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Cognitive Estimation and Affective Judgments in Alcoholic Korsakoff Patients

Matthias Brand[1], Esther Fujiwara[1], Elke Kalbe[2], Hans-Peter Steingass[3], Josef Kessler[2], and Hans J. Markowitsch[1]
[1]Physiological Psychology, University of Bielefeld, Germany, [2]Max-Planck-Institute for Neurological Research, Cologne, Germany, and [3]Haus Remscheid, Soziotherapeutisches Heim, Remscheid, Germany

ABSTRACT

Alcoholic Korsakoff patients have their most marked deficits in memory, but may exhibit problems in further cognitive and behavioral domains, particularly in so-called frontal lobe functions and on the emotional level. Cognitive estimation is among the frontal lobe-associated functions; nevertheless, the underlying processes of estimation and estimation deficits are still unknown. Additionally, though affective judgments were found to be disturbed in Korsakoff patients one can question whether this result is due to a deficiency in emotional processing itself, or whether deteriorated basic processes underlying all kinds of judgment tasks result in affective judgment errors. In this study, possible relations and underlying cognitive processes of affective and nonaffective judgments (cognitive estimates) were analyzed in a large sample of 39 Korsakoff patients. A neuropsychological test battery was administered together with a new test for cognitive estimation consisting of four dimensions ('size,' 'weight,' 'quantity,' and 'time') and an affective judgment task comprising negative, neutral, and positive words. The Korsakoff patients' results showed marked deficits concerning both, cognitive estimation and affective judgments. These deficits were highly intercorrelated and performance in both tasks was related to basic (e.g., information processing speed) and higher cognitive functions (executive functions and memory), suggesting a common basis in cognitive estimation and in affective judgments in Korsakoff syndrome.

INTRODUCTION

Korsakoff syndrome is one of the possible sequelae of chronic and excessive alcohol abuse. Structural and functional brain changes and corresponding neuropsychological impairment are discussed controversially. As well, the syndrome can be caused by various etiologies beside alcoholism such as anorexia (Becker, Furman, Panisset, & Smith, 1990) or gastrectomy (Shimomura, Mori, Hirono, Imamura, & Yamashita, 1998). In the causation of alcoholic Korsakoff syndrome it is discussed whether direct neurotoxic effects of ethanol or thiamine (Vitamin B1) deficiency or a combination of both is the main contributing factor (Lishman, 1990). Severe and persistent memory impairment and deterioration in the sense of time constitute the cardinal symptoms of Korsakoff syndrome (World-Health-Organization, 1994). Additionally, confabulations and emotional changes are observed. The neuropsychological symptoms of alcoholic Korsakoff patients are most commonly attributed to degeneration in diencephalic regions such as mammillary bodies and thalamic nuclei, and further the cerebellum, periaqueductal and

Address correspondence to: Matthias Brand, Physiological Psychology, University of Bielefeld, P.O. Box 100131, 33501 Bielefeld, Germany. Tel.: +49-521-106-4482. Fax: +49-521-106-6049. E-mail: M.Brand@uni-bielefeld.de
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periventricular gray matter (Cravioto, Korein, & Silberman, 1961; Mair, Warrington, & Weiskrantz, 1979; Malamud & Skillicorn, 1956; Victor, Adams, & Collins, 1989). Pathologies of additional brain regions, including frontal lobes (Kril, Halliday, Svoboda, & Cartwright, 1997), and subcortical structures (Halliday, Ellis, & Harper, 1992; Halliday, Ellis, Heard, Caine, & Harper, 1993) such as the basal forebrain (Cullen, Halliday, Caine, & Kril, 1997), are also described.

Both the acquisition of new information and the recall of formerly stored information may be impaired (Korsakoff, 1887; Mair et al., 1979; Victor et al., 1989). Though earlier studies described a more pronounced deterioration of verbal learning (e.g., Butters, Lewis, Cermak, & Goodglass, 1973), recent research revealed additional figural and visuo-spatial learning problems (Holdstock, Mayes, Cezayirli, Aggleton, & Roberts, 1999; Kessels, Postma, Wester, & de Haan, 2000; Kixmiller, Verfaellie, Mather, & Cermak, 2000; Mayes, Meudell, & MacDonald, 1991). The remote memory disturbances can comprise general knowledge (Cermak, Reale, & Baker, 1978; Kovner, Mattis, Gartner, & Goldmeier, 1981) as well as public and personal facts and events (Dalla Barba, Cipolotti, & Denes, 1990; Kopelman, 1989; Kopelman, Stanhope, & Kingsley, 1999; Mayes, Daum, Markowitsch, & Sauter, 1997; Shimamura & Squire, 1986; Zola-Morgan, Cohen, & Squire, 1983). However, it is still under controversial discussion whether Korsakoff patients show impairments in implicit memory tasks – such as priming (Beauregard et al., 1997; Brunfaut & d'Ydewalle, 1996) – and in short-term memory tasks (Cermak & Butters, 1972; Kopelman, 1985; Kopelman, 1991b).

According to the aforementioned neuropathological findings, Korsakoff patients can exhibit a wide range of cognitive dysfunctions beyond the more prominent memory deficits. Among them, executive functions often associated with the frontal lobes can be affected. The term executive functions does not indicate a consistent entity (Miyake et al., 2000) but rather constitute complex cognitive processes such as planning, problem solving, monitoring, or goal directed behavior. Smith and Jonides (1999) suggest five components of executive functions: attention and inhibition, task management, planning, monitoring, and coding. A major part of these functions may reside in working memory which involves the temporary storage and manipulation of new information for the performance of cognitively demanding tasks (see D'Esposito & Grossman, 1996). According to the multifaceted nature of executive functions their comprehensive assessment requires extensive test batteries such as the BADS (Wilson, Alderman, Burgess, Emslie, & Evans, 1996) covering several of these functions. However, also simpler tasks such as verbal fluency are discussed as measuring executive functions, namely strategic retrieval search (Bryan & Luszcz, 2000). Regarding alcoholic Korsakoff patients, disturbances in higher cognitive functions (set shifting, cognitive flexibility, interference susceptibility, and verbal fluency) as well as in working memory have been reported (Joyce & Robbins, 1991; Kopelman, 1991a; Krabbendam et al., 2000).

This paper addresses the question whether performance in two specific tasks assessing cognitive estimation and affective judgments may share similar underlying factors presumably subcomponents of executive functions. Cognitive estimation is a type of problem solving ability and can be defined as a process of answer generation in which an exact answer is not readily available. Semantic information and (comparison) strategies are used to generate an appropriate answer (Brand, Kalbe, & Kessler, in press). Though Leng and Parkin (1988) did not find impairments in the Cognitive Estimation Test (CET) of Shallice and Evans (1978) in Korsakoff patients, Shoqueirat, Mayes, MacDonald, Meudell, and Pickering (1990) revised this finding. Comparing the CET performance of patients with different neurological disorders including Alzheimer's disease, head injury, encephalitis and others (Taylor & O'Carroll, 1995) the most pronounced deficits were found in the Korsakoff patients. Kopelman (1991a) on the other hand, observed no differences in the CET performance between patients with Alzheimer's disease and Korsakoff patients

whereas in all other tests of frontal functions, Alzheimer patients were more deteriorated. Though cognitive estimation can be assumed to be disturbed in Korsakoff patients it is not clear until now whether the estimation of qualitatively different categories or dimensions (e.g., size, weight or time) is affected equally or whether specific dimensions are more deteriorated than others.

Apart from the mentioned cognitive deficits in Korsakoff patients, clinical observation often revealed affective changes such as apathy, dullness, motivational deficits, reduced spontaneously affective behavior, emotional flatness or emotional hyperarousability (Rapaport, 1961; Talland, 1965). Changes in emotional perception and processing were also noted in few neuropsychological investigations. Though Douglas and Wilkinson (1993) did not find significant deterioration of emotional reactivity in Korsakoff patients, Markowitsch, Kessler, Bast-Kessler, and Riess (1984) and Markowitsch, Kessler, and Denzler (1986) revealed reduced emotional reactivity in their patients. Oscar-Berman, Hancock, Mildworf, Hutner, and Altman Weber (1990) found affective judgments of Korsakoff patients to be more extreme compared to judgments of controls.

Regarding the importance of diencephalic structures such as hypothalamic nuclei for the autonomic regulation of emotional states (see Gainotti, 2001; Weddel, 1994) it may be self-evident that – due to their diencephalic damage – Korsakoff patients display emotional changes. In the interpretation of affective judgment errors, however, one can question whether this impairment is due to a deficiency in emotional processing itself, or whether a disturbance in basic processes underlying all kinds of judgment tasks results in affective judgment errors. Therefore, the impairment of Korsakoff patients in emotional judgments can also be due to their deficits in memory (e.g., general knowledge) and a failure in answer monitoring.

In this study, possible relations and underlying cognitive processes of affective and nonaffective judgments (cognitive estimates) were analyzed in a large sample of clinically diagnosed Korsakoff patients.

MATERIALS AND METHODS

Subjects

A total of 41 patients with alcoholic Korsakoff syndrome (KS) were recruited from four different homes for chronically-multi-impaired addicts of the Allgemeine Hospitalgesellschaft (AHG; Germany). All patients were permanent residents of the institutions.

All patients underwent an extensive neurological and psychiatric examination, carried out by the physicians of the different cooperating institutions. On the basis of these examinations 2 patients were excluded: 1 patient had previously suffered a stroke and 1 had schizophrenic psychosis. The remaining 39 patients were diagnosed as alcoholic Korsakoff patients according to ICD-10 (World-Health-Organization, 1994) and DSM-IV (American Psychiatric Association, 1994) criteria (for Alcohol-Induced Amnesic Syndrome or Alcohol-Induced Persisting Amnestic Disorder, respectively). All patients had a documented history or residual signs of a Wernicke episode which preceded the chronic state of the Korsakoff syndrome. The history of alcohol consumption of the KS patients was revealed by checking medical documentations and by interviewing their relatives. All KS patients had extensive alcohol consumption over continuous periods of more than 12 years. They did not, however, exhibit typical signs of dementia and were therefore not diagnosed as patients with alcohol related dementia according to the criteria of Oslin, Atkinson, Smith, and Hendrie (1998).

Additionally, 39 healthy controls without neurological or psychiatric history were recruited. The control group contains staff members of the administration and the cafeteria of the University of Bielefeld and their relatives and friends.

Subjects did not receive financial allowance for participation. The groups were comparable regarding age, years of education and profession, but control subjects were slightly but not significantly older (see Table 1).

Materials

The general cognitive state was determined by a German version (Kessler, Markowitsch, & Denzler, 1990) of the Mini Mental State Examination (MMSE; Folstein, Folstein, & McHugh, 1975). Additionally, an extensive neuropsychological test battery was administered to all KS patients (see Table 2). Control subjects were examined with a reduced test battery. In case of administered tests, means and standard deviations of control subjects are given in Table 2. Otherwise scores of the standardized tests' norm groups were used.

Table 1. Demographic Variables.

	Korsakoff patients	Controls	Significance
Age			
Mean (*SD*[1])	56.77 (6.49)	59.74 (7.55)	$T=1.9$ ($p=.07$)
Sex			
Female	16	17	$\chi^2=.05$ ($p=.82$)
Male	23	22	
Years of education			
9 or less yrs.	27	22	$\chi^2=3.5$ ($p=.18$)
10 yrs.	6	13	
11 or more yrs.	6	4	
Profession			
Unskilled	13	7	$\chi^2=2.5$ ($p=.29$)
Apprenticeship	24	29	
University	2	3	

Note. [1]Standard deviation.

Intelligence

The subtest 'Reasoning' of the Leistungsprüfsystem, (Sturm, Willmes, & Horn, 1993) was administered to assess global intellectual functions. In this test subjects are shown several rows of digits and/or letters and are required to detect a rule in each row. The rule must be used to eliminate one wrong item in every sequence.

Speed of Information Processing

To study speed of information processing the 'Word Trial' and the 'Color Trial' of the Word Color Interference Test of the Nürnberger-Alters-Inventar (Oswald & Fleischmann, 1997) was used. In the Word Trial subjects have to read randomized color names printed in black type and in the Color Trial subjects have to name the color of squares. In both trials the required time is measured.

Memory

Verbal short- and long-term memory was assessed by a verbal selective reminding task (Memo-Test; Schaaf, Kessler, Grond, & Fink, 1992). Here, 10 words are read to the subjects and they have to recall as many of the words as possible. Each of the subsequent five learning trials involves the selective presentation of those items that were not recalled on the immediately preceding trial. After 15 min also a delayed recall is conducted. Further standard tests were applied to examine verbal short-term memory ('Digit Span' of the German version of the Wechsler Adult Intelligence Scale – Revised; Tewes, 1991), figural short and long-term memory (subtest 'Block Span' of the Wechsler Memory Scale – Revised; Wechsler, 1987, Rey Osterrieth Complex Figure Test delayed recall; Osterrieth, 1944), priming ('Fragmented Pictures Test'; Kessler, Schaaf, & Mielke, 1993), and general knowledge (subtest 'Information' of the German version of the Wechsler Adult Intelligence Scale – Revised; Tewes, 1991).

Executive Functions

Executive functions were examined with the Wisconsin Card Sorting Test – modified version (Nelson, 1976), 'Interference Trial' of the Word Color Interference Test (Oswald & Fleischmann, 1997) and the FAS-Test (Spreen & Strauss, 1991). The Wisconsin Card Sorting Test is supposed to assess the ability to form abstract concepts, to shift and maintain set, and utilize feedback (see Spreen & Strauss, 1991). In the Interference Trial of the Word Color Interference Test subjects read color names printed in color ink ignoring the color of the print while the print color never corresponds to the color name. This trial measures a subjects' susceptibility to interference. The FAS-Test assesses verbal fluency.

Cognitive Estimation

Cognitive estimation was assessed with the Test for Cognitive Estimation (German: 'Test zum kognitiven Schätzen, TKS'; Brand, Kalbe, & Kessler, 2002). The TKS consists of four dimensions: size, weight, quantity and time comprising 16 items (each dimension having four). For the dimensions size, weight and quantity subjects are shown pictures of objects (see Fig. 1), for the

Table 2. Results in the Neuropsychological Test Battery.

	Korsakoff patients; Mean (*SD*[1])	Controls; Mean (*SD*[1])	Significance	
Orientation				
Mini Mental State Examination	24.8 (2.2)	<26[2]		
Intelligence				
I.Q. (Reasoning)	95.4 (9.2)	108.8 (11.2)	$T=4.2$	$p<.001$
General knowledge				
Information (WAIS-R)	10.7 (5.4)	17.1 (3.1)	$T=5.9$	$p<.001$
Information Processing				
Word Color Interference Test (Word Trial)	17.8 (5.9)	<17[2]		
Visuo-constructive abilities				
Rey Osterrieth Figure (copy)	26.3 (8.1)	31.3 (3.7)	$T=3.1$	$p=.003$
Memory				
Digit Span forward	6 (4–8)[3]	7 (5–8)[3]	$U=202$	$p=.007$
Digit Span reversed	3.7 (1.0)	4.7 (1.1)	$T=3.2$	$p=.003$
Memo Test (immediate)	5.0 (1.3)	7.1 (0.8)	$T=6.4$	$p<.001$
Memo Test (delayed)	1 (0–6)[3]	6 (2–10)[3]	$U=98$	$p<.001$
Block Span	4.6 (0.9)	≥5[2]		
Rey Osterrieth Figure (delayed)	2.9 (2.7)	16.2 (5.1)	$T=9.7$	$p<.001$
Fragmented Pictures Test	6.9 (3.9)	11.1 (3.5)	$T=6.4$	$p<.001$
Executive Functions				
Wisconsin Card Sorting Test				
correct	28.6 (8.1)	39.1 (4.4)	$T=8.4$	$p<.001$
errors	13.0 (6.1)	7.3 (2.7)	$T=5.8$	$p<.001$
perseverations	5.7 (4.5)	1.2 (0.8)	$T=4.2$	$p=.002$
Word Color Interference Test				
Interference Trial (s)	59.6 (30.8)	<42[2]		
Interference – Color (s)	31.7 (21.4)	<17[2]		
FAS-Test	24.1 (10.8)	37.1 (13.1)	$T=4.8$	$p<.001$

Note. [1]Standard deviation.
[2]Cut-off score of norm group.
[3]Median and range.

time items, subjects are asked to estimate the duration of four different events which are presented verbally (e.g., 'How long does a morning shower usually take?').

Affective Judgments

Judgments of affective materials were tested using the Affective Word Test (German: 'Affektiver Wörtertest, AWT'; Fujiwara, Brand, & Markowitsch, in preparation). The AWT consists of 15 nouns with different affective valence: 5 positive (e.g., 'peace'), 5 negative (e.g., 'torture') and 5 neutral words (e.g., 'surface'). Subjects are asked to read each word and to judge the affective valence of each word with the help of a nonverbal rating scale (see Fig. 2).

Statistical Analyses

All statistical analyses were carried out with Superior Performance Software System (SPSS) version 10.0 for Windows. In case of normally distributed variables, between-subjects differences were analyzed by analysis of variance (including post hoc Scheffé tests) and *t* tests for independent groups. Inner subject comparisons were computed using analysis of variance with repeated measures. Covariations were analyzed by Pearson correlations. In case of violation of the normal distribution, comparable nonparametric measures were used (Mann–Whitney-*U* test, Friedman test and Spearman correlations).

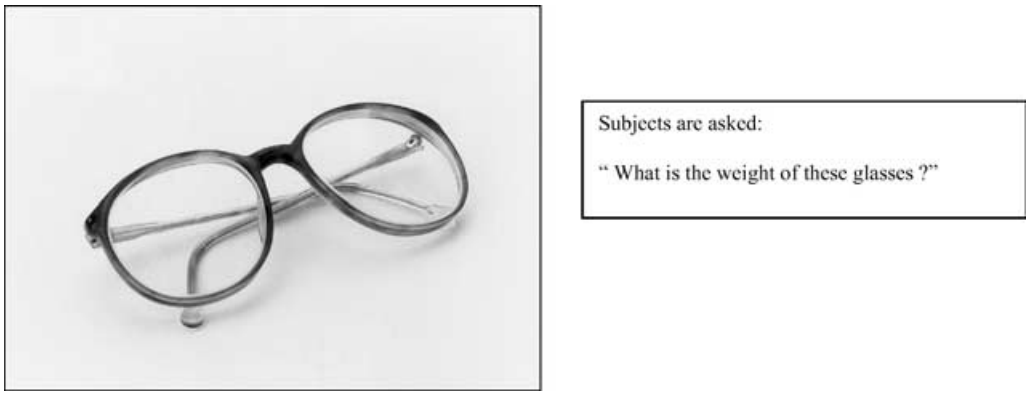

Fig. 1. Example of the TKS dimension 'weight' (reproduced from Brand et al., 2002, with permission).

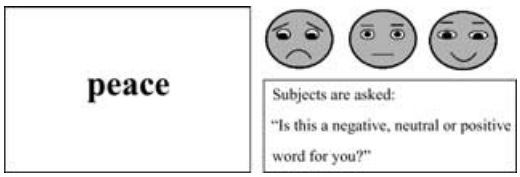

Fig. 2. Example of the AWT with nonverbal rating scale.

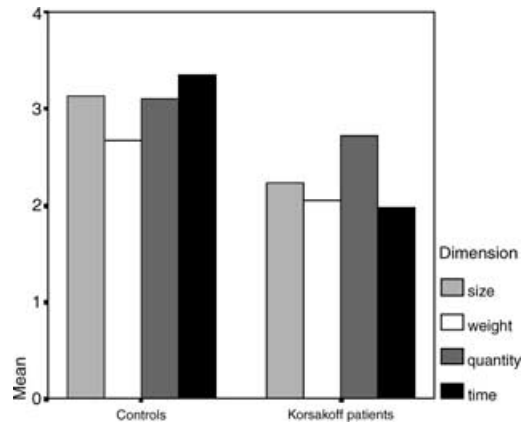

Fig. 3. Cognitive estimation profiles of the two groups.

RESULTS

Neuropsychological Test Battery

The Korsakoff patients were impaired in most of the tested neuropsychological domains as shown in Table 2.

Cognitive Estimation

Compared to the controls the Korsakoff patients performed significantly lower in the TKS (KS-patients: mean = 8.9, $SD = 2.7$; CG: mean = 12.2, $SD = 1.8$; $T = 6.1$, $p < .001$).[1] In an analysis of variance there was a main effect for group ($F = 18.7$, $p < .001$) but no effects for gender ($F = 0.2$, $p = .63$), education ($F = 2.0$, $p = .14$), and age (as a covariate, $F = 0.1$, $p = .85$). Interactions were also not significant.

A significant main effect of the inner subject factor 'dimension' ($F = 4.2$, $p = .006$) and also an interaction of 'dimension' × 'group' ($F = 3.8$, $p = .011$) was found. While control subjects performed on a similar level in all dimensions, with 'weight' being the most difficult, for the Korsakoff patients time estimates were the most difficult and the quantity items were the easiest. The different estimation profiles of the two groups are shown in Figure 3.

In the TKS bizarre errors are defined as estimates below or above 2 standard deviations of the answers of the norm group (see Brand et al., 2002). These kinds of estimates were exclusively produced by the Korsakoff patients and constituted 35.7% of the total number of errors in this group. These bizarre answers were observed in all dimensions with 'time' being the most affected

[1]Correct estimations were defined by the mean estimates (±1 standard deviation) of the norm group (Brand et al., 2002).

and 'quantity' being the least. For example, the duration of a morning shower was estimated as 15 s or 1 hr, and the weight of a car was rated as 4 kg or 15 t.

Affective Judgments

In the AWT the Korsakoff patients showed significantly more affective judgment errors compared to control subjects (KS-patients: median = 3, range = 0–11; CG: median = 1, range = 0–4; $U = 211.5$, $p < .001$). Nonparametric analysis of between subjects differences revealed no significant effects for gender ($U = 347.0$, $p < .08$) and education ($\chi^2 = .76$, $p = .68$). There was also no significant covariation between age and test performance ($\rho = .19$, $p = .13$).

With respect to affective valence, in the Korsakoff group judgment errors showed a marked tendency to the positive direction ($\chi^2 = 11.6$, $p = .001$). For example, the word 'cough' was rated as 'positive' by 7 Korsakoff patients but by none of the control subjects.

Correlations

The TKS total score was correlated with general knowledge (subtest 'Information': $r = .51$, $p = .001$), visuo-construction (Rey Osterrieth Complex Figure, copy: $r = .43$, $p = .007$) and speed of information processing ('Word Trial': $r = -.50$, $p = .001$). The bizarre estimation errors were related to general knowledge ($r = -.57$, $p < .001$) and also to executive functions such as interference ('Interference Trial': $r = .37$, $p = .02$) and verbal fluency (FAS-test: $r = -.43$, $p = .006$). Further correlations were found between the bizarre errors and working memory ('Digit Span reverse': $r = -.35$, $p = .03$), and visuo-construction ($r = -.55$, $p < .001$). Moreover, the TKS performance (total score as well as bizarre errors) was correlated with affective judgment errors in the AWT ($\rho = -.45$, $p = .01$; $\rho = .46$, $p = .009$). Affective judgment errors were correlated with general knowledge ($\rho = -.35$, $p = .04$), working memory ($\rho = -.33$, $p = .05$), visuo-construction ($\rho = -.35$, $p = .05$) and speed of information processing ($\rho = .43$, $p = .02$).

DISCUSSION

Consistent with the findings of Joyce and Robbins (1991), Kopelman (1991a) and Krabbendam et al. (2000), the Korsakoff patients examined in this study showed marked impairments in different executive functions besides severe memory deficits. Thus, cognitive estimation discussed as an executive function was also disturbed in the patients confirming the findings of Kopelman (1991a), Kopelman et al. (1999), and Taylor and O'Carroll, (1995). The Korsakoff patients in our study exhibited deficits in all tested estimation dimensions ('size,' 'weight,' 'quantity,' and 'time') whereby time estimations were the most deteriorated. Already in early clinical studies disturbances in the sense of time were described in Korsakoff patients (see Talland, 1965; Victor et al., 1989). More recently, time estimation deficits in these patients were revealed by Kinsbourne and Hicks (1990), Mimura, Kinsbourne, and O'Connor (2000) and Shaw and Aggleton (1994). Mimura et al. (2000) argued that in Korsakoff patients either an internal clock may be inactivated or episodic memory disturbances would possibly cause the time estimation impairment. In contrast to our study, Kinsbourne and Hicks (1990), Mimura et al. (2000), and Shaw and Aggleton (1994) assessed time estimation using subjective temporal judgment tasks (e.g., judging the length of intervals of 10, 20, 30 or 60 s). In the time estimation tasks employed here, subjects are asked to estimate the duration of specific events (e.g., duration of a morning shower) without directly experiencing them in the test situation. The TKS items require the additional retrieval of information stored in the episodic and semantic memory system, namely knowledge about the duration of specific or comparable events, about numbers and units of measurement and/or specific episodes of test related situations (e.g., last morning shower). Deficits in the TKS time items may be dependent on timing deficits combined with remote memory impairment. Indeed, the recall of information from long-term memory stores is not only required in the time items but also in the estimation of the other TKS dimensions. This assumption is supported by the high correlation between the TKS performance and general

knowledge (subtest information of the WAIS–R). It might also be important to recall episodes in which the dimensions in question were used or were of importance. As Korsakoff patients have particular problems in the episodic memory domain, cognitive estimation deficits can also be caused by an episodic memory retrieval failure, even if this was not detected in our study.

Beyond the lower overall performance of the Korsakoff patients a more qualitative analysis of the patients' estimates revealed rather bizarre errors. Bizarre errors, defined as answers below or above 2 standard deviations of the norm groups' mean, were related to working memory and executive functions. Thus, it is assumed that – additional to general knowledge – for the production of appropriate estimates different aspects of executive functions such as solution monitoring or answer control and a 'plausibility check' are necessary.

The normal steps of cognitive estimation could follow a route from a task specific representation in the working memory, to an activation of information from the long-term memory and subsequently a 'plausibility check' of the generated answer by a central processing control. Finally, if no errors are detected by this control, the solution is transformed into an output code and the answer is given. Therefore, in Korsakoff patients the production of bizarre estimates can be explained by impairments in general knowledge and/or episodic memory and further by an impaired 'plausibility check' as well as working memory deficits. Similarly, Taylor and O'Carroll (1995) suggested that cognitive estimation deficits of Korsakoff patients are caused by long-term memory deficits as well as a disturbed 'error check'.

Compared to control subjects the Korsakoff patients produced more affective judgment errors in the AWT and with respect to affective valence, judgment errors showed a marked tendency to the positive direction. This result is in accordance with Markowitsch et al. (1986) and Oscar-Berman et al. (1990), who found severe emotional processing disturbances in Korsakoff patients. One can argue that judging neutral and negative words as positive may reflect a disinhibition tendency and disturbed control processes: the Korsakoff patients tended to perseverate on judgments of the (initially five) positive words and inferred positive valence also to the other words. However, the affective judgment task applied here refers to only one aspect of affective processing, namely the classification of written words into semantic categories. Compared to material presumably bearing a higher affective impact (e.g., pictorial stimuli), the reading of affective words may induce relatively less emotional arousal. Thus, in the task applied here, also a general deficit in semantic classification or semantic memory retrieval might be reflected by our results. Therefore, the observed deficits in verbal affective judgments cannot be generalized to all kinds of affective evaluations in Korsakoff patients.

The correlation between the TKS performance (total score as well as bizarre errors) and the affective judgments may reflect an involvement of components of cognitive estimation (e.g., general knowledge, solution monitoring, and plausibility check) in the affective judgments. One common aspect of estimation and affective judgments seems to lie in the retrieval of information from long-term memory as can be assumed from the correlation between AWT judgment errors and general knowledge (subtest 'Information' of the WAIS–R). In both, affective judgments as well as cognitive estimates, subjects have to evaluate objects, events or words regarding specific dimensions (e.g., size, time, or affective valence). If the retrieval of the relevant knowledge fails, a tendency to confabulate which can be a clinical symptom of the Korsakoff syndrome (World-Health-Organization, 1994) may account for a random access of deficient solutions. The analysis of visual material seems to be a further common aspect of both tasks as can be seen in the correlations between TKS, AWT, and visuo-constructive abilities. In both, TKS and AWT, stimuli are presented in a visual form (photos of the objects to estimate and visually presented words with a pictorial rating scale) which requires a precise visual analysis of the material. Apart from severe signs of apraxia, inaccuracies in copying complex figures may also correspond to imprecise analyses of pictures or written words. One can hypothesize that in patients displaying

visuo-constructive deficits all incoming visual input can contain misinformation and thus providing an incorrect basis for higher cognitive processing as required in judgment tasks. This hypothesis of imprecise input as a source of errors in judgments is additionally supported by the correlations between the TKS, AWT, and speed of information processing ('Word Trial' of the 'Word Color Interference Test'). The covariation between AWT and the 'Word Trial' may as well – with respect to the affective judgments required here – reflect the importance of reading and comprehending written words. However, it has to be mentioned that the participants had no impairment in linguistic functions as examined with the reading and writing tasks of the MMSE.

To summarize, Korsakoff patients exhibit various neuropsychological impairments beyond the more prominent memory deficits. Among several dimensions of cognitive estimation, time estimates were the most deteriorated. This may reflect a specific timing deficit in Korsakoff patients.

Here, a common basic function of affective and nonaffective judgments may be the precise analysis of sensory input. In further processing, deficits in monitoring, viewed as a component of executive functions, and failures in organizing or retrieval of general knowledge can lead to errors in cognitive estimation and affective judgments. Further studies will have to show whether the correlational relationship between certain underlying functions and judgment tasks has a causal origin. Moreover, in order to specify the contribution of underlying processes to affective judgments, the application of a broader range of affective judgment tasks including pictorial or acoustic stimuli may be of particular interest.

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