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A clinical case study of a psychoanalytic psychotherapy monitored with functional neuroimaging

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Monitoring via fMRT

- This case study describes one year of the psychoanalytic psychotherapy using clinical data, a standardized assessment instrument of the psychotherapeutic process (Psychotherapy process Q-Set, PQS), and functional neuroimaging (fMRI).
- A female dysthymic patient with narcissistic traits was assessed at monthly intervals (12 sessions).
- In the fMRI scans, which took place immediately after therapy hours, the patient looked at pictures of attachment - relevant scenes (from the Adult Attachment Projective Picture System, AAP) divided into two groups:
- those accompanied by a neutral description, and those accompanied by a description tailored to core conflicts of the patient as assessed in the AAP interview.

Monitoring via fMRT

- Clinically, this patient presented a defense structure that influenced the relationship with the therapist and that was characterized by fluctuations of mood that lasted whole days, following a pattern that remained stable during the year of the study.
- The two modes of functioning associated with the mood shifts strongly affected the interaction with the therapist, whose quality varied accordingly (‚easy ' and ‚difficult ' sessions).
- The PQS analysis showed the association of 'easy' sessions with involvement with relationship issues, and of 'difficult sessions with self-distancing, a defensive manoeuvre common in narcissistic personality structures.

Monitoring via fMRT

- In the fMRI data, the modes of functioning visible in the therapy sessions were significantly associated with modulation of the signal elicited by personalized attachment-related scenes in the posterior cingulate (p=0.017 cluster-level, whole-volume corrected).
- This region has been associated in previous studies to self-distancing from negatively valenced pictures presented during the scan.
- The present study may provide evidence of the possible involvement of this brain area in spontaneously enacted self-distancing defensive strategies, which may be of relevance in resistant patient reactions in the course of a psychoanalytic psychotherapy.

Single Case Monitoring

- The aim of the present study was exploring for the first time the feasibility of single case research of an ongoing psychoanalysis in a neurobiological context using repeated fMRI measurements.
- We pursued the integration of clinical presentation, of operationalized formal instruments to describe the individual psychotherapeutic process, and of neuroimaging techniques to monitor the psychotherapeutic process on both the clinical and the neural levels.

Single Case Monitoring

- One year of psychoanalytic therapy of a patient with a chronic depressive disorder and narcissistic traits was assessed at monthly intervals (N=12 sessions) with an established measure for the characterization of therapy (The Psychotherapy Process Q-Set, PQS, Jones 2000),
- and with a functional neuroimaging probe that was successfully used to elicit signal in an adult attachment context in a previous study of the psychoanalytic treatment of recurrent depression (Buchheim et al. 2012).

The Patient

- The patient, a 42 years old female lawyer, suffered from rapidly fluctuating affective states. Waking up the morning she knew that „this will be an easy day“ or “this will be a difficult day“
- Her capacity for successful work and concentration was reduced when she felt depressed and in a “difficult day mood“.
- During these occasions she isolated herself, tended to withdraw from relationships, and worked hard to hide her emotional vulnerability.
- This chronic and fluctuating depressive pathology and a fragile, vulnerable perception of self and others brought her in a psychoanalytic treatment consisting of 2 sessions per week.

Assessment

- In order to obtain an objective assessment of the psychotherapy process describing the psychodynamic pattern of the patient and the interaction between the patient and the therapist,
- 12 sessions at monthly intervals were audiotaped, transcribed and analyzed with the PQS approach.

Psychotherapy Proces Q-Set

- The Psychotherapy Process Q-Set (PQS, Jones 2000) is a rating instrument designed to provide a basic vocabulary for the description and classification of psychotherapy processes in a form suitable to quantitative analysis (Q-sort methodology).
- The PQS captures a wide range of events in the psychotherapeutic session 42 attributable to both the therapist´s activity and the patient, including transference manifestations, resistance, and the accompanying affective states.

Functional Neuroimaging Scans

- Functional neuroimaging scans were taken on the same days as the recorded therapy sessions.
- As in a previous study (Buchheim et al. 2012), attachment-relevant scenes were used to capture individual attachment related features relevant for the psychotherapeutic relationship.
- In the scanner, the patient looked at the scenes used in a formal measure for the assessment of adult attachment representations (George and West 2008, 2012).
- These scenes were alternately accompanied by sentences neutrally describing their content, or by sentences that referred to the personally relevant content evoked by them as extracted by a previous AAP interview.

Functional Neuroimaging Scans

- The contrast of interest was the difference between the signal evoked by the personalized and the neutral textual descriptions of the scenes.
- This contrast detected neural substrates activated by the appraisal of the personal element in the attachment scenes, at the net of generic activations due to the perceptual encoding of the scenes and reading the textual description.

The Main Question

- The main question we were interested in examining was the extent to which the data from functional neuroimaging could be brought to bear on our theoretical understanding of the psychoanalytic process.
- Likewise, we were interested in verifying if existing interpretations of cortical activity gained in controlled experimental settings from neuroimaging studies would maintain their explanatory power in the context of the single case study of a psychoanalytic process.
- A crucial question was therefore the existence of an association between symptoms, the character of the relationship with the therapist in individual therapy hours, and variation in the signal from the attachment-scenes probe in the scanner.

2. Methods and Materials: 2.1.participants

- The *analyst* was a very experienced training analyst with an interest in research. She agreed to take part in our study and to audiotape one therapy session a month for the PQS- analysis. She works in a private practice as a MD.
- The *patient* also agreed to take part in the study. She was given information about the study and signed a declaration of her willingness to participate for one year and to be assessed with several questionnaires and the functional neuroimaging scans. The treatment was paid by the health insurance.
- This study was approved by the ethical committee by the University of Ulm in the context of the Hanse-Neuro-Psychoanalysis Study (Buchheim et al. 2008, 2012)

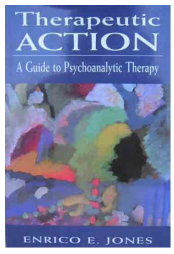
2.2 Treatment

- This patient was treated with a long-term psychoanalytic setting (face-to-face) two sessions per week. Key techniques included interpretive interventions aiming to enhance the patient´s insight into her repetitive conflicts sustaining her problems; supportive interventions aimed to strengthen abilities that were temporarily inaccessible to the patient´s owing to acute stress (e.g. traumatic events) or were not sufficiently developed.
- The establishment of a helping (or therapeutic) alliance is regarded as an important component of supportive interventions. Transference, defined as the repetition of past experiences in present interpersonal relations, constitutes another important dimension of the therapeutic relationship. In psychodynamic psychotherapy, transference is regarded as a primary source of understanding and therapeutic change (e.g. Fonagy & Kächele 2009).

2.3 Clinical Outcome Variables

- *2.3.1 Clinical rating of the hour by the therapist*
- The analyst rated on a subjective level if the sessions were „difficult“ or “easy“.
- *2.3.2 Psychopathology monitoring with self-rating scales*
- At each scanning session, the patient filled a number of self-rating scales documenting her psychopathological state.
- State depressiveness was rated with the CIPS-depressiveness scale (German version, Zerssen 1976). The general burden of symptoms was gauged with the OQ-burden subscale (German version, Haug et al. 2004).

2.3.2 Psychotherapy Process Q-Set



- The PQS identifies both the unity and coherence of treatment sessions, and detects changes between hours and patients.
- The PQS-instrument shows excellent inter-rater reliability, item reliability, concurrent and predictive validity for several studies and various types of treatment samples (see Levy et al. 2012).

2.3.2 Psychotherapy Process Q-Set

- The inter-rater reliability, assessed for all 100 items and tested by correlating the Q-sorts of multiple raters, is high as evidenced by levels of inter-rater agreement/reliability (kappa ranges from 0.83 to 0.89).
- Reliability varies from adequate to excellent for individual items, giving values between .50 and .95 (see Levy et al. 2012).
- In this study verbatim transcribed sessions were coded by two independent raters, who were blind to all therapy hours. Two independent trained judges rated all 12 psychotherapy sessions and achieved a correspondence of kappa between .80 and .97.

Hypothesis Testing on PQS Items

- Hypothesis testing on PQS items were conducted on the linear trend (the months of therapy from 1 to 12) and on the classification of „easy“ and “difficult“ sessions provided by the analyst.
- Tests were carried out independently on each PQS item, correcting for the multiple comparison using a permutation method with 2000 steps (Blair et al. 1994).
- In this approach, at each permutation the maximal (minimal) *t*-value obtained from conducting the test on the PQS item was recorded.
- The significance levels of high (low) *t*-values, with adjustment for multiple testing, were given by the quantiles of the recorded maximal (minimal) *t*-values.

2.4. Neuroimaging Outcome Variables

- The neuroimaging session took place on the same day as the recorded psychotherapy session.
- It consisted of the task in the scanner and in the administration of a rating instrument to assess the patient's reaction to the items presented in the scanner.

2.4.1. Neuroimaging Task

- In each trial, the patient looked at pictures of attachment-relevant AAP scenes, accompanied by a short descriptive text. Each picture was presented for 20 sec., followed by a fixation point for about the same duration (Figure 1).
- The AAP consists of a set of seven of such pictures; this set was repeated 12 times, for a total of 84 trials.
- Repetitions of the set were divided into two groups: those in which the descriptive text was a neutral rendering of the figures appearing in the scene (*neutral trials*), and those where the description was tailored to core conflicts of the patient as assessed in the initial AAP interview (*personalized trials*).

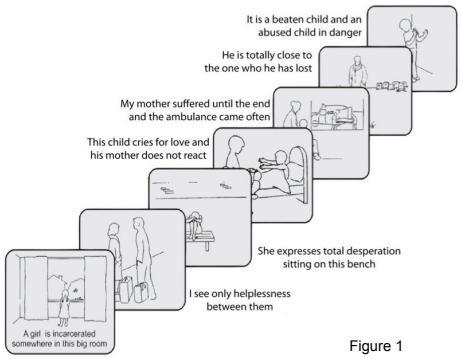


Figure 1

Emotional Involvment

- To monitor the extent of emotional involvement and autobiographical character of the three core-sentences during the course of the psychotherapy, we administered a self-rating questionnaire to the patient after each fMRI session.
- In the questionnaire the patient was asked to rate the personalized sentences from the AAP scenes used in the scanner by answering the following two questions: "How much of the sentence applies to you autobiographically?" and "How strong did this sentence move you emotionally?".
- The patient had to assign a score between 1 and 7, where 1 meant not at all, 4 meant middle intensity, and 7 meant very much.

2.4.2. Image Acquisition

- MRI data were recorded using a 3-T Magnetom Allegra head scanner (Siemens, Erlangen, Germany), equipped with a standard head coil. In each session, 508 EPI T2*- weighted whole brain volumes were acquired (TR/TE = 2500/30ms, flip angle 90degree, FOV 192 mm, matrix 64 x 64, voxel size 3 x 3 mm, slice thickness 3 mm, 44 slices, standard AC-PC orientation).
- Sessions were repeated in monthly intervals for a year, for a total of 12 sessions.

2.4.3 Preprocessing and Statistical Analysis of Neuroimaging Data

- Data were analyzed with the SPM package (Statistical Parametric Mapping, Frackowiak et al. 2003), using a voxelwise approach.
- After realignment and normalization into Montreal Neurological Institute (MNI) space, volumes were smoothed with a Gaussian isotropic kernel (8 mm full width-half maximum).
- The blood oxygenation level-dependent (BOLD) response function was modeled by convolving the trial onsets with a standard hemodynamic response function.

2.4.3 Preprocessing and Statistical Analysis of Neuroimaging Data

- Effects of interest were estimated for each session separately (in a model that included presentation of the scene + textual description combination and whether the combination was personalized or not) and brought to the second level to account for a random effect of sessions (Penny and Holmes 2007).
- At the second level, main effects were tested with one-sample t tests.
- The interaction between quality of the hour and personalized effect was given by an additional second-level regressor indicating whether the hour was "easy" or "difficult".
- Note that this regressor is orthogonal to the one-sample t test of the personalized effect (Viviani 2010).

2.4.3 Preprocessing and Statistical Analysis of Neuroimaging Data

- The main effect of interest of the study was given by the contrast relevant vs. neutral, and its interaction with the index of the quality of the session, as indicated by the therapist and its operational characterization through the PQS scores.
- To identify regions associated with the presentation of the personalized trials, we performed a whole-brain estimation of the model voxel by voxel.
- The significance levels reported in the text of the Results section are corrected at cluster level for the whole volume.

2.4.3 Preprocessing and Statistical Analysis of Neuroimaging Data

- The post-scanning self-rating scales were analyzed separately from neuroimaging data using a freely available package R.
- The dependent variable (emotional involvement or extent of autobiographical character of the scene-sentence couple) was modelled in a repeated measurements linear model as an effect of the hour character ("easy" or "difficult") and the relevant AAP scene as fixed effects, and the session and the sentences as grouping variables for the random effects.

3. Results

3.1. Clinical Description of the Patient

- The patient, a 42 years old lawyer, suffered since the birth of her first daughter from rapidly fluctuating affective states.
- During the so called „difficult days"-states she isolated herself and tended to withdraw herself in relationships and hide her emotional vulnerability in contrast to the so called „easy days"-states, where the patient felt self-conscious and full of personal strength.
- Regarding her personality structure she showed some narcissistic features being self-centered and rather achievement oriented. She defined herself frequently via money, success and reputation.

3.1. Clinical Description of the Patient

- When she felt in her job that clients were not as satisfied with her work as she expected from herself she broke down and was ruminating anxiously if they will come back.
- This pattern demonstrated that her self-esteem fluctuated according to the gratifying or frustrating experiences in relationships and how she evaluated the distance between the goals and aspirations.
- Because of her harsh super-ego demand for perfection she was in an instable inner state and self-esteem could be diminished rapidly.

3.1. Clinical Description of the Patient

- The patient lived in a long-lasting relationship.
- However, she characterized the relationship with her husband as competitive with respect to their tendency to experience rivalry and envy.
- Moreover, there was a clear discrepancy between her self-perception and the perception that significant others had of the patient.
- Although easier days were subjectively felt more pleasant by the patient, her husband reportedly found it very difficult to deal with her.
- This often led to constant, seemingly unsolvable conflicts and to repeatedly considering separation.

3.1. Clinical Description of the Patient

- One of her major unconscious defensive structure seemed to circle around fantasies of success and grandiosity, leading to her dependency to be admired by others and to bouts of insecurity disrupting her sense of grandiosity or specialness
- (for a description of the related dynamic, see Kernberg and Yeomans 2013).

3.1. Clinical Description of the Patient

- According to the observations of the analyst, the following topics may be considered key to the psychodynamic understanding of the patient and her treatment:
- On“ „difficult“ days the patient showed a severely inhibited capacity to think and to express feelings and thoughts and fell into silence.
- On “easy“ days the patient talked expansively and her personality appeared strong.The association of the fluctuating symptoms with unresolved loss experiences and fear due to uncontrollable guilt-feelings.
- As we shall see later, these two core issues could be retrieved in the formal assessment of the interaction between the patient and the therapist using the PQS methodology.

3.1. Clinical Description of the Patient

- From a psychodynamic and biographic perspective the analyst suggested that the patient´s symptoms might be connected to two events of death, which revealed the underlying vulnerability of the patient with respect to this issue and the related latent feelings of helplessness and impotence.
- When the patient was thirty years old her mother died unexpectedly. She felt guilty, because she was unable to call the emergency doctor in time.
- Moreover, the tragic loss through death of a colleague some years previously coincided with 18the birth of her first child, a son. .

3.1. Clinical Description of the Patient

- Again the patient felt guilty, because she was not able to reach her colleague in time to be able to help her. Her fluctuating depressive symptoms might be interpreted as the outcome of this defensive structure.
- On „easy days“ her functioning was predominantly characterized by externalization with an increase of activity and personal strength, while on “difficult days“ internalization led to inhibition of activity and severe self- doubts.
- These latter phases were characterized by affective distance between the patient and her object world in an effort to preserve the illusion of control relative to object loss (Modell 1975).

3.1. Clinical Description of the Patient

- Since the patient demonstrated a complex chronic affective disorder with difficult personality traits and a rigid defensive structure, there was an indication for long-term psychoanalytic treatment with two sessions per week (Leichsenring and Rabung 2011).
- The treatment setting was face-to-face, thus creating a positive stable counter pole to her mood changes. The positive stabilizing effect of the therapy was noticeable early in the treatment even though the total process was taking a very long time.
- The treatment centered on the deeper understanding of her uncontrollable mood-shifts and her impaired self-perception and perception of others. The question of failure and/or the continuing of the analytic work were constantly present.

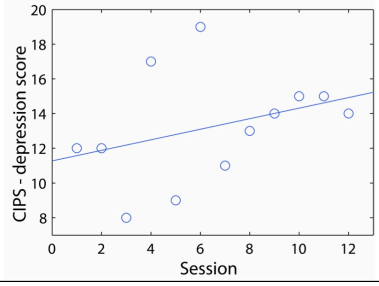
3.1. Clinical Description of the Patient

- The transference relationship was mirrored by her experiences of loss: She failed to prevent the unexpected deaths, and for a long time the analyst and the patient failed to prevent the unexpected mood-shifts and to find ways how she could regulate and stabilize her affective instability.
- Gradually, the patients internalized a better perception of her self and it became easier for the patient to succeed regulating her mood toward the state characterizing „easy“ days.
- One major focus of the treatment was to increase the patient´s ability to react timely in case of severe events like illness or death, and therefore to be able to process these potential traumatic events in a more controlled and integrated way.

3.2. Analysis of self-rating scales

- Analysis of the CIPS-depressiveness score gave a mean value of 12.2 (SD 5.2, range 8- 19).
- The regression of the scores over time failed to demonstrate the existence of changes.
- Nominally, in the examined monthly sessions the patient became more depressed during the year she was monitored (Figure 2), but the result was far from significant (t = 1.05; df = 10, p 3= 0.34, two-tailed).

CIPS Depression Score



OQ- General Burden of Symptom

- The general burden of symptom, as measured by the OQ subscale, was on average 41.75 (SD 5.0, range 33.53), indicating alternating degree of symptom severities crossing the line of norm values (Haug et al. 2004).
- Like depressiveness, the symptom burden also increased lightly, but not significantly, during this period (t = 1.16, df = 10, p = 0.27, two- 9tailed).

3.3. PQS scores

- The analysis of the PQS scores took place in three steps. In the first step, we undertook an explorative analysis to answer the question of whether there were consistent changes over time across different items of the PQS, by carrying out a principal component analysis of the PQS scores.
- This analysis aimed at detecting items that were high or low together in the same session, without imposing *a priori* constraints on what these items should be, as would be the case if items had been grouped into preformed scores.
- We also looked at whether these 17changes were consistent with a linear trend (i.e., a gradual change over time). In the second step, we looked at the existence of items that were associated with the analyst´s classification of the hours in good and bad.
- In the final step, we looked at whether changes detected during 20the explorative analysis related to the changes associated with the analyst´s judgment.

3.3. PQS scores

- In the principal component analysis of PQS scores, the first detected component, which explained about 32% of the variance of PQS items over time, was highly significant ($p < 230.001$).
- A second component only reached trend significance ($p = 0.06$), explaining 16.7% of the overall variance over time.
- Further components, explaining 13% of the variance of less, failed to reach significance even at trend level.
- The ten items scoring highest in the first and second component are shown in Table 1.

3.3. PQS scores

Table 1. Ten highest scoring items from the principal component analysis of the PQS

Polarity	Weight	PQS item
		FIRST COMPONENT
+	0.41	25: Patient has difficulty beginning the hour.
+	0.33	12: Silences occur during the hour.
−	-0.30	54: Patient is clear and organized in self-expression.
+	0.25	7: Patient is anxious or tense (vs. calm and relaxed).
−	-0.21	13: Patient is animated or excited.
−	-0.21	23: Dialogue has a specific focus.
−	-0.20	74: Humor is used.
+	0.16	8: Patient is concerned or conflicted about his or her dependence on the therapist (vs. comfortable with dependency, or wanting dependency).
−	-0.16	87: Patient is controlling.
+	0.15	15: Patient does not initiate or elaborate topics.

3.3. PQS scores

		SECOND COMPONENT
−	-0.29	30: Discussion centers on cognitive themes, i.e. about ideas or belief systems.
−	-0.28	31: Therapist asks for more information or elaboration.
+	0.27	40: Therapist makes interpretations referring to actual people in the patient's life.
−	-0.25	45: Therapist adopts supportive stance.
+	0.25	63: Patient's interpersonal relationships are a major theme.
−	-0.22	12: Silences occur during the hour.
−	-0.21	66: Therapist is directly reassuring
−	-0.20	95: Patient feels helped.
+	0.19	1: Patient verbalizes negative feelings (e.g. criticism, hostility) toward therapist (vs. makes approving or admiring remarks).
+	0.19	49: The patient experiences ambivalent or conflicted feelings about the therapist.

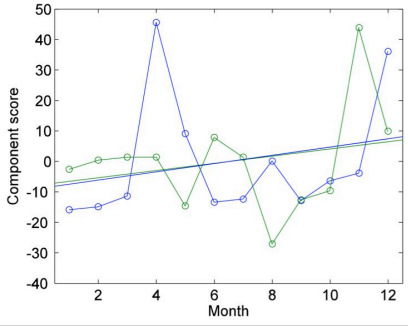
Existence of a Linear Trend?

- We then tested the existence of a linear trend in the changes over time in these component scores. This would have been the case, for example, if the character of the hours changed over the year of therapy, and these components reflected this systematic change.
- However, the regression of the component scores on the time trend was not significant (first component: t = 0.99, df = 9, p = 0.35, two-tailed; second component: t = 0.82,df = 9, 33, p = 0.43, two-tailed), suggesting that they did not change over time (Figure 3).
- Even if the main components did not appear to reflect a change over time, it is conceivable that some other isolated item did.

Trends over Time ?

- To verify this hypothesis, we tested the regression of each item score over time separately, correcting the significance level for the 100 tests.
- Also this analysis failed to detect items reflecting a change over the year of therapy. The item that was most associated with time was item 76 (‚therapist suggests that patient accept responsibility for his or her problems', which however failed to reach significance (t = 4.22, p = 0.14, two-tailed corrected for multiple comparisons).
- In summary, change over time in the PQS scores did not document a systematic change after one year of therapy relative to the beginning of the monitoring period.

PQS Components



Second Step

- In the second step of the analysis we looked at the existence of items that were associated with the analyst´s classification of the hours in “easy and difficult“.
- Both ‚easy ‘ and ‚difficult ‘ sessions occurred during this year, and a logistic regression of the occurrence of ‚easy ‘ session over time showed the absence of a significant time trend (z = −0.53, p = 0.60).
- The separate regression of each PQS item on the analyst indicator of the quality of the hour detected three significant items, after correcting significance levels for multiple comparisons: item 12 (‘Silences occur during the hour“), t = −9.16, p = 0.004 (two-tailed, corrected); item 961 (‘Patient feels shy and embarrassed (vs. un-self-conscious and assured ‘), t = −5.76, p =100.03; item 54 (‘Patient is clear and organized in self-expression ‘), t = 5.39, p = 0.04. A fourth 11item reached trend significance, item 7 (‘Patient is anxious or tense (vs. calm and relaxed) ‘), t = −4.95, p = 0.063.

Third Step

- Finally, we looked at whether changes detected during the explorative analysis related to the changes associated with the analyst´s judgment.
- There was a significant association 15between the first component scores and the analyst´s indicator of the quality of the hour 16 ($t = -5.03$, df = 9, $p = 0.0006$).
- The second component, in contrast, was not significantly associated ($t = 1.01$, df = 9, $p = 0.33$).

3.4. Attachment Data

- The patient was administered the AAP interview at the beginning of the fMRI 20experiments and one year later.
- The AAP interview had two purposes. On the one hand we assessed the patient´s attachment representation at the beginning of the fMRI assessment and on the other hand we extracted core sentences of the patient´s narratives in the AAP interview as the personalized stimulus material in the fMRI setting (see neuroimaging task).
- The patient was classified as unresolved (i.e. disorganized).

3.4. Attachment Data

- Unresolved stories typically leave characters without protection, describe feelings of extreme mental distress that have not been diminished or transformed, or leave threatening images looming without addressing them further.
- The patient demonstrated a lack of resolution especially in the AAP Picture ‚Cemetery ' where the loss of the father was associated with mourning, loneliness and a present dialogue with the dead father, which indicated a spectral quality.

3.5. Core Psychodynamic Features of the Patient and PQS Results

- We compared the clinical features of "difficult" and "easy" days with the independent PQS analysis (see Table 2).
- This comparison revealed convergent patterns. We conclude that the PQS analysis could validate the subjective evaluations of the analyst.

3.5. Core Psychodynamic Features of the Patient and PQS Results

Table 2. Clinical characteristics compared to PQS-Items (principal component analysis)

Clinical characteristics	PQS-Items
On "difficult" days the patient showed a severely inhibited capacity to think and to express feelings and thoughts and fell in silence.	Item 25: Patient has difficulty beginning the hour. Item 12: Silences occur during the hour. 15: Patient does not initiate or elaborate topics. Item 15: Patient does not initiate or elaborate topics.
The association of the fluctuating symptoms with unresolved loss experiences and fear due to uncontrollable guilt-feelings	Item 7: Patient is anxious or tense (vs. calm and relaxed). Item 8: Patient is concerned or conflicted about his or her dependence on the therapist (vs. comfortable with dependency, or wanting dependency).

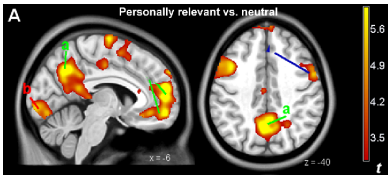
3.6. Analysis of Post-scan Self-rating Questionnaire

- The self-rating data confirmed the existence of a qualitative difference between "easy" and "difficult" days through the tendency of a higher self-rated emotional involvement on "easy" days.
- However, over and above this association, there was an even stronger association at each individual rating between the level of self-involvement and the level of autobiographical character of the scene+text combination.

3.7. Neuroimaging Results

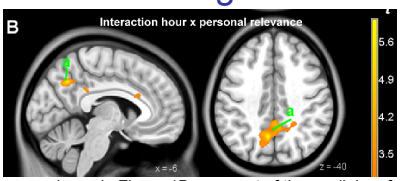
- When viewing the pictures described by personalized text, relative to those with neutral descriptions, the patient activated several areas, prevalently on the left, known to be active while focusing attention to a task (Corbetta et al. 2008; Shulman et al. 1997).
- The most prominent activations involved the ventrolateral and the dorsolateral prefrontal cortex, the perigenual portion of the medial prefrontal cortex, the posterior cingulus and precuneus, the middle temporal gyrus and the anterior tip of the inferior temporal gyrus, and the occipital/calcarine cortex (see Figure 4A and Table 3).
- No area was significantly more active when looking at the neutral scenes

Imaging Findings



The interaction of the effect of personal relevance with goodness of therapy hours was significant in the posterior cingulus/precuneal region.
Here, the signal while looking at personalized scenes was higher when the therapy hour was bad.

Comments on Imaging Findings



- This area, shown in Figure 1B, was part of the medial prefrontal network that was associated with viewing personalized scenes.
- Other, smaller areas detected in the interaction failed to reach significance. No significant interaction was observed in the opposite direction.

Comments on Imaging Findings

- We also tested the interaction between the effect of personal relevance and a linear time trend, to detect changes in activation that developed during the year of therapy.
- In the interaction with the positive time trend, a cluster extending from the left postcentral gyrus to the middle frontal gyrus was significant (MNI coordinates, *x*, *y*, *z*: −54, −12, 40, *t* = 10.2, cluster size in voxels: 1410, $p < 0.001$).
- This interaction partially overlapped with the prefrontal interaction in Figure 4A (d, dorsolateral prefrontal cortex).
- No effect was observed in the interaction with a negative time trend.

4. Discussion

- Recently, the issue of the relationship between Freudian thought or psychoanalytic theory and technique more generally and neuroscience has been the object of renewed interest
- (Carhart-Harris et al. 2008, 2010; Solms and Panksepp 2012; Zellner 2012; Schmeing et al. 392013).

4. Discussion

- In the present study, we attempted to integrate a clinical description of the psychoanalytic process with two empirical instruments, one providing an operationalized assessment of the therapeutic interaction, and the other information on brain activity based on a functional neuroimaging probe.
- Our aim was to explore the extent to which the two main mental states of the patient and their effect on the psychoanalytic interaction could be observed not only at the clinical level, but also through the data delivered by these two additional instruments.

4. Discussion

- Analysis of the symptomatic scales gave the picture of a patient with intermitted 5symptom severity of moderate intensity.

4. Discussion

- The analysis of the PQS data showed that sessions differed along a main axis, defined by the first component. This component was highly correlated with the judgment of the 8analyst on the quality of the sessions.
- This analysis revealed that ‘easy ‘ sessions were associated with items describing working through relationship issues, ‘difficult ‘ session with silence in the therapy hours and difficulties of the patient to feel at ease.
- Furthermore, there was no evidence in the PQS data of a linear trend over time that reflected systematic changes from the initial to the final phases of the year monitored by the study.

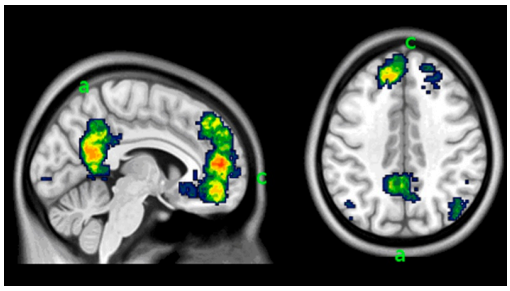
4. Discussion

- In summary, the main change across sessions present in the PQS data was the one documented by the analyst through her judgment in a phase of therapy where the patient remained stable.
- This source of change was not associated with a time trend, as "easy" or "difficult" days did not occur more often at the beginning or end of the observation year.
- This allows excluding the confounds of habituation or learning effects from the regressor representing quality of the session.

4. Discussion

- The activation pattern in the contrast of the main effect relevant vs. neutral (Figure 4A) was consistent with the activation found in studies in the literature in which participants were asked to judge the degree to which stimuli presented during the scan were attributed to the self, or were felt to be part on oneself/one´s own description (Figure 5);
- for a systematic review and meta-analysis of the literature, see van der Meer et al. 2010, Qin and Northoff 2011).

Imaging Findings Fig. 5



Discussion

- Within this pattern of activation of areas associated to the self, the posterior cingulate cortex was modulated by the interaction with the quality of the sessions that had immediately preceded the scan.
- This association represent evidence of a neural substrates accompanying opposing mental states that, as shown in the self-rating scales, the judgment of the analyst on the quality of the session,
- and the formal instrument for assessing the therapeutic exchange, represented a coherent constellation of internally experienced and interpersonally exchanged affect.

Discussion

- The posterior cingulate cortex has been shown in other studies to be modulated by self- distancing from negatively valenced pictures presented during the scan (Koenigsberg et al. 342010)
- or when down-regulating the reaction to a negative stimulus by self-distraction (Kanske 35et al. 2011).
- Of particular interest in the present context is the study by van Reekum et al. 36(2007), in which gaze fixations were recorded while participants viewed aversive scenes and were left free to choose the down-regulating strategy.

Discussion

- This area highly correlated with the amount of eye movements of the participants, who were directing their gaze so as to avoid the focal area of the image where the disturbing content was represented.
- This area was also reported to be active in regulation strategies adopted by patients with personality disorders characterized by poor emotion regulation
- (Koenigsberg et al. 2009; Doering et al. 2012; Lang 42et al. 2012).

Discussion

- The self-rating data collected after the scan confirmed the association between the enactment of a self-distancing strategy from the material and the quality of the hour.
- On "difficult" days, the patient indicated that her overall emotional involvement with the visuotextual material was lower than on the "easy" days.
- This corresponded to a higher activity in the posterior cingulate area, associated in the previous studies with self-distancing emotion regulation strategies.

Discussion

- In view of the documented association between the quality of the session and the quality of the interaction with the therapist, and the clinical judgment of the therapist himself,
- the present study provides evidence on the possible involvement of the posterior cingulate area in spontaneously enacted self-distancing emotion-handling strategies representing defensive maneuvers in the course of a psychoanalytic therapy.

Discussion

- Among the areas active in the contrast personally relevant vs. neutral there were also 10areas prevalently involved in attentional processes (dorsolateral prefrontal cortex, Figure 4A letter c).
- Also this area was modulated during the year of therapy, showing a progressive increase of the signal due to personally relevant trials.
- This suggests a dissociation of the areas detected in the contrast personally relevant vs. neutral, with the posterior medial area associating with quality of the session, and the dorsolateral prefrontal areas associating with change over time.

Discussion

- The change over time in the dorsolateral prefrontal cortex might be due to a progressive loss of attentional pull of the non-relevant trials, or to the increased recruitment of attentional resources in looking at scenes in the personally relevant trials.
- From a clinical point of view it could mean that the patient was more effective in appraising and reflecting on her own personal core attachment-related issues.

Discussion

- In summary,
- this case report gives indications on the interplay between activity in neural circuits and quality of the psychotherapeutic sessions in the context of psychoanalytic process research.
- In this specific single case, major characteristics of the patient´s defensive structure could be demonstrated on a behavioral and neural level and validated the subjective evaluation of the analyst.

Discussion

- Specifically,
- affective distancing has been identified in the literature as a hallmark defensive maneuver in personality organization with narcissistic traits (Modell 1975).
- Using functional neuroimaging, we were able to objectify the defensive structure of this patient during this phase of psychoanalytic treatment and the occurrence of difficult sessions.

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