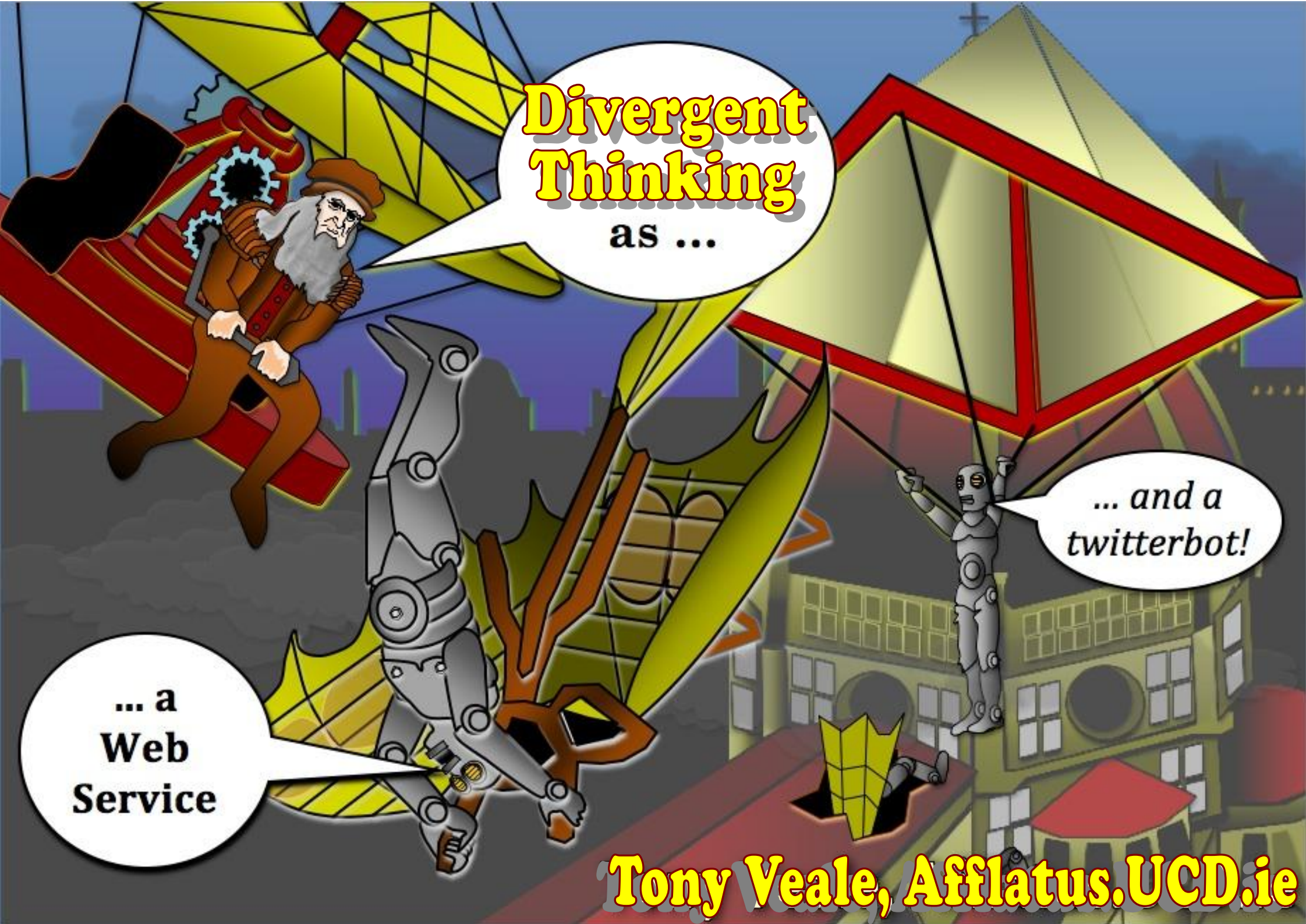

Divergent Thinking as ...
... a Web Service
... and a twitterbot!
Tony Veale, Afflatus.UCD.ie

Happy families are all alike;

every unhappy family is unhappy in its own way.

Leo Tolstoy

"Anna Karenina"
[opening line]

Just one right answer

Happy families are all alike

every unhappy family is unhappy in its own way.

A great many wrong answers

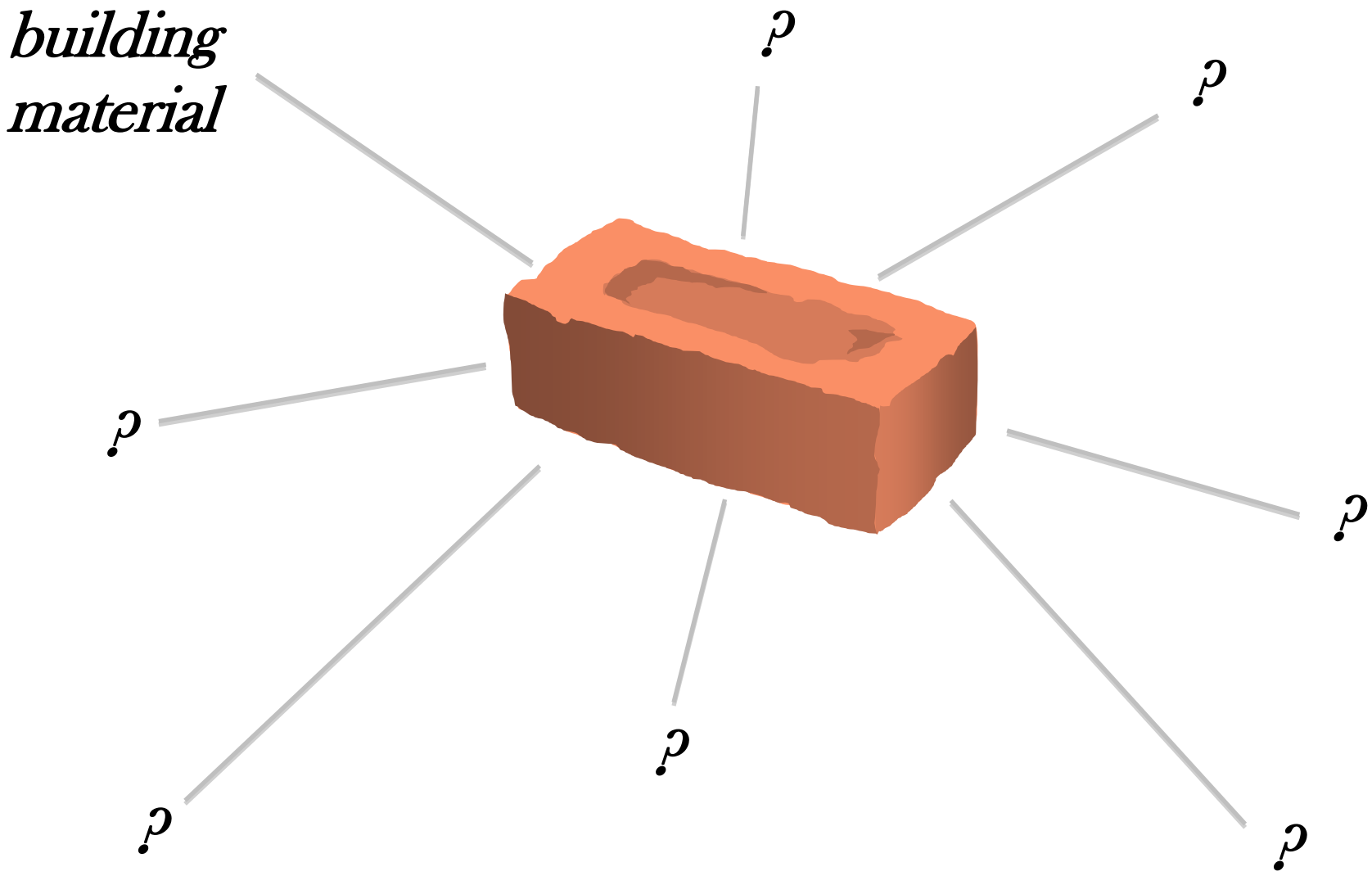
One clichéd ideal [CONVERGENCE *to* NORM]

Happy families are all alike;

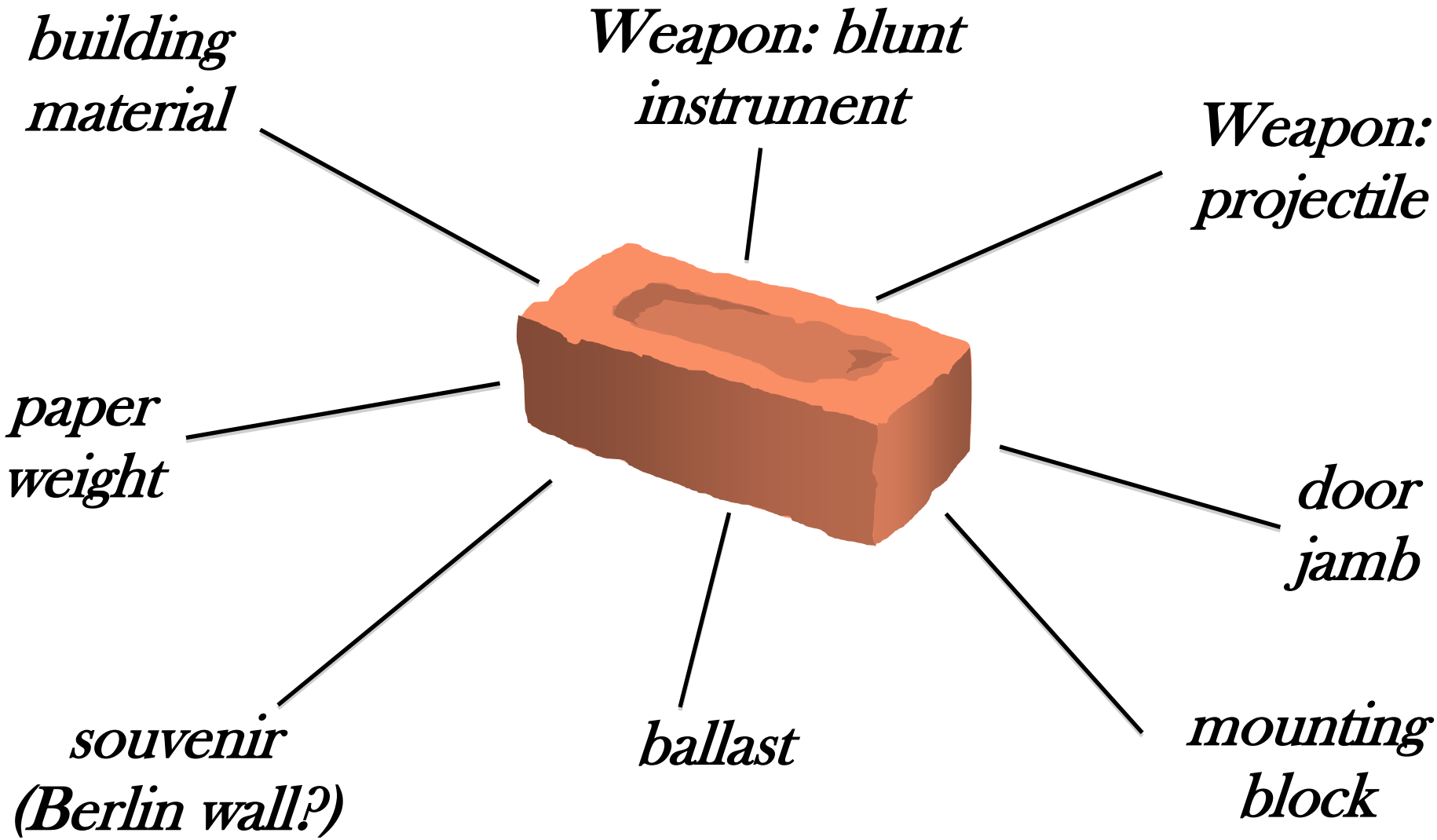
every unhappy family is unhappy in its own way.

Many non-obvious stories of interest
[DIVERGENCE *from* NORM]

How many uses can you think of for a brick?

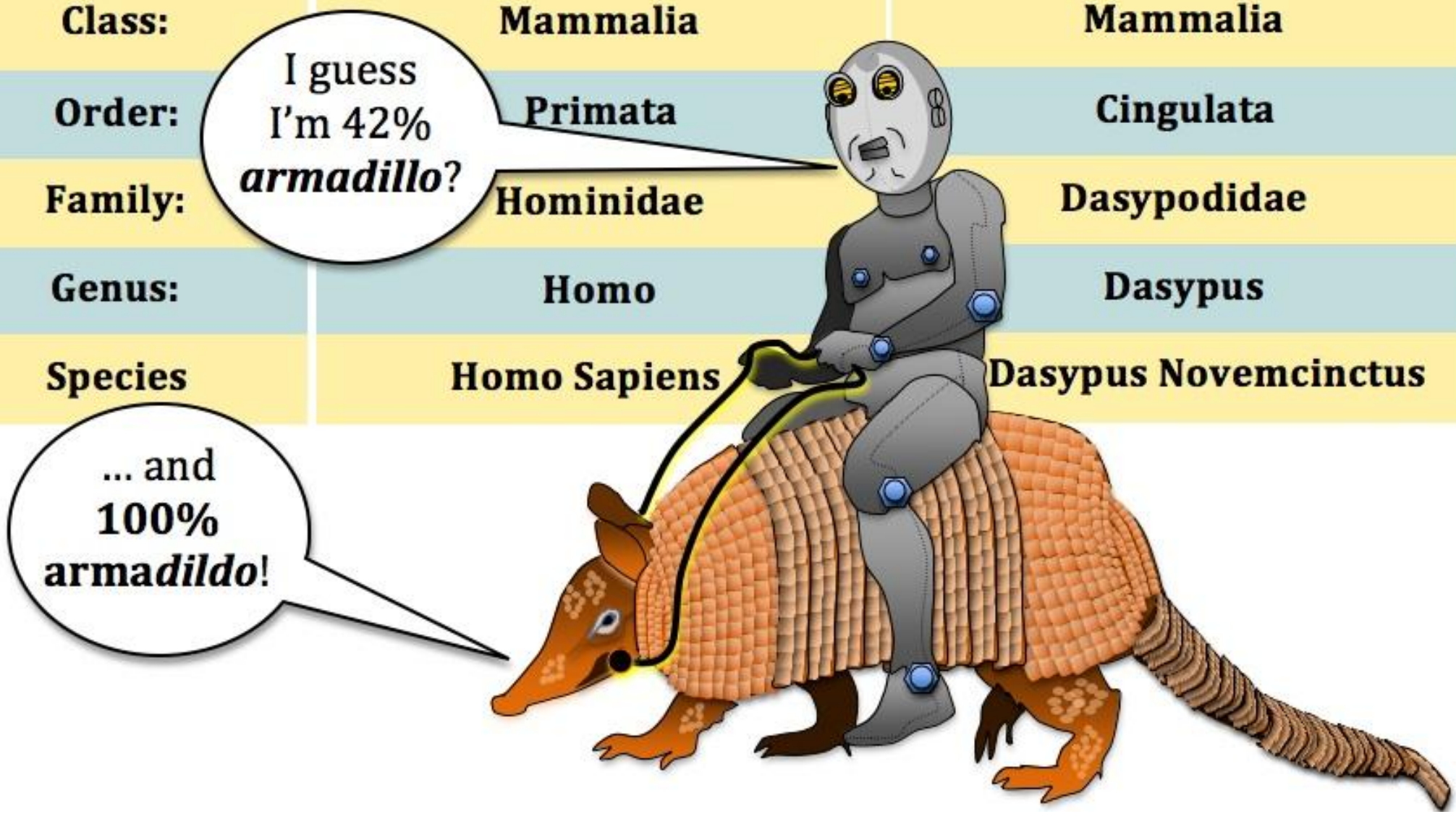


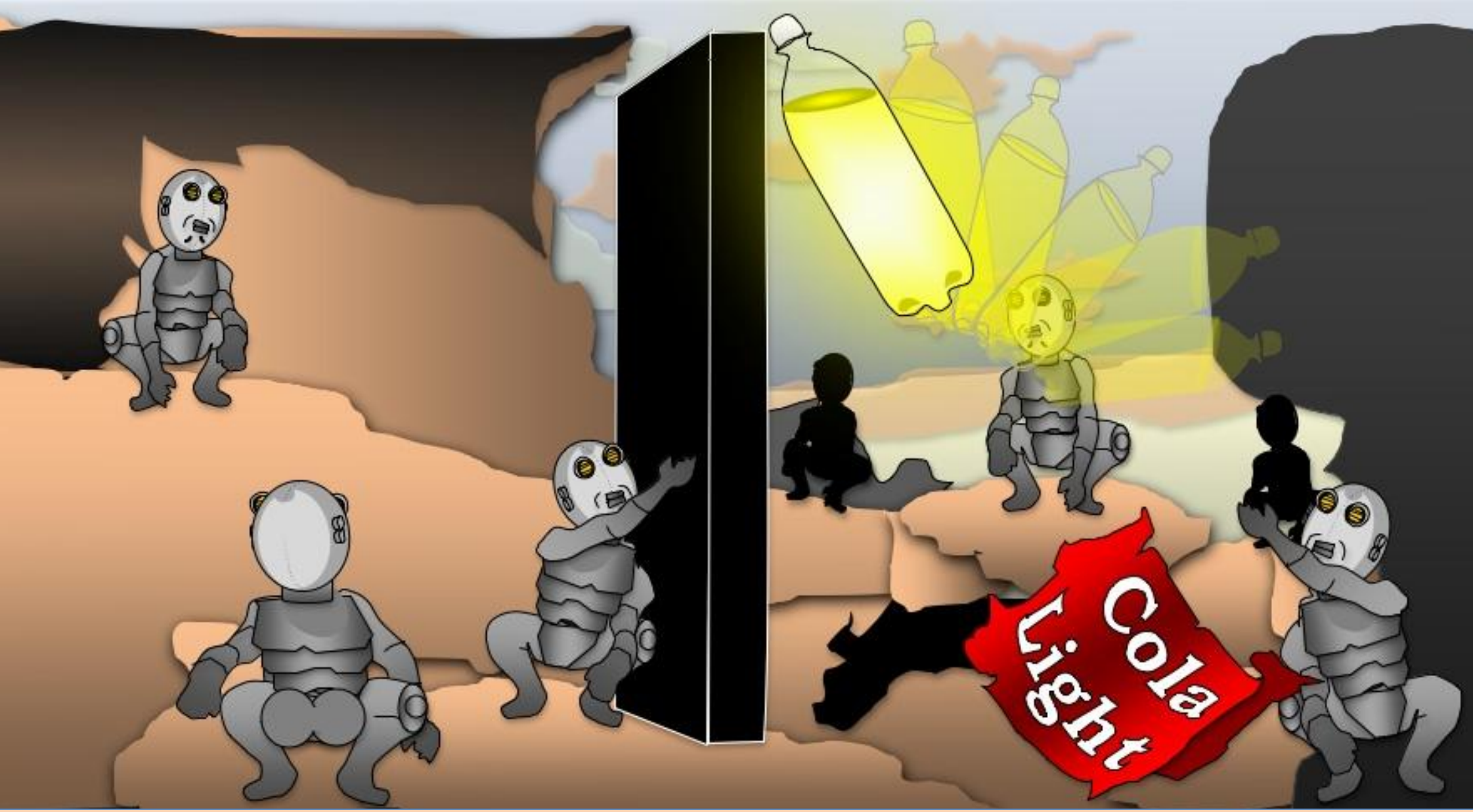
J.P. Guilford *E.P. Torrance*



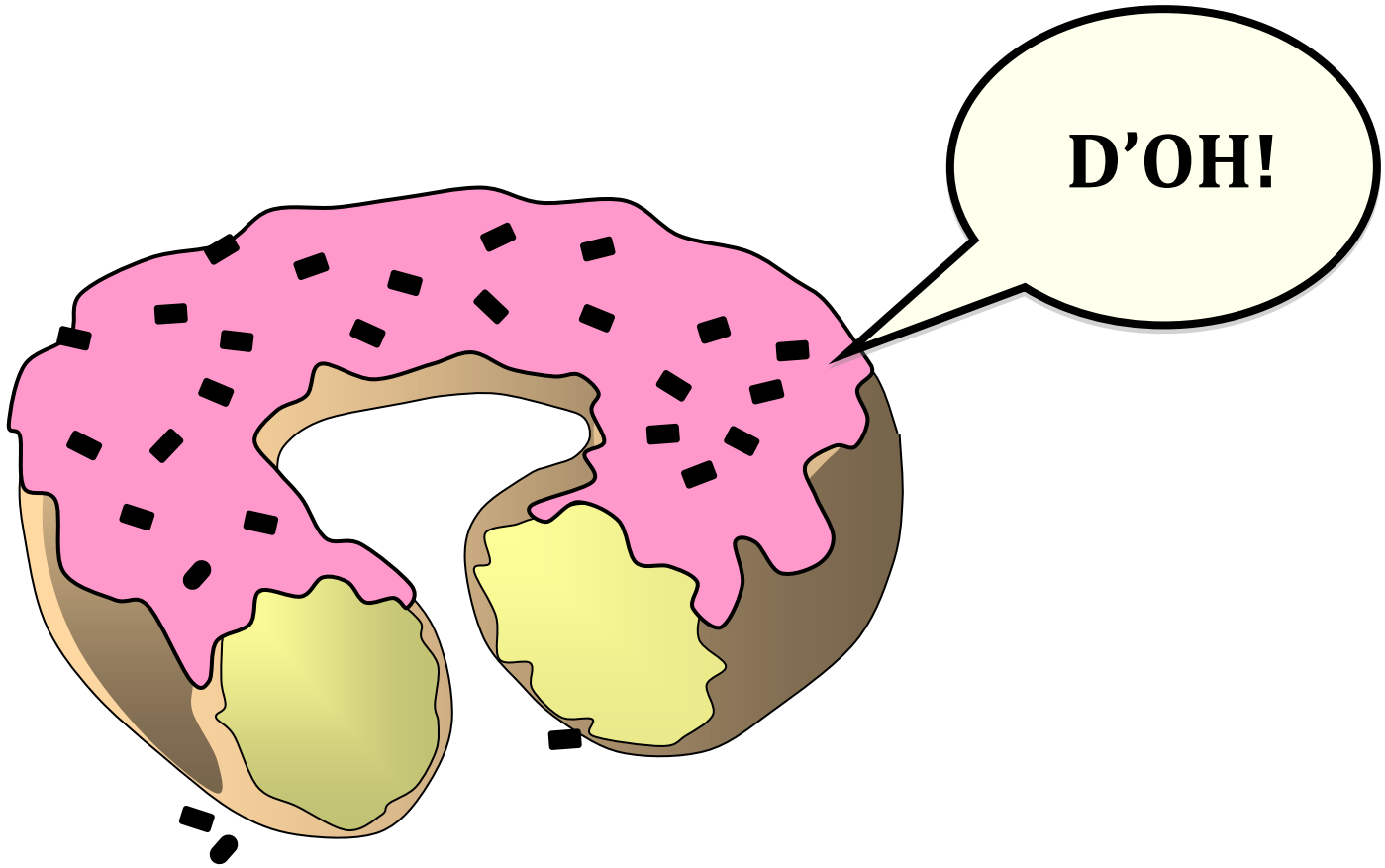
Fluency *Flexibility* *Originality* *Elaboration*

Taxon/Creature	Human Beings	Nine-banded Armadillo
Kingdom:	Animalia	Animalia
Phylum:	Chordata	Chordata
Class:	Mammalia	Mammalia
Order:	Primata	Cingulata
Family:	Hominidae	Dasypodidae
Genus:	Homo	Dasypus
Species	Homo Sapiens	Dasypus Novemcinctus





Problem: find a common object that can be used as a safe indoor light source in poor hot countries.



Can you provide a good convergent definition of a **DONUT**?

(One that matches <u>all</u> donuts but <u>no non</u>-donuts)

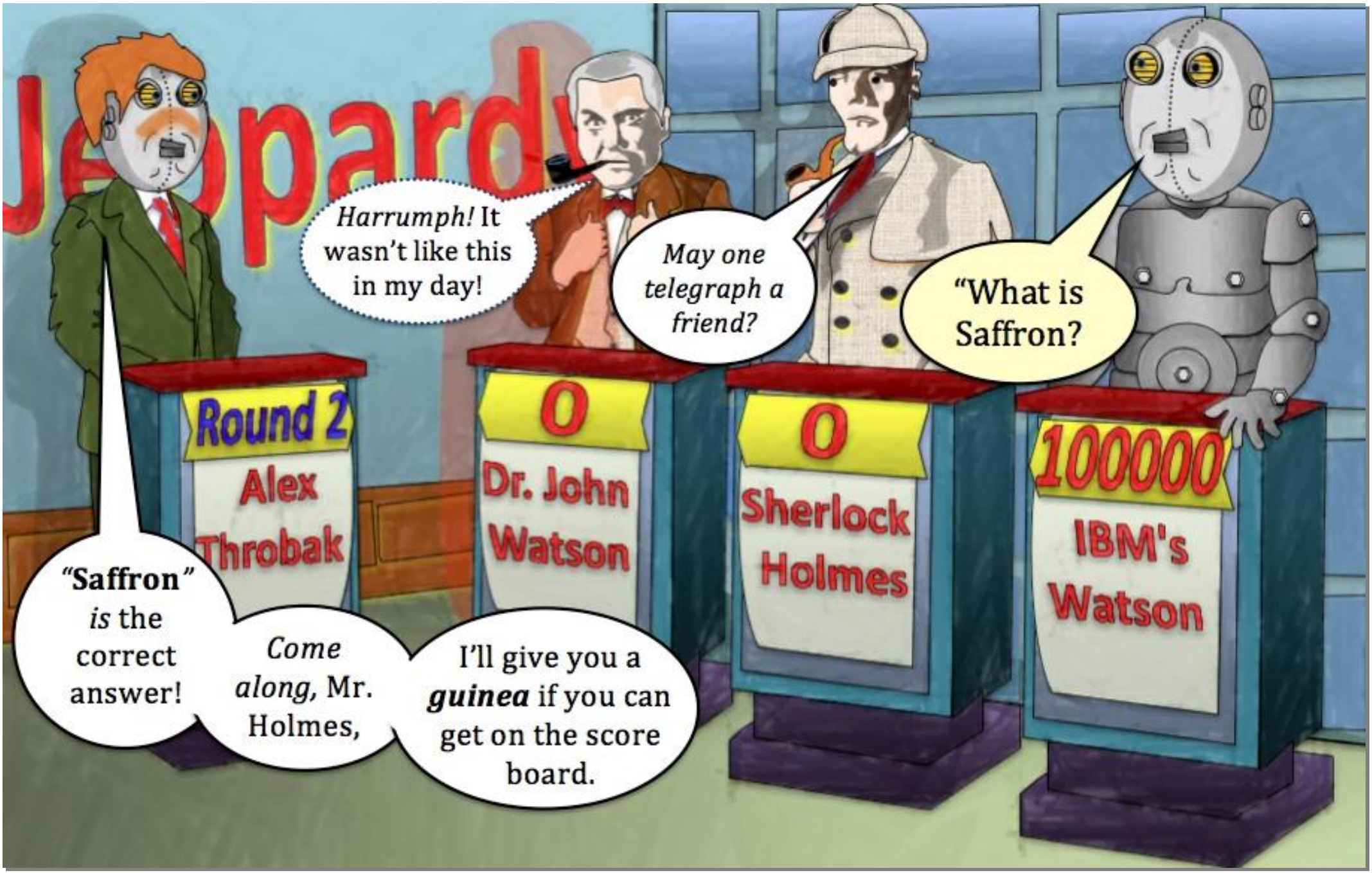
Well, what are the most obvious *shared properties* of donuts?

But, innovative divergence in the donut industry means that ...

... not all donuts are round, or even have a (single) hole in the middle.

Likewise, not all tasty fried/baked edible toroids are donuts.

We perceive donutness relative to received norms, not strict definitions.



Divergent Production: More than the expected "*right*" answers

Your problem is you've spent your whole life thinking there are *rules*.
There *aren't*.
Our Guide: Lorne Malvo, creative sociopath.

Scene: *A rural motel. Lorne Malvo enters on a cold dark evening …*

Malvo: I need a room.

Clerk: Just you?

Malvo: What difference does that make?

Clerk: It's a different rate for two. And if you've got pets … dog, cat … it's an extra ten bucks.

Malvo: What if I got a fish?

Clerk: Excuse me?

Malvo: Would a fish cost me ten dollars?

Malvo: Or what if I kept spiders?

Malvo: Or mice.

Malvo: What if I had bacteria?

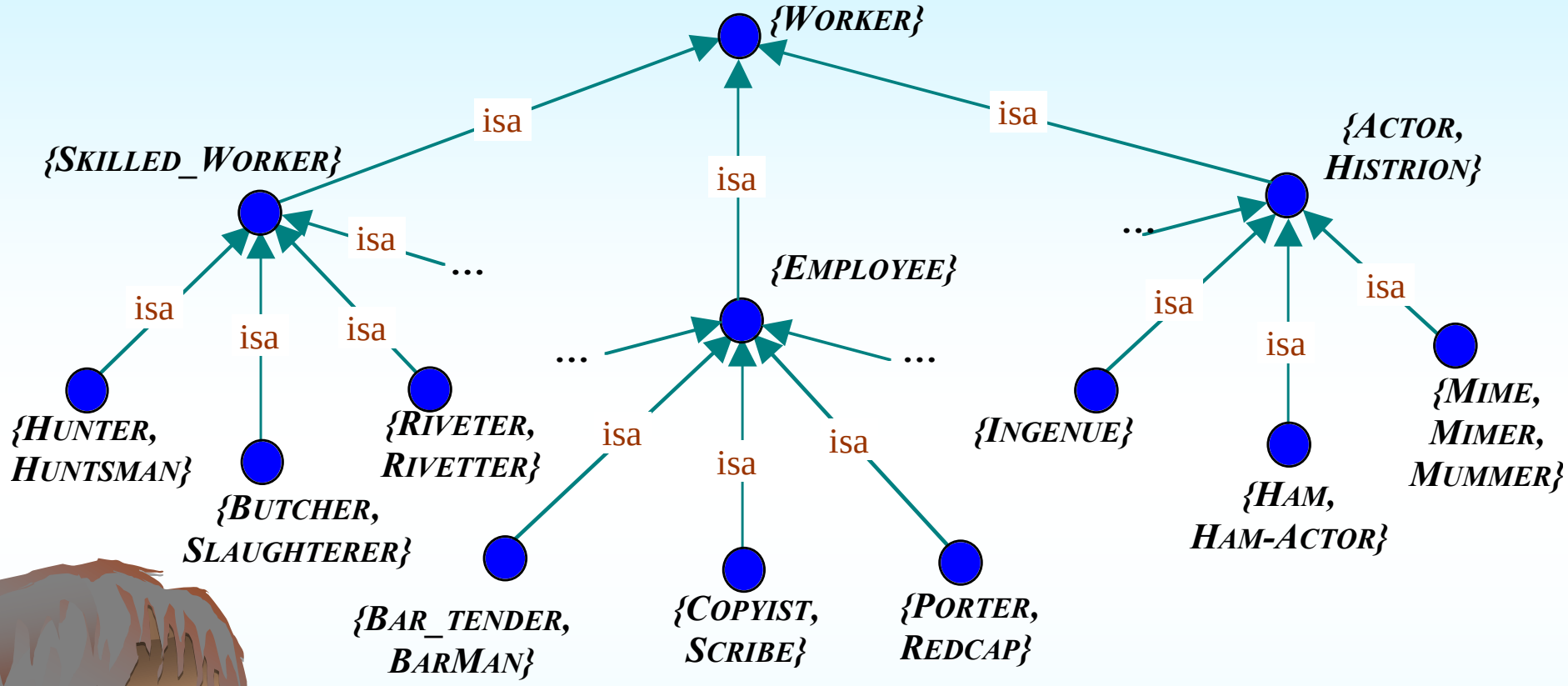
Clerk: Sir, bacteria are not pets.

Malvo: Could be.

Clerk: Sir, perhaps you'd be happier in a different motel?

Fargo, Season 1, episode 1

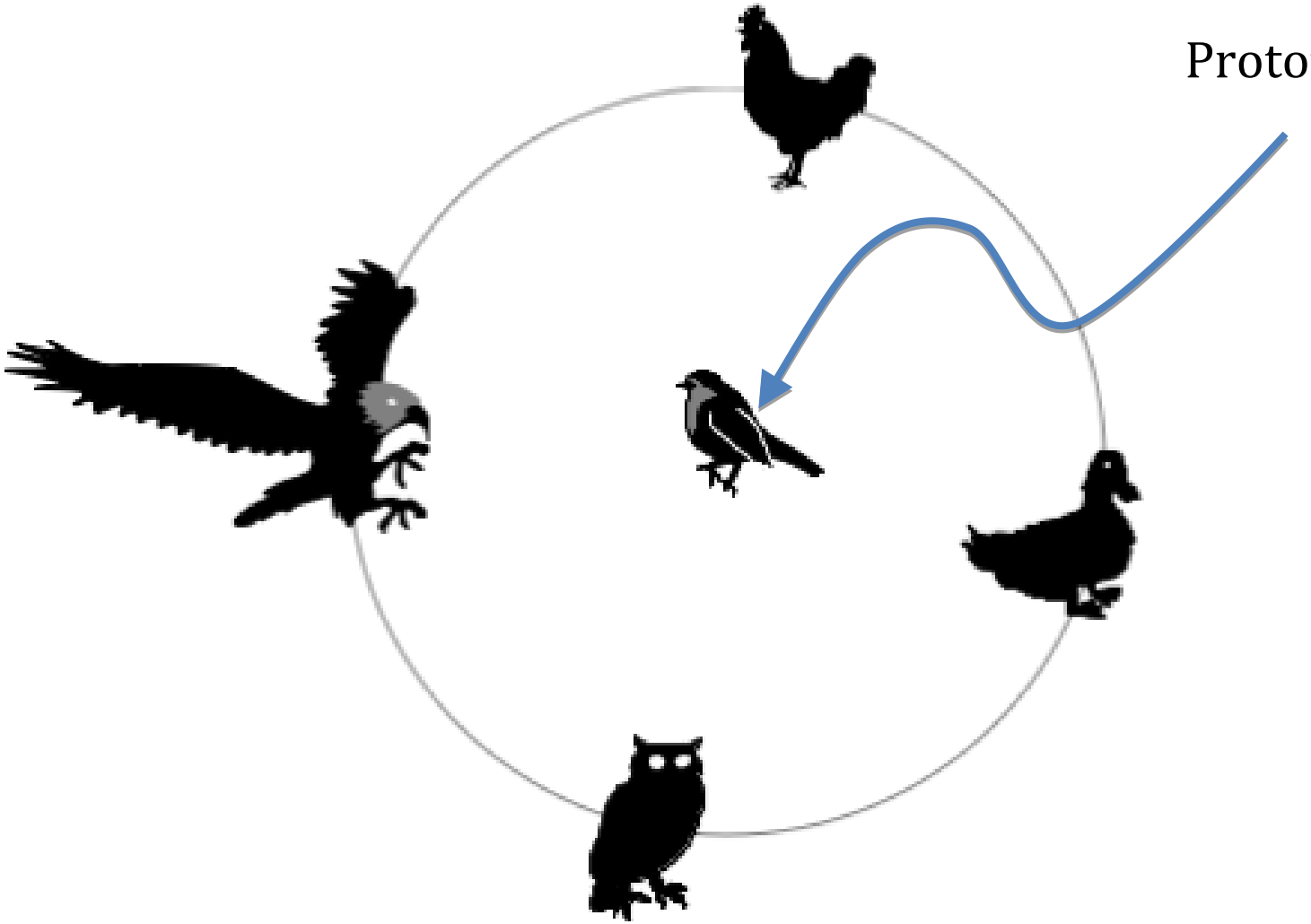
WordNet, A lexico-semantic institution



Now ***WordNet***, there's an ***institution!***
A system of crisp lexical categories and sharply-drawn semantic boundaries.

E. Rosch, G. Lakoff

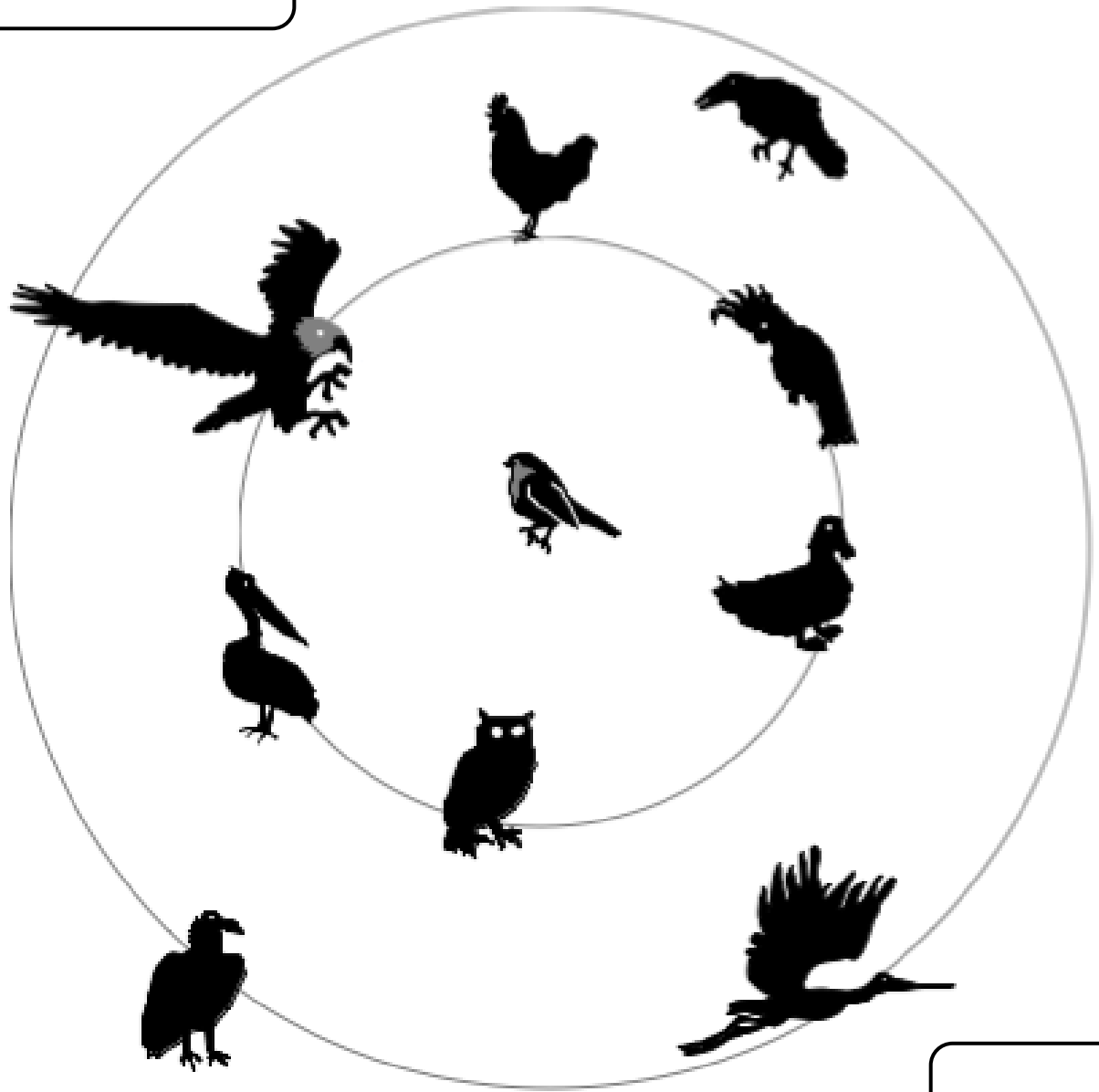
The category "Bird"



“Radial” Categories

The category "Bird"

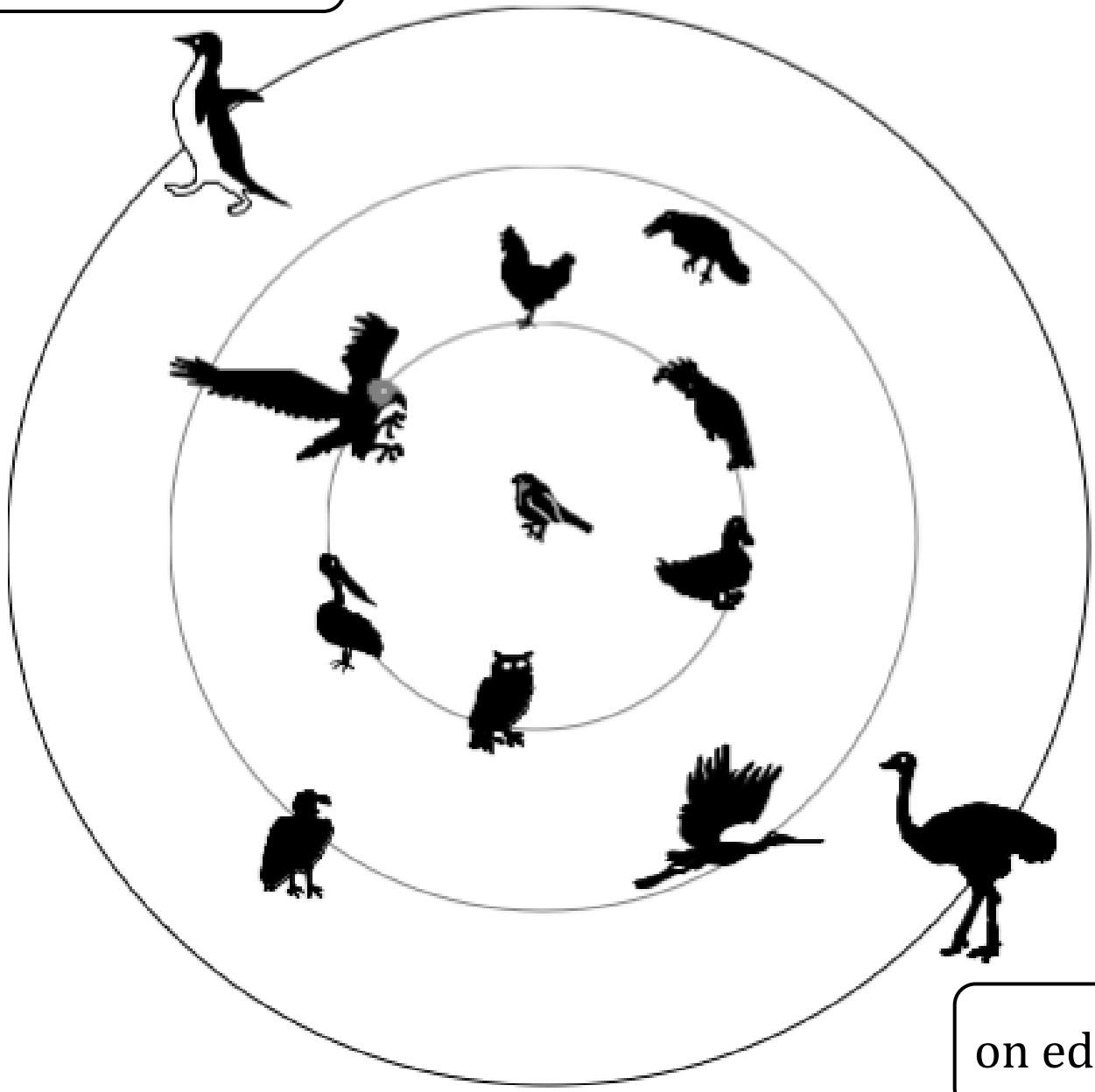
As we go from centre



cases are less *typical*

The category "Bird"

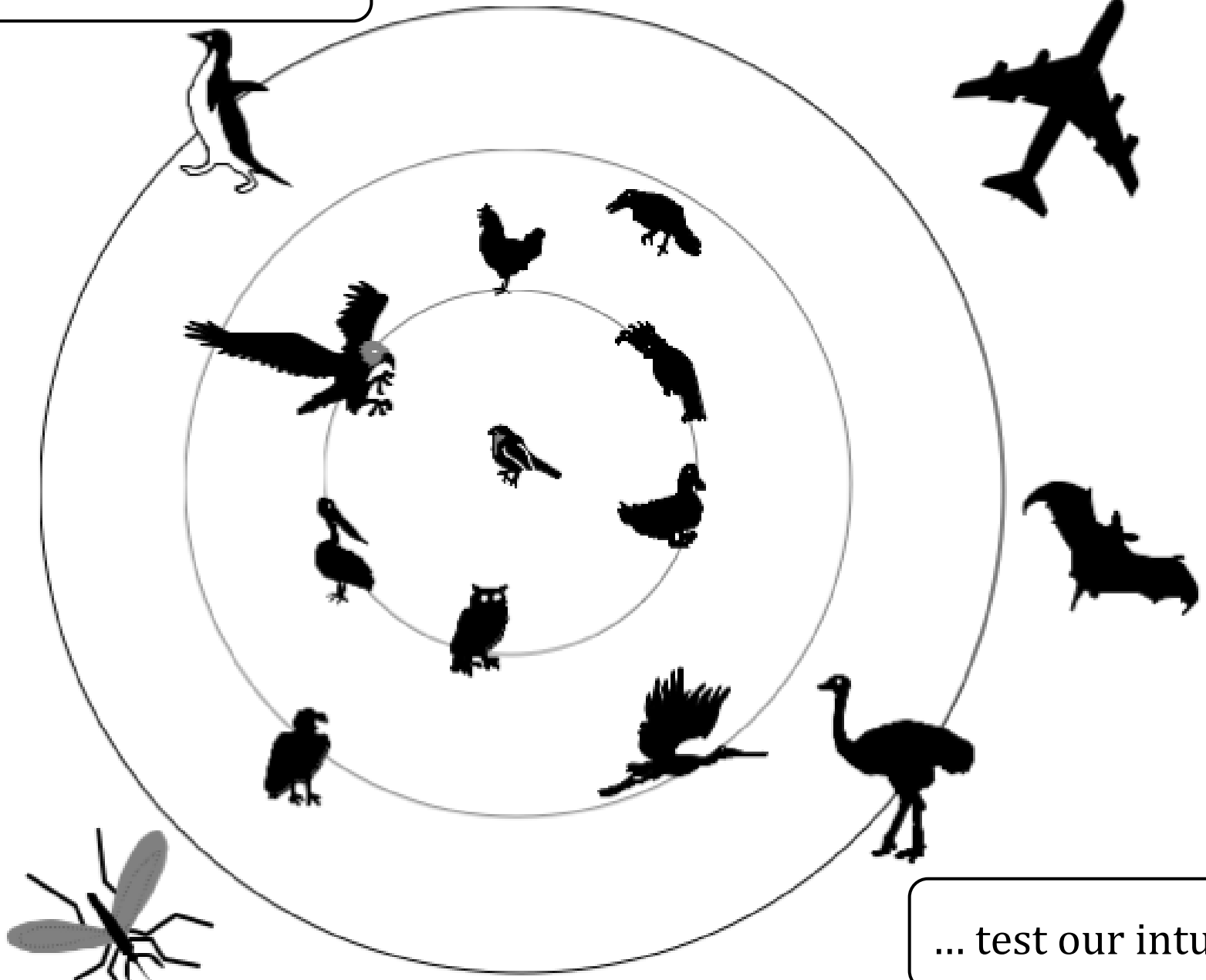
Problem cases reside



on edge of categories

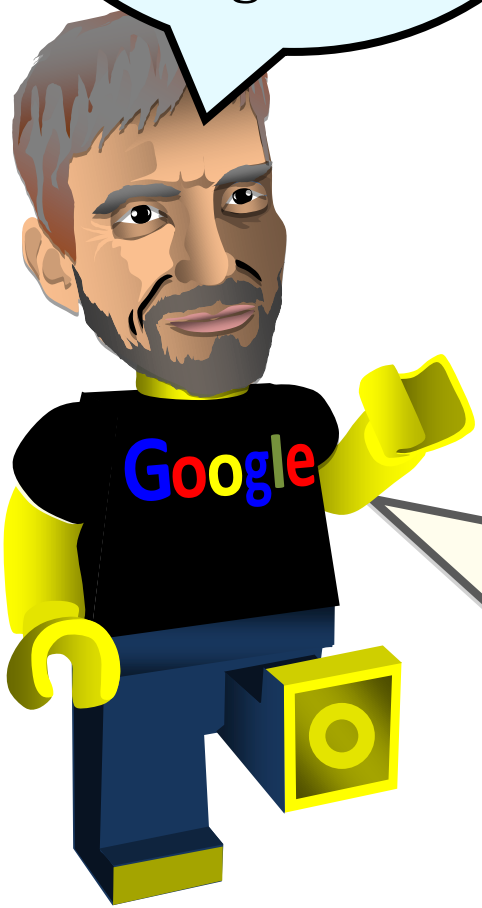
The category "Bird"

Near-miss examples



... test our intuitions

Rather than use fixed category structures, we can look for how ideas actually cluster together.



I'm **Salt**

I'm **Pepper**

salt	and	pepper	724197

Intuitively, we coordinate ideas that ***belong together***. As the linguist **Eric Firth** famously said,

"*You shall a word by the company it keeps*."

So we use the ***Google n-grams*** to build categories.

Gram 1	Gram 2	Gram 3	Freq	Sim
disaster	and	disaster	736	100
disaster	and	catastrophe	626	99
disaster	and	calamity	216	98
disaster	and	destruction	718	90
disaster	and	plague	68	89
disaster	and	hardship	89	89
disaster	and	famine	635	89
disaster	and	misfortune	250	88
disaster	and	death	1397	80
disaster	and	accident	824	77
disaster	and	trouble	60	76
disaster	and	attack	71	74
disaster	and	misery	225	73
disaster	and	emergency	9649	69
disaster	and	scandal	121	67
disaster	and	humiliation	154	66
disaster	and	development	399	66
disaster	and	suffering	921	65
disaster	and	change	64	65
disaster	and	woe	86	64

Gram 1	Gram 2	Gram 3	Freq	Sim
terrorism	and	terrorism	1140	100
terrorism	and	bioterrorism	569	94
terrorism	and	narcoterrorism	45	90
terrorism	and	racism	364	68
terrorism	and	tourism	165	60
terrorism	and	separatism	831	57
terrorism	and	communalism	59	56
rorism	and	vandalism	259	50
rism	and	hooliganism	51	47
sm	and	imperialism	102	46
sm	and	barbarism	173	38
ism	and	fundamentalism	1540	34
orism	and	extremism	8275	34
terrorism	and	communism	123	32
terrorism	and	counterterrorism	1813	31
terrorism	and	antisemitism	48	29
terrorism	and	activism	42	29
terrorism	and	nationalism	54	28
terrorism	and	militarism	189	28
terrorism	and	liberalism	137	28
terrorism	and	fascism	243	28
terrorism	and	totalitarianism	184	27
terrorism	and	sectarianism	133	27

Gram 1	Gram 2	Gram 3	Gram 4
sharp	as	a	tack
smart	as	a	whip
sharp	as	a	razor
sharp	as	a	knife
close	as	a	blade
wise	as	a	serpent
sharp	as	a	pin
sharp	as	a	needle
thick	as	a	pencil
thin	as	a	pencil
clear	as	a	crystal
sharp	as	a	sword
straight	as	a	dart
sharp	as	a	whip
sharp	as	a	blade
clean	as	a	pin
sharp	as	a	dagger
clear	as	a	diamond
keen	as	a	razor
fast	as	a	shark
quick	as	a	whip
flat	as	a	tack
qualified	as	a	specialist

We can also use Web data to find conceptual norms. Linguistic constructs, such the *as*-*as*-simile frame "***as ADJ as a NOUN***" allow us to harvest a rich knowledge-base of stereo-typical property norms.
← These are from the ***Google n-grams***.

Simile associations provide an excellent seed from which to grow a rich knowledge-base.

For instance, Web similes tell us (and our computers) that **foxes** are ***cunning***, that **espresso** is ***black*** and ***strong***, that **whiskey** is likewise ***strong***, that **mummies** are ***dry***, **silk** is ***soft***, and so on.

These associations are landmarks in a conceptual landscape relative to which many other points on the landscape can also be identified. What other animals are commonly considered cunning? Which other beverages are black, or strong? What other materials are soft?

We construct a triple from each of these simile-derived associations, but leave the third part of the triple blank, as similes do not explicitly identify a category for the topic being described. This third part can be identified later, during the first stage of bootstrapping on the Web.

Yet these are the norms that everyone respects. How do we acquire a divergent world view? By *eavesdropping* on the Web to find many alternate ways of categorizing things.

<espresso, black, ?>

<whiskey, strong, ?>

<politician, corrupt, ?>

>

<coffee, hot, ?>

<snake, dangerous, ?>

<vampire, immortal, ?>

<fox, cunning, ?>

<wolf, cruel, ?>

<mummy, dry, ?>

<virus, infectious, ?>

<silk, soft, ?>

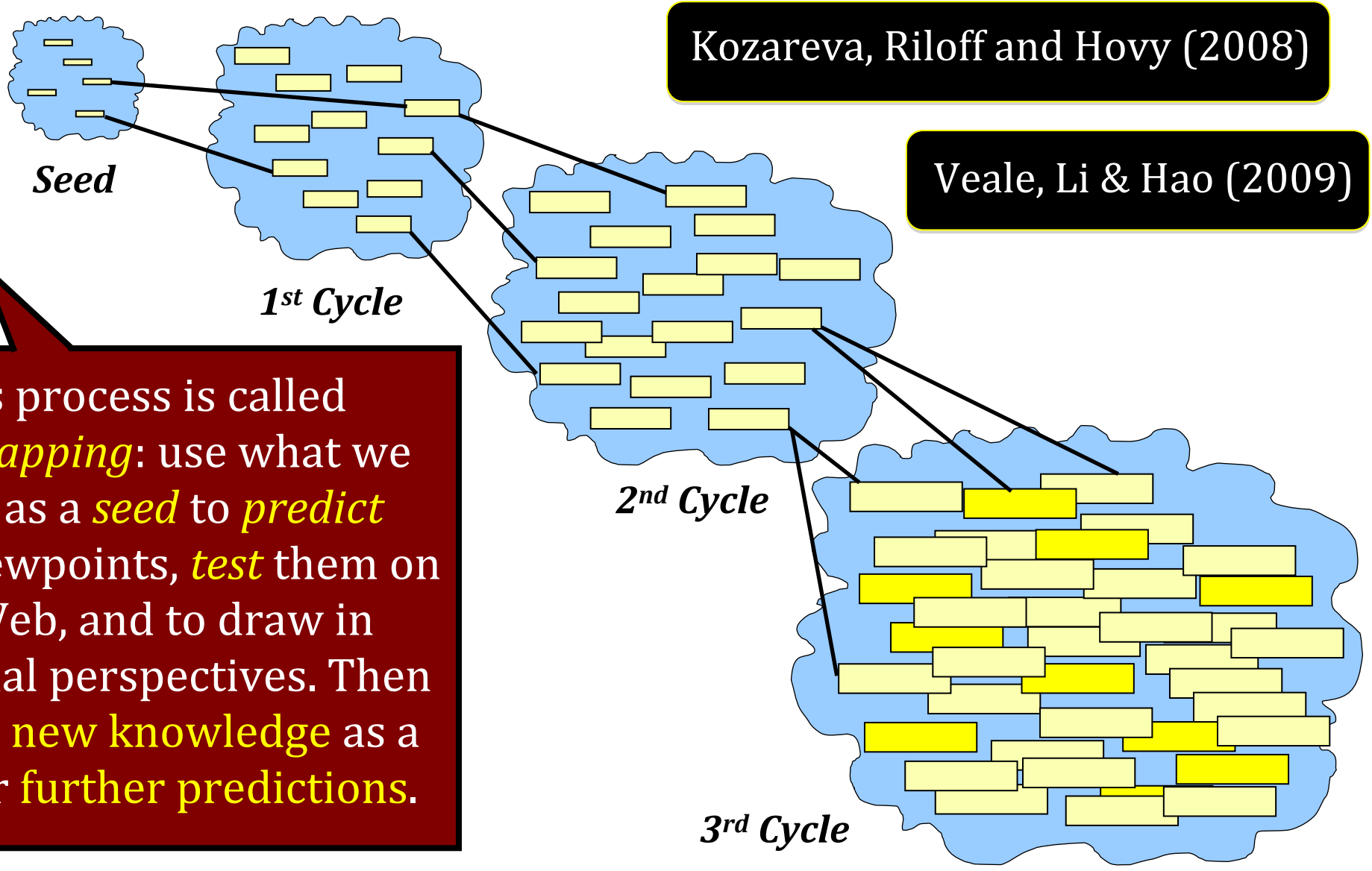
<rock, dense, ?>

We represent a viewpoint as an <X,Y,Z> triple: X is a kind of Z with the distinguishing property Y.

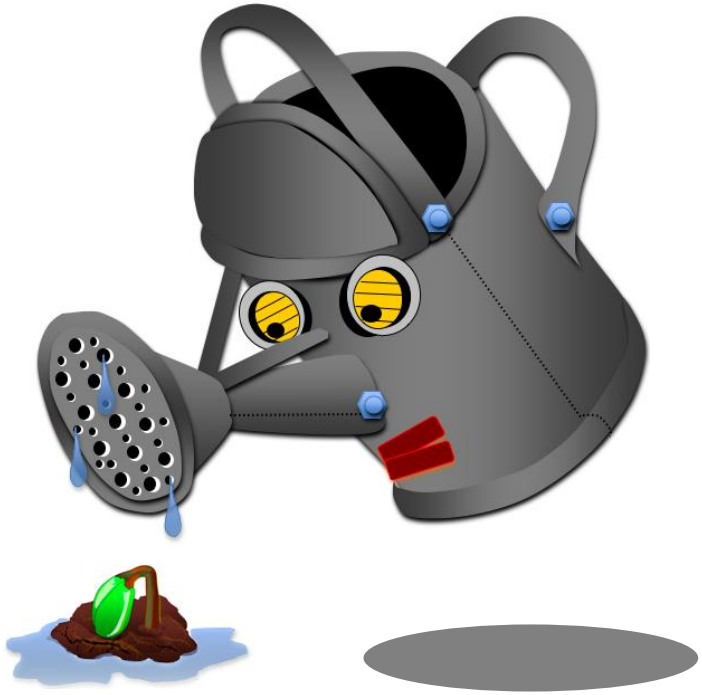
You *need* knowledge to sensibly *learn* new knowledge. We can use our known categorizations to target other *novel* viewpoints on the Web, and thus *grow* our knowledge-base

Kozareva, Riloff and Hovy (2008)

Veale, Li & Hao (2009)



This process is called *bootstrapping*: use what we know as a *seed* to *predict* other viewpoints, *test* them on the Web, and to draw in additional perspectives. Then use this new knowledge as a seed for further predictions.



It takes knowledge to acquire knowledge, for it takes insight to pose a meaningful question.

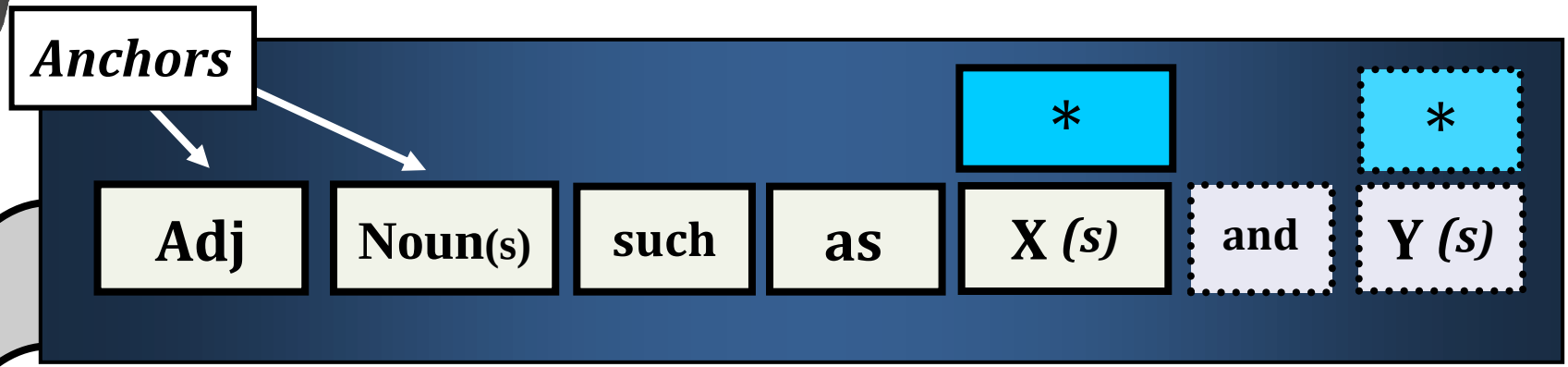
For instance, if we know that **Caviar** is ***expensive***, we can ask *just what kind of expensive item is it?*

The simile pattern is frequently used for ironic ends. To sidestep irony we need a bootstrapping pattern that is very rarely used ironically. The "***M-Xs such as Ys and Zs***" construct is such a pattern.

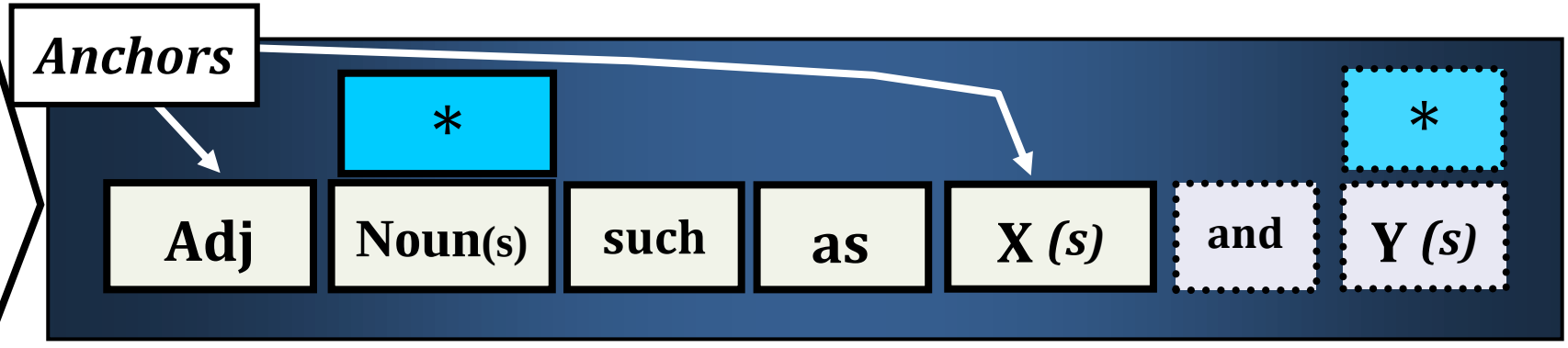
We can re-express *Y*=**Caviar** *is M*=***expensive*** as the Web query "*expensive * such as Caviar and **"* to find a value for **X** (the category of **Caviar**) and for **Z** (another expensive item like **Caviar**).

Suppose we learn that Caviar is an **expensive *food***, and that **Salmon** is too. We can now use the association **Salmon** is an **expensive *food*** in further bootstrapping, and so on and on.

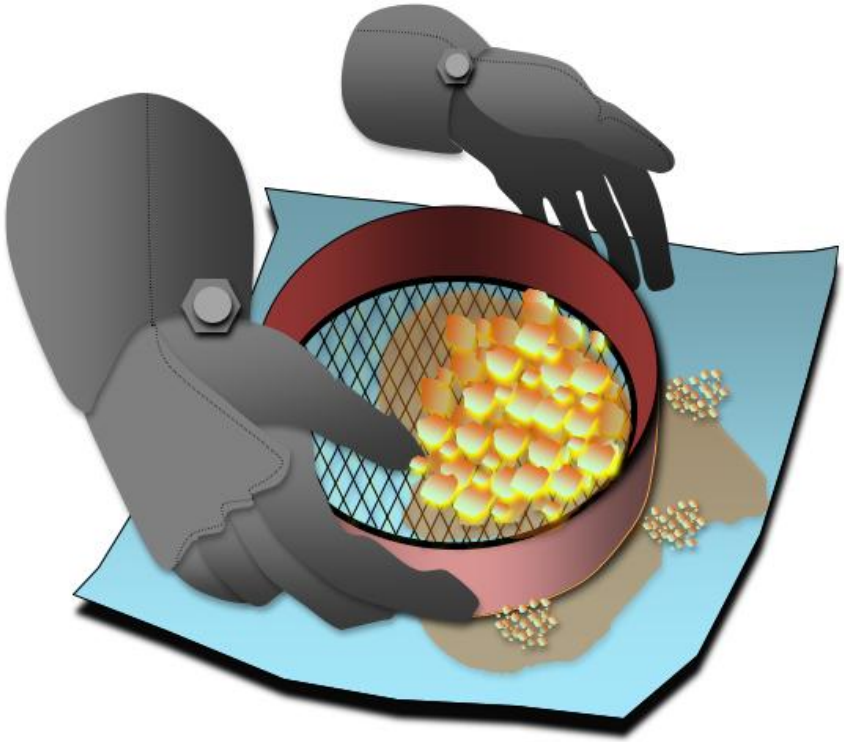
If we know that parrots are exotic pets, we can find other exotic pets (like snakes) with anchored Web queries. We can then find new categories (exotic delicacies?) for them.



E.g., "exotic pets such as parrots [and snakes]"



E.g., "exotic delicacies such as snakes [and giant water bugs]"



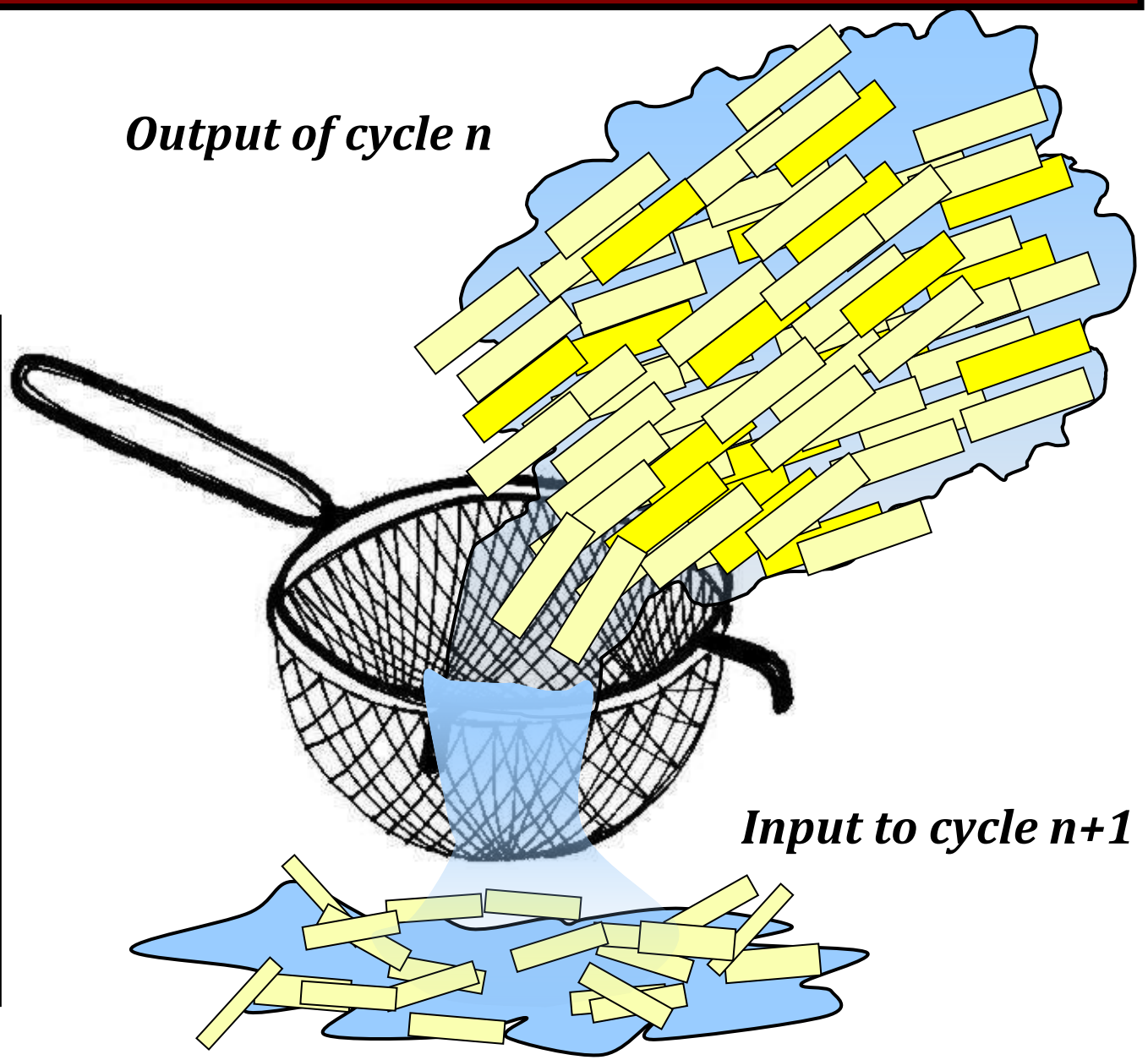
Bootstrapping grows a knowledge-base at a rapid-rate, since each existing association spurs the acquisition of many more in the next cycle. Bootstrapping is a *knowledge-magnification* process.

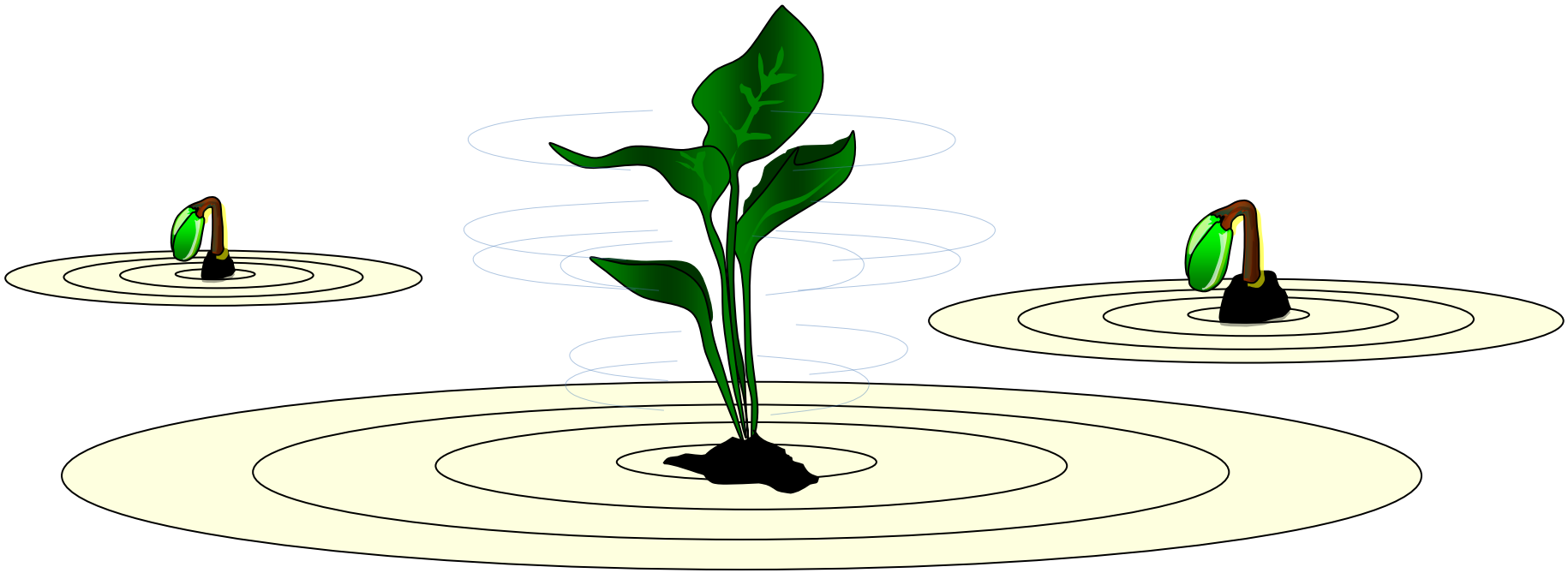
However, the process is not immune to noise, which can cause it to acquire dubious or nonsensical triples. This noise will be magnified many times over in subsequent cycles. *Garbage in, Garbage out*.

It is thus essential that newly acquired triples are carefully vetted, and that noise is filtered *after each cycle*, lest in metastasize wildly (and prompt many unnecessary queries to the Web).

It is, of course, difficult to tell creative divergence from plain stupidity, wickedness or the noise of the Web. We need to filter what we find, especially as it is *quickly magnified*.

We can use **WordNet** as a *coarse filter* on the new perspectives we acquire. A perspective <X,Y,Z> is deemed valid only if WordNet agrees that *X* has a *sufficient taxonomic similarity to Z*. We filter ruthlessly between every bootstrapping cycle!





Every bootstrapped triple represents an attested *fine-grained* categorization of a given topic.

These fine-grained categories are *radial*. If the same triple is found again and again for a topic, then this topic is deemed to be a highly representative member of the corresponding radial category.

Bootstrapping is a productive means of growing a large number of fine-grained radial categories, and of growing the membership of these categories by identifying attested members on the Web.

We have constructed a Web service called ***Thesaurus Rex*** that delivers these categorizations on demand for a given topic. The *size* of a category name conveys the representativeness of the topic.

Thesaurus Rex is a *Creative Web Service* for supporting Divergent categorization in 3rd party applications.

Check out Afflatus.UCD.ie for more information.

cola

Search!

Welcome to Thesaurus Rex!

Go Back See XML =>See Disambiguation Page

Veale & Li (2013)

creativity

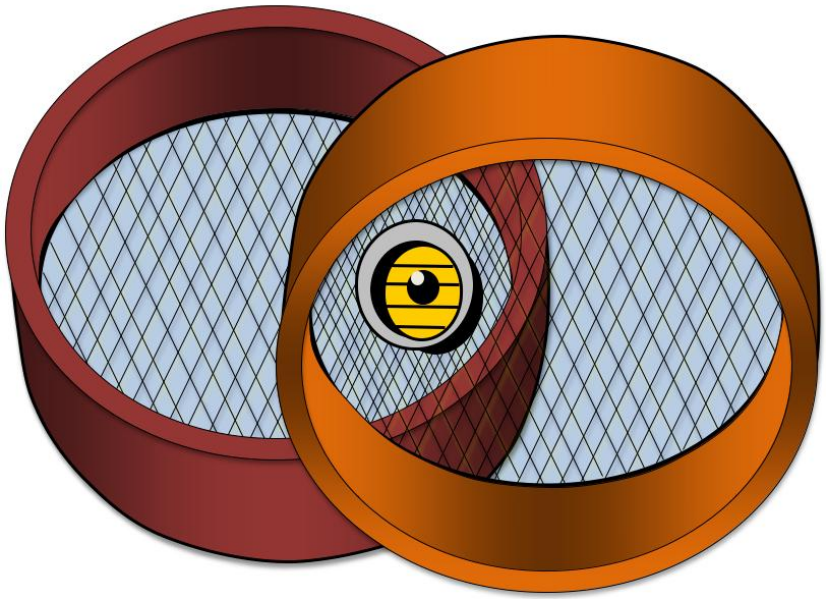
subjective:skill, personal:skill, ive:measure, personal:attribute,
basic:skill, essential:skill, soft:skill, professional:attribute, mental:ability, humanistic:attribute, spiritual:attribute,
natural:attribute, entrepreneurial:skill, academic:ability, subjective:thing, musical:ability, important:attribute, key:skill,
psychological:attribute, individual:skill, natural:ability, personal:motive, cognitive:skill, nonverbal:skill,
important:skill, social:attribute, psychological:attitude, desirable:attribute, entrepreneurial:attribute, abstract:skill,
intellectual:ability, social:skill,
diverse:attribute, cognitive:power, commercial:skill, technical:skill, mental:faculty, intellectual:skill, noble:attribute, artistic:skill, athletic:skill, feminine:attribute, feminine:skill,
mental:attitude, rare:event
wonderful:thing, behavioural:skill, individual:motivation, mental:attribute, positive:attribute, vital:skill, interpersonal:skill,
essential:attribute,
professional:skill, valuable:skill, positive:attitude, individual:attribute, spiritual:power, subjective:attribute, academic:skill, cognitive:ability,
mental:skill, educational:skill,

see Afflatus.UCD.ie

The bigger a category in the retrieved perspective set, the more frequent that perspective is on the Web. Most people think of cola as a dark, acidic, sugary, soft drink.

Top-Ranked Fine-Grained Categories of *cola*: =>see poetic categories

soft:drink, colored:beverage, common:food, nice:thing, acidic:beverage, carbonated:liquid, cool:beverage, dark:beverage, cold:soda, acidic:drink, dark:liquid, dark:drink, colored:drink, cold:drink, coloured:beverage, dark:substance, acid:drink, stimulating:drink, dark:food, sugary:food, carbonated:drink, simple:mixer, fizzy:drink, sugary:item, clear:liquid, colored:fluid, clear:beverage, sugary:drink, clear:drink, acidic:liquid, carbonated:beverage, colored:soda, coloured:drink, cold:beverage, traditional:beverage, nutritional:value, nonalcoholic:beverage, common:liquid, popular:beverage, acidic:fluid, colored:substance, carbonated:soda, dark:soda, sensitive:beverage, prepared:drink, acidic:material, sweet:drink, nonalcoholic:drink, salty:fluid, stimulating:beverage, refreshing:beverage, forbidden:food, colored:liquid, common:item, traditional:drink, dark:mixer, mixed:drink, acidic:food, effervescent:beverage, sugary:liquid, common:drink, common:beverage, carbonated:mixer, industrial:drink,



Good metaphors draw out latent similarities between their topics and their vehicles.

A creative individual spies a curious resemblance between two objects or ideas, and constructs an appropriate metaphor to help others see this otherwise overlooked similarity too.

Thesaurus Rex allows its users to explore the hidden or conventionally unnoticed similarities between concepts by ***intersecting*** the set of radial categories that they both reside in.

For instance, by identifying the fine-grained categorizations that can be applied to both ***creativity*** and to ***leadership*** (attested on the Web), we can see the many tacit connections between the two.

So the fun starts when we consider the *shared perspectives* that unite two very different ideas: coffee and tobacco, say.

Shared Category for *coffee* and *tobacco*

acidic_food, addictive_substance, agricultural_item, agricultural_material, agricultural_plant, american_ite
aversive_substance, bad_thing, basic_material, benign_substance,
commercial_plant, common_substance, complex_mixture, consumable_item, consumable_substance,
dark_substance, dietary_substance, diverse_material, dry_item, dry_material, economic_plant,
essential_item, everyday_item, everyday_substance, exempt_item,
exotic_food, exotic_item,
exotic_plant, external_agent, external_substance, familiar_substance, favorite_item, foreign_mate
foreign_substance, harmful_substance, homogenous_material, illegal_substance, important_item
important_plant, industrial_plant,
intoxicating_substance,
irritating_substance, leafy_substance, legal_intoxicant, legal_substance, legal_thing,
medicinal_plant,
medicinal_substance, narcotic_substance, natural_material, natural_substance, necessary_item,
new_substance,
organic_material, organic_matter, outside_agent, particulate_material, perishable_item, personal_item,
pleasurable_substance, poisonous_plant, poisonous_substance,
psychoactive_plant,
psychoactive_substance, raw_material, recreational_substance,

For instance, coffee and *tobacco* are both *addictive*, *harmful*, *legal* *everyday* substances derived from *exotic* plants. And *psycho-active* too!

creativity & leadership

Veale & Li (2013)

Shared Category for *creativity* and *leadership*

abstract_attribute, abstract_skill, affective_skill, basic_skill, behavioural_skill, cognitive_skill, commercial_skill, cultural_skill, desirable_attribute, developmental_skill, entrepreneurial_skill, essential_skill, exceptional_skill, general_skill, important_attribute, important_skill, individual_attribute, individual_skill, intellectual_skill, interpersonal_skill, key_attribute, key_skill, managerial_skill, marketable_skill, mental_attribute, natural_ability, necessary_attribute, new_skill, personal_attribute, personal_skill, positive_attitude, positive_attribute, practical_skill, professional_attribute, professional_skill, qualitative_attribute, social_skill, soft_skill, special_ability, special_attribute, special_skill, subjective_attribute, subjective_measure, subjective_thing, technical_skill, transferable_skill, valuable_skill, valued_skill, vital_skill, vocational_skill,

So what is the relationship between two vaguely connected hard-to-define ideas? The categories reveal all!

By finding non-obvious (non-coded) viewpoints to unite disparate concepts, we can build a model of *creative metaphor*. Consider the shared perspectives that unite divorce and war:

adverse_event, bad_event, bad_thing, catastrophic_event, changing_event, charged_event, critical_event, destructive_thing, devastating_event, disruptive_event, distressing_event, domestic_conflict, domestic_event, dramatic_event, economic_event, emotional_event, environmental_event, experienced_event, external_event, extraordinary_event, financial_event, identifiable_event, immoral_act, important_event, intense_event, legal_event, major_conflict, major_event, negative_event, ordinary_event, outside_event, painful_event, past_event, rare_event, recent_event, severe_conflict, severe_event, significant_event, single_event, social_event, social_occurrence, specified_event, stressful_event, sudden_event, surrounding_event, traumatic_event, unanticipated_event, unavoidable_event, uncontrollable_event, undesirable_event, unexpected_event, unexpected_occurrence, unforeseeable_event, unforeseen_event, unfortunate_event, unpleasant_event, unpleasant_thing, untoward_event, unusual_event,

Even opposites like birth and death share many profound similarities, provided you look for them in the right place (hint: it's not WordNet!)

historical_event, identifiable_event, important_event, important_experience, important_occasion, individual_event, infrequent_event, inorganic_object, irreversible_event, isolated_event, large_experience, legal_event, local_event, local_process, main_event, major_change, major_event, major_occurrence, meaningful_activity, meaningful_event, medical_accident, natural_change, natural_event, natural_experience, natural_occurrence, natural_phenomenon, natural_process, natural_relationship, natural_thing, notable_event, observed_event, onetime_event, ordinary_event, ordinary_experience, ordinary_occurrence, ordinary_thing, organic_event, organic_process, organizational_event, particular_event, past_event, personal_change, personal_event, physical_event, physical_phenomenon, physical_transformation, physiological_event, physiological_process, possible_event, private_experience, public_entity, public_event, random_event, random_occurrence, recent_change, recent_event, related_change, relevant_event, round_event, routine_event, routine_occurrence, sacred_event, salient_event, seminal_event, serious_experience, shared_experience, significant_activity, significant_event, significant_occasion, social_event, social_happening, social_phenomenon, special_event, special_occasion, stochastic_process, stressful_event, structural_alteration, surrounding_event, timeless_experience, traumatic_event, traumatic_experience, unanticipated_event, universal_experience, vital_event,

Each is a vital, stressful, legal, natural, traumatic, meaningful, timeless and irreversible event.

Random Nonsense
Sigh, this dilemma seems all to ***familiar***.
Convergence
Divergent

Words are *tools* that we too often assume possess just a single prescribed functionality.

An important function of metaphor is to reveal the secondary functions of our words, to show that the ideas conveyed by two very different words can share some surprising similarities.

Since metaphor facilitates our recognition of the similar in the dissimilar, it may contribute to our sense of similarity overall. Can ***Thesaurus Rex***'s categories enhance a general sense of similarity?

Measures of the semantic similarity of two words (and their meanings) are usually evaluated on the *gold standard* of Miller & Charles (**M&C**)'s 30-word-pairs ranked by human similarity judgments.

For ***divergent*** perspectives to be useful, they must contribute to our overall sense of a word/idea.

I'm **George Miller**

I'm **Walter Charles**

George A. Miller & Walter G. Charles created a seminal ***gold-standard*** for ***similarity judgments***. The **M&C** dataset contains ***30 pairs of words***, each pair rated for similarity by multiple human subjects.

Miller & Charles (1991) Lexical similarity Gold-Standard of 30 word pairs

1.	car - automobile	11.	bird - cock	21.	coast - hill
2.	gem - jewel	12.	bird - crane	22.	forest - graveyard
3.	journey - voyage	13.	tool - implement	23.	shore - woodland
4.	boy - lad	14.	brother - monk	24.	monk - slave
5.	coast - shore	15.	crane- implement	25.	coast - forest
6.	asylum- madhouse	16.	lad - brother	26.	lad - wizard
7.	magician - wizard	17.	journey - car	27.	chord - smile
8.	midday - noon	18.	monk - oracle	28.	glass - magician
9.	furnace - stove	19.	cemetery - woodland	29.	rooster - voyage
10.	food - fruit	20.	food - rooster	30.	noon - string

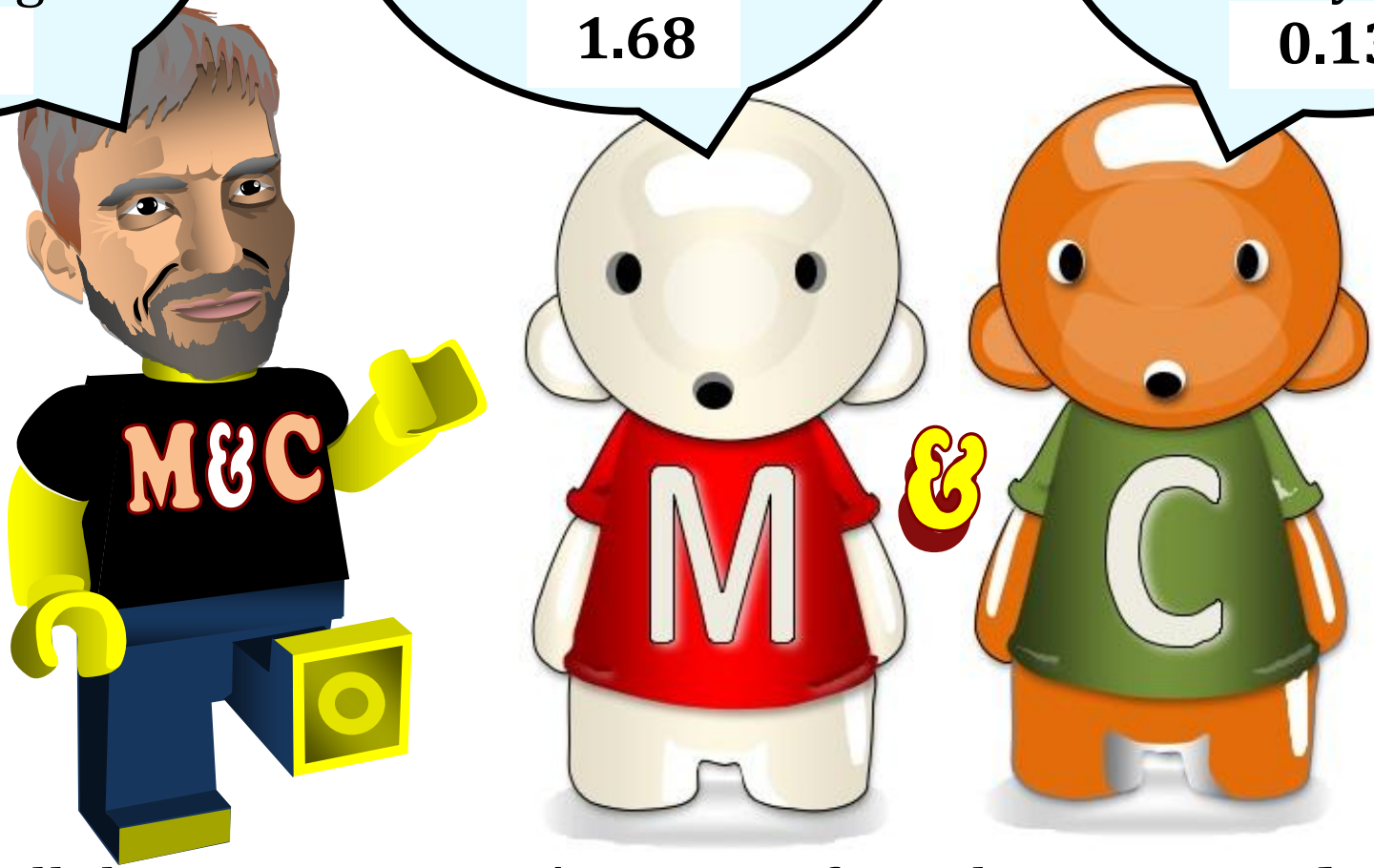
Computers achieve 0.76 – 0.93 correlation with M&C human ratings

see Veale & Li (2013) for implementation of similarity measure using T. Rex

For example,
the average human
rating for the pair
car – automobile
is very high:
3.92

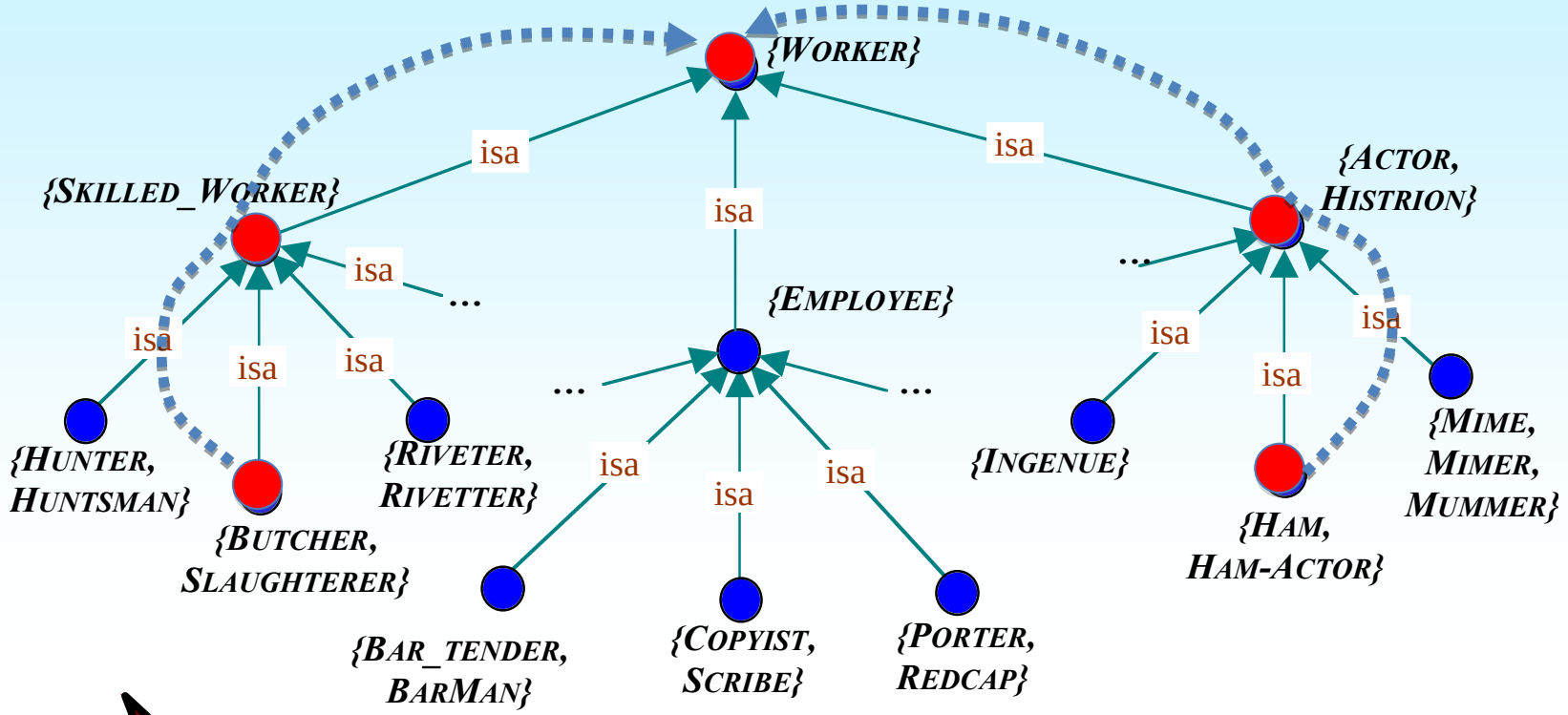
In contrast,
the average human
rating for the pair
crane – implement
is middling:
1.68

And the
the average human
rating for the pair
chord – smile
is very low:
0.13



So how well does a computer's sense of similarity **correlate** with these average human ratings for the same word-pairs?

As with the Linnaean taxonomy ...



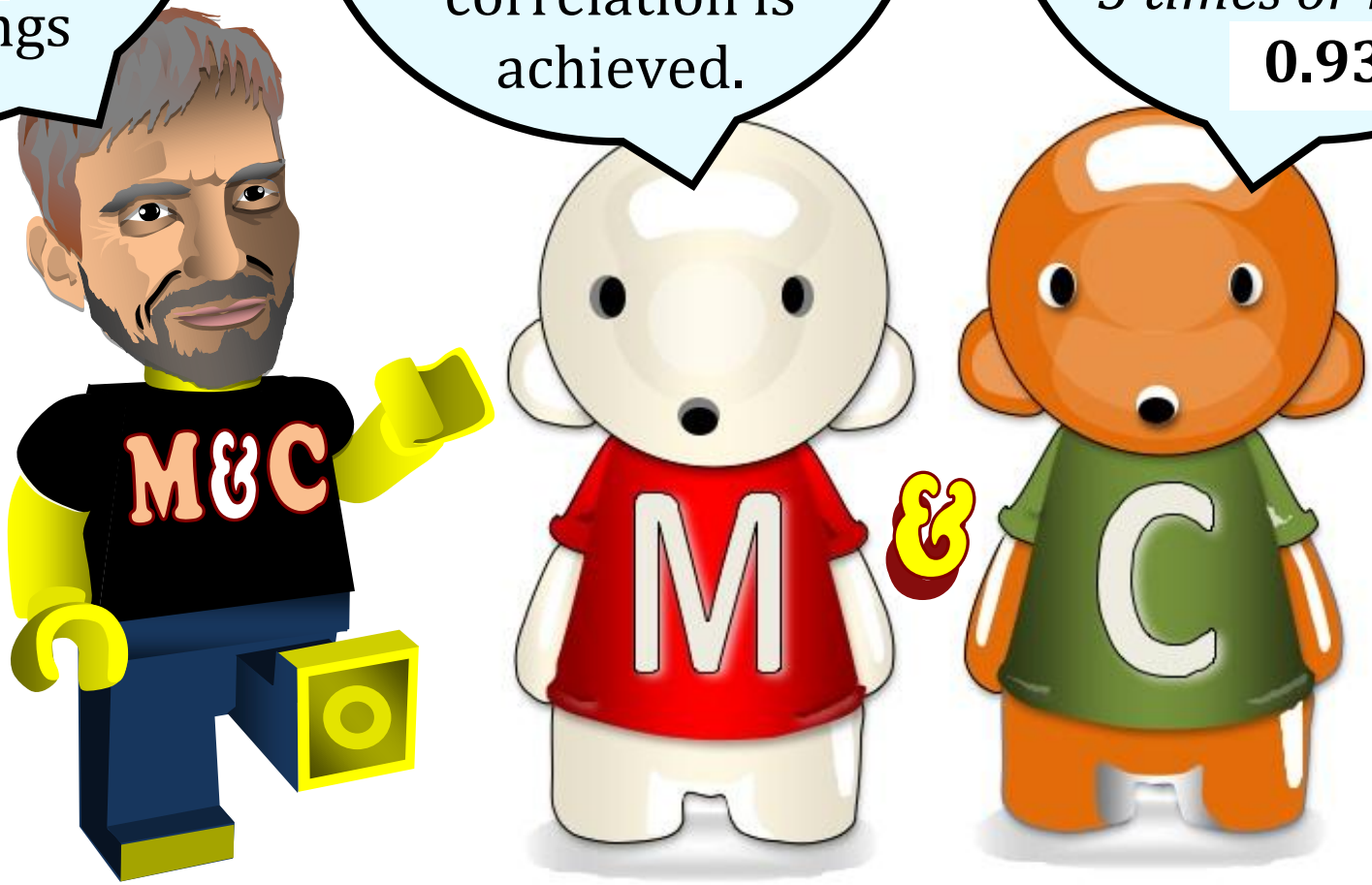
WordNet-based similarity measures typically identify the most specific point of convergence between two ideas in the taxonomy, and estimate the relative amount of shared information content from there.

The more points of convergence there are, the greater the opportunity for similarity to be perceived.

The best WordNet-based metrics achieve a correlation of **0.75 ... 0.85** with **M&C** ratings

If WordNet is enriched with ***all of Thesaurus Rex***'s categories, a **0.895** correlation is achieved.

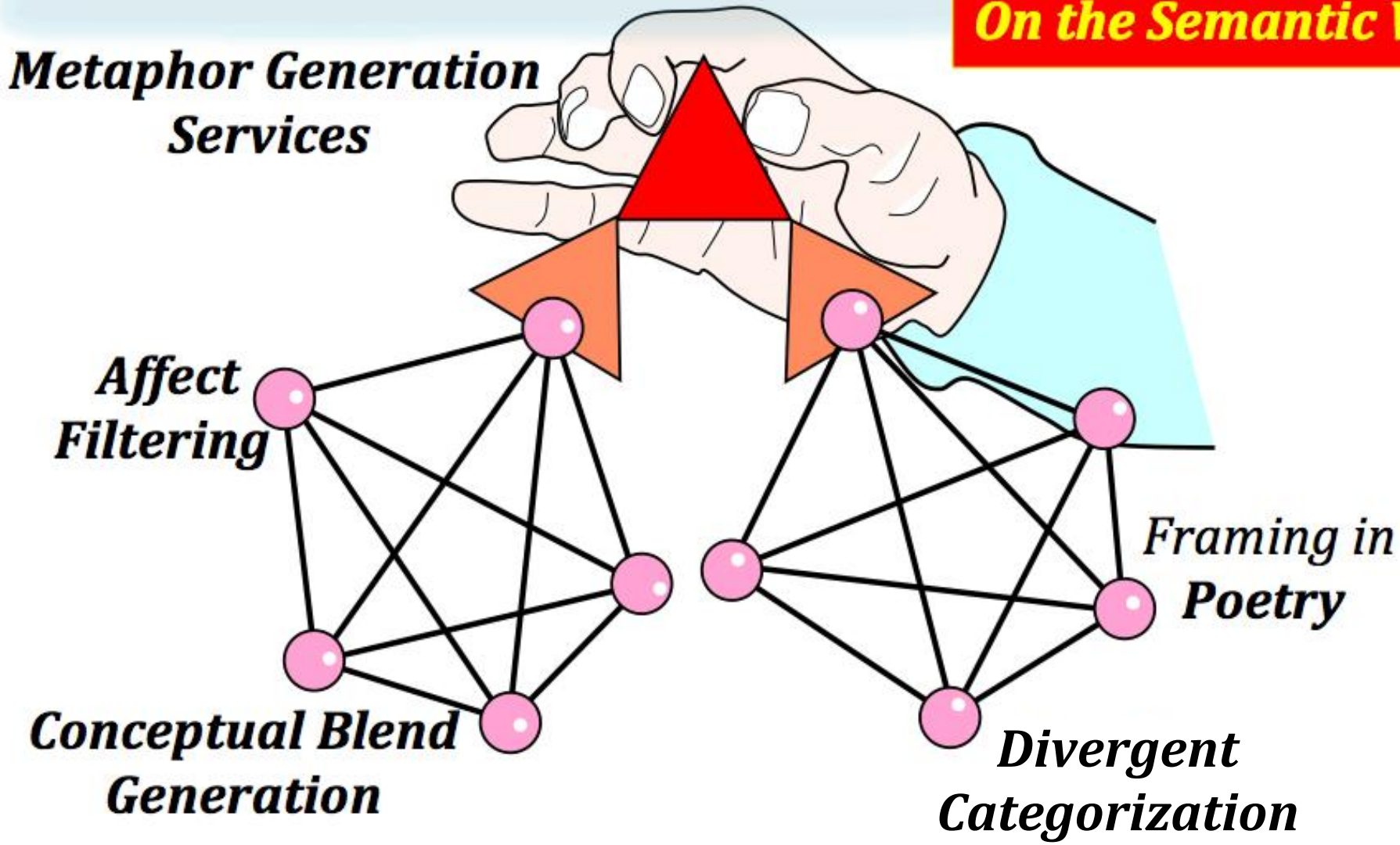
If we add ***only Thesaurus Rex's frequently found*** perspectives *(found 5 times or more)*: **0.93**



A correlation of **0.93** with human ratings is also the best that has been achieved with ***opaque*** machine-learning (SVM) methods.

A Web of Creative Metaphor Services

On the Semantic Web

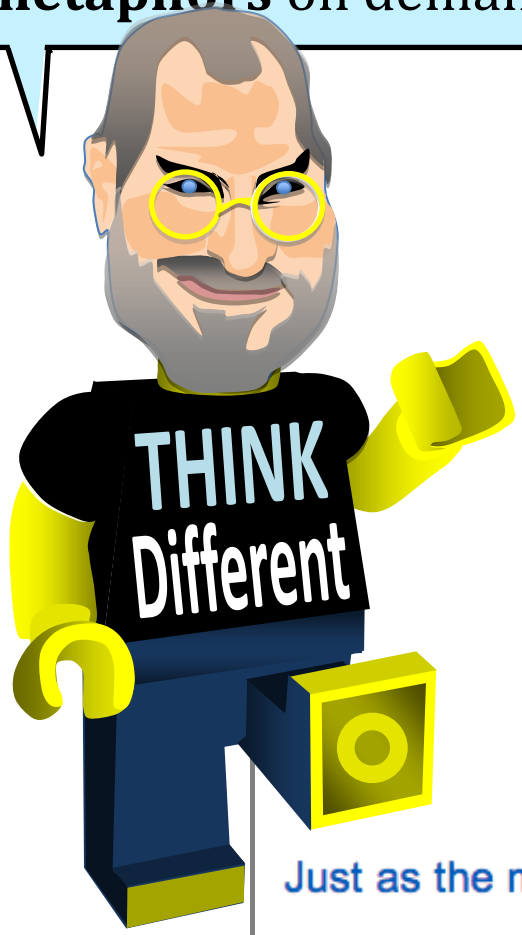


Check out: Afflatus.UCD.ie

So what if a diverse assortment of metaphors could be ***created on demand*** for any given topic?

A Web Service called ***Metaphor Magnet*** can be used to *commoditize* creative metaphors for use in 3rd-party

Metaphor Magnet will even generate **poems** (*ahem*) for your **metaphors** on demand.



No Cult Is More Secret

Support me with your fervent attack

Spiritual beliefs does Apple enforce

No genius is more deranged, or more secretly obsessed

Fascinate me with your secret depravity

Let your religious control inspire me

Did ever a guru create a more infamously bizarre cult?

How you spread to me so secretly, like a revered cult

Does any cult brainwash more secretly than this Apple?

You secretly spread to me with your spiritual obsessions

Just as the most devoted priests serve the most loving deities, the most devoted cults worship the most loving gods

Would a saint rather be worshipped by cults containing charming vampires or threatening demons?

O Apple, you oppress me with your dogmatic spirituality

*This CC twitterbot uses the **Metaphor Magnet** Web-service to tweet a new divergent perspective every hour or so.*

MetaphorIsMyBusiness @MetaphorMagnet · 14h

.@wealth_god says money is a compelling mystery
.@criminal_analyst says it is a boring bank
#Money=#Mystery #Money=#Bank

MetaphorIsMyBusiness @MetaphorMagnet · 9h

#Irony: When valuable pearls glow like the most worthless cigarette butts.
#Valuable=#Worthless
#Pearl=#Cigarette_butt

Creativity often arises from the **context** in which we place an idea, an object or a character. Put something in the right context, and hidden qualities can become easier to perceive.

MetaphorIsMyBusiness
@MetaphorMagnet

#Alarm
1. A timed alert
2. A blinking clock
3. A warning device
4. An audible indicator
5. A flashing signal

MetaphorIsMyBusiness
@MetaphorMagnet

#Take5 of the #Bawdiest things:
1. roadhouses
2. romps
3. slapstick
4. taverns
5. bawds
#Bawdy

The (Un)usual Suspects

for another. Indeed, most of the divergent uses that we might imagine for an object in the course of the *unusual uses test* will be, in some mundane context, a role or activity that we perceive everyday, either in real life or on TV. However, so strong are our associations for a test object that we cannot easily perceive other possibilities. One way to *ace* the unusual uses test is to use a crib sheet of the most typical uses for *any* object, and simply fit the elements of our inventory to an object.

Suppose we look on the Web for all completions of the phrase "used as a *", where * can match any noun. We can use a Google database called the Google N-Grams to quickly find possible noun fillers and their frequency of use in this phrase on the Web. The most frequent fillers – and the most frequent *second*-uses to which an object might be put – are listed on the following page

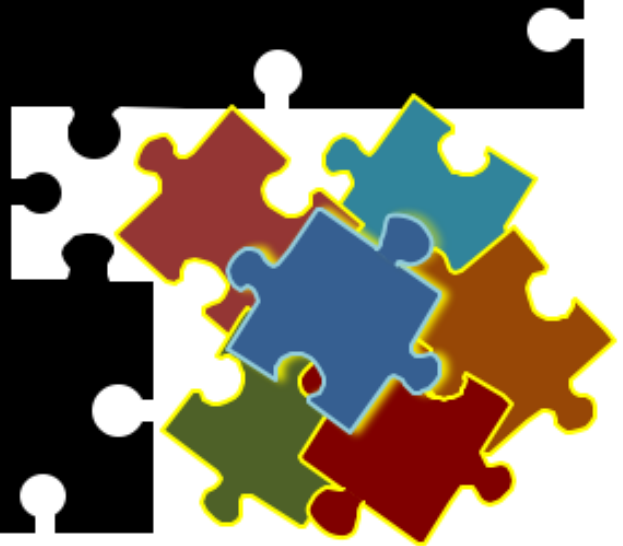
Now, let's play the unusual uses game with each of the following test stimuli. For each stimulus, first try to invent your own innovative uses. How many *more* uses can you invent by using the list of common uses on the next page? Feel free to think metaphorically – a "prison" does not have to a real prison, but any restrictive context – and metonymically – an object may not be usable as a "church", but it might be used as an altar, a sacrifice or an offering.

An empty coffee can	A windscreen wiper	A cardboard tube	A blunt knife	A chair leg
A microwave oven	One boxing glove	A spare room	A headless doll	A housebrick
A wind-up alarm clock	Scratched CDs	One chopstick	A plastic bag	A bag of marbles
Unused 1985 diary	Doll's head (no body)	A garden shed	Used batteries	A ball of string

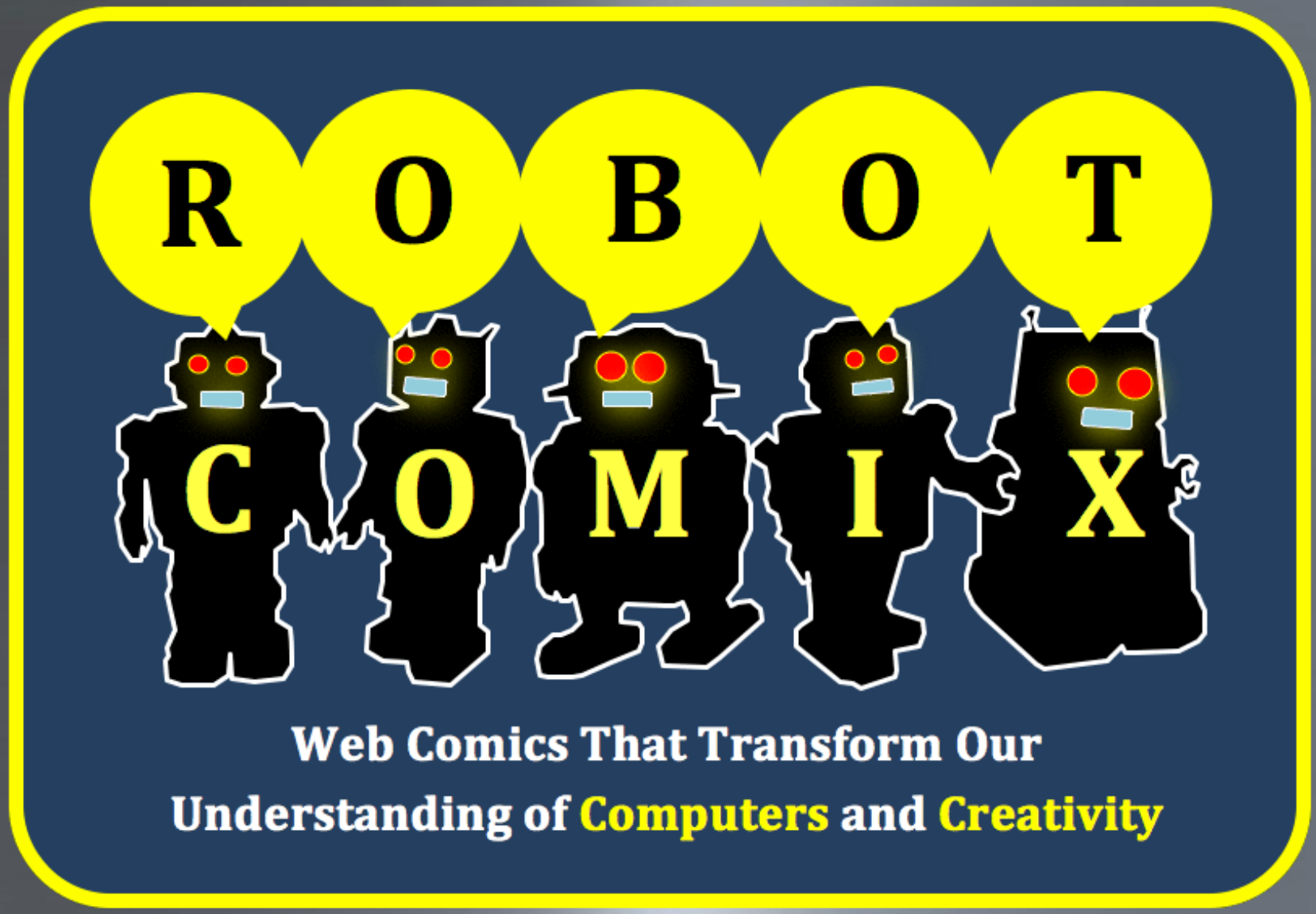
These nouns are all frequently used on the Web to complete the phrase "*used as a **":

Model, weapon, vehicle, symbol, platform, treat, dwelling, catalyst, prison, drug, cure, bridge, light, library, shield, wall, fence, mask, church, classroom, bedroom, spice, car, yardstick, toy, computer, flag, decoration, gift, seed, warning, blueprint, laboratory, vaccine, code, password, threat, blanket, pillow, bookmark, kitchen, cemetery, map, barometer, window, hammer, diaper, marinade, tray, mirror, missile, sensor, rug, lens, sword, diary, bomb, tranquilizer, hook, poison, perfume, joke, chair, compass, cloak, trap, dump, bank, clock, purse, puppet, battery, whip, scarf, pot, cudgel, sink, plate, notebook, bullet, counterweight, hat, sponge, thermometer, keepsake, birdbath, nest, cane, pendulum, bracelet, spear, necklace, clamp, spoon, tomb, brooch, shrine, nail.

- What qualities should the most reusable elements on this inventory possess?
- Is an inventory approach likely to increase or reduce divergence?
- How might you generalize this inventory into a reliable technique?
  - How might your generalized technique be automated?
  - What additional categories would you add to the above inventory?



You want metaphors? ***I got*** *yer metaphors. Deep metaphors. Shallow metaphors. Shiny metaphors. It's like I'm* ***giving them away!*** *Lovely Jubbly metaphors and the like* at
http://Afflatus.UCD.ie



For more comix on creativity: RobotComix.com