

Are ABS and OR Commensurable Paradigms?

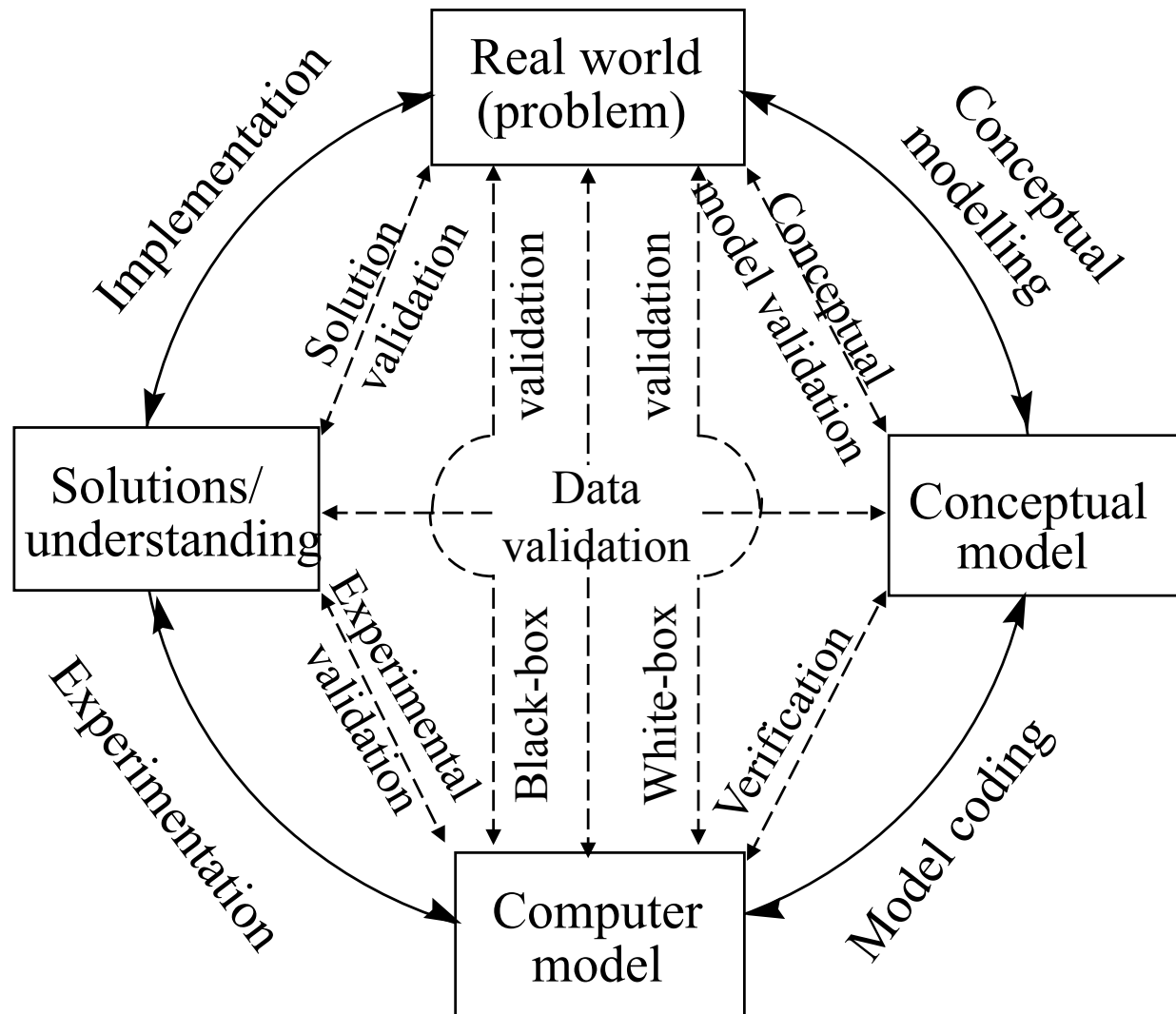
Stewart Robinson

Warwick Business School

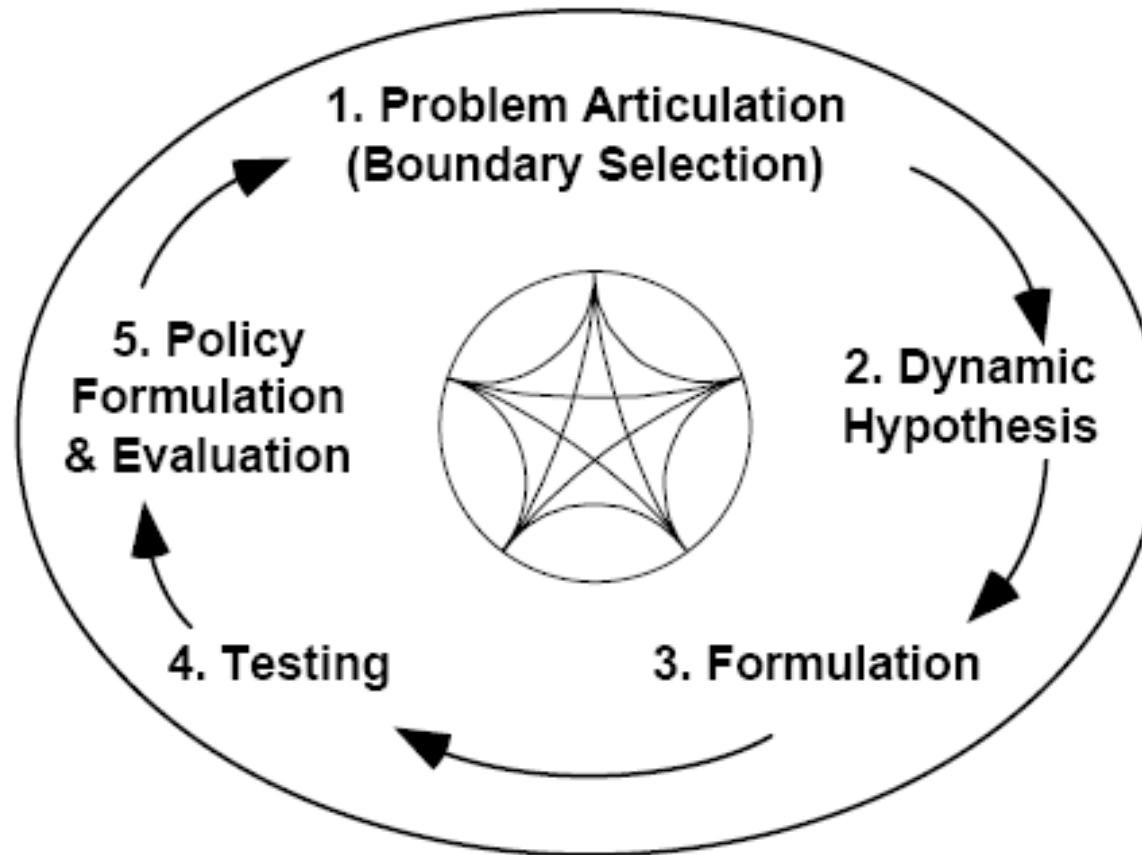
CRESS/Sim SIG, 24 March 2011



The Simulation Modelling Process



The ABS Modelling Life-Cycle?



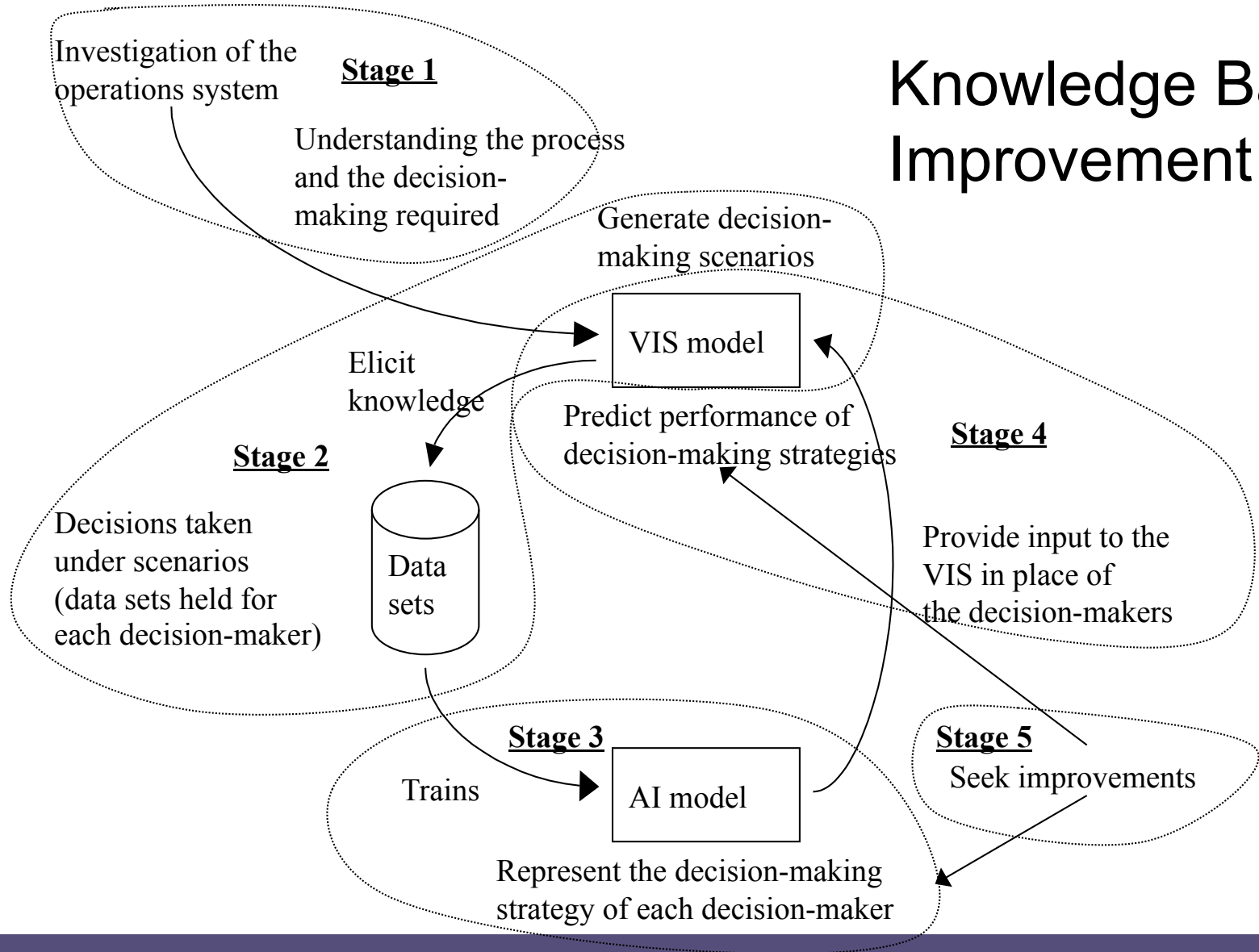
System Dynamics Modelling Process (Sterman, 2000, pp. 87)

OR and ABS Paradigms

OR Emphasis	ABS Emphasis
Empirical basis	Theoretical basis
Improving the real world	Thinking about the real world
Data collection and analysis	Dynamic hypotheses
Validation: sufficient accuracy for purpose	Plausibility: seeming reasonable or probable
Implementing findings	Learning/understanding

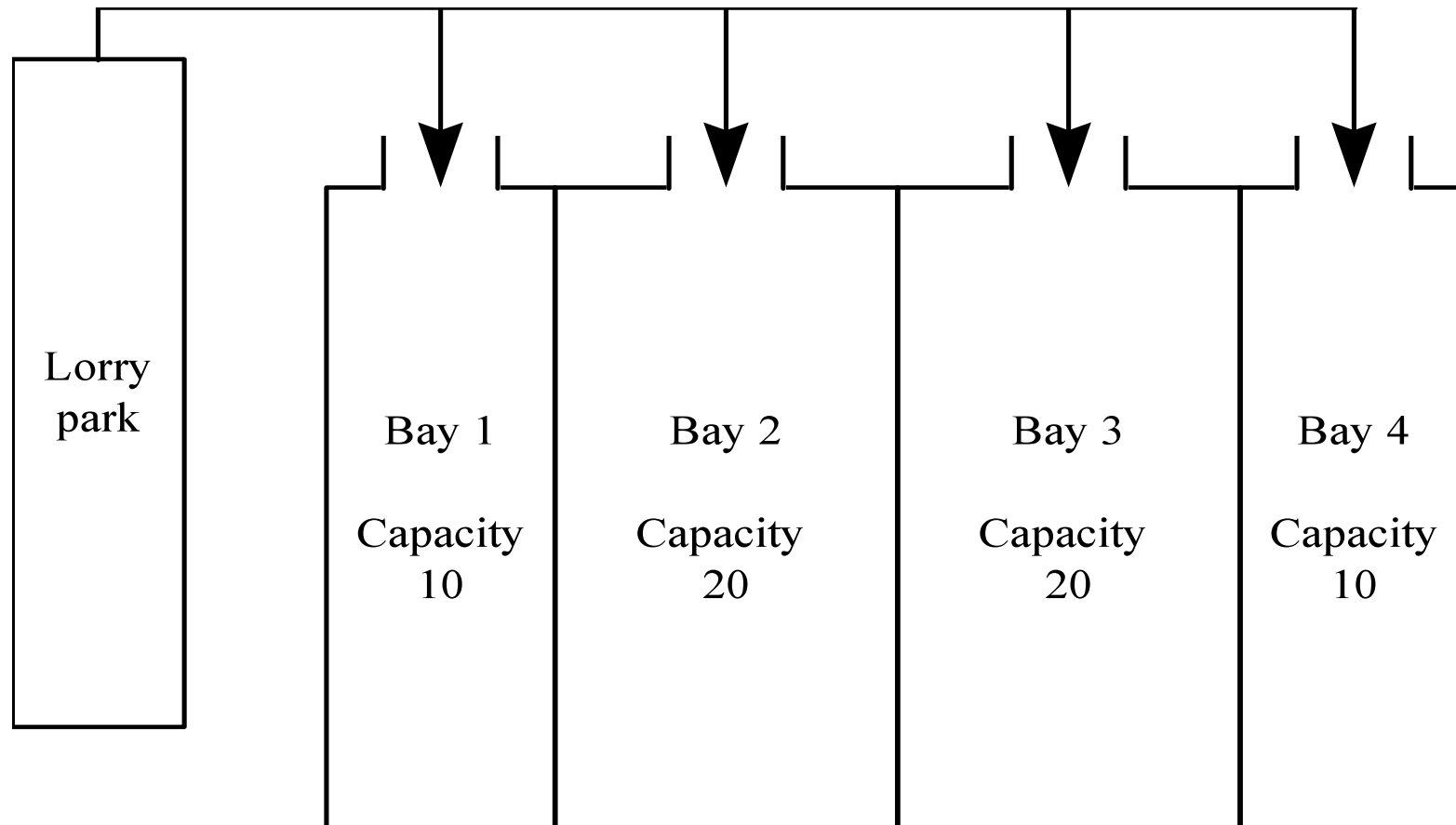
So are they commensurable?

'Empirical' ABS?



A Standard OR Model

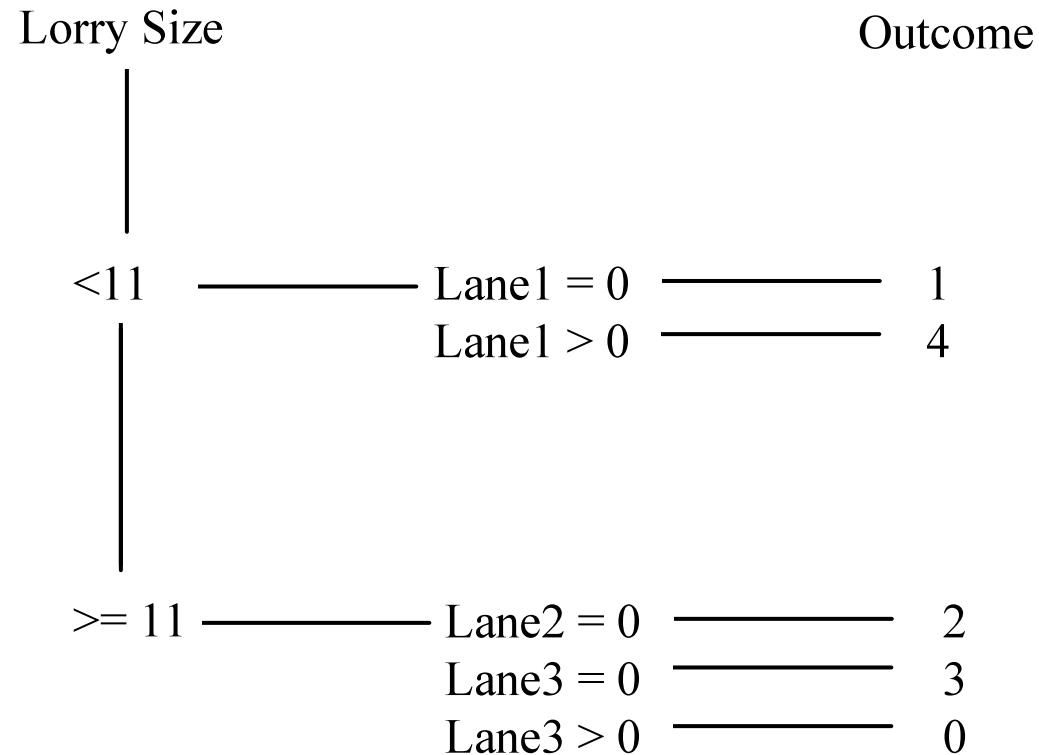
A Lorry Loading Bay Problem



A Standard OR Model

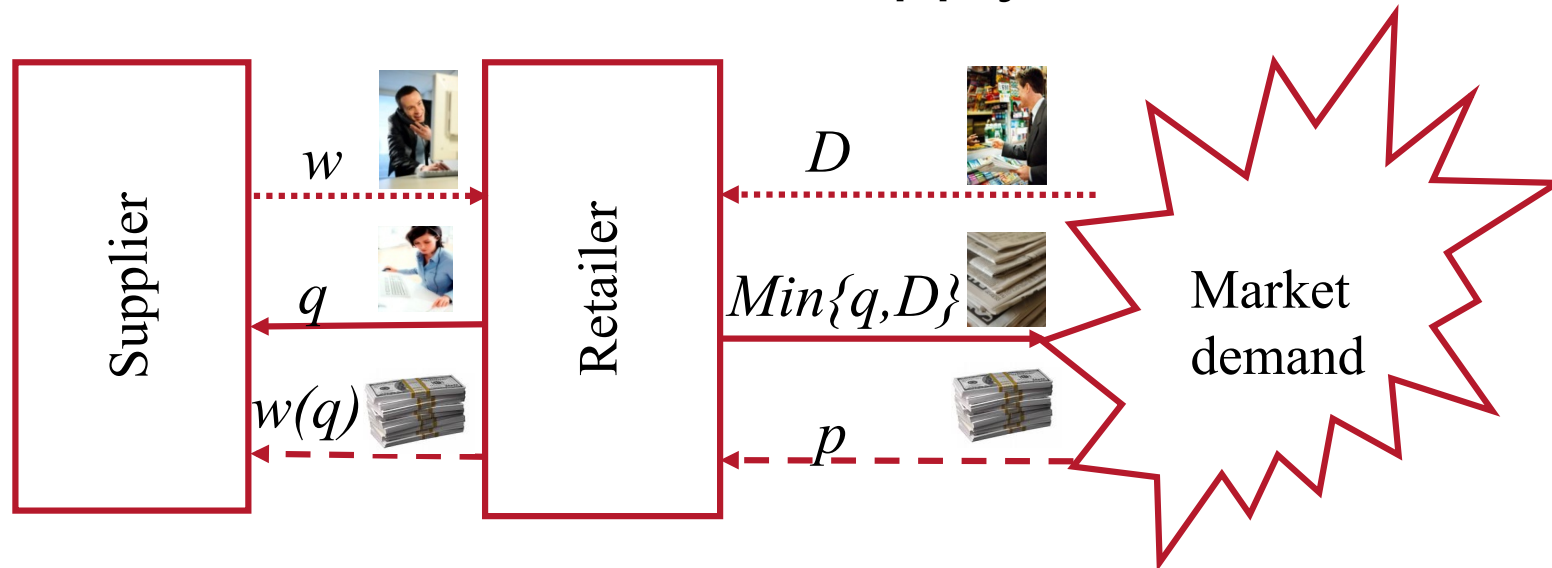
A Lorry Loading Bay Problem:

Decision tree derived from example cases using a simulation model



An Empirical ABS Model

Agent Based Simulation of Supply Chains



Sole product of perishable nature

No left-over inventory can be carried over from one period to the next



An Empirical ABS Model

Newsvendor Problem (Stackelberg Game)

Numerical Example:

Manufacturing cost, $c=50$

Selling price, $p=250$

Good will cost, $g=1$

Demand, $D \sim (\mu=140, \sigma=80)$

Under centralised operation: $\pi = 24,900$

Under decentralised operation: $\pi = 21,166$

Efficiency = $21,166/24,900 = 85\%$

An Empirical ABS Model

Suppliers $\langle w(t) \rangle_i = \alpha_0^i + \alpha_w^i \cdot w(t-1) + \alpha_q^i \cdot q(t-1) + \alpha_P^i \cdot P_s(t-1)$

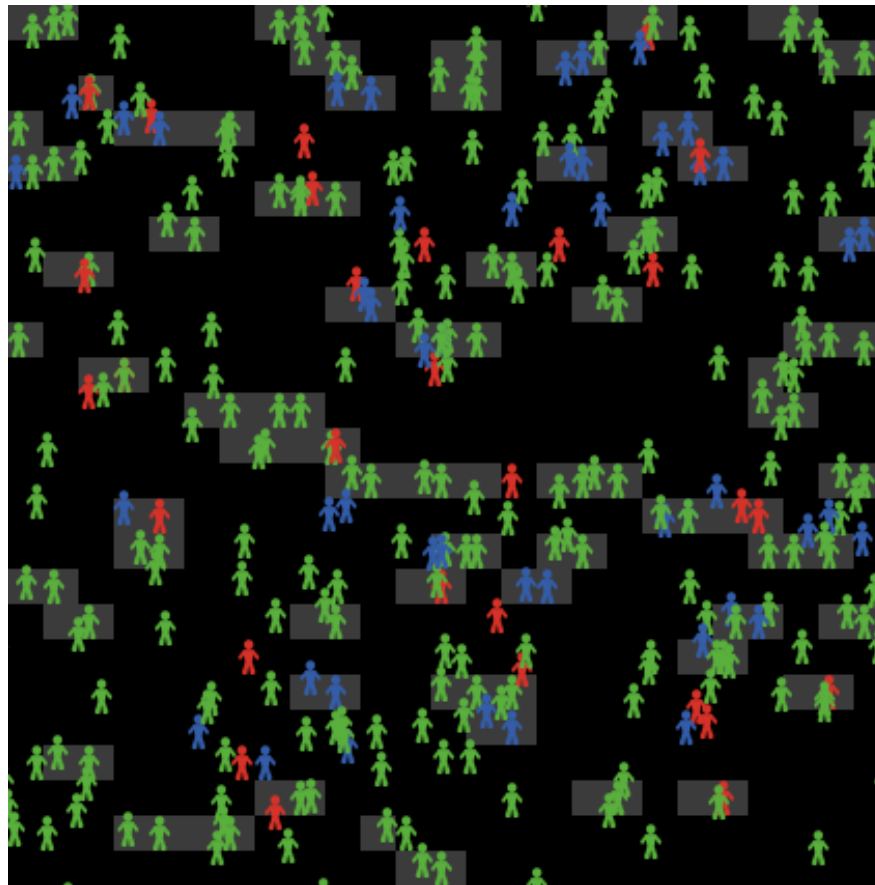
Retailers $\langle q(t) \rangle_j = \beta_o^j + \beta_w^j \cdot w(t) + \beta_q^j \cdot q(t-1) + \beta_d^j \cdot d(t-1) + \beta_P^j \cdot P_r(t-1)$

Efficiency scores

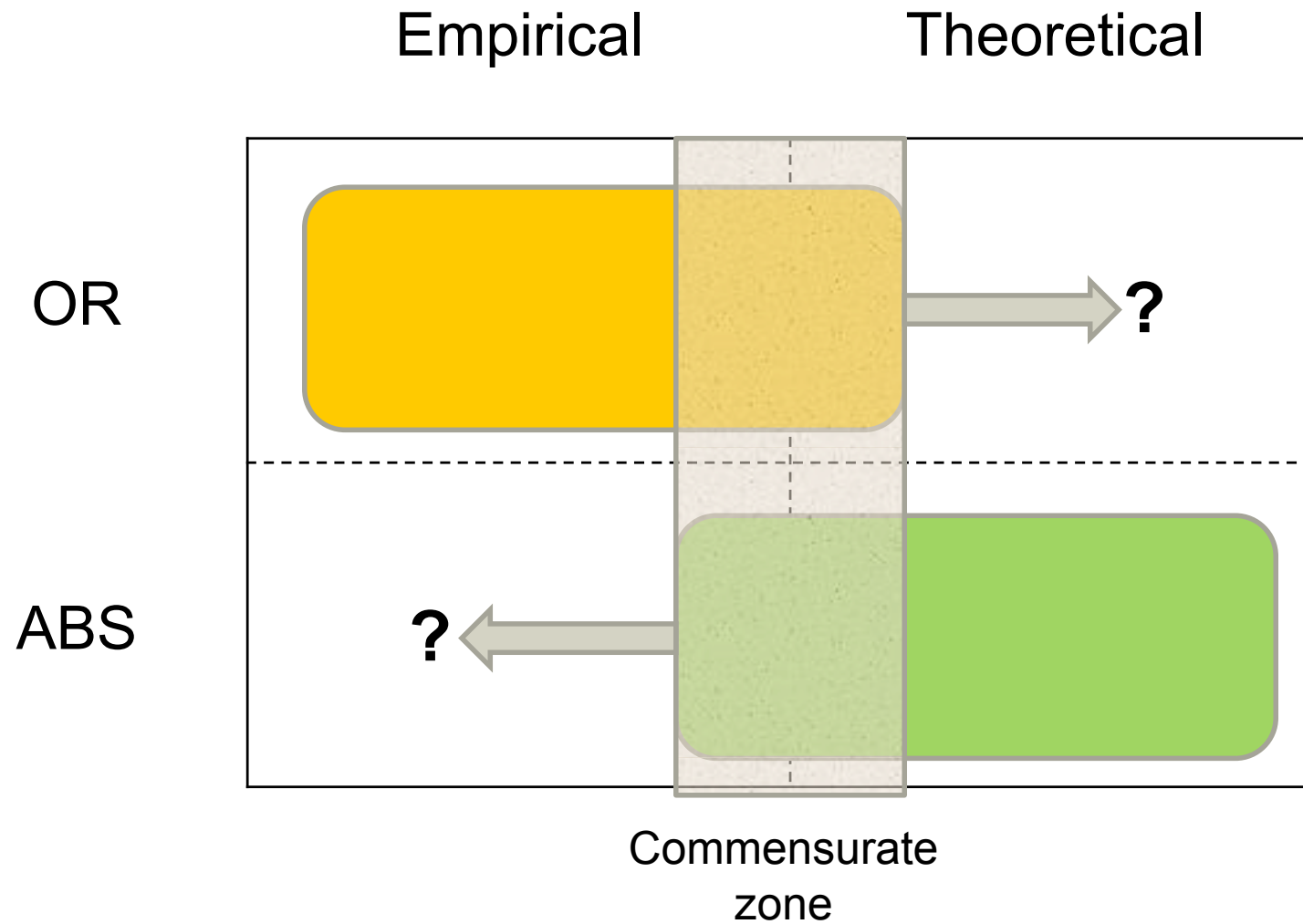
F_2 F_1	RET ₁	RET ₂	RET ₃	RET ₄	RET _{OPT}
SUP ₁	0.132 (0.055) [±0.026]	0.812 (0.081) [±0.037]	0.572 (0.110) [±0.050]	0.911 (0.059) [±0.027]	0.572 (0.110) [±0.051]
SUP ₂	0.428 (0.120) [±0.055]	0.918 (0.060) [±0.027]	0.756 (0.089) [±0.041]	0.892 (0.064) [±0.029]	0.798 (0.084) [±0.039]
SUP ₃	0.822 (0.080) [±0.037]	0.998 (0.020) [±0.009]	0.941 (0.053) [±0.024]	0.857 (0.072) [±0.033]	0.946 (0.051) [±0.024]
SUP _{OPT}	0.004 (0.007) [±0.003]	0.705 (0.100) [±0.044]	0.387 (0.106) [±0.049]	0.923 (0.055) [±0.025]	0.85 (0) [±0]

‘Theoretical’ OR?

NetLogo model of spread of HIV



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