

Life is an adventure!

Unifying Scientific and Narrative Worldviews

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Science (formal theories)	Narrative (literature, myth, religion)
Laws	Stories
Certain knowledge	Surprises, mysteries
Objective	Subject-centered
Universal	Context-dependent
Static description	Time sequence of events
Difficult to grasp	Intuitive

The Clockwork Universe

Change is reducible to regular, predictable motion

Laplace's demon

- Knows the exact state of the universe
- Can predict the whole future/past

Implications

- Determinism
- No uncertainty, surprises, novelty, creativity, goal-directedness...

The End of Certainty

20th Century Limitation principles

- Heisenberg Uncertainty principle
- Theorem of Gödel
- Butterfly Effect / Chaos
- Halting Problem
- Finiteness of speed of light
- ...

-> **demon of Laplace impossible**

Complexity and Evolution

Emerging new scientific worldview

- dealing with unpredictable evolution
- Allows creativity and goal-directedness

Implemented as CAS/MAS

- Complex Adaptive Systems (CAS)
 - E.g. societies, markets, ecosystems, Internet...
- Multi-Agent Simulations (MAS) of CAS

Agents and actions

Agent= autonomous, goal-directed system

- Overall goal = maximizing *fitness*

Acts on environment in order to attain goal

- *Action*_: reduces perceived difference between present state and goal state

Locality principle

- Agent only perceives/acts on immediate neighborhood
- No awareness of global situation

The Exploitation /Exploration Tradeoff

Two complementary strategies to increase fitness:

1) Exploitation

- Making use of known resources

2) Exploration

- Searching for new resources

Exploitation better if resources predictable

Exploration better if resources changeful or unknown

Course of Action

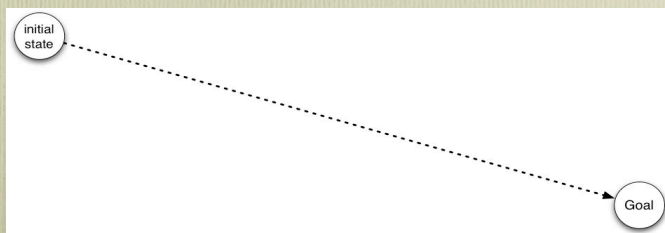
Intended trajectory, from present state to goal

Will be changed by *diversions*

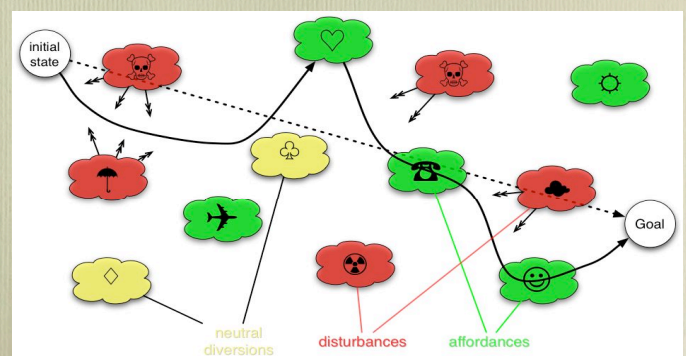
- Uncontrolled phenomena
- Negative: *disturbances* (problems, dangers, obstacles, ...)
- Positive: *affordances* (resources, opportunities...)
- Neutral: *general diversions* (surprises, deviations...)

Course of action

Without diversions



Course of action, with diversions



Navigation

Setting out and following a course of action

Balanced mixture of:

- *Regulation*: compensating for disturbances, known (feedforward) or unknown (feedback)
- *Exploitation*: approaching and using known affordances
- *Exploration*: venturing into the unknown, looking for affordances, and knowledge

Adventure

Advenire: Latin for "happen to, come about"

Adventurus: "what is about to happen"

Adventure: course of action involving unpredictable "happenings" (diversions)

- Potentially involving great *danger*, but also great *opportunities*
- Requiring forceful action
- Eliciting excitement/emotion
 - *Emotion*= action readiness (Frijda)

The Monomyth

Joseph Campbell: *The Hero with a Thousand Faces* (1949)

- Book that has inspired thousands

Argues that all myths, legends and fairy tales have a common structure

Centered around a hero

Undergoing an adventure

The Hero

Can be virtually anybody

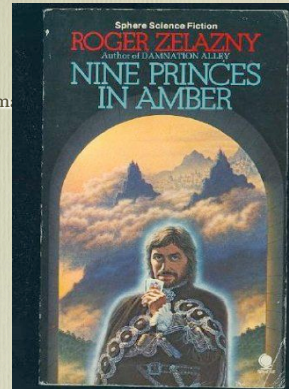
- Male, female, young, old, rich, poor, animal...

But with special gifts

- Smart, strong, gentle, beautiful, wise...

-> Self-assurance

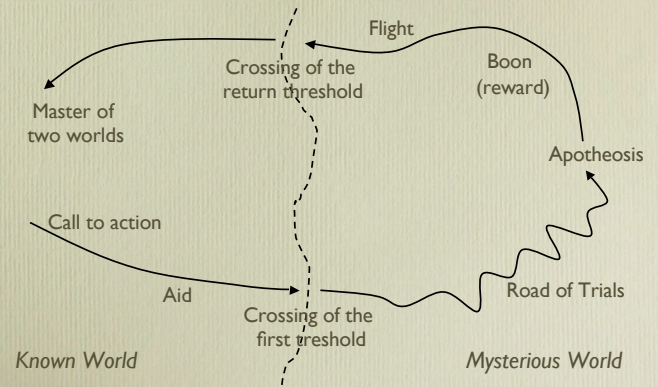
- Needed to explore unknown domains
- Where others are afraid to go...



THE HERO'S JOURNEY



The Hero's Journey



The hero's journey



The quest

The hero searches for some great benefit

- Holy grail, fountain of youth, philosopher's stone, enlightenment, ...

Search is described in the theory of problem-solving

- Setting out a path in a search space/landscape
- Using heuristics
- Such as hill-climbing

Fitness Landscapes

Abstract representation of search space

Fitness = “closeness to goal”

Depicted as elevation above the horizontal plane

- Hills = high fitness
- Valleys = low fitness
- Navigation = hill-climbing
 - Always choose path of steepest ascent

Hill climbing



Esthetics of Landscapes

What makes landscapes attractive?

Features that indicate presence of affordances

- E.g. lakes, flowers, animals

Absence of disturbances

- E.g. thunderstorm, spiders, sharp objects

More abstract features

- Prospect and mystery

Prospect

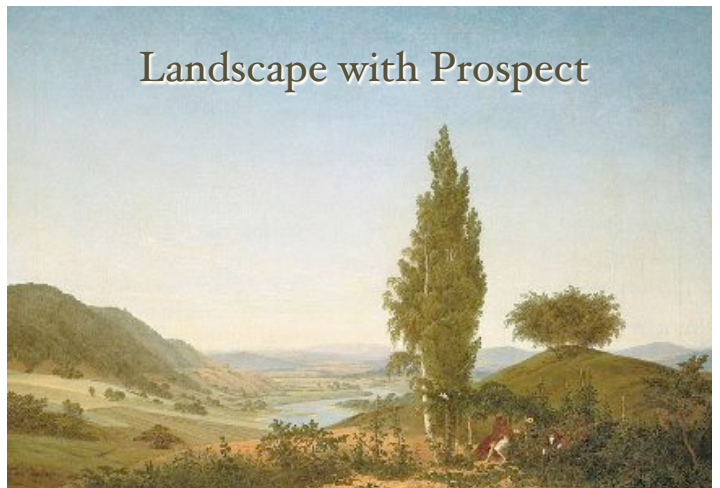
Wide view, ability to look ahead

- Prospect high from top of mountain
- Prospect low from bottom of pit

More generally: ability to foresee diversions

- Dangers, resources, obstacles, ...
- Makes it easier to set out effective course of action

Landscape with Prospect



Landscape with Prospect and...



Mystery

Mystery = Lack of prospect

***But*, promise of prospect if one can venture deeper into the scene**

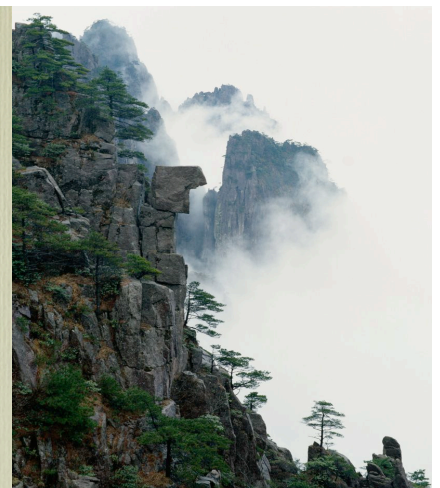
- Requires extra effort
- But offers potential extra reward

Second-order anticipation:

- *Prospect* = anticipation of diversions
- *Mystery* = anticipation of prospect



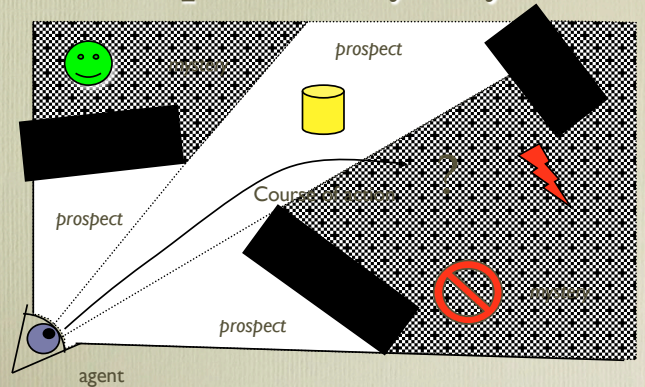
Mystery
Landscape



Mystery

More generally

Prospect and Mystery



Alternating prospect and mystery

A mystery invites further exploration

Resolving it produces a new prospect

But this prospect contains new mysteries

- Which challenge the agent to further explore them...

Such continuous alternation produces “flow”

- Pleasurable feeling of full absorption and control

Mystery/Prospect: Examples

Hiking in the mountains

Driving on a winding road

Playing a virtual reality computer game

A mystery novel, like “The Da Vinci Code”

- Each mystery solved introduces a new mystery
- Gradually, things become clearer
- But the suspense forces things to move on as quickly as possible...

Mystery/Prospect: Examples

Which men are attractive to women?

- *Those having fun*:
 - prospect of having a good time
- *The cool, James Bond type*:
 - mystery to be resolved
- *The ideal*:
 - the international man of mystery turns out to be great fun

Mystery/Prospect: Examples

Sex Appeal

- The naked body of a potential sex partner offers an attractive *prospect*
- The covered body of a potential sex partner offers an attractive *mystery*

Striptease

- gradual uncovering turns the mystery into prospect
- This increases the excitement/feeling of adventure

Back to Science

Newtonian mechanics is based on dynamical systems

- Following trajectories through state space
- Obeying an optimization principle
 - E.g. minimizing potential energy

System has zero prospect (locality principle)

Observer has full prospect

- Demon of Laplace

Generalization

Agent has variable prospect

Never complete -> uncertainty about course of action

- Positive: allows discovery, novelty, goal-directedness
- Negative: carries risks, danger, stress
- Neutral: allows surprises, diversions

Teaching function

Science

- Teaching by general rules
- Proposing optimization criteria that *determine* trajectories

Narrative (literature, myth, religion)

- Teaching by examples
- Proposing guidelines, values, “morals” that *help you to choose* a good course of action

Unification?

Multi-agent simulations are

- **Like science:** generalizable, formal, repeatable, measurable, ...
- **Like narrative:** each run is unique, agents explore prospects and mysteries, successful runs depend on heuristic criteria...



Conclusion

Old worldview: ***The universe is a clockwork***

- The world is determined, predictable, fixed

New worldview: ***Life is an adventure***

- The world is full of uncertainty, surprises, mystery, ...
- You have the freedom to explore and set out your own path