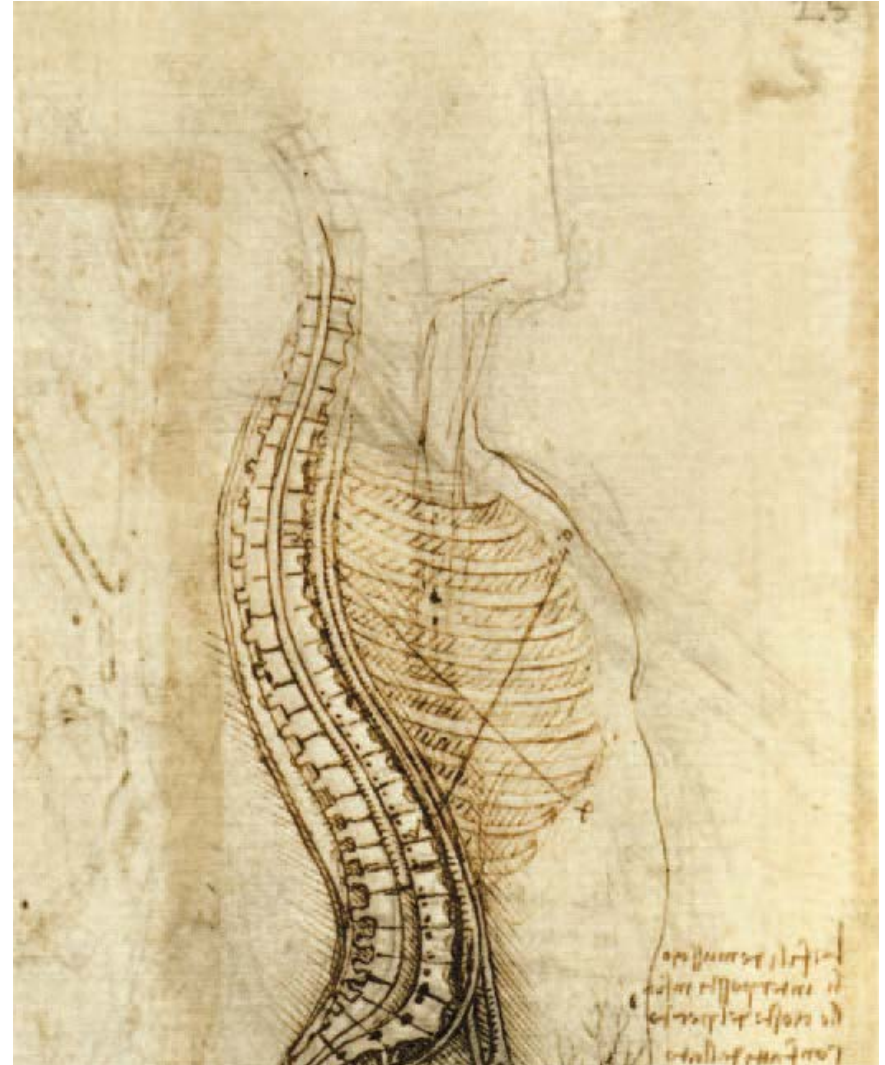


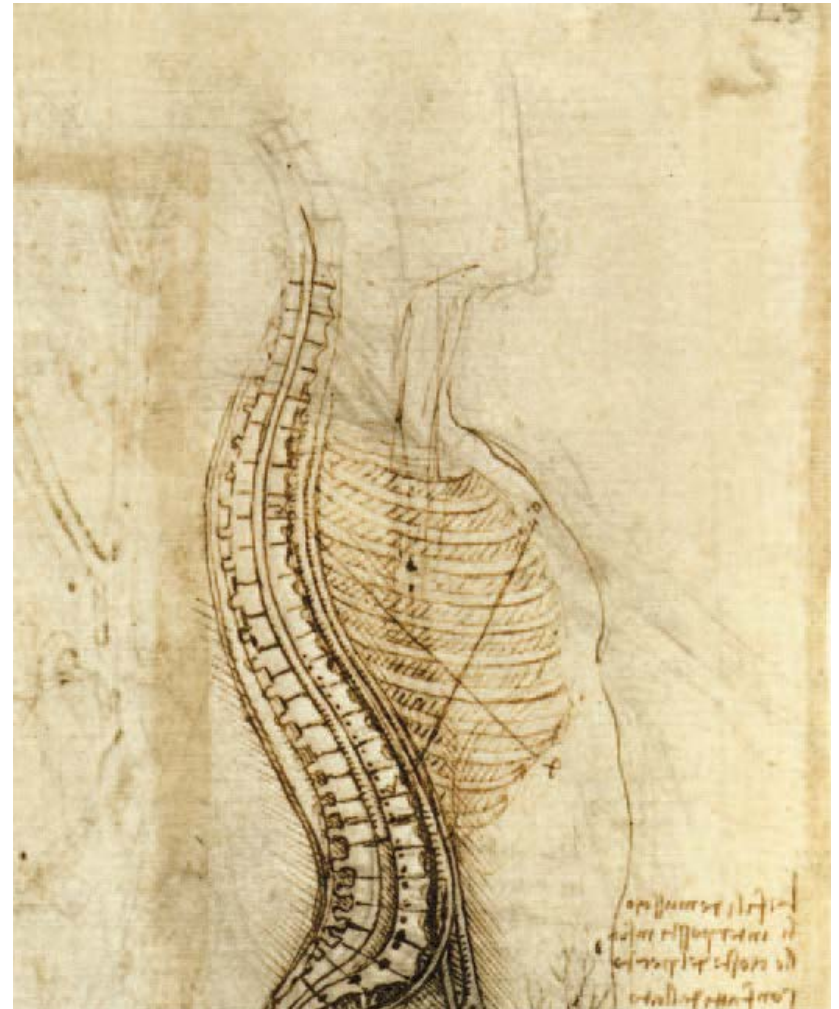
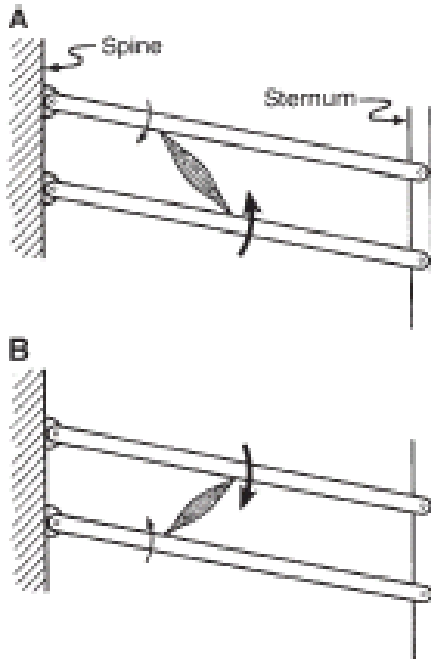
An Accurate Sense of Breath

- *How deep, how fast, to breath*
- *When we're falling behind*



Neural Processing- Primary Breathing Sensors

- Mechanoreceptors
- Nociceptors
- chemoreceptors





Respiratory Sensory Gating

J. S. H.				J. G. P.			
Barometric pressure in mm. of Hg.	CO ₂ % end of inspiration	CO ₂ % end of expiration	CO ₂ % mean	Barometric pressure in mm. of Hg.	CO ₂ % end of inspiration	CO ₂ % end of expiration	CO ₂ % mean
759	5.33	5.76	5.545	759	6.18	6.43	6.305
747	5.47	5.69	5.56	754	6.51	6.63	6.575
748	5.56	5.70	5.63	747	6.10	6.70	6.40
748	5.59	5.87	5.73	753	6.81	6.86	6.835
748	5.38	5.60	5.49	758	5.95	6.74	6.35
748	5.33	5.47	5.40	758	5.82	6.23	6.025
749	5.80	5.94	5.87	758	5.93	6.21	6.07
749	5.66	5.51	5.585	754	6.12	6.33	6.215
765	5.63	5.59	5.61	754	6.26	6.20	6.23
759	5.42	5.83	5.625	754	6.23	6.05	6.14
758	5.74	5.72	5.71	751	5.66	6.75	6.205

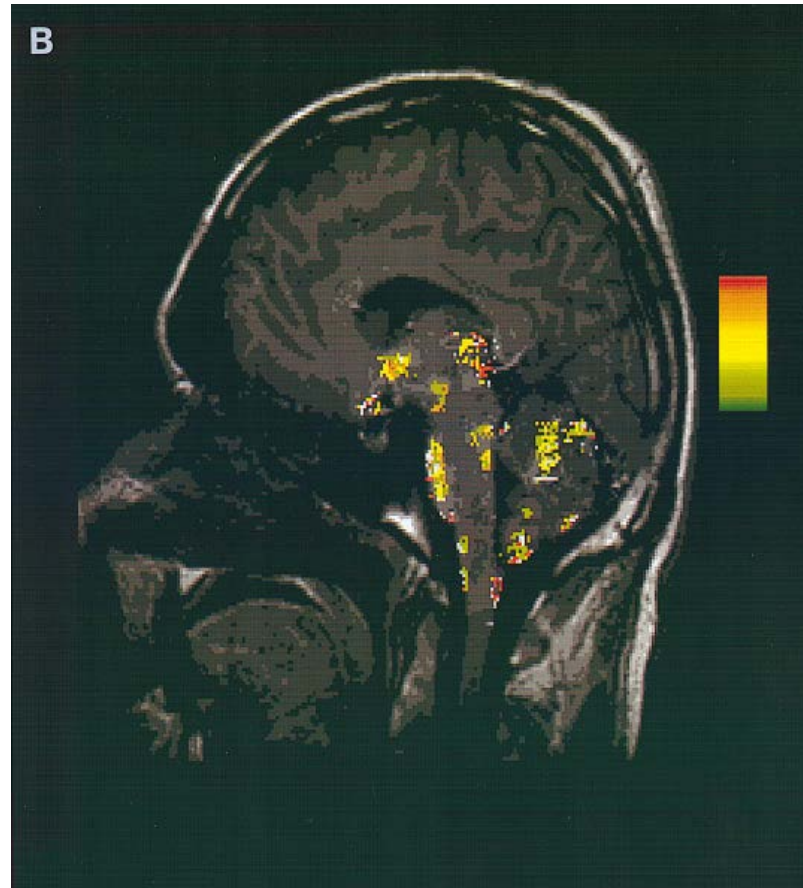
The hyperpnœa was very marked. An increase of about 0.2 % in the alveolar CO₂ caused in both of us an increase in the lung-ventilation by about 100 % of the normal ; and, to judge from this fact, a diminution of 0.2 % in the normal alveolar CO₂ percentage would suffice to produce apnœa.

Record in breath-holding (4/30/08)

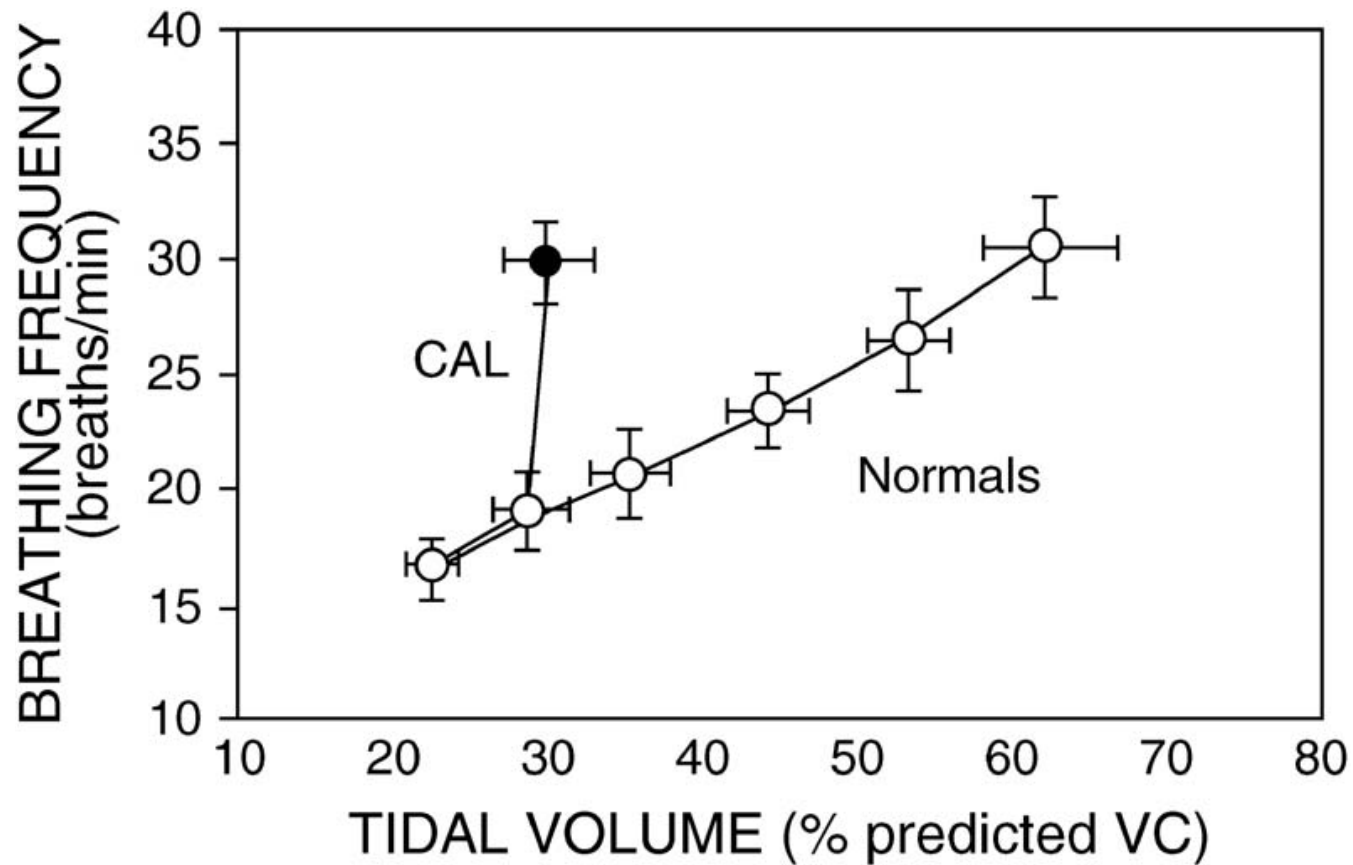




FMRI of brain areas activated in response to resistive load

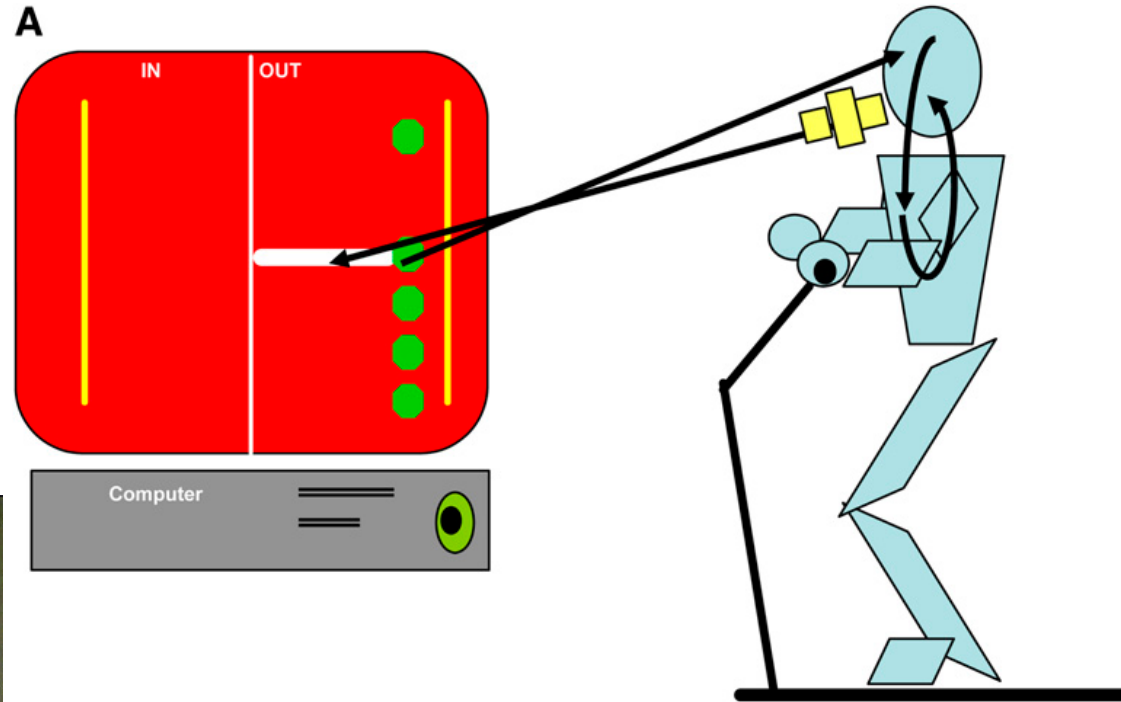


Gozal D, Omidvar O, Kirlew KAT, Hathout GM, Lufkin RB, Harper RM.
Functional magnetic resonance imaging reveals brain regions
mediating the response to resistive expiratory loads in humans.
J Clin Invest. 1996 Jan;97(1):47-53.



[O'Donnell, Denis E](#) Hyperinflation, dyspnea, and
exercise intolerance in chronic obstructive pulmonary disease
Proc Am Thorac Soc 3 180-4 2006

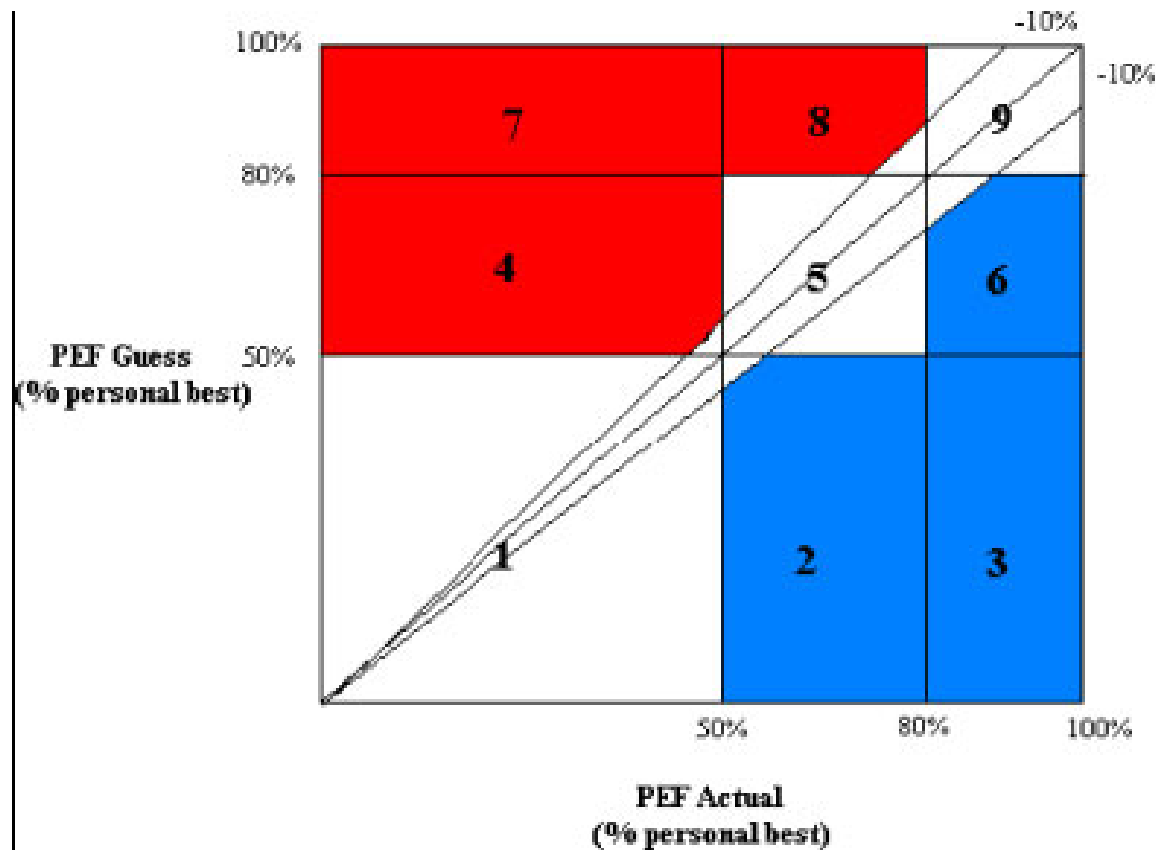
Re-training the (maladaptive) COPD breathing pattern



Dyspnea – Misperception?

Hypo-receivers

Hyper-receivers



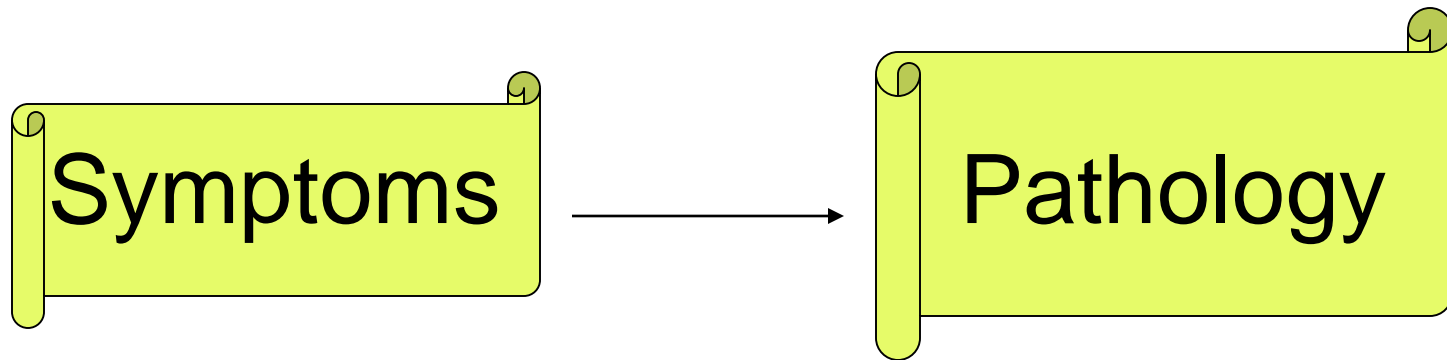
Pediatric Pulmonology 42:339–347 (2007)
 Symptom Perception and Functional Morbidity Across a
 1-Year Follow-up in Pediatric Asthma
 Jonathan M. Feldman,

Somatization



www.tonysteelemorgan.co.uk/gallery.php?sort=f...

Clinical Work:

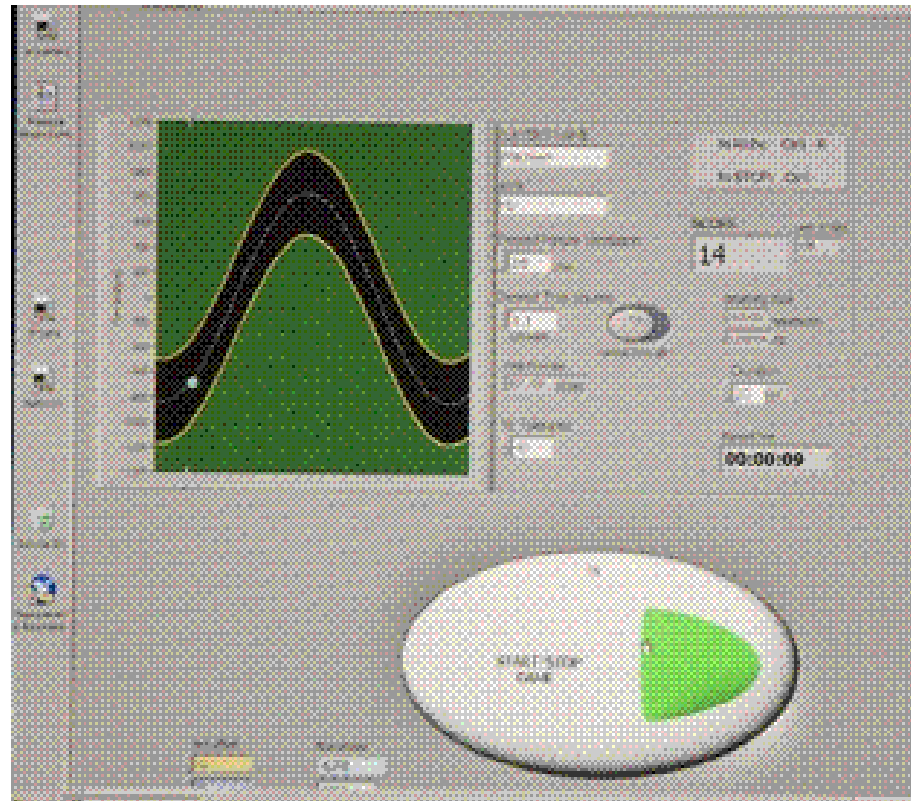




LIMBOGAME.ORG

Respiratory Interoception – can it be learned?





Respiratory Interoception – can it be learned?

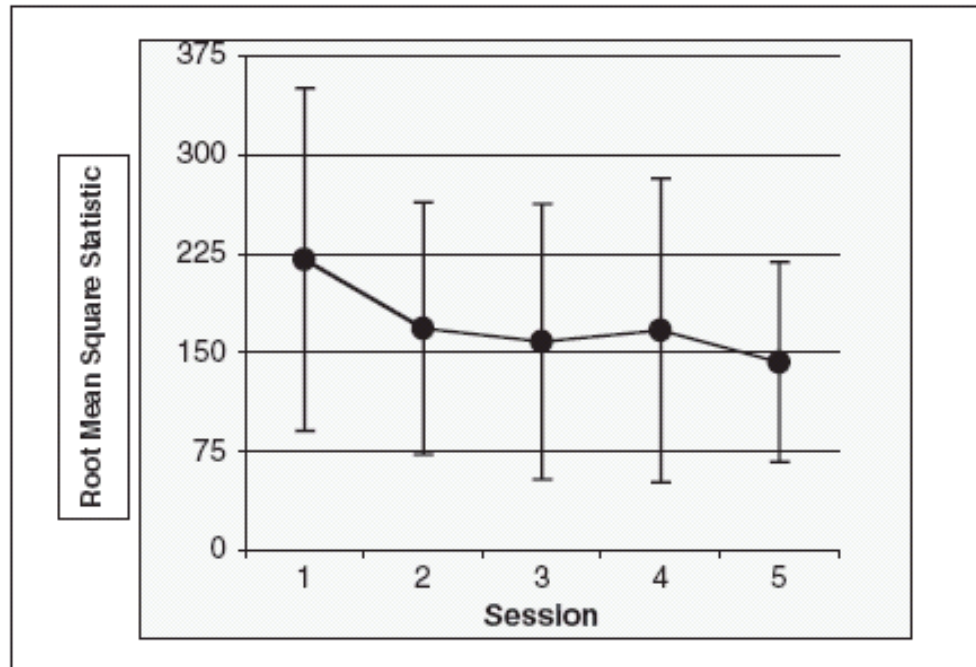
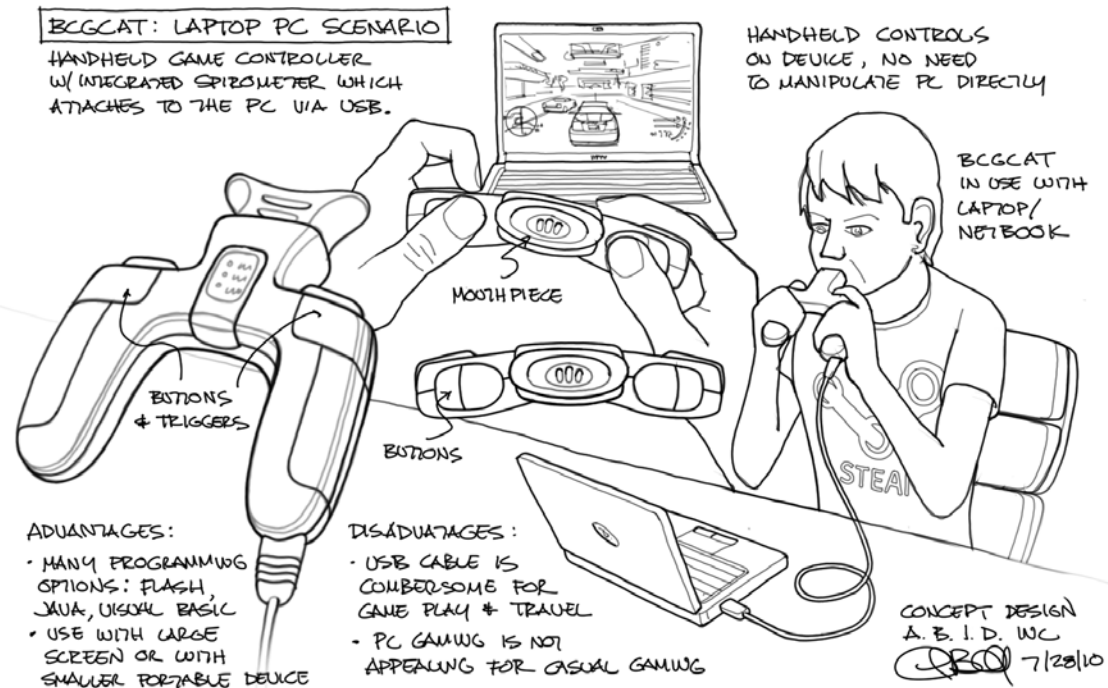


Figure 2. Improved eye–breath tracking fidelity in 10 hospitalized subjects with cystic fibrosis. Fidelity is represented on the vertical axis by the root mean square statistic. At each of 5 successive sessions, the results of 3 trials of the tracking game were recorded for each subject. Graph represents the average performance of all subjects for each session.

Breath Biofeedback Game Controller – Pediatric Asthma (R43103370)

- Interview adolescents with asthma
- Design/build a breath-game controller modeled after clinical spirometers
- Create/Pilot software to train eye-breath/ear-breath coordination



"Addicted to games?" - *BBC*

- Reporter Raphael Rowe meets a series of people who it is claimed developed an addiction to videogames that is wreaking havoc on their emotional and social lives.
- Joe Staley, from Nottingham, "couldn't physically pull away from" Modern Warfare 2 and was thrown out of university in thousands of pounds of debt.
- 22 year-old Leo played World of Warcraft for "12 hours per day for two years", and calls it "a disease, it's horrible. I would never inflict this game on anyone".
- Alison Dando, mother of Chris, recounts her son's "outpouring of violence – he just went berserk" after the internet connection was switched off and he could no longer play Warcraft. "My dad almost had to pin me down on the ground," Chris adds.

Summary

- Dyspnea is the focus of clinical studies of “symptom misperception”
- Neural processing of dyspnea involves anterior insula as well as brainstem
- Respiratory interoceptive accuracy, like some other respiratory perceptions, is likely ‘plastic’ (i.e., train-able)
- Cognition and Pulmonary Function Correspondence

Thanks!

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