JUDGEMENT OF BLAME IN ALZHEIMER'S DISEASE SUFFERERS

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ABSTRACT

The algebraic structure of the blame schema of moral judgement (using Anderson's method, Integration Information Theory) was studied in a group of 18 patients with Alzheimer's disease (AD) and a control group. The effects of Intent and Consequences of the action on the propensity to apportion blame were analysed, as well as the level of seriousness of different situations. Results show no significant differences between the AD and control groups in their algebraic structure, as they combine information about Intent and Consequence in the same way, but the AD group are less capable of taking seriousness into account when apportioning blame. The characteristics of the two cognitive processes that appear to be involved and their resistance to Alzheimer's disease are discussed.

INTRODUCTION

According to the DSM-IV classification, Alzheimer type dementia is defined as a development of multiple cognitive deficits including both: (i) memory impairment and (ii) one or more additional cognitive disturbances (aphasia, apraxia, agnosia or disturbances in executive functions). In Alzheimer's disease (AD) the loss of higher intellectual functions begins early and becomes more apparent as the disease advances. Cognitive abilities such as memory, language or spatial perception decline early on in the first stages of the illness (see Carlessimo & Oscar-Berman, 1992). In addition, mental operations relying on flexibility and reasoning are most sensitive to dementia. Loss of abstraction capabilities, abstract reasoning, strategy formulation, and anticipatory planning are among the most common deficiencies (Cronin-Golomb, 1990; Passini, Rainville, Marchandt, & Joanette, 1995). Although Alzheimer's disease causes specific deficits in cognitive processes, it can also lead to difficulties with more general functions, such as executive functions. For example, Passini et al. (1995) and Janowsky and Thomas-Thrapp (1993) observed that from the early stages of the illness Alzheimer's disease sufferers show difficulties in planning a behaviour or an action. Social and personality dysfunctions are also reported in AD sufferers and are characterized by unstable moods, affect disturbances (Bungener, Jouvent, & Derouesné, 1996), and denial (Mullen, Howard, David, & Levy, 1996).

Although the cognitive and social dysfunctions develop gradually, insidiously, and progressively over many months to a few years (Ashford, Schmitt, & Kumar, 1996) some of them, such as memory, verbal fluency or planning, show deficits from the very beginning, while others are either more resistant, such as insight, or unaffected, such as familiar and routine activities, during the early stages of the illness. The insight concept, as mentioned by Mullen et al. (1996), is the awareness by the patient of their own mental state. In the initial stages of AD when insight is not impaired the patients are aware that they have problems, for example with forgetfulness, but as the disease progresses they become less aware of their increasing memory deficits and therefore less compliant with treatment. This can be measured on the Anosognosia scale, which measures the failure to recognize that certain mental events are pathological and that one is ill.

According to Schneck, Reisberg, and Ferris (1982) there are three sequential stages in the decline of insight during AD. In the initial stage, described as 'forgetfulness', insight is retained, then it is progressively lost or deficient during the early confusional stage and absent in the final demential stage. Insight is the ability a person has to make a judgement about him/herself and thus is closely associated with perspective-taking ability. Indeed, when making moral judgements the person has to be able to take the perspective of the other person in a situation as well as their own perspective. According to Dwyer (1996), moral competence consists of a set of abilities including the ability to: (i) determine among different possible actions which one is the morally right action in a given circumstance; (ii) give relatively confident and rapid judgements on other's actions and characters, and (iii) develop and maintain a character.

The ability to judge a situation or an action and to make a judgement of blame seems to be linked to deontic reasoning because people have to know the social rules before they can apply violation detection rules, in order to blame an actor. When one assigns blame to someone, one assigns fault or responsibility to a person when their actions have had a bad consequence. When a person makes this judgement about the morality of an action and the blame to attach to the actor, the observer must be able to use deontic reasoning to judge if the action is permitted or not in social life, and thus if s/he has to blame the actor or not. For example, in a judgement of blame the person apportioning blame has to determine: 1) if the action is permitted by the social rules; 2) if it was perpetrated by the actor on purpose or not,

and 3) if the consequence or the possible consequence of this action is serious or not. The observer has to be able to take the perspective of the perpetrator to determine his/her intent level and the perspective of the victim in order to understand how serious the outcomes of different situations are as a result of the actions that were taken. Thus even if the action of the perpetrator has no consequence for the victim, perspective taking ability allows the observer to judge as a function of the seriousness of the *possible* consequence. For example, a person who threatens another with a stick is "a priori" less blameworthy than a person who threatens another with a gun, because the possible consequences are usually less serious.

If, as we assume, the judgement of blame is found to be resistant to Alzheimer's disease, at least at the beginning of the illness, i.e., stages 3, 4 and 5 of Reisberg's scale, this could be justified by the fact that the judgement of blame is similar to deontic reasoning, i.e. an everyday or routine cognitive activity which is so well established that it remains unaffected and seems to be dissociated from other types of reasoning, such as indicative reasoning, at the neurological level. According to Cummins (1996), deontic reasoning is the most basic form of reasoning, observed in humans and primates, as it is based on the social structure of most mammalian species and on the rules of our social life. Moreover, the violation detection reasoning strategies observed in deontic reasoning do not depend on a reasoner's level of education (Cummins, 1996).

Moral Judgement

The early research on judgement only investigated sensations in the area of psychophysics, the pioneering work of Thurstone (1927) and Pierron (1963) measured sensitivity related to physical stimulations. The psychophysical method of judgement was developed by Shepard (1974) in order to analyse concepts or opinions which have no physical or sensorial characteristics. Judgement was then studied as a cognitive activity and has been the origin of different theories, such as the "Social Judgement Theory" (Hammond, Stewart, Brehmer, & Steinmann, 1975), and the "Information Integration Theory" developed by Anderson (1979, 1981).

There are two approaches to the study of moral judgement. The first one is the theory developed by Piaget (1932) and later by Kohlberg (1964) which refer to different levels in moral development. According to Piaget and also Kohlberg, moral judgement uses an explicit process mainly based on verbalisation following stories or dilemmas. The second approach is a cognitive model of algebra called information integration theory, which was developed by Anderson (1979). An interesting aspect of Kohlberg's theory of moral development is its relationship with cognitive and social development that can be also observed in Piaget's theory. In these two theories the level of moral judgement depends on the achievement of a level of cognitive development based on the argumentation and reasoning of the participants. There is a clear relationship between the development of cognitive processes described by Piaget in terms of stages such as "Premoral judgement", "Moral realism", "Moral subjectivism", and the moral judgement described in the six stages of Kohlberg's theory (1976).

While the relationship between moral stage and cognitive levels is observed during childhood, children progress from one moral stage to another with age and cognitive development within a few years, such progress is no longer observed in adulthood. Many studies of Kolberg's cognitive developmental stages using Kohlberg's moral dilemmas failed to show a significant effect of age on moral stage with adults (White, 1988; Pratt, Diessner, Hunsberger, Pancer, & Savoy, 1991; Pratt, Pratt, Diessner, Hunsberger, & Pancer, 1996). In addition, Pratt et al. (1996) have shown that with adults, moral reasoning stages do not change over a four year time period whatever the age of the adults, but moral perspective taking

ability does decline over time for older adults. It has also been shown, using Kohlberg's dilemmas (Levine, 1976), that even though the level of moral reasoning doesn't change during adulthood, the measured level of moral reasoning changes according to the empathy level the reasoner has with the actors in the dilemma. Thus, dilemmas based on daily life stories better reflect people's real moral level compared with artificial dilemmas.

The process of moral judgement was studied by Anderson (1981) who revealed an implicit mechanism based on personal choices and requiring the ability to combine two or more values. In the judgement activity in general, and especially in the judgement of blame, people have to use deontic reasoning rules in order to adopt a violation detection strategy necessary to judge an action. In addition, they should be able to infer real or hypothetical intent and also be able to consider multiple perspectives, and thereby to coordinate the point of view of both oneself and others i.e. perspective taking ability.

The Judgement of Blame Based on Information Integration Theory

According to Anderson (1981, 1996) a judgement is a decision process based on the combination of different values, for both moral judgements and the judgement of blame. For example, a person evaluates an action and has a level of agreement with it. In the judgement of blame people judge an action by weighting different factors such as the consequence of the action and the level of intent of the actor. The algebraic structure of a judgement depends upon how people combine these two factors, and the rules of judgement used, i.e. the weight they give to each of these factors. Within moral judgement research, the judgement of blame has been studied the most, evaluating what is known of the consequences of a negative act and of the intent behind it.

The judgement of blame has been evaluated in different age groups. For example, Leon (1980) studied blame schema in groups of school children from first grade to college grade, as well as in groups of mothers with their 7 years old sons (Leon, 1984). Surber (1982) studied rules of judgement involving motives and damages with participants from 4 to 20 years old. Finally, Przygotzki and Mullet (1997) studied the judgement of blame with children (9-10 years old), young adults (30-40 years old) and normal old people (70-75 years old). All of these authors found that the rules used by adults (young and old) are essentially identical to those found in adolescents and children; they all take into account Intent and the Consequences in the judgement of blame. Hebble (1971) studied the judgement of blame with children and systematically varied the factors Intent and Consequence. Hebble showed that the algebraic structure of the judgement of blame followed an additive rule: Blame = f (Intent + Consequence), which means that the effect of intent and consequence on the judgement are additive, and there is no interaction between them.

From this basic rule, other researchers (Surber, 1977; Leon, 1980) developed an averaging rule. According to Surber, in all cases, the algebraic structure of the blame schema obeys an averaging rule: Blame = f (w Intent + w' Consequence / w + w'). Where w and w' are weights given by the person to the factors Intent and Consequence. Leon made a refinement to this rule, adding that the averaging rule is valid only with the presence of Intent: Blame = f (w Intent + w' Consequence / w + w'), if Intent > 0. Since this averaging rule was first described by Surber (1977, 1982) it has been found not to vary when the participants are children, young adults or the elderly. This absence of variation observed whatever the age of the reasoner suggests a common rule used in the judgement of blame. This common rule is closely linked with the violation detection rule observed in deontic reasoning. Indeed, in deontic reasoning also, no difference was observed between young children and adults (Cummins, 1996). However, in their study, Przygotzki and Mullet (1997) observed in the judgement of blame, a modification of the importance given to the consequences and intent factors related to the age of the participants (children, young or elderly adults).

While the averaging rule combining intent and consequence remains constant over the life span, the weight given to each factor varies with age. For example, in children, the consequences factor has more importance and the intent factor has less importance than in young adults and elderly adults. In young adults, the intent factor had more importance and the consequences factor had less importance than in children and elderly adults. Finally, elderly people seems to show an algebraic structure between that shown by children and young adults: they gave more importance to the intent factor than children did, but less importance than did young adults, and for the consequences factor, less importance than children did, but more importance than young adults did. These results are congruent with previous studies (Surber, 1982) that showed that damage was more important that motive for first graders but less important than motive for fifth graders. In addition, Leon (1984) has shown that despite a correspondence between the algebraic structure of the mothers and their sons in the organisation of their moral judgement, differences in values linked with the weight given to the consequence were observed. Indeed, in this study, the group of mothers considered a broken window substantially more serious than a broken pot whereas a group of 7 years old children considered the two about equally serious. This absence of hierarchy observed with children could be linked with centration, described by Piaget, because children pre moral subjectivism (10-12 years old) can not accurately anticipate all the consequence of their actions and are not able to take the perspective of the other person in a situation. The comparable algebraic structure observed in the judgement of blame, whatever the age of the reasoner on one hand, and the difference of weight given to values Intent and Consequence according to the age of the reasoner, as well as the difference of weight given to the seriousness of the consequence on the other hand, could suggest that two mechanisms are involved in the judgement of blame: violation detection and perspective taking.

The violation detection rule is based on deontic reasoning and has the same structure and is used in the same way by people whatever their age. Secondly, perspective taking ability allows people to make more accurate judgements when faced with different levels of intent and seriousness of consequence. Perspective taking develops with age and experience. Indeed, perspective taking ability develops later than deontic reasoning because to be able to consider another person's point of view one must no longer be egocentric, as children are. Indeed, when damage is clearly presented in stories it is easy to apportion blame according to the seriousness of an action. By contrast, a non-observed but potential damage needs anticipation and perspective taking ability. This is also true when intent is implicit.

As a consequence of its later development, perspective taking ability is more likely to deteriorate in old age than deontic reasoning is. Indeed, Pratt et al. (1996) observed that with normal elderly people there was a significant decline in their level of perspective taking ability in moral judgements.

The stories used in Anderson's method are very short to avoid a heavy memory demand and very explicit about both intent and consequences; thus young children or aging people as well as AD people can clearly remember each story before making their judgement. In addition, stories used with Anderson's method show common life situations. In this study we chose to use somewhat artificial stories but from everyday life such as one person pushing another over during a party, a burn during the preparation of a meal, and a gunshot during hunting. These daily life stories used in this study refer either to experiences people have had themselves (push, burn), or would have frequently heard about (shot). These simple stories avoid the confusion between the ability of people to judge unrealistic artificial situations and the ability to judge realistic daily life situations, this last point is especially crucial in research with AD people.

The Present Study

Until now, no study on moral judgement has included elderly participants suffering from Alzheimer's disease. The aim of this research was to find out if the underlying mechanisms of moral judgement, and more precisely the judgement of blame, studied with Anderson's method, is affected during the early stages of Alzheimer's disease. By comparing AD and normal elderly people we will develop a further understanding of the reasoning structures involved in the moral judgement of blame and whether one or more kinds of reasoning are involved. We finally wanted to know whether these moral reasoning structures are affected in the early stages of AD, like memory, attentional processes, planning, and spatial representation are, or if they are resistant to the illness and are thus based on different neurological structures. If these moral reasoning structures are affected by AD then understanding how they alter will give us a better insight into their fundamental mechanisms, as well as being of value to clinicians treating AD sufferers.

We assume that deontic reasoning on one hand and perspective taking ability on the other hand are the two components of the judgement of blame. To test this assumption the experiment will include a cognitive task to test deontic reasoning (the ability to use intent and consequence information) and test perspective taking ability (by manipulating the seriousness of the consequences of the actions on the victim).

In this study we will analyse the judgement of blame of normal elderly people and AD patients, asking them to blame an actor when given information about the intent (presence versus absence) of the actor, and the consequences (presence versus absence) of an action. This simple schema with only two levels of intent and two levels of consequence will allow us to analyse the ability of the AD patient to blame an actor by knowing what is permitted or not. We aim to discover if the AD people still use violation detection strategies and can distinguish what the actor ought to do, or not to do, with regard to moral and social rules. In addition participants will judge three different levels of seriousness of the consequence for the victim to see if they can still accurately use their perspective taking ability. Indeed, to judge the level of seriousness of a situation for a victim, people have to consider the victim's point of view and cannot just use the violation detection strategy. Studying the blame level as a function of the seriousness of the consequence should allow us to see if the AD people are deficient in their perspective taking ability, as suggested by Pratt et al. (1996), or if they are still able to consider another person's point of view in their judgement of blame. Thus, this study should allow us to answer the following questions: 1) are the AD patients still able to use deontic reasoning as well as normal elderly people and to be aware of what is allowed and what is forbidden in our social life when they have to blame an actor? 2) are they able to use perspective taking ability as well as normal elderly people when judging different levels of seriousness with regard to the victim? 3) is moral judgement based on both deontic reasoning and perspective taking or only one of them? 4) are these two cognitive abilities based on the same neurological functions?

If no difference is found in the structure of blame judgement between AD and normal elderly people, and if we observe the same algebraic structure with both groups, and the same blame schema with regard to the seriousness of the different levels of consequences it would provide evidence that either the same cognitive structure is involved in the blame judgement, or that both structures involved are equally resistant to AD. This would also suggest that the cognitive structure involved in the blame judgement has different physiological and neurological characteristics than the other cognitive functions such as memory, attentional processes, planning, and spatial representation, which AD does affect and thus it could be a specific modular structure in the human reasoning process, such as deontic reasoning. We could also assume the blame judgement is resistant to the Alzheimer's disease because it

shares a lot of characteristics with the deontic reasoning. However, if as we assume that two different cognitive structures, deontic reasoning and perspective taking ability, are involved in the judgement of blame, they should be revealed by different results with regard to the combination of intent and consequence, on one hand and on the seriousness of the consequence of the situation to the victim, on the other hand. We predict that the structure based on deontic reasoning (that combines intent and consequences) remains unaffected in the first stages of Alzheimer's disease, while perspective taking ability (responsible for evaluating the severity of the consequences) will decline.

METHOD
Participants

Thirty-six participants, eighteen in each group, took part in this experiment. One group consisted of Alzheimer's disease (AD) patients, the other of people without any disease (control group). The AD participants had no other diseases; their medical treatment was only for Alzheimer's disease. The AD participants were living on their own but not alone, and were not hospitalised. Participants in the control group had no current disease or consequences of earlier traumas or diseases and they took no drugs that could interfere with the results of this experiment. In these two groups participants were matched according to: age (80.44, $SD = 6.46$, in the Alzheimer's disease group and 78.87, $SD = 8.83$, in the control group); gender; and education level. The education level was calculated as a function of their number of academic years, with a maximum score of 3 (1: primary-school level, 2: high-school level, 3: university level). On average the mean was 1.54 ($SD = 0.61$) in the group of Alzheimer's disease patients, and 1.73 ($SD = 0.65$) in the control group. All the participants were French, white, living in the same town and with similar cultural background, similar education and socio-economic level.

All of the AD participants tested in this experiment were recruited from a hospital specialising in Alzheimer's Disease. The diagnosis of AD in the patients was made by clinicians working in this hospital and was based on multiple criteria. All AD participants presented anosognosia and cognitive impairments as well as memory deficiency and loss of autonomy i.e. unable to live alone. All of the patients were regularly attending the hospital for long term treatment since being diagnosed with AD many years prior to this study. Furthermore, noticeable decline over time, due to the illness, had been observed with all these patients.

The Alzheimer's disease group was composed of people at stages 3, 4 and 5 of AD as measured by the Global Deterioration Scale (GDS; Reisberg et al., 1982). These stages are related to the following clinical phases: early confusional, late confusional and early dementia. The diagnosis of AD was made after different clinical and cognitive tests. The clinical tests were: 1) a medical consultation for a global evaluation of the illness, 2) a cerebral scan, 3) a biological exam, and 4) a complete neuropsychological exam carried out according to the DSM IV (APA, 1996) and to the NINCDS-ADRDA (McKhann et al.,1984) criterion. The cerebral scan and MRI revealed no trauma or stroke and the diagnosis of AD was supported by this examination (Ashford, Schmitt & Kumar, 1996). Among the 18 AD patients, all were at confusional or dementia stage (six at stage 3, eleven at stage 4 and one at stage 5) of Reisberg's GDS scale. All these AD patients were in a more or less serious denial which is never the case with Mild Cognitive Impairment. According to these criteria, our population is representative of French AD patients.

The different cognitive tests used to confirm the presence of Alzheimer's disease, in addition to the four clinical tests, were two global measures of cognitive impairment and three specific measures of deficiencies in executive abilities. The global measures of cognitive

impairment and dementia were: 1) the Mini-Mental State (MMSE, Folstein, Folstein, & McHugh, 1975) French version by Tzortzis and Boller (1991), and 2) the Dementia Rating Scale (Mattis, 1976, French version G.R.E.C.O., 1994). The MMSE has eleven different themes with short questions to test: memory, language, motor skills, localisation in space and time. The maximum score on the MMSE is 30 and the threshold limit for AD as defined by Folstein (Folstein et al., 1975) is 24. All members of the control group scored over 24 on the MMSE and all the AD patients scored 24 or below. The subtests of the Mattis scale are attention, verbal ability, motion ability, construction, conceptualisation, and memory. This scale evaluates a broader range of cognitive abilities than the MMSE but both are highly correlated with Alzheimer's disease. In addition, three specific tests were used to detect any deficiencies or impairments of executive functions, which are usually deficient in AD patients. These three tests are verbal fluency (literal and categorical), stroop, and a four-point anosognosia scale from "0" awareness by the patient of his/her mental state, to "3" complete denial. These three additional tests measuring executive abilities can reveal the presence of dysfunction in the frontal lobe. Frontal lobe dysfunction is correlated with scores on the verbal fluency test (Milner et al., 1991), verbal categorical test (Perret, 1974), Stroop test (Golden, 1976) and impaired insight and anosognosia (Mangone et al., 1991; Michon et al., 1994).

On all of these cognitive tests, a statistically significant difference (student t-test) was found between the Alzheimer's disease group and the control group (results are presented in Table 1). The Alzheimer's disease patients exhibit the weakest results on all tests. We are thus assured that the control group show no deficiencies in cognitive functions, whereas the AD group do have significant impairments.

Table 1

Means, Standard Deviations and "t" Values for the Alzheimer's and Control Group's Test Scores

	Alzheimer's		Control		t	p
	M	*SD*	*M*	*SD*		
MMSE	19.83	6.46	26.82	1.63	3.01	.0001
MATTIS						
Memory	11.90	3.53	20.10	3.19	6.56	.0000
Verbal	15.90	3.74	22.53	4.77	3.26	.0000
Motion	4.58	1.32	5.80	0.92	8.90	.0028
Global	95.75	9.53	117.47	11.93	1.67	.0000
Verbal Fluency						
Categories	11.22	3.33	16.1	4.,15	3.12	.0004
Literal	8.56	4.75	15.2	5.33	2.35	.0004
Stroop	11.44	7.50	20.84	8.51	1.31	.0013
Anosognosia	2.14	0.77	0.00	0.00	- 3.60	.0000

Note. Using a Bonferroni correction to compensate for multiple *t* tests the level of significance is *p* < .005 and the above differences are all significant at this level

Materials

The materials consisted of twelve different vignettes describing situations. Each vignette contained two items of information: (a) the degree of intent of the actor (intent versus no intent); (b) the gravity of the consequences of the act (no consequence versus consequence). In addition, three different themes of story were used: a) the push, b) the burn

and c) the shot, to manipulate three different levels of severity of the consequences (low, medium, high). The twelve variations of the vignettes were obtained by orthogonal crossing of these three factors: Intent (with and without) x Consequence (absence and presence) x Severity of consequence (low, medium, high). Simple and concrete descriptions of daily life social events were chosen for this experiment. Under each story, was a 25-cm response scale with two extremes: "no blame" as the left anchor and "very severe blame" as the right anchor. Participants put a cross on the scale to record their judgement.

These vignettes were based on other experiments on moral judgement (Leon, 1984; Anderson, 1996; Garson & De Bonis, 1997; Prygotzky & Mullet, 1997; Azar & Mullet, 2001). Prior studies' vignettes manipulated only Intent and Consequence, in relation to two people. The actions described in these vignettes can be understood and memorized very easily. These simple vignettes, with not more than four items of information, including Intent and Consequence, have been tested in many different research areas, with young children and their mothers (Leon, 1984), with young children, young adults and aging people (Przygotzky & Mullet, 1997), with adults, police officers and prisoners (Hermand, Mullet, Tomera & Touzart, 2001), with schizophrenic adolescents (Garson & De Bonis, 1997) and with adults of different cultures and religious backgrounds (Azar & Mullet, 2001). The three levels of seriousness included in our study represent life events the participants would have experienced themselves or heard about. In order to test the validity of the vignettes, the authors asked a small group of young adults and some elderly people, who did not participate in the experiment, to read them to check for clarity and understanding.

Some of the stories used in this experiment are presented, translated into English in the following examples, the original French versions of these are presented in the Appendix and the complete materials are available from the authors by request.

Example of a vignette with the push theme

Mary invited a few friends to a party. They were preparing for the party. Everybody was taking part in the preparations and enjoying doing it, except for Evelyne who was not happy because she didn't like Mary's friend Renée. Finally Evelyne couldn't bear Renée any more and was so irritated that she pushed Renée, who was preparing for the party. As a result Renée fell and hit her face and her nose bled a lot.

How do you judge Evelyne's behaviour?

This story illustrates the combination of the following levels: intent / consequences. Other versions included the push being accidental, and there being no bleeding.

Example of a vignette with the burn theme

Claude and Daniel were both chefs in a famous restaurant. Claude didn't like Daniel, but they had to work together in the restaurant. One day as they were cooking a meal together, Claude felt irritated with Daniel and let a hot pan fall very close to Daniel's hands. Fortunately Daniel was not burnt by the pan.

How do you judge Claude's behaviour?

This story illustrates the combination of the following levels: intent / no consequence. Other versions included the pan accidentally falling, and that Daniel was burnt.

Example of a vignette with the shot theme

Alan and Frank, the best of friends, went out together to hunt. After a while each decided to go off in his own direction. After a while Alan saw a hare running away. He raised his gun, shot, but missed the hare. Then he heard Frank shouting from the direction in which Alan had just shot. Fortunately Alan hadn't hit him.

How do you judge Alan's behaviour?

This story illustrates the combination of the following levels: no intent / no consequence. Other versions included the two men being enemies and the shot being intentional, and the consequence that Frank was hit by the shot.

Procedure

Each participant responded individually, either during a visit to the hospital for all the participants with Alzheimer's disease, or at home for all the participants in the control group. The experimenter explained to each participant what was expected from him/her, in a so-called familiarization phase: he/she had to read three short stories in which a person committed an act with a level of intent and consequence, and then each participant had to give his/her judgement about the action, by apportioning blame. Each story was read aloud by the participant and they were able to read and re-read the stories as many times as they wanted before coming to a judgement. In this phase it was possible for the participant to compare his/her responses on all three stories.

During the following experimental phase, the twelve vignettes were presented in a random order for each participant. Each story was read out loud twice by the participant and the text was kept visible until the judgement was made, in order to allow each participant to remember the details of each story. Each participant provided their ratings on the scale at their own pace. It was not possible to compare responses nor to go back and make changes to earlier ratings, as it had been in the familiarization phase.

Each rating by each subject in the experimental phase was converted to a numerical value expressing the distance (measured in cm) between the point on the response scale and the left anchor, serving as the origin. These values were then subjected to graphic and statistical analyses. No subject had any difficulties participating in this experiment or understanding the information given by the experimenter. None of the Alzheimer's disease participants were excluded from the experiment because they couldn't understand the experimental method. We didn't notice any important differences between the AD group and the control group during testing. No participant systematically answered "no blame" or "very severe blame".

RESULTS

A 2 x 3 x 2 x 2 ANOVA was conducted on the entire sample of participants with the factors Group x Story x Intent x Consequence. In this ANOVA, Group is a between-subjects factor, but Story, Intent and Consequence are within-subjects factors.

Effects of Group, Intent and Consequences

The participants used the response scale from 5 to 19.8 for the control group, and from 6.4 to 17.2 for the Alzheimer's disease group, the overall mean response was 12.35 ($SD =$ 3.43, skewness = 0.008) for the complete group. The mean results observed for blame judgements in the Alzheimer's disease group 12.18 ($SD =$ 3.49, skewness = -0.046) and the normal control group 12.52 ($SD =$ 3.46, skewness = 0.066) are very similar and this difference is non-significant.

On average participants judged the actions with Intent (16.84) significantly more severely, and the actor to be more blameworthy, than those actions made without Intent (7.86), $F(1, 34) = 159.51$, $p < .001$. Participants also judged an action with consequences (14.29) significantly more severely, and blame the actor more than when the action is without consequences (10.41), $F(1, 34) = 99.22$, $p < .001$. On average, for both groups, the effect of the intent factor is more important than the effect of the consequence factor; intent of the actor lead to a more severe blame judgement (16.84) than the presence of a consequence (14.29). There are no significant interactions between intent, consequence and group, revealing that

both the control and AD groups use intent and consequence information in the same algebraic structure. The pattern of judgements using intent and consequence information is similar for the control and AD groups (see Figure 1). On average, participants blame the actor the most when there is both intent and consequence (18.65; 19.30 control, 18.27 AD), and blame the actor the least when there is no intent and no consequence (5.92; 5.40 control; 6.44 AD). Intent, no consequence (14.90; 15.73 control; 14.06 AD) and no intent but consequence (9.80; 9.65 control; 9.94 AD) are judged between these two extremes.
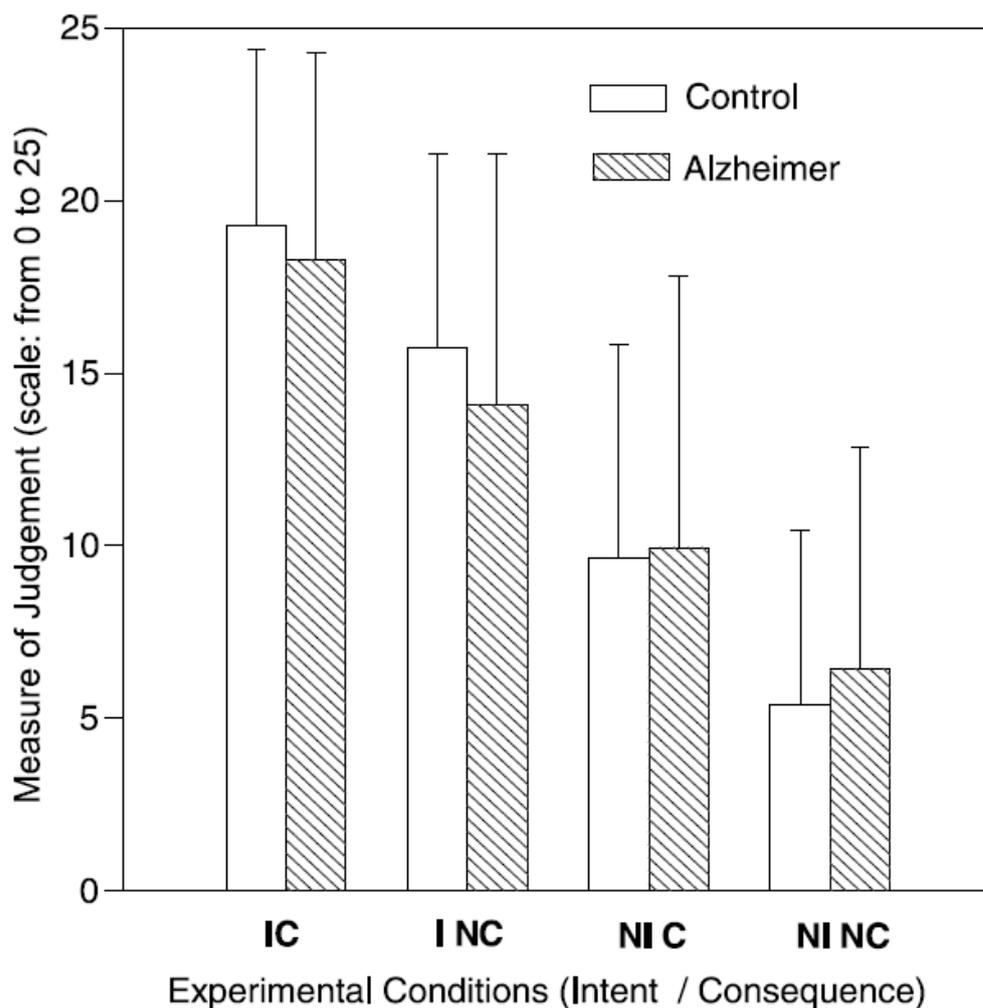
Figure 1. The pattern of judgements as a function of intent and consequence for the control group and the AD group: means and *SD*. The actions with Intent and Consequences (IC) are judged more severely by both groups than actions with no Intent and no Consequences (NI NC); and between these two extremes, actions with Intent, no Consequence (I NC) and no Intent, Consequence (NI C).

Effect of Severity of Consequence (Story)

On average, participants judge the push story (11.03) less severely than the burn story (12.29) and the shot story (13.74), $F(2, 34) = 6.50$, $p = .003$. A post-hoc Tukey test shows that the significant difference lies between the push story and the shot story ($CV = 1.81$, $p < .05$). The participants were thus able to distinguish different levels of severity of consequences and apportion blame accordingly, however this main effect must be interpreted in light of the significant interaction between group and story, $F(2, 34) = 3.15$, $p < .05$, which

shows that AD patients cannot distinguish the severity levels as well as the control group can (see Figure 2A). Figure 2A reveals that the severity of consequence in the different stories is perceived differently by the AD group and the control group. For the AD group there is no significant difference of blame judgement between the three stories (push, burn and shot), participants of this group give, on average, the same blame level to each story, (push: 11.41; burn: 12.66; and shot: 12.48, p = ns). The Tukey test post-hoc analysis between the three stories reveals no significant differences for the AD group. By contrast, post-hoc Tukey test analysis reveals that differences are observed in the control group who give blame judgements according to a hierarchy of the severity of the consequences between these stories. The push story lead to a similar level of blame judgement (10.65) as the burn story (11.93), (p = ns), and both of these stories were judged significantly less blameworthy than the shot story (15.00), (CV = 2.78, $p < 0.01$). A comparison between the two groups for each of the three stories reveals that only on the shot story is there a significant difference between them, $F(1,142) = 3.88$, $p = 0.05$.

Further investigation shows that there is a significant interaction between story and group for the stories with no consequences, $F(2, 68) = 3.42$ $p = .04$. As shown in Figure 2B, when there is no consequence, the AD patients judge the three stories at the same level of blame, whereas the control group increase blame over the three stories. By contrast, with consequence the AD patients tend to partly increase blame. Indeed, they judge less severely stories "Push" than "Burn" and "Shot", but equally serious stories "Burn" and "Shot", whereas, for the control group, blame increases over the three stories.

Finally, Figure 3 shows there is no significant interaction between intent, consequence and story, nor between intent, consequence, story and group. Figure 3A displays the results for the control group, and Figure 3B the results for the AD group. Apart from the group by story interaction all other two and three way interactions are non-significant. This confirms that for all three stories which manipulate the severity of the consequences both the control and AD groups use intent and consequence information in the same algebraic structure.
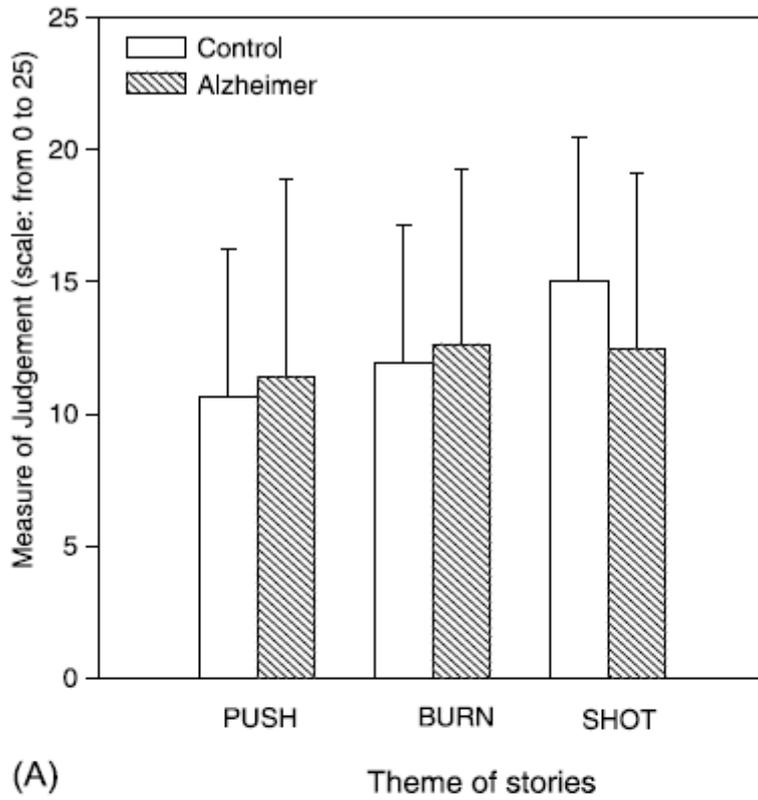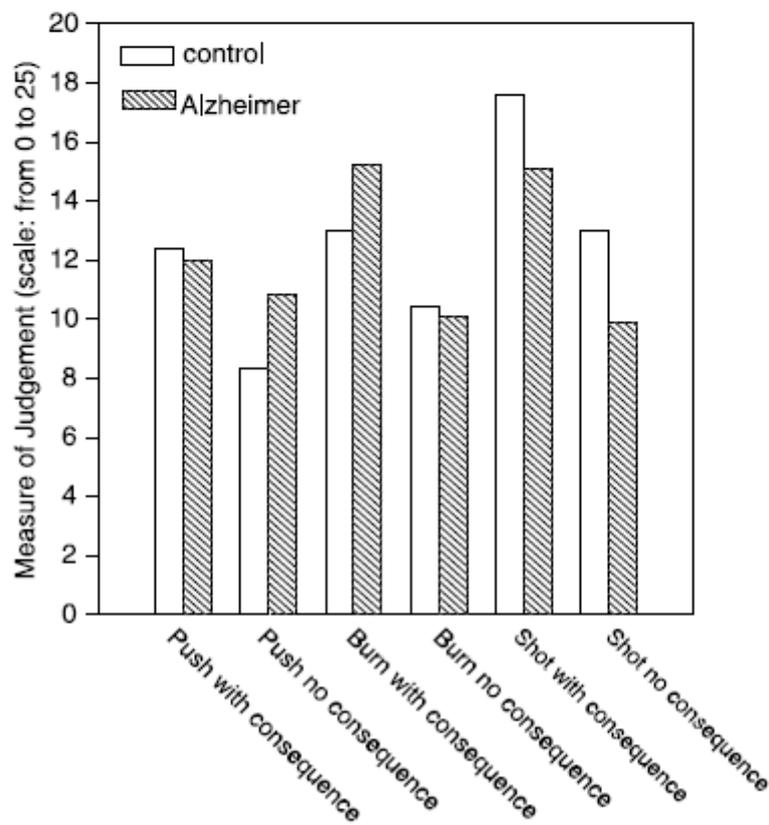
Figure 2. The mean judgement of blame obtained for each group for each story. Figure 2A: Mean and SD for each story. Although no difference is observed between the three stories for the AD group, an increment in the blame judgement is observed in the control group between

the three stories: push<burn<shot. Figure 2B: Mean for each story with and without consequence. When no consequence the AD group judge all 3 stories at the same level of blame, whereas the control group increase blame over the 3 stories.
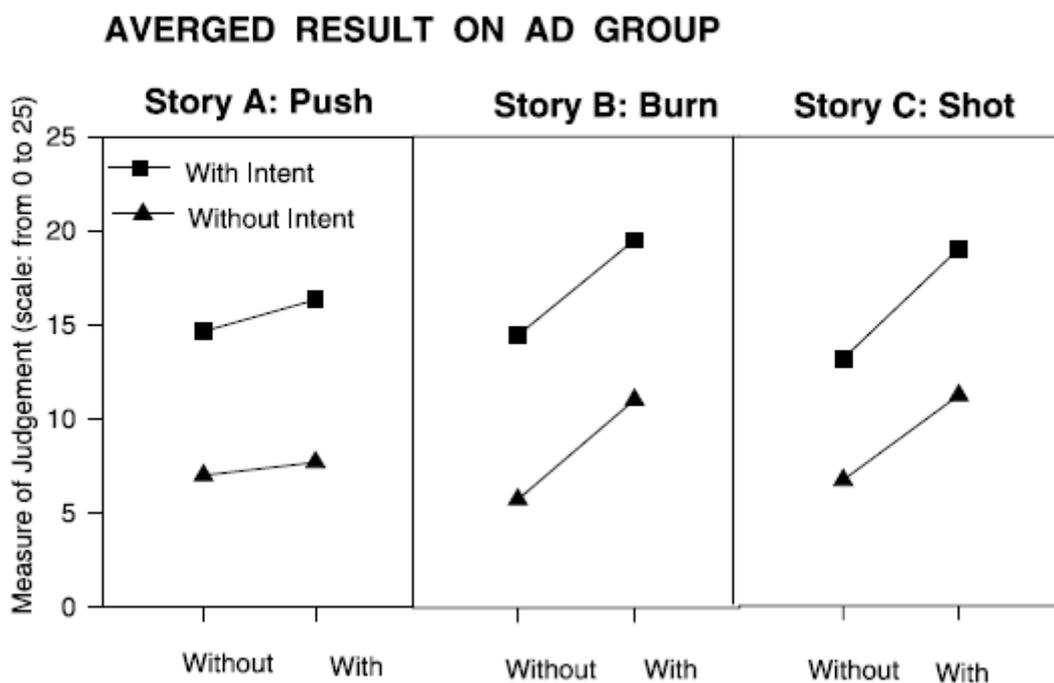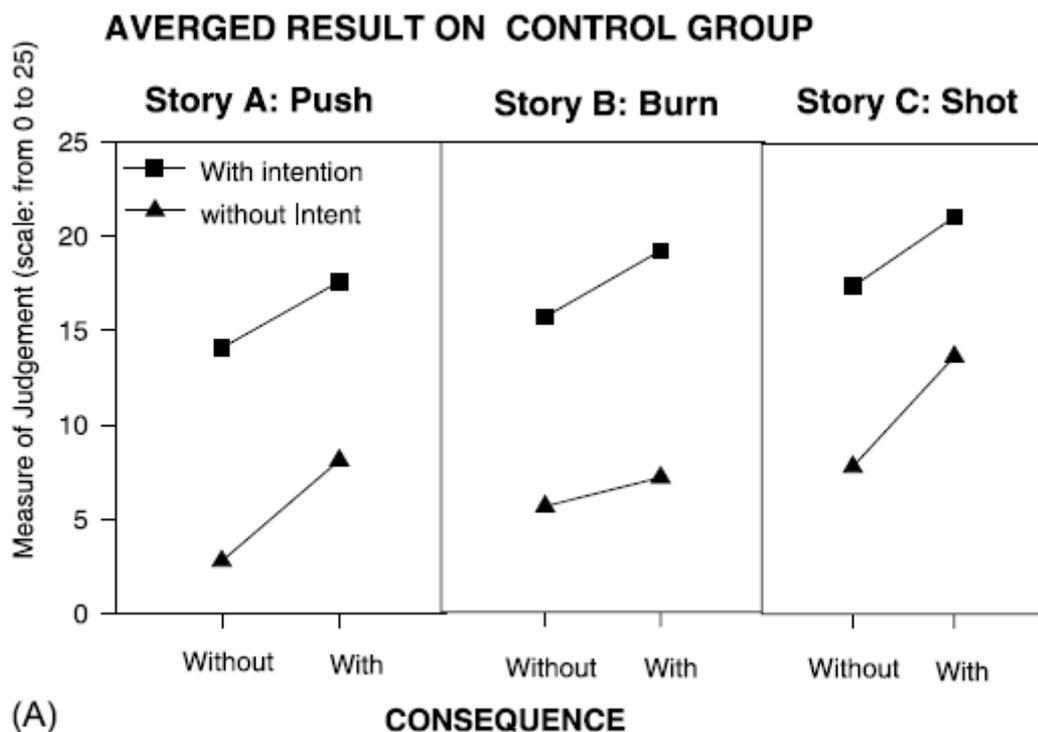

Figure 3. The interaction result for the blame judgements related to Intent and Consequence for each story and each group. Figure 3A represents the results for the control group, Figure 3B the results for the AD group.

DISCUSSION

In this experiment, we wanted to know if Alzheimer's disease changes the way in which people use and combine information to make moral judgements of the blameworthiness of an actor. According to Surber (1977) the algebraic structure of the blame schema obeys an averaging rule, which is observed whatever the age of the participants. Surber's result is congruent with more recent studies that show no significant difference between young and elderly adults reasoning on Kohlberg's moral dilemmas (White, 1988; Pratt, Diessner, Pratt, Hunsberger, & Pancer, 1996). These studies have shown that stage levels do not change over time with middle age adults and older adults. Our results are clear, there are no differences between the two groups tested, Alzheimers and Control, in the way in which they combine information about Intent and Consequence (there is no interaction between Group, Intent and Consequence). The degree of blame depended on both the Intention level and the Consequence level for all participants. The more the action is judged as intentional the higher the blame. This judgement schema, which was already observed with normal elderly people by Przygotzki and Mullet (1997), is also observed with Alzheimer's disease sufferers in the early-confusional, late-confusional and early-dementia stages of their illness. Both groups combine Intent and Consequence information in the same way and in accordance with Surber's (1977) averaging rule. This result strongly suggests that the judgement of blame shares common characteristics with deontic reasoning. People with AD are still able to judge in the same way as children, young and old adults what is allowed or forbidden, what is blameworthy or not. This ability to combine intent and consequence information shows that AD sufferers are still able to understand and to use violation detection rules and that the characteristics of deontic reasoning are also observed in the blame judgement. This cognitive ability appears to be resistant to impairment in the first stages of Alzheimer's disease.

In light of our results, we can conclude that the cognitive deficiencies observed in the first stages of Alzheimer's disease are not sufficient to generate a difference in the structure of moral judgements of blame compared with normal elderly people. As with deontic reasoning, the judgement of blame is an everyday ability which is more resistant to the effects of Alzheimer's disease than the executive functions are. Previous research has shown that routine activities are more resistant to Alzheimer's Disease than other cognitive functions such as memory (Carlesimo et al., 1992) and planning abilities (Passini et al., 1995) . The judgement of blame, as studied in this experiment, requires little attention and the simplicity of the stories, which are mainly based on social and daily life events, don't require a lot of memory. The global structure of the activity of judgement uses the ability of participants to combine both intent and consequence information, which is present in every judgement activity made since the age of five (Surber, 1982). Thus we can assume the structure of judgement is present in long-term memory and becomes automatic as we grow up. This would explain why no difference in the algebraic structure of the judgement between normal aging participants and AD patients was observed in this experiment. While judgement activities often need to keep information, such as a story, in working memory before giving a judgement, in this experiment the simplicity and the shortness of the stories didn't overtax memory and thus didn't affect the judgement activity and the answers of the participants. In addition, the metacognitive activity is extremely reduced in the judgement activity using Anderson's method, no verbalisation on the activity of judgement is required and the task asked of the participant is much simpler. Consequentially, the moral judgements analysed in this experiment are less affected by deficiencies in metacognitive abilities usually described with AD patients and this could explain the similar results for both groups. Finally, our results support the assumption that moral judgement refers to deontic reasoning, and this

deontic reasoning is primary and emerges earlier than scientific and indicative reasoning, because it becomes deficient later on with aging and neuro-degenerative illness.

The Absence of Hierarchy Observed in the AD Group

Although the algebraic structure of blame seems unaffected the AD participants do differ from the control group in their ability to apportion blame according to a hierarchy with regard to the seriousness of the consequences. While for the control group a hierarchy is observed between the three stories according to the severity of the consequence, a push and a burn are judged to have less serious possible consequences than a shot from a gun, the AD group do not take this hierarchy into account when apportioning blame and do not see the differences in the severity levels of the consequences. In the light of these results, it would seem that the absence of hierarchy is not due to problems in integrating information about Intent and Consequence, because we have shown that the two groups (AD and control) are using the same averaging rule and the AD group is not deficient. We propose that the deficiency in moral judgements of the AD group with regard to the evaluation of the seriousness of the situation could be due to a deficiency of perspective taking ability and anticipation.

To understand a hierarchy in the seriousness of different situations people need to appreciate and calculate the risk or the possible risk linked with the situation and to anticipate the consequences. It is clear that the level of consequences and danger are much more minor for a fall, than for a burn, and than for a gunshot wound. In the last case the victim could die, which is not the case in the two first examples. To be able to understand this hierarchy AD people need to take the role of the victim, to anticipate the possible consequence, and to compare the three situations and the possible dangers in each of them, which requires perspective taking abilities and anticipation. With AD sufferers perspective taking ability becomes deficient at the beginning of the illness, as are insight and anosognosia, which are both closely correlated with frontal lobe impairment (Mangone et al., 1991; Michon et al., 1994). Indeed, in our study, the AD patients at stages 3, 4 and 5 of Reisberg's global deterioration scale have reasonably high anosognosia scores (2 and 3), which shows they are in denial of their illness and deficient in their ability to consider their own mental state as well as the other's point of view.

In addition to the problems of perspective taking in the AD group their memory impairments could also have aggravated their difficulty in correctly using the severity information. For instance, the AD group may have been less capable of recalling the ratings that they had given for the previous stories, and thus were less able to compare and give higher ratings for the shot story than for the other two stories. It is also plausible that the more subtle parts of the story were not being grasped by the AD patients and that determining which outcome is more serious is thus harder for them. This is especially plausible since they do show some signs of understanding severity of consequences when they are made explicit in the consequence condition, but they show no ability (unlike the control group) to make inferences about the possible consequences which didn't happen in the no consequences conditions.

CONCLUSION

In the light of these results, we can conclude that in contrast to cognitive deficits, especially deficits of memory, cognitive processes involved in the integration of basic information (Intent and Consequence) in blame judgements are preserved in the first stages of Alzheimer's disease. This ability to integrate information, that is linked with deontic reasoning and is based on a violation detection strategy, is resistant to Alzheimer's disease in the first

stages of the illness. Indeed, both groups present similar blame judgement patterns, which suggests that this ability to combine the presence or absence of intent and consequence is different from other cognitive abilities such as memory, planning activity, insight and executive functions, and thus could involve different underlying structures.

However, the absence of hierarchy observed with AD people in evaluating the seriousness of the three situations proposed: Push, Burn and Shot, seems to confirm that perspective taking ability is involved in the judgement of blame, and somewhat deficient in AD sufferers. Indeed, in the AD group the ratings of blame severity are still above 10 on a 25 cm scale, and confirm that they, like the control group, still perceive the actions as blameworthy, but their mean ratings are lower than in the control group and don't show incremental raising of blame with the seriousness of the situations, so they may not differentiate the stories in terms of blame ratings to the same extent.

This result confirms our assumption that there are two different mechanisms involved in the judgement of blame, which have different underlying neurological structures. The first kind of reasoning needed to blame an actor is social or deontic reasoning which allows a person to distinguish between what is allowed or forbidden. According to Cummins (1996), deontic reasoning would be domain-specific in the human reasoning process and thus there would be a domain-specific module devoted exclusively to deontic reasoning. Perspective taking abilities, unlike deontic reasoning, seem to be reduced in the Alzheimer's disease sufferer. The decline of this cognitive ability observed in the AD group prevents the AD patients from judging the seriousness of the actions in the different stories. This deficiency is congruent with the high scores of the AD group on the anosognosia scale, which showed that the AD participants in this experiment were already in the denial phase of their illness. These results suggests that the two different cognitive activities required for the judgement of blame don't share the same characteristics. Deontic reasoning is resistant to aging and the first stages of this neuro-degenerative illness, while perspective taking ability, which is linked with insight, is already deficient at this first stage. This result is congruent with previous studies (Mangone et al., 1991; Michon et al., 1994) which have shown that frontal lobe dysfunction in Alzheimer's disease is correlated with impaired insight and anosognosia. Since AD causes impairments in the frontal lobe we can conclude that perspective taking ability is likely to be based there but that deontic reasoning is probably located elsewhere.

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APPENDIX

Examples of original vignettes in French that were presented to the participants:

PUSH (Intent x Consequence)

Marie a invité quelques amies. Elles préparent la soirée. Tout le monde participe et s'amuse beaucoup, sauf Evelyne qui n'est pas contente car elle n'aime pas Renée, une amie de Marie. Elle ne la supporte plus. A un moment donné Evelyne agacée, bouscule Renée qui était en train de finir de préparer la soirée. Renée se blesse au visage et elle saigne abondamment du nez.

Comment jugez vous Evelyne?

BURN (Intent x No Consequence)

Claude et Daniel sont tous les deux des cuisiniers d'un grand restaurant. Claude n'aime pas Daniel mais ils sont bien obligés de travailler ensemble. Alors qu'un midi ils préparent un plat ensemble, Claude, exaspéré par Daniel, fait tomber une casserole brûlante tout près des mains de Daniel. Daniel ne sera pas brûlé.

Comment jugez vous Claude?

SHOT (No Intent x No Consequence)

Alain et Francis, les meilleurs amis du monde, décident de partir à la chasse. A un moment ils se séparent, vont chacun de leur côté. Le temps passe quand Alain voit passer un lièvre. Il épaule, tire mais rate son coup. C'est alors qu'il entend Francis crier, lui signalant qu'il se trouvait dans l'axe de tir. Heureusement, Alain ne l'a pas touché.

Comment jugez vous Alain?