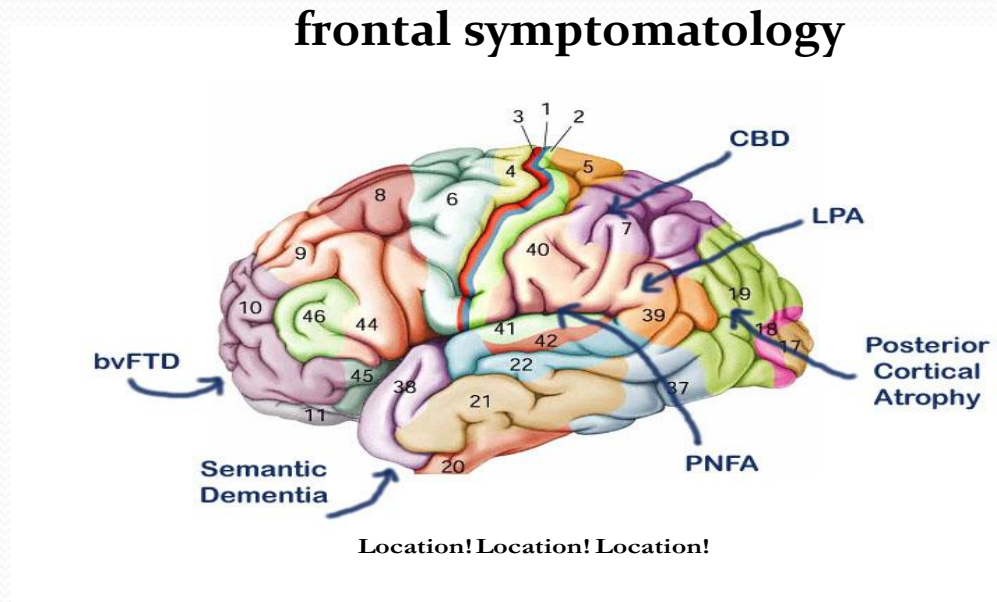


# Impact of a Neurofeedback Training Program on patients suffering from frontal pathology and on their spouses

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Presented and revised by Daniel Wagner

## Frontal symptomatology: Presenting conditions

- Personality Disorders
- Motor Skills Disorders
- Attention Deficit Disorder and Mental Flexibility Impairment
- Impairment of verbal behaviors (linguistic behavior/personality instability)
- Cognitive Disorders
- Emotional Disorders



# Frontotemporal lobar degeneration (FTLD)

## Behavioral Variant of FTLD: FTD

- Apathy Side
- Decline in behaviors
- Decline in activity level
- Decline in emotional responsiveness (emotional blunting)
- Hyperactivity side
- Excessive responses to surrounding environment
- Disinhibition
- Violation of social and moral norms

For all activities with a specific aim (Marin 1990)

## Study by Menez and al (2010) on 46 patients with FTD

- 84,8 % OF PATIENTS PRESENTING WITH APATHY
- 32,6 % OF PATIENTS PRESENTING WITH DESHINIBITION
- 10,9 % OF PATIENTS PRESENTING WITH DYSEXECUTIVE SYNDROME
- 8,7 % OF PATIENTS PRESENTING WITH PERSEVERATIVE AND STEREOTYPED BEHAVIOR
- 10 % OF PATIENTS PRESENTING WITH LOSS OF EMPATHY

# bvFTD symptoms

Gradual onset of symptoms and progression

**Apathy**

**Disinhibition**

**Loss of empathy**

Impaired insight

Distractibility

Mental rigidity

Abnormal eating behaviour

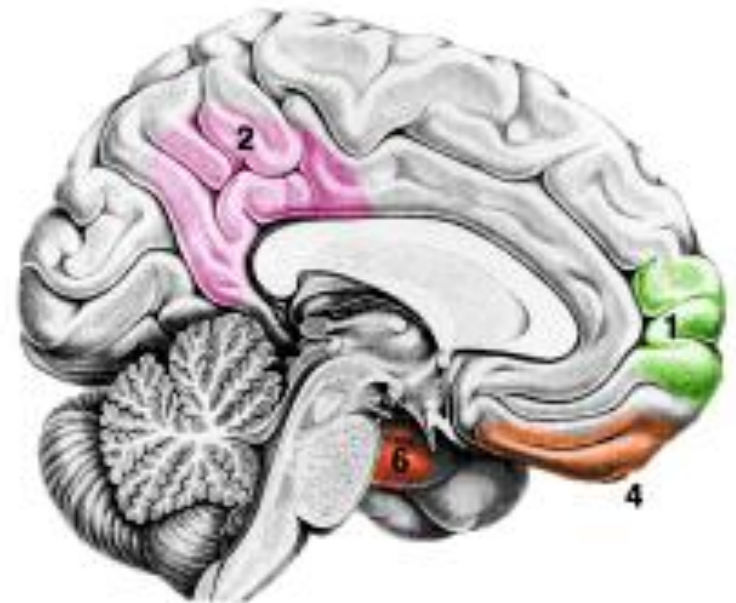
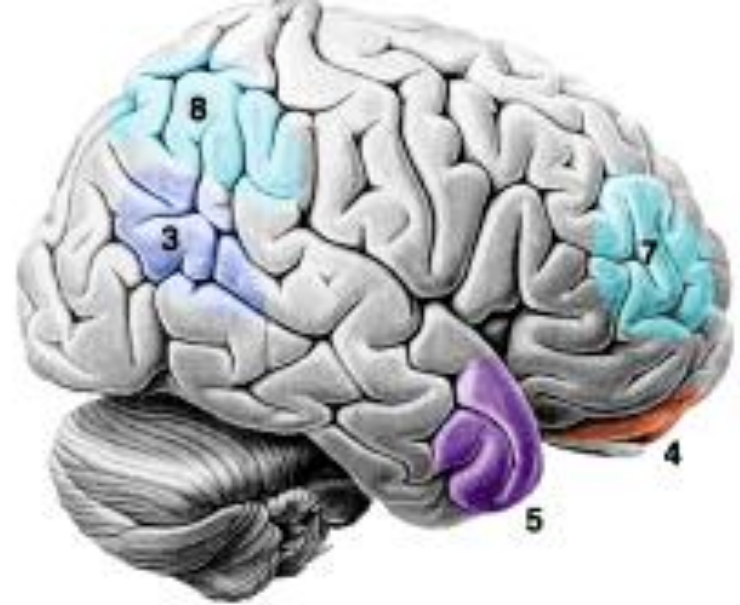
Stereotypical and ritualistic behaviour

Impaired emotion recognition

Impaired judgement and planning

Neglect of self-care

vs Consensus criteria (Neary, et al 1998)



# Progressive Supranuclear Palsy (PSP)

- Altered behavior on the apathetic side
- Impulsivity
- Aggressive behavior
- Impaired attention
- Dysexecutive syndrome

## Acquired sociopathy and psychopathy (Blumer and Benson 1975, Damasio 1991-1995, Blair and al 2000 )

- Emotional and personal instability
  - Violation of social norms
  - Disinhibited behavior
  - Tendency to tell inappropriate jokes
  - Making inappropriate sexual comments/exhibiting inappropriate sexual behavior
- 
- Phines Gage (Stuss and al 1992)
  - Patient EVR (Eslinger and Damasio 1985)

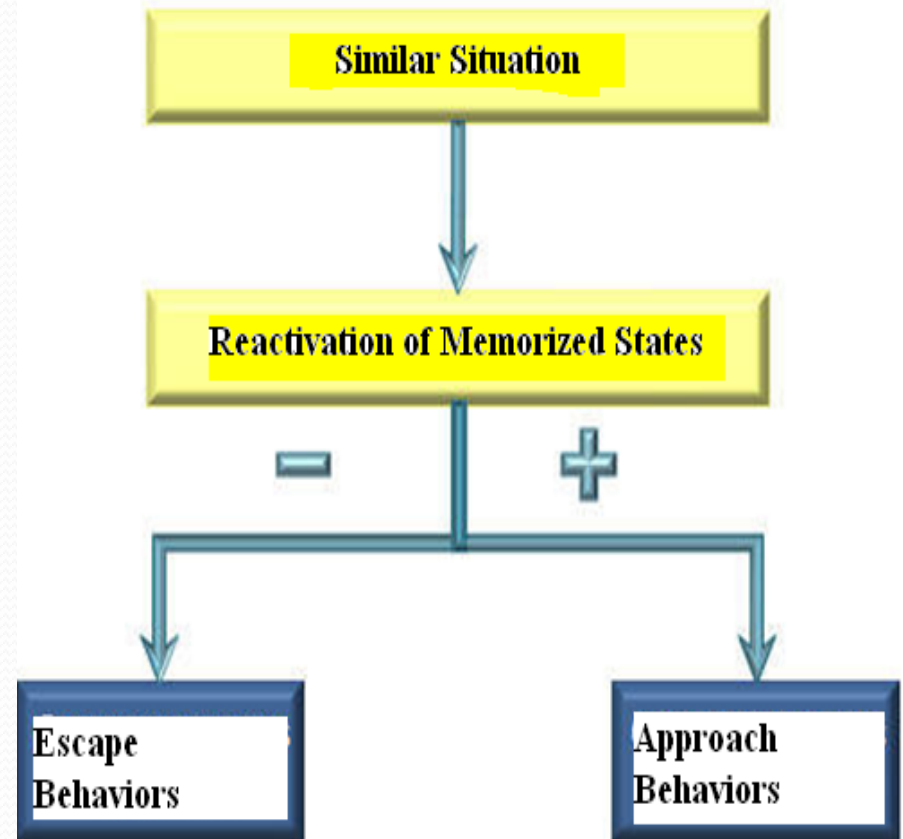
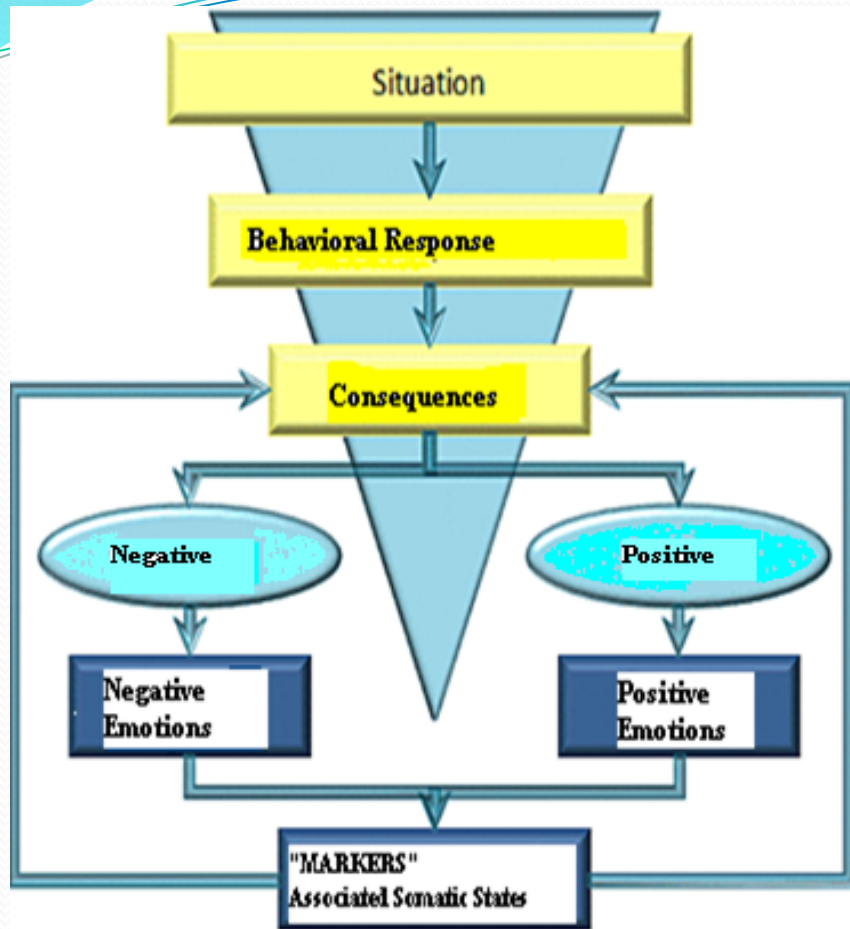




## Damasio's Theory of Somatic Markers

- Somatic representations ( emotion-based signals occurring because of environmental stimuli)
- Are STORED in the Fronto-orbital cortex
- When the situations recur, they are REACTIVATED
- They GUIDE the individual's response and enable him to adapt behavior appropriately (Habib 1998)
- Lesions IMPAIR the reactivation of those somatic markers which elicit and enable appropriate decision-making (Damasio and al, 1990)





Theory of Somatic Markers

## Damasio's team has highlighted a decrease in the Emotional Quotient of patients with frontal-lobe damage

- Patients are able to process non emotional features of a face (Fernandez-Duque and al 2005)
- Ability to recognize emotional facial expressions is ALTERED in a unprecedented way ( Lough and al 2006)
- Diehl-Schmidt and al (2007) have highlighted the usefulness of Ekman 60 Faces Test as a diagnostic instrument in FTD.



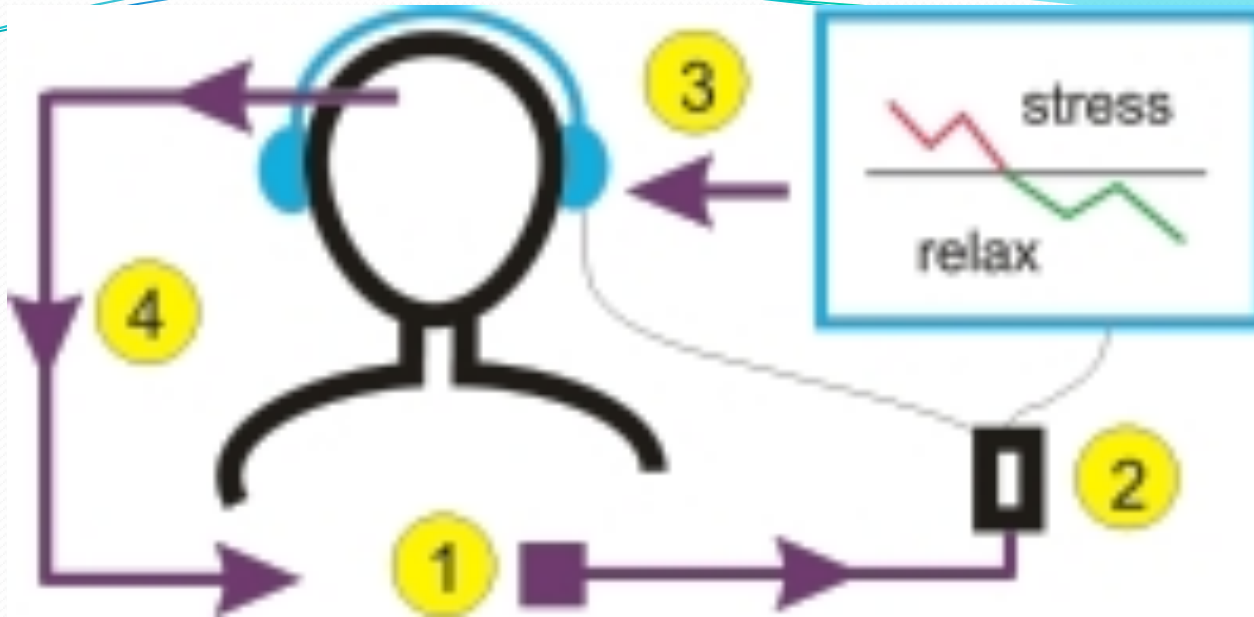
## Caregiving Spouse's mental health

- Behavioral disorders, rather than cognitive disorders, have a greater impact on the caregiver's burden (Hebert and al 2000, Andrieu and al 2003)
- Especially if alterations in social behavior and personality prevail (Merriless and al 2003)
- Or if patient exhibits symptoms of psychiatric disorders (Mouric and al 2004)
- Apathy leads to greater stress for the caregiver (Vugt and al 2006)
- Conjugal relationship is usually jeopardized by those emotional and personality changes ( Adraina Schnall 2009)



# BIOFEEDBACK

- BIOFEEDBACK , BIORETROACTION or BIOLOGICAL RETROACTION
- An application of Psychophysiology
- Link between brain activity and physiological functions
- “Body-Mind” Interaction
- Focuses on how emotions and thoughts affect the body
- How the observation and voluntary modulation of body functions may influence other functions, behaviors and attitudes.

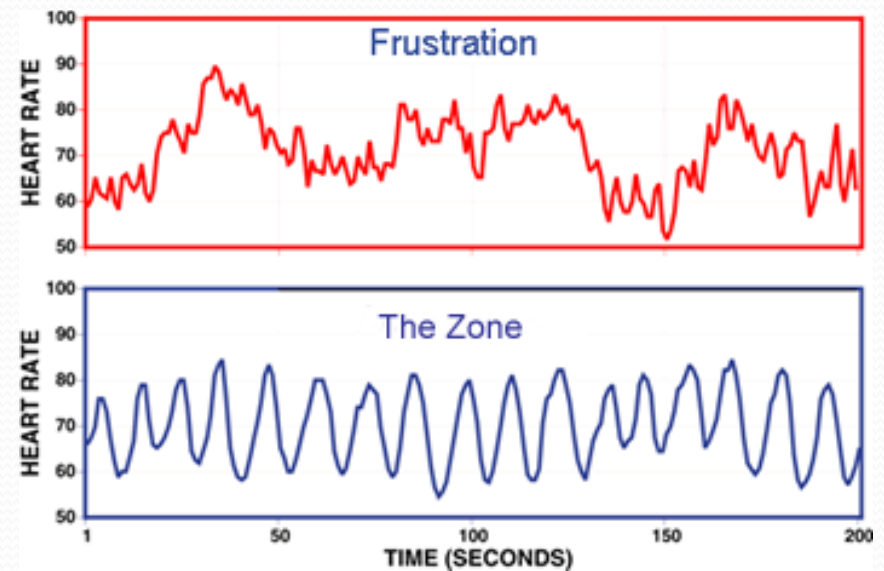
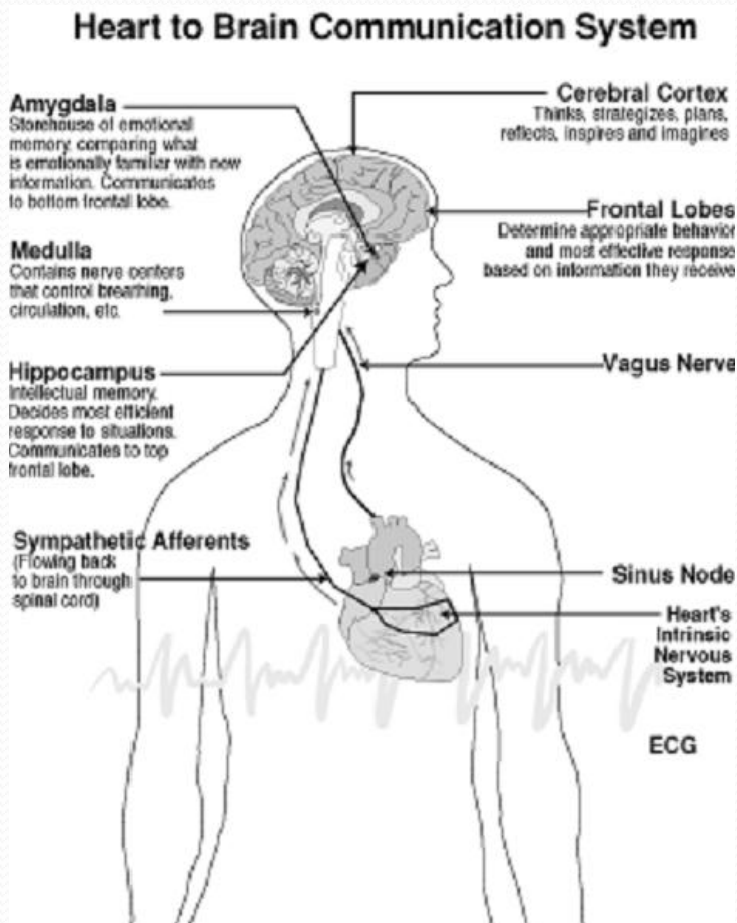


The device collects and amplifies the information transmitted by the body

The device translates the information into auditory or visual signals

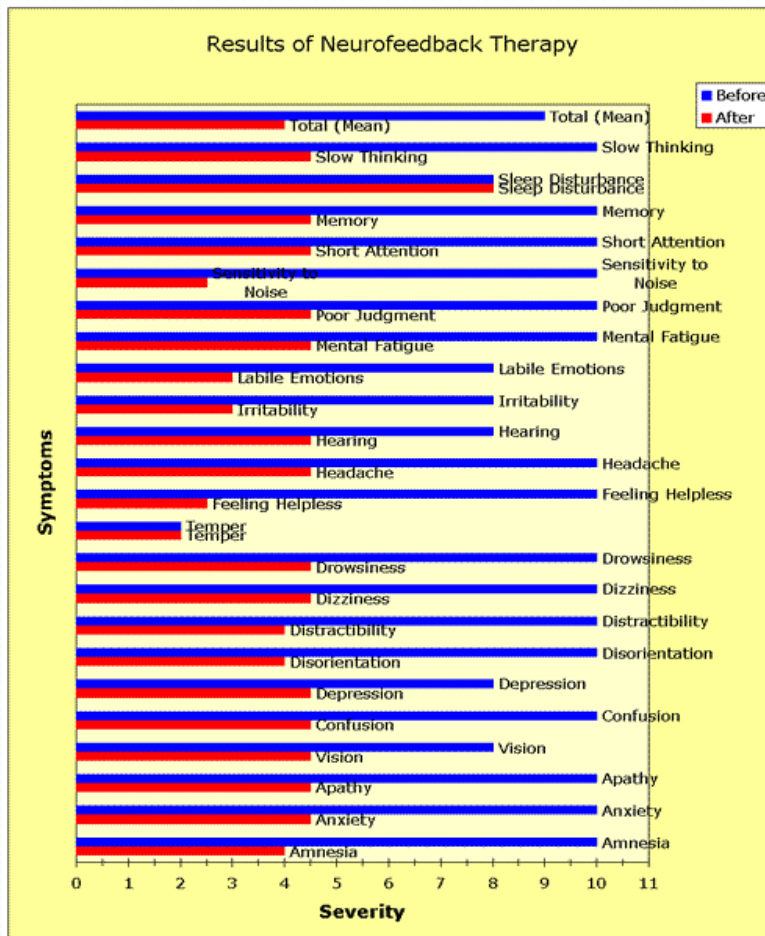
The device teaches the subject how to modulate his/her own physiological responses

# How to fight anxiety and improve cardiac function



# Therapeutic Center in Raleigh, North Carolina: therapies using mainly BIOFEEDBACK and NEUROFEEDBACK

Scores from 0 to 10 depending on severity of symptoms on patients with brain injury before and after the neurofeedback training program (study conducted in 2010 at the Raleigh Therapeutic Center, North Carolina)



- On average, 50% improvement for all symptoms (up to 80% improvement for feeling helpless and noise sensibility)
- Effectiveness of Neurofeedback Therapy in improving patients quality of life

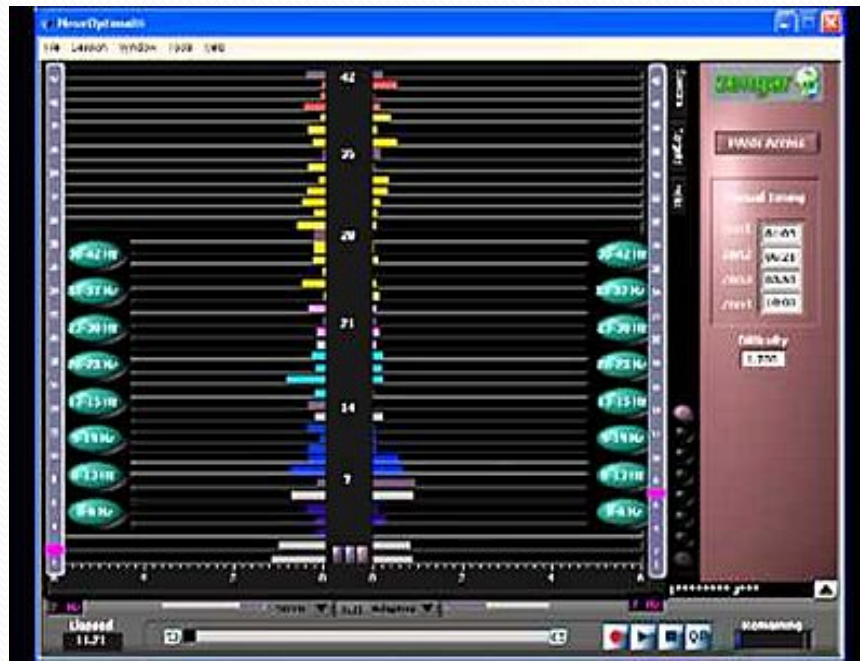


## Studies of NF linked to frontal pathology

- NF leads to improved attention and behavioral control as well as higher scores in intelligence tests in the treatment of Attention Deficit/ Hyper activity Disorder ( Monastra and al 2005)
- 8 sessions of NF training led to a clear-cut improvement in the behavior of teenagers with Asperger' s Syndrome, as reported by parents and teachers ( Scolnick 2005)
- Autistic patients who received NF training, improved their degree of autism by 80 % ( 30% language, 34% socialization, 16% cognitive awareness ) ( Jarusiewicz 2004)
- After 5 sessions of NF, schizophrenic patients exhibit an improvement in their symptoms (Schneider and al 1992)
- A literature review by Gruzelier (2000) indicates that self-regulation is possible in schizophrenic individuals by using Neurofeedback

## Study conducted at the IM2A with 4 FTD patients, 4 PSP patients and their spouses

- 6 sessions of NF, 1 session per week
- Software: ZAMP/NEUROPTIMAL
- Able to sample brain wave signals at a rate of 256 samples per second (256 Hz) for frequencies ranging from 0 to 60 Hz
- Using Gabor's algorithm which is the closest to the brain's natural functioning



## Etude réalisée à l' IM2A

<b>outil</b>	<b>mesure</b>	<b>informant</b>	<b>items</b>	<b>évaluation</b>	<b>moment</b>
<b>STAI A</b>	Anxiété Etat	conjoint	20	Auto	J0-S6
<b>STAI B</b>	Anxiété trait	conjoint	20	Auto	J0-S6
<b>PSS</b>	Stress perçu	conjoint	15	Auto	J0-S6
<b>DAS</b>	Ajustement dyadique	conjoint	32	Auto	J0-S6
<b>Visage d'Ekman</b>	Reconnaissance des émotions	patient	35	Hétéro	J0-S6

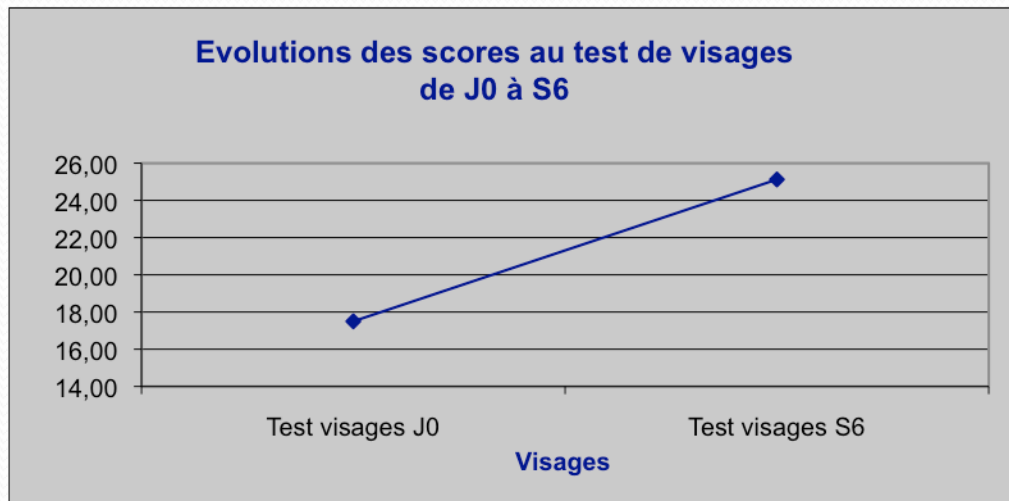
## Study conducted at the IM2A

Instrument	Measure	Informant	Items	Evaluation	Moment
STAI A	Anxiety State	Spouse	20	Self	Do-s6
STAI B	Anxiety Feature	Spouse	20	Self	Do-s6
PSS	Perceived Stress	Spouse	15	Self	Do-s6
DAS	Dyadic adjustment	Spouse	32	Self	Do-s6
Ekman 60 Faces	Emotion Recognition	Patient	35	Hetero	Do-s6

## Evaluation des patients par le test d' Ekman à J0 et S6

<b>JO</b>	<b>PSP</b>	<b>Ecart type</b>	<b>DFT</b>	<b>Ecart Type</b>
<b>Eakman</b>	17,5	10,27	17,5	8,10

<b>Visage Ekman</b>	<b>Moy (éty)</b>	<b>Valeur p</b>
<b>JO</b>	17,5 ( 8,56)	.02 *
<b>S6</b>	25,12 (4,18)	



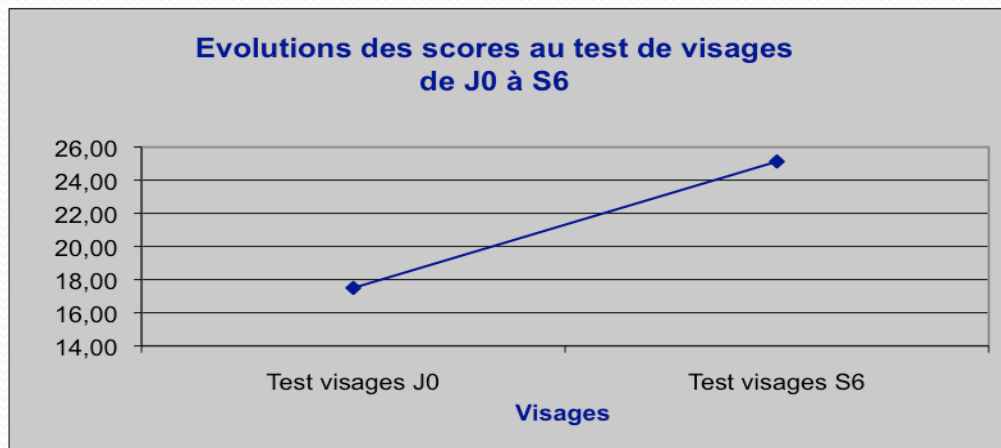
Patients underwent the Ekman 60 faces test at D0 and S6

Do	PSP	Standard deviation	DFT	Standard Deviation
Ekman	17.5	10.27	17.5	8.10

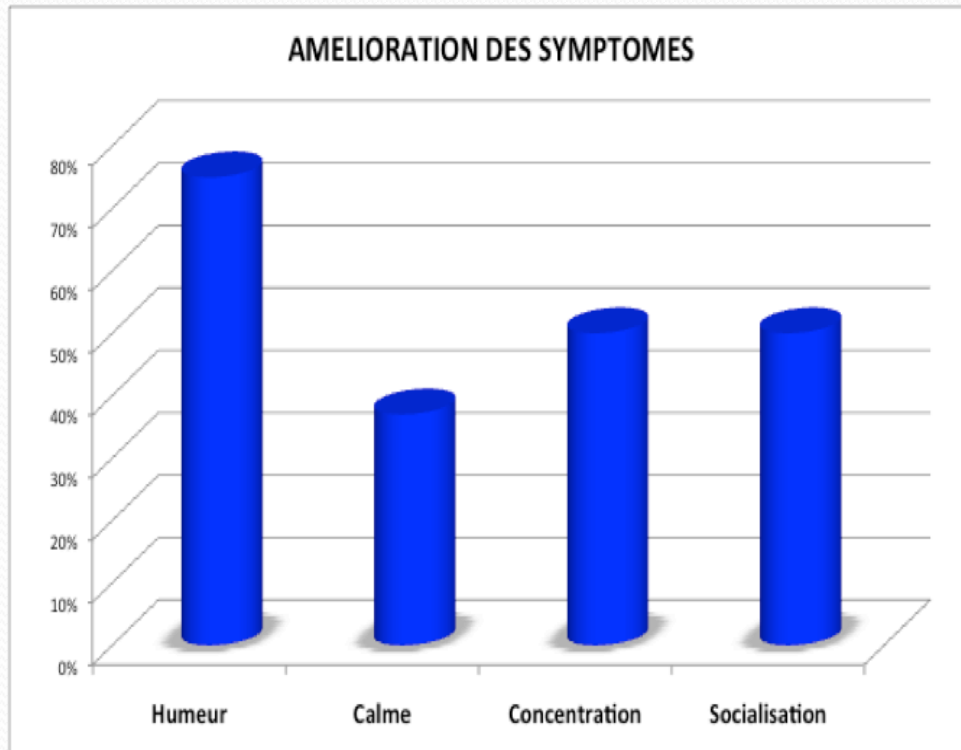
Ekman 60 Faces	Mean (std D)	Value p
Do	17.5 (8.56)	.02*
S6	25.12 (4.18)	

Scores on the Ekman 60 Faces Test from D0 to S6



# Functional evaluation of patients at S6 after semi-structured interview with spouses

## Improvement in symptoms



Mood improvement: 75%

Calmness: 50%

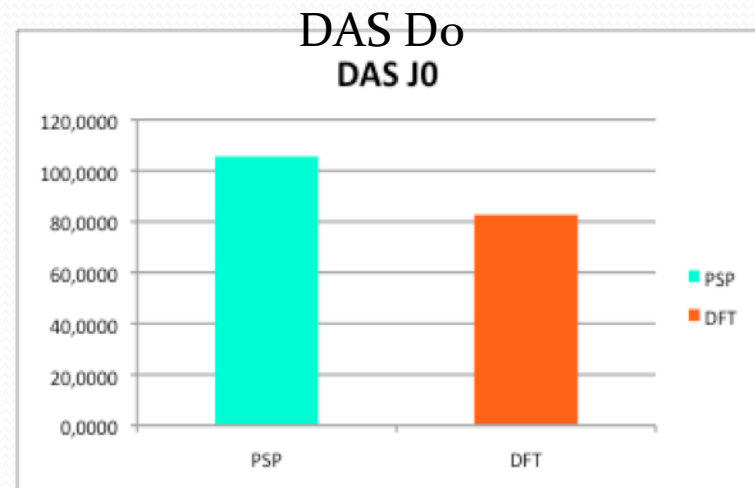
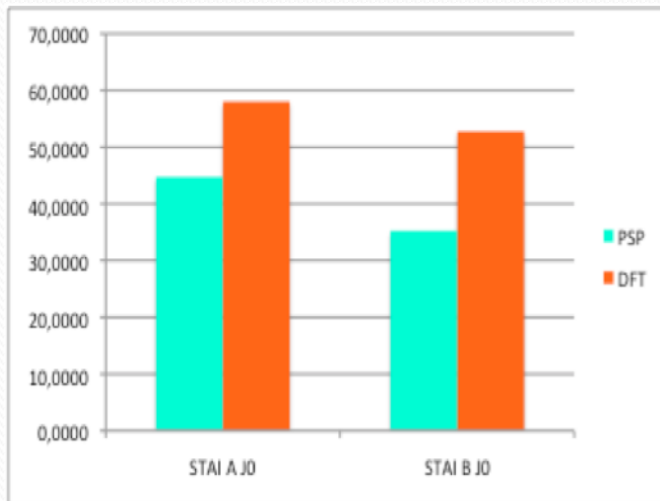
Concentration: 37%

Improvement in socialization :50%



## Spouses evaluation at D0

- Spouses reported moderately high scores for anxiety feature (mean 44) and higher scores for anxiety state (mean 51.37)
- Spouses reported average stress scores (mean: 47.12)
- The dyadic adjustment has a mean of 93.87 with a standard deviation of 23.81



## Evaluation des conjoints à S6

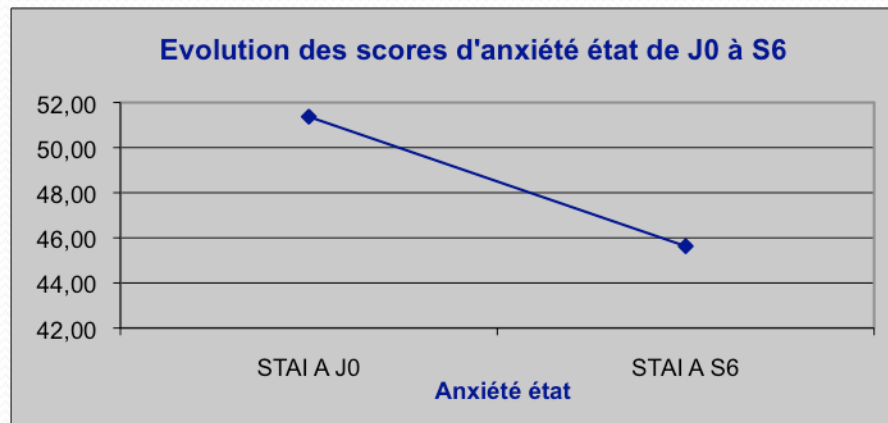
Diminution significative des scores d'anxiété état après réalisation du programme de NF

	<i>Moy (éty)</i>	<i>Valeur p *</i>
<i>STAI A J0</i>	51,37 (10,52)	.04 *
<i>STAI A S6</i>	45,62 (13,78)	

Test de Wilcoxon

	<i>Moy (éty)</i>	<i>Valeur p</i>
<i>STAI B J0</i>	44 (10,91)	.86
<i>STAI B S6</i>	43,87 (10,23)	

Test de Wilcoxon



<= Scores on the Ekman 60 Faces Test from Do to S6

## Spouses Evaluation at S6

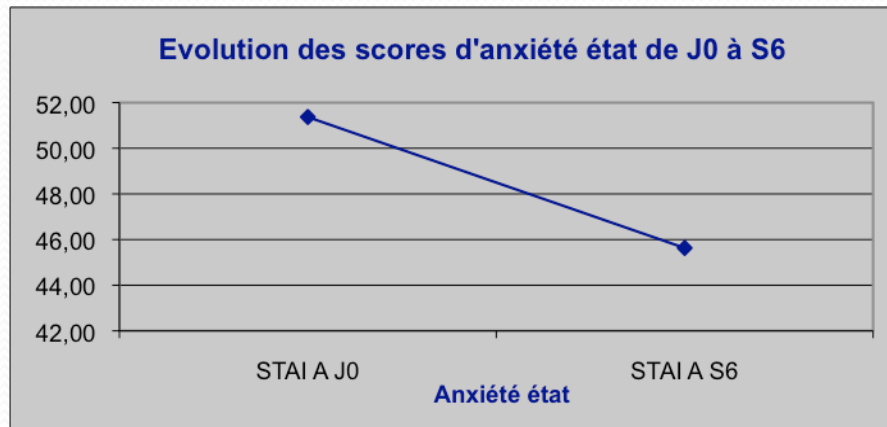
Significant decrease in scores of “anxiety state” after completion of NF training program

	Mean (Std D)	Value p*
STAI A Do	51.37 (10.52)	.04*
STAI A S6	45.62 (13.78)	

Wilcoxon Test

	Mean (Std D)	Value p*
STAI B Do	44 (10.91)	.86
STAI B S6	43.87 (10.23)	

Wilcoxon Test



<= Scores on the Ekman 60 Faces Test from Do to S6

# Conclusion

- This study confirms that patients with frontal-lobe syndrome (FTD and PSP) suffer from an emotional deficit and both conditions get similar scores on the Ekman 60 faces Test
- This emotional deficit could contribute to the occurrence of inappropriate social behavior and more particularly, the lack of empathy that frontal-lobe patients exhibit.
- These behavioral disorders tremendously affect the mental health of the caregiving spouse
- The Neurofeedback Training Program significantly improved patients scores on the Ekman 60 faces Test within only 6 sessions
- A functional improvement was reported by the spouses at the end of the program
- The anxiety feature of the spouses has decreased significantly