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Short title: future thinking

Future-oriented repetitive thought:

pessimistic view of future in patients with Alzheimer's Disease

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Abstract

Objective: In this study, we, for the first time, evaluated future-oriented repetitive thought in patients with Alzheimer’s disease (AD), that is, how they think and **worry** about the future.

Methods: We administered the Future-Oriented Repetitive Thought Scale to 34 patients with AD and 37 control participants. This scale assessed three categories of future-oriented repetitive thought: 1) pessimistic repetitive future thinking (e.g., “I think about the possibility of losing people or things that are important to me”), 2) repetitive thinking about future goals (e.g., “I make specific plans for how to get things that I want in life”), and 3) positive indulging about the future (e.g., “When I picture good things happening in my future, it is as if they were actually happening to me now”).

Results: Analysis demonstrated more pessimistic repetitive future thinking, but less repetitive thinking about future goals and positive indulging about the future, in patients with AD than in control participants.

Conclusion: Our findings demonstrate a pessimistic view of future in patients with AD, which is possibly attributed to hopelessness and depression.

Keywords: Alzheimer’s disease; future thinking; future-oriented repetitive thought;

Introduction

In everyday life, we spend an inordinate amount of time imagining the future (1, 2). Time spent in the construction of hypothetical future scenarios are purposeful as future thinking serves to cope with the vicissitudes of daily life (3). More specifically, from an adaptive perspective, future thinking facilitates decision-making processes by providing a virtual platform on which decisions can be appraised, adjusted and optimized, which improves our ability to deal with everyday problems and action planning (4, 5). In addition, future thinking is intimately linked with emotion regulation as projecting ourselves into the future involves construction of positive situations that we strive to achieve or negative situations that we would rather avoid (6-8). Future thinking typically declines in Alzheimer's Disease (AD), leading to a diminished sense of the self and diminished emotional regulation (9-13) (see, however, (14) for an alternative view on emotional regulation in AD). While the consequences of future thinking decline in AD have been well studied, little is known about future-oriented repetitive thought in AD, that is, how patients with AD may predict future events (e.g., whether they may be pessimistic regarding these events) or **worry** about future events (e.g., whether they repetitively think about these events). The present paper thus assesses characteristics of future-oriented repetitive thought.

In a pioneering study on future thinking, Addis et al. (15) invited patients with AD to imagine personal future events; the study reported poor specificity, that is, poor ability to generate events situated in time and space. Several findings were reported demonstrating poor specificity of future thinking in AD (9, 10, 16), which was associated with a poor subjective experience during future thinking in AD. This relationship was demonstrated by a study in which patients with AD were invited to imagine future events and, afterward, indicate whether they were able to mentally travel in time to pre-experience these events; results demonstrated poor

specificity as well as poor subjective experience of future thinking in AD (9). Similar findings were reported in a recent study in which patients with AD were invited to imagine future events and, afterward, rate their ability to **relive** (i.e., “I feel as though I am pre experiencing that event”) and travel in time (i.e., “I feel that I travel back to the time it will happen”); results demonstrated poor subjective experience during future thinking in AD (13). The decline of subjective experience during future thinking was also reported in a recent study in which patients with AD were invited to imagine future events and, afterward, indicate whether they see the event through their own eyes (i.e., “Field perspective”), or whether they see themselves in the scene as a spectator would (i.e., “Observer perspective”) (12). Results demonstrated low “Field perspective” in patients with AD, suggesting a diminished ability to mentally visualize future events in AD.

While previous research has addressed numerous aspects of future thinking in AD, little is known about future-oriented repetitive thought in AD, that is, how patients with AD engage in repetitive thoughts about the future. More specifically, to the best of our knowledge, there is a lack of research on pessimistic repetitive future thinking, repetitive thinking about future goals, and positive indulging about the future, in AD patients. The evaluation of these characteristics is important as it allows to better understand attitudes or beliefs of patients about the future. For instance, the evaluation of pessimistic future thinking and positive indulging about the future may reveal potential hopelessness about the future as patients with AD may demonstrate a tendency to expect that negative future events would inevitably occur and that positive future events would not occur. **This negative view of the future has been reported by a study on past rumination in which patients with AD were invited to describe how they ruminate about the past (17). Results demonstrated that patients with AD ruminate about their past to reduce boredom**

and to prepare themselves for the idea of their own mortality. Thus, past rumination can be used by patients with AD to cope with the negative view of the future.

To evaluate future-oriented repetitive thought in AD, this present study used the Future-Oriented Repetitive Thought Scale. This scale was developed by Miranda, Wheeler, Polanco-Roman, and Marroquín (18) to assess three categories of future-oriented repetitive thought: pessimistic repetitive future thinking, repetitive thinking about future goals, and positive indulging about the future. According to Miranda et al. (18), these three categories of future-oriented repetitive thought assess not only the content of our expectancies about the future but, critically, how we engage in repetitive expectancies. In their study, Miranda et al. (18) tested the psychometric characteristics (e.g., convergent, discriminant, and concurrent validity) of the scale in a large sample ($n = 612$ participants, *Mean* age = 20.30 years, *SD* = 3.30) and reported validity of this scale as well as its associations with symptoms of depression. According to Miranda et al. (18), the Future-Oriented Repetitive Thought Scale can be used as a reliable and valid measure of repetitive thinking about the future.

To summarize, while previous research has demonstrated **poor specificity** of future thinking in AD (9-13, 15), little is known about how patients with AD engage in repetitive thoughts about the future. The present paper addresses this gap by capturing three characteristics of future-oriented repetitive thought (i.e., pessimistic repetitive future thinking, repetitive thinking about future goals, and positive indulging about the future) as measured by the Future-Oriented Repetitive Thought Scale. We expected that AD patients would demonstrate more pessimistic, and less positive, future thought, based on the high prevalence of hopelessness and depression in AD in general (19, 20).

Method

Participants

The study included 34 patients with a clinical diagnosis of probable mild AD and 37 healthy controls. All participants were native French speakers. Exclusion criteria were significant psychiatric or neurological illness and major visual or auditory acuity difficulties that could prevent adequate assessment. Patients with AD were recruited from local retirement homes and diagnosis of mild AD dementia was made by experienced neurologists or geriatricians based on the NINCDS-ADRDA clinical criteria (21). The mild stage of AD was also confirmed by scores on the Mini Mental State Exam (22) (see below). Control participants were recruited from local community and were living independently at home; their normal cognitive functioning was confirmed by their performance on other cognitive tests (see below). As shown in Table 1, no significant differences were observed between patients with AD and control participants in terms of sex, age, and educational level; however, patients with AD had lower cognitive ability than control participants. This study was designed and conducted in accordance with the Declaration of Helsinki, and all participants provided written informed consent to participate in the study and were given the opportunity to withdraw whenever they wished.

[INSERT TABLE 1 APPROXIMATELY HERE]

Cognitive and clinical characteristics

Cognitive and clinical characteristics of all participants were evaluated with a battery assessing general cognitive functioning, episodic memory, and working memory. Scores are shown in Table 1. General cognitive functioning was assessed using the Mini Mental State Exam (22) and the maximum score was 30 points. Episodic memory was assessed using a French

version (23) of the episodic task of Grober and Buschke (24) in which the participants had to retain 16 words, each describing an item belonging to a different semantic category. Immediate cued recall was succeeded by a distraction phase during which participants had to count backwards from 374 in 20 s. This distraction phase was succeeded by two minutes of free recall and the score from this phase provided a measure of episodic recall (16 points maximum). As for working memory, participants were asked to repeat a string of single digits in the same order (i.e., forward spans) or in reverse order (i.e., backward spans).

Procedures

Future-Oriented Repetitive Thought scale

We used the Future-Oriented Repetitive Thought scale (18), consisting of 15 items assessing pessimistic repetitive future thinking, repetitive thinking about future goals, and positive indulging about the future (see Table 2). Note that we translated these 15 items from their original language (i.e., English) into French by an expert in both English and French. The French version was translated-back into English to examine any possible conceptual discrepancies in equivalence. Several rounds of discussions led to the final French translation.

Prior to administering the scale, participants were informed “Please read the following 15 items. For each item, consider how often, in general, you think about the future in these ways and indicate whether you do so *never, sometimes, often, or always.*” Each item was therefore rated on a four-point Likert-type scale: zero = never; one = sometimes; two = often; or three = always. Participants were asked to repeat back the instructions with their own words to ensure their learning.

[INSERT TABLE 2 APPROXIMATELY HERE]

Results

We investigated differences between AD participants and controls in each of the three components of the Future-Oriented Repetitive Thought Scale. Because data were not distributed normally as observed by Kolmogorov-Smirnov tests, Mann-Whitney U-test was used for inter-groups comparisons and Wilcoxon's signed-rank test was used for within-groups comparisons. We provided effect sizes using Cohen's d (25): 0.20 = small, 0.50 = medium, 0.80 = large. Cohen's d was calculated for non-parametric tests according to the recommendations of Rosenthal and DiMatteo (26) and Ellis (27). For all tests, the level of significance was set as $p \leq 0.05$; p values between 0.051 and 0.10 were considered as trends.

Pessimistic future thinking in AD

The scores on the Future-Oriented Repetitive Thought Scale are provided in [Table 3](#). Analysis showed significantly higher scores in patients with AD than in control participants on the pessimistic repetitive future thinking factor ($Z = 5.35$, $p < .001$, Cohen's $d = 1.64$). Analysis also showed significantly lower scores in patients with AD than in control participants on the repetitive thinking about future goals factor ($Z = 5.19$, $p < .001$, Cohen's $d = 1.56$), and the positive indulging about the future factor ($Z = 4.63$, $p < .001$, Cohen's $d = 1.31$). As for within-group comparisons in patients with AD, analysis showed higher scores on the pessimistic repetitive future thinking factor than on the repetitive thinking about future goals factor ($Z = 5.07$, $p < .001$, Cohen's $d = 3.52$) or positive indulging about the future factor ($Z = 4.48$, $p < .001$, Cohen's $d = 2.40$), but no significant differences between scores on the repetitive thinking about future goals factor and positive indulging about the future factor ($Z = .51$, $p = .61$, Cohen's $d = .17$). In control participants, analysis showed lower scores on the pessimistic repetitive future thinking factor than on the repetitive thinking about future goals factor ($Z = 3.77$, $p < .001$,

Cohen's $d = 1.60$) or positive indulging about the future factor ($Z = 4.54$, $p < .001$, Cohen's $d = 2.24$), but no significant differences between scores on the repetitive thinking about future goals factor and positive indulging about the future factor ($Z = .27$, $p = .78$, Cohen's $d = .09$). Generally speaking, these findings demonstrate more pessimistic, and less positive, future thinking in patients with AD.

[INSERT TABLE 3 APPROXIMATELY HERE]

Complementary analysis

For convenience, we analyzed correlations between the three categories of future-oriented repetitive thought and episodic and working memory. Analysis demonstrated no significant correlations in patients with AD or in control participants ($p > .1$).

Discussion

This study, for the first time, investigated future-oriented repetitive thought in AD. Our analysis demonstrated more pessimistic future thinking, but less repetitive thinking about future goals and positive indulging about the future, in patients with AD than in control participants.

By investigating future-oriented repetitive thought, our paper contributes to the literature on future thinking in AD. This literature has demonstrated difficulties of AD patients to construct specific future scenarios (9, 10, 15, 16) or even to subjectively experience these events (12, 13). The current study adds to this literature by assessing how patients with AD worry about the future. More specifically, our paper reveals a pessimistic view of future in patients with AD. This pessimistic view can be expressed by a significant tendency of patients with AD to predict, or spend time thinking about, negative events in the future. This view can also be expressed in terms of patients' tendency to think about the worst possible things that could happen in the

future or even to think about the possibility of losing people. This view can be attributed to factors such as depression and hopelessness. Hopelessness, a core feature of depression, typically refers to the tendency to expect that negative future events would inevitably occur and that positive future events would inevitably fail to occur (28). Therefore, the pessimistic view of the future, as may be expressed by patients with AD, may be attributed to depression and hopelessness which frequently occur in AD (19, 20). Our suggestion can be further supported by the study of Miranda et al. (29) demonstrating associations between the Future-Oriented Repetitive Thought Scale and hopelessness and depression. At the clinical level, the concept of incurable disease and the consideration of dementia as predisposing or contributing to the end of life may also contribute to the pessimistic view of future in patients with AD. Our findings are also in line with a study assessing time-perspectives in AD (30) using a questionnaire evaluating present-hedonistic orientation (e.g., “I do things impulsively”, “When listening to my favorite music, I often lose track of time), present-fatalistic orientation (e.g., “Fate determines much of my life”, “Since whatever will be will be, it doesn’t really matter what I do”) and future orientation (“I believe that a person’s day should be planned ahead each morning”, “I make lists of things to do”). The results of this prior study demonstrated low future orientation in patients with AD.

In our current study, patients with AD did not only demonstrate a pessimistic view of the future but also a little tendency to prepare future goals or even to imagine steps and plans to achieve these goals (as evaluated by items on repetitive thinking about future goals). This tendency mirrors the overgenerality of future thinking as demonstrated by literature on future thinking (9, 10, 15, 16). This literature demonstrates the difficulty in patients with AD to imagine specific future goals; our findings extend this literature by demonstrating little tendency to

imagine specific steps and plans to achieve future goals in patients with AD. This tendency can be attributed to hopelessness and depression, or even to executive dysfunction. According to the executive account, as executive functions (e.g., elaboration, organization in memory) weaken, search for specific memories may stop at intermediate stages of more generic representations, which may result in overgeneral retrieval (11, 31, 32). While the executive account can explain difficulties in future thinking in AD, its relationship with future-oriented repetitive thought should be investigated with a comprehensive evaluation of specific executive functions (e.g., inhibition, flexibility, updating). The spans task, while assessing phonological loop of working memory, offers little assessment of executive function, which may explain the lack of significant correlations between the spans task and future-oriented repetitive thought.

Besides demonstrating pessimistic view of future and little tendency to imagine future steps and plans, our findings demonstrate little positive indulging about the future in AD. As demonstrated by our findings, patients with AD tend to demonstrate little tendency to look forward to something, or to picture good things happening in the future, or even to daydream about things that they want in the future. In other words, patients with AD tend to demonstrate little tendency to expect positive future outcomes. This tendency can be attributed to hopelessness and depression in general, which should be investigated in future studies.

Regardless of depression, our findings can be influenced by diminished temporal orientation, and diminished awareness in general, in AD. Patients with AD tend to demonstrate difficulties in temporal orientation (for a review, see, (33), and these difficulties can influence the ability of patients to project themselves in time to construct future goals. The diminished awareness in general (i.e., anosognosia) may also influence repetitive thinking (e.g., lower level of anosognosia could be related to higher frequency of repetitive pessimistic future thinking).

AD is characterized by anosognosia (34, 35) and research on anosognosia emphasizes the difficulties of patients with AD to estimate their own cognitive functioning and introspect into their own subjective experience (36). Thus, awareness deficits may influence the ability of patients to project themselves in time to construct future goals or positive future scenarios, which may result in more pessimistic future thinking in the patients.

Unlike patients with AD, control participants have demonstrated less pessimistic repetitive future thinking and more positive indulging about the future. These findings can be attributed to our inclusion criteria (i.e., the lack of psychiatric or neurological history in control participants), as well as to the normal cognitive functioning in these participants as observed on the cognitive battery. The positive indulging about the future in control participants aligns with the Socio-emotional Selectivity Theory (37, 38), according to which healthy older adults tend to show an increased motivation to process positive emotional stimuli and to evoke emotional regulation processes in favor of a maximization of positive compared to negative information, a mechanism that has been referred to as an age-related “positivity effect”. Together, our findings support the Socio-emotional Selectivity Theory by demonstrating a positive shift toward positive future goals.

One potential shortcoming of our study may be the lack of assessment of depression. While we tend to attribute the pessimistic view of future in patients with AD to depression, this attribution should be interpreted with some caution because our study did not include an assessment of depression. It is noteworthy however that the relationship between future-oriented repetitive thought and depression has been observed by Miranda et al. (29) in the general population and that, in our study, we could not add a scale to measure depression to avoid fatigue in the patients. **Regardless of depression, one suggestion for future research would be to study**

future-oriented repetitive thought in a population with a terminal illness that does not affect the brain, this to better understand whether incurable brain diseases (which is the case of AD) may account for the pessimistic view of future.

Together, our study, for the first time, provides indices of future-oriented repetitive thought in AD. More specifically, our study provides indices of pessimistic future thinking in patients with AD. By doing this, our study does not only pave the way for qualitative studies on future thinking, but also for research on spontaneous future thinking in general as previous research has mainly focused on the ability of patients with AD to deliberately construct future events whereas our study deals with their ability to spontaneously engage with future thoughts.

Disclosure statement

The authors declare no conflict of interests

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Table 1. *Demographic and cognitive characteristics of Alzheimer's disease (AD) and control participants*

		AD	Controls	
		<i>n</i> = 34	<i>n</i> = 37	
Women/Men		22/12	22/15	$X^2(1, N = 71) = .21, p = .65$
Age in years		72.62 (5.77)	70.43 (7.63)	$t(69) = 1.35, p = .18$
Education in years		8.53 (2.74)	9.32 (2.12)	$t(69) = 1.37, p = .17$
General Cognitive functioning	Mini-Mental State Examination	22.85 (1.48) Range: 20-25	27.62 (1.42) Range: 26-30	$t(69) = 13.85, p < .001$
Episodic memory	Grober and Buschke	5.85 (2.45)	10.81 (3.29)	$t(69) = 7.15, p < .001$
Working memory	Forward span	4.68 (1.22)	6.11 (1.56)	$t(69) = 4.28, p < .001$
	Backward span	3.59 (1.10)	5.35 (1.69)	$t(69) = 5.16, p < .001$

Note. Standard deviations are given between brackets; performance on the Mini-Mental State Examination was correct responses (out of 30); performance on the Grober and Buschke task were correct responses (out of 16); performance on the forward and backward spans were number of correctly repeated digits.

Table 2.

the Future-Oriented Repetitive Thought Scale

Pessimistic repetitive future thinking	“I think about the possibility of good things not happening in the future”
	“I spend time thinking about bad things that could happen”
	“When something bad happens, I can’t stop myself from thinking about whether it will happen again”
	“When I do not get something that I want, I think about whether I will ever get the things that I want in life”
	“I think about the worst possible things that could happen”
	“I think about the possibility of losing people or things that are important to me”
	“When I think about something bad happening, I have a hard time thinking about anything else”
	“I play out scenes in my head over and over again about bad things that could happen”
Repetitive thinking about future goals	“I think about how to accomplish my future goals”
	“I imagine the steps I need to take to get things that I want in life”
	“I make specific plans for how to get things that I want in life”
	“I think about the ways in which my life will be good in the future”
Positive indulging about the future	“When I am looking forward to something, I can’t stop myself from thinking about what it will be like”
	“When I picture good things happening in my future, it is as if they were actually happening to me now”
	“I daydream about the things that I want happening to me in the future”

Table 3.

Scores of Alzheimer's disease (AD) participants and control participants on the three components Future-Oriented Repetitive Thought Scale

	AD	Controls
Pessimistic repetitive future thinking	<i>M</i> = 1.93, <i>Median</i> = 2.00 (.79) ^{***}	<i>M</i> = .81, <i>Median</i> = 1.00 (.53)
Repetitive thinking about future goals	<i>M</i> = .87, <i>Median</i> = 1.00 (.66) ^{***}	<i>M</i> = 1.86, <i>Median</i> = 2.00 (.60)
Positive indulging about the future	<i>M</i> = .90, <i>Median</i> = .87 (.57) ^{***}	<i>M</i> = 1.77, <i>Median</i> = 2.00 (.76)

Note. Items were filled in by participants on a **four**-point Likert-type scale ranging from zero “never” to three “**always**”; Standard deviations are given between brackets; differences between groups were significant at: ^{***} $p < .001$