Implicit learning of affective responses in dementia patients: a face-emotion-association paradigm

Blessing, A; Zoellig, J; Dammann, G; Martin, M


Postprint available at:
http://www.zora.uzh.ch

Posted at the Zurich Open Repository and Archive, University of Zurich.
http://www.zora.uzh.ch

Originally published at:
Implicit learning of affective responses in dementia patients: a face-emotion-association paradigm

Abstract

The aim of the present study was to develop and evaluate an ecologically valid approach to assess implicit learning of affective responses in dementia patients. We designed a Face-Emotion-Association paradigm (FEA) that allows to quantify the influence of stimuli with positive and negative valence on affective responses. Two pictures of neutral male faces are rated on the dimensions of valence and arousal before and after aversive versus pleasant fictitious biographical information is paired with each of the pictures. At the second measurement time point, memory for pictures and biographical content is tested. The FEA was tested in 21 patients with dementia and 13 healthy controls. Despite severely impaired explicit memory, patients changed valence and arousal ratings according to the biographical content and did not differ in their ratings from the control group. The results demonstrate that our FEA paradigm is a valid instrument to investigate learning of affective responses in dementia patients.
IMPLICIT LEARNING OF AFFECTIVE RESPONSES IN DEMENTIA PATIENTS:
A FACE-EMOTION-ASSOCIATION PARADIGM

Andreas Blessing\textsuperscript{1,2*}, Jacqueline Zoellig\textsuperscript{2}, Gerhard Dammann\textsuperscript{1}, Mike Martin\textsuperscript{2}

University of Zurich, Department of Psychology, Gerontopsychology

\textsuperscript{1}Psychiatric Clinic of Muensterlingen
\textsuperscript{2}University of Zurich, Department of Psychology, Gerontopsychology

The work was conducted at the Memory Clinic Muensterlingen

Running head: Learning of affective responses in dementia

* Corresponding author:
Andreas Blessing, MSc
Psychiatric Clinic of Muensterlingen
Postfach 154
CH – 8596 Muensterlingen
+41 71 686 48 43
andreas.blessing@stgag.ch
Abstract

The aim of the present study was to develop and evaluate an ecologically valid approach to assess implicit learning of affective responses in dementia patients. We designed a Face-Emotion-Association paradigm (FEA) that allows to quantify the influence of stimuli with positive and negative valence on affective responses. Two pictures of neutral male faces are rated on the dimensions of valence and arousal before and after aversive versus pleasant fictitious biographical information is paired with each of the pictures. At the second measurement time point, memory for pictures and biographical content is tested. The FEA was tested in 21 patients with dementia and 13 healthy controls. Despite severely impaired explicit memory, patients changed valence and arousal ratings according to the biographical content and did not differ in their ratings from the control group. The results demonstrate that our FEA paradigm is a valid instrument to investigate learning of affective responses in dementia patients.

Key words: affective responding, memory, conditioning, emotion, Alzheimer’s Disease, dementia
Introduction

There is growing interest in emotion processing of patients with dementia, as resources in this area may be relevant for their as well as caregivers’ quality of life. Most studies investigating emotional processing in dementia patients have focused on the interaction of explicit memory and emotion (Boller et al., 2002; Ikeda et al., 1998; Kazui et al., 2000; Kensinger, Anderson, Growdon, & Corkin, 2004; Moayeri, Cahill, Jin, & Potkin, 2000) or on the recognition of facial expressions of emotions (Kohler et al., 2005; Shimokawa et al., 2003; Roudier et al., 1998; Hargrave, Maddock, & Stone, 2002). Little is known about the acquisition of affective responses in dementia patients, learning processes involving affective content have been addressed by few studies only (Blessing, Keil, Linden, Heim, & Ray, 2006; Hamann, Monarch, & Goldstein, 2002; Hoefer, Allison, Schauer, Neuhaus, Hall, Dang, Weiner, Miller, & Rosen, 2008). However, these processes might constitute essential aspects of non-drug therapies, because the emotional content of social interactions could have lasting effects on patients’ attitudes and influence their behaviour toward carers. Clinical experience and recent experimental findings (e.g., Blessing, Keil, Linden, Heim, & Ray, 2006) suggest that implicit learning of affective responses might still be possible in patients with dementia. Hence, these patients might be able to change their attitudes towards persons and situations based on affective content without explicit knowledge.

Methodologically, it is well known from research in social psychology that attitudes of healthy subjects can be formed unconsciously through simple classical conditioning procedures (Olsen, & Fazio, 2002). A classical approach to assess conditioning of affective reactions is fear conditioning. Consistently, Hamann, Monarch, & Goldstein (2002) and Hoefer and colleagues (2008) applied this method in patients with Alzheimer’s Disease (AD) using skin conductance as
Learning of affective responses in dementia

The results suggest that fear conditioning is impaired in AD patients as they show no change in skin conductance. However, external validity of fear conditioning tasks might be limited in dementia patients, as dependent measures are usually restricted to psychophysiological responses. In patients with Alzheimer’s disease there might be a dissociation between the emotional experience as measured by self-report scales and psychophysiological responses. In fact, Burton and Kaszniak (2006) presented AD patients and a control group positive, negative and neutral pictures that were rated on the dimensions of valence and arousal and recorded corrugator and zygomatic EMG muscle activity. They found that AD patients and a control group rated their emotional experiences towards emotional stimuli similarly on the dimensions of valence and arousal. However muscle activity patterns in response to emotional stimuli differed between groups. AD subjects demonstrated an inverted pattern of zygomatic activity compared to controls. These results make the application of psychophysiological measures to study changes in affective reactions in AD patients problematic, as the emotional experience in response to the conditioned stimuli may change without corresponding changes in psychophysiological responses. Another critical aspect of this approach is the selection of conditioned stimuli in fear conditioning studies. The conditioning of responses on green and red rectangles does not seem to be representative of everyday experiences of AD patients and conditioned affective responses might be easier acquired when socially meaningful stimuli are used.

Accordingly, ecological validity of a paradigm to assess the conditioning of emotional reactions in dementia patients can be established by the use of stimuli for conditioning (i.e., conditioned stimulus, CS) that have a high social relevance such as face stimuli. The conditioning procedure should simulate processes that appear in real life interactions and use
Learning of affective responses in dementia

Both positive and negative stimuli to initiate conditioning (i.e., unconditioned stimulus, US).

Some studies have used face stimuli (CS) and fictitious biographical content describing depicted persons (US) to study learning of affective responses in clinical populations (Blessing, Keil, Linden, Heim, & Ray, 2006; Johnson, Kim, & Risse, 1994). The fictitious content described depicted persons in terms of socially acceptable and unacceptable behaviour. Affective reactions to pictures before presentation of fictitious biographical content and after a retention interval were compared. This seems to be a reasonable approach that simulates processes that appear in real life interactions. However, the procedures used in previous studies suffered from several shortcomings: For instance, Johnson and Kim (1994), who first addressed the topic of preserved learning abilities in dementia patients used two faces and measured preference and impression ratings as dependent variables. The statistical power of such a preference test to detect changes in liking is extremely low however: There is a 50% probability for subjects to prefer the face that is later associated with positive affective content simply by chance, prior to the presentation of biographical information. Those who initially preferred the face later to be associated with unpleasant content will often only change their preference if they did not have a strong preference in the first place. For that reason small changes in liking will sometimes go undetected. Even if there are a substantial number of subjects who change their preference, the probability follows a binomial distribution and a large sample size is needed to detect changes in preference (N = 9). Furthermore the preference test was not applied correctly, since preference was not tested before the presentation of the fictitious biographical content. In the same vein, the impression ratings used by Johnson and Kim was challenging for dementia patients: Subjects had to rate stimuli on 20 dimensions such as: honest, polite, tolerant, energetic, independent, mature, cautious and practical. Dementia patients often have difficulty with this scale and the changes in
ratings on multiple scales are difficult to score and interpret for researchers. Finally, in the procedure used Johnson and Kim (1994), the intervals between measurement time points varied between groups, recognition of pictures was only tested in the fourth and fifth session, recognition of biographical content was not tested and not all subjects were tested at all measurement time points. Dependent measures suitable for measures of emotional changes in dementia patients should be sensible to detect changes in affective reactions toward conditioned stimuli and should be easy to use for cognitively impaired subjects. Promising candidates are scales such as the affective rating system Self-Assessment Manikin (SAM), that assess important dimensions of emotional experience and were successfully used in samples with AD patients (Burton and Kaszniak, 2006) and MCI subjects (Döhnel et al. 2008).

Blessing and colleagues (2006) adopted the procedure from Johnson & Kim (1994) and presented pictures of faces and fictitious biographical content. However, as dependent measure they used the SAM valence and arousal rating scales as well as a preference ranking. These authors used four pictures and four fictitious biographical descriptions, but only two of the descriptions seemed to influence the ratings systematically in both groups. This did not allow comparing the influence of positive and negative information on affective reactions. The four fictitious biographical descriptions contained information varying in several aspects and accordingly in their evoked arousal. Therefore, they could not simply be divided into two positive and two negative descriptions. Especially the different levels of arousal evoked by the four descriptions would not allow comparing the influence on ratings since stronger effects can be expected when more arousing material is used. However, comparing the influence of positive and negative information on affective ratings seems especially important as different neural correlates might be involved in processing a specific valence. Consequently, neuropathological
changes in dementia patients might selectively influence conditioning of stimuli depending on their valence. In line with the hypotheses of differential impairment a study by Blessing et al. (2009) shows that the emotional memory effect is stronger in AD patients when negative material is used. The procedure used by Blessing et al. (2006) does not control for the potential influence of explicit memories on changes in affective responses – which, however, is important to demonstrate that the learning process takes place implicitly without any awareness of the CS-US pairings. Finally, the changes in preference rankings seemed to parallel changes in valence ratings, hence, adding not much information. Furthermore, the statistical procedure used to analyse preference rankings seems questionable.

To address these shortcomings of the two studies, we aimed at designing and evaluating an optimised Face-Emotion-Association (FEA) paradigm to study learning of affective responses in dementia patients. We considered literature findings and own experiences in previous experiments with dementia patients (Blessing et al., 2006; Blessing et al., 2009). Essentially, the paradigm consists of two neutral male faces that are paired with fictitious biographical content characterizing the depicted person in terms of either positive or negative traits. Both descriptions contained highly emotional arousing material. Pictures were rated before and after the presentation of fictitious biographical content with respect to valence and arousal. Recognition of pictures as well as free recall and recognition of fictitious biographical content were tested.

Support for the validity of our FEA paradigm to assess the acquisition of affective reactions in dementia patients will be provided if the patient group changes ratings of pictures after the presentation of the fictitious biographical information. If no rating changes are observed, this would leave two explanations: our approach may not be suited to assess learning processes involving affective content in dementia patients or these learning processes are
generally impaired in these populations. Patients were supposed to neither recognise nor recall fictitious biographical information or to recognise the pictures. It was hypothesized that the ratings of the control group would also be influenced by the biographical information, but that they would recognise the pictures and recall some of the biographical information.

Methods

Design of the FEA paradigm and material

*Procedure.* The first session was scheduled between 9 and 10 am. Each participant viewed pictures of neutral male faces and was asked to rate the two faces in terms of valence and arousal with the SAM rating scale (Lang, 1980). Subsequently, fictitious biographical information about the two men on the pictures was presented. To avoid effects of a priori preference for a particular face stimulus two combinations of the two pictures and the two fictitious biographies (positive, negative) were used, one picture was paired 16 times with positive and 18 times with negative content the other picture was paired 18 times with positive and 16 times with negative content. Both combinations were presented in two orders (first positive content than negative and vice versa), resulting in four different versions. We had to use each different version in the patient group more often than in the control group due to the larger sample size, thus in the control group no version was used more than four times, in the patient group no version was used more than six times. The fictitious information characterised the respective person in the picture in terms of socially acceptable or unacceptable behaviour. While participants heard the biographical information, the appropriate picture was placed before them again. The next session was scheduled 190 minutes after the first session. During the interval patients participated in group activities, subjects of the control group on the other hand followed their everyday routines. After a retention interval of 190 minutes, participants completed a forced
choice recognition test. They were presented with two pairs of faces each containing a previously shown target face and a novel distractor face. For each pair, participants were requested to indicate which face was more familiar to them. Furthermore, they were asked whether they had seen the picture before and which biographical information they could recall. Subsequently, the pictures that had been presented during the first exposure phase were rated again on the dimensions of valence and arousal. At the end of the session, recognition of the fictitious biographical content was tested with a forced choice recognition task on four story elements. Each item contained one story element and three false answers.

*Pictures.* Test stimuli were two pictures of neutral and unfamiliar male faces selected from the International Affective Picture System (IAPS, (Lang, Bradley, & Cuthert, 1999), Pictures: 2200, 2210). Two other pictures of neutral male faces served as control stimuli for the recognition task (Pictures: 2214, 2020). Table 1 shows their respective normative values on the dimensions of emotional valence and arousal. All stimuli were printed in US letter format on white paper.

*Emotional ratings.* The Self-Assessment Manikin (SAM) is an affective rating system to assess participants’ ratings of various stimuli (Lang, 1980). Its dimensions of valence (ranging from pleasant to aversive) and arousal (ranging from low to high intensity) have shown reliable relationships with other measures of emotional responses such as physiological and behavioural parameters in healthy young adults (Greenwald, Cook, & Lang, 1988). Using the paper-pencil version of this instrument, participants rated the stimuli as to their emotional valence and arousal. The rating is given on a nine-point rating scale.

Data Analysis

To score the participants’ report of the biographical information, the participants’
Learning of affective responses in dementia

Statements were transcribed verbatim. Using these transcripts, each correctly recalled element was assigned a point, and responses were rated by the first author (A.B.). With the stories containing 46 story elements, a total of 46 points was possible (24 negative, 22 positive). Information such as “he stole a car” received a score of one point. Unspecific information such as “he did something bad” received a score of zero points. Repeated measures Analyses of Variance (ANOVAs) were conducted for the dimensional ratings of pleasure and arousal. The scales were adjusted so that all changes from T1 to T2 that were in the expected direction (i.e., more negative after pairing the respective picture with negative fictitious biographical information) were scaled in the same direction. This transformation allowed to analyse the differential influence of positive and negative content on ratings, if ratings are stronger influenced by either positive or negative content, this would result in an interaction between biographical content and pre-post intervention rating changes. Thus, arousal and valence ratings for pictures associated with negative content were reversed (e.g., a rating of 1 was transformed to a rating of 9 and vice versa). For each of the two dependent variables, two within-participant factors were used: (i) the two different biographical contents (pleasant and aversive characterisation) and (ii) pre-post intervention measurement (measurement time points: immediate, 190 minutes delay). Group was included as a between participant factor.

The transformation of scales resulted in differences between mean ratings of the picture associated with positive content and the picture associated with negative content. More precisely, if the mean rating of pictures that are associated with positive and negative content is for example 4, the transformation as described above results in a mean rating of 6 for the picture associated with negative content. Thus there is a difference between pictures associated with different contents, which is substantially the result of the transformation. Hence, because the main effect of biographical content and interaction between biographical content and group can
not be interpreted when the transformed scales are used, a second repeated measures ANOVA was conducted. The second ANOVA using the original variables was conducted to test for pre-intervention differences between pictures later associated with positive and negative content and their interactions with groups. This was done to ensure that ratings did not differ between groups and pictures already before the manipulation which could have influenced the results. Only the ratings of the first measurement time point (pre-intervention) were included. For each of the two dependent variables, one within-participant factor was used: pictures later associated with positive vs. negative biographical content. Group was included as a between participant factor.

Participants

The study included 21 patients diagnosed as either AD (N=13) or mixed dementia (N=8) (mean age 76.6 years (SD = 6.7); mean education 10.3 years (SD = 2.9); mean Mini Mental State (Folstein, Folstein, & McHugh, 1975; Tombaugh, & McIntyre, 1992) 21.33 points (SD = 3.1); 13 females and 8 males).

Patients were recruited in a regional facility at the time of testing. All patients were diagnosed by a multidisciplinary team of the hospital ward using ICD 10 criteria (Dilling, Mombour, & Schmidt, 1992). The diagnosis was based on general medical, neurological and neuropsychological examinations. All patients had received medical attendance including computerized tomography or magnetic resonance imaging and specific screening blood tests, in order to exclude syphilis, diabetes, thyroid disorders and vitamin B12 and folic acid deficiency.

Thirteen healthy elderly participants were recruited as controls (mean age 76.6 years (SD = 5.9); mean education 13.3 years (SD = 2.8); 8 females and 5 males). The mean age of patients and controls did not differ (t(32) = 0.019; p > .985). The mean education time of participants in the control group was higher than that of patients (t(32) = 3.046; p < .01). Controls were non-institutionalized and managed their own household. They reported that they had no known CNS
diseases, contact with toxic substances or substance abuse. All participants gave written informed consent. The local ethics committee approved the testing protocol.

Results

Recognition and free recall

Faces. In the forced choice recognition test for the faces, all persons of the control group identified both faces correctly, whereas patients did not differ from chance level (patients: M = 1 (SD = 0.78), p > .999). A total of six patients reported that they had seen at least one of the pictures before. Of these six patients, only three identified both pictures in the forced choice recognition test.

Biographical information. In the forced choice recognition test of the biographical information, the control group identified 3.15 (SD = 1.14) out of four story elements, which was significantly above chance level (t(12) = 6.791, p < .001). Again, the patient group did not differ significantly from chance level (i.e. 1) in the amount of story elements recognised (patients, M = 1.05 (SD = 0.23), t(20) = 0.204, p > .841). In the free recall test, the healthy control group recalled 8.2 (SD = 4.8) out of 46 story elements after the delay, whereas none of the patients recalled any of the fictitious biographical content.

Valence and arousal ratings

Valence. The descriptive values are presented in Table 2. As expected, the repeated measures ANOVA on valence ratings using the transformed scales indicated a significant main effect of pre-post intervention measurement (F(1,32) = 30.189; p < .001, η² = .485), reflecting the success of the experimental manipulation. Ratings of pictures associated with negative as well as positive fictitious biographies changed in the expected direction after the presentation of the fictitious biographical content. Importantly, no interaction between time and group was
observed \((F(1,32) = 1.097; p > .303, \eta^2 = .033)\), showing that the strength of the effect of the experimental manipulation was not moderated by group; both groups changed their ratings to the same degree. There was no significant interaction between pre-post intervention measurement and biographical content \((F(1,32) = .85; p > .773, \eta^2 = .003)\) indicating that rating changes of pictures associated with pleasant and unpleasant content did not differ. ANOVA revealed no significant interaction between group, pre-post intervention measurement, and biographical content \((F(1,32) = 0.163; p > .689, \eta^2 = .005)\), suggesting that rating changes of the two groups did not differ with respect to the valence of the biographical content.

The repeated measures ANOVA on pre-intervention valence ratings using the original variables indicated no main effect of biographical content \((F(1,34) = 1.487; p > .231, \eta^2 = .042)\), showing that pre-intervention ratings of pictures later associated with positive and negative content did not differ. No interaction between group and the within-participant factor was observed \((F(1,34) < 0.001; p > .995, \eta^2 < .001)\).

**Arousal.** The descriptive values are presented in table 3. As anticipated, repeated measures ANOVA on arousal ratings using the transformed scales indicated a significant main effect of pre-post intervention measurement \((F(1,32) = 10.957; p < .002, \eta^2 = .255)\) suggesting that participants rated pictures associated with aversive biographical content as being more arousing and pictures associated with pleasant content as being less arousing after the presentation of the fictitious biographies. Again, no interaction between pre-post intervention measurement and group was observed \((F(1,32) = .004; p > .949, \eta^2 < .001)\), indicating that the strength of the effect of the experimental manipulation was not moderated by group. The interaction between pre-post intervention measurement and biographical content reached trend level \((F(1,32) = 3.722; p < .063, \eta^2 = .104)\), showing that rating changes of pictures associated
with positive content tended to be smaller than rating changes of pictures associated with negative content. There was no interaction between group, pre-post intervention measurement and biographical content ($F(1,32) = 1.954; p > .172, \eta^2 = .058$), indicating that rating changes of the two groups did not differ with respect to the valence of the biographical content.

The repeated measures ANOVA on pre-intervention arousal ratings using the original variables indicated no main effect of biographical content ($F(1,34) = 0.506; p > .482, \eta^2 = .015$), showing that pre-intervention ratings of pictures associated with positive and negative content did not differ. No interaction between group and the within-participant factor was observed ($F(1,34) = 0.034; p > .855, \eta^2 = .001$).

Discussion

The main goal of our study was to evaluate a naturalistic and ecologically valid paradigm to examine implicit learning of affective reactions in clinical populations. Ecological validity is established by the use of stimuli with a high social relevance. The results we obtained by using our Face-Emotion-Association (FEA) paradigm indicate that it can be successfully used to manipulate affective reactions in dementia patients. As learning of affective reactions was influenced by both positive and negative information the valence of stimulus material seems not to play an important role. From a clinical point of view, these findings have a strong implication considering social interactions with patients with dementia. Patients might forget explicit information concerning people or events in their everyday interactions, but they still possess the ability to be influenced by the emotional valence of these interactions. Thus, it is possible for a particular person or situation to acquire negative or positive connotations through a simple procedure as used in the present study and this seems to be independent of the patients’ cognitive understanding of the origin of these connotations.
More specifically, all participants changed their judgments of neutral faces along the dimensions of valence and arousal according to the associated content as indicated by the main effect of time. Valence and arousal are important dimensions of emotional appraisal and rating changes did not differ significantly between groups on both dimensions. Accordingly, dementia patients seem to be sensitive to information varying along both dimensions. In fact, dementia patients showed the same magnitude of rating changes as the control group, although they did neither recognise the pictures nor recall the biographical information. They were also unable to recognise the story elements above chance level in forced choice recognition tests. Further analysis showed that the small sub-sample of patients who indicated familiarity with some of the faces changed their ratings to the same degree as the other patients. Thus, the rating changes in dementia patients could not be explained by remaining explicit memories. Patients retained affective connotations implicitly, whereas participants of the control group could also use explicit memory to retain information about affective connotations.

These findings are generally in line with the results of the study by Blessing et al. (2006). However in contrast to their results we found no group differences for valence ratings. This discrepancy could be the result of the different procedures used. In the study of Blessing et al. (2006) four pictures and biographical descriptions were presented. We hypothesize that ANOVA detected a group difference in this study because some of the pictures did not influence ratings consistently in both groups contributing to unshared variance. Furthermore, the power to detect group differences seems stronger in the present study due to larger sample size (N = 34 in this study, N = 26 in the Blessing et al., 2006 study).

A further aim of our study was to examine if affective judgements are influenced both by positive and negative information and to what degree. Research on attitude formation shows that in healthy subjects’ attitudes can be formed unconsciously through simple classical conditioning
using positive and negative US (Olsen, & Fazio, 2002). In the present study no differential influence of the valence of stimuli was found between the groups. However, differential influence of content with positive or negative valence on affective ratings could have been reduced due to the mere exposure effect. The mere exposure effect describes the preference for stimuli that have been previously presented over novel stimuli (Zajonc, 1968). Preference changes due to the mere exposure effect have been demonstrated in dementia patients in several studies (Halpern, & O’Connor, 2000; Winograd et al., 1999; Willems, Adam & Van der Linden, 2002). Since the mere exposure effect should be the same for all presented pictures regardless of their association with positive or negative content, we would predict that both pictures should be rated more favourably at the second session. We cannot exclude that the mere exposure effect contributed to rating changes of pictures associated with positive content and reduced rating changes of pictures associated with negative content. However, the influence of the experimental manipulation was clearly stronger than the mere exposure effect at least for pictures associated with negative content. Since the pictures were presented only twice the influence of the mere exposure effect should, moreover, be very limited in this study.

The finding that dementia patients and the control group were influenced by positive and negative stimuli might not seem very surprising from an emotional network perspective. Dispositions of approach versus withdrawal might be robust against deterioration of their neural basis, as they are associated with qualitatively different action representations (Bradley, Codispoti, Cuthbert, & Lang, 2001). However, independent of group there was a trend for arousal ratings to be influenced more by negative content. This might be explained with the high emotional intensity of the biographical contents we used. Neutral face stimuli are not very arousing and for that reason, the positive content could not reduce arousal ratings to the same
extent as negative content could raise arousal ratings. Our results suggest that the valence of stimuli does not seem to play an important role in implicit learning processes involving affective content. However a study by Blessing et al. (2009) shows that the affective valence of material is important when explicit memory is tested. They found that aversive information is better retained by dementia patients than pleasant information, especially when nonverbal material is used. Patients remembered more aversive pictures than pleasant pictures, whereas controls remembered emotionally arousing pictures with different valence equally well. Other studies that found a differential influence of the valence of material on explicit memory in dementia patients (Fleming, Kim, Doo, Maguire, & Potkin 2003; Hamann, Monarch, & Goldstein, 2000; Kensinger, Brierley, Medford, Growdon, & Corkin, 2002) did not match the arousal level of stimuli, which strongly influences the emotional memory effect (Buchanan, 2007). Thus, these studies are not suited to compare the influence of pleasant and aversive stimuli on memory processes. The valence of stimuli might play a discrete role in implicit and explicit learning processes in dementia patients. However, the possible influence of the valence of stimuli in conditioning affective responses and the neural mechanisms involved are not yet clearly understood and should be examined in future studies.

The aim of the present study was to develop an ecologically valid paradigm to assess learning of affective reactions in dementia patients controlling for the shortcomings of the two previous studies. While our paradigm does account for these methodological problems, it has a few limitations itself. First, activities during the interval between the first and the second session differed between groups, since patients participated in group activities. This difference might have influenced the results, for example patients might have had more distraction and social stimulation than controls which might have resulted in faster forgetting. Controls had more years
of education than patients which might have influenced especially explicit memory performance. However, post-hoc analyses of the influence of education in the patient group revealed no significant results. In the present study we used only pictures of male faces because the sample size was too small to consider different stimulus types. To examine this influence of stimuli, future studies may use a combination of male and female faces.

An important question that remains is what conclusions might be drawn from this study for real life interactions. Our results show that affective reactions of dementia patients can be influenced by positive and negative information. This suggests that patient’s attitudes toward carers can be influenced by previous experiences with these people. Yet, most relationships are a mix of positive and negative interactions and experiences, caution is warranted concerning conclusions for real life interactions. We expect that only intense or repeated positive or negative experiences have an impact on patients attitudes, however further research is needed.

Overall, our findings suggest that affective responding of dementia patients can be influenced through a simple conditioning procedure without awareness of previous CS-US pairing. Accordingly, our FEA paradigm seems to be a useful tool to study implicit learning of affective responses in cognitively impaired clinical populations.
References


Other Dementias, 18, 340-342.


Neurological Sciences, 154, 151-158.


### Tables

**Table 1. IAPS (Lang et al., 1999) pictures’ normative ratings**

<table>
<thead>
<tr>
<th>picture</th>
<th>2200 (Valence)</th>
<th>2210 (Valence)</th>
<th>2214 (Valence)</th>
<th>2020 (Valence)</th>
<th>2200 (Arousal)</th>
<th>2210 (Arousal)</th>
<th>2214 (Arousal)</th>
<th>2020 (Arousal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valence (mean (SD))</td>
<td>4.79 (1.38)</td>
<td>4.70 (0.93)</td>
<td>5.01 (1.12)</td>
<td>5.68 (1.99)</td>
<td>3.18 (2.17)</td>
<td>3.08 (1.76)</td>
<td>3.46 (1.97)</td>
<td>3.34 (1.89)</td>
</tr>
</tbody>
</table>

**Table 2. Mean Valence ratings**

<table>
<thead>
<tr>
<th>Type of fictitious content</th>
<th>Group</th>
<th>Pre-intervention mean (SD)</th>
<th>Post-intervention mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Patients</td>
<td>5.33 (2.42)</td>
<td>6.43 (1.97)</td>
</tr>
<tr>
<td></td>
<td>Controls</td>
<td>4.46 (1.45)</td>
<td>6.46 (1.51)</td>
</tr>
<tr>
<td>Pleasure</td>
<td>Patients</td>
<td>6.24 (1.97)</td>
<td>4.67 (2.65)</td>
</tr>
<tr>
<td></td>
<td>Controls</td>
<td>5.08 (2.10)</td>
<td>3.15 (1.95)</td>
</tr>
</tbody>
</table>

**Notes:** Higher ratings denote higher pleasure. SD = standard deviation

**Table 3. Mean arousal ratings**

<table>
<thead>
<tr>
<th>Type of fictitious content</th>
<th>Group</th>
<th>Pre-intervention mean (SD)</th>
<th>Post-intervention mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Patients</td>
<td>3.57 (1.89)</td>
<td>2.76 (1.87)</td>
</tr>
<tr>
<td></td>
<td>Controls</td>
<td>3.08 (2.02)</td>
<td>3.31 (1.93)</td>
</tr>
<tr>
<td>Aversive</td>
<td>Patients</td>
<td>3.76 (1.95)</td>
<td>4.95 (2.56)</td>
</tr>
<tr>
<td></td>
<td>Controls</td>
<td>3.31 (1.93)</td>
<td>5.46 (1.61)</td>
</tr>
</tbody>
</table>

**Notes:** Higher ratings denote higher arousal. SD = standard deviation
Appendix

Examples of fictitious biographical information

<table>
<thead>
<tr>
<th>Pleasant</th>
<th>Aversive</th>
</tr>
</thead>
<tbody>
<tr>
<td>He had good grades at school, even though he helped his mother who raised five children on her own.</td>
<td>He got involved in a fight and hurt a fellow soldier with a knife when he was in the army; he was dishonourably discharged from the army.</td>
</tr>
<tr>
<td>He worked at a grocery store and in the evening he visited school.</td>
<td>He broke his wife’s arm, when he tried to rape her.</td>
</tr>
</tbody>
</table>