

## The Centre of Gravity over an Indo Board

Luke Hampson - 7326890

**The Centre of Gravity** of an object is defined as:

“the point about which the body is balanced or the point through which the weight of the body acts.”

T. Ji & A. Bell 2008.

### **Introduction:**

The Centre of Gravity (C of G) is an integral part of the sport of surfing where it needs to be consistently maintained to ensure a smooth action. An Indo Board is a specific practicing apparatus which is used by surfers to improve the manipulation of their C of G through core control.



<http://www.outdooradventure.co.uk/education/surfing.htm>



[http://www.surfingonline.co.uk/index.php?main\\_page=index&cPath=141](http://www.surfingonline.co.uk/index.php?main_page=index&cPath=141)

An Indo board is simply a board positioned upon a free moving cylinder. It is the freedom of movement of this cylinder which ensures that you can recover the angular position of the board from balancing out the moments either side. The aim is to keep a steady movement over the board to stop it coming into contact with the floor.

This apparatus works by initially positioning yourself equally over the board and cylinder. There will be slight eccentricities to your C of G which causes the board to become unbalanced from moments not being equal. From this a dynamic horizontal force is induced upon the cylinder which causes it to rotate and move towards, and under, your C of G which aids in recovering the equilibrium before the board comes into contact with the floor. The end result, from practice, is that you can shift your weight across either side of the board to balance out the moments and create a static equilibrium.

**Analysis:**

Figure (a) – Centre of gravity is centred over the cylinder.

$$V(L) + V(R) = V(\text{tot})$$

$$V(L) * x = V(R) * y$$

$$\Sigma \text{ Moments anticlockwise} = \Sigma \text{ Moments clockwise}$$

(Structure is in static equilibrium)

Figure (b) – Centre of gravity becomes slightly offset over cylinder.

$$V(L) * x \neq V(R) * y$$

(Moments unbalanced leading to rotation of board -> force exerted upon cylinder which rolls it towards your offset C of G)

(You have time to position yourself over cylinder before contact with floor)

Figure (c) – Static equilibrium recovered due to free moving cylinder.

$$V(L) * x = V(R) * y$$

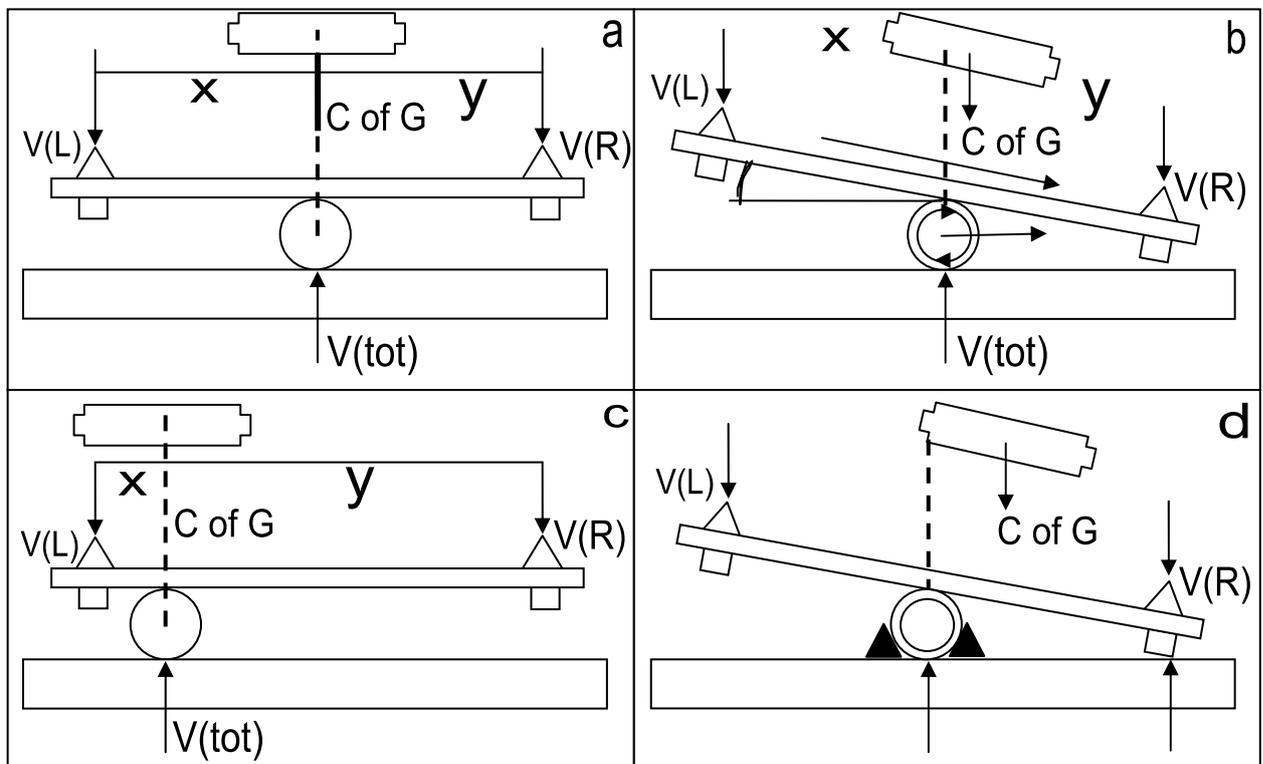


Figure (d) – This is the scenario of the cylinder being restrained in its horizontal movement and so it cannot roll back into position under you C of G for you to recover the equilibrium.

When the cylinder is restrained it effectively becomes an immobile pivot for the board.

The board ultimately comes into contact with the floor to create a different equilibrium of moments/forces with the floor.

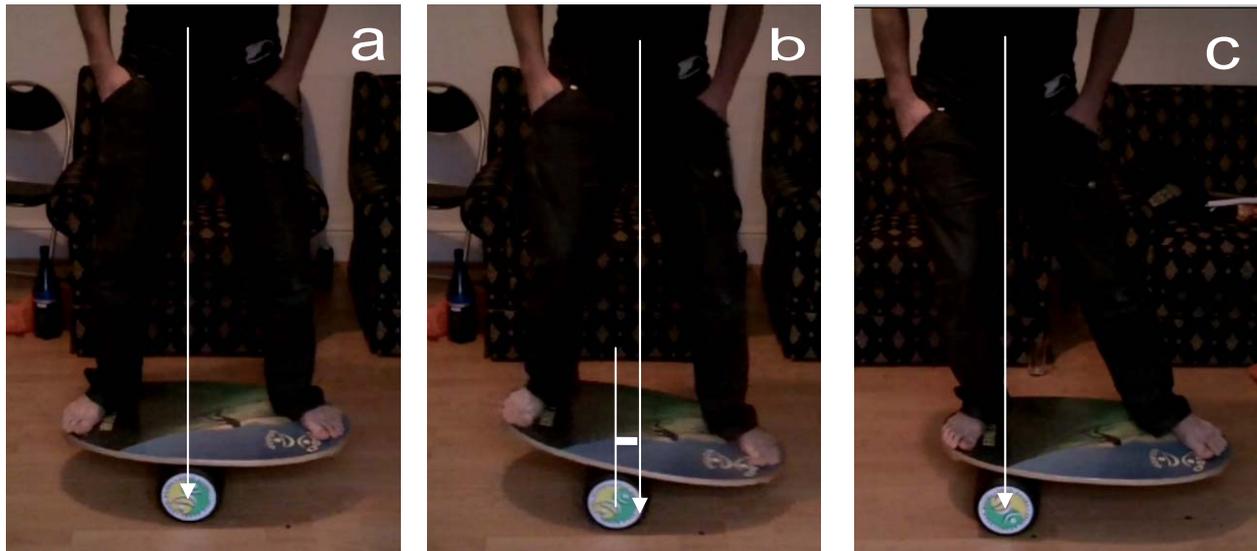
**Video:**

The video can be viewed on Youtube:

<http://www.youtube.com/watch?v=LuwF5mpUjQ0>

The video shows the basic idea of these sequences and shows the short amount of time required between each stage of the board movements.

The video also shows an attempt in restraining the cylinder even if the results were not as smooth as perhaps anticipated.



**Conclusions:**

The C of G does play a vital role in this apparatus along with the separate forces which occur with it.

Further analysis into this structure would cover the accelerations induced over the person and board however it would be too complex to go into now.

**References:**

Tianjian Ji, Adrian Bell. - *Seeing and Touching Structural Concepts.*

**Indoboarding** - <http://www.indoeurope.com/?gclid=CO0lkrPmjKcCFcse4QoduSwXdg>

**Surfing School** - <http://www.outdooradventure.co.uk/education/surfing.htm>

[http://www.surfingonline.co.uk/index.php?main\\_page=index&cPath=141](http://www.surfingonline.co.uk/index.php?main_page=index&cPath=141)

**Video link** - <http://www.youtube.com/watch?v=LuwF5mpUjQ0>