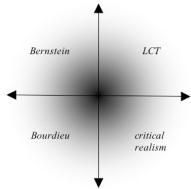


LEGITIMATION CODE THEORY

Mastering Semantic Waves

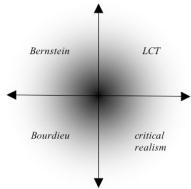
A key to cumulative learning & social justice

Karl Maton
University of Sydney



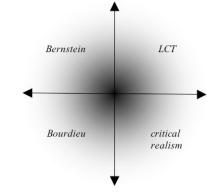
Plan

- problem: enabling cumulative learning
 - problems understanding the problem
 - from sociology of education side of street
- Legitimation Code Theory
 - extending inherited code theory
 - Semantics: semantic gravity and semantic density
- Semantic waves
 - what are they and why should we bother?



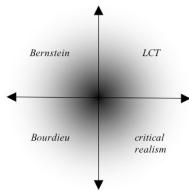
A starting point

- Problem of segmentalism
 - *research*: new knowledge fails to integrate and extend existing knowledge
 - e.g. Land & Canning (2010) on ‘situated learning’
 - *teaching & learning*: students learn segmented ideas or skills
- At heart of education
 - policy focus: ‘lifelong learning’ to work in ‘knowledge economies’



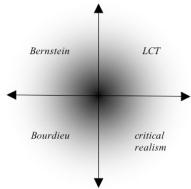
Problems understanding segmentalism

- ‘knowledge’ = subjective knowledge
 - learning as generic process - knowing
 - ‘whose knowledge?’ - knowers
 - obscures knowledge as an object
- accounts of forms of knowledge are themselves segmental
 - static dichotomous types



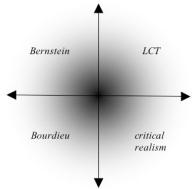
Typologies of knowledge

Bernstein	vertical discourse	horizontal discourse
Bourdieu	theoretical logic	practical logic
Foucault	programmes	technologies
Freud	ego	id
Levi-Strauss	science	bricolage
Levy-Bruhl	modern thinking	primitive thinking
Lotman	rule-governed	exemplary texts
Luria	abstract thinking	situational thinking
Piaget	science/effective thought	technique/sensorimotor
Sohn-rethel	intellectual	manual
Vygotsky	conceptual thinking	complex thinking
Walkerdine	formal reasoning	practical reasoning



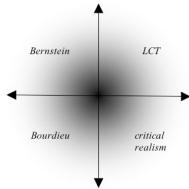
Typologies of knowledge

- Biglan (1973): hard / soft, pure / applied, life / non-life
- Kolb (1981): abstract / concrete, active / reflective
- Becher (1994) mixture of above typologies
- Others:
 - effective / ineffective
 - elaborated / restricted
 - context-independent / context-dependent
 - singulars / regions
 - conceptual / contextual
 - generalizing / localizing



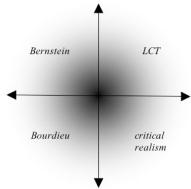
Missing the point

- Criticisms and caveats focus on whether typologies include all kinds of knowledge
 - admit they ‘cannot do justice to the complexity and variation of inquiry processes and knowledge structures in various disciplines’ (Kolb 1981: 245)
 - critics typically argue need for more categories
- Based on empiricist desire for a map as big as the country



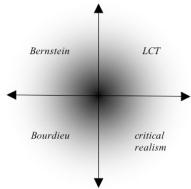
Segmental thinking

- dichotomous types only describe features of knowledge
- lack analysis of organising principles
- empirical practices do not neatly fit types
- obscure processes of change between different forms
 - e.g. how to move from one form to another



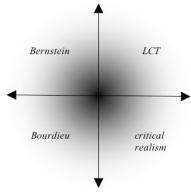
Bernstein's typology

- Horizontal discourse
 - everyday knowledge: ‘local, segmentally organised, context specific and dependent’ (1999: 159)
- Vertical discourse
 - ‘takes the form of a coherent, explicit, and systematically principled structure’ (1999: 159)
- Knowledge structures
 - *hierarchical*: integration and subsumption
 - *horizontal*: accumulation and segmentation



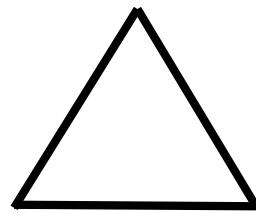
Extending Bernstein's typology

- *hierarchical curriculum structures*
 - units of curriculum build on and integrate knowledge from previous units
- *horizontal curriculum structures*
 - segmented series of skills or knowledge
- *cumulative learning*
 - knowledge transferred across curricular and pedagogic contexts
- *segmented learning*
 - knowledge is locked into its curricular and pedagogic contexts, problematising transfer



Knowledge structures

Hierarchical

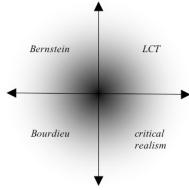


Horizontal



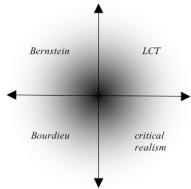
‘an explicit, coherent, systematically principled and hierarchical organisation of knowledge’ which develops through integrating ‘knowledge at lower levels, and across an expanding range of phenomena’

‘a series of specialised languages, each with its own specialised modes of interrogation and specialised criteria ... with non-comparable principles of description based on different, often opposed, assumptions’



Bernstein's guide to what's needed

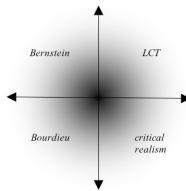
- move beyond typologies to conceptualise organising principles
 - difference, variation, similarity
 - change over time
- encompass more phenomena with conceptual economy
- potential for enactment in empirical research of wide range of issues



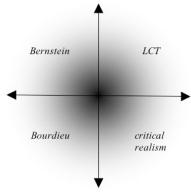
Principles

Modalities

Legitimation Device	Autonomy	PA+/-, RA+/-	legitimation codes
	Density	MaD+/-, MoD+/-	
	Specialisation	ER+/-, SR+/-	
	Semantics	SG+/-, SD+/-	
	Temporality	TP+/-, TO+/-	

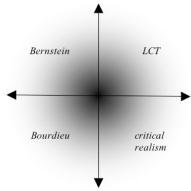


<u>Dimension</u>	<u>Referent relations</u>	<u>Principal concepts</u>
Autonomy	external	positional autonomy, relational autonomy
Density	internal	material density, moral density
Specialisation	social-symbolic	epistemic relations, social relations
Semantics	meaning	semantic gravity, semantic density
Temporality	temporal	temporal positioning, temporal orientation



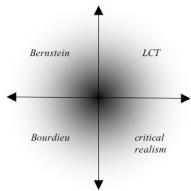
Intrinsic dynamics of code theory

- pedagogic codes
 - classification & framing: $\pm C$, $\pm F$
 - model for concepts, but not whole story
- specialisation codes (LCT)
 - found second dimension for using $\pm C$, $\pm F$
 - became: epistemic relations / social relations
 - extends, integrates and subsumes inherited framework



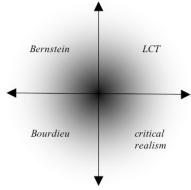
Extending inherited framework

Inherited concepts	LCT(Specialisation)
pedagogic codes <u>+C</u> , <u>+F</u>	specialisation codes ER+/-, SR+/- - abbreviates : ER(<u>+C</u> , <u>+F</u>), SR(<u>+C</u> , <u>+F</u>)
pedagogic device	epistemic-pedagogic device
knowledge structures • grammars • gazes	knowledge-knowers structures • epistemic relations • social relations



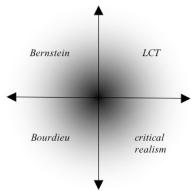
LCT in practice

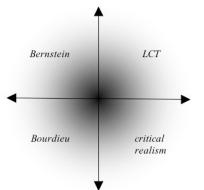
- nursing education
- mathematics, school music, school English
- physics and biology at school and university
- design studies
- ‘critical thinking’ across range of disciplines
- rise of neoliberalism
- informal learning in museums
- curriculum and assessment in higher education
- forms of writing in different disciplines
- regionalisation of higher education degrees
- cumulative learning in classrooms
- online internationalised education
- Chinese students learning online
- educational technology (e.g. the Digital Education Revolution in Australia)
- young people’s knowledge practices with technology
- Freemasonry apprenticeship
- Indigenous Native Title claims
- ... and many others, available at:



Intrinsic dynamics of code theory

- specialisation codes do not exhaust organising principles
- context-dependence highlighted by inherited theory
 - elaborated / restricted codes
 - knowledge structures
- feedback from empirical studies using LCT

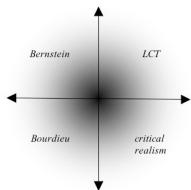


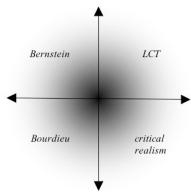


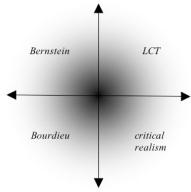


Neighbourhood watch

- Christie, F. & Martin, J. (eds) (2007) *Language, Knowledge and Pedagogy: Functional linguistic and sociological perspectives*. London, Continuum.
- Christie, F. & Maton, K. (eds) (2011) *Disciplinarity: Functional linguistic and sociological perspectives*. London, Continuum.
- Hood, S. (2010) *Appraising Research: Evaluation in academic writing*. London, Palgrave Macmillan.
- Maton, K., Hood, S. & Shay, S. (eds) (in preparation) *Knowledge-Building: Educational studies in Legitimation Code Theory*. London, Routledge.
- as well as dozens of articles, chapters and conference papers, many available at website...







Extrinsic impetus from SFL

- Geoff Williams on ‘protorecon’ and working with Frances Christie and Mary Macken-Horarik
 - pushing towards *semantic gravity*
- J.R. Martin on grammatical metaphor and technicality
 - emergence of *semantic density*
- interdisciplinary ARC research
 - tools for analysing texts (including graffiti)



Some LCT notation and graffiti

- +/- stronger / weaker
- ↑/↓ strengthening / weakening
- ↑ weaker being strengthened;
- +↑ stronger being strengthened
- ↓ weaker being weakened;
- ↑ weaker being strengthened
- +↓+ stronger being weakened but still stronger
- +↓- stronger being weakened to weaker
- forward in time
- ← backwards in time
- (x) focus of action, e.g. "SR↑(classroom)" = "strengthening social relation re classroom"
- (x,y) focus of action, kind of SR / ER, e.g. "SR↑(classroom, dispositions)" = "strengthening social relation re

dispositions of actors in classroom"

SR^f superscript f = focus; e.g. social relation as focus (can be ER, SR, SG, SD, etc)

SR^b superscript b = basis; e.g. social relation as basis

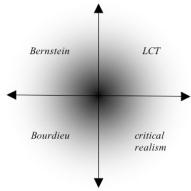
$SD+(ER)$ is stronger semantic density (based on epistemic relations), i.e. epistemological condensation

$SD+(SR)$ is stronger semantic density (based on social relations), i.e. axiological condensation

SMALL CAPITALS = symbol with stronger *epistemological* semantic density

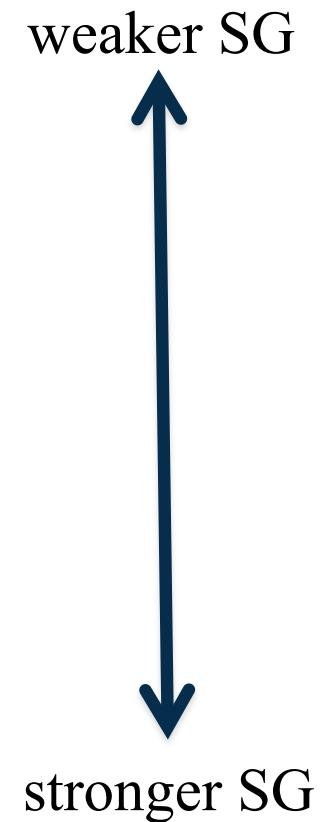
wavy underline = symbol with stronger *axiological* semantic density

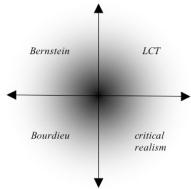
~~BOTH~~ = symbol with stronger *epistemological* and *axiological* semantic density



Semantic gravity

- degree to which meaning relates to its context (whether social or symbolic)
- may be stronger (+) or weaker (-) along a continuum of strengths
 - the stronger SG, the more closely meaning relates to its context
 - the weaker SG, the less meaning is dependent on its context

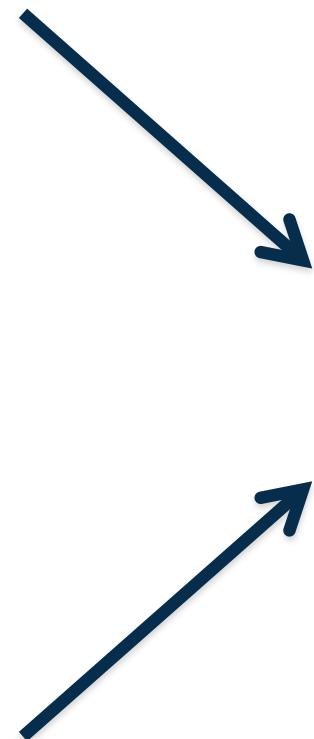


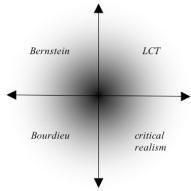


Semantic gravity

- *strengthening* semantic gravity
 - e.g. moving down from an abstract concept to concrete examples of that concept

- *weakening* semantic gravity
 - e.g. abstracting generalising principles from the concrete particulars of a specific context or case

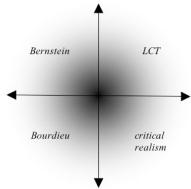




Semantic density

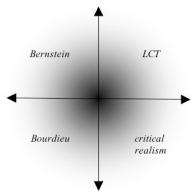
- degree of condensation of meaning
- may be stronger (+) or weaker (-) along a continuum of strengths
 - weaker = fewer meanings are condensed
 - stronger = more meanings are condensed





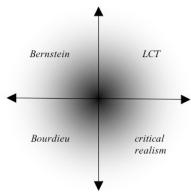
Gold

- me:
 - bright yellow, shiny, malleable metal used in coins, jewellery, dentistry and electronics



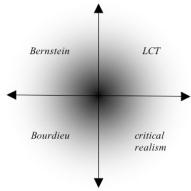
Gold

- Atomic Number: 79
- Symbol: Au
- Atomic Weight: 196.9665
- Electron Configuration:[Xe] $6s^14f^{14}5d^{10}$
- Isotopes: 18.
- Density (g/cc): 19.3
- Melting Point (°K): 1337.58
- Boiling Point (°K): 3080
- Atomic Radius (pm): 146
- Atomic Volume (cc/mol): 10.2
- Covalent Radius (pm): 134
- Ionic Radius: 85 (+3e) 137 (+1e)
- Specific Heat (@20°C J/g mol): 0.129
- Fusion Heat (kJ/mol): 12.68
- Evaporation Heat (kJ/mol): ~340
- Debye Temperature (°K): 170.00
- Pauling Negativity Number: 2.54
- First Ionizing Energy (kJ/mol): 889.3
- Oxidation States: 3, 1
- Lattice Structure: Face-Centered Cubic (FCC)
- Lattice Constant (Å): 4.080
- Specific Gravity (20°C): 18.88



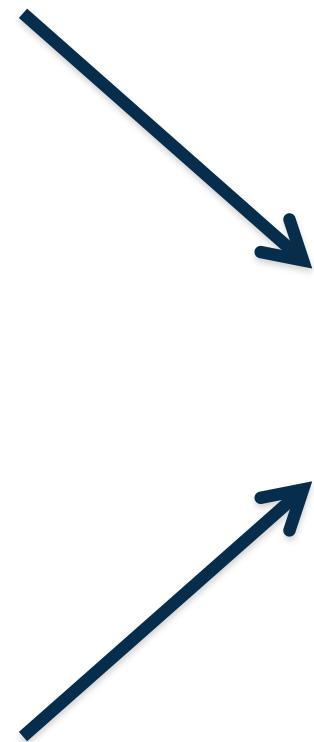
Gold

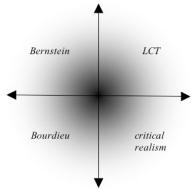
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Semantic density

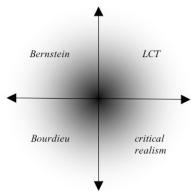
- *weakening* semantic density
 - e.g. ‘unpacking’ a dense concept into everyday language
- *strengthening* semantic density
 - e.g. condensing a large range of meanings into a symbol or technical term



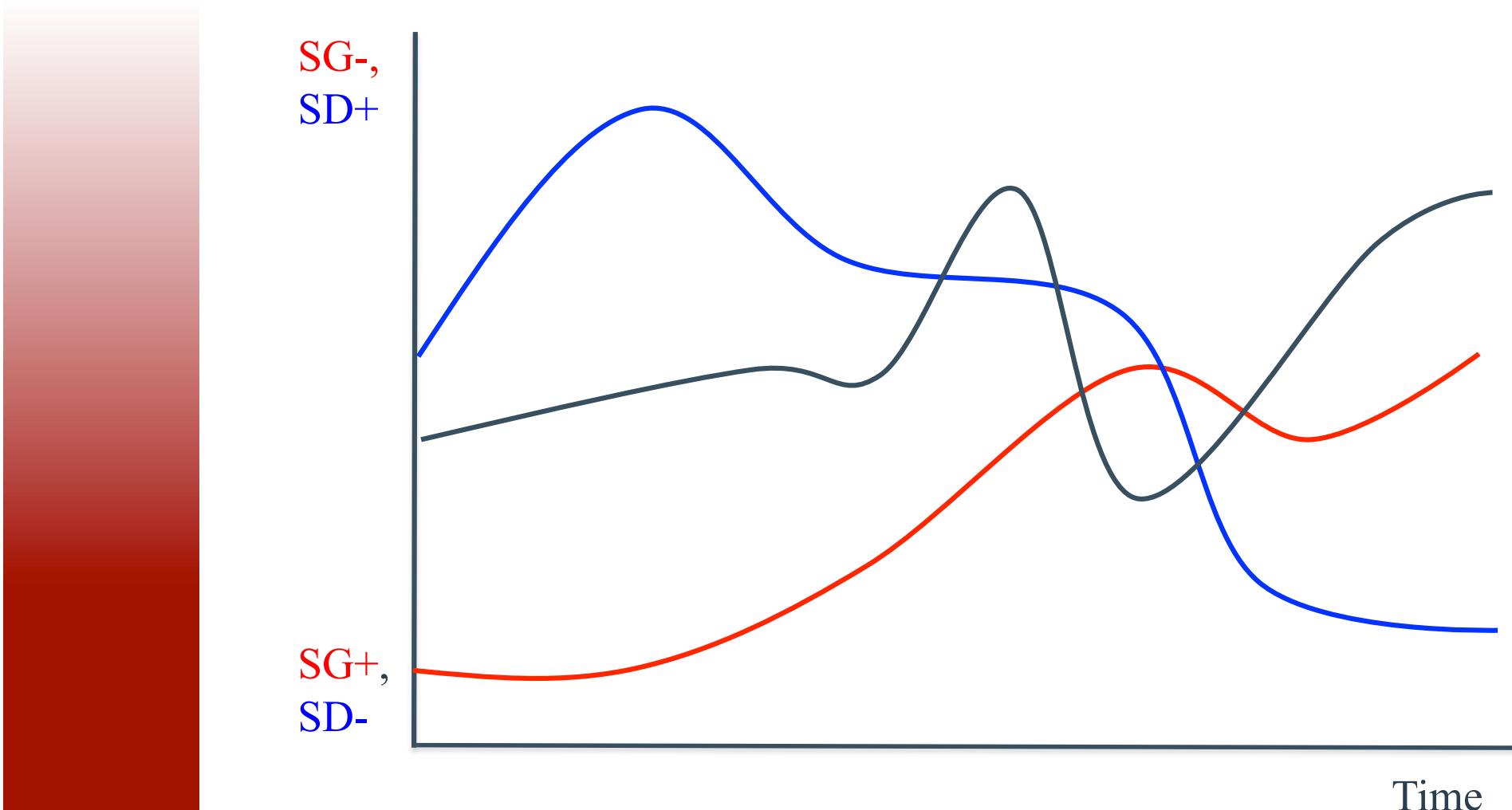


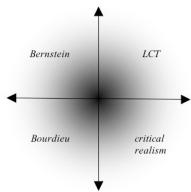
Semantics

- Semantic codes: SG $+$ / $-$, SD $+$ / $-$
 - distinguishes previously elided issues
 - organising principles (not dichotomous types)
 - continua with infinite capacity for gradation
- Chart change over time: SG $\uparrow\downarrow$, SD $\uparrow\downarrow$
 - semantic profiles
 - semantic wave
 - semantic flatline

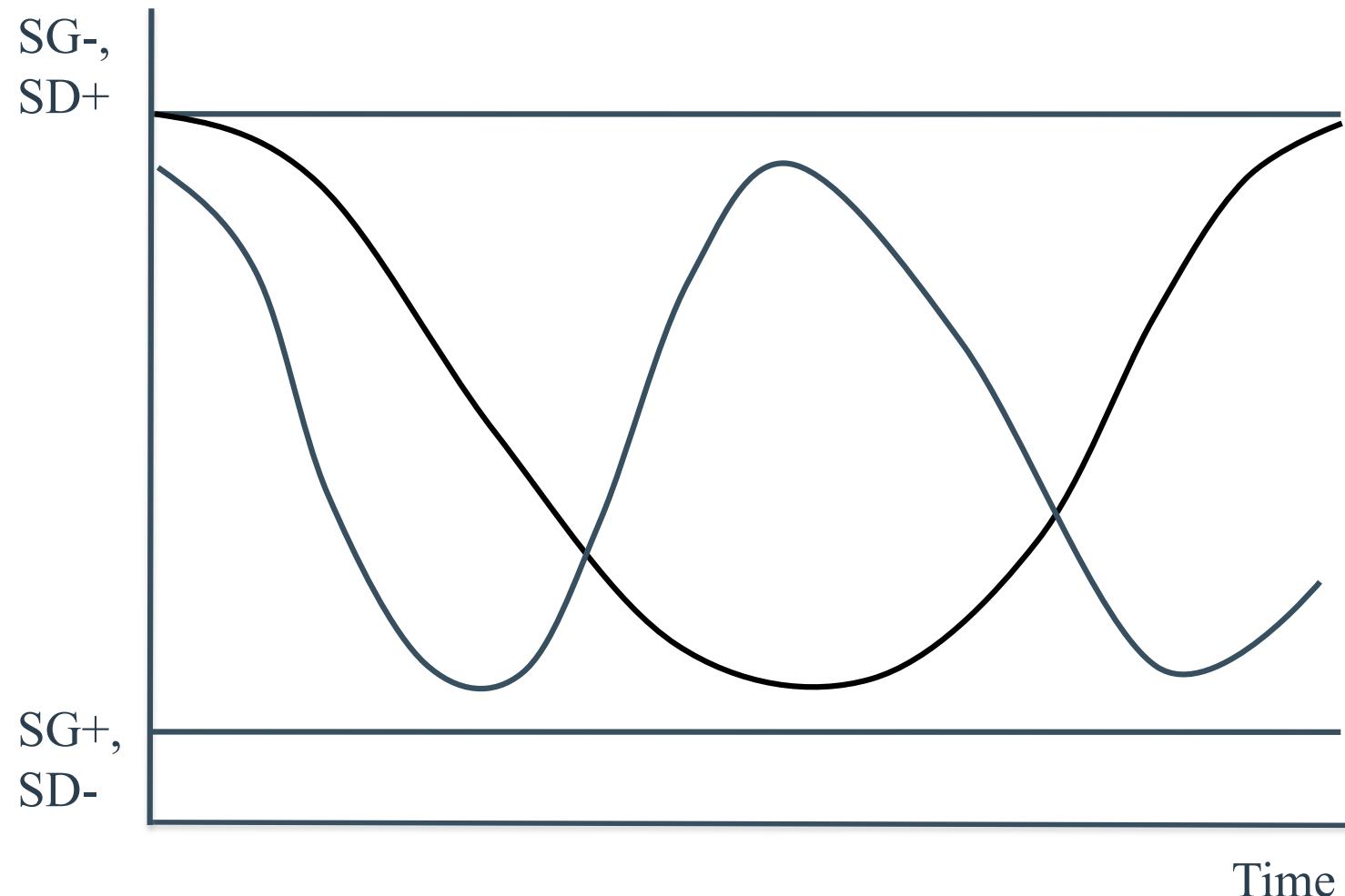


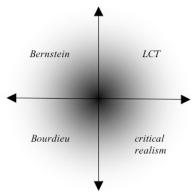
Semantic profiles





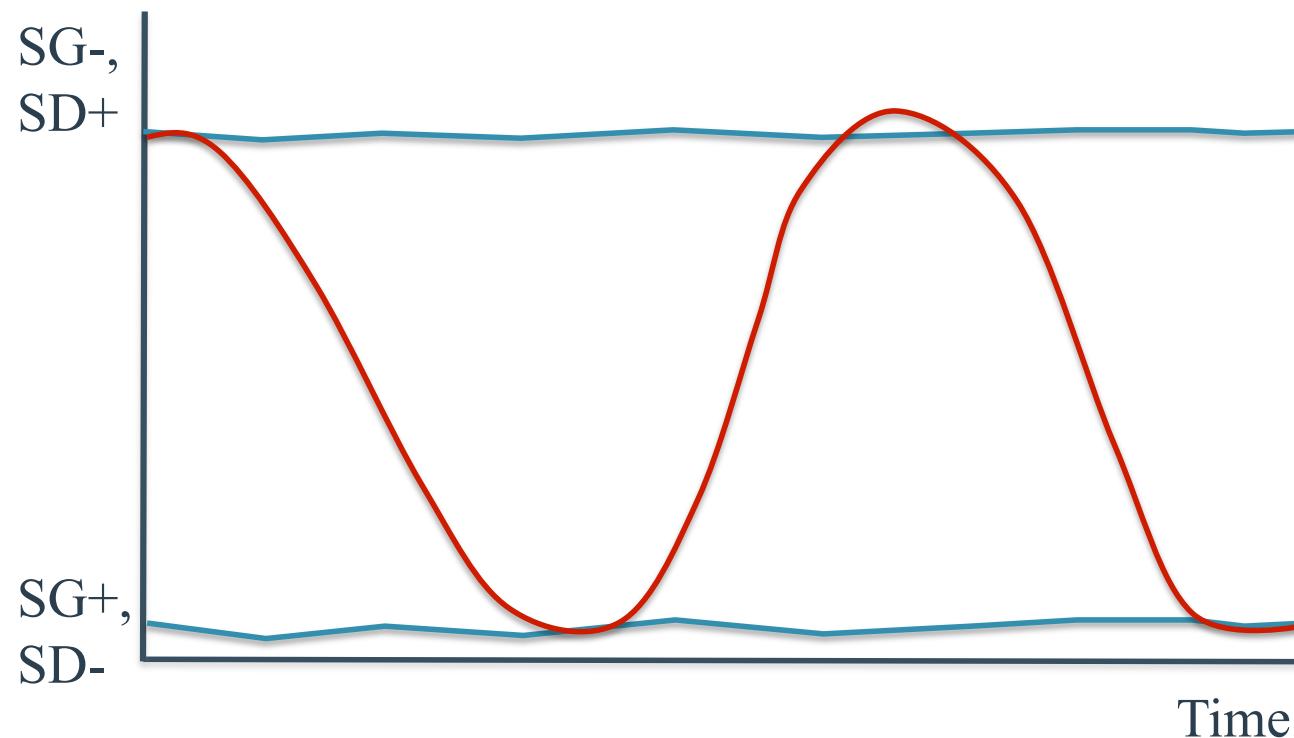
Semantic profiles

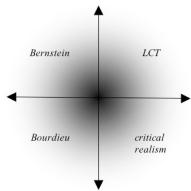




Semantic waves

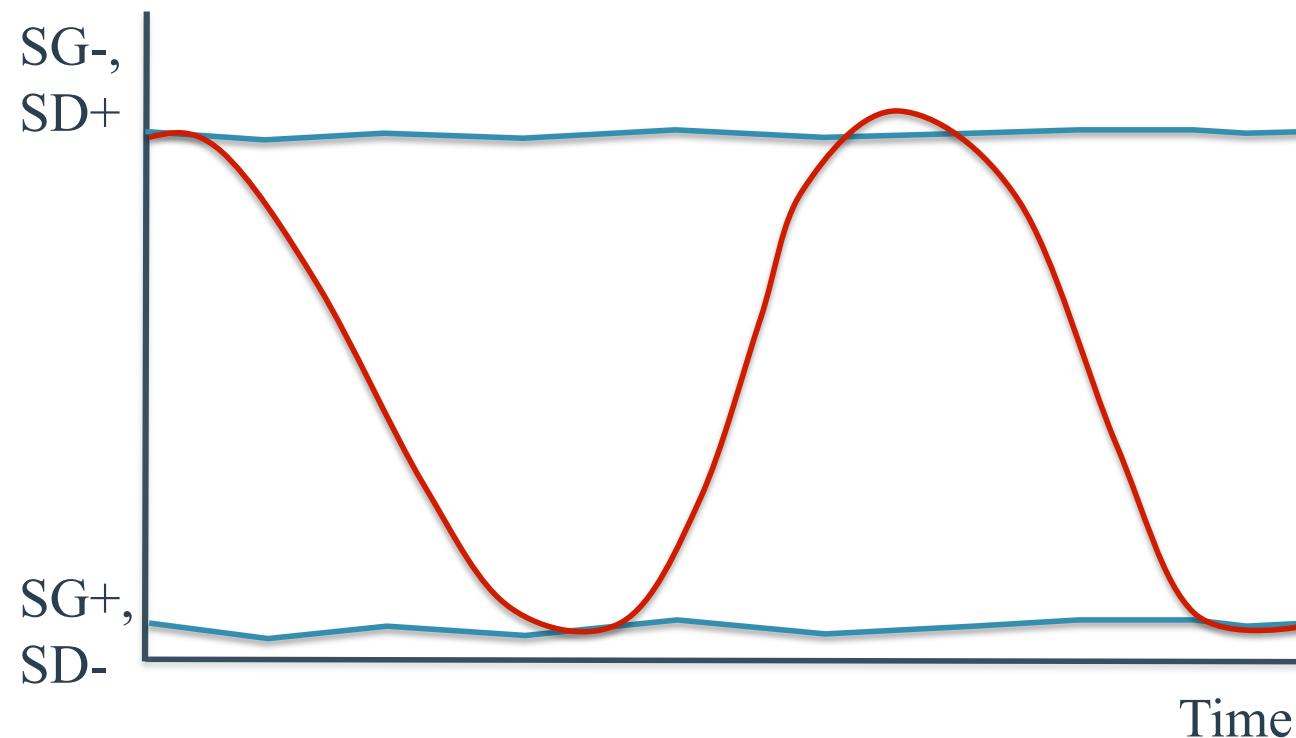
- profile of cumulative research

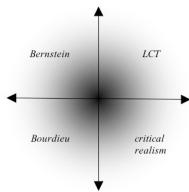




Semantic waves

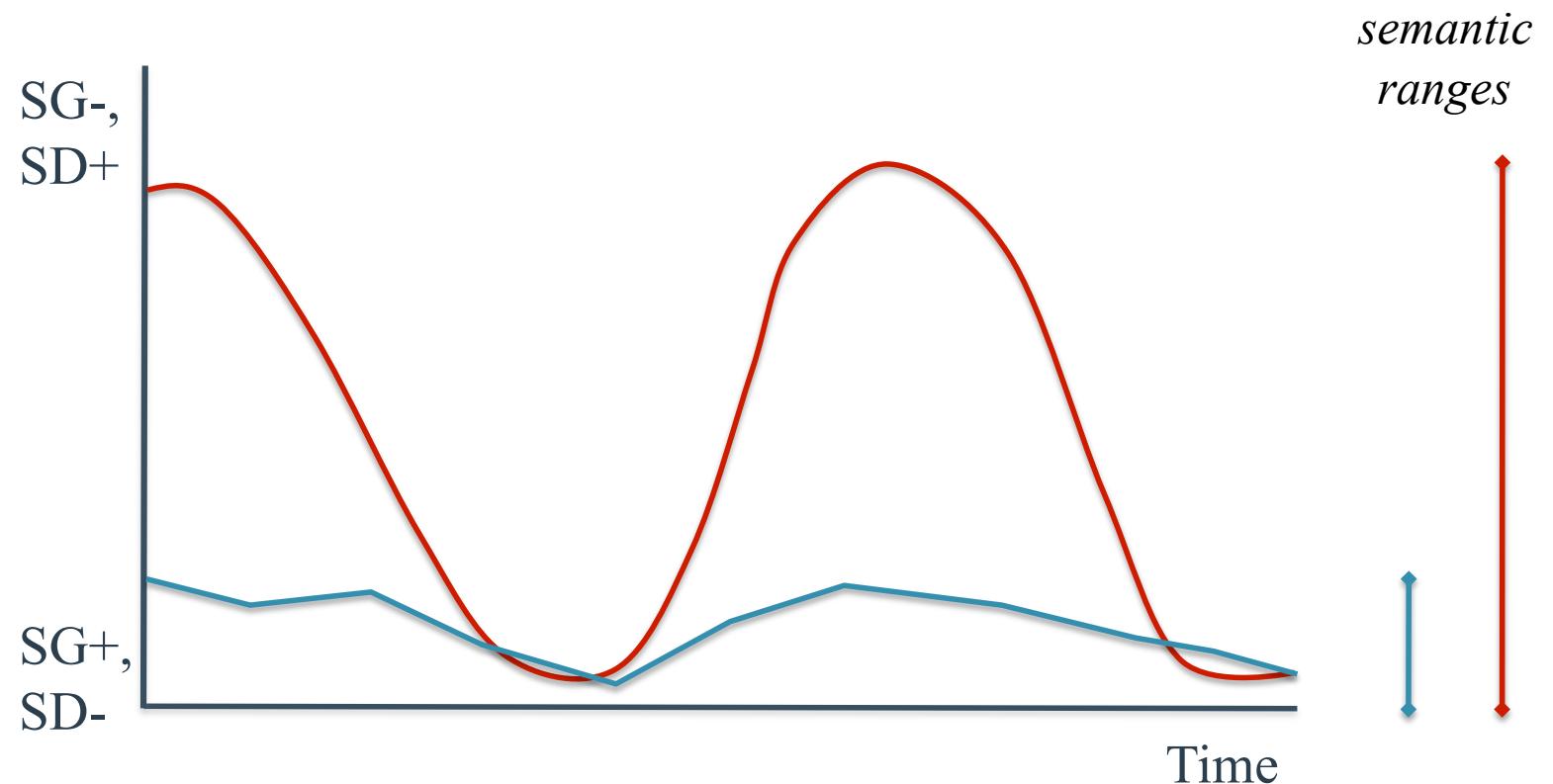
- profile of cumulative learning

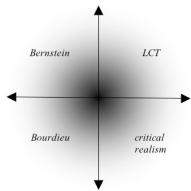




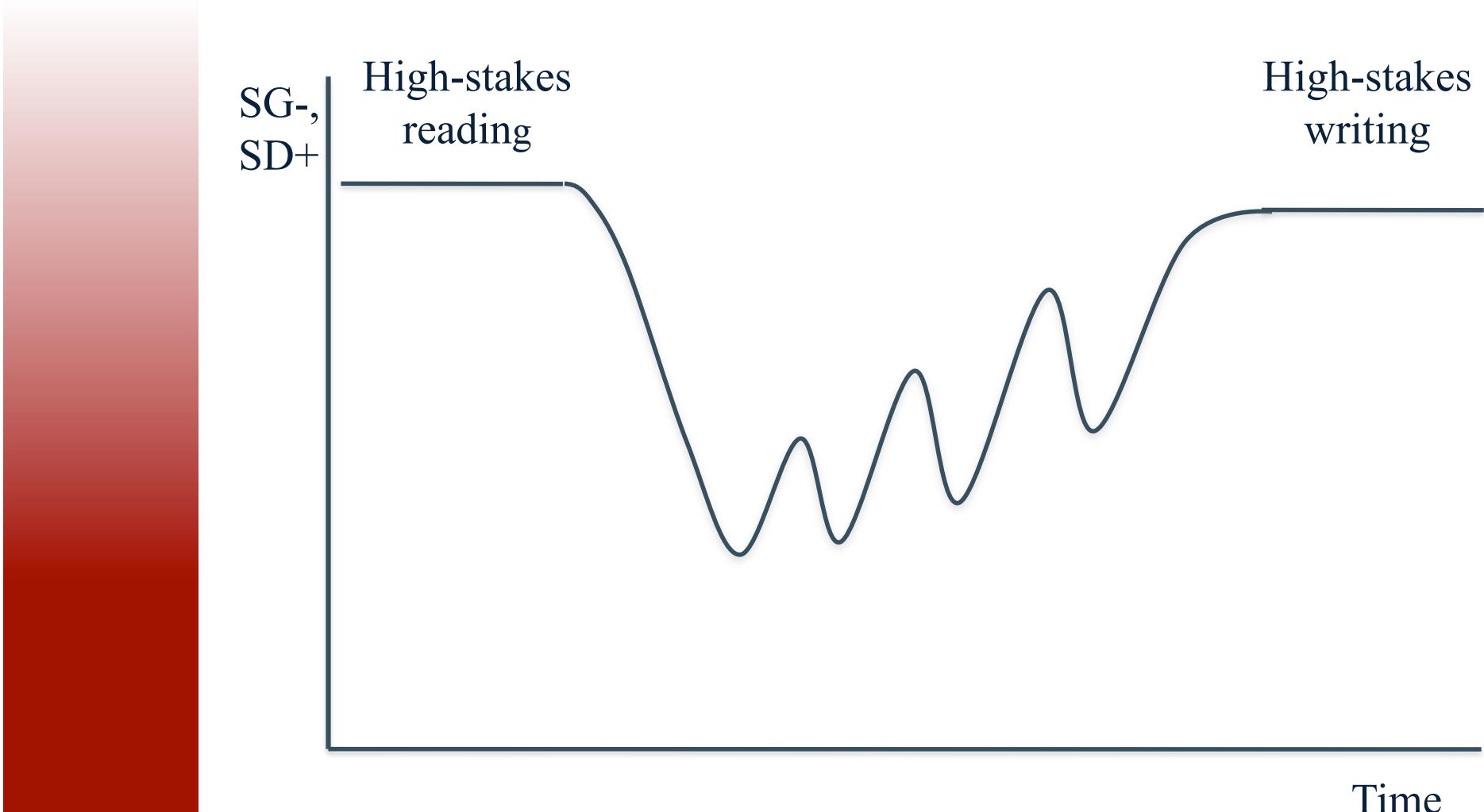
Semantic ranges

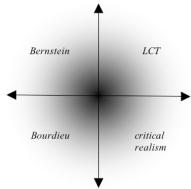
- relations between students' semantic ranges and those required for success





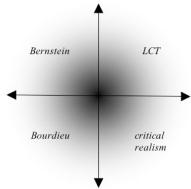
What's at stake





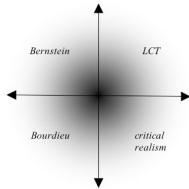
DISKS Project

- ‘Disciplinarity, Knowledge and Schooling’
 - funded by Australian Research Council
- Questions
 - How is cumulative learning enabled in classrooms?
 - How does this differ across subjects?
 - How can we help teachers improve cumulative learning?



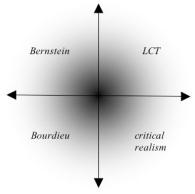
Stages of DISKS

1. Collection: classroom observation and student work samples
2. Analysis using SFL and LCT
 - J.R. Martin: SFL's side of the street (Friday)
 - LCT: Specialisation, Semantics & Temporality (Matruglio *et al.*, Friday)
3. Collaborative intervention with teachers
 - Joint Construction (Macnaught *et al.*, Friday)
 - design-based research



Phase 1: data collection

- New South Wales, Australia
- secondary schooling: History and Biology
- Year 8 (ages 13-14) and Year 11 (ages 16-17)
- 100 lessons in Science/Biology (55) and History (45) of 1 hour each
- 4 urban schools and 2 rural schools

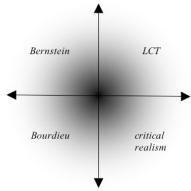


T Okay B [student's name] what are the 'cilia'. What was it? No? A [student's name] do you know what cilia is? No? Someone must know what they are...

S Hairs

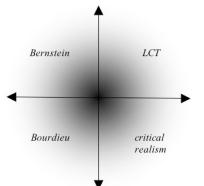
S The little hairs?

T The little hairs. And basically, they beat in an upward motion from inside your body out through to your nose. ((Teacher is waving arms up)). So, they beat up and they take the pathogens away with them. And, guys, I don't know if I've ever told you this but when you smoke cigarettes, the tar actually causes your cilia to, because its so heavy, to drop, and so your cilia don't work probably after that because they're too heavy they've dropped, so they can't beat the pathogens out of your body! So that's one reason that smoking's bad as well. Okay! Alright, write this down under description!

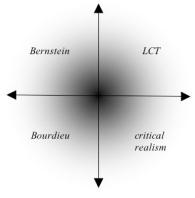


((Teacher writes on the board))

cilia	Hair-like projections from cells lining the air passages	Move with a wavelike motion to move pathogens from the lungs until it can be swallowed into the acid of the stomach
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Line of defence	Description	What it does
skin	Skin continuously grows by new cells being produced from below. Cells fit tightly together to form a protective layer covered by dead cells.	When unbroken skin prevents the entry of pathogens. Pores in the skin secrete substances that kill microbes. Skin constantly flakes off carrying microbes away. It is a difficult environment for a pathogen to grow (no water).
mucous membrane	Cells lining the respiratory tract and openings of the urinary and reproductive systems that secrete a protective layer of mucus.	
cilia	Hair-like projections from cells lining the air passages	Move with a wavelike motion to move pathogens from the lungs until it can be swallowed into the acid of the stomach
chemical barriers	Acid in the stomach, alkali in the small intestine, the enzyme lysozyme in the tears.	Stomach acid destroys pathogens including those that are carried to the throat by cilia and then swallowed. Alkali destroys acid resistant pathogens. Lysozyme dissolves the cell membranes of bacteria.
other body secretions	Secretions from sweat glands and oily secretions from glands in hair follicles.	Contain chemicals that destroy bacteria and fungi.

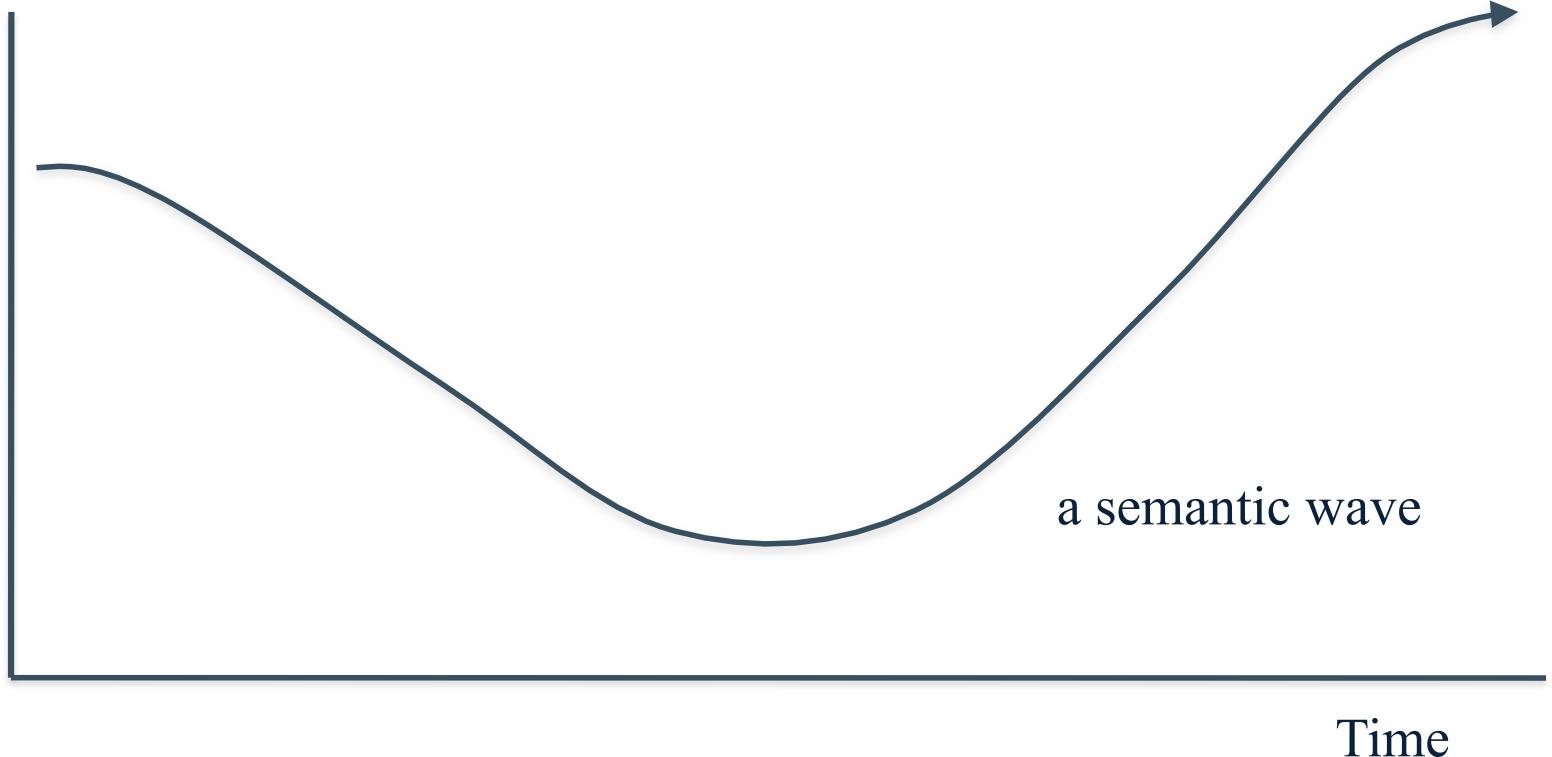


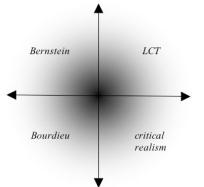
conceptual term

unpacking of term using previously learnt terms, everyday language and body language, including an example from everyday life

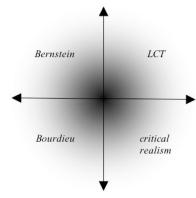
repacking of descriptions into table

SG-,
SD+

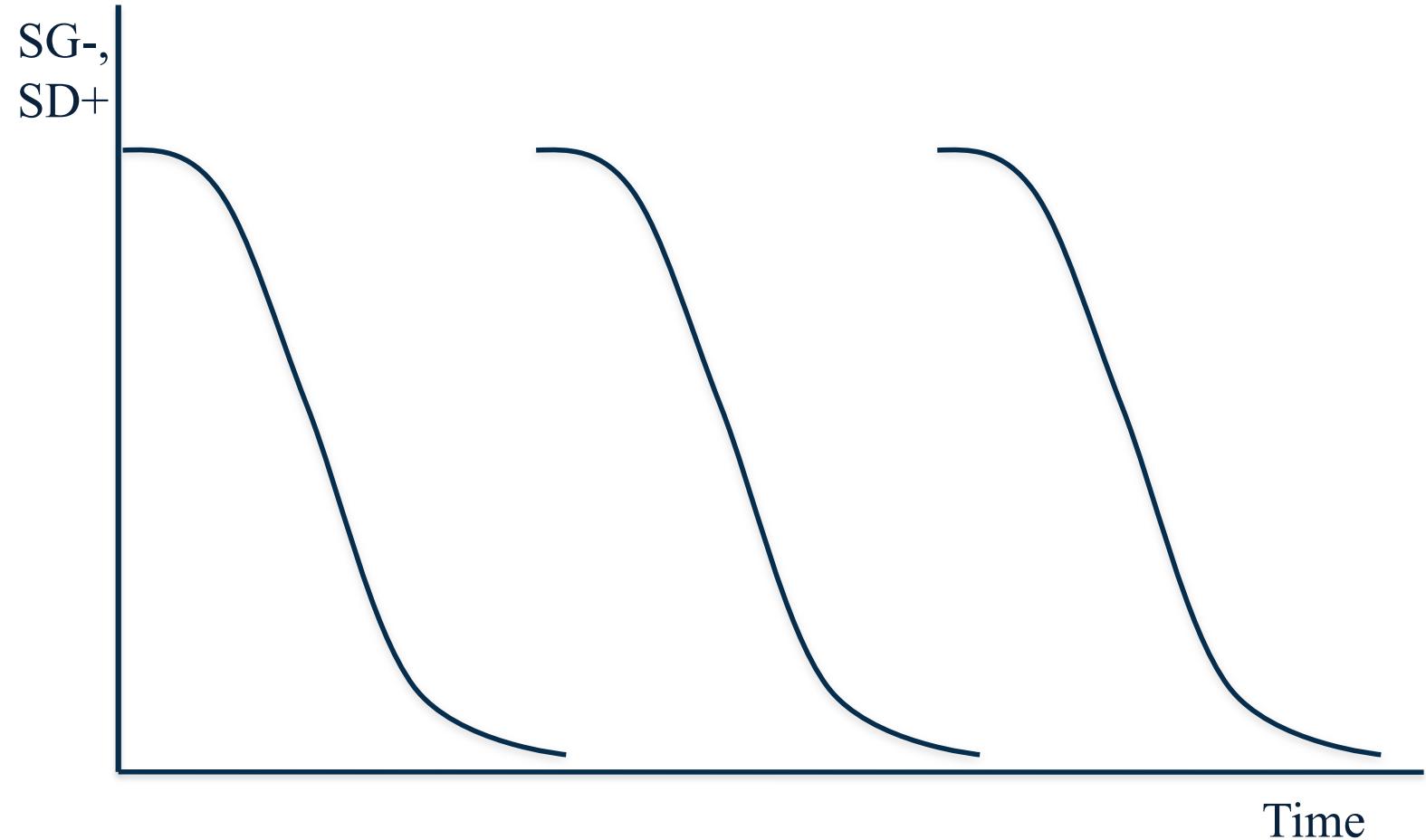


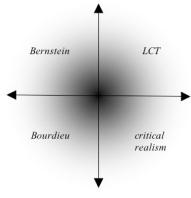


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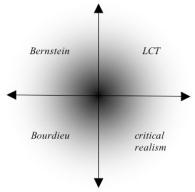


Half wave (or ‘broken elevator’)

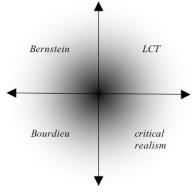




T “THE INFLUENCE OF GREEK AND EGYPTIAN CULTURES”. What does that mean? What would the influence of Greek and Egyptian cultures mean, okay? No idea, right. What it means is, if we started to look at all the things in Pompeii and Herculaneum, what objects may be showing Greek design? Or Egyptian design? Or Greek mythology? Or Egyptian mythology? Or what building techniques, like columns? Are there Greek columns? Do, you know, are the themes of their artwork reflecting it? So, it's saying ...remember when we started, we said that Pompeii had originally been settled by Greeks? Okay? And if we look at where Italy is, it's not that far from Egypt at this time, umm, we've, we've had, umm ... Cleopatra has been killed by the time the volcano erupts, she and Mark Antony are dead and Egypt is part of the Roman empire.



- T So, there would be massive amounts of trade going on, and umm, you know people visiting their diplomats you know or their, their, ambassadors... like their envoys and things like that all going back and forth across the countries. So, ideas. When you get trade in ideas - you wouldn't have heard this word before - we call it 'aesthetic trade'. Have you heard of it? Yeah
- S You told us before
- T Ohh! Told you before great, *excellent!* You remember aesthetic trade! 'Trade in ideas'. So, of course, when you've got contact with the country you're gonna get the trade in ideas coming as well.



- T So that's what that one is. It looks hard, but all you've gotta do is have a look and think what things are there. Let me give you a big clue some of them are massive. Laah-la-lah-la- la-la-la-la-lahh, la-lah
- S Theatres
- S La-lahh
- T Theatres. Okay theatres are a Greek design. The Greeks invented the theatre, and then the Romans take the idea because they like it too. So, some of them are very obvious.



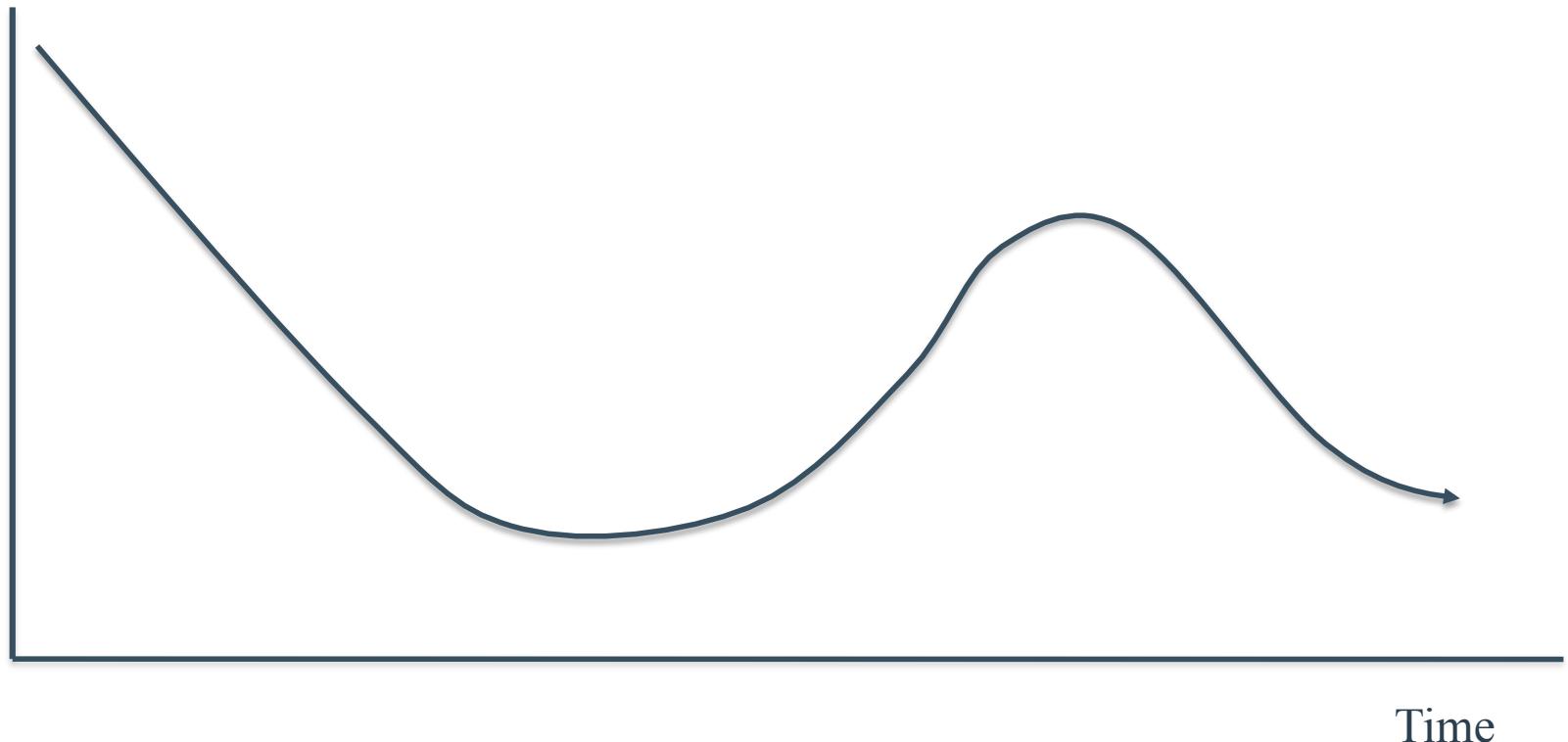
question

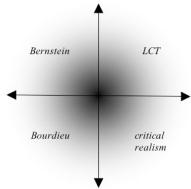
*unpacking with examples
and grounding in context
of period*

*repacking into
'aesthetic
trade'*

*new
examples*

SG-,
SD+





Waving in biology

Re-enacting

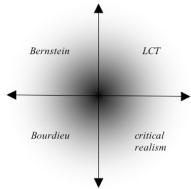
S Disinfect the benches=

T Disinfect the benches. Why.

S To get rid of any other microbes?

T Good. Okay, next...

S Disinfect the benches and then we -ahh,
oh over the Bunsen burner ((inaudible))
and then the inoculation loop...



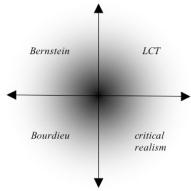
Beginning to wave up

- T Alright you're doing more than one, so you've got the Bunsen burner, why.
- S To kill the microbes
- T Yes, which microbes.
- S The one on the ((inaudible))
- T Oh, when you're actually inoculating, yes you wanna make sure that any microbes on the loop are killed. Well, what else are we trying to-do? ((waving)) I'm trying to give you clues!
- S Convections
- T The convection currents, and remember what the convection currents is they move any microbes in the vicinity away. So they're not going to drop-on your sample.



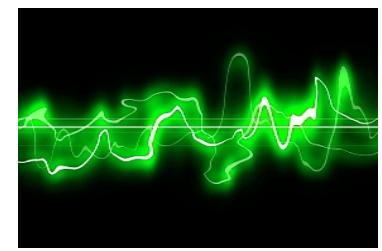
Waves are deep

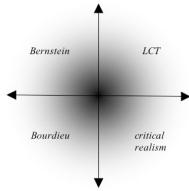
- language
 - features that enable / constrain semantic waving
- teaching waving to students
 - Joint Construction
- social distribution of semantic codes and ranges
- other knowledge features of semantic waves
 - Temporality
 - Autonomy
 - Specialisation



Semantic density

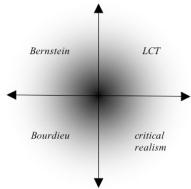
- epistemological condensation
 - emphasises epistemic relations
- axiological condensation
 - emphasises social relations
- can vary independently
- condensation may be different in fields e.g. humanities / science





Axiological condensation

- ‘authentic learning’ - ‘humanise the online experience with greater compassion, empathy and open-mindedness ... deep and lifelong learning...real world relevance and utility.’ (Herrington, et al. 2003: 69)
- design research as ‘socially responsible research’ (Reeves, et al. 2005)
- post-structuralism as ‘critical theory’



Conclusions

- semantic profiles significant for cumulative knowledge-building and learning
- maximising semantic range and ability to wave are issues of social justice
- LCT(Semantics) offers analysis of:
 - organising principles of many kinds of practices;
 - and change over time;
 - with considerable semantic range
- everybody needs good neighbours