Metaphor Mapping

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March 2006

Multivariate data

- Data presented along n-many different dimensions is difficult to *interpret* as n increases.

  Cognitive limits
  Computational overhead (Interactions)

- Data presented along any number of dimensions is difficult to *visualize*. Difficulty increases with dimensionality.

  Tables
  Graphs
  } (Tufte 2001)

Multivariate data

- Several recommendations to *ameliorate* the dimensionality issue.

Multiple Views (Baldonado et al. 2000)

Rules of Diversity, Complementarity, Decomposition, Parsimony

N-dimensional data visualization (Ward 1994)

Scatter plots
Glyphs
Parallel coordinates
Hierarchical techniques

Face metaphor (Chernoff 1973)

Multivariate data

- Metaphorical representation

  Faces used because "natural affinity…" (Chernoff 1973)
  No special benefit of faces (Morris et al. 1999)

- Natural questions arise

  What about *personal metaphors*?
  What about *functional metaphors*?

Metaphor representation

- Personal metaphors

  The data are what the data are…

  … but representation into a simple, personally relevant metaphor may *facilitate understanding*.

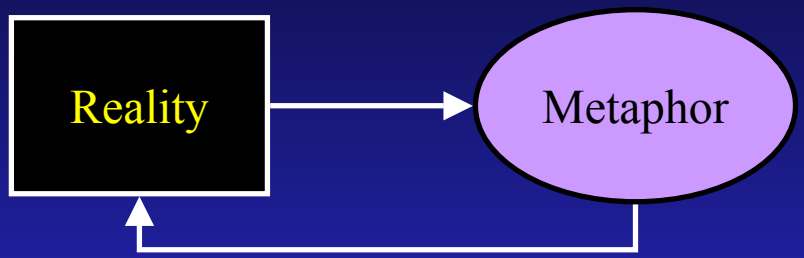
  Personal because your gardening might be my scuba diving…

- Functional metaphors

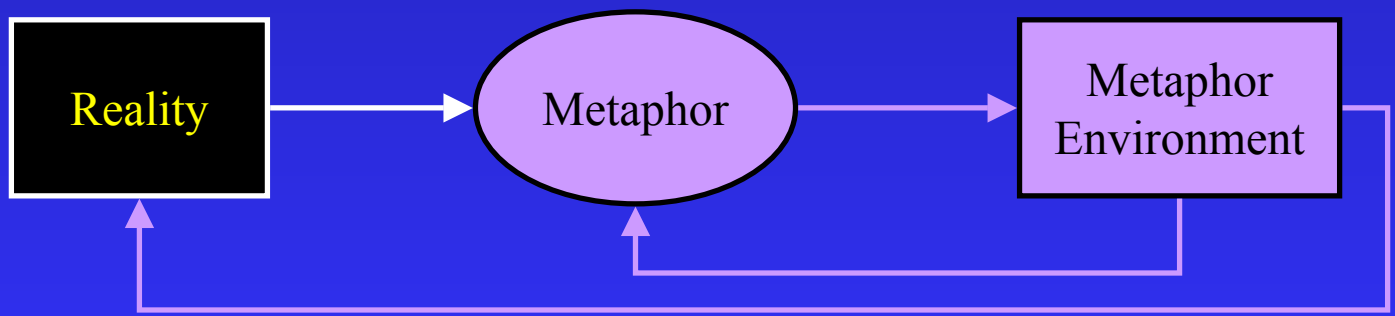
  Can a metaphor map embed data into a simple, personal metaphorical image that can *then be used as a model* to gain insight into the behavior of the underlying system?

Metaphor representation

- Simple metaphor:

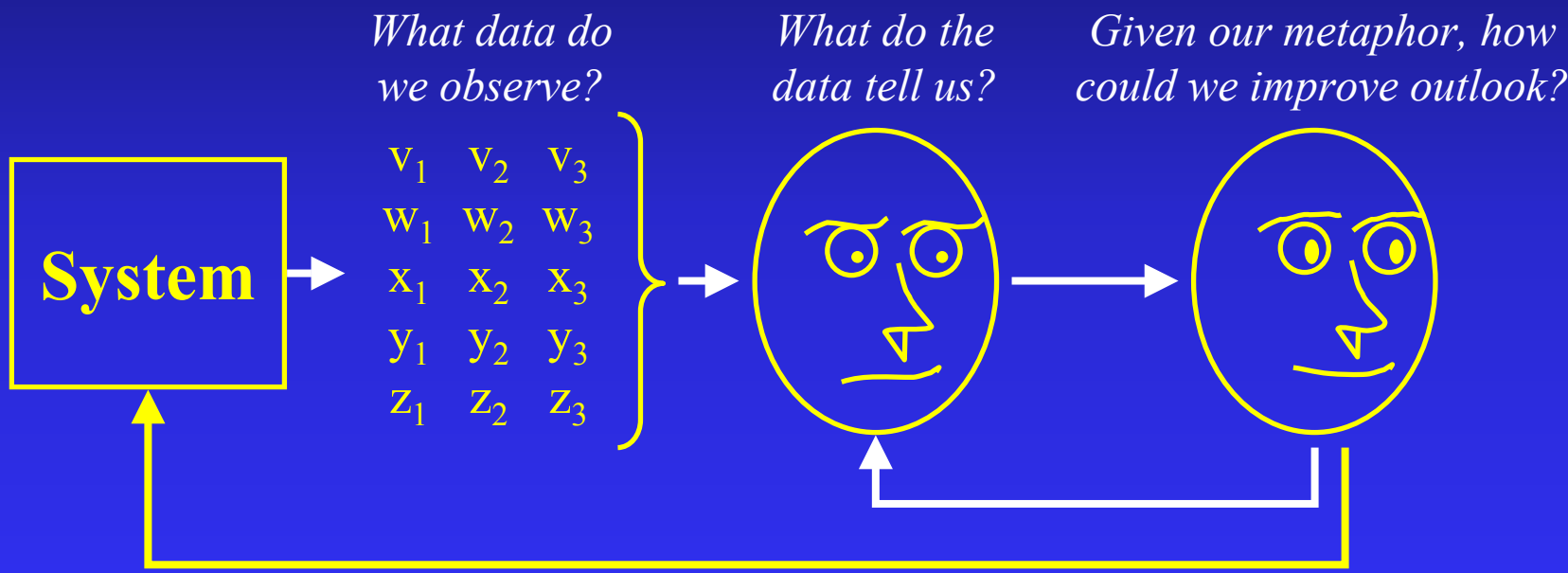


- Functional metaphor:

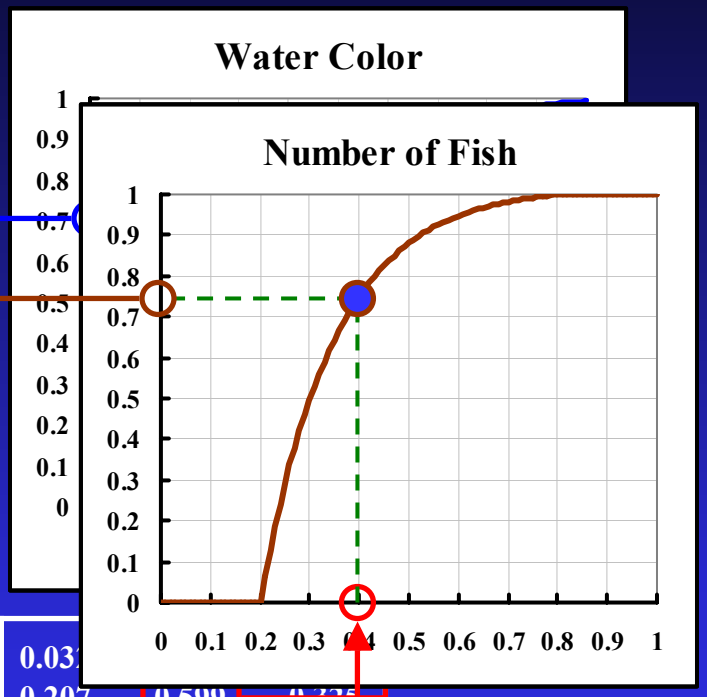


Functional metaphors

- Functional metaphors can map multidimensional data into a metaphorical image that can *then be used as a model* to gain insight into the underlying system.
- Consider Chernoff faces as an example…



Functional metaphor: coral reef



System Data			
	0.03		
	0.207	0.599	0.325
	0.348	0.774	0.237
	0.775	0.405	0.849
	0.746	0.063	0.082
	0.037	0.467	0.159
	0.607	0.200	0.397
	0.427	0.216	0.582
	0.377	0.256	0.175
		Water Color	*No. of Fish*

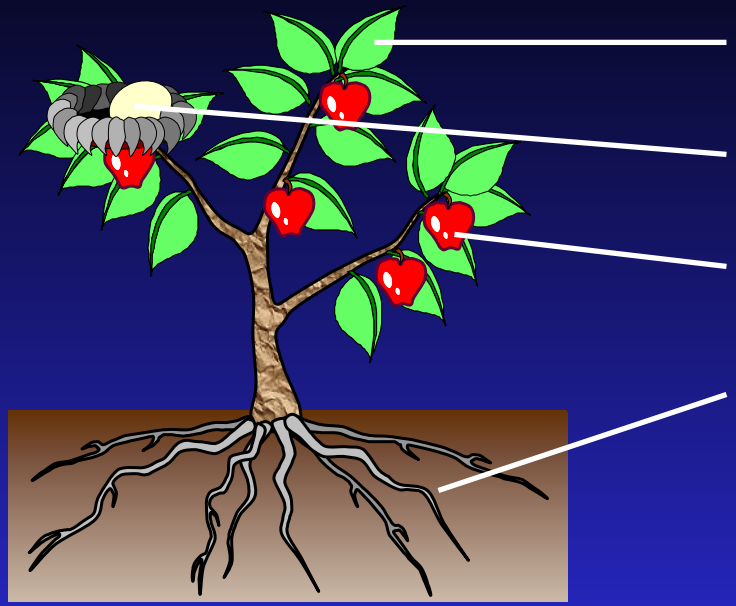
Simple metaphor:

Data as reef

Functional metaphor:

Reef management as system control

Functional metaphor: plant for pharmaceuticals

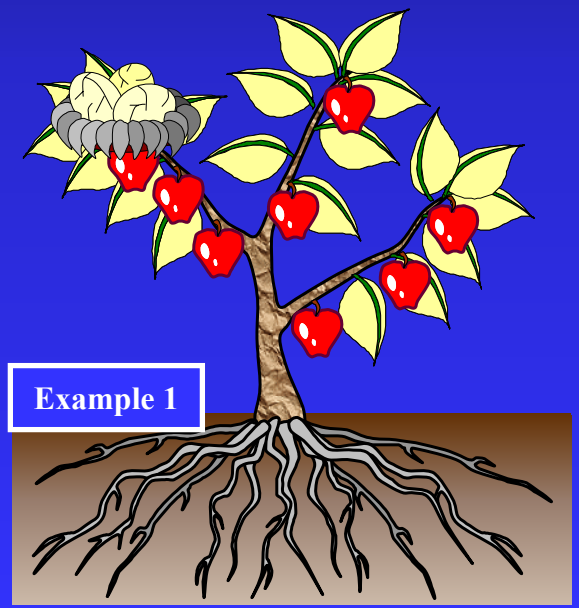


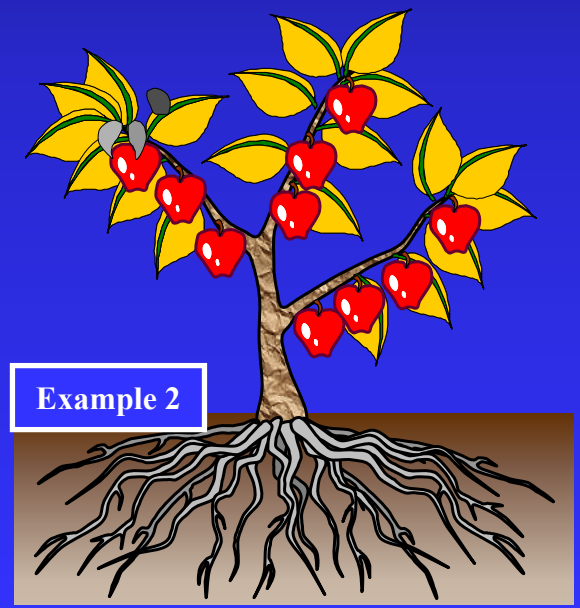
Leaf Color represents **P(TS)**. Leaves change from Brown to green as P(TS) increases.

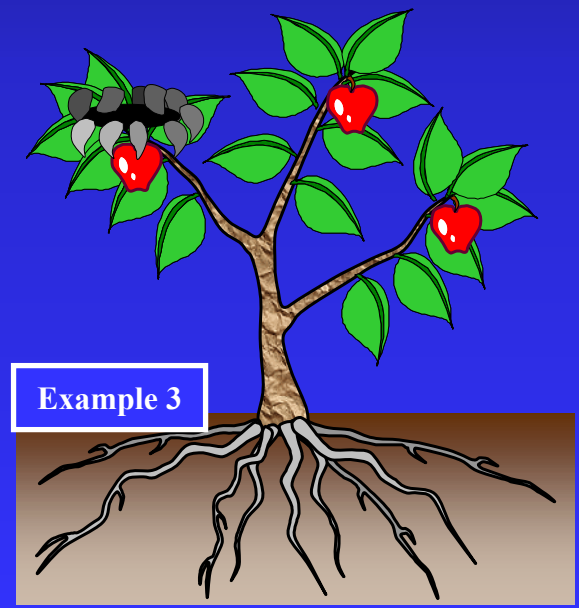
A **nest** begins to build as we **near launch**. Eggs eventually appear and crack as the launch date draws nearer.

Fruit represents the monetary return. The more fruit, the greater the monetary return.

Roots represent the resources required to support remaining development. More roots imply greater resource requirements.







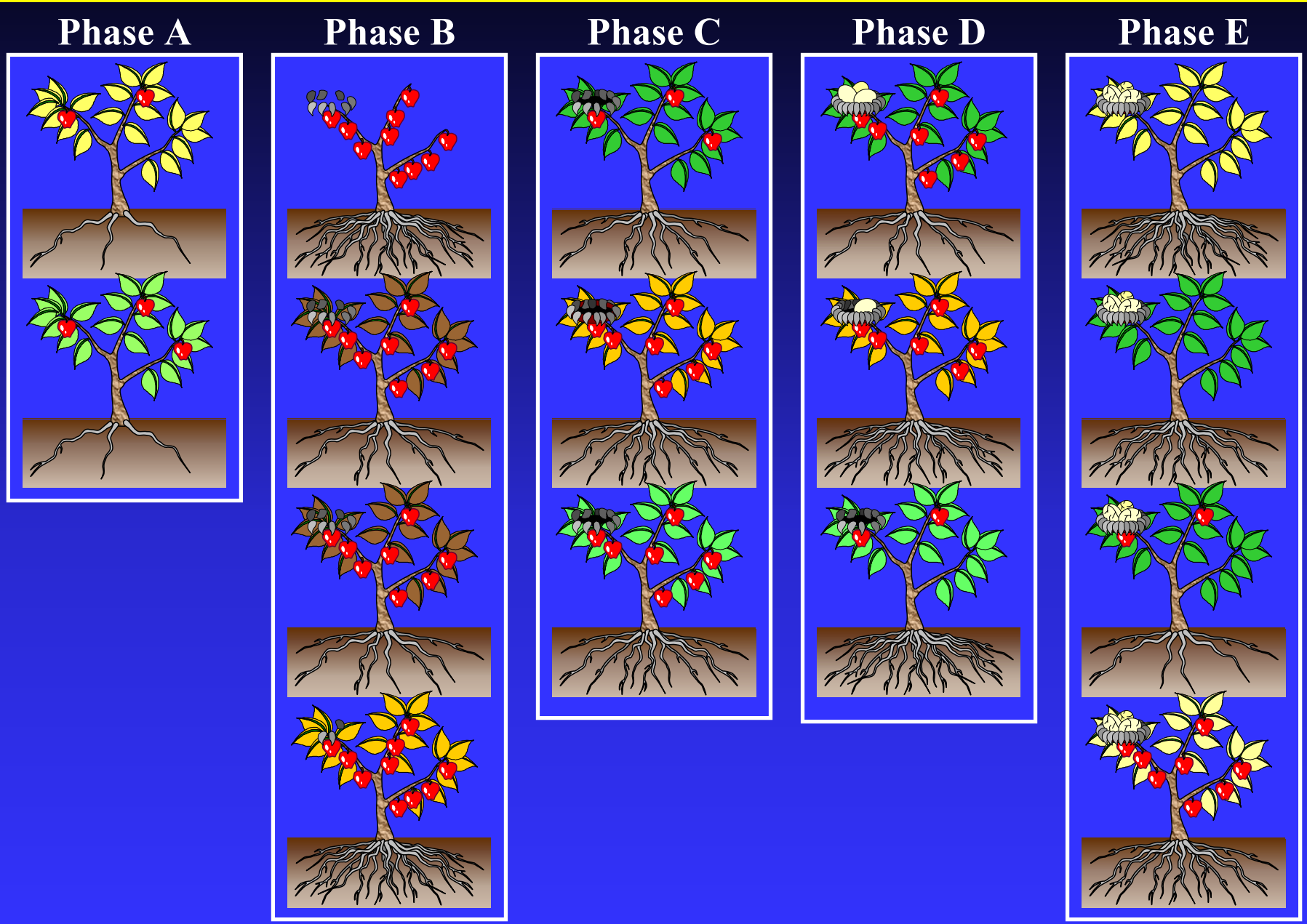
Applying the plant metaphor

DrugCo has 16 compounds under development in various stages of development across 4 therapeutic areas.*

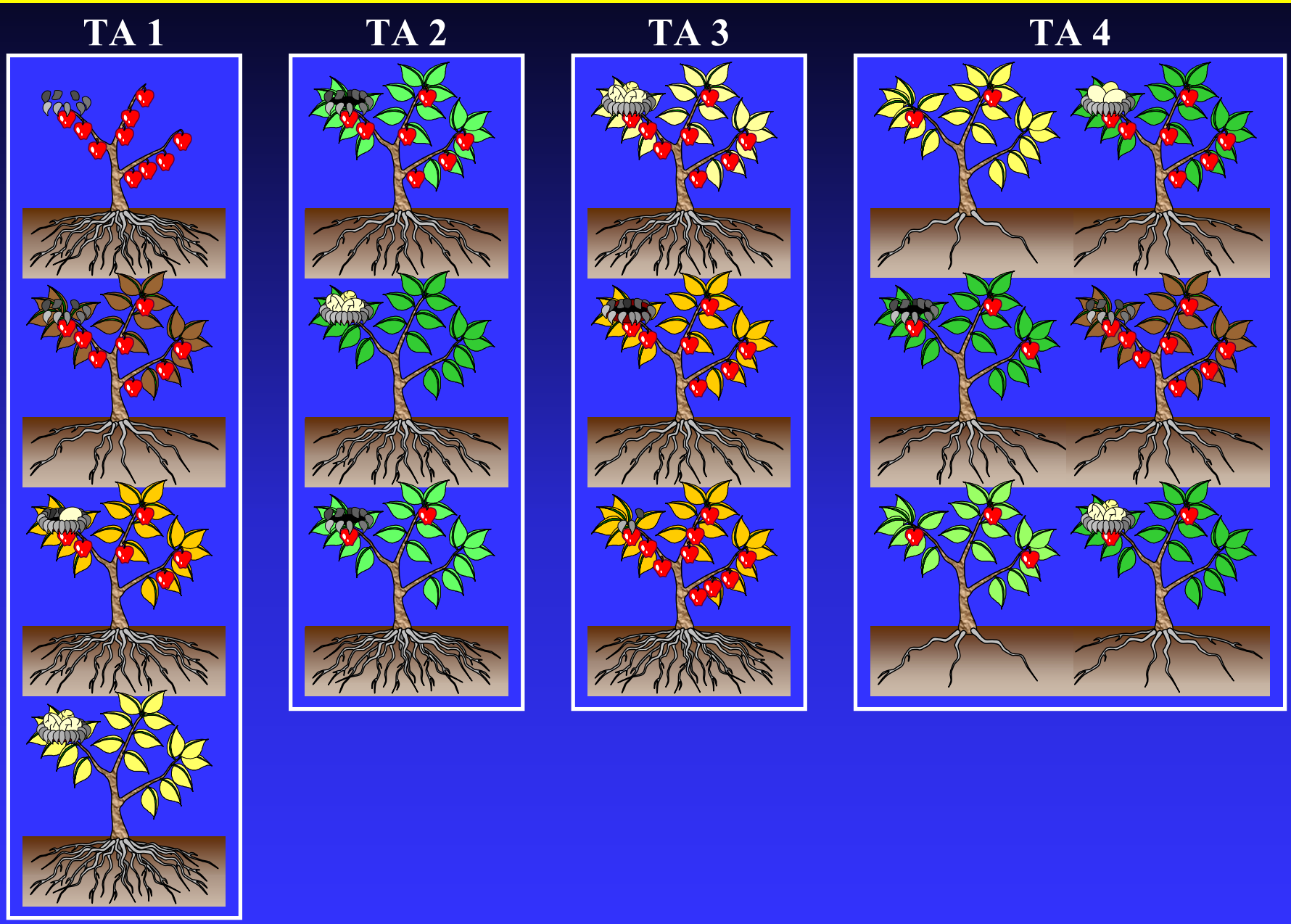
Compound	P(TS)	Market Value ($M)	Time to Launch (m)	Resources Required ($M)
A	0.38	$236	96	$81
B	0.77	$294	106	$64
C	0.09	$2,450	74	$515
D	0.16	$1,099	73	$212
E	0.19	$1,195	77	$195
F	0.3	$2,209	84	$598
G	0.89	$331	62	$233
H	0.32	$806	52	$295
I	0.82	$993	66	$310
J	0.93	$849	25	$202
K	0.31	$709	35	$410
L	0.86	$221	64	$506
M	0.36	$47	12	$543
N	0.92	$44	13	$361
O	0.9	$243	13	$162
P	0.35	$1,056	14	$342

* *These data are completely fictitious and provided for illustration only.*

Applying the plant metaphor



Applying the plant metaphor

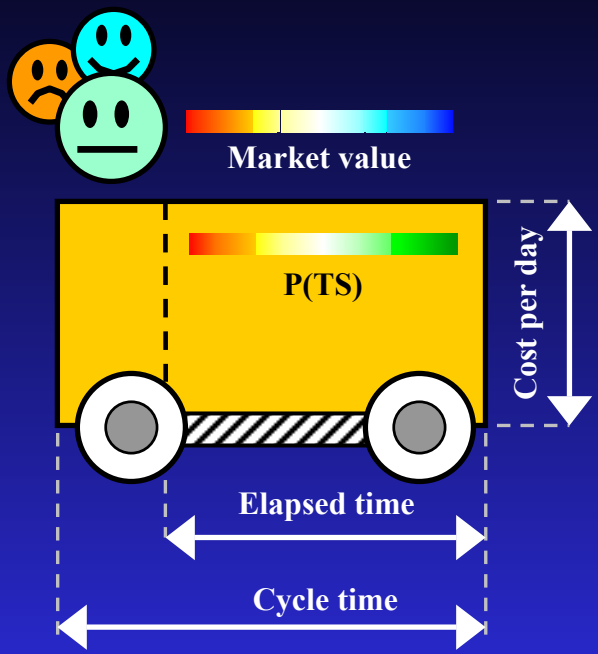


Applying the plant metaphor

What can learn from thinking about a garden?

- *irrigation?*
- *fertilizer?*
- *plant mix?*
- *pesticides?*
- *rotation?*
- *weeds?*
- *weather?*

Functional metaphor: boxcar for pharmaceuticals

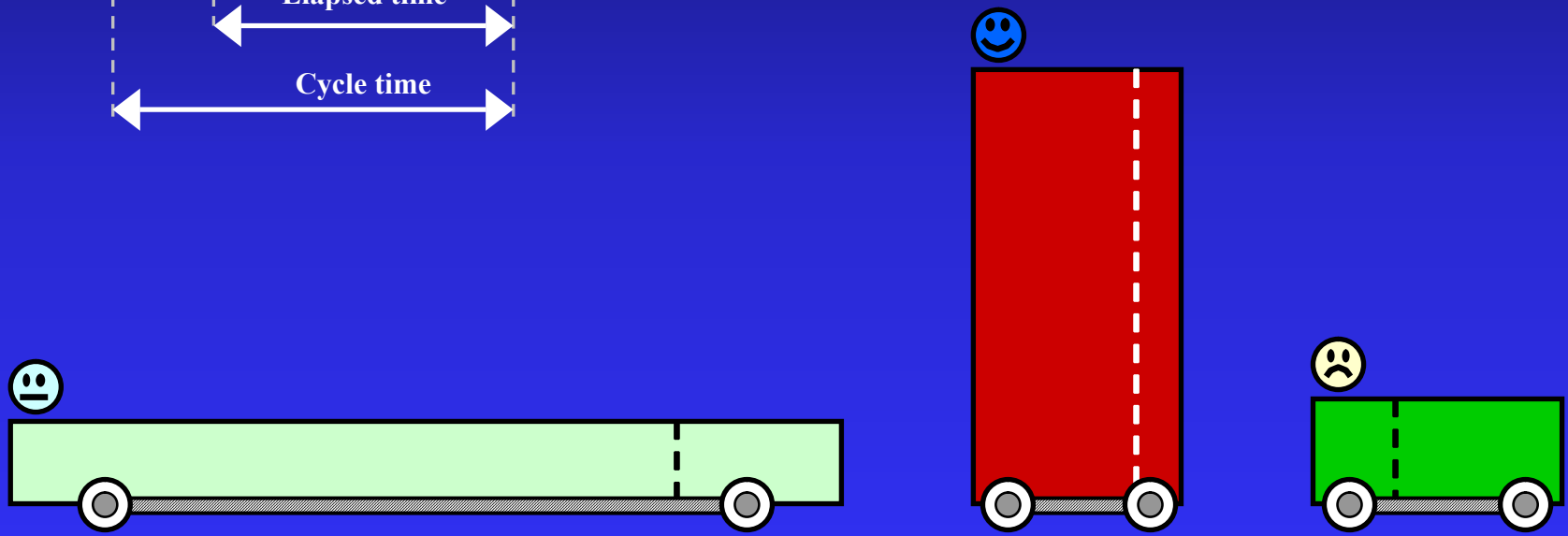


Each portfolio element (molecule) is represented by a **boxcar** that captures cycle time, elapsed time and monetary burn rate.

The boxcar **color** represents P(TS).

Emote face and color represent market value.

Emote **faces** can express broad range market value information (e.g., all losses are frowns).

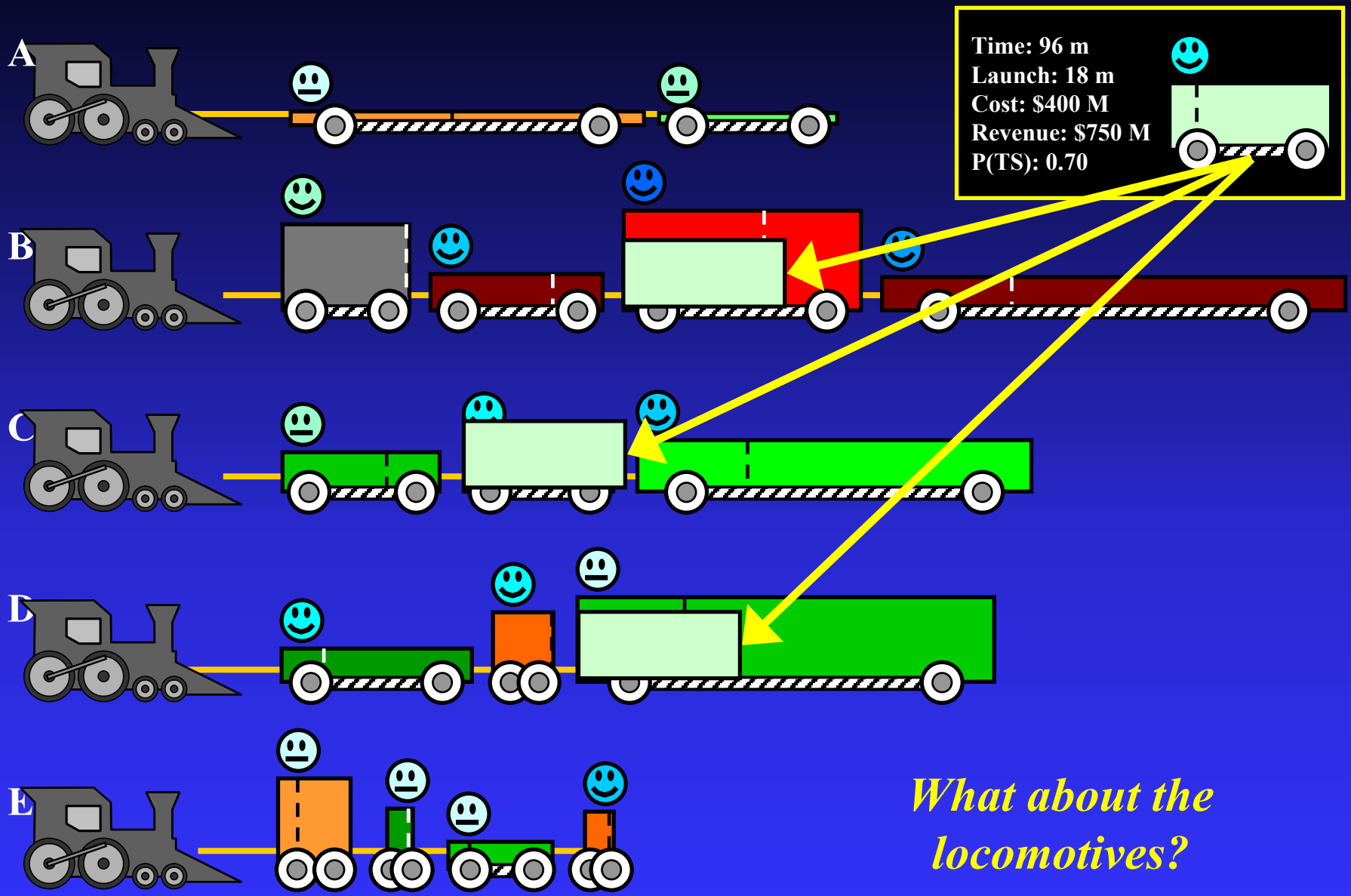


Example 1

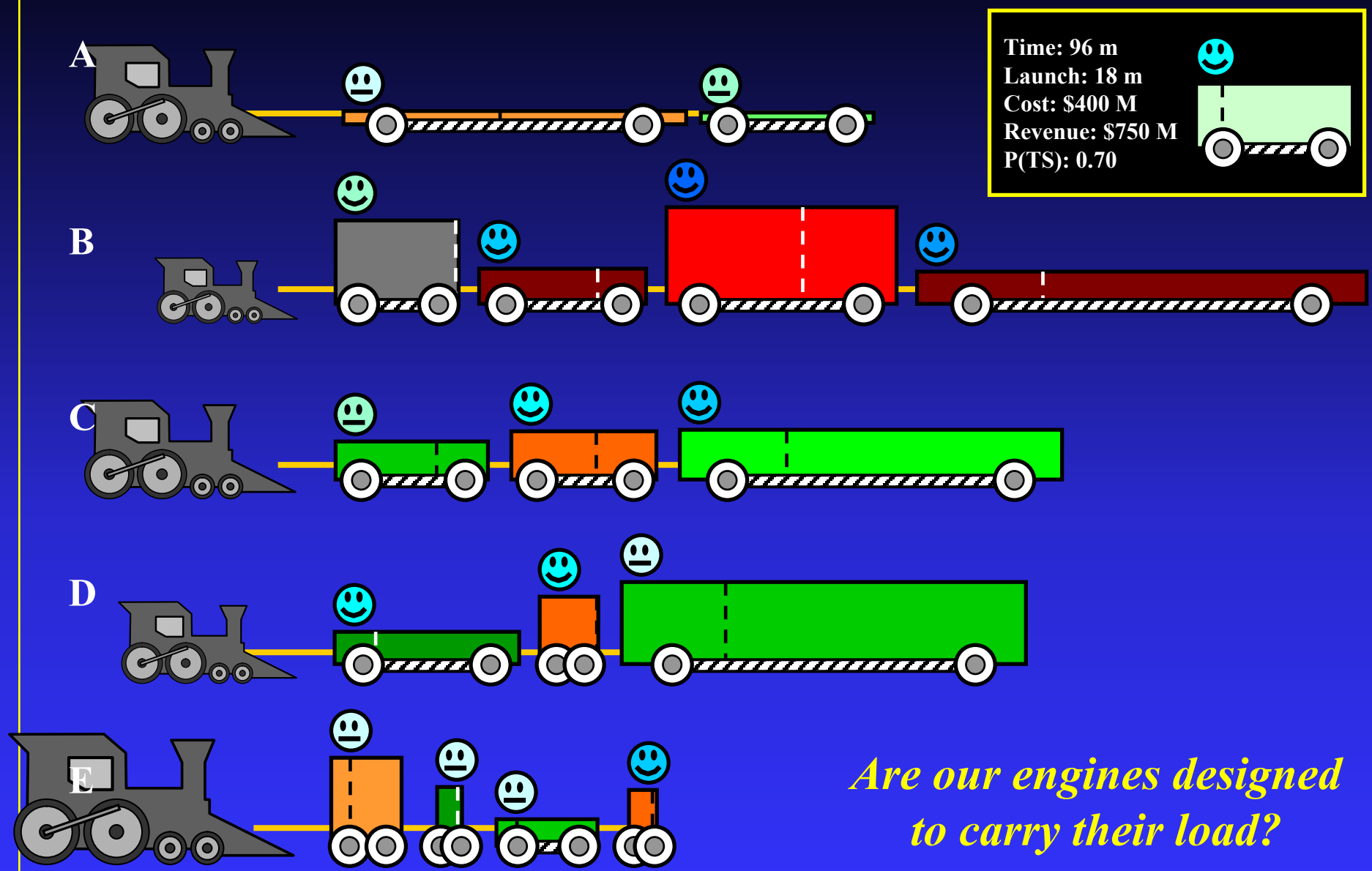
Example 2

Example 3

Applying the boxcar metaphor



Applying the boxcar metaphor



Are our engines designed to carry their load?

Conclusions

- Multidimensional data is difficult to *interpret* and *visualize*.
- *Simple metaphor maps* can be used to translate multidimensional data into personal, readily digestible representational forms.
  - For the analyst
  - For the non-analyst consumer (e.g., Sr. Mgmt)
- *Functional metaphors* can map multidimensional data into a metaphorical image that can *then be used as a model* to gain insight into the underlying system.

The end

Backup section

References

- Chernoff H. 1973. "Using faces to represent points in k-dimensional space graphically." Journal of American Statistical Association, 68, 361-368.
- Morris CJ, Ebert DS, Rheingans P. 1999. "An experimental analysis of the pre-attentiveness of features in Chernoff faces." Proceedings of Applied Imagery Pattern Recognition '99: 3D Visualization for Data Exploration and Decision Making. October 1999.
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