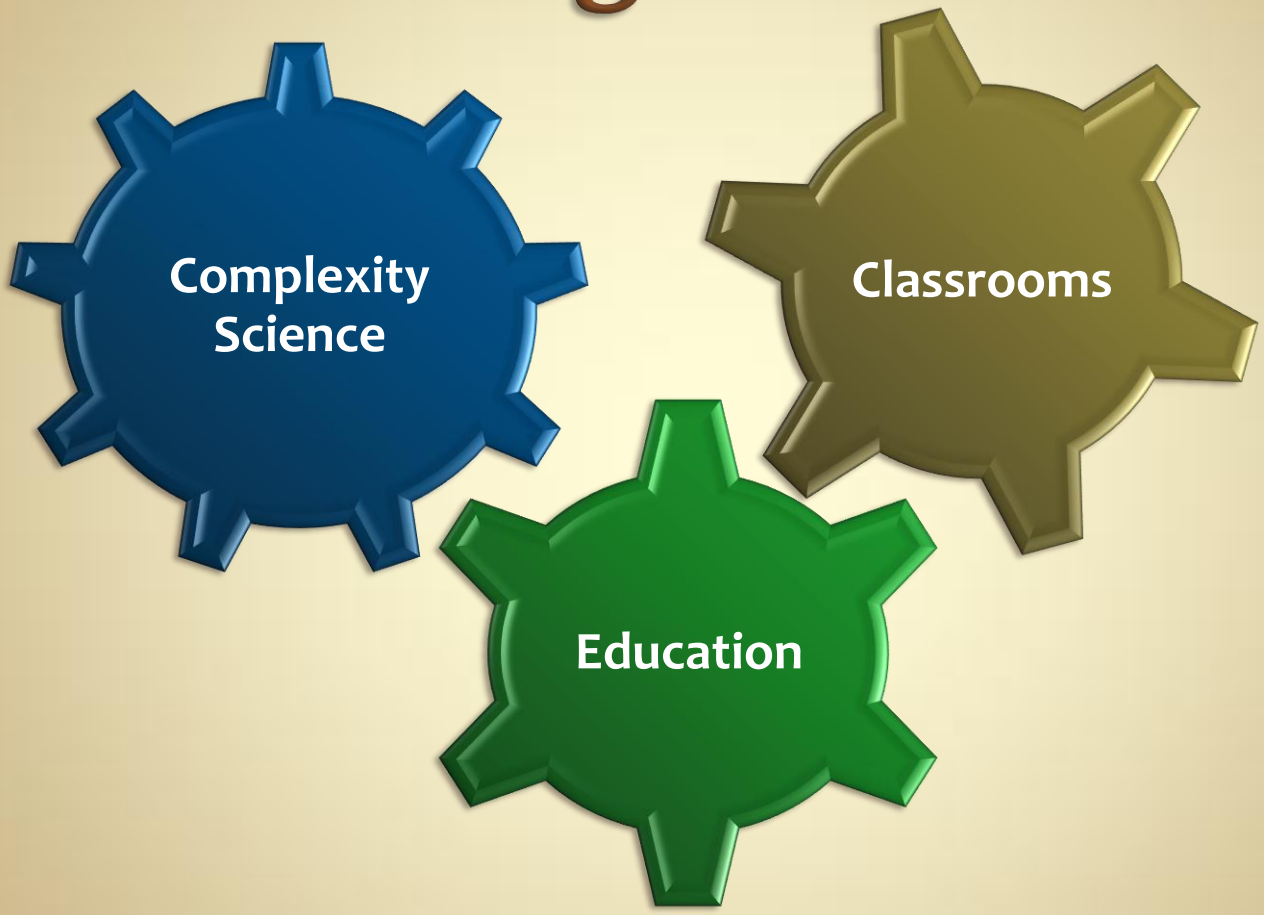
Is complexity theory useful in describing classrooms?



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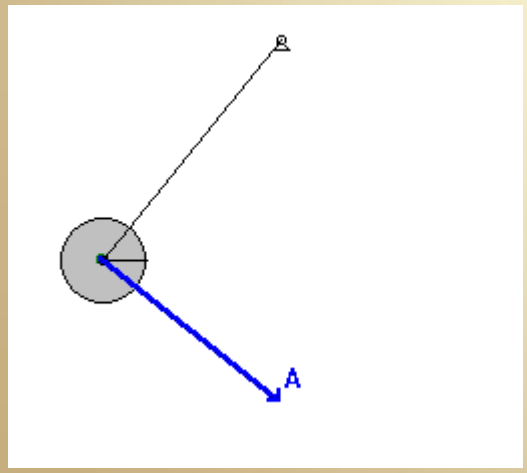
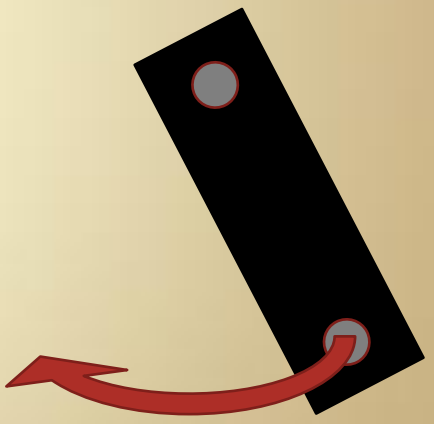
What is Complexity?

In contrast to:

Classical (Newtonian) Science

- Input variable related to output: 'Linear' relationships
- All other variables isolated
- History of system is not important





$$x(t) = A\sin(2\pi ft + \phi)$$

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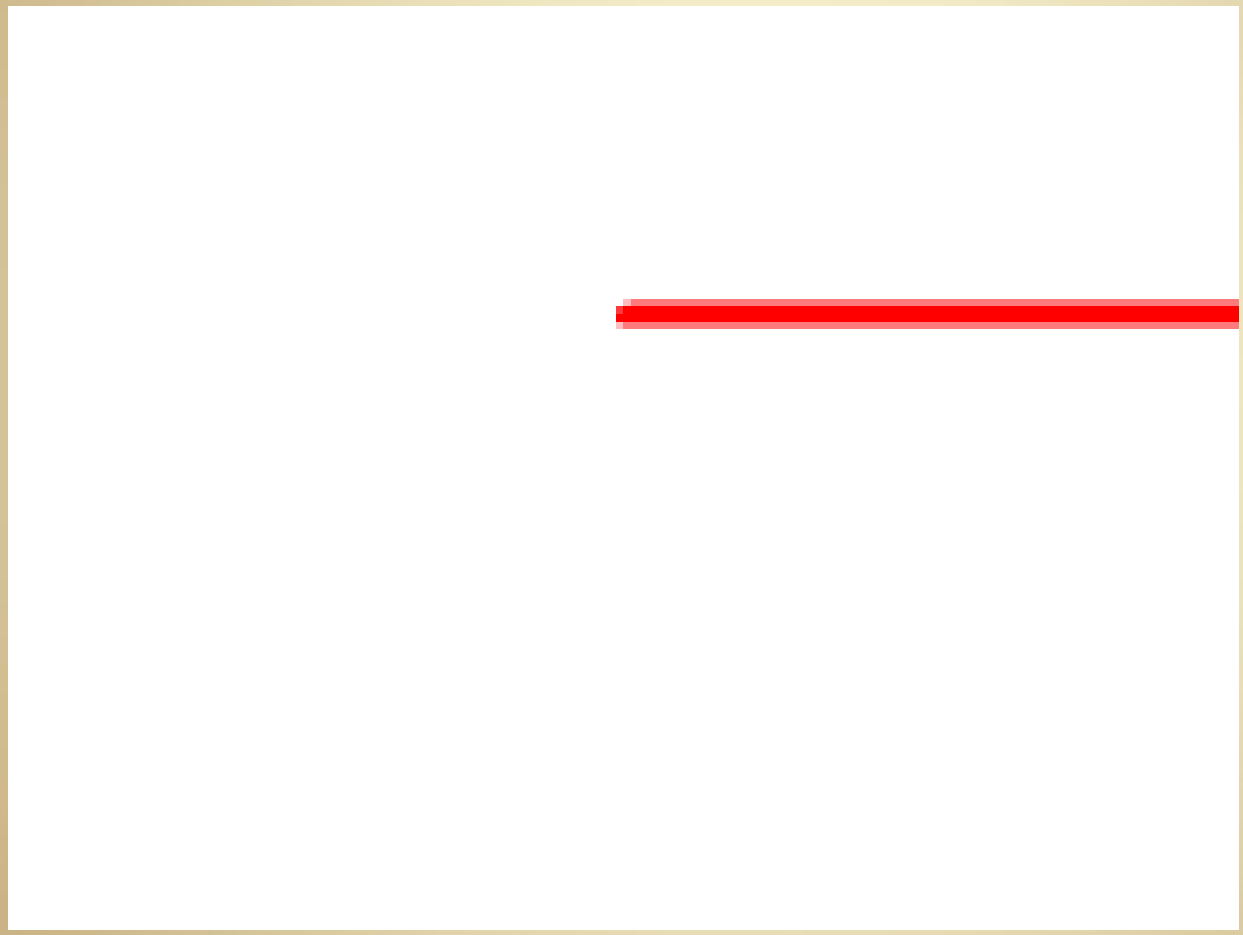
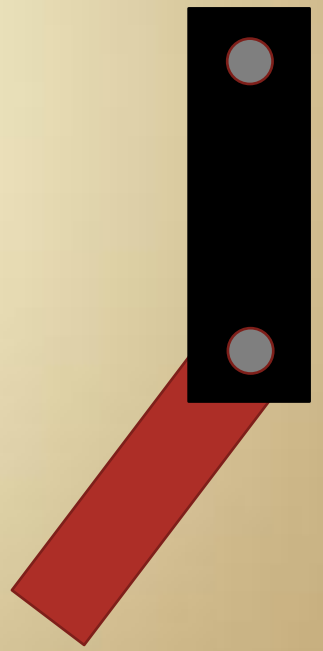
What is Complexity?

Nonlinear Science

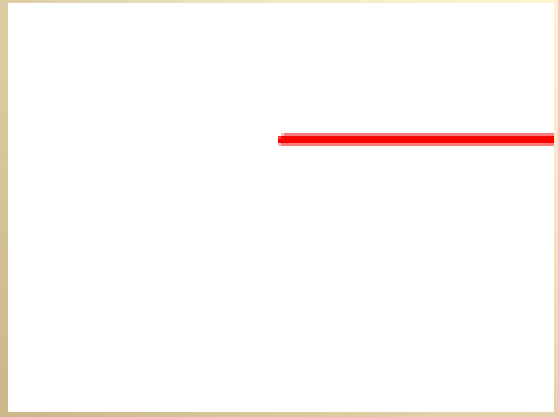


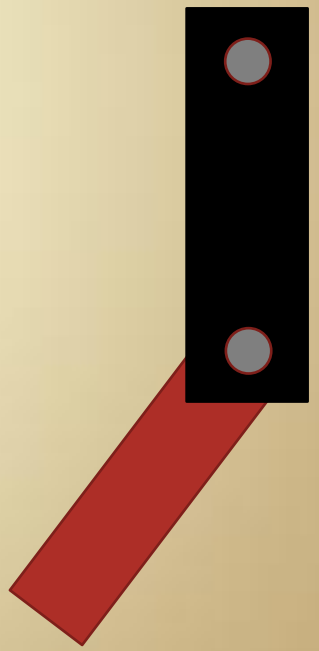


What is Complexity?

Nonlinear Science

- Variables cannot be isolated: ‘nonlinear’ relationships
- Whole system is dynamic and sensitive
- Influenced by environment
- History of system is important



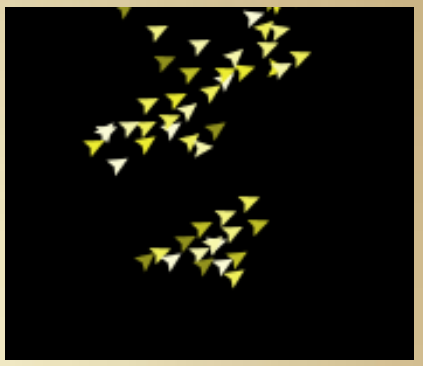


What is Complexity?

Two more examples

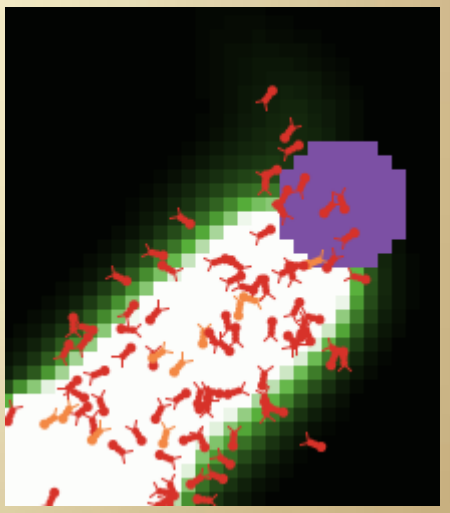
Flocking http://ccl.northwestern.edu/netlogo/models/Flocking

- Birds tend to turn to fly in same direction
- Birds avoid getting too close
- Birds tend to move together



Ants http://ccl.northwestern.edu/netlogo/models/Ants

- Ants move randomly
- When find food, return to nest
- Drop chemical as returning
- Other ants follow chemical



Complexity in Education

In contrast to:

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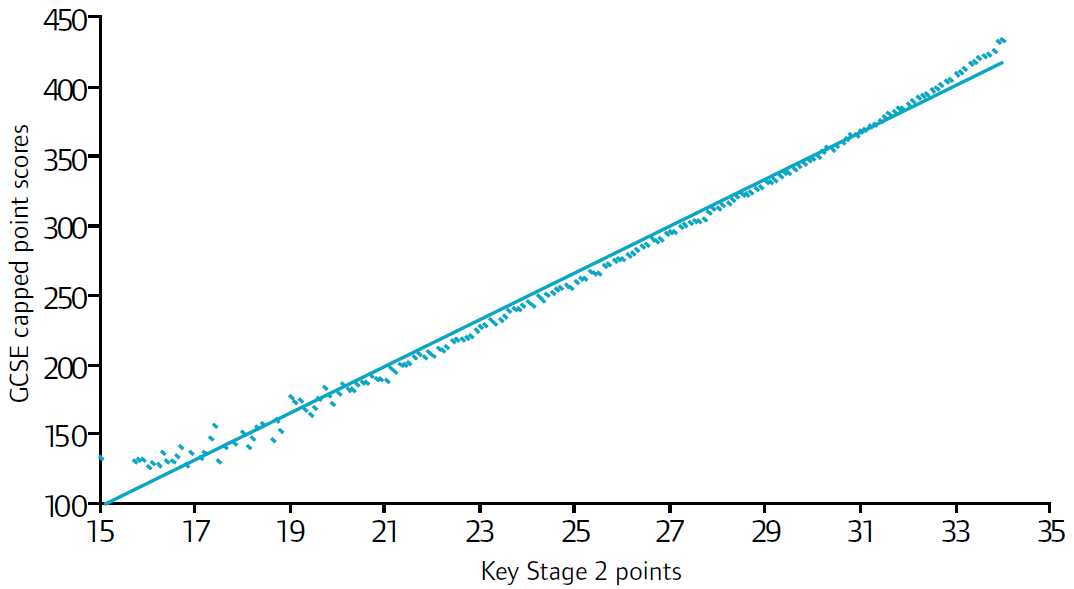
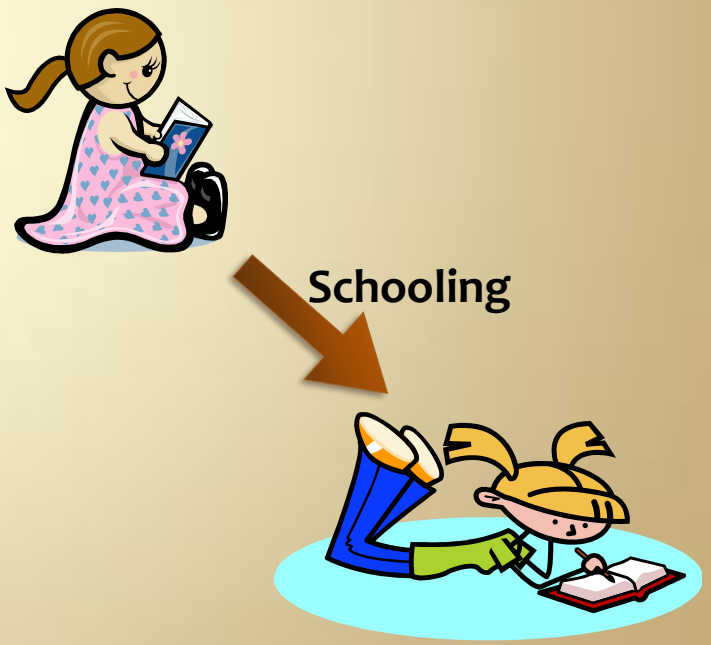
Figure 1: GCSE capped points and Key Stage 2 points





Ofsted (2008) Using Data Improving Schools

Complexity in Education

Complexity Science

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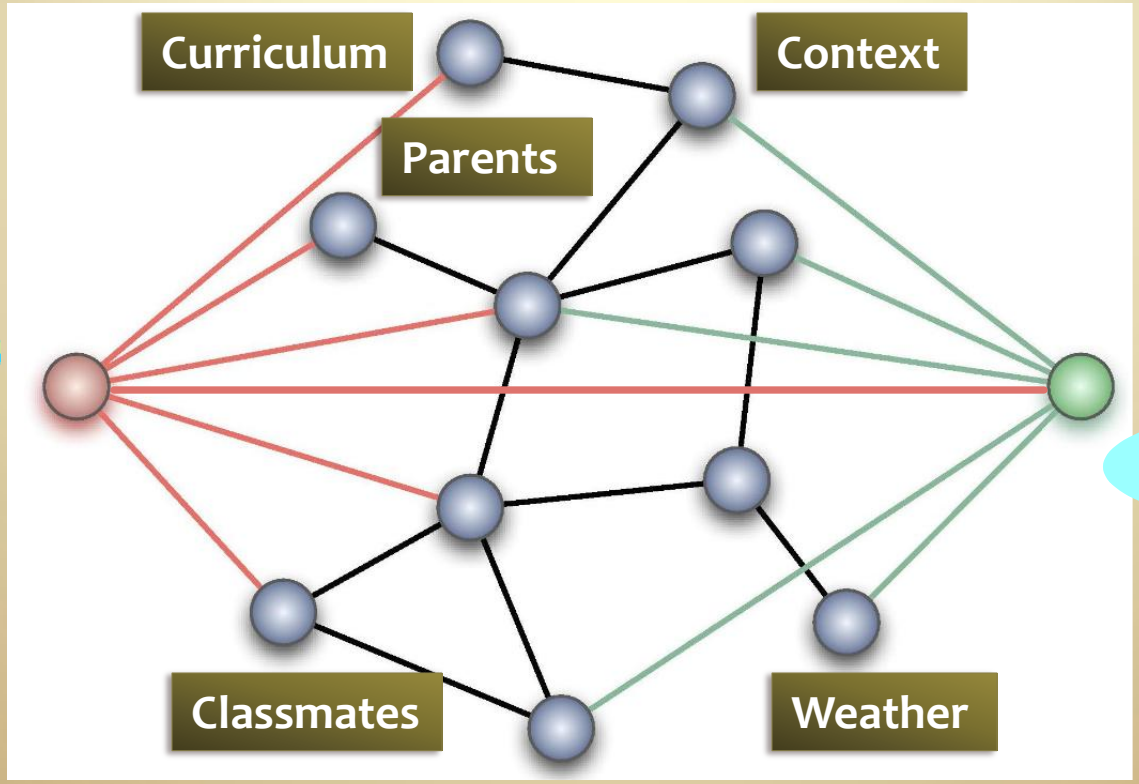


Complexity in Education

Is complexity a useful framework?

Methodological Framework

A. Richardson & Cilliers (2001) categorisation of complexity science:
   1. Hard Complexity Science
   2. Soft Complexity Science
   3. Complexity thinking

B. What has changed in 'transfer' of concepts from physical science to social science:
   1. Additions
   2. Misunderstanding
   3. Reinterpretation

C. Focus on educational literature primarily.

Hard Complexity Science

- Reductionist approach, seeking ‘universal laws’.
- Aligned with modernist positions.

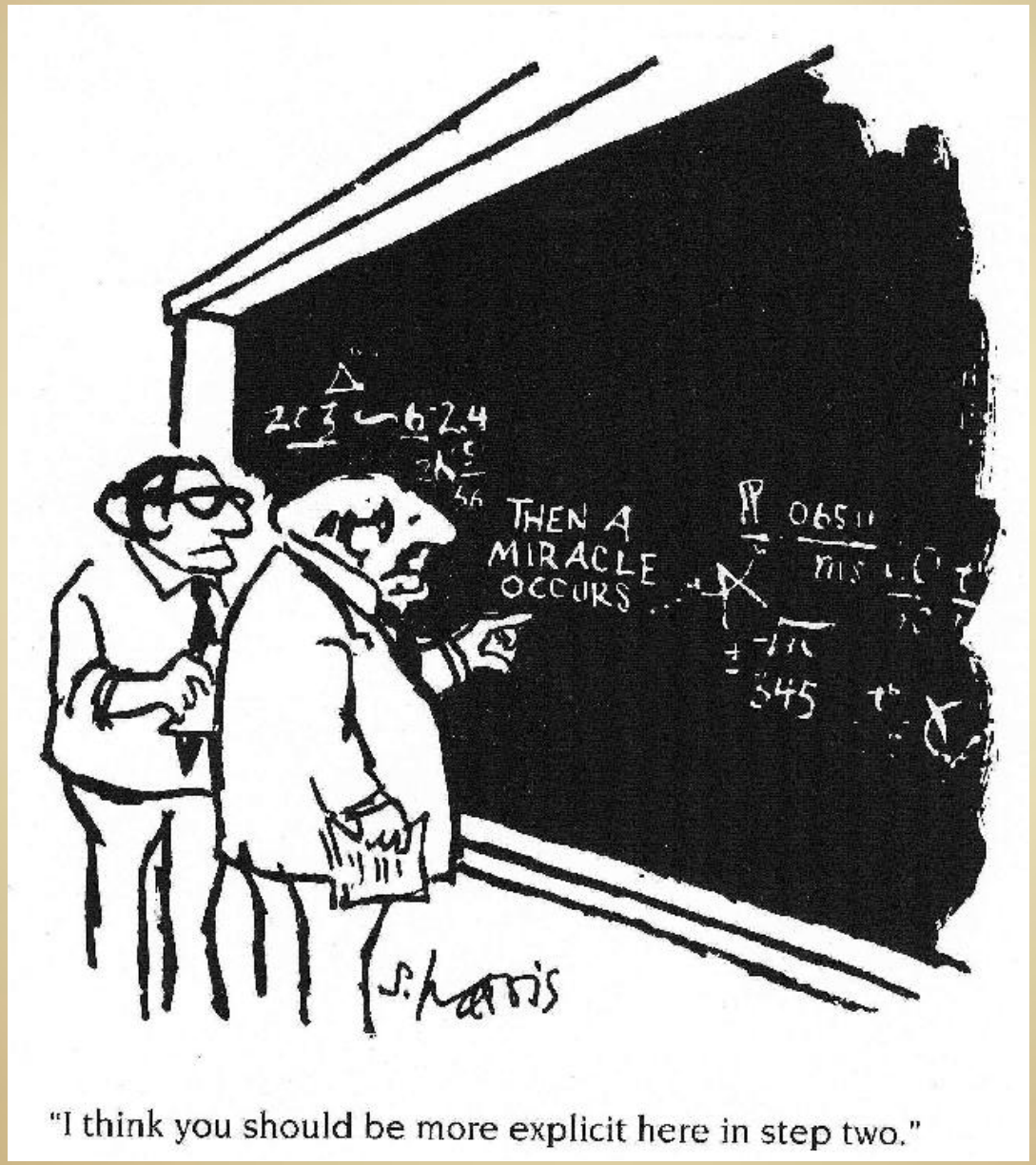
Status

- Rarely seen within social sciences, not at all within educational literature.

Critique

- Due to sensitivity and interaction of elements any reduction of the system is inaccurate and therefore of limited use.

Hard Complexity Science



"I think you should be more explicit here in step two."

Soft Complexity Science

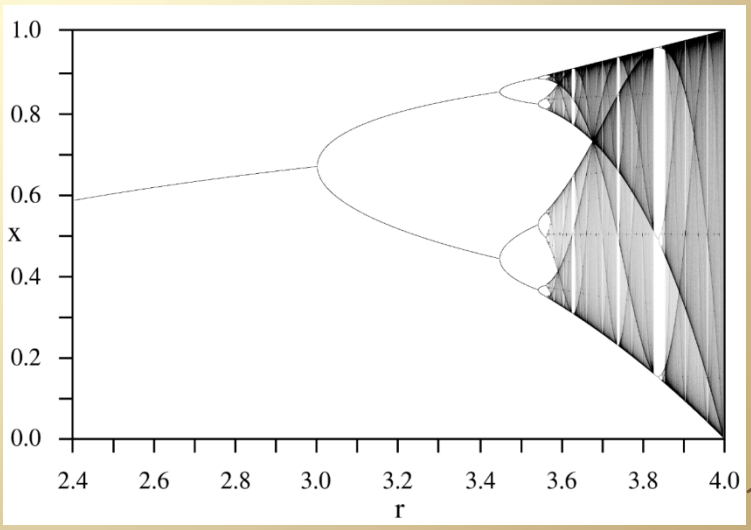
- Complexity as a metaphor for social systems.
- Social world is intrinsically different from the natural world: language and meaning.

Status

- Particularly dominant within management and organisational sciences, used as the basis for description and modelling within education.

Additions

- ‘Edge of chaos’
- Chaos=complexity
- Self-aware agents



Soft Complexity Science

Critique

- Metaphor can be easily applied without clear definition. *Metaphor for metaphors sake.*
- Complexity might not add any new insights
- Needs to be applied to specific systems and terms defined.
- May be useful in explaining sensitivity and unpredictability of classrooms.

Complexity Thinking

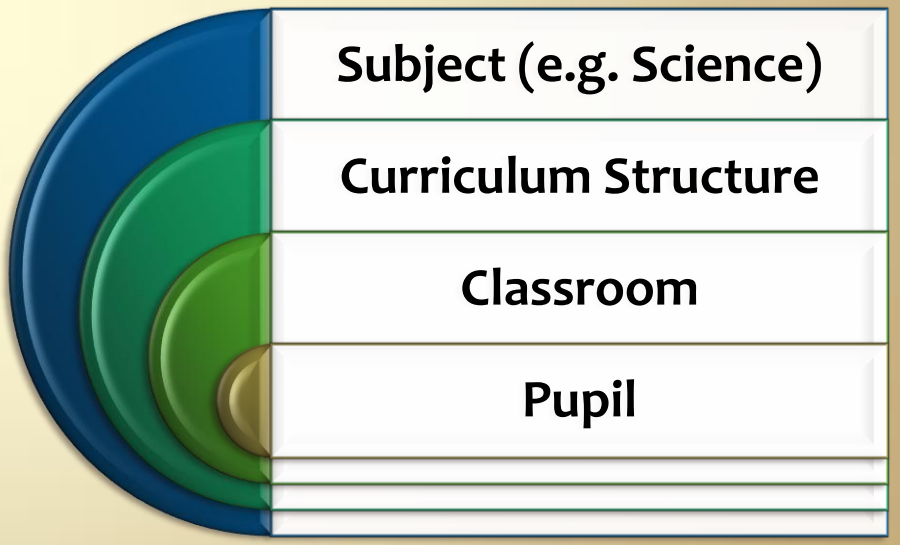
- All knowledge of complex systems is limited.
- Researchers/practitioners are complicit in systems.

Status

- Particularly dominant within the USA and seemingly expanding.

Additions

- ‘Emergence’
- ‘Level-jumping’
- Positive action



Davis & Sumara (2006)

Complexity Thinking

Critique

- Emergent phenomenon might not be what you want to emerge
- No mechanism for 'judging' descriptions/actions
- Epistemology is difficult to pin down
- A 'more positive' form of postmodernism?

Cautions from the Literature

- Any representation must be a reduction
- Social systems are implicitly different from physical ones
- Don’t apply metaphor for metaphor’s sake
- Need to focus on a specific system and define terms
- Descriptions must be judged on their own value, not by appeal to other systems or assuming good things will happen

Is complexity theory useful in describing classrooms?

Possible uses

1. Recognition that classrooms are sensitive, dynamic and unpredictable. They resist 'linear' descriptions.

2. A framework for investigating how successful teachers deal with complexity.

3. Provide specific insight into dynamics of learning within classrooms.

Next Steps

- Focus on the classroom
- Define terms and mechanisms
- Use computational modelling to investigate interactions in classrooms
- Consider how teachers deal with complex systems

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Ofsted (2008) Using Data Improving Schools.

Davis, B. and Sumara, D. (2006) Complexity and education: Inquiries into learning, teaching and research. New Jersey: Lawrence Erlbaum Associates.

Further Reading

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Cilliers, P. (1998) Complexity & Postmodernism – Understanding Complex Systems. London: Routledge

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