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Remediation of impairments in facial affect recognition in schizophrenia: Efficacy and specificity of a new training program

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Abstract

Objective: Schizophrenia patients often exhibit impairments in facial affect recognition which contribute to their poor social functioning. These impairments are stable in the course of the disorder and seem not to be affected by conventional treatment. The present study investigates the efficacy and specificity of a new training program for the remediation of such impairments.
Method: A newly developed training program tackling affect recognition (TAR) was compared with a cognitive remediation training program (CRT) and treatment as usual (TAU) within a randomized three group pre-post design in $n = 77$ post-acute schizophrenia patients. The TAR is a computer-aided 12-session program focussing on facial affect recognition, whereas the CRT aims to improve attention, memory and executive functioning. Facial affect recognition, face recognition, and neurocognitive performance were assessed before (T0) and after (T1) the six week training phase. During the training period all patients received antipsychotic medication.
Results: Patients under TAR significantly improved in facial affect recognition, with recognition performance after training approaching the level of healthy controls from former studies. Patients under CRT and those without special training (TAU) did not improve in affect recognition, though patients under CRT improved in verbal memory functions.
Conclusion: According to these results, remediation of disturbed facial affect recognition in schizophrenia patients is possible, but not achievable with a traditional cognitive rehabilitation program such as the CRT. Instead, functional specialized remediation programs such as the newly developed TAR are a more suitable option.

Keywords: Schizophrenia; Facial affect recognition; Rehabilitation; Cognitive impairment; Social perception

1. Introduction

Impairments in neurocognitive functioning concerning attention, memory and executive functions

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are well established in patients with schizophrenia (e.g., Goldberg et al., 2003; Heinrichs and Zakzanis, 1998). Besides such impairments in basic or "cold cognition" impairments in social cognitive functions have also come more and more into the focus of schizophrenia research during the last years (Penn et al., 1997, 2001; Edwards et al., 2002). Particular attention has been paid to facial affect perception as one important aspect of social cognition (Toomey et al., 2002). Impairments in facial affect recognition are ubiquitous features of schizophrenia, which seem not to exist to a comparable extent in other psychiatric disorders (Gaebel and Wölwer, 1992; Wagner and Linehan, 1999; Loughland et al., 2002). In schizophrenia, impairments in facial affect recognition are stable across different stages of the disorder (Gaebel and Wölwer, 1992; Wölwer et al., 1996; Streit et al., 1997; Addington and Addington, 1998), are already present in first-episode patients (Edwards et al., 2001), and even in high-risk persons with initial prodromes (Streit et al., submitted for publication) and in unaffected siblings of schizophrenia patients (Kee et al., 2004). These findings suggest affect recognition deficits to be a trait marker, probably associated with the vulnerability for schizophrenia.

Deficits in affect recognition are strongly associated with more global social dysfunctions characteristic of schizophrenia (Green, 2001; Hooker and Park, 2002; Ihnen et al., 1998; Kee et al., 2003; Mueser et al., 1996; Penn et al., 1995, 1996, 1997). Impaired affect recognition may have adverse effects on psychosocial functioning independent of the presence and severity of positive and negative symptoms and cognitive deficits (Kohler et al., 2000).

Thus, these impairments represent a core feature of the disorder and are of high relevance for the psychosocial functioning of the patients. However, how affect recognition can be improved is one of the still unanswered questions related to social cognitive functioning in schizophrenia (Penn and Corrigan, 2001). The traditional drug and psychological treatment usually applied to schizophrenia patients seem to be ineffective to this regard as indicated by the stability of the impairment across different stages of the disorder despite treatment. However, newer atypical drugs may slightly facilitate patients' ability to accurately perceive emotion (Kee et al., 1998). Nevertheless, special treatment approaches to overcome the impairment in affect recognition are still rare.

The general possibility to modify affect recognition by behavioral methods was first shown by Penn and Combs (2000) comparing three minimal treatments (facial feedback, monetary reinforcement, combination of both) with repeated practice. Although all three interventions showed an effect, a 1 week follow-up assessment yielded significant effects for monetary reinforcement only. Since training and assessment material were identical in this study, it is questionable whether the effects could generalize beyond the training material.

It is still under discussion whether poor affect recognition in schizophrenia patients represents a differential deficit or whether it is part of more global cognitive impairment (Novic et al., 1984; Kerr and Neale, 1993; Bryson et al., 1997; Kohler et al., 2000). Related to this question, it is unclear whether enhancement in social cognition is possible already by strengthening basic neurocognitive functioning (Spaulding and Poland, 2001). It is well known now that dysfunctions in "cold cognition" have a strong relationship to poor social functioning (Green, 1996, 1998; Green et al., 2000). According to Green and Nuechterlein (1999), emotion perception as a critical component of social cognition may serve as a mediator between basic neurocognition and social functional outcome. Indeed, there is some evidence that neurocognitive rehabilitation strategies may improve social functioning (Wykes et al., 1999). On the other hand, it has been claimed that specific interventions are needed to remedy impairments in facial affect recognition (Bryson et al., 1997).

The aim of the present study was to investigate the efficacy and specificity of a new training program particularly designed for the remediation of impairments in facial affect recognition. The effects of this "Training of Affect Recognition" (Frommann et al., 2003) was compared with a cognitive remediation program primarily aiming at improving attention, memory and executive functioning, and with treatment as usual without participation in a specific remediation program.

2. Methods

2.1. Sample and design

A randomized three group pre-post design was used to investigate effects of the program "Training of Affect Recognition" (TAR), compared to a cognitive remediation training program (CRT) focusing on cold cognition, and to treatment as usual (TAU) without any special cognitive training. Performance in facial affect recognition and basic cognitive functioning were assessed before (T0) and after (T1) a six week training phase.

After a complete description of the study to the subjects, written informed consent was obtained from a total of 77 schizophrenia patients (ICD-10 F20). Sample characteristics for each treatment condition are given in Table 1. Subjects were recruited in the post acute stage of the disorder from open wards ($n=58$) during the last weeks before discharge and from the outpatient clinic of our hospital ($n=19$). Diagnoses were verified using the International Diagnostic Checklist of ICD-10 (IDCL, Hiller et al., 1996) by a trained psychiatrist (author AP). The study protocol was approved by the local ethics committee and the study was carried out in accordance with the Code of Ethics of the World Medical Association.

No group differences emerged between the three training conditions regarding mean age, crystallized intelligence, number of previous manifestations, and number of in- and outpatients. The CRT group contained a higher rate of female patients, indeed, and TAD and TAU differed in general psychopathology at study intake (but neither in positive nor negative symptoms). However, psychopathological improvement between T0 and T1 did not differ between groups and no gender effects could be found regarding the main outcome variables.

Fifty-three patients completed the six week training phase, while 24 patients prematurely terminated participation due to loss of interest in continuing the training or due to discharge without possibility to further participate in the study (TAD: $n=8$, CRT: $n=10$, TAU: $n=6$). There were no significant group differences between treatment conditions regarding attrition rate. Furthermore, no significant group differences could be found between completers and dropouts regarding age, gender, intelligence, and psychopathological status at study intake.

During the training period all patients received anti-psychotic medication: 71% patients were treated with atypical antipsychotics, 8% patients were treated with typical anti-psychotics, and 21% patients received a combination of typical and atypical anti-psychotics. There were no differences between the three training conditions and no differences between completers and the dropouts regarding medication type.

Table 1
Sample characteristics

	Treatment		
	TAR	CRT	TAU
n	28	24	25
Gender (*n* male)	25	14	21
Age (mean, SD)	31.5 (6.9)	36.7 (11.4)	35.2 (11.1)
IQ (mean, SD)	107.6 (16.0)	105.2 (16.1)	106.3 (14.6)
Number of first episode patients	7	5	3
Number of prior hospitalizations in multiple episode patients (mean, SD)	4.8 (4.1)	6.2 (4.7)	3.3 (2.2)
PANSS-NS			
T0	22.2 (8.6)	20.7 (7.8)	18.6 (7.1)
T1	18.5 (8.4)	18.6 (7.4)	17.2 (7.8)
PANSS-PS			
T0	14.8 (5.9)	14.2 (5.4)	11.8 (4.3)
T1	12.1 (4.7)	12.1 (5.5)	10.2 (3.4)
PANSS-GS			
T0	32.9 (10.0)	30.0 (5.0)	26.7 (6.4)
T1	27.4 (9.0)	26.4 (6.9)	24.0 (6.5)

See text for abbreviations.

2.2. Training conditions

Both active training strategies (TAR, CRT) are based upon manuals comprising 12-session programs. Programs were matched as far as possible regarding non-specific factors, thus only the targeted cognitive process differed. Two sessions of about 45 min were carried out per week. The programs involve restitution and compensation strategies, the principles of errorless learning (Baddeley and Wilson, 1994), direct positive reinforcement, feature abstraction as well as verbalization and self-instruction (Meichenbaum and Cameron, 1973). Each training comprises computer tasks and desk work to about the same extent, with task increasing in complexity and difficulty. The training took place in small groups of two patients and one psychotherapist, i.e., authors NF or SH who intensively participated in the development of the TAR and CRT (TAR and CRT conditions were equally distributed to the two therapists). Most of the time patients work as a team, which is always coached by the therapist. This provides the opportunity to adapt task severity and working speed to the patients' level of performance by repeating or discontinuing tasks and to practice special strategies such as verbalization or self-instruction more intensely. Homework is given in order to enhance generalization of strategies and training contents into everyday life.

The TAR focuses on remediation of facial affect recognition, which roughly cuts into three blocks of four sessions (Frommann et al., 2003): First patients learn gradually to identify and discriminate the prototypical facial signs of the six basic emotions as well as to use verbalization and self-instruction as alternative strategies to analyze facial affect step by step. The second block supports the reintegration of this piecemeal approach to facial affect into an increasingly holistic processing mode with fast decisions, relying on first impression, nonverbal processing, and processing of facial expression with small intensities. The third block comprises the processing of non-prototypical, ambiguous expression of affect often occurring in everyday life and the integration of facial expression into the social, behavioral and situational context.

Since impairments in attention, memory and executive functions are well known in schizophrenia, TAR tries to avoid high demands on these functions. The CRT on the other hand focuses on exactly these functions without addressing any kind of social cognition; in particular the CRT does not deal with facial affect recognition. While the training material used in the TAR was particularly produced for this program, the CRT uses existing computer tasks of the software Cogpack Professional (Version 5.9j, Marker Software). This program is often used for cognitive rehabilitation in patients with brain injuries, but also in schizophrenia patients (see Vauth et al., 2000 for review). Differing from the usual use of the program, Cogpack-tasks concerning attention, memory and executive functions were supplemented within the CRT by desk work and accompanied by compensation strategies like verbalization and self-instruction, in order to correspond to formal aspects of the TAR as far as possible.

Within the TAU condition all treatment strategies usually offered to schizophrenia patients at our clinic were allowed (e.g., medication, psychoeducational therapy) according to clinical demands, with the exception of any specific cognitive training.

2.3. Assessment

Before treatment onset and within one week after the end of treatment the performance regarding basic cognitive functions and regarding facial affect recognition as well as psychopathological status were recorded.

Facial affect recognition was assessed by a multiple choice labeling task (PFA-test) containing 24 pictures (i.e., 2 women and 2 men each expressing the six basic emotions) from the "Pictures of Facial Affect" (Ekman and Friesen, 1976). Test items were not used as training material within the TAR. In order to investigate the specificity of TAR-effects non-affective face recognition was assessed using the Benton Face Recognition Test (BFRT, Benton et al., 1994). Furthermore, attention was assessed by the Concentration-Endurance-Test d2 (Brickenkamp, 1981) and the Trail-Making Test A (TMT-A, Reitan, 1958), memory by the German version of the Auditory Verbal Learning Test (AVLT, Schmidt, 1986) and by Digit Span Forward and Backward from the German revised version of the Wechsler Adult Intelligence Test (WAIS-R, Wechsler, 1981). The WAIS-R subtest Picture Arrangement was used to assess situational understanding, i.e., the comprehension of social scripts. Executive functions were measured by a design fluency test (Five-Point Test FPT, Regard et al., 1982), verbal fluency (German version of the FAS-Test) and by the Trail Making Test-B (TMT-B, Reitan, 1958).

Psychopathological status was assessed by a trained psychiatrist (author AP) using the Positive and Negative Syndrome Scale (PANSS, Kay et al., 1987) with its three subscales "negative symptoms" (PANSS-NS), "positive symptoms" (PANSS-PS) and "general psychopathology" (PANSS-GP).

2.4. Analysis

Statistical analyses were performed according to an intention to treat (ITT) approach with last observations carried forward (LOCF) in all $n=77$ randomized patients. For comparison a completer analysis was computed for those $n=53$ patients fully completing the training. Univariate one way analyses of variance (ANOVA) were used to compare change in performance regarding basic cognitive functions and facial affect recognition between the three treatment groups. Baseline scores at T0 and age were included as two covariates into the analyses of T1-data to adjust for any baseline and age differences. After adjustment the resulting change scores were transformed to z-values in order to obtain comparable measurement units in all cognitive domains. For post hoc comparison in case of a significant main effect, Tukey honestly significant difference tests (HSD) were used.

3. Results

3.1. Performance in facial affect recognition and basic cognition

One way ITT ANOVAs indicated significant main effects for change in facial affect recognition (PFA) and in the three AVLT scores "learning" (i.e., the sum of correct answers across the five presentations of the first list), "recognition" (i.e., the sum of correct answers in the recognition test after the learning phase) and "delayed recall" (i.e., number of correct answers in the free recall test 20 min after the learning phase). Post hoc comparisons revealed that performance in facial affect recognition improved significantly more under TAR between T0 and T1 than under CRT and under TAU (Fig. 1, Table 2). Referring to baseline- and age-corrected PFA scores before z-transformation, patients under TAR on average improved from the common baseline of 16.6 correct answers at T0 to 19.0 correct answers at T1, whereas patients under CRT and TAU only had a mean of 17.1 and 16.8 correct answers at T1, respectively (common standard deviation across $s=2.2$). In

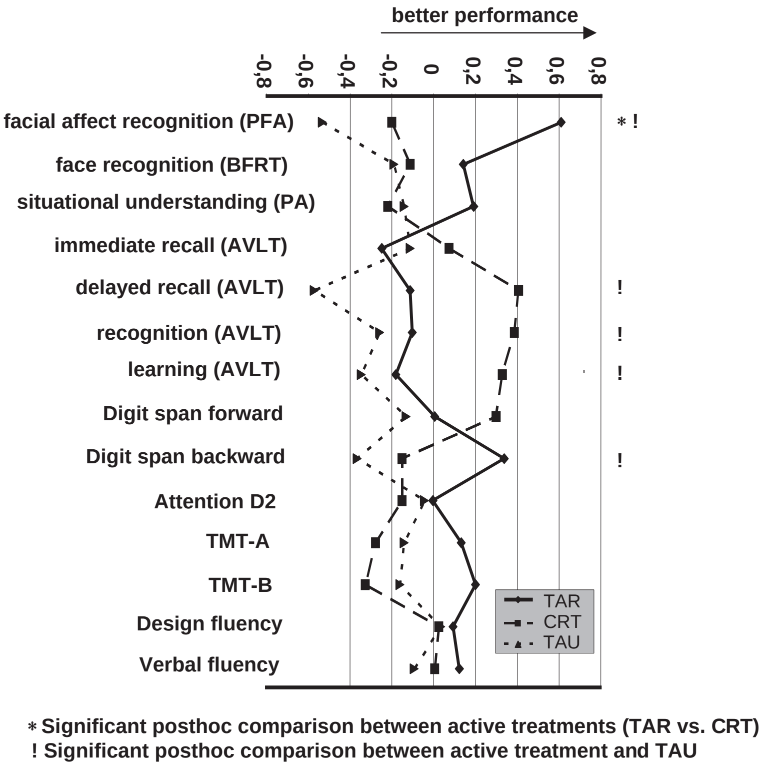

Fig. 1. Z-transformed performance scores after treatment (T1) adjusted for baseline (T0) and age (Training of Affect Recognition, TAR, $n=28$; Cognitive Remediation Training, CRT, $n=24$; Treatment as Usual, TAU, $n=25$).

Table 2
Results of one way ANOVA with post hoc comparisons (Tukey honestly significant difference tests, HSD; MD = difference of group means of post treatment scores adjusted for baseline and age; Intention to Treat ITT analysis)

	ANOVA (df = 2, 74)		Post hoc comparison (TUKEY-HSD)					
			TAR vs. CRT		TAR vs. TAU		CRT vs. TAU	
	F	p	MD	p	MD	p	MD	p
Facial affect recognition PFA	10.288	0.000	0.825	.009	1.167	0.000	0.342	0.443
Face recognition BFRT	0.815	0.447						
Situational understanding WAIS-PA	1.372	0.260						
Immediate recall AVLT	0.786	0.460						
Delayed recall AVLT	7.373	0.001	−0.528	.096	0.472	0.157	1.00	0.001
Recognition AVLT	3.378	0.040	−0.50	.132	0.159	0.813	0.660	0.041
Learning AVLT	3.754	0.028	−0.523	.113	0.166	0.797	0.689	0.029
Digit span forward	1.288	0.282						
Digit span backward	4.038	0.022	0.50	.143	0.714	0.020	0.212	0.711
Attention D2	0.163	0.850						
TMT-A	1.143	0.324						
TMT-B	1.787	0.175						
Design fluency	0.042	0.959						
Verbal fluency	0.331	0.720						

addition patients receiving TAR performed better on the working memory version of the digit span test (digit span backward) than TAU patients (common age-corrected baseline at T0: 6.0; baseline- and age-corrected mean scores at T1: TAR: 6.7, TAU: 5.9, CRT: 6.2; common standard deviation $s = 1.3$). No other significant effects could be demonstrated for TAR.

Under CRT on the other hand a significant larger improvement in the learning and memory scores assessed by the AVLT could be obtained as compared to TAU. Referring to baseline- and age-corrected “learning” scores before z-transformation, CRT-patients on average improved from 39.0 up to 44.5 correctly recalled items between T0 and T1, whereas the other patients did not improve (TAR: 40.8, TAU: 39.5 correctly recalled items at T1, common standard deviation $s = 7.5$). Post treatment “recognition” (AVLT) was significantly better under CRT than under TAU, but not significantly different from TAR (common age-corrected baseline at T0: 11.5; baseline- and age-corrected mean scores at T1: CRT: 12.8, TAU: 11.3, TAR: 11.7; common standard deviation $s = 2.2$). Furthermore, post treatment “delayed recall” (AVLT) was significantly better under CRT than under TAU and slightly significantly better than under TAR (common age-corrected baseline at T0: 7.6; baseline- and age-corrected mean scores at T1: CRT: 8.9, TAU: 6.4, TAR: 7.7; common standard deviation across $s = 2.6$). Other effects of the CRT could not be demonstrated.

Analyses restricted to the $n = 53$ patients completing the trial per protocol substantially confirmed the reported results from ITT analyses: The only effects not confirmed on the basis of the smaller sample of completers were the TAR effect on working memory (digit span backward) and the CRT effect on AVLT recognition performance. However, in completers learning rate (AVLT) after 4 weeks of CRT was not only significantly better than after TAU but also as compared to TAR.

3.2. Relationship between facial affect recognition and basic cognition

A linear stepwise regression analysis with the performance in facial affect recognition as criterion and performance in basic neurocognitive functions as predictors (baseline- and age-corrected T1-scores) revealed attention (d2) and comprehension of social scripts (picture arrangement subtest of the WAIS) as the only significant predictors (d2: $\beta = 0.32$, $p = .007$; WAIS-PA: $\beta = 0.24$, $p = .040$). However explained variance was only 19% (adjusted $R^2 = 0.19$). None of the other cognitive functions showed a significant relationship with facial affect recognition.

3.3. Relationship between facial affect recognition and psychopathology

A further linear stepwise regression analysis with the performance in facial affect recognition as criterion and change in psychopathology as predictors (baseline- and age-corrected T1-scores) revealed a negative relationship between facial affect recognition at T1 and the amount of clinical negative symptoms at T1 ($\beta = -0.28$, $p = .018$), i.e., improvement in facial affect recognition performance was positively related to clinical improvement regarding negative symptoms. However, common variance was only about 7% (adjusted $R^2=0.067$); thus, using clinical improvement as a covariate in the analyses of the performance in facial affect recognition did not alter the above reported results.

4. Discussion

The first aim of the present study was to investigate whether impaired recognition of facial affect in schizophrenia patients could be improved with the newly developed TAR. Actually it could be shown that the TAR significantly improves this important component of social cognition. Compared to the performance of healthy controls from a former study (Wölwer et al., 1996), schizophrenia patients under TAR even approached a normal performance level (see Frommann et al., 2003 for details of analysis). The patients receiving TAU on the other hand did not improve, which is in line with former results demonstrating a considerable stability of impairments in facial affect recognition across different stages of schizophrenia despite treatment with anti-psychotics (Gaebel and Wölwer, 1992; Wölwer et al., 1996; Streit et al., 1997; Addington and Addington, 1998). Considered in the light of the results obtained with the TAR, this stability obviously does not mean that the impairments are not remediable in principle — first evidence of this have previously been found by Penn and Combs (2000). However, special training programs beyond the usual treatment seem to be needed to obtain improvements in affect recognition.

This conclusion is in accordance with the results concerning the second aim of the study, the investigation of the specificity of the treatment effects. For this purpose CRT as an active control treatment had been included in the study. Results demonstrate that CRT only improves verbal memory as a basic cognitive function but not facial affect recognition as a social cognitive function. This is just the opposite pattern of effects as obtained with TAR. This double dissociation of treatment effects strongly proves the specificity of training effects. At the same time these results confirm Bryson et al. (1997), who argued that cognitive training intended to increase attention, memory, and abstract reasoning skills either may not or may only slightly improve affect recognition. They assumed that special remediation programs have to be developed to address this impairment in schizophrenia — the TAR represents such a program.

At the same time these results may be taken as an indirect indicator that impairments in facial affect recognition in schizophrenia are specific deficits and are not only a consequence of basic neurocognitive impairments or only part of a generalized deficit. In line with this conclusion, only moderate relationship between facial affect recognition and basic neurocognitive functions could be found. Though TAR also slightly improved working memory, the results altogether do not support the hypothesis that the improvement in affect recognition was caused by secondary training effects like unspecific cognitive activation or improvements in memory, attention or executive functions. Furthermore, the improvement in affect recognition was not just a spin-off of the psychopathological improvement, nor a function of time or an effect of repeated practice. These alternative explanations can be ruled out since comparable psychopathological improvements occurred in the active and passive control treatments CRT and TAU without comparable improvement in facial affect recognition. Finally, there was no group difference in the number of patients medicated with new generation anti-psychotics. Positive effects on affect recognition have been shown for these new generation anti-psychotics in some studies (Kee et al., 1998; Lewis and Garver, 1995). The present results of the patients receiving TAU or CRT, who with few exceptions were treated with new generation anti-psychotics, demonstrate that these effects — if present at all — fall clearly behind the effects of a special psychological remediation program like the TAR.

Due to the triadic group setting, the personnel expense of the TAR is comparably high. Since intensive coaching and modeling by the therapist is necessary, working with larger groups comprising more than two patients does not seem to be feasible. On the other hand, considering the importance of affect recognition for social functioning (Green, 2001; Hooker and Park, 2002; Ihnen et al., 1998; Kee et al., 2003; Mueser et al., 1996; Penn et al., 1995, 1996, 1997) the high effort seems to be worthwhile. However, the effort may be spread to other professions: Since the TAR has a detailed manual, it may be possible for nursing staff or occupational therapists to assist in training following thorough guidance.

Future studies need to replicate these promising training effects. Future studies also need to verify that training effects of the TAR endure across time and that improvement in facial affect recognition pervade into everyday social functioning. Given these preconditions such training programs could become an important module of psychosocial rehabilitation programs. Although not intended within the TAR yet, it would be of interest whether not only schizophrenia patients with impairments regarding the perception of facial emotions profit from remediation programs but also patients with known impairments regarding the perception of emotions in the auditory modality (e.g., Novic et al., 1984; Borod et al., 1989; Kerr and Neale, 1993) on the one hand and regarding the expression of facial emotions on the other hand (e.g., Kring and Neale, 1996; Gaebel and Wölwer, 2004). In contrast to the present study which included schizophrenia patients regardless of whether they actually demonstrated impairments in facial affect recognition, a modular structure of psychosocial rehabilitation programs would allow each module to be applied matched to the patients' needs. Proceeding in this way may help schizophrenia patients to significantly improve their social functioning.

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