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# The Concept of Affordance in the Teaching and Learning of Undergraduate Science

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## Overview

**History of the term affordance**

**Disciplinary affordance**

**Teaching with disciplinary affordance**

**Two problems**

**Pedagogical affordance**

**Summary**



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## Disciplinary meaning making

Interested in the relationship between **knowledge** and its **representation**.

**Claim:**

Physics forms a perfect playground for semioticians since **disciplinary meaning** is **largely agreed** and **relatively fixed**.



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## Disciplinary meaning making

**View this disciplinary meaning making in terms  
of **disciplinary affordance****

**(Fredlund et al. 2012, Airey 2015, Airey & Linder 2017).**



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## Background to the term affordance

**Gibson (1979)**

**Interested in organism in the environment.**

***Affordance is an invitation to action that is inherent in the environment***

**Affordance is an **inherent property** of an object.**

**A single object has **a myriad of affordances** depending on the setting and the organism.**



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## Background to the term affordance

Norman (1988) Interested in design.

Affordance is only that which is *perceived by the user*.

Affordance is only what a resource affords to one individual, **here and now**.

This means that **affordance changes** depending on the individual and setting.



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## Disciplinary affordance

Introduced the term **disciplinary affordance** for semiotic resources.

Fredlund *et al.* (2012)



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## Disciplinary affordance

### Definition:

*The agreed meaning making functions that a semiotic resource fulfils for a particular disciplinary community.*

Airey (2014)





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## Disciplinary affordance

**Radical break with Gibson and Norman.**

**Focuses on the **discipline's collective, agreed interpretation** of the resource rather than the individual learner's experience.**

**Has potential for education research.**

**This is what we want students to learn.**



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## Disciplinary affordance

**If each disciplinary-specific semiotic resource has a particular disciplinary affordance**

**Then**

**Disciplinary learning can be problematised in terms of coming to appreciate the disciplinary affordances of semiotic resources**

**Fredlund *et al* (2012:658)**



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# Teaching with disciplinary affordance

## Two problems:

### 1. Experts leave things out

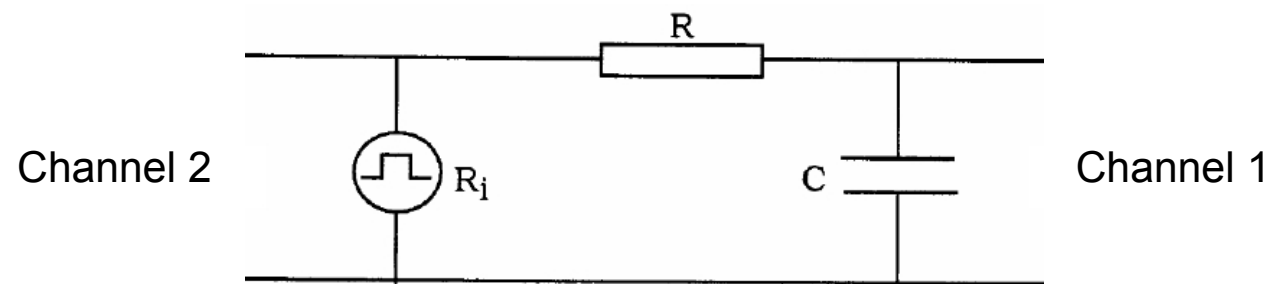
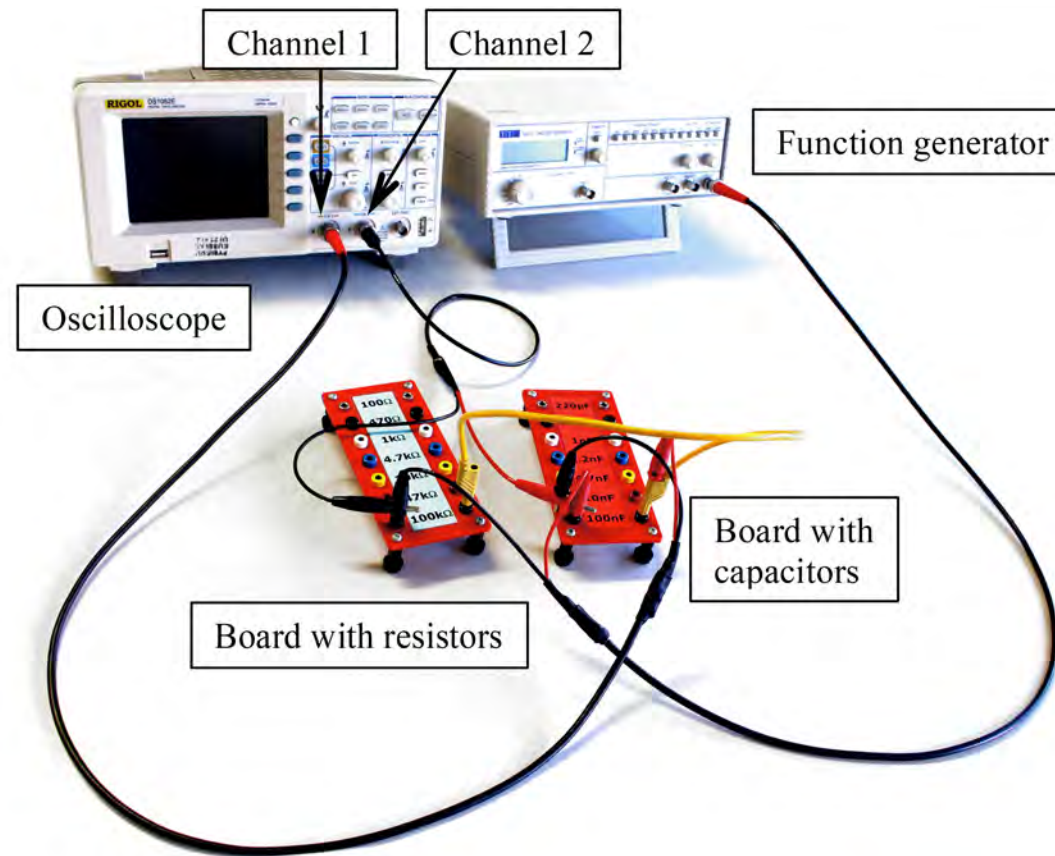
**They know what to add**

### 2. Experts include irrelevant information

**They know where to look**



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## Disciplinary affordance

**Six different ways to connect the circuit**

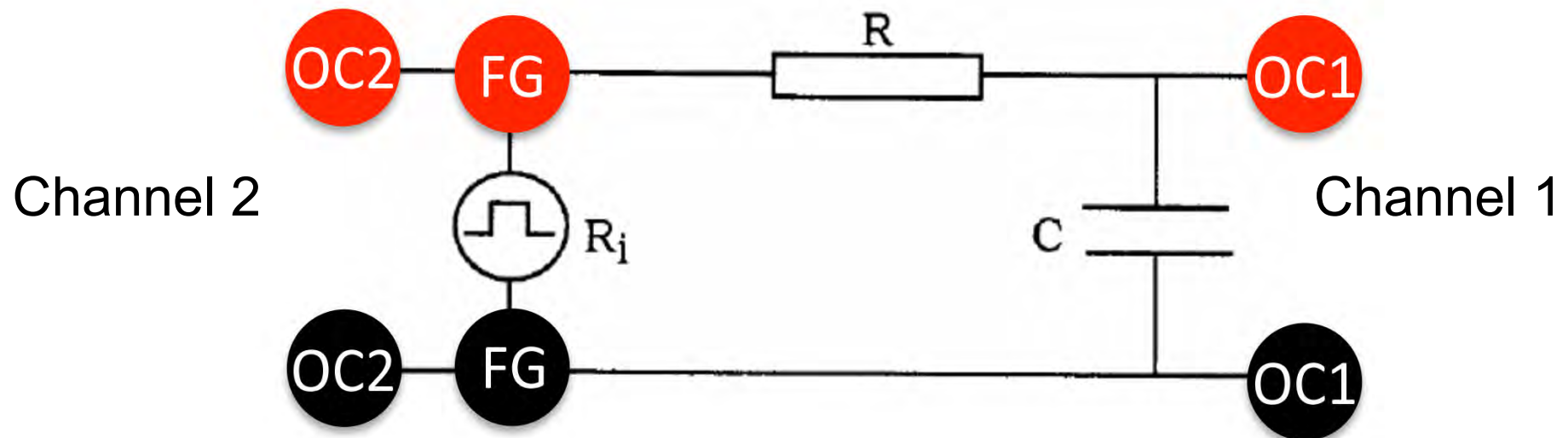
**Only one is correct**

**Deal with this by **unpacking****



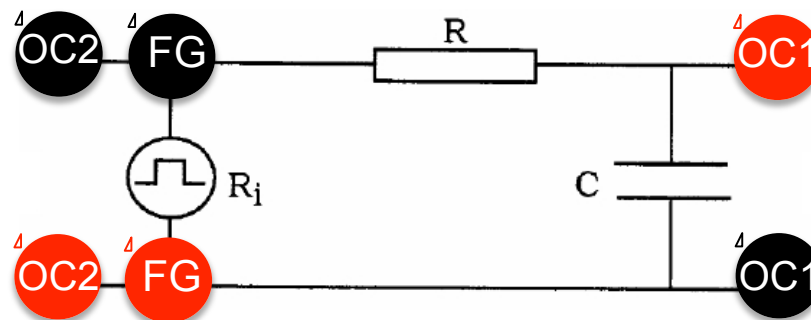
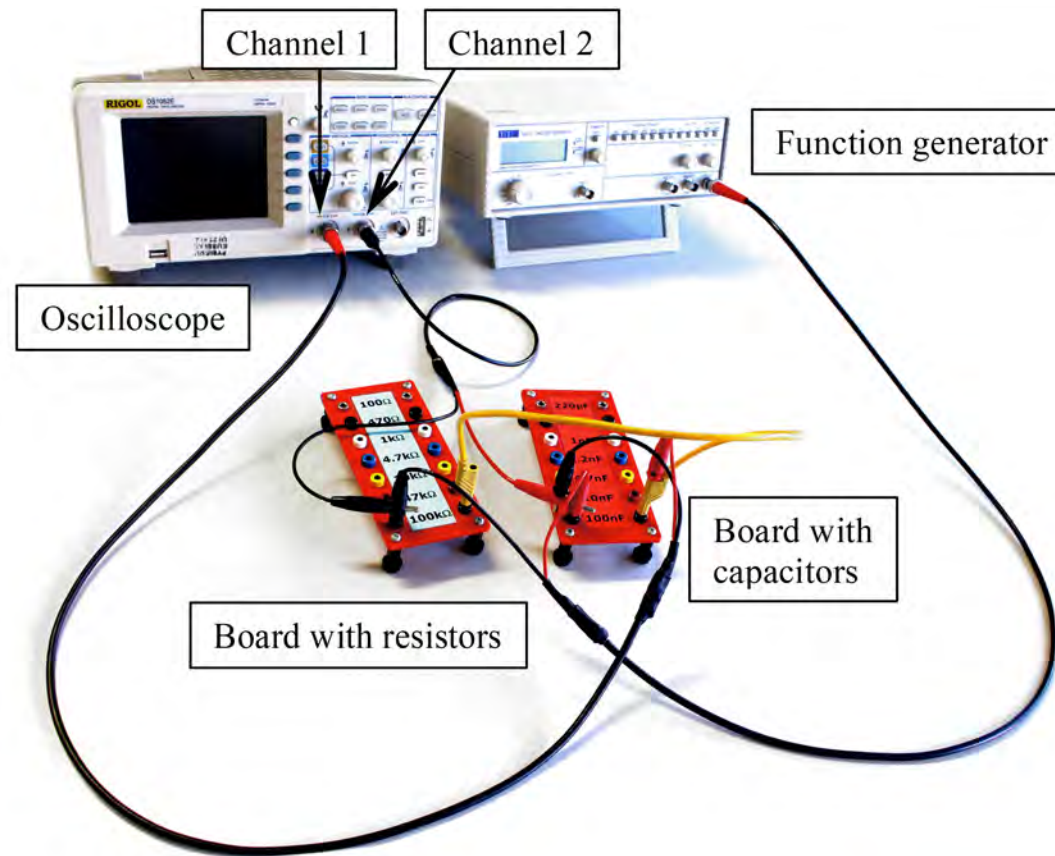
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## Unpacking disciplinary affordance





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## Unpacking disciplinary affordance

The disciplinary affordance has been  
**unpacked**

The resource has been given more  
**pedagogical affordance**





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# Pedagogical affordance

## Definition:

*The **aptness** of a semiotic resource for teaching some particular educational content*

Airey (2015); Airey & Linder (2017)

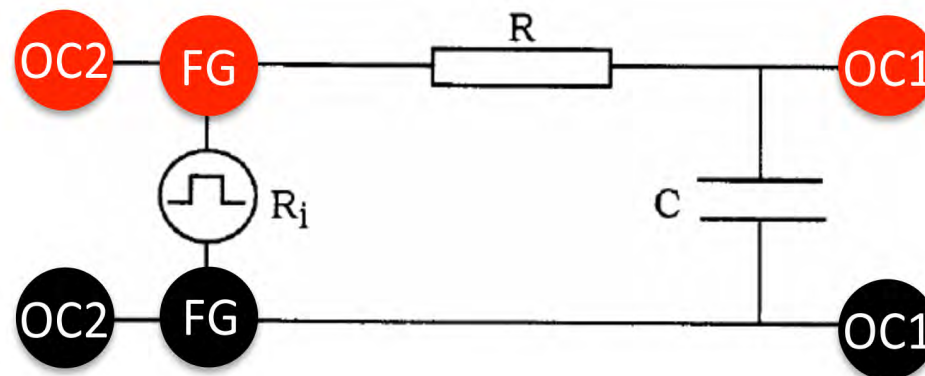


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## Unpacking disciplinary affordance

Unpacking a semiotic resource *increases* its *pedagogical affordance* but *decreases* its *disciplinary affordance*

Airey (2015)

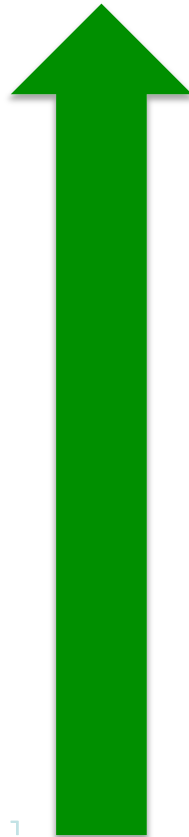




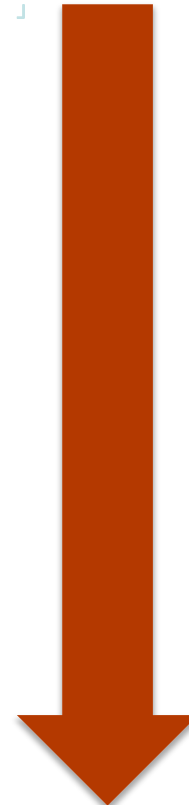
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## Pedagogical vs disciplinary affordance

**Disciplinary  
affordance**



**Pedagogical  
affordance**



Airey (2015)



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# Teaching with pedagogical affordance

**Main problem:**

**Can't usually do physics as easily (or at all)**

**Low disciplinary affordance**

**Usually need to change to another semiotic resource**



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# Teaching with disciplinary affordance

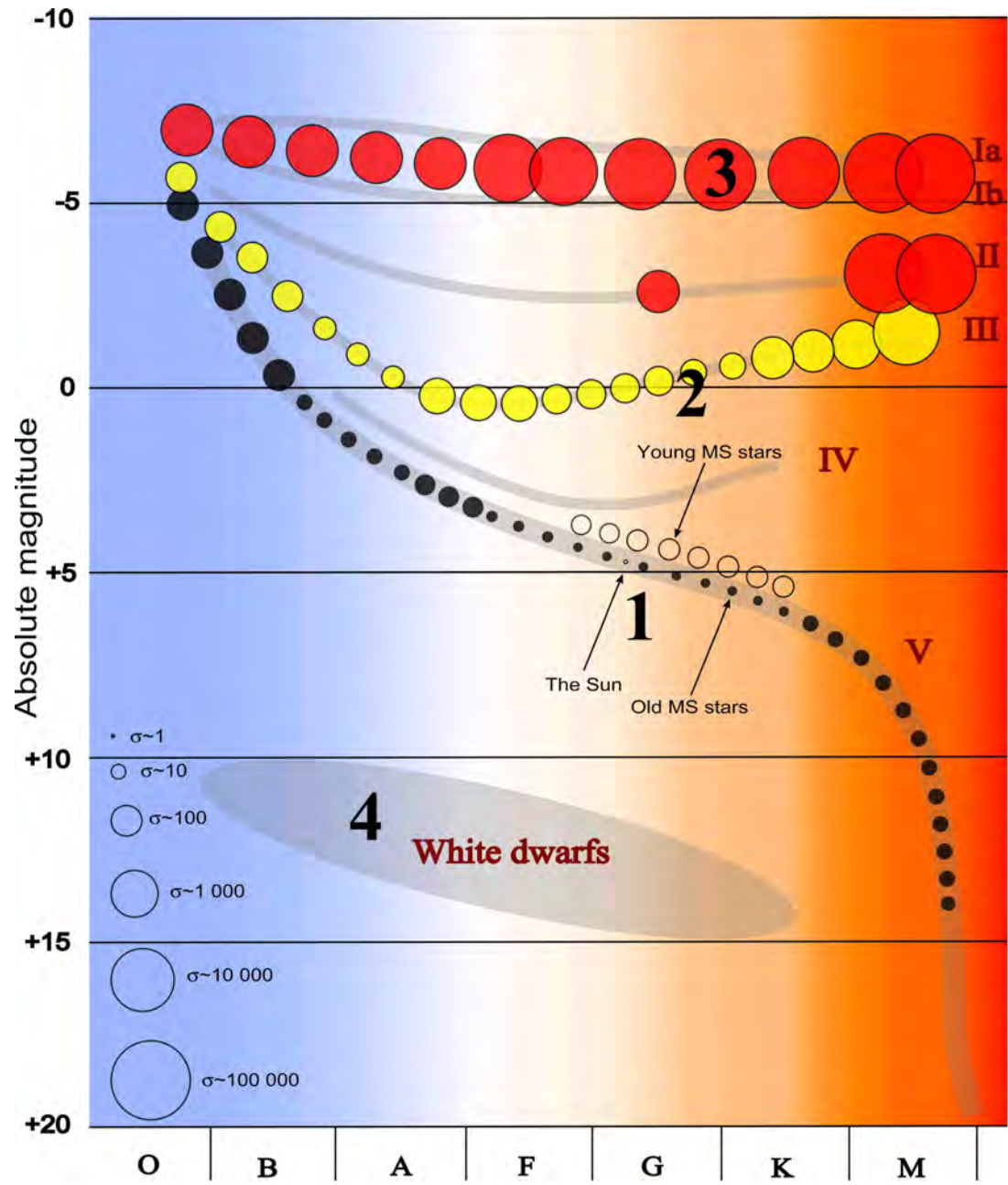
## Two problems:

### 1. Experts leave things out

**They know what to add**

### 2. Experts include irrelevant information

**They know where to look**





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**Too much information**

**Students don't know where to look!**



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## **Disciplinary discernment**

**Imagine you are out with your two-year old son.**

**You see a worm on the ground.**

**He doesn't know what a worm is.**

**How do you get him to notice?**





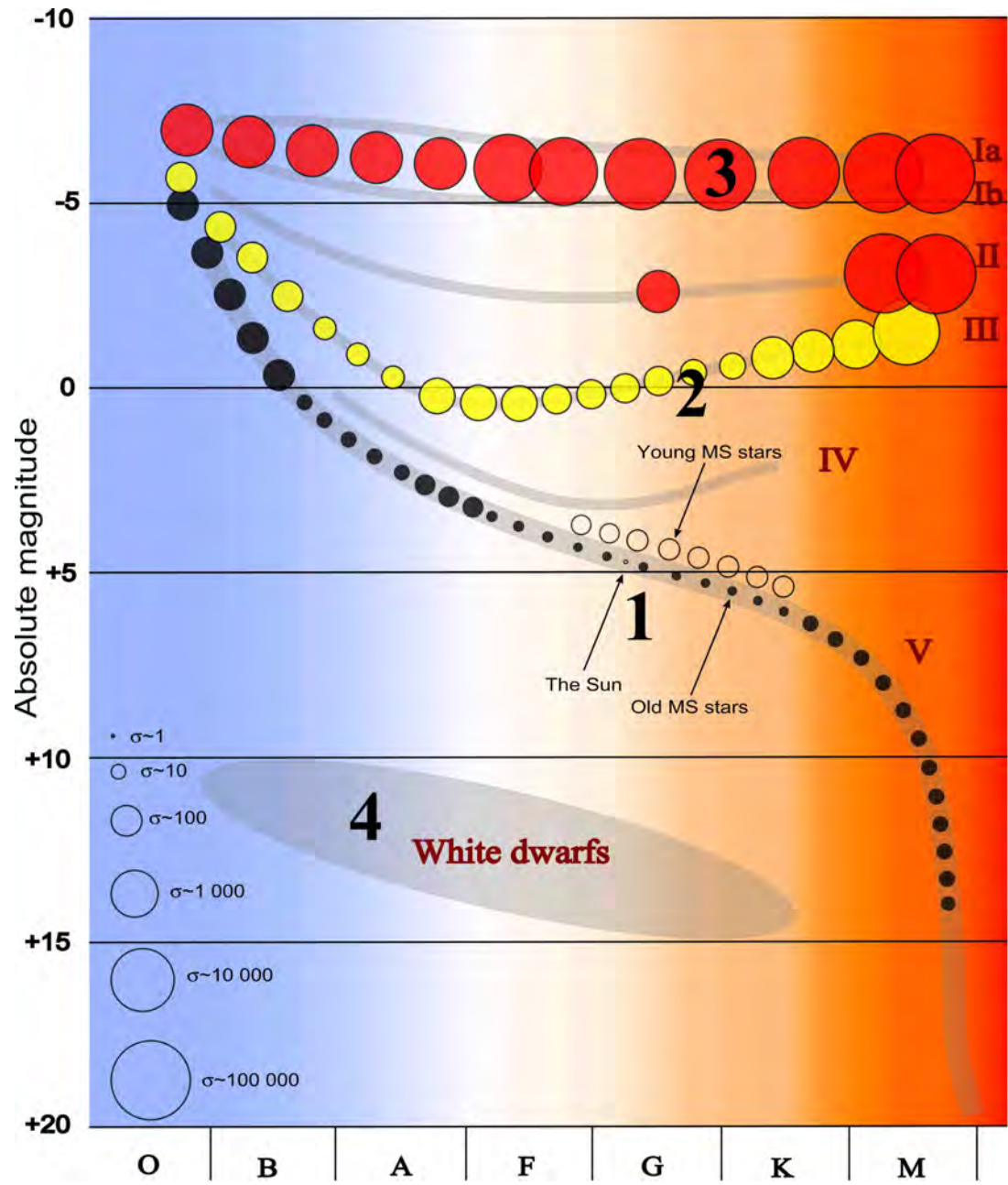


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**This is the essence of variation theory**

**(Marton & Booth 1997)**

**We notice what changes.**







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See Fredlund, Airey & Linder (2015a)

John Airey, ISEC 2018, NIE, Singapore, 21<sup>st</sup> June



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## Variation for noticing disciplinary affordance

- 1. Choose an appropriate semiotic resource**
- 2. Get rid of unnecessary information**
- 3. Hold all aspects constant except for the aspect you want students to notice**

Fredlund (2015), Fredlund, *et al* (2015 a; 2015b; 2015c)



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## Summary

### **Disciplinary Affordance**

*The agreed meaning making functions that a semiotic resource fulfils for a particular disciplinary community.*

### **Pedagogical Affordance**

*The aptness of a semiotic resource for teaching some particular educational content*

**These two are often in functional opposition**



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## Summary

**When teaching with disciplinary affordance experts tend to either:**

- 1. Leave things out.**
- 2. Include too much information.**

**It is possible to solve the first problem by unpacking**

**Unpacking increases the pedagogical affordance but decreases the disciplinary affordance**





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## Summary

**It is possible to solve the second problem by using variation.**



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## Variation for noticing disciplinary affordance

- 1. Choose an appropriate semiotic resource**
- 2. Get rid of unnecessary information**
- 3. Hold all aspects constant except for the aspect you want students to notice**

Fredlund (2015), Fredlund, *et al* (2015 a; 2015b; 2015c)



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# Questions and Comments



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