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

John Airey

Department of Physics and Astronomy
Uppsala University

Department of Mathematics and Science Education
Stockholm University
Overview

History of the term affordance
Disciplinary affordance
Teaching with disciplinary affordance
  Two problems
Pedagogical affordance
Summary
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.
Disciplinary meaning making

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

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.
Background to the term affordance


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.
Disciplinary affordance

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

Fredlund *et al.* (2012)
Disciplinary affordance

Definition:

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

Airey (2014)
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.
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)
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
Channel 2

Channel 1

Function generator

Oscilloscope

Board with resistors

Board with capacitors

\[ R \]

\[ R_i \]

\[ C \]
Disciplinary affordance

Six different ways to connect the circuit

Only one is correct

Deal with this by unpacking
Unpacking disciplinary affordance

Channel 2

Channel 1

John Airey, ISEC 2018, NIE, Singapore, 21st June
Unpacking disciplinary affordance

The disciplinary affordance has been unpacked

The resource has been given more pedagogical affordance
Pedagogical affordance

Definition:

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

Airey (2015); Airey & Linder (2017)
Unpacking a semiotic resource *increases* its *pedagogical affordance* but *decreases* its *disciplinary affordance*.

Airey (2015)
Pedagogical vs disciplinary affordance

Disciplinary affordance

Pedagogical affordance

Airey (2015)

John Airey, ISEC 2018, NIE, Singapore, 21st June
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
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
Too much information

Students don’t know where to look!
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?
This is the essence of variation theory
(Marton & Booth 1997)

We notice what changes.
See Fredlund, Airey & Linder (2015a)

John Airey, ISEC 2018, NIE, Singapore, 21st June
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

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
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
Summary

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

Questions and Comments
References


