to be at the other end of the spectrum from systems which take on much of the creative responsibility themselves, work on it will help to guide designers to strike an appropriate balance of creative input by human and machine.

Related to this, we can also learn from art therapists' experiences of the processes involved in people's 'creative moments', in order to develop insight into the creative flow and when intervention might be appropriate. For instance, some champion Csikszentmihalyi's idea of the struggle and moments of 'being stuck' as important parts of the process (Csikszentmihalyi 1975). Designers of co-creative systems would need to incorporate this into the interaction dynamics

between computers and people: simply making the process quicker and easier for the human may not be desirable.

Another example is inspired from a demonstration of Vishnevsky's interactive generative art program *Silk*<sup>9</sup> to a psychotherapist (an author on this paper). She used a touch screen to draw pictures, and enthused about the therapeutic potential of such a system: "That's the colour of my touch"; "I was nearly dancing"; "That's what my energy looks like". She connected this experience to movement therapy, in particular Gabrielle Roth's movement meditation practice 5Rhythms (Roth 1995). This practice is structured around five basic rhythms, each representing distinct musical, movement, and metaphorical qualities – *Flowing*, *Staccato*, *Chaos*, *Lyrical* and *Stillness*. The therapist's experience of the visual quality of *Silk* inspired her to consider what the five rhythms would look like as visual art. We then showed her another system, ViFlow (Brockhoeft et al. 2016), in which dancers' limbs were tracked and their movements shown in real-time on a large screen. From this we devised together a hypothetical therapeutic system, in which a human would dance the 5Rhythms and their movements would be represented in real-time as visual art. This suggests how work in TCC might benefit from a theoretical underpinning in art therapy.

### **Recommendation 3: Distinguish therapeutic from therapy**

Everyday therapeutic art can consist in varying levels of creative responsibility; for instance, with some experiences having a meditative quality. There is space here for co-creative tools, that a client can use on their own, at home, as part of a therapeutic routine. Art therapy on the other hand is usually done under the guidance of a trained therapist. Co-creative tools here may be appropriate for some approaches; for instance, occupational therapy, which emphasises skills and meaningful activity, or some forms of integrative therapy or psychotherapy. In other contexts, such as those aspects of psychotherapy which emphasise the human to human connection, sensory experience, child-like states and unconscious expression, we would expect TCC to be of limited use.

### **Recommendation 4: Match the client to the medium**

We suspect that certain populations will be better suited to therapeutic CC than others. In the case studies described above, computer art therapy was found to work well with people with various (often overlapping) characteristics. These included learning disabled youth (Parker-Bell 1999), people who are familiar with computers (Parker-Bell 1999), people who are "defended against" traditional art expressions (Thong 2007), people between 18 and 30 (Cheatley et al. 2022), children and adolescents (Canter 1987; Ranger 1996), people with little motor control (Ranger 1996), suddenly disabled people (Weinberg 1985), people who were accomplished artists prior to a sudden disability

(Weinberg 1985) and people without deep psychological illness (Weinberg 1985). We further hypothesise that specific art forms such as co-creative songwriting might work especially well for people who struggle with linguistic expression, such as clients with substance abuse, people who are dyslexic, or people who are semi-literate. In these cases, the prompts given by a songwriting system such as ALYSIA could enable people to create lyrics where otherwise they simply would not have been able to.

### **Recommendation 5: Develop a set of guidelines for responsible research in TCC**

TCC research will raise issues around trust, privacy, data protection, therapeutic support and so on, and it is imperative that these are considered in advance of and during design processes. Responsible Research and Innovation (RRI) offers ways to incorporate ethical design into emerging technologies. This covers a wide range of tools, including traditional technology ethics by philosophers and social scientists; value sensitive design (Van der Hoven 2013) in which values are incorporated into the design process of new technologies based on an assessment of the potential implications of the innovations and values at stake; and interactive processes by which societal actors (researchers, citizens, policy makers, business, third sector organisations, etc.) work together and are mutually responsive to each other. There is now a wealth of work on how to incorporate RRI into research, both generally (e.g. (Schuijf and Dijkstra 2019)) and in neighbouring TCC domains, such as robotics and healthcare (e.g. (Stahl and Coeckelbergh 2016)).

### **Recommendation 6: Consider diversity issues in TCC**

Diversity was identified as an issue in computer art therapy by Parker-Bell in 1999 (Parker-Bell 1999) and is still relevant today. The same arguments that recommend that therapists come from a wide variety of backgrounds, in terms of race, sex, class, abilities, age and so on, hold for developers of CC systems for therapy. In the wake of the Black Lives Matter movement and the resultant awareness of the socio-political, socio-cultural, and socio-structural realities within which our community operates, we have a shared responsibility to widen our focus. Cultural notions of creativity, cultural availability of computers, more participatory research and an inclusivity of race, gender, abilities and age should be reflected in our research. As well as enriching the subject, this will help to ensure relevance and avoid "the singular white lens that pervades arts therapies discourse." (Gipson, Williams, and Norris 2020, p 4). For CC this means diversifying the community ((Cook and Colton 2018) offers some practical suggestions of how we might do this) and ensuring diversity in both therapists and clients.

### **Recommendation 7: Employ user-centred methodologies**

Neighbouring disciplines such as Human Computer Interaction and Interaction Design have developed and applied user-centred design principles, such as cooperative design,

<sup>9</sup>weavesilk.com



participatory design, contextual design and empathetic design (e.g. (Norman 1986)). These are driven by understanding, consideration and inclusion of the user and their experience of a computer system. Investigative methods such as ethnographic study, contextual inquiry, prototype testing and usability testing are employed in order to ensure that the user (in this case both art therapist and client) is included in every step of the design, development and evaluation process. These methodologies are already applied in some CC work (for instance (Bray and Bown 2016)) and will be essential in designing TCC for meaningful use.

### **Recommendation 8: Develop appropriate ways to evaluate TCC**

Evaluation of therapeutic effectiveness, human-machine interaction and appropriate levels of creative input from the machine will all be necessary for TCC to progress as a field. Evaluation is an active research area in CC. Proposed methods so far include measuring relevant characteristics of system-produced artefacts, such as relative novelty and value (Ritchie 2007) or novelty as the violation of observers' expectations (Grace and Maher 2019). Alternatively, (Colton, Charnley, and Pease 2011) suggest breaking down the creative act into component parts and measuring progress in automation along relevant axes. (Jordanous and Keller 2016) propose using qualitative methods, such as interviews, to evaluate characteristics associated with creativity in a system's process and output. (Jordanous 2019) further provides an overarching set of evaluation guidelines designed to provide a general framework to standardise different approaches, and proposes meta-evaluation criteria. Much of the evaluation in art therapy of a client's progress within a programme focuses on the results of case studies. There are some empirical studies, however, which aim to evaluate the impact of art therapy on measurable outcomes such as depression, self-esteem and harmful behaviours (see (Reynolds, Nabors, and Quinlan 2000) for a review).

Evaluation criteria from both disciplines will need to be combined and developed to formulate suitable, practical metrics for TCC.

### **Further work and conclusions**

In this paper, we set out to share guiding principles for future work in TCC. Naturally, these principles themselves should be further developed via discussions with a wide range of stakeholders. These will then form the basis of a framework within which to operate, once the field has sufficiently matured.

In these early days of TCC, it has been found that younger audiences, who are used to interacting with technology on a daily basis, may be particularly responsive to electronically delivered creativity-based therapies (Cheatley et al. 2022). While we are currently at the inception of the field, this early finding along with the potential for safe, scalable mental health solutions suggests that, in time, TCC may become an important part of mental health support and therapy.

A primary dichotomy in the development of TCC systems centres on whether to develop systems that integrate with in-person therapy, or instead offer scalable solutions that do not require a human therapist. Integrating TCC systems into the therapy room offers a safer route, and may facilitate faster developments in the field through collaborative opportunities with therapists. TCC may look different depending on the type of therapy into which it is integrated (e.g. psychotherapy or occupational therapy) and across different client populations with respect to age and condition.

On the other hand, the case for more scalable systems is born from the pressing need for providing mental wellness and health support. The already under-served mental health needs of the general population reached critical heights due to the impact of the COVID-19 pandemic. The US alone saw a steep increase in people experiencing depression and anxiety, raising from one in ten to four in ten, with increased mental health support needs expected to persist for years after the conclusion of the pandemic (Chidambaram 2021). TCC may be part of the solution to this mental health crisis, helping the general population maintain and improve mental wellness.

The wide reaching promise of TCC suggests an exploration into a range of conditions, spanning anxiety, depression, post-traumatic stress disorder, bereavement, and marriage and family therapy, to name a few. Similarly, the wide range of artistic modalities which have been studied in the context of CC include visual art, music, poetry, and dance and movement. This and other domains may be explored as potential therapeutic modalities through a CC lens, allowing people across all levels of artistic expertise to better express their emotions and formulate meaning from challenging experiences through creative expression.

Exploring the synergy between art therapy and CC will open up new modalities and opportunities within therapy, offering a unique and promising approach to this challenge. With decades of research into creativity through a computational lens, the CC community is uniquely positioned to bring out the healing aspects of the creative process through the use of creative machines. This exploration calls for great respect for therapeutic traditions, coupled with a profound understanding of the intricacies of both human and machine creativity.

The novel perspective of a new application domain for CC will also further a variety of research directions within CC, such as the development of theoretical concepts, methodologies and co-creative interaction protocols. These are essential for a healthy and flourishing field, and offer ways in which we can extend the reach of CC within society. We hope that the roadmap outlined in this paper will help to inspire the blossoming of TCC, leading both to profound academic exploration and social good.

### **Author Contributions**

All four co-authors held a series of discussions in which AP and MA described CC; MA demonstrated CC systems; and NP and BM described their work in psychotherapy and other approaches to therapy. All co-authors discussed TCC and formulated the eight recommendations together. AP wrote

the sections on creative arts therapy, the use of computers in art therapy, the case studies and implications for TCC. MA wrote the introduction and further work and conclusions.

## Acknowledgments

We are grateful to our three anonymous reviewers for their thoughtful comments, which helped to improve the paper.

## References

- Abd-alrazaq, A. A.; Alajlani, M.; Abdallah Alalwan, A.; Bewick, B. M.; Gardner, P.; and Househ, M. 2019. An overview of the features of chatbots in mental health: A scoping review. *International Journal of Medical Informatics* 132:103978.
- Ackerman, M., and Loker, D. 2017. Algorithmic songwriting with ALYSIA. In *International conference on evolutionary and biologically inspired music and art*, 1–16. Springer.
- Adolfsson, A.; Bernal, J.; Ackerman, M.; and Scott, J. 2019. Musical mandala mindfulness: a generative biofeedback experience. *Musical Metacreation, Charlotte, NC*.
- Asawa, P. 2009. Art therapists' emotional reactions to the demands of technology. *Art Therapy: Journal of the American Art Therapy Association* 26(2):58–65.
- Bathje, M. 2012. Art in occupational therapy: An introduction to occupation and the artist. *The Open Journal of Occupational Therapy* 1(1).
- Bray, L., and Bown, O. 2016. Applying core interaction design principles to computational creativity. In *Proc. of the Seventh International Conference on Computational Creativity*, 93–97.
- Brockhoeft, T.; Petuch, J.; Bach, J.; Djerekarov, E.; Ackerman, M.; and Tyson, G. 2016. Interactive augmented reality for dance. In *Proc. of the Seventh International Conference on Computational Creativity*, 396–403.
- Canter, D. 1987. The therapeutic effects of combining apple macintosh computers and creativity software in art therapy sessions. *Art Therapy: Journal of the American Art Therapy Association* 4:17–26.
- Cheatley, L.; Ackerman, M.; Pease, A.; and Moncur, W. 2022. Musical creativity support tools for bereavement support. *Digital Creativity*.
- Cheatley, L.; Moncur, W.; and Pease, A. 2019. Opportunities for computational creativity in a therapeutic context. In *International Conference on Computational Creativity*.
- Chidambaram, P. 2021. The Implications of COVID-19 for Mental Health and Substance Use. <https://www.kff.org/health-reform/issue-brief/the-implications-of-covid-19-for-mental-health-and-substance-use/>.
- Clarkson, P. 2003. *The Therapeutic Relationship (2nd edition)*. Wiley.
- Colton, S.; Charnley, J. W.; and Pease, A. 2011. Computational creativity theory: The face and idea descriptive models. In *Proc. of the Second International Conference on Computational Creativity*, 90–95. Mexico City.
- Colton; Pease, A.; and Saunders, R. 2018. Issues of authenticity in autonomously creative systems. In *Proc. of the Ninth International Conference on Computational Creativity*.
- Compton, K., and Mateas, M. 2015. Casual creators. In *Proc. of the Sixth International Conference on Computational Creativity*, 228–235.
- Conner, T. S.; DeYoung, C. G.; and Silvia, P. J. 2018. Everyday creative activity as a path to flourishing. *The Journal of Positive Psychology* 13(2):181–189.
- Cook, M., and Colton, S. 2018. Neighbouring communities: Interaction, lessons and opportunities. In *Proc. of the Ninth International Conference on Computational Creativity*, 256–263. Association for Computational Creativity (ACC).
- Csikszentmihalyi, M. 1975. *Beyond boredom and anxiety*. San Francisco: Jossey-Bass.
- Emmelkamp, P. M., and Meyerbröcker, K. 2021. Virtual reality therapy in mental health. *Annual Review of Clinical Psychology* 17:495–519.
- Fernández-Aranda, F.; Jiménez-Murcia, S.; Santamaría, J. J.; Gunnard, K.; Soto, A.; Kalapanidas, E.; Bults, R. G.; Davarakis, C.; Ganchev, T.; Granero, R.; et al. 2012. Video games as a complementary therapy tool in mental disorders: Playmancer, a european multicentre study. *Journal of Mental Health* 21(4):364–374.
- Gerity, L.; Henley, D.; Howie, P.; Kramer, E.; and Williams, K. 1996. The seductive environment revisited: Addressing the problem. In *Proc. of the 27th Annual Conference of the American Art Therapy Association, Philadelphia, PA*.
- Gerity, L. A. 2001. Joise, winnicott, and the hungry ghosts. *Art Therapy: Journal of the American Art Therapy Association* 18(1):44–49.
- Gipson, L. R.; Williams, B.; and Norris, M. 2020. Three black women's reflections on covid-19 and creative arts therapies: Then and now. *Voices: A World Forum for Music Therapy* 20(2):1–5.
- Goldstein, R., and Vainauskas, A. 2019. Mindmusic: Brain-controlled musical improvisation.
- Grace, K., and Maher, M. L. 2019. Expectation-based models of novelty for evaluating computational creativity. In *Computational Creativity*. Springer. 195–209.
- Hartwich, P., and Brandecker, R. 1997. Computer-based art therapy with inpatients: Acute and chronic schizophrenics and borderline cases. *The Arts in Psychotherapy* 24(4):367–373.
- Hussey, S. M.; Sabonis-Chafee, B.; and O'Brien, J. C. 2007. *Introduction to Occupational Therapy (3rd ed.)*. St. Louis, MO: Mosby.
- Jordanous, A., and Keller, B. 2016. Modelling creativity: Identifying key components through a corpus-based approach. *PloS one* 11(10):e0162959.
- Jordanous, A. 2016. Four PPPPerspectives on computational creativity in theory and in practice. *Connection Science* 28(2):194–216.

- Jordanous, A. 2019. Evaluating evaluation: Assessing progress and practices in computational creativity research. In Veale, T., and Cardoso, A., eds., *Computational Creativity: Computational Synthesis and Creative Systems*. Springer.
- Kantosallo, A.; Toivanen, J. M.; and Toivonen, H. 2015. Interaction evaluation for human-computer co-creativity: A case study. In *Proc. of the Sixth International Conference on Computational Creativity*. Brigham Young University.
- Kapitan, L. 2007. Will art therapy cross the digital culture divide? *Art Therapy: Journal of the American Art Therapy Association* 24(2):50–51.
- Karimi, P.; Grace, K.; Maher, M.; and Davis, N. 2018. Evaluating creativity in computational co-creative systems. *arXiv preprint arXiv:1807.09886*.
- Keller, R., et al. 2012. Impro-visor. *Harvey Mudd Computer Science Department*, [online] Available from: <http://www.cs.hmc.edu/~keller/jazz/improvisor/> (Accessed 27 March 2013).
- Kramer, E. 1986. The art therapist's third hand: Reflections on art, art therapy, and society at large. *American Journal of Art Therapy* 71–86.
- Kramer, E. 2000. In Gerity, L. A., ed., *Art as therapy: collected papers*. London and Philadelphia: Jessica Kingsley Publishers.
- Law, M.; Steinwender, S.; and Leclair, L. 1998. Occupation, health and well-being. *Canadian Journal of Occupational Therapy* 65(2):81–91.
- Llano, T.; d'Inverno, M.; Yee-King, M.; McCormack, J.; Ilsar, A.; Pease, A.; and Colton, S. 2020. Explainable computational creativity. In *Proc. of the Eleventh International Conference on Computational Creativity*.
- Lomas, T. 2016. Positive art: Artistic expression and appreciation as an exemplary vehicle for flourishing. *Review of General Psychology* 20(2):171–182.
- Norcross, J. C.; R., M.; and Goldfried, M. R., eds. 2019. *Handbook of Psychotherapy Integration (3rd Edition)*. OUP USA.
- Norman, D. A., ed. 1986. *User-Centered System Design: New Perspectives on Human-Computer Interaction*. CRC Press.
- Parker-Bell, B. 1999. Embracing a future with computers and art therapy. *Art Therapy: Journal of the American Art Therapy Association* 16(4):180–185.
- Perrin, T. 2001. Don't despise the fluffy bunny: A reflection from practice. *British Journal of Occupational Therapy* 64(3):129–134.
- Perruzza, N., and Kinsella, E. A. 2010. Creative arts occupations in therapeutic practice: A review of the literature. *British Journal of Occupational Therapy* 73(6):261–268.
- Peterson, B.; Stovall, K.; and Elkins, D. 2005. Art therapists and computer technology. *Art Therapy: Journal of the American Art Therapy Association* 22(3):139–149.
- Petrovskaya, E.; Deterding, C. S.; and Colton, S. 2020. Casual creators in the wild: A typology of commercial generative creativity support tools. In *Proc. of the Eleventh International Conference on Computational Creativity*. Association for Computational Creativity (ACC).
- Ranger, D. 1996. Art therapy, a computer, and two exceptional children. In *Paper presented at the annual conference of the Canadian Art Therapy Association*.
- Reynolds, M. W.; Nabors, L.; and Quinlan, A. 2000. The effectiveness of art therapy: does it work? *Art Therapy* 17(3):207–213.
- Reynolds, F. 2003. Reclaiming a positive identity in chronic illness through artistic occupation. *Occupational Therapy Journal of Research (OTJR): Occupation, Participation and Health* 23(3):118–27.
- Ritchie, G. 2007. Some empirical criteria for attributing creativity to a computer program. *Minds and Machines* 17(1):67–99.
- Rogers, C. 1977. *On Becoming a Person*. Robinson.
- Roth, G. 1995. *Maps to ecstasy: A healing journey for the untamed spirit*. Thorsons.
- Rubin, J. A. 1984. *The art of art therapy*. New York: Brunner/Mazel.
- Schmid, T. 2004. Meanings of creativity within occupational therapy practice. *Australian Occupational Therapy Journal* 51:80–88.
- Schuijf, M., and Dijkstra, A. M. 2019. Practices of responsible research and innovation: A review. *Science and Engineering Ethics* 26(2):533–574.
- Stahl, B. C., and Coeckelbergh, M. 2016. Ethics of health-care robotics: Towards responsible research and innovation. *Robotics and Autonomous Systems* 86:152–161.
- Stuckey, H. L., and Nobel, J. 2010. The connection between art, healing, and public health: A review of current literature. *American Journal of Public Health* 100(2):254–263.
- Tennant, R.; Hiller, L.; Fishwick, R.; Platt, S.; Joseph, S.; Weich, S.; Parkinson, J.; Secker, J.; and Stewart-Brown, S. 2007. The Warwick-Edinburgh mental well-being scale (WEMWBS): development and UK validation. *Health and Quality of Life Outcomes* 63 (5).
- Thong, S. A. 2007. Redefining the tools of art therapy. *Art Therapy: Journal of the American Art Therapy Association* 24(2):52–59.
- Van der Hoven, J. 2013. Value sensitive design and responsible innovation. In Owen, R.; Bessant, J.; and Heintz, M., eds., *Responsible innovation. Managing the responsible emergence of science and innovation in society*. London: John Wiley. 75–84.
- Weinberg, D. 1985. The potential of rehabilitative computer art therapy for the quadriplegic, cerebral vascular accident, and brain trauma patient. *Art Therapy: Journal of the American Art Therapy Association* 2(2):66–72.
- Weizenbaum, J. 1966. ELIZA – a computer program for the study of natural language communication between man and machine. *Communications of the ACM* 9(1).
- Yannakakis, G. N.; Liapis, A.; and Alexopoulos, C. 2014. Mixed-initiative co-creativity.