Effects of learning on somatosensory and auditory decision-making and experiences: Implications for medically unexplained symptoms

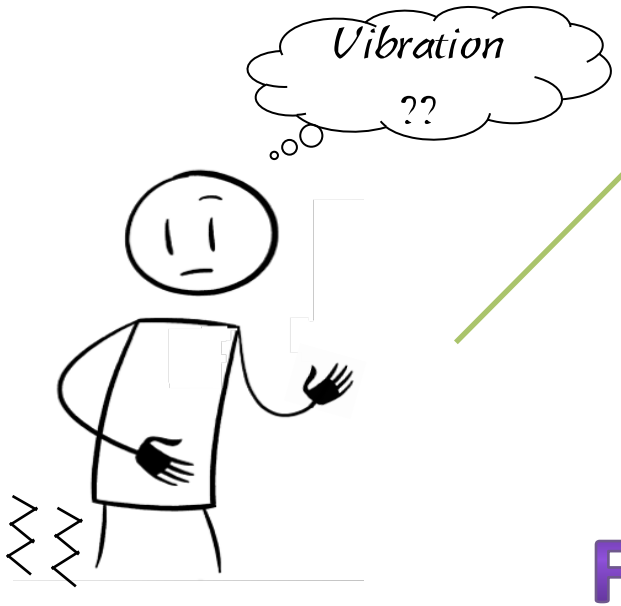
Akib Ul Huque[1*], Dr Ellen Poliakoff[1], and Dr Richard Brown[1]

[1]University of Manchester

[*]University of Dhaka

Have you ever

thought someone was calling your name only to find that no-one was there?



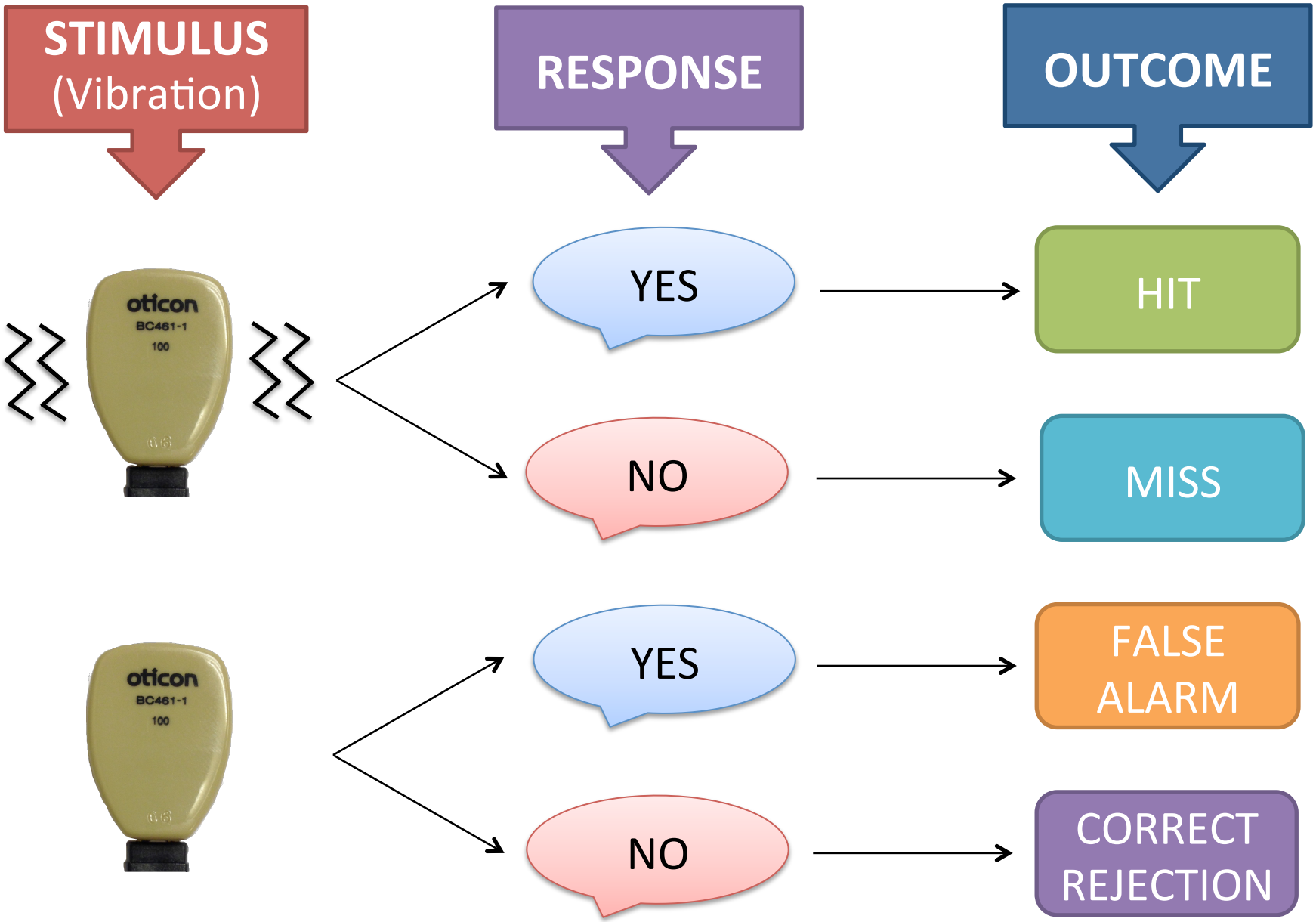
felt a vibration and thought you received a text when you didn't?

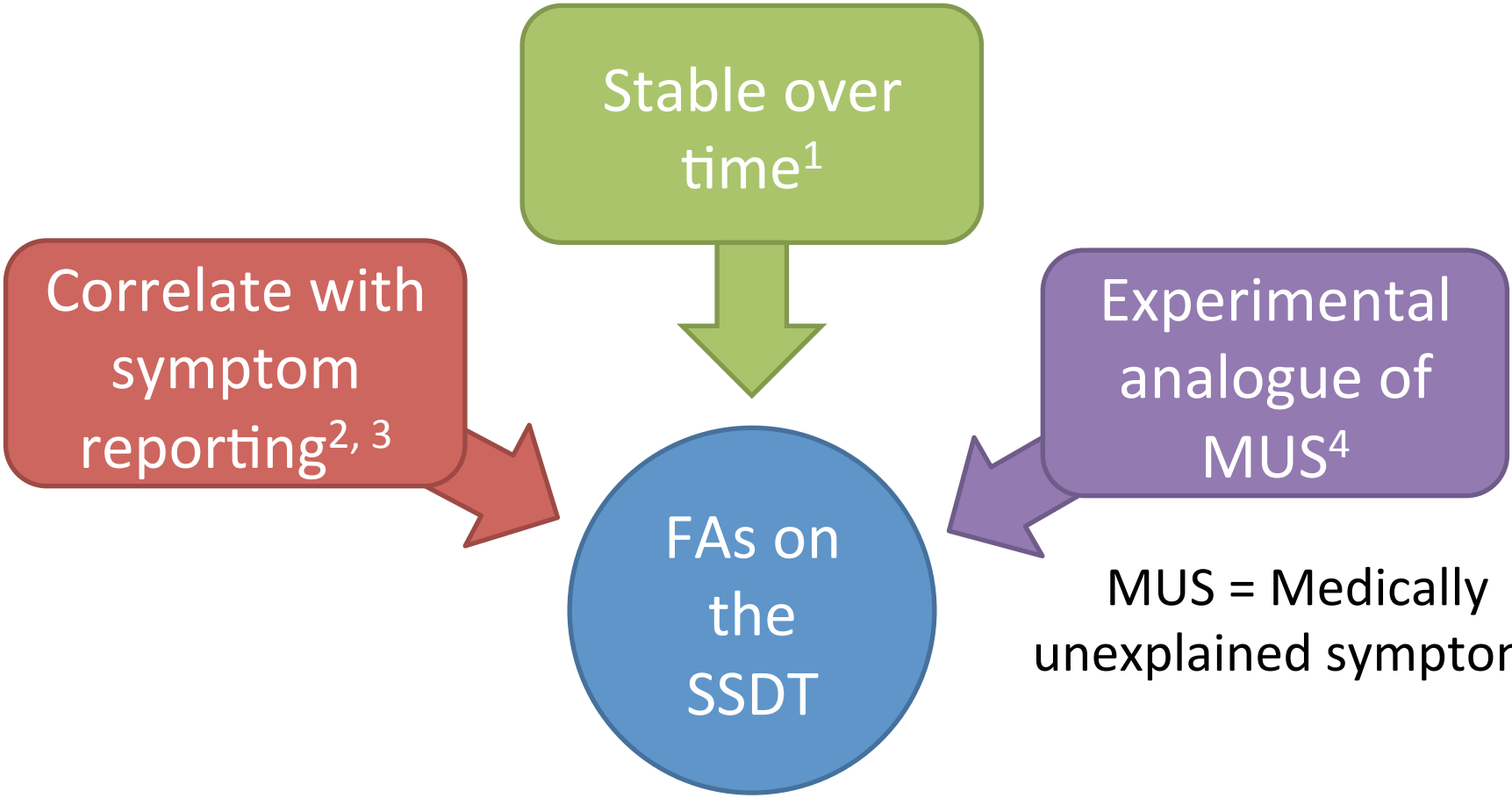
FALSE ALARMS!

Somatosensory signal detection task (SSDT)

Reference:

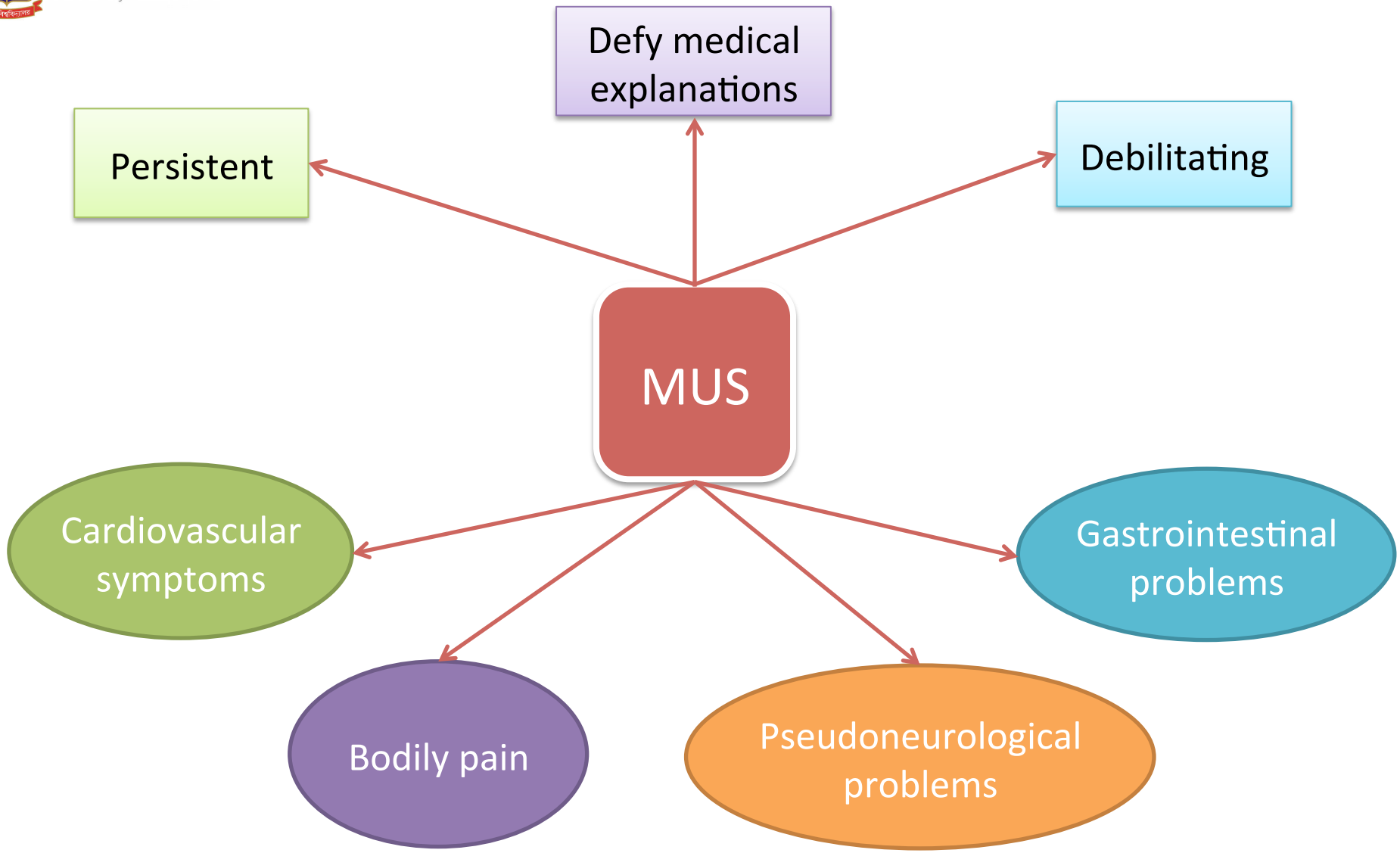
Lloyd, D. M., Mason, L., Brown, R. J., & Poliakoff, E. (2008). *Journal of Psychosomatic Research*, *64*(1), 21–24


STIMULUS
(Vibration)
RESPONSE
OUTCOME
oticon
BC461-1
100
YES
NO
HIT
MISS
oticon
BC461-1
100
YES
NO
FALSE ALARM
CORRECT REJECTION



MUS = Medically unexplained symptoms

References:
1. McKenzie et al. (2010). *Perception*, *39*(6), 839 – 850.
2. Brown et al. (2012). *Psychosomatic Medicine*, *74*(6), 648–655.
3. Katzer et al. (2012). *Journal of Abnormal Psychology*, *121*(2), 530–543.
4. Lloyd, D. M., Mason, L., Brown, R. J., & Poliakoff, E. (2008). *Journal of Psychosomatic Research*, *64*(1), 21–24.



Reference:
Brown, R. J. (2007). *Clinical Psychology Review*, *27*(7), 769–780.

Prevalence rate of MUS:

- Survey in two general hospitals in southeast London: 52% (1)

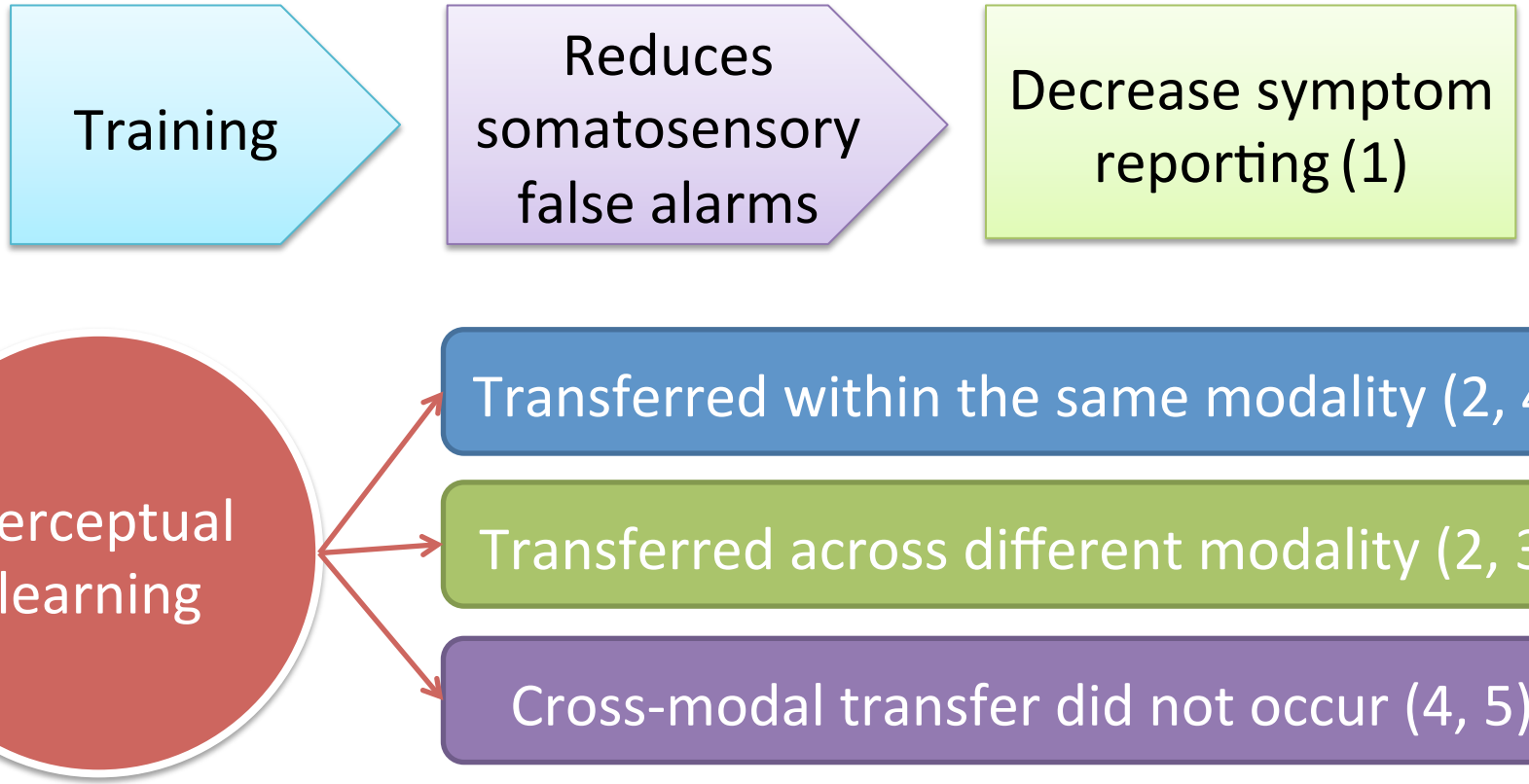
Treatment cost:

- £3 billion in 2008-2009 (10% of total NHS expenditure; 2)
- Total: Over £14 billion

References:

1. Nimnuan, C., Hotopf, M., & Wessely, S. (2001). *Journal of Psychosomatic Research*, *51*(1), 361–367.
2. Bermingham, S. L., Cohen, A., Hague, J., & Parsonage, M. (2010). *Mental Health in Family Medicine*, *7*(2), 71–84.

Background:



References:

1. Brown, R. J. (2004). *Psychological Bulletin*, *130*(5), 793–812.
2. Nagarajan, S. S. et al. (1998). *The Journal of Neuroscience*, *18*(4), 1559–1570.
3. Meegan, D. V., Aslin, R. N., & Jacobs, R. A. (2000). *Nature Neuroscience*, *3*(9), 860–862.
4. Lapid, E., Ulrich, R., & Rammsayer, T. (2009). . *Psychonomic Bulletin & Review*, *16*(2), 382–389.
5. Grondin, S., & Ulrich, R. (2011). *Multidisciplinary Aspects of Time and Time Perception* (pp. 92–100).

Research questions:

1. Can people be trained to make more false alarms on the SSDT?
2. Can the tendency to false alarm on the SSDT be reduced?
3. Will training-induced change in false alarm rate persist over time?
4. Will changes in false alarm rate affect similar perceptual experiences such as spontaneous sensations in the body and voice hearing?

Previous research findings:

- McKenzie et al. (2012) used associative learning paradigm to train participants but failed to increase the false alarm rate on the SSDT.
- An alternative approach would be to use operant conditioning principles.

Reference:

McKenzie, K. J. et al. (2012). *Acta Psychologica*, *139*(1), 46–53.

Conditioning Procedure:

To increase FAs:

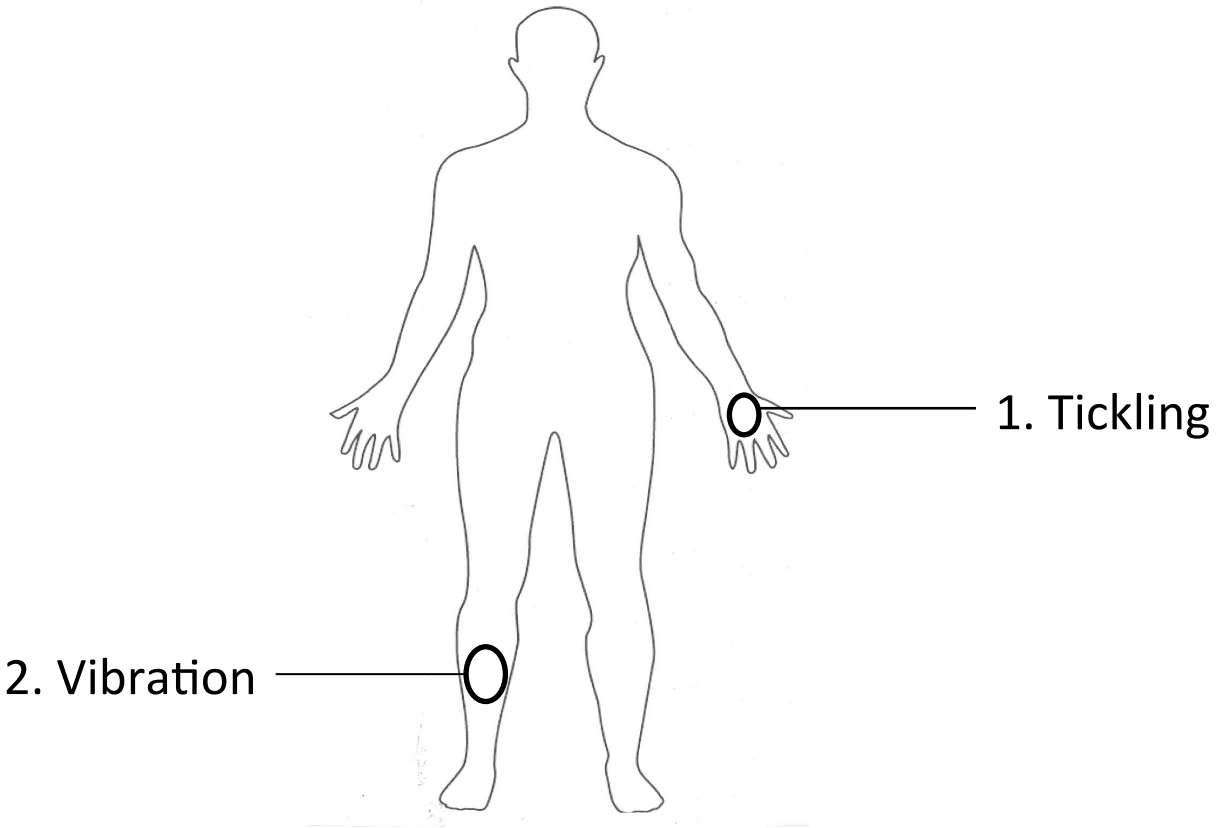
- Reward hits
- Punish misses

To decrease FAs:

- Reward correct rejections
- Punish false alarms

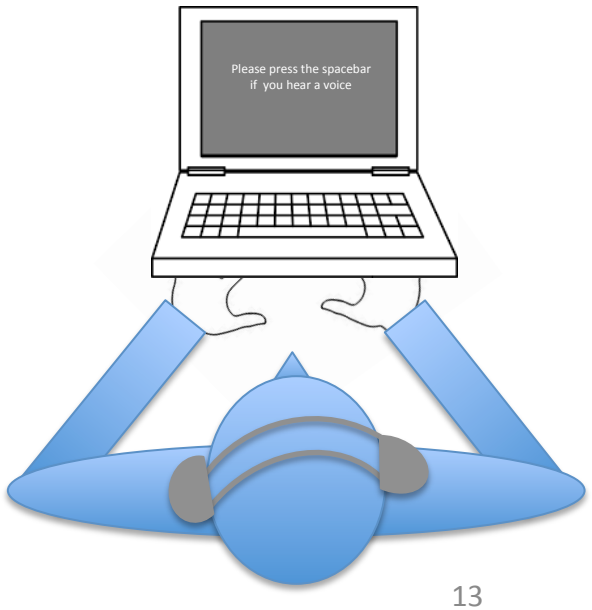
Spontaneous sensation test:

- Be relaxed; focus all over your body; try to identify if you feel any automatic sensation.
- Duration of a trial: 20 seconds

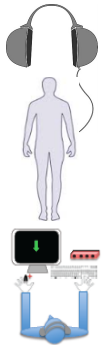


Voice Detection Task:

- Nonsense Voices appeared randomly against a continuous background white noise.
- Amplitude: both threshold and suprathreshold (based on a pilot study).
- Participants pressed the spacebar every time they thought they heard a voice.



Study 1 & 2: Design and Procedure



1. Baseline voice detection task

2. Baseline Spontaneous Sensation Test

3. Baseline SSDT (2 x 80 trials)

Study 1: *n* = 75 (41 control participants)
Study 2: *n* = 76 (37 control participants

CONTROL condition
(both studies)

EXPERIMENTAL condition
Identification of high and low false alarmers

STUDY 1 (False alarm increasing study)
Baseline false alarm rate < .15

STUDY 2 (False alarm decreasing study)
Baseline false alarm rate ≥ .15

4. Sham SSDT training (4 x 80 trials ; pseudo winning and losing of points)

4. Manipulation SSDT (4 x 80 trials)
- Won 5 points for hits
- Lost 5 points for misses

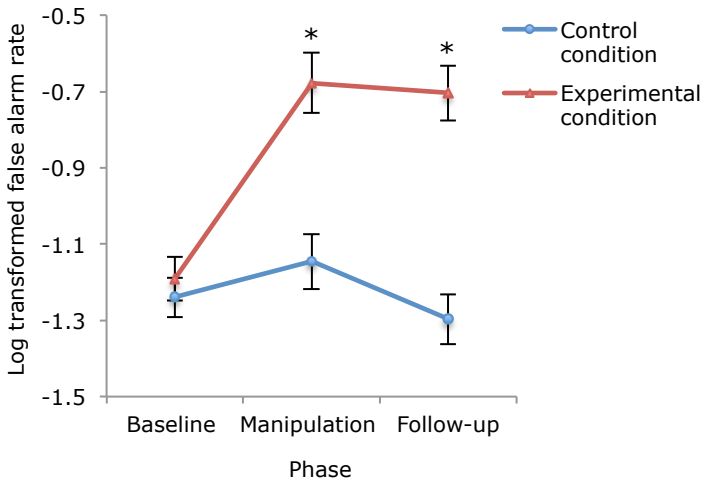
4. Manipulation SSDT (4 x 80 trials)
- Won 5 points for correct rejections
- Lost 5 points for false alarms

5. Follow-up voice detection task

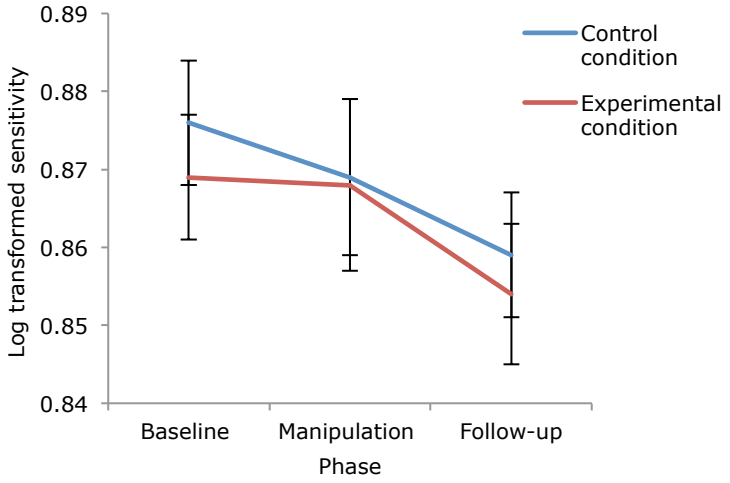
6. Follow up Spontaneous Sensation Test

7. Follow-up SSDT (2 x 80 trials)

SSDT Findings of Study 1 (Training to Increase False Alarms):

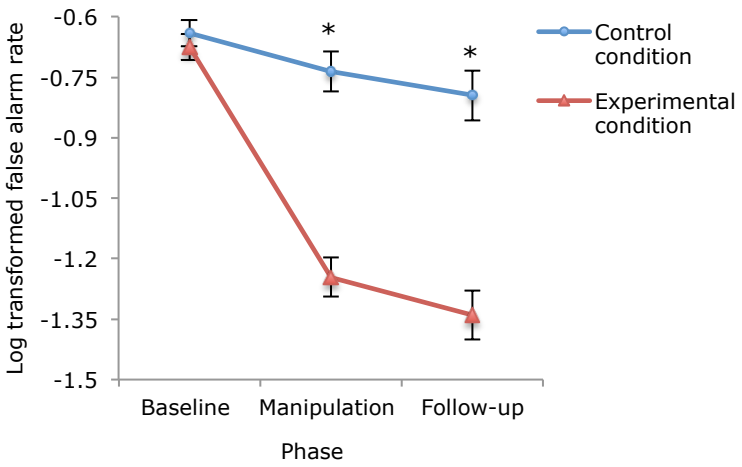


F (1.54,112.17) = 18.21, p < .0001, η^2_p = .20

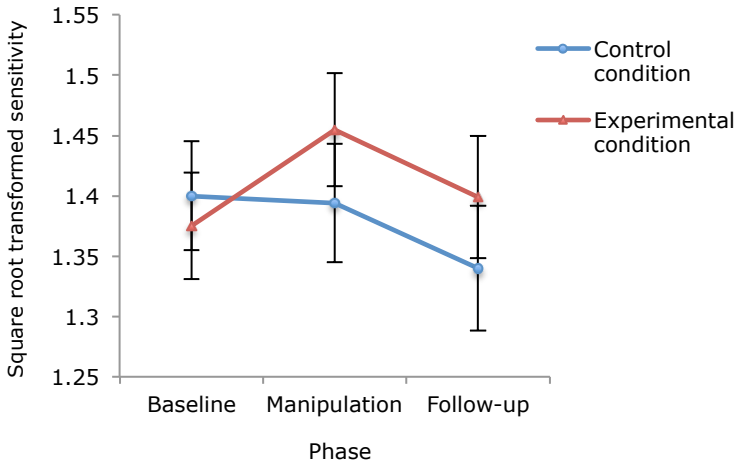


F(1.84,134.38) = .386, p = .663, η^2_p = .005

SSDT findings of Study 2 (Training to decrease false alarms):



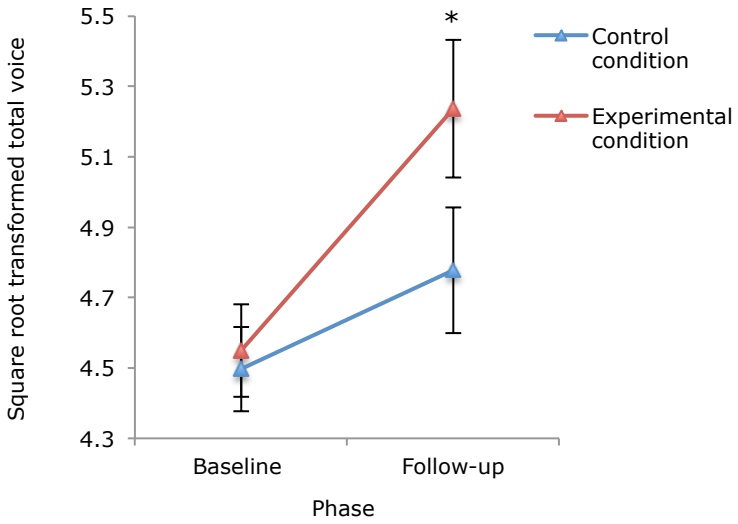
$F(1.78,131.56) = 32.62$, $p < .0001$, $\eta^2_p = .306$



$F(1.72,127.60) = 2.00$, $p = .146$, $\eta^2_p = .03$

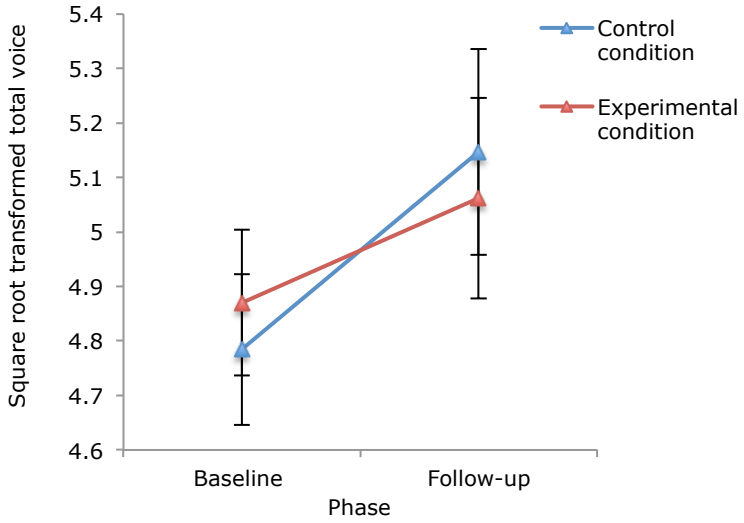
Voice detection task:

Study 1
(False alarm increasing study)



$F(1, 73) = 4.495$, $p < .05$, $\eta^2_p = .058$

Study 2
(False alarm decreasing study)



$F(1, 74) = .665$, $p = .417$, $\eta^2_p = .009$

- There was no effects of the training on the spontaneous sensation task performance.

Correlational Analyses:

Variables	SSDT baseline FA in light present condition	SSDT baseline FA in light absent condition	Total voice
SSDT baseline FA in light absent condition	.651****		
Total voice	**.164***	**.262****	
Voice FAs	**.171***	**.214****	.514****

Note. * $p < .05$, ** $p < .01$, *** $p < .005$, **** $p < .001$.

- The spontaneous sensation task did not correlate significantly with the SSDT or voice detection task.

Conclusion:

- Somatosensory misperception can be changed with training.
- Sensory modalities seem to share common perceptual decision-making processes.
- The findings that perceptual distortions and decision-making processes underlying cross-modal perception could be changed with training might have important implications for the management of medically unexplained symptoms.

MANCHESTER 1824
The University of Manchester

Thank You