New Perspectives into Art Therapy Approaches for Clients with Alzheimer's Disease,

Informed by Neuroscience Findings Related to Implicit Memory Processes.

A Theoretical Study

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Abstract

The foci of this study is on how research on implicit memory preserved in Alzheimer's disease (AD) can inform art therapy approaches for this population, and on the possibility of art therapy to use and stimulate implicit processes that are still available in this neuropathology. Therefore, this paper connects findings about implicit brain processes in AD, about types of brain stimulation during art-making process, and research data from art therapy for clients with AD. The theoretical methodology based on literature review was an appropriate tool to explore this topic. Available implicit memory processes in AD – related to sensory processes, emotions, perceptual and procedural memory, implicit associative processes, and attention – were found to play a consistent role in art therapy for those suffering of AD. The comparison led to findings that, besides clients' changes in artistic expression due to cognitive loss in AD, art therapy can rely on implicit processes and has a great potential in offering multisensory and motor-sensory stimulation, enhancing attention and associative functions, regulating emotions, reducing anxiety, stimulating skill learning, and improving the overall well-being. This study could offer a background of understanding on how art therapy is using implicit brain processes and could provide directions for future research.

keywords: Alzheimer's disease, implicit memory, art therapy, explicit memory, cognitive impairment, visual impairment, aesthetic taste, sensory stimulation, emotions, skill learning, attention, associations, well-being, flow.

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New perspectives into art therapy approaches for clients with Alzheimer's disease, informed by neuroscience findings related to implicit memory processes.

A theoretical study

Introduction

For many seniors, being routinely involved in acts of art-making is part of a healthy social life (Perry-Magniant, 2001), with many of them adding arts and crafts to their activities in order to enrich their life experience. In the case of people suffering from Alzheimer's disease (AD) though, the multiple changes in their lives progressively reduce the opportunity for participating in art activities. Therefore the pursuit of arts and creative crafts is much less the consequence of an intrinsic urge or desire to diversify one's experience, and more of a bona fide therapeutic tool alleviating some of the psychological and social side-effects of the disease (Percoskie, 2010).

Some of the ways art therapy may be helpful for clients with AD is stimulating a sense of social life and the enjoyment of *doing* something by him/herself (Hattori, Hattori, Hokao, Mizushima, & Mase, 2011; Mimica & Kalini, 2011; Ozdemir & Akdemir, 2009). Also, being creatively occupied helps the AD sufferer to experience some level of independence (lost, otherwise, as the person is often dependent on caregivers).

Furthermore, art making uses vision, tactile sense, and sometimes other senses, allowing the clients with AD to exercise their sensory capacities (Killick & Craig, 2012). Besides the benefits above mentioned, viewing and making art appear to stimulate a complex set of processes and types of memory. While research in art therapy shows that art activities have proven a good therapeutic tool in approaching this clientele (e. g. Hattori et al., 2011; Maujean, Pepping, & Kendall, 2014), the increased need to understanding AD mechanisms and how art

could stimulate the brain affected by AD has been addressed within the field of neuroscience. So far neuroscience gave us important data about brain pathways that are progressively lost or preserved longer in AD and, on the other hand, about brain pathways that are usually stimulated by art activities. This is of a tremendous importance in any clinician's attempt to better understand how it feels to have AD and what brain processes can be used and stimulated during an art therapy session. Important steps in deciphering how the brain may work in individuals with AD have been made in the neuroscientific domain. And important steps in acknowledging the beneficial effect of art therapy over the brain affected by AD and over general well-being of clients with AD have been made. However, data from the two domains remain still disparate in their efforts to understand the causes and alleviate the effects of AD.

Rationale for this study

This study intends to build a bridge between findings in neuroscience related to implicit memory processing in Alzheimer's disease (AD) and art therapy approaches available for clients with AD. It stands as an integrative review of the literature dedicated to two domains: findings in brain functioning in AD and art therapy research for this population. Therefore, the study analyzes significant concepts and views into the topic that could build a bridge between the areas studied (neuroscience and art therapy related to AD) and it also addresses, briefly, inconsistencies and contradictions in the literature.

The neuroscientific findings related to brain processes involving senses, emotions, and creating art appear to be increasingly included in art therapy research (e.g. Hass-Cohen, 2008; Stewart, 2004), as necessary for understanding the mechanisms through which art could be applied to various disorders and medical issues and of course to AD. By adding a scientific explanation to phenomena otherwise only perceived by the therapist in the sessions, art therapy

could better help alleviate some of the effects of AD neuropathology. Knowing how art stimulates the brain and also understanding what processes of the brain are still available in AD (so on what to expect in the sessions) could allow art therapists to make more informed choices of interventions that foster a longer preservation (by stimulation) of brain processes otherwise prone to deterioration.

Studies blending neuroscience and art therapy (e.g. Stewart, 2004; Safar and Press, 2011) are of a growing importance in approaching clientele affected by neurodegenerative diseases. This is a trend that may nuance continuously, while neuroscience advances with research, the goals and interventions in AD. Several studies in art therapy emphasize a scientific explanation of the effects art has on the brain, so, implicitly, how this therapeutic modality stimulates, depending on art activity, various processes of the brain (either more cognitive or more unconscious, implying affect or not, using intensively sensory stimulation or, on contrary, focusing on movement). Understanding both the inner mechanisms of AD and the way art stimulates the brain, along with the clinical results from art therapy sessions may, as I mentioned before, help therapists optimize the interventions for this clientele. So far, one of the approaches in art therapy, the expressive therapy continuum (ETC) – a method of assessment and a therapeutic approach, developed by Lusebrink and Hinz (Hinz, 2009; Lusebrink, 1991) already tries to make a link between brain functioning and art media preferred by a client in sessions (e.g. using watercolour may involve affective brain). Although the approach is a step forward, offering the possibility of adjusting art therapy themes and materials to the preferences or available brain functions of each client, it is very general and doesn't speak much about other aspects of art making like attention, skill formation, aesthetic taste, and associations. So, still, more needs to be done in this direction to have a clearer perspective.

In this study, the focus is on how research on implicit memory processes in patients with AD can inform art therapy approaches for the AD population; in other words, the main accent is on the connections between findings about implicit brain processes in AD and art therapy, and the secondary focus is on the possibility of exploiting and stimulating these types of processes that are not (or not dramatically) affected. I am also attempting to explore whether the AD-affected memory could still facilitate or allow skill learning. This could trigger new insights for the art therapy field, and offer a comprehensive background of understanding for future research, and possibly provide inspiration for new research (Chronic, Ryan, & Coughlan, 2008, p.43)

Methodology

This study is theoretical research, based on literature review. Since "any kind of research that produces findings not arrived at by means of statistical procedures or other means of quantification" (Strauss and Corbin, 1990, p. 17) is considered qualitative, this theoretical study, relying on reviewing literature is, of course, qualitative.

Unlike quantitative research (that looks for causation, prediction, and generalization), qualitative research seeks "instead illumination, understanding, and extrapolation to similar situations" (Golafshani, 2003, p.600). On that ground, the further steps of such methodology, the critical analysis and synthesis of the literature and connecting all perspectives together, are focused on finding meaning in the data collected. The main focus of theoretical research is on clarifying and identifying what has been done and what needs to be done in further research (Randolph, 2009, p. 2).

Because my research aims to find what processes of the brain are still functional in AD and to connect these findings with research in art therapy, in order to give a scientific explanation to interventions that already work and offer new perspectives for art therapy for this

population, literature review is the most appropriate methodology for this study. It is known that "the purpose of a literature review is to objectively report the current knowledge on a topic and base this summary on previously published research" (Green, Johnson, & Adams, 2006, p. 102), therefore this research proposes to analyze and synthesize significant data from literature (both quantitative and qualitative) and to organize and link concepts from the two fields of study identified by the research question: art therapy for AD population and neuroscientific investigation into preserved functions and processes in AD, related to artistic process and skill learning. Components of these two areas of interest are widely present in the literature, permitting to determine a relationship to each other and to structure and redefine their synthesis.

An extensive review of the literature was performed in order to collect significant data related to the themes identified as relevant for this study, covering books and online journal articles. PubMed, PsycInfo, Eric, EBSCO, Elsevier, Wiley and other databases, available through Concordia library, were used to collect data, along with books and other online sources. Data originated from research done in various disciplines, including neuroscience, neuropsychology, psychotherapy, geriatrics, social sciences, and creative arts therapies (with a strong emphasis on art therapy). In art therapy I searched for both AD and dementia (from those retaining only the articles which referred in the body text to AD as well). Other search keys were: "Alzheimer" (or "dementia") and "implicit," "esthetics, "skills," "learning," "art," and other keywords referring to narrower topics as "hippocampus," "temporal lobe," "prefrontal cortex, "face-recognition," "association," "emotion,", "attention" (all searched together with "Alzheimer" or "dementia," from which selecting again only articles related to AD).

One of the main problems when reviewing a body of literature related to a topic is the diversity of material (Hart, 2009, p. 10); therefore, a structure in collecting the data is required.

Themes that inform better the research question were identified during searching through literature. Also, I tried to search for the material that elaborates on key processes that are preserved in AD and used in art therapy. That's why, extensive search into literature was related to three themes: implicit memory in AD (mostly related to sensory and motor processes, emotional processes, and skill learning), brain processes involved in art making, art viewing and art therapy, and art therapy studies for AD population.

A research diagram (Kapitain, 2010, p.13) was created, allowing a more structured search of the data, and allowing a narrower structure of the three themes into sub-problems. Subcategories for each theme were identified during data analysis, placing a great emphasis on "keeping accurate records and establishing reliable procedures to manage materials" (Hart, 2009, p. 6). The sub-categories responded to various nuclei of information found in literature. However, I presented only research material that corresponded to my area of study. For example I excluded data about deteriorated or preserved processes that had no evident connection to art therapy. Also I excluded data from art therapy research that did not relate directly to implicit processes. The first theme was, consequently, sub-divided in an overview of processes deteriorated in AD, then implicit processes in AD related to senses (especially visual and haptic), motor skills, associations, emotion and aesthetic taste, attention, and implicit learning. The second theme contains subdivisions as visual function, sensory and motor processes involved in art therapy, emotion during artistic process and esthetic perception. The third part is focused on art therapy research (mainly clinical) for AD population and has the following sub-divisions: changes in artistic representation, based on case studies (of professional and non-professional artists with AD), clinical research regarding artistic preferences and emotion in AD, learning artistic skills in art therapy, implicit associations in art therapy, anxiety-reducing, well-being and

attention during art-making. To the third theme I also dedicated a sub-section about artistic media reported to be successfully used by AD clients in art therapy practice.

Dividing the review into three themes helped me stay objective towards the literature of each domain. Due to the scarce evidence in some sub-categories either in neuroscience or in art therapy, I couldn't follow perfectly the points I was interested in for each section. However, sensory preservation and stimulation, attention, esthetic preference, associations, and skill learning were my domains of interest. I chose these domains since they are connected both to implicit memory and to artistic process. In consequence, I adjusted the structure of each theme, based on the findings from literature, having sub-divisions where to present relevant data from the literature.

Summarizing and evaluating the evidence about the topic is the final step of the methodology. I looked for "links and gaps" (Chronic, Ryan, & Coughlan, 2008, p.43) between parts in order to gain new perspectives (Randolph, 2009, p. 2) about possible art therapy approaches under the new light cast by the latest findings in neuroscience, related to both processes and the corresponding cortical structures that are preserved in AD and used in art making and viewing (Chronic, Ryan, & Coughlan, 2008, p.43)

Although in qualitative studies the validity is rather internal, it still measures if "the evidence reported does in fact support the claim hypothesized". (Carolan, 2001, p. 193). Therefore, in order to maximize validity, extra care has been used for including all relevant reports available, while making sure that none of them would contradict or undermine the validity of the interpretations.

The current review has some limitations. Data used from the research, was obtained through expansive, but not exhaustive, review of literature. Also, being a qualitative study, the

data synthesis is hard to be kept away from any personal biases and assumptions, although I tried to minimize them by crystallization, multivocality and triangulation techniques (Tracy, 2010, pp.843-844). While crystallization was ensured by gathering multiple types of data from various disciplines (Tracy, 2010) to enhance the understanding of each cluster of information to be synthesized, I extrapolated the meaning of multivocality to the theoretical framework, by allowing various divergent concepts to surface in the study. Triangulation (Golafshani, 2003) was accomplished by involving my supervisor's and peers' interpretation of the data at various moments of my research.

I entered this research process after a positive clinical experience with clients suffering of AD (as a student-intern). This particular meaningful experience for me generated my research question and led me to believe that this study could bring a scientific understanding of why most of my clients responded positively to art media, in my opinion, showing increased enjoyment and mastery in handling them over the time, although some of them didn't experience art benefices before art therapy sessions. While being involved in this research, I made a positive effort toward maintaining the awareness of my biases. Therefore, I tried to present objectively all data that I could find through available databases mentioned in this chapter, whether in concordance or discordance with my clinical impressions.

Compensatory and Preserved Processes in AD

Alzheimer's disease is a degenerative neural disease manifested by progressive cognitive loss (disintegration of semantic and conceptual memory, of cognitive associative functions, of the capacity of planning and spatial orientation) (Baudic et al., 2006; Ehresman, 2014; Moreno-Martínez, Goñi-Imízcoz, & Spitznagel, 2011; Stopford, Thompson, Neary, Richardson, & Snowden, 2012). Research has documented extensively the pervasive changes involving neural

tissue loss and the formation of plaques and tangles of proteins that obstruct the synapses between nervous cells (Brion, 1998; German & Eisch, 2004; Götz, Schild, Hoerndli, & Pennanen, 2004). That impedes normal functioning of the brain, especially of areas responsible for remembering and planning, along with other functions that require high cognitive thinking. This most common type of senile dementia presents a progressive impairment of memory and cognitive functioning starting from the early stages of the disease.

However, the progressive loss of these functions is decelerating by compensatory processes (healthy adjacent parts of the brain that carry on processes otherwise specific to parts of brain that are deteriorated in AD). Also, there are still processes that remain functional until the last phases of this neuropathology. Neuroscientific research revealed that, at early stages of AD, adjacent areas of those affected perform compensatory processes, ensuring a certain level of functioning (Dubovik et al., 2013). Besides this brain plasticity, that appear to be present only for early stages, other unconscious processes remain stable until late stages of the disease (Fleischman, Wilson, Gabrieli, Bienias, & Bennett, 2004; Maki, 1995; Mitchell & Schmitt, 2006, etc.), and some of them are the object of study for this paper.

Literature has consistently demonstrated the brain degeneration and functioning losses in this disease. However, over the last three decades, research in neuroscience started to focus also on finding on brain processes that are used to compensate the cognitive functions deteriorated, or to look for types of memory that are more resistant to the disease. The first theme, presenting the findings in neuroscience, will focus on research related to three areas of interest: affected processes of the brain (due to neural structures deterioration), compensatory processes, and types of memory less deteriorated that could still perform well for those with AD.

Brain Structures and Processes Affected by AD

All the catastrophic deterioration of cognitive functions presented above are due to a massive death of neural cells (accentuated by protein tangle and plaques formation) (Brion, 1998; Buckner, 2004; Caddell & Clare, 2011; German & Eisch, 2004; Götz, Schild, Hoerndli, & Pennanen, 2004; etc.). Not all the structures of the brain are identically damaged, some have a very early deterioration, such as the hippocampus and temporal lobes (Carmichael, Xie, Fletcher, Singh, & DeCarli, 2012; Dickerson et al., 2001; Perri, Serra, Carlesimo, & Caltagirone, 2007; Soldan et al., 2015).

Consistent data show that medial temporal lobes are (together with parietal areas) the most affected by neuronal atrophy and amyloidal deposition, causing extensive neuronal damage and function loss (Ballatore, Lee, & Trojanowski, 2007). Lesions in the medial-temporal lobe (Dickerson et al., 2001; Small, Herlitz, Fratiglioni, Almkvist, & Bäckman, 1997; Tulving & Schacter, 1990) and diencephalon (Fleischman, 2007) affect the declarative (episodic and semantic) memory, producing a selective decline of functions including conceptual representations (natural and human-made categories) (Peraita & Moreno, 2006) and cognitive associations (Carmichael et al., 2012). The AD neuropathology in medial-temporal lobe system starts from incipient phases of mild cognitive impairment (MCI) - a transitional state between normal cognition and clinical Alzheimer's disease. The neural loss is manifested especially in entorhinal cortex, a part of this lobe, associated with "explicit memory and conceptual priming" (Fleischman et al., 2005, p. 890), considered the earliest site devastated by AD (Bennett et al., 2005; e.g. Petersen et al., 2001; Ballesteros, Reales, & Mayas, 2007). MRI studies in AD patients have shown also decreased hippocampal volumetry (Burns & Zaudig, 2002; Gerardin et

al., 2009; Kantarci et al., 2002), affecting conscious processes related to episodic memory and spatial navigation (King, Trinkler, Hartley, Vargha-Khadem, & Burgess, 2004).

In addition to the two structures – temporal lobe and hippocampus – other brain regions are affected, although not as dramatically, producing disruption in various functions and impairing daily living of persons with AD. While there is a plethora of these regions with diminished performance, an important structure is the prefrontal cortex (PFC), critically involved in the control of behavior (Miller & Cohen, 2001), in voluntary attention (Weissman, Roberts, Visscher, & Woldorff, 2006) and working memory. Cognitive control (or attentional system), the ability to sustain and guide an action according with intentions, "lies at the heart of most higher mental faculties that make us human, such as planning, reasoning, problem solving and language" (E. K. Miller & Cohen, 2001, p. 421). All these mental faculties, also highly cognitive, are affected by AD psychopathology.

Besides progressive impairment in semantic and episodic memory, persons with AD also present a certain visual impairment. Some of the impaired visual processes are affected by central causes, by the accumulations of senile plaques and neurofibrillary tangles and by astrocytic death (Beach & McGeer, 1988) in the cognitive pathways, affecting progressively the integration and recognition of the image, while others are sensorial, due to a decrease in macular electrical activity (Moschos et al., 2012)

The ventral stream (situated in temporal lobe) runs few key cognitive visual processes that make possible the full, aware object recognition (Kalat, 2013). In AD, the ventral visual areas are part of the affected neural structures that cannot anymore sustain the normal degree of visual attention and working memory processing. Thus, AD patients are unable to process some of the low-level visual information necessary for cognitive associations and object recognition.

They can rely mostly on visual and perceptual pathways that remain intact, showing visual acuity and color recognition. However, they manifest decreased ability to visually recognize common objects, famous faces or complex figures (Mendez, Mendez, Martin, Smyth, & Whitehouse, 1990).

Another effect of neuronal death in the visual pathways (of striate cortex) is the fact that the feedback connections between neurons slow down and the global information from the environment is harder to be processed. Nervous system processes first the global information, and then details. Therefore, to keep up with the global information of the environment, brain affected by AD tends to ignore backgrounds in favour of close objects, and complicate shapes (as faces for example) in favour of simple shapes. Background suppression and processing global details, omitting the finer differences (e.g. expressions on a face) (Bullier, 2001) is a common characteristic in AD, accentuated with the progression of the disease.

Also, AD presents a progressive deficit of visual focus. AD pathology disrupts effective connectivity between visual stimuli and attention network during conflict processing, allowing an increased interference of distracting stimuli (Finke, Myers, Bublak, & Sorg, 2013). One of the areas where clients with AD manifest a slowed attentional response is orientation. The progressive hippocampal and parietal lesions in AD lead over time to reduced or even lack of reorienting following central cues (Caffarra, P., Riggio, L., Malvezzi, L., Scaglioni, A., & Freedman, 1997; Crawford, Devereaux, Higham, & Kelly, 2015; Tales, Muir, Bayer, & Snowden, 2002; Tracy, 2010). Neurodegenerative progression of AD affects integration of the environment through association of recognizable stimuli and later the reorienting cues that uses visual attention (Maruff, Malone, & Currie, 1995; Tales et al., 2002). Therefore clients with AD

experience a continuous state of disorientation and anxiety when navigating through environment and when focusing on tasks that imply global information.

Besides disruptions in visual focus, the whole attentional system is affected progressively in AD. The attentional control (capacity to concentrate), a complex cognitive process, is impaired in AD (Balota & Faust, 2001), from early stages. The attentional control is dependent not only on the prefrontal cortex (PFC) - that is apparently better preserved than other structures, but also on the parietal lobe, anterior cingulate that are deteriorated early in the disease. In normal functioning, control of attention performs each moment the regulation of various cognitive and behavioral processes, maintaining a good level of response to stimuli over time (Stuss, Murphy, Binns, & Alexander, 2003). If attention control is deregulated, the regulatory constancy is disrupted and fluctuating, unstable levels of performance across time and situations could lead to anxiety and hyper-vigilance to perceived cognitive failures (Smart, Segalowitz, Mulligan, & MacDonald, 2014). Certainly, if a person with AD cannot regulate basic attention, this will interfere with learning new information (on encoding, and consolidation and retrieval), leading to the sensation that there is a memory problem, instead of a function of impaired attention. That's why Gordon and colleagues (2015) launched the idea that attention low performance may be actually the cause of some "early memory deficits in AD, rather than real declines of memory subsystems" (Gordon et al., 2015, p. 1772).

As expected, cognitive attention dysfunction is considered to affect negatively the performance of a person with AD. It is still unclear whether the overactivation of implicit attention network is not actually a compensatory mechanism, although it appears to play a detrimental role. However, the data collected until now show that dysfunctions in attention control progress with AD neuropathology (Belleville, Chertkow, & Gauthier, 2007), aggravating

the perceived memory declining (Smart et al., 2014) by maintaining a state of anxiety related to incapacity to control the decline of brain functions.

Another consequence of the incapacity to adapt to cognitive loses is apathy, directly derived from the deterioration of reward-seeking pathways and motivation decrease (Forstmeier & Maercker, 2015) and often comorbid to AD. Apathy is also related to previous type of lifestyle of the client (less active) before AD onset. Unfortunately "apathy is also associated with a higher rate of conversion form MCI to dementia" (Forstmeier & Maercker, 2015, p. 3), and that is an alarming problem for this population.

At a close look, the dramatically deteriorated processes are the cognitive processes. Also, it appears that the form of memory the most affected in AD is conscious recall or recognition of processed information, called *explicit memory* (Fleischman et al., 2005, p.127)

Compensatory processes in the brain affected by AD

Besides the decline of explicit memory, neuroscientific research revealed processes that compensate functions of the damaged neural tissue, especially in incipient phases of AD. Gordon and colleagues (2015) questioned if attention dysfunction is actually a part of a compensatory process or not. While research didn't find this answer yet, there are other processes that are considered compensatory. Surprisingly, recent research by Dubovik and colleagues (2013) pointed out that patients with early stages of AD show unmistakable signs of brain plasticity, stimulation of the areas afferent to the affected ones and the emergence of theta waves (the slow waves usually associated with memory formation, in electrophysiological recordings). These areas appear to take over parts of the disabled functions, as reflected by neuroimaging (Dubovik, Bouzerda-Wahlen, Nahum, Gold, Schnider, & Guggisberg, 2013). Same researchers (Dubovik et al., 2013) showed that verbal fluency function, for example, is sustained initially by hippocampus and temporo-parietal junction, while in first phases of AD the hippocampus deteriorates and it is replaced by other vicinity areas. One interpretation could be that a certain level of function related to the affected lobes and areas (e.g. language, some associative functions) is maintained, at least during the early stages of disease, through the compensatory activity of these afferent centers. In addition to this form of plasticity, many highly overlearned skills of adult life may remain resistant to brain damage. Moreover, the frontal lobes, responsible, among others, for motor functions as well as for character and emotional control are often relatively intact, until the end stages of the disease (Berger et al., 2015).

Implicit memory in AD

Besides the above compensatory processes that may not be resistant to progression of AD neuropathology, research has focused lately on other processes of the brain that remain intact or at least are much better preserved than cognitive processes. Extensive attention was given by neuroscientific research to a type of memory that records, retains and retrieves data rather unconsciously, at an implicit level: *implicit memory* (Fleischman et al., 2004). Implicit memory has a more diffuse way of retaining information, through prolonged repetition, so information retrieval is mostly automatized, not implying conscious, deliberate recollection (Meiran & Jelicic, 1995). One explanation is that this type of memory is apparently more connected to areas less exposed to deterioration in AD, such as the neocortex, striatum, amygdala, and cerebellum (Byrne, 1997). On the other hand, even the parts of the brain massively affected by AD could still run certain implicit functions, although the pathways for highly cognitive processes are damaged (Duss et al., 2014). Implicit memory refers mostly to priming, simple conditioning, habits and skills formation and emotional responses (Byrne, 1997). Tests administered to participants with AD, showed that implicit memory is one of the best preserved memory in AD.

For example, research (Ally, Gold, & Budson, 2009; Martins & Lloyd-Jones, 1999) brings to light that implicit processing of visual stimuli is relatively intact in at least mild and moderate AD. That was explained by the fact that implicit memory related to vision relies to specific cortical areas (the extrastriate visual areas, from occipital cortex) that are preserved in the disease. For the visual pathway, the first substrate that initiates the processing of the visual stimulus is the so-called M channel, with "high contrast sensitivity, poor composed chromatic selectivity, larger receptive fields and lower spatial sampling rate", offering a rough analysis of the environment (Bullier, 2001, p. 100). This channel seems to be intact and mostly used while other sophisticated visual processes are affected, so it's likely that individuals with AD understand better images with high contrast and fewer details. So, while persons with AD present decreased global perception and low facial expression recognition (Bullier, 2001), local information about familiar objects still functions well.

Other recent behavioural and imaging studies (Amedi, von Kriegstein, van Atteveldt, Beauchamp, & Naumer, 2005; James et al., 2002) propose that extrastriate areas are also responsible for haptic priming. Studies using familiar, unfamiliar objects, 2-D or 3-D shapes reported common activation of the lateral occipital complex during both visual and haptic exploration. (Ballesteros & Reales, 2004; Bullier, Hupé, James, & Girard, 2001). These findings suggest also that some parts of ventral visual pathway are used for both visual and *haptic perception* and are reliable until late stages of the disease. (Ballesteros & Reales, 2004, p. 243). That means tactile sensations and tactile representation of objects are also reliable tools in interacting with the environment.

Also, similar to visual function, *perceptual processes* can be performed implicitly, outside of conscious awareness (Seriès & Seitz, 2013; Shmuelof & Krakauer, 2014). Therefore,

acquisition of a new procedural or perceptual skill is often a sequential progression from a goaldirected action (willingness to learn) to habit-formation (Shmuelof & Krakauer, 2014), without conscious retrieval. Numerous studies (Fleischman, 2007; Jelicic, Bonebakker, & Bonke, 1995; Jelicic, 1995; Kane, Festa, Salmon, & Heindel, 2015) brought evidence that perceptual memory is preserved in AD, meaning that perceptual memory and unconscious learning of perceptual skills – related to sensory tasks acquisition – are learned and performed without involvement of explicit memory (Shmuelof & Krakauer, 2014).

Motor skills are regularly acquired through a mix of both conscious and unconscious processes. However, since AD sufferers could rely mostly on unconscious learning, research (Eslinger & Damasio, 1986; Kim & Park, 2010; Shmuelof & Krakauer, 2014; Willingham, Peterson, Manning, & Brashear, 1997) found that individuals with AD still show the ability to learn motor skills, but they learn motor tasks through continuous repetition, not through conscientious memorization. Therefore, while some motor processes usually require knowledge of facts and planning (intention) in order to perform a new action (so they rely on both implicit and explicit memories) others are mostly automated, procedural skills, using only the implicit memory pathways (e.g. grabbing or handling art materials).

Research (Beaunieux et al., 2012; van Halteren-van Tilborg, Scherder, & Hulstijn, 2007) shows that *procedural learning* abilities are preserved longer than other types of learning (e.g. cognitive learning) in AD, probably a consequence of spared procedural pathways. Seifert and Baker (2003) emphasize that implicit "memories [...] primarily depend on automatized performance – as occurs in the motor programs for sipping a beverage from a cup, zipping one's coat, sanding wood, or stuffing/stamping envelopes–and may remain intact much longer" (Seifert & Baker, 2002, p. 4). Implicit memory related to perceptual and motor priming (neural

pathways preserved in AD, as presented before) was found to play a large role in daily functioning of AD patients, helping them to adjust to changes in their life and learn new daily habits. Studies focused on aspects of procedural-motor learning (e.g. on rotor-test) (Bondi & Kaszniak, 1991; Dick, Hsieh, Bricker, & Dick-Muehlke, 2003; Dick, Hsieh, Dick-Muehlke, Davis, & Cotman, 2000; Eslinger & Damasio, 1986) obtained good results. Studies (Seifert, 1997; Jacobs et al. 1999; Rouleau et al. 2002) related to visual-motor skill acquisition in AD have also promising results. While the methods used in these studies differ (maze completion or trace tracking), the outcome of exposure to the tasks is constantly positive. Although participants' levels of learning were lower than the healthy controls, and with slower speed of reaction, consistent data show that learning during visual-motor activities is possible. Moreover, "visual feedback appears to have a positive effect on their learning pace" (van Halteren-van Tilborg et al., 2007, p. 207), reinforcing and facilitating learning. Also, perceptual-verbal learning was tested in AD at the level of mirror-reading task, but findings were controversial, some studies found the learning process is slower than in healthy elderly, but measurable (Desgranges et al., 2002; Desgranges, Eustache, Rioux, de la Sayette, & Lechevalier, 1996; Deweer, Pillon, Michon, & Dubois, 1993), other found that the sample didn't present evident learning abilities during follow-ups (Bondi & Kaszniak, 1991). These last contradictory results may be a consequence of the fact that implicit networking cannot carry too complex information in the same time. Researchers (Kéri et al., 2002) found that, because these are 'winner-take-all'type networks, is also possible that, in complex processing of a visual image, inhibitory connections may command repetition suppression. So, in implicit learning, if the network is weighted too much with tasks, in order to preserve its stability, "the system may resist learning" in the phases of consolidation (Carpenter, 2001, p. 118). That may lead to the conclusion that the

simpler information the easiest to be learned implicitly, while the complicated visual priming may block the memory formation instead of boosting it.

Therefore, while usually tasks can be learned quickly by memorization, in the case of AD sufferers learning process is based only on "habit-based strategy, albeit much more slowly" (Squire & Dede, 2015), through multiple trials before the evidence of learning is visible, measurable (Musen & O'Neill, 1997). Prefrontal cortex may also be important in this process, acting as a switch and determining which memory system is more appropriate to be used for a certain behavior (Squire & Dede, 2015): implicit or explicit.

However, the participants seem to have more difficulties with implicit learning when completing tasks that includes two learning processes in the same time. Therefore complicated tasks, using both implicit and explicit memory, are not successfully learned and performed in AD. Instead, performing tasks that employ automatic and procedural memory processes (Tak & Hong, 2014) seem to be a path to follow in designing therapeutic interventions for AD clientele (Bier et al., 2008; Clare, Rowlands, Bruce, Surr, & Downs, 2008; Schmitz et al., 2014). Selfgeneration of cues and various forms of cueing are emphasized for persons with AD (Dunn & Clare, 2007; Laffan, Metzler-Baddeley, Walker, & Jones, 2010). A recent review of memory stimulation programs in AD concluded that errorless learning (learning with cues), is the most efficient in stimulating memory in persons with AD" (Tak & Hong, 2014, p. 292). Errorless learning, a relatively new and successful therapeutic method in acquisition of new knowledge for AD clients (de Werd, Boelen, Olde Rikkert, & Kessels, 2013; Kessels & Hensken, 2009; van Tilborg, Kessels, & Hulstijn, 2011) may be an easier and more successful form of learning than trial-and-error, excluding errors from the process (by using cueing techniques).

Also, research (Rusted & Sheppard, 2002; Stewart, 2004) shows that overlearned skills (so, respective brain connections, intensely used all life) are not subject to significant deterioration until late stages of AD. There are few cases reported in literature and press that apparently contradict the general pathology of the disease. The case of a person that could maintain the professional demands after AD onset and could, despite all the cognitive impairments due to progression of the disease, still be sharp in math after years of living with AD and solving number puzzles (Wang, 2008), or cases of professional artists (Espinel, 2007; B. L. Miller & Hou, 2004) that continued their creative work after AD onset, put a new emphasis on the importance of overlearning: what is learned and retrieved of so many times became automatic and better preserved in AD. Repeating a complex activity again and again until relevant neural circuitries involved in the activity work together producing "overlearned" skills. These overlearned skills are mostly relying on implicit memory and are utilized during activities unconsciously, as automatic processes. Studies (de Werd et al., 2013; Kontos, 2003; Rusted & Sheppard, 2002) suggest that implicit memory sustains learning skills through repetition (overlearning), even after the onset of AD.

Research of the last two decades suggests that implicit memory may be involved even in *associative learning*, along with explicit memory processes (Hupbach, Melzer, & Hardt, 2006; Lloyd-Jones, 2005; Musen & O'Neill, 1997). Explicit associative function – related to spatial navigation (Maguire et al., 1998), temporal sequences (Lehn et al., 2009), character association (relationship between stimuli) (Eichenbaum, Schoenbaum, Young, & Bunsey, 1996) – are processed in the hippocampus and related structures. However, findings in associative learning brought a new perspective on these processes, suggesting that the hippocampus may not be the only one center in combining two or more categories of information into a memory

representation, when exposed to repeated stimuli (Musen & O'Neill, 1997). In fact a lot of memory tasks could be learned through implicit memory, so independent from the hippocampus. Moreover, another hypothesis (Duss et al., 2011; Reber and Henke, 2011, 2012) suggests that even hippocampus may still run residual unconscious associative processes related to associations, successful subliminal relational encoding and a flexible binding (performed in faceword and word-word retrieval). The two independent systems (implicit memory outside and inside the hippocampus) may sustain, to a certain extent an implicit association function, mostly sensorial, perceptual or procedural (based on implicit learning – that meaning that the information is learned through prolonged repetition, and becomes habit, allowing automated retrieval). Therefore, persons with AD still have the possibility of forming new associations between two or several categories (e.g. attributes of an object: shape, colour), although not at a conscious level. Some studies on AD emphasize that short-term conjunctive binding that facilitates the integration of features of an object such as shape-colours and face-name (which confers identity to objects) is impaired in AD (Della Sala, Parra, Fabi, Luzzi, & Abrahams, 2012; Parra, Della Sala, Logie, & Morcom, 2014). However, Fleischman (2007) argued that these results may not show implicit processes, partially due to the difficulty to isolate implicit memory from cognitive retrieval and due to the experimental design that used mostly word priming, that may rely on language and semantic memory (Fleischman, 2007) instead of implicit processes. Other studies on AD show positive results when testing shapes and colours associations (Bastin et al., 2013; Lloyd-Jones, 2005; Musen & O'Neill, 1997), colour association to simple objects, and shape recognition. (Hupbach et al., 2006; Lloyd-Jones, 2005) Srinivas (1996) tested object recognition when their size was manipulated and obtained also a positive result. Therefore,

specific object characteristics can be "remembered" implicitly and retrieved automatically by AD sufferers.

Another aspect is to be retained in AD: despite the deterioration of the inhibition centers (Berger et al., 2015) that might have an unexpected positive effect over artistic outcome of some of the individuals with AD (enhancing creative processes), prefrontal cortex (PFC) is later affected in AD (Berger et al., 2015). Berger's data suggests compensatory activation in prefrontal cortex and amygdala, but not the ability to sustain higher working memory tasks. Although still not fully understood, the prefrontal cortex is considered the seat of conscience and the area mainly responsible for the unique, subjective reactions that form our personality.

PFC is also important in decision making, considered implicated in visual aesthetic perception (Cela-Conde et al., 2004). Aesthetic taste, responsible for having artistic, visual preferences that construct the personality is preserved in this neuropathology. Halpern and colleagues (2007) set to address the question of stability of artistic taste in AD sufferers: performing a couple of simple but key experiments, the study evaluates the preference rankings for art (pictures of a series of less-famous painting masterpieces, covering a range of styles, from representational, to quasi-representational, to abstract art) in AD patients and non-AD controls. When the control group subjects were tested in two sessions, two weeks apart, they showed a stable order of preference for the styles of paintings in the set. What was somewhat surprising was the fact that the AD patients, subjected to the same test, showed a remarkably stable aesthetic preference, as well. Nevertheless, as expected, when the memory of the names of paintings and styles presented during the experiment was tested, the AD patients performed very poorly comparing with the healthy controls, indicating that while their memory is dramatically impaired, their sense of artistic preference is conserved and active (Halpern, Elkin-Frankston, &

O'Connor, 2007). This may also imply that, despite the catastrophic intellectual decline defining dementia, the AD patients maintain an aesthetic functionality (that could be taken advantage of during art therapy sessions).

Also, brain processes performed at the prefrontal cortex or in conjunction with other, impaired, centers as working memory, attention, choice, (Christian, 2008, p. 70) are affected by AD. However, the control of emotions may be functional until late phases of AD (B. L. Miller & Hou, 2004; Soldan et al., 2015), relying on connections of PFC to implicit processes of amygdala. Nevertheless, due to the intense use of the primary brain, self-actualization, motivation, gratification delay may not work concordant to emotional impulses, leading to a decrease in self-awareness (Kalenzaga & Clarys, 2013; Shany-ur et al., 2014), increasing apathy (Forstmeier & Maercker, 2015) and to misunderstanding others' actions and intentions.

Although patients with AD have higher levels of alexithymia than healthy elderly (having trouble identifying and describing their feelings) (Shany-Ur & Rankin, 2011) and results (Torres et al., 2015) suggest that some AD patients fail to recognize facial emotion on displayed pictures (static images), the failure may often reflect general cognitive state, language or visual perception impairment "rather than a focal emotion processing deficit" (Shany-Ur & Rankin, 2011, p. 552). Moreover, the ability to recognize strong emotions displayed in more realistic and dynamic modalities does not differ from AD sufferers to healthy control group (Henry et al., 2008). Additionally, clients with AD present an intact recognition of eye gaze direction (Bediou et al., 2009) and engage in this gaze, being able to sustain it during communication. The brain structures affected by the disease do not affect, at least during the first phases of AD, the neural basis for cooperation during social interactions and are able to sustain decisions according to

preferences, personality and to basic social norms (Bosch-Domènech, Nagel, & Sánchez-Andrés, 2010).

Above I presented a wide area of processes implicit memory performs successfully in AD. Priming still shows flexibility to a certain extent by allowing access to implicit associative tasks (Duss et al., 2014), to skill acquisition, being reliable in implicit perceptual, haptic and motor functions.

Art Therapy and Implicit Memory

Engagement in art therapy is considered to involve multiple brain functions, from the highly cognitive functions to the preverbal, primary processes (sensorial and kinesthetic) (Hinz, 2009; Lusebrink, 2004), requiring a complex activation and coordination of centers from multiple regions. Also, different types of memory are used in creating art. Vance and Wahlin (2008) explored the memory function when client uses different artistic media, and concluded that art processing helps clients maintaining the functionality of implicit, explicit and motor memories.

In the present study, I will focus only on the findings that underline a relationship between artistic pursuit and implicit memory. Therefore, artistic process implies vision, motor functions, emotions, motivation, skill acquisition, attention, associations and other memory processes that partially or entirely rely on implicit memory.

Visual Perception

Visual perception is usually extensively used in art therapy. Seeing and recognizing our environment is accomplished by multiple processes, of which many are unconscious: integrating size-object relation, understanding textures and patterns, adding colour to a shape, retrieving artistic preferences to shapes, colours and compositions (Adlington, Laws, & Gale, 2009; Kim &

Park, 2010; Park et al., 1998). Others are mostly cognitive, implying planning the steps of constructing the desired composition, using perspective or reproducing complicate shapes from the nature.

Art therapy practice is usually informed by visual stimuli. Visual integration is influenced by intrapersonal affects, interpersonal demands, and relational support. The ability of humans to uniquely process, organize, and express retinal signals highlights the distinctiveness of each individual's mental imagery and the artwork they produce (Hass-Cohen & Loya, 2008, p. 92).

Sensory and Motor Stimulation

Art making and art contemplating during art therapy sessions play versatile roles, adapted to the needs of the clients. Art (making and viewing) stimulates senses, motor pathways, affective and/or perceptual processes and cognitive brain (Hinz, 2009). Siegel (2012) noted that art-making process could enhance the brain plasticity, through repeated experience of multisensory stimulation. That could both sustain brain connectivity between processes activated by artistic pursuit and solidify the newly formed pathways due to acquisition of new memory information (skills, sensations, emotions, preferences). Besides visual sense, art therapy sessions rely on the sensory modalities of touch and haptic sense. For example, touch activates the cutaneous senses that allow the clients feeling "the pressure, vibration, cooling, and heating". (Lusebrink, 2004, p.127) Therefore, during art-making process, the art materials and the artwork itself are experienced not only through seeing, but also through touching them, feeling their texture and shape, manipulating them. It also helps in perceiving the shape, weight, texture through the kinesthetic impulses from joints and muscles, experienced in the manipulation of the object (Lusebrink, 2004). By handling art materials, the body creates movement that accompanies the sensorial perception.

Touch and haptic perceptions involve movement.[...] It can be used therapeutically to express energy through the art media. [...] Most of the art activities involve movement, but movement can also be in art therapy a valuable tool in "decreasing bodily tension", "express energy", "connect to and reestablish bodily rhythms. (Hinz, 2009, p. 40)

Art therapy stimulates various senses - from tactile (mentioned above) to hearing, smell, and even taste (for edible projects) - and stimulates movement. Both sensory and kinesthetic stimulation refers to implicit brain processes, and constitute a non-verbal form of learning about environment, active since childhood, and of expressing own personality (Malchiodi, 2003a). Due to the fact that sensory information is structured in layers of unconscious information about shapes, smells, sounds gathered from preverbal stage to present moment, sensory stimulation (available from art activities such as finger painting or clay sculpting) could be an important component in balancing (calming or energizing) the brain reactivity to sensory stimuli (Hinz, 2009). On the other hand, "sensory stimulation, exploration, and play with art media facilitate [...] symbolic expression through metaphors during art-making" (Lusebrink, 2004, p. 149). And moreover, since sensory experiences evoke affect, art therapy could also provide opportunities to explore internal emotional states of a client (Kearns, 2004).

Emotional Activation during Art-making and Art-viewing

The flow of visual stimuli is processed in multiple centers, and among them the somatosensory primary cortex transmits information to the amygdala that detects emotional information from the outside world and create own emotional responses to environment (Carlson, 2001; Hass-Cohen & Loya, 2008). Therefore visual information generates emotions. That explains why art making and art appreciation, based mostly on visual stimuli processing, can produce emotional responses. Since most of the sensory pathways present implicit processes,

and also emotion formation is an implicit memory process, art making and art viewing access emotional content, releasing it unconsciously during artistic activities. Art provides a tool to communicating tensions or positive affect (Mimica & Kalini, 2011; Wadeson, 2000; Withrow, 2004), in a discrete, non-threatening way, through visual-emotional connections (sensory cortex – amygdala). Thus, information that cannot be accessed through verbal or even conscious processes can be accessed through art-making and revealed on the art work (Hinz, 2009; Lusebrink, 2010).

Aesthetic Perception

There is also another function of art (making and viewing), important for the art therapy clientele: that of creating and contemplating beauty. Zeki (2009) emphasizes that beauty and aesthetics preoccupied humans from millennia (and that's why the criteria to define this concept in art evolved over centuries). Art is one of the activities that is directed to seeking, creating beauty and harmony.

Beauty and the search of beauty make the fatigue implied in the creative art bearable. We love beauty at all times in our lives, and can achieve it in different ways, for there are many different moments and opportunities to express it. Beauty is always the goal one aims to achieve: it is a reward and a consolation. (Cossio, 2002, p. 48)

The categorial decision about what is beautiful / not beautiful (the aesthetic taste) is responsible for "judging" consciously and unconsciously the images around us and it crystallizes over years, becoming more stable after maturity. Maclagen (2001) explores this aesthetic experience, the response to what we see or create. The author suggests that this response is not one disembodied, distanced; on contrary it involves "much more of a cross-over or 'interweaving' between mind and body" creating "diffuse or inarticulate fantasies" (Maclagen,

2001, pp. 37–38). By just looking at an art production, one activates "complex, subliminal and multi-sensory responses" (Maclagen, 2001, p. 37). Same thing happens when the viewer is the creator himself. When making artwork, the artist uses his own aesthetic eye during the artistic creation to obtain a beautiful image. "Beyond the parietal lobes and the visual streams, artists use a multitude of cortical and subcortical brain regions in the organization of a visually appealing painting, drawing, or piece of sculpture" (B. L. Miller & Hou, 2004).

The aesthetic quality is even more profoundly experienced in art therapy, although at a different level. Art-making process in art therapy involves both the client (as actor) and the therapist (as witness). That makes aesthetic experience special, more intense and nuanced, because client and therapist are both sharing emotions and thoughts during the process of creating an image, culminating with viewing it together (Schaverien, 1992).

However, besides the aesthetic quality of art production, art therapy puts emphasis on the client's whole process of creating art and not on the final product, since the expression through art reveals, over sessions, both weaknesses of the client and also the strengths, the potential to change (Malchiodi, 2003a). Along the creation of an art work in art therapy sessions, all steps are important: from preparation of the materials or of the composition, to mental visualization of the image, then starting to work on the image and finalizing it, culminating with contemplating and sharing it with others. Ultimately, sharing with the therapist the preferred artistic style, materials or techniques, composition (all manifestations of aesthetic taste) and the artistic skills acquired so far creates a strong relationship of trust and acceptance in the sessions.

Research in Art Therapy for Clients with AD

While neuroscience focuses on evidence-based research of brain functioning, art therapy for clients with AD is more directed towards alleviating the effects of living with AD and

understanding the effects of artistic process for this population. The starting point to understand art therapy for clients with AD is that art-making and art-appreciation is still possible until the late phases of this neuropathology. This is a sine qua non condition for art therapy with AD clients and actually the foundation on which art therapy constructed all the clinical and theoretical approach for AD. In a systematic literature review, Chancellor and colleagues arrived to the conclusion that art therapy research sustain the hypothesis that "preserved sensory and motor cortices enable patients to see and produce art" (Chancellor, Duncan, & Chatterjee, 2014, p. 5). The cognitive deficits in AD, "impaired episodic memory, learning, and language, are not impediments to producing art. [...] Semantic and visuospatial deficits may alter the content of art, but does not prevent its production" (Chancellor et al., 2014, p. 5).

However, how art-making and art appreciation is possible with AD neural loss and what are the changes in visual representation, motivation, attention, etc., due to the neurogenerative disease, is a continuous subject of research in the field.

Patterns of Drawing and Painting in Artists Affected by AD

Changes in visual and decisional brain have impact into art production. Case studies of professional artists affected by AD, along with data provided by art therapy research, lead to important findings. For example, de Kooning (Espinel, 2007), Utermohlen and Carolus Horn (Sellal & Musacchio, 2008), three case studies of artists that continued to paint after AD onset, could give us valuable longitudinal data about changes in the artistic production after AD onset, sometimes hard to assess during art therapy programs (that are not lifelong). Despite their memory loss and confusion, the three cases are painters who continued to have an increased ability to use art materials for expressing themselves after AD onset. De Kooning is one of the famous references for that phenomenon (Espinel, 2007). The artist started with modest realistic

advertising drawings, moving after 20 years to deformed bodies of women in colourful chaotic compositions. From here to abstractionism, was the only one step that he made after AD onset. Before the disease, he painted very few canvases, concentrating a great amount of time on each of them, then he suddenly became a prolific artist and between 1981 and 1986 he painted 256 paintings. Although in daily routine his cognitive functions declined substantially, to the point that he depended entirely on his wife, his traces on the canvas remained dense and precise, and not a simple squiggle (Espinel, 1996). De Kooning had no difficulties concentrating on a canvas for several hours daily and to continue the canvas next day, knowing that he painted the canvas over few days each (Garrels, 1995). Therefore, it appears that he actually accessed a memory function that helped him plan the composition during successive days. He remembered what he accomplished and how to continue the canvas AD, which report the loss of planning capacities and recent past memories from the early stages of AD.

Utermohlen, another artist diagnosed with AD, also started to paint more abstract paintings after the onset of the disease. Losing the construction abilities in drawing, especially in depicting faces, the artist was still motivated to paint, in a more non-figurative way (Crutch, Isaacs, & Rossor, 2001). Sellal and Musacchio (2008) noticed that, besides a simplification in composition and a distortion of figurative elements and space, a tendency toward shape abstraction and use of vibrant colours, the artists with AD still produce fresh compositions that transpire their emotions. This was indeed true in the two cases illustrated above.

One other case, of an illustrator, is presented by the same researchers (Sellal & Musacchio, 2008): the case of Carolus Horn. Carolus Horn's illustrations, formerly strongly anchored in reality, but tern, became, similar to the above mentioned painters, more colourful
and perspective-neglectful. The case studies of the three artists underline the change from figurative to abstract composition, with distorted objects and faces, but nevertheless more expressive and vivid than previous styles. Colour seems to be also used differently after AD onset, in a more vibrant and contrasted way. Loss of perspective, a more "naïve" drawing, and the limitation to mostly primary and secondary colours attest a turn in artistic style, but show a preserved creativity and prolific artistic drive to all the presented artists.

Two other cases, this time from art therapy practice, offer support for these suggestions: one of an 82 year old woman who never showed interest in art, but started painting and enjoying this activity four years after AD onset (Chakravarty, 2011); the second, of a man with moderate AD, who started painting for the first time in an AD rehabilitation center. Both cases present art works with high aesthetic value, showing a disinhibition in the artistic pursuit, suggesting that acquiring artistic skills may be possible even after onset of the disease and confirming that aesthetic visual function is preserved (Halpern, Ly, Elkin-Frankston, & O'Connor, 2008).

Miller and Hou (2004) focused their research on art productions of non-artist individuals with different neurodegenerative diseases. The authors noticed that art production of persons with AD becomes with time less figurative and lose precision of shapes, but benefits from the use of more vivid colours and a certain disinhibition. Consequently, that enhances the aesthetic value of the image and allows the manifestation of creativity. (Miller & Hou, 2004). However, case reports of artists affected by AD also confirm a "declining ability to represent subject matter in a representational fashion" (Rankin et al., 2007, p. 3) and declined drawing abilities (Kirk & Kertesz, 1991; Rankin et al., 2007), being related to the deterioration in the cognitive perception of objects and space. Moreover, studies on art productions in AD report preference for more contrasted or saturated colours (Rankin et al., 2007), especially red and yellow (Gretton &

Ffytche, 2014), and less complex compositions (Seifert, Drennan, & Baker, 2001). Queen-Doherty (2002) presents another characteristic that art production of clients with AD may have: the presence of "picky lines or preservation" (p.27) in drawing and painting that may be a consequence of visual and perceptual impairments, but may also be a connection with an internal rhythm or an "abstraction of emotion" (Queen-Daugherty, 2002, p. 29).

All the above cases have few common characteristics: they confirm the possibility to access concentration, artistic skills, and aesthetic values in the condition of cognitive impairment and show an overall figurative drawing declining. Despite the distorted perception of objects and their spatial arrangement, there seems to be a progressive disinhibition towards figurative rules, a more reliability on the artistic intuition, therefore a creative availability.

Sensory Stimulation for Clients with AD

Vance and Wahlin (2008) argued that repeated art experience contributes to acquisition and strengthens the retaining of those memories, that, of course would be beneficial in AD. Furthermore, depending on the technique and the theme chosen, art can activate the peripheral pathways of different senses, can involve complex processes implicating thoughts, emotions, and internal imagery (e.g., painting from memory) or can be "a mixture of both perceptual and cognitive activity" (Safar & Press, 2011, p. 96). For AD individuals, since cognitive functions are harder to rely on, the perceptual and sensory-kinesthetic activities appear more reliable (Abraham, 2005) and could be successfully be used in this case.

Nevertheless, due to differences in affected brain, each individual with AD may have more or less abilities of figurative representation or other visual cognitive task. Some individuals may follow a path of creativity after AD onset, others (especially if they have the posterior cortex affected) may abandon creative pursuit, focusing on "copying previous efforts" (Mendez,

2004). Kitchen and Rosling (1992) found that visual-hearing stimulation enhances responsiveness and well-being in clients with AD. Another example of multisensory stimulation (Jensen, 1997) presents a flow of music-art-movement during sessions. Sessions were designed mostly as art and movement responses to various types of music. During multisensory stimulation, clients (among them 60% with AD) were touched differently by the three creative modalities, some being responsive mostly to one of them, others to all of them. Jensen noticed that this holistic sensorial stimulation gave clients access to self and increase their positive energy levels. Also, the researcher concluded that multisensory stimulation is a way to follow in sessions, since it will enable client to respond best to information presented to as many sensory pathways possible (Jensen, 1997), an important benefit of this approach. Similar results have Ozdemir and Akdemir (2009) who conducted a study including 12 sessions of art and music with 27 participants with AD. The researchers found that anxiety score dropped considerably immediately after the intervention using this method of multisensory stimulation. Furthermore, for three weeks following the intervention the anxiety score remains low, starting to have an upward trend only after the third week following the intervention.

Emotion Expression and Communication in Art Therapy for Clients with AD

After AD onset, clients reportedly manifest a "loss of one's identity and dignity, and relationship stress with family and friends" (Powers, Dawson, Krestar, Yarry, & Judge, 2014, p. 7). Individuals with AD perceive that it doesn't matter anymore what they think and want, because the others will not listen anyway. They may become fearful to engage in relationships because "the others will notice and leave them" (Powers et al., 2014, p. 7). This situation, corroborated to the loss of memory has catastrophic effects for an AD sufferer. Art therapy research speaks of dealing with these issues and trying to meet the emotional needs of the client

in the sessions (Queen-Daugherty, 2002). "Unconditional acceptance, wholehearting giving and receiving, without expectation towards the person creating art" creates a state of comfort and security to the client (Queen-Daugherty, 2002, p. 32). Art provides a nonverbal mode of communication and allows self-expression beyond the verbal and cognitive capacities of the clients affected by AD (Gretton & Ffytche, 2014). It is about revealing something from our inner world to the others, and therefore creativity expresses who we are (Killick & Craig, 2012). Self-expression, a benefit presented extensively in art therapy literature for AD (C. Johnson, Lahey, & Shore, 1992; Kinney & Rentz, 2005; McFadden & Basting, 2010; Shore, 1997 and many others) gives access (and relief) to emotional states hard to express through language. Cowl and Gauglel (2014) found a whole repertoire of emotional changes presented by clients in the sessions: changes in mood, attitude, and increasing self-esteem, hope, motivation, and selfsatisfaction. Killick and Craig (2009) believe the arts can provide "outlets for distressing feelingstates, which at the least can make circumstances more tolerable, and at their best can confer a whole new meaning on the processes being undergone" (Killick & Craig, 2012, p. 24). Jensen (1997) found that many clients use this opportunity offered by art to access affective expression. Thus, the art therapy session not only ensures the physical safety of the clients, but also the "psychological safety" (Queen-Daugherty, 2002, p. 31) within its settings, acting as a container for emotional responses of the clients with AD to environment.

Manifesting Preferences

Both art-making and art appreciation involve assigning emotional and cognitive significance to artworks. Clients with AD have their favourite colours, themes or can "rank paintings according to their own aesthetic preferences" (Chancellor et al., 2014, p. 4), meaning that aesthetic taste is also preserved and reliable (Halpern et al., 2008).

This trait – aesthetic taste – has a great importance for art therapy approaches, as being one of the ways individuality can still be evident and help persons with AD make their own choices and express their own preferences. Although art therapy for people with AD does not focus on the aesthetic value of the artwork, "the attitude of the art therapist in focusing on the creative process as much as on product would seem to encourage the individual client to use materials in his own way to express his own aesthetic preferences" (Byers, 2011, p. 83).

Several qualitative studies have suggested there are beneficial consequences of offering aesthetic choices to clients with AD in art therapy sessions. Giving freedom of choice or options of artistic media, colours, and preferred theme allows a sense of control over sensory, perceptual, and motor skills and a sense of independence and normality (Berardi, 1997; Wald, 1983). Choosing and expressing their preferences are relatively rare for this population outside therapy, since most decisions are made by others due to decline of the cognitive functions. Stallings (2010) and Cossio (2002) remark that, during collage, clients chose images related to their preferred activities, food, faces, or images that often elicit memories and foster emotions and verbal communication.

Attention Stimulation in Art Therapy Sessions for Population with AD

Another concern in AD is a deficit of visual attention. AD pathology disrupts effective connectivity within an attention network during conflict processing, allowing an increased interference of distracting stimuli (Finke et al., 2013). Therefore many clients with AD experience a continuous state of disorientation and anxiety. However, Chancellor, Duncan, and Chatterjee (2014) confirm that "with appropriate structure" (Chancellor et al., 2014, p. 1) in the sessions, patients with AD produce and enjoy visual art, being able to focus their scattered attention into the artwork. Also, Kahn-Denis (1997) presents few case studies, one of a woman

with AD. An 82-year-old person with AD was engaged in a sensory exploration using paint and "remained actively engaged for 55 minutes" (Kahn-Denis, 1997, p. 197). Silently involved in the process of using color, the client showed a good concentration on the artwork for almost an hour. Also, findings of two small trials (Kinney & Rentz, 2005; Rentz, 2002) confirm that art therapy sustains and enhances attention. Participants in these studies were able to maintain more than 10 minutes of focused attention without prompting, and even after prompts were given for the next steps to follow (until completion of the artwork), they reengaged easily into art-making.

Of special significance for attention, is the sense of flow which is experienced in art therapy. Killick and Craig (2012) dedicated a whole chapter to this important feature in artmaking for clients with dementia, a feature also mentioned by Chancellor and colleagues (2013), but otherwise not elsewhere discussed by art therapy literature for AD. Brought for the first time into positive psychology by Csíkszentmihályi, the concept of "flow" refers to a state of mind where the person is completely absorbed in what she is doing, suspending temporal reality and having all the energies channeled into the task (Csíkszentmihályi, 1990). Although there is not a constant in all the sessions, being involved in art activities could transpose the clients in a state of flow. During the state of flow, paradoxically, "concentration on an activity can lessen selfconsciousness. It improves focus and excludes distraction. The sense of time is suspended, and this emphasizes the importance of the moment" (Killick & Craig, 2012, p. 14). Killick and Craig (2012) present a case of a heavy smoker suffering of dementia who, engrossed in art activity, "forgot to ask for a cigarette throughout a one-hour art group, painting being an activity that commanded her absorption" (Killick & Craig, 2012, p. 14). Flow is, therefore, an important factor that could enhance concentration and give clients a sense of accomplishment and positive feelings about their artistic process.

Enhancing Well-being, Vitality (Reducing Apathy), and Stress Relief in Art Therapy

Several studies (Ferrero-Arias et al., 2011; Jensen, 1997; Kinney & Rentz, 2005; Ozdemir & Akdemir, 2009) suggest that art therapy improves the well-being and vitality (so decreasing apathy) of the person suffering of AD. Moreover, a quantitative study (Hattori et al., 2011) comparing art therapy to non-creative, cognitive therapies concluded that patients with mild Alzheimer's disease improve the vitality and quality of life during art therapy sessions, while in the calculation drill group, only an improvement in the cognitive function was noted, the other variables being unclear. Moreover the increased well-being was prolonged after the completion of the art therapy program, over the next six weeks.

The use of implicit brain processes (sensory, learning, implicit associations, etc.) in art therapy brings, besides the possibility to preserve them longer, a valuable occupation. The stimulation through art-making may reduce agitation having a calming effect (C. M. Johnson & Sullivan-Marx, 2006).

Making Associations and Reminiscence Process

Despite the fact that neuroscientific studies confirmed that in AD visual-verbal associations (picture naming) are much harder to be retrieved, object identification and information about object functions were still functional processes, as I presented before (Hupbach et al., 2006; Lloyd-Jones, 2005) . Moreover, Seifert and Baker (1999) found that participants have abilities to associate meaning to viewed pictures. Thus, it appears that clients with AD could still make association to visual representations (e.g. responding 'oink' to the image of a pig), but not being able to name the objects from the pictures (Seifert & Baker, 1999). However the two researchers noticed that participants make mistakes in categorization. It is possible that some "errors in translation between the lexicon and semantic memory [occur],

which may very well be the result of burdens on short-term memory that exceed the limitations imposed on it by disease processes" (Seifert & Baker, 1999, p. 13).

Another form of association frequently mentioned in art therapy is reminiscence, when engagement in art-making, art-appreciation and discussions that triggers memories of past events. Although time frame may be often disrupted, reminiscence is a way to preserve clusters of past memories by retrieving them during art therapy sessions. Reminiscence and life review is a process that has been used with older adults suffering of AD for more than five decades in art therapy. In a study using collage as media, Stallings (2010) noted that all three participants engaged in reminiscence during the process of art-making and during the discussions about their artworks. Reminiscing is "a way of thinking and talking about one's life" (Stallings, 2010) and art therapy use visual ways to foster this process. The reminiscence outcome is overall positive and clients see their life more positively after completing a life review, gaining more confidence in what they are (Ravid-Horesh, 2004). Other two case studies (Johnson & Sullivan-Marx, 2006) confirm that connecting with fragments from the past, when making and discussing their artworks, help clients grieve their lost memories and honour their past, therefore increase selfesteem.

Use of Creativity and Learning New Skills in Art Therapy

When beginning an art making process, there are only art materials and an idea about the artwork that will be made. But at the end of the activity, something will have been achieved, whatever its scope and quality. More important, a potential for creativity may have been attained. This gives the opportunity for admiration and celebration. The expression of creativity is always to be welcomed, especially in people suffering of AD, where the possibilities for underachieving are endless and their occurrences frequent (Killick & Craig, 2012).

Seifert (2013) deduced that art production might preserve art-making skills, especially when the person has a history of art- and/or crafts-making anterior to AD onset. The participant from her study followed several small steps until reaching the point of finalizing the project. The author emphasizes that repeating a sub-task would help correct implicit priming and, consequently, each sub-task would be automatically performed until the whole task finalization, without the need to learn the sequences through a cognitive process. Learning to paint, to correctly handle art materials, to create is indeed based on implicit learned skills that patients with AD retrieve every time during art therapy session. Another study that touches this subject is proposed by Seifert and Baker (2008). The research used a group of five individuals suffering of AD and a control group. The groups participated to a three-month art therapy program mostly working with stickers. The authors found that both groups were able to acquire basic skills in using the stickers to create images. Moreover, when groups were asked to perform a slightly different task, the "sticker placing" learned skill was successfully used to complete the new task. The new task consisted in creating a collective multigenerational banner, decorated with stickers. The skill retention from the three-month learning was successfully applied in making the banner. In addition, the current study has extended findings beyond mild dementia to include individuals with moderate to severe dementia.

Examples of Media and Themes Used with AD Sufferers in Art Therapy Sessions

Art therapy has positive results in emotion regulation, skill learning, sensory and motor stimulation. However, art therapy research revealed that the techniques and themes should be adapted function of the stage of the clients and preferences. In consequence, there are materials and techniques more likely to obtain a positive outcome, while others may obtain non-satisfactory outcomes for AD clients. Seifert and Baker (1999) reported that sticker placing

proved to be an enjoyable activity for them, while paint-pens were a failure for her researched group of clients with AD. Sticker placing offered the clients a ready-made image that they need to arrange on the page, so tasks were very simple, accessible to the clients from various stages of AD. Other clinical studies (Stallings, 2010; Stewart, 2004) describe clinical interventions using collage, for various benefits this technique may provide in AD. Working with pictures may stimulate visual associations and uses intensely the procedural memory, preserved in AD (Seifert, 1998). Being an activity that doesn't appear difficult for AD clients, collage produce enjoyment and increase attention, favouring reminiscence while deciphering and arranging the images on the paper. Also, collage provides "a nonverbal mode of communication and allowed for expression beyond the verbal and cognitive abilities of the clients" (Stallings, 2010, p. 140). All three participants from Stalling's case study (2010) showed reminiscence and explained their images during the collage process. Other case studies (Johnson & Sullivan-Marx, 2006; Stewart, 2004) reports the same effects of collage: fostering reminiscence and allowing verbalization in explaining the images created.

Painting is a common activity in art therapy for AD clients. Despite their confusion and loss of cognitive functions, AD sufferers seem to continue enjoying painting, finding this activity a way of expressing themselves in a meaningful way. Painting (especially watercolour) is apparently largely used for AD clientele, since it is a "flowing media" and could "promote freedom of expression" (Chancellor et al., 2014, p. 6). Several case studies (Johnson & Sullivan-Marx, 2006; Kahn-Denis, 1997; Rentz, 2002; Stewart, 2004) noted positive outcomes from painting with water based colours, painting fostering self-expression, expression of deep emotion.

Approaches in art therapy are less directed for clients in first phases of AD, "encouraging patients to choose their own media", providing an opportunity to "exercise personal choice and control" (Chancellor et al., 2014, p. 6). Instead, free studio art is not suitable for advanced phases of AD, when clients lose the capacity to initiate tasks. Considering the progressive limitations in approaching free media and themes chosen by clients, free studio can progressively be replaced by more directed sessions. Queen-Daugherty (2002) suggests that these art therapy sessions need, however, to give an idea of autonomy without creating sensation of failure or of childish activity. The art therapist introduced stamps to her clients and reported that stamps are a good media that offer a sensation of autonomy and mastery even to clients in more advanced phases of AD.

Johnson and Sulivan-Marx (2006) suggests that, to allow more control, for certain clients, besides watercolour and collage, "structured art materials (stencils, pencil drawings, and collage pictures)" (Johnson & Sullivan-Marx, 2006, p. 315). That allowed for maximum control. In addition, the two researchers noted that

"Art tasks need to use clients' strengths to provide success in art making. Whereas some clients respond well to a multistep task, such as painting and rinsing the brush between colors, other clients need an approach that requires only one step, such as receiving a paintbrush already dipped in paint. For some clients, having choices is invigorating. For others, having choices is immobilizing, and limiting their choices facilitates their successful participation "(Johnson & Sullivan-Marx, 2006, p. 312).

Either using more fluid or more structured media, art therapy session must include materials that are safe for the clients and are not toxic or harmful for them (Queen-Daugherty, 2002). Since "confusion in persons with AD creates risks in using art materials, such as eating

paints, pastels" (Queen-Daugherty, 2002, p. 30), art therapist needs to try to exclude materials with a great risk of being ingurgitated, for the security on the sessions. Also, Queen-Daugherty (2002) suggests that focusing on positive themes in art-making process is beneficial for this population, helping the clients preserve a positive mood over the session. Ensuring an overall state of positive experience during art therapy is also suggested by other researchers (Chilton, Gerber, Councill, Dreyer, & Strecker, 2015; Stallings, 2010). An addition to art, using music during art-making, may elicit calming and even artwork creation in response to the feelings evoked by the music (Jensen, 1997).

Discussion:

The goal of this literature review was to identify resilient brain processes in AD and to link findings from neuroscience and art therapy. In terms of preserved memory, besides compensatory processes that prolong the availability of certain cortical functions in early phase of AD, implicit brain processes involving senses, perceptual and procedural memory, preference, and emotion are still reliable until last phases of this neurodegenerative disease. While explicit memory (episodic and semantic memory) is progressively affected in AD – leading to errors in naming, recognizing, or describing objects (conceptual representations, corresponding to semantic memory deterioration) (Peraita & Moreno, 2006) or not recollecting autobiographical events (episodic memory), orientation problems and limited capacity to planning – implicit processes are spared.

Trying to relate data from neurophysiology of artistic pursuit to the preserved cerebral functions in AD led to valuable findings. There are some similitudes between preserved brain processes in AD and brain processes activated in art therapy. For example, all implicit processes mentioned before are used in art expression. Therefore there may be a neuroscientific reason why art is a helpful therapeutic tool in approaching this population, but on the other hand we have a scientific basis to modulate art therapy interventions to respond to AD realities and to stimulate as many brain processes as possible, employing the use of implicit memory. Stimulation of preserved functions is of great importance in AD, considering that the more the respective pathways are used, the more resistant the structure becomes to deterioration (Rusted & Sheppard, 2002; Stewart, 2004; Vance & Wahlin, 2008).

On the other hand, art therapy research is focused on more general aspects of clinical outcomes for clients suffering of AD. Mostly qualitative (although there are quantitative studies as well), the research in art therapy reported positive outcomes in well-being, calming, pleasure, artistic expression, emotion regulation, increasing attention, enhancing a sense of independence and mastery, valuing the personhood, findings presented above. Few studies (Seifert & Baker, 1999, 2002; Seifert, 1998) focus on learning and association abilities in art therapy. Many studies mention the art media used in sessions, as having a considerable importance to the success of art therapy sessions. Also, studies report the progressive changes in artistic representation due to visual perception deterioration.

Art therapy literature presents more discrete, diffuse outcomes, "often measured as subjective impressions from participants and staff" (Cowl & Gaugler, 2014, p. 319). Many factors contribute to the difficulty to assess objectively variables in art therapy. Mostly, because art production and artistic process has a deeply subjective character and also few variables are less likely to be easily quantifiable (e.g. independence, emotions, self-identity). However, few links could be established. First, neuroscience has sufficient data to explain the mechanisms that foster changes in behaviours and in artistic representation at different stages of the disease. Second, neuroscientific findings about implicit processes (perceptual, procedural and sensory) could support certain approaches in art therapy that imply a greater variety of stimuli and brain

processes (e.g. multisensory- or motor-sensory approaches), and also for possibility of learning new skills in sessions. And third, by using preserved processes and its specific approach through art expression, art therapy was reported to be beneficial in enhancing attention, increasing calm, increasing vitality, inspiring positive emotions in sessions, and increasing clients' overall wellbeing(Hattori et al., 2011). Art therapy has demonstrated to be beneficial in areas where usually there is a decline for individuals with AD.

Changes in Artistic Representation after AD Onset

One of the important sensorial and perceptual processes that change progressively in AD is vision, and these changes plenary manifest in art-making and art-viewing. The losses in episodic and semantic memory, corroborated to a certain deterioration of visual pathway and distortions in spatial representation lead progressively to deformed perception of space: perspective and distances between objects in a composition. Backgrounds may be ignored partially or entirely during visual processing, due to progression of impaired global information. AD sufferers show also progressive decreased ability to visually recognize ordinary objects, especially the complicate ones, or to recognize facial details. That may be also an explanation why there are contradictory findings about facial recognition in AD and why facial recognition is better when exposed to real faces or wide format pictures.

Nevertheless, local information about familiar objects, especially the simple ones, still functions well until last phases of the neuropathology, being related to implicit perceptual processes. Also, implicit processing of visual stimuli is relatively intact in at least mild to moderate AD. That means that rough data about environment (colour, contrast, shape) are still well-processed by the brain. But, although visual acuity and colour recognition are functional, visual pathways process faster contrast and primary colour. The changes in perceptive and visual

processing are also reflected in artworks, art therapy research bringing evidence about distorted perspective and objects, the preference for bright, primary colours and the simplification of the composition.

In consequence, art therapy practice needs to take into account that the more the neurodegenerative disease progresses, the more artistic production may change, relying on contrasts, on bright saturated (mostly primary) colours. Thus, it is likely that individuals with AD understand better images with high contrast and fewer details and are more able to represent them in art. The perspective and the spatial relationship between figurative elements in an artistic composition may be more and more distorted. Moreover, since shape representation becomes also difficult to represent, clients with AD may neglect things outside the center of interest in an artwork during art-making process or may end up preferring the abstract to figurative, engaging more easily in abstract representations. Therefore, drawing, sculpting and painting after nature (still life, landscapes) may become a frustrating activity and abstract representations may be perceived as less challenging and having a safer, more acceptable outcome while AD progresses. Also, since both planning function and episodic memory are impaired, clients may not be able to project the steps to complete their artworks, so they need gentle guidance during the artistic process. However, despite the changes occurred in artistic production, proper adaptation to clients' stage of disease makes art remain a pleasurable and stimulant activity for this clientele. Few studies launched the idea that, due to deterioration of inhibitor centers (Berger et al., 2015; B. L. Miller & Hou, 2004; Stuss, 2007), clients may enter more disinhibited in art-making process, obtaining sometimes spectacular results. However, this hypothesis is a result of few case studies and more in depth research is needed to be able to affirm this.

Multisensory and Motor-sensory Stimulation

Art therapy literature (Lusebrink, 2004; Wadeson, 2001) underscores that sessions offer multisensory stimulation, involving regularly sight and touch but also often smell, hearing, and even tasting. On the other hand, all these primary sensorial functions that don't need high associative and cognitive processing, are preserved or satisfactory functional in AD. In this case, the multisensory approach in art therapy is possible, since it uses the functional pathways of implicit sensorial processes that are preserved longer in the disease. Already art therapy research reported positive outcomes from using mixed stimulation art-music (so visual and hearing stimulation). Therefore, designing sessions that purposely provide multisensory stimulation (e.g. edible art, working with various textured media, response art to music, scented materials, and more other creative sensorial activities) may enhance well-being and provide enjoyable, interesting activities and also help preserving these sensory pathways for a longer time.

Also, procedural memory (related to motor functions), another type of implicit memory, is relatively preserved in AD. Art therapy relies heavily on haptic and motor memory (Chancellor et al., 2014) to complete tasks. Using brushes or pencils, scissors, applying glue or placing a photo on the desired place on the artwork require procedural memory. Art-making usually involves hands and sometimes the whole body (Cane, 1983), energizing or calming function of the speed of immersing into the process of art-making (Hinz, 2009). Thus, it appears that art therapy could successfully use these preserved function in designing sessions. Moreover, few voices in art therapy promote a mind-body approach that relax and calm the mind through the body movement (Graham-Pole, 2002; Malchiodi, 2003b) and may be a good therapy for anxiety – often experienced by persons with AD. This approach may have the same long-term

positive outcome: repeatedly stimulating motor functions may help in preserving these brain pathways longer.

Preserving and Learning Skills

Implicit memory may play a critical role in successful adaptation to changes, based on preserving, adapting, and acquiring skills in daily tasks (Seifert & Baker, 2002). A few of the case studies (Espinel, 2007; B. L. Miller & Hou, 2004) presented above suggest that brain pathways (therefore processes) that were used intensely in life are less prone to deterioration. Therefore skills used throughout life (overlearned) are preserved for a longer period of time and are more easily accessible after AD onset. However, though it may sound surprising, while the cognitive brain declines and clients with AD cannot remember their recent past, learning is still possible. Still reliable in AD, perceptual memory, that helps in learning about the sensorial qualities of an art material (shape, texture, colour), and procedural memory, responsible for implicit motor actions, are actively involved in learning and in compensating other types of memory that are compromised in AD. Data from neuroscience and other types of therapies presented before underscore that, in fact, the brain doesn't lose the whole potential of learning in AD, despite losing other functions, showing the great capacity of adaptation of the human brain. However learning new skills using only implicit memory is much slower than when both explicit and implicit types of memory are used. Learning skills through implicit memory is based mostly on sustained repetition (overlearning) until the tasks becomes automated. In AD neuropathology, especially in severe stages, implicit memory becomes the main process available in receiving and retrieval of information, and the performance of task completion depends on automatic processes that don't require conscious control (Hudson & Robertson, 2007).

However, both neuroscience and art therapy emphasize that learning in AD occurs if tasks are clearly divided in very simple sub-tasks that are learned at an implicit level (Seifert & Baker, 2002; Seifert, 2001) through repetition. These finding are also confirmed by other clinical domains (Holborn & Boe, 1965). Consequently, art therapy could contribute to skill acquisition if it focuses on clear and simple subtasks, presented in a consistent sequence and repeated over time (Seifert, 2001). Art therapy may also benefit from the know-how of errorless learning (EL), a method of learning used successfully by other professionals working with clients in the first stages of AD, and based on same principle of overlearning presented above. EL refers to applying learning techniques that may be beneficial to AD sufferers: eliminate guessing from tasks, using succession of small steps with offering verbal and visual cues, using vanishing cues (giving less and less cueing during learning a task, while maintaining errorless environment) and spaced retrieval methods (participant is asked to perform the task from time to time, until maintenance levels are achieved).

Extrapolating this technique to art therapy, helping clients to do and repeat simple tasks over the sessions (e.g. mixing colours to obtain new shades or using different art tools and art techniques) may not only enhance skill acquisition, but also have further benefits for clients with AD. The fact that a client could (under the art therapist's supervision) paint and draw, perform with minimum prompting valuable activities as art is in itself a step forward to normality. While outside the therapy the life of the clients with AD is a continue struggle with the limitations the disease impose progressively, in art therapy they have access to art-making, that implies skills, decision-making, task-completion, and creation, so normal steps in obtaining a final artwork. Furthermore, validation and positive achievements in art therapy sessions bring a sense of competence, mastery (Killick & Craig, 2012; Weller, 2013).

Benefices of Art therapy Related to Use of Implicit Processes

There is a widespread medical perception of AD that stigmatizes, labels (Kitwood, 1990), and sometimes "infantilizes" (Lyman, 1988, p. 72) sufferers of AD. Individuals with AD are at risk to lose their self-confidence. Being involved in a non-pathologizing activity, succeeding in it and learning new skills, could help AD sufferers recognize and feel their own value as persons that can still produce art and enjoy doing that; this may help restore some sense of normality in their lives.

Giving choices. According to neuroscience, there are few functions relatively spared that could be successfully used by art therapy sessions. While I have not allocated the space to explore the functions of PFC due to my focus on implicit memory, the implications of PFC in control (e.g. emotional regulation), categorial representation (beautiful/not beautiful) used in aesthetic taste, and in defining other traits of personality are important for art therapy practice. However, PFC may be supported by other structures (that sustain familiarity-based, implicit processes) in the performance of complex processes such those involved in aesthetic taste. Halpern and colleagues (2008) found that the aesthetic taste remains intact for participants with AD, no matter their impaired ability to remember any famous painter or painting. It means that viewing and making art could still follow the preferences of the clients and offer them choices. It also means that even choosing a colour or a shape is a decisional step according to their personality. These important functions, speculated in art therapy sessions, come to sustain the sense of self-worthiness and independence during art therapy sessions, so important for AD population. By having the opportunity to manifest preferences (e.g. for colours, techniques, styles, art materials, patterns, textures), and even act in the sense of spontaneously including these preferences into an artwork that is made by themselves, is a huge step into exercising the

independence and showing their personality in art production, expressing themselves genuinely with the aid of artistic media. Besides, by having the therapist witnessing the artistic act of each client and appreciating the final artistic product, the aesthetic experience is also manifested in sharing emotions and thoughts about the art-making process and the finalized artwork. Therefore, sharing both preferences for art materials and colours and impressions about the artwork with the therapist could be a vehicle to restore dignity, normality.

Attention enhancement. There is a set of processes overwhelmed by the changes in brain processes: attention. Neuroscientific findings stress that attention deficits may interfere with learning process, accentuating the perception that there are memory problems (when, in fact, the issues are related mostly to the incapacity to focus on task). Therefore, gradual attention deterioration in AD brings a series of unwanted consequences. Fluctuations in attention control give the client with AD the sensation of failure and therefore put the mind in a continuous monitoring of actions, to avoid perceived failure. Because attention control is deregulated in AD, the performance of tasks is also fluctuating across time and situations and could lead to anxiety and to hyper-vigilance to perceived cognitive failures (therefore more sensitive to any perceived critique). Although studies of attention in art therapy with clients suffering of AD are few, all of them have promising, convergent conclusions that this modality improves attention on tasks during art-making.

Flow. Art therapy can give the clients a unique feeling: of being suspended in the artistic reality, being deeply immersed in the process of art-making that lead to a mind relaxation and a state of bodily and mental "fluency", called flow. Although there is not a constant in all the sessions, being involved in art activities could transpose the clients in a state of flow. The experience of flow is one of integration, whereas it appears that in many instances the experience

of dementia is one of disintegration" (Killick & Craig, 2012, p. 27). The flow could be also one explanation for de Kooning's artistic process. While cognitive activities require structured steps and planning, art is a deeply intuitional activity. If few skills are learned (e.g. to work with a brush), in art-making following inspiration is an "in the moment" process. For individuals who were involved in art-making process, this state of "letting go", of abandonment of any cognitive planning in favour of intuition is well known. The more a person experiences the state of flow (or abandon to intuition), the easier he or she enters in this state during subsequent times of doing art. Therefore the case of de Kooning or of other artists may not contradict the general findings that planning capacity and short term memory are impaired in AD. They may just give the researchers another path to explore. /Once experienced and learned, flow could ensure a deep focus, spontaneity and fluency in creative activities.

Emotion regulation. Facts, events vanish first from memory when a person is suffering with AD. However, emotional memory that registers unconsciously the affect related to events is still functional until late stages of this neuropathology. Consequently, while the disease progresses, emotions are still captured by the brain through implicit processes, although dissociated from the facts that triggered them. Therefore those with AD may not remember what event generated the negative emotions, and they may be unable to express what caused the reactive emotional response. That could lead to painful experiences for persons suffering with this disease, since negative emotions generated by failing to perform a task, for example, may stay with the client until other event, and consequently another emotion, replaces it. Art therapy, if designed appropriately (e. g. using positive, non-infantile themes and clear, simple steps), provides a pleasurable activity that may give the sense of competence and ultimately produce positive emotions and self-confidence.

Non-verbal communication. Language is also gradually impaired in AD and there can be interruptions in cohesive speech due to lapses in recollection of words, meanings and events. Art therapy allows various artistic expressions, offering a language without words for a clientele in a continuous negotiation with the new condition and social role, that usually generates deep withdrawal "into themselves because of increasing disorientation" (Stewart, 2004, p. 154). In this case, art expression may become an important support to discharge emotional content related to living with AD (memory loss, social life loss, moving to a new residence and many other painful changes) therefore to provide emotion regulation mostly in a non-verbal way. On the other hand, expressing strong negative emotions onto or through the artwork, grieving the remembered past or the loss of memories that are traumatic, needs to happen in controlled and caring environment that ultimately provides an overall feeling of safety and understanding. Also, emotions discharged on the artworks or discussed in a safe therapeutic environment may relieve anxiety and work on withdrawal due to the continuous adjustment of cognitive loss. Most of the art therapy studies mention about the non-verbal expression art offers to clients with AD, and the strong connection between this expression and lessen the anxiety or building self-esteem (Chilton et al., 2015; Kinney & Rentz, 2005; Ozdemir & Akdemir, 2009; Tanner, 2013)

Associations and reminiscence. While AD progresses, the associations related to spatial organization of the objects in the environment, temporal situation of past memories, and other cognitive associations related to language (e.g. word-picture, name – face associations) decline. These types of associations makes spatial navigation in an unknown environment (outside the house, for example) or calling a dear person by her or his name impossible. Besides these impairments, other associations that use the more resilient processes of implicit memory are made continuously by a sufferer of AD. Studies noted that the associations regarding the visual

qualities of objects (shape – colour – size) are still happening until late stages of the disease. Also, other associations are possible, related to various sensorial qualities of objects (e.g. visualtactile), or being able to associate a picture of an animal to the sound it makes (Seifert, & Baker, 1999). An important type of association is when a sensorial stimuli triggers past memories (otherwise hard to retrieve): reminiscence. Art therapy research has documented many case studies where a picture, a touch, a musical piece, a colour, or a technique fosters reminiscence (C. Johnson et al., 1992; Stallings, 2010). Therefore, making various sensory associations and stimulating reminiscence may be also a strong point of art therapy.

Media and themes. Understanding the reality of each phase of AD should lead to the use of appropriate materials and themes for this population, focusing on preserving the processes that are still available and less on continuously challenging lost brain functions. While the safety of materials is on the first place in art therapy sessions, a variety of materials are presented in art therapy studies: more controlled media (pencils pastels, etc.) and flowing media (watercolour, gouache, and acrylic), along with collage and stickers. But besides art media, offering themes that are not over their cognitive possibilities (to induce the feeling of failure), but also not infantile is a very important aspect in designing art therapy sessions. The right amount of stimulations and relaxation, of difficulty and of having fun during art-making constitutes the key in attaining the goals, whether general or restrained.

Well-being enhancement through a creative activity. Stewart (2004, p.154) stresses that clients presented in her multiple case study "continued to express themselves even though aware of increasing confusion and loss of cognitive skills." Despite the scarce research on certain punctual benefits of art therapy in sessions (discussed above), there is, however, a large amount of literature that emphasizes on larger effects, as well-being and self-esteem improvement in art

therapy programs for this population (e.g. Hattori et al., 2011; Li, 2012; Newman, Goulding, & Whitehead, 2013). An explanation is that the general effect of well-being or mastery, or normality is a summit of all the components that may be ameliorated by art therapy in sessions: emotion regulation, a sense of independence and competence due to learning skills and decision-making according to personal taste, attention improvement and lowering anxiety. From all the puzzle pieces, the general outcome is, indeed a stronger sense of self, of worthiness, and a sensation of well-being. Striving for wellbeing of clients during the sessions is a goal in art therapy that should not be underestimated. Wellbeing produces positive emotions that, on long term, help the process of learning and skill acquisition (Biss & Hasher, 2011). It helps also clients to lessen the anxiety and engage in activities that ultimately could reduce apathy, a comorbid symptom to AD that may speed the progression of AD. Hattori and colleagues (2011) emphasized on the component of well-being in art therapy while comparing the outcomes of two programs: a creative approach (art therapy) and a non-creative approach (calculation drill), underlining that well-being is maintain even few weeks after art therapy sessions.

While art therapy could trigger the well-being, self-worthiness and the intense feeling of flow, at times it could be a threatening activity, accentuating the stress of failure. Is impossible to totally avoid this stress, and there are clients who experience this fear during art more than others, due to personal experiences with art. However, a good understanding of clients' capabilities and limitations could reduce the risk of a difficult, unsuccessful art therapy session.

Implications and Recommendations

Implications

There are key components of art therapy that makes this modality suitable for clients with AD and most of them coincide with implicit processes, preserved in AD. Simple deduction

following data from the two domains leads to the hypothesis that sensory and motor stimulation along with emotion regulation during art therapy sessions could help in preserving those pathways longer (of course depending on the frequency, approach, length of the program, etc.). Also additional benefits include preserving a sense of self, helping in learning new skills, in focusing on tasks, reducing stress, and increasing well-being. There are other outcomes that apparently contradict the findings of neuroscience and are derived from the specific of artistic pursuit: the attention enhancement and a state of flow in art-making process, reminiscence and implicit associations, and skill retention by following and repeating steps to complete an art work. But the starting point for any research in art therapy, including the present literature review, is knowing that the artistic process is available to clients with AD until the last stages, offering a valuable activity that allows feelings of normality, worthiness, mastery, and wellbeing.

Recommendations for future research

This literature review may constitute the basis of more systematic research. For example, studies with a bigger sample or longitudinal on attention for clients affected by AD during (and after) art therapy sessions would be of a great importance. Alleviation of attention deficit in AD would be an important benefit for this clientele. Also, it would be valuable to have more qualitative and quantitative studies that confirm the emotion regulative effect of art therapy sessions over the time during and after therapy for clients with AD. Skill learning is relatively new for art therapy, present in very few studies. Therefore, more studies are needed to be able to conclude that skill retention in art therapy is possible and under what conditions.

Two possible approaches in art therapy, multisensory stimulation and body-mind stimulation, may have possible benefits in preserving the senses and motor functions longer,

through repeated stimulation and connectedness between processes involved. However, this hypothesis is based on deductions from neuroscience; clinical studies on senses stimulation and motor-sensory stimulation are strongly needed for a valid conclusion if the approaches have indeed these benefits. So far these studies are rare in creative arts therapies literature and focused mainly on music-art expression. Also, studies on possible sensorial associations during sessions are scarce. It would be important to have more data about conditions and types of associations possible in art therapy.

Conclusion

Neuroscience shows that, besides losses in cognitive functioning, there are many implicit processes based on sensorial, perceptual, emotional, and procedural functions (Besson, Fischler, Boaz, & Raney, 1992) still available in moderate to more progressed stages of AD. Art-making processes in therapeutic sessions rely heavily on implicit processes. Art therapy may play a beneficial role in enhancing attention, reducing anxiety, regulating emotions, fostering associations, and well-being. Also, this creative therapy situates the client into a "here and now" reality, where clients can focus on momentary feelings and actions. Although this approach is highly beneficial for the clients, it often undermines the importance of having goals and seeking therapeutic results in working with this population. There is no recovery from AD, but art therapy is called upon, along with other forms of therapies, to improve clients' lives, both by "restoring dignity and resuscitat[ing] the humanity of individuals diagnosed with Alzheimer's" (Herskovitz, 1995, p. 154) and by trying to stimulate the preserved and functioning memory processes.

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