



Reasoning and Invention

What does the ink jet printer, the aspartame and teflon have in common?

&

What is the link with the innovation process?

Reasoning: Deduction, Induction

◆ Deduction (Aristote)

derives the inevitable consequences from a pure hypothesis
prove that something must be

- ◆ All the men are mortals, Socrate is a man, therefore Socrate is mortal.

◆ Induction (Aristote et Platon)

determine a value, shows that something goes “de facto”.

From singularity to Generality, psychological validity (sometime contradicted by the facts)

- ◆ Socrate is bald, Socrate is a man, therefore men are bald

◆ Induction and deduction: never produced ideas.

Reasoning: abduction

- ◆ Retroduction (Aristote, translated as abduction)
Facts study and elaboration of a theory to explain them
Imagination process of an explanatory hypothesis

Only logical operation able to introduce a new idea
All the ideas in science come by abduction.

- ◆ Analogy (Aristote paradeigma [**παραδειγμα**]) combines induction and abduction

(John Poinsot, 1631, philosophe portuguais)
(Charles Pierce, 1866, philosophe pragmatique américain)

Serendipity

- ◆ observation of a not-anticipated, abnormal and strategic fact which becomes the occasion of the development of a new theory, or the extension of an existing theory.
 - abnormal, surprising and incompatible observation is with the current theories, or other noted facts.
 - the “prima facie” incompatibility wakes up curiosity, encourage the investigator to explain the data with a broader framework off knowledge.
 - strategic unexpected fact : implications related to a generalized theory.
 - observer is more important than the data.
 - sensitized observer with the theory: detect the general in the particular.

Serendipity

- ◆ observation of a surprising fact followed by a correct abduction (explanation)

the only abduction only suggests that it would be possible

- ◆ Example: Velcro, 1948 : serendipity coupled with an invention
 - a discovery (burrs that stuck to the wool)
 - an invention (touch fastener)



(Robert Merton, 1976, sociologue des sciences américain)

Luc Quoniam USTV

Serendipity: how does it “works”?

- test an assumption and observe an anomaly
(which does not correspond to your ideas, opinions, prejudices, dogmas and knowledge)
- think that there is an error, but exclude this possibility
- explain differently to nevertheless understand the anomaly.
- if this explanation is sufficiently interesting, elegant and simple
 - ◆ Transform it in a new working hypothesis
 - ◆ test it with experimentation, independently from the first abnormality to avoid “thinking in round”.
- A two stage methodology:
 - ◆ one to explain a surprising anomaly (anomaly-abductive method = serendipity)
 - ◆ the other to test an assumption (hypothetico-deductive method)not exclusive but alternate, are supplemented and even in synergy

Does not always “works”!!!

- not all anomalies occur during the first test of assumptions
- new assumptions not always emerge as explanations of the anomalies.
- assumption test does not always provide a “fresh” anomaly
- an anomaly does not always give a new assumption

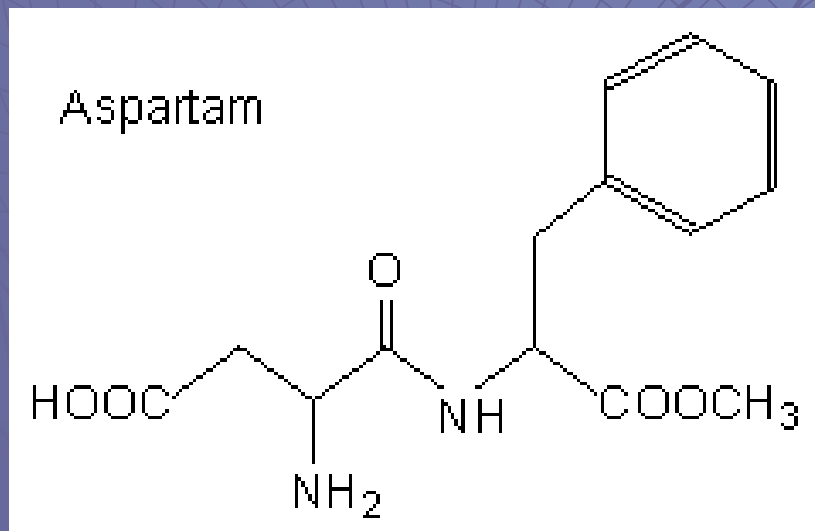


Serendipity: not a new idea!!!

- ★ *“Serendipity is the art to profit from unexpected occurrences” (Irving Langmuir, Nobel prize laureate, 1881-1957)*
- ★ *“Who finds what it seeks, in general, does a good schoolboy work; thinking about what he wishes, he often neglects the signs, sometimes tiny, which shows another thing than the object of his forecasts. The true researcher must know how to pay attention to the signs which will reveal the existence of a non expected phenomenon.” (Louis Leprince-Ringuet, 1901-2000)*
- ★ *«One often sees the merit without the chance but never the chance without the merit» (Von Laue, Nobel prize, 1879-1960)*
- ★ *«When the unexpected is not awaited, it is not discovered because one cannot find it and that there remains inaccessible» Héraclite d'Ephèze, 550-475 av. J.C.)*
- ★ *« In the field of the observation, the chance supports only the prepared spirits. ” (Louis Pasteur 1822-1895)*

What is the “serendipist” attitude?

- ◆ observers, curious, easily inattentive, intuitive, judicious, flexible, feel humour but not easily controllable because they have an independent spirit and an unforeseeable behavior.
- ◆ cannot be managed in an authoritative way because of their intrinsic motivation



Serendipity : samples and attitude

- be attentive with the astonishing errors, the unexplained accidents, all that does not appear “normal” (Pasteur et Fleming)
- wonder how to benefit from an error (Arthur Fry, 3M)
What could we make with “a stick that does not stick”? Response : post-it note.
- create facing the unforeseen, be flexible to change course quickly (Pfizer : Viagra).
- Listen to the collaborators, customers, suppliers and partners of the company, they can bring serendipity too.



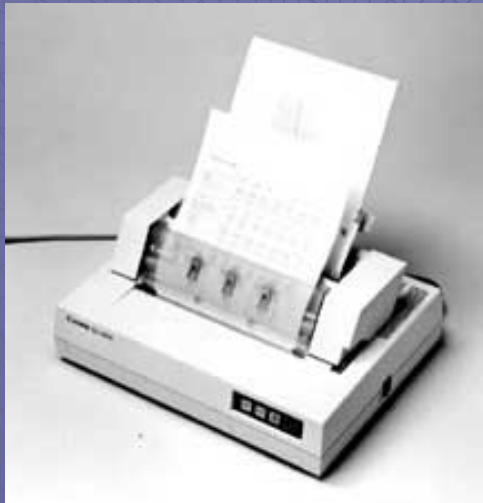
Building models?

The god's will, our unconscious, a plan, a strategy, an ideology, a research program or computer program

will never be able to anticipate

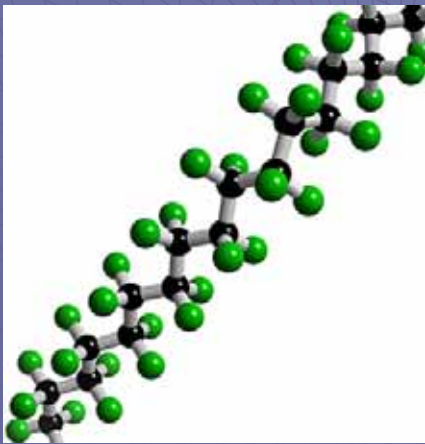
the unknown, the impossible, the anti-intuitive, the arrival of the facts, relations, points of view or perverse effects

which are surprising.



Serendipity : research program coordination

- The coordinator is the guard of an open system, safe from bureaucratic domination.
- The research planning must be made in a simple way. Planning should be followed but that should not become a goal
- With too much planning, too many people beats around the pot without being in the pot itself. In other terms, the bureaucracy becomes increasingly important and real research disappears.



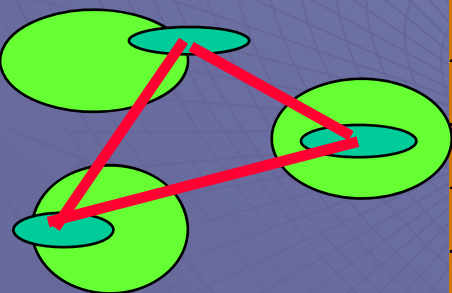
Harry Beckers, Shell

Serendipity, creativity and Human Network

◆ ENTP, innovators INTP, inventors

◆ Shadows xSFJ : ISTJ administrators ou organizers.

	Organization	Imagination, creativity, serendipity
ClubMed	Gilbert Trigano	Gérard Blitz
Microsoft	Steve Balmer	Bill Gâtes
Nike	Phil Knight	Bill Bowerman
Hewlett-Packard	Dave Packard	Bill Hewlett (HP-35)
eBay	Jeff Skol & Meg Whitman	Pierre et Pam Omidyar
Sony	Akio Morita	Masaru Ibuka (Transistor radio, walkman)
Tupperware	Brownie Wise (réseau)	Earl Tupper (chimist)
PalmComputmg	Donna Dubinsky	Jeff Hawkins
L'Espace (Renault)	Jean-Luc Lagardère	Philippe Guédon, Bernard Hanon
Le BMX (olympique)	Ron Mackler	ScotBreithaupt(13 year)
Harley-Davidson	Rich Teerlink	Wili Davidson
Apple	Steve Jobs	Steve Wozniak
Intel	Andy Grove	Cordon Moore & Robert Noyce
Amazon.com	JeffWilke (Accenture, 6 Sigma)	JeffBezos
Accor	Gérard Pélisson	Paul Dubrule
Nouvelles Frontières	Lucien Meudec	Jacques Maillot



Serendipity & methodology are not incompatible

- ◆ Systematic, finalized research and serendipity are not excluded but are complementary and even are reinforced
 - serendipity can emerge by carrying out a planned project: vulcanization
 - Charles Goodyear found but by an unforeseen road.
- ◆ A four stage methodology:
 - test an assumption (hypothetico-deductive method)
 - be attentive to the unforeseen (attitude)
 - one to explain a surprising anomaly (anomaly-abductive method = serendipity)
 - the other to test an assumption (hypothetico-deductive method)

Serendity and evaluation

- ◆ Martin Harwit (American astronomer and historian)
 - 43 discovered cosmic phenomena
 - half of these observations were serendipity
 - « That throws a little doubt about the normal criteria of the “peer review” because the current criteria rest on a theoretical justification of the work which the researcher wants to make: especially if one asks for time for [to use] a telescope or anything else. »

all the projects evaluation rest on “a priori” justification

http://www.intelligence-creative.com/351_serendip_retrochrono.html

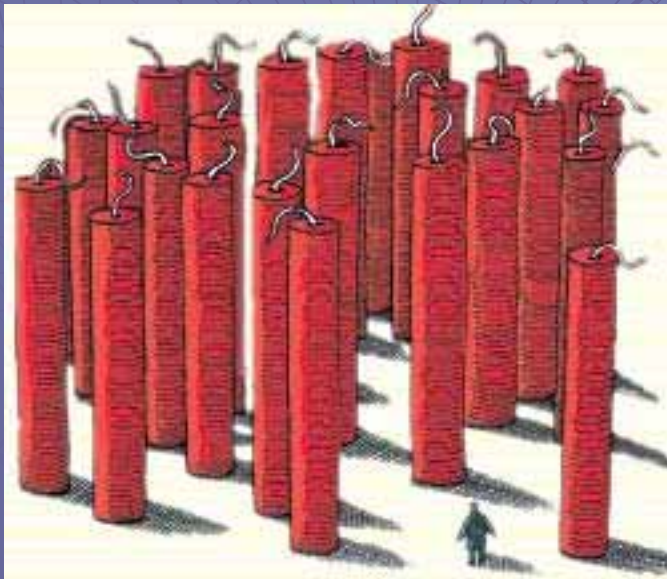
Serendipity and expertise

- ◆ Shortly before the creation of what became Gemplus (world leader in smart card), a market study was commissioned in the United States by the Thomson group with the Boston Consulting Group.
The study was fairly negative.
- ◆ The reasons are (obvious a posteriori!)
- ◆ The study was done by asking the U.S. market (mainly U.S.), especially banks (mainly American) who felt that the security of transactions was not (then) a big problem or an urgent problem.

(Jean Pierre Gloton Cofounder VP technology R&D, CEO GEMPLUS Electronics at GEMPLUS) personal communication to Elio Flesia, innovation specialist)

Serendipity and ethics

- ◆ European Anti-Fraud Office (OLAF) 1999 is charged to discover the not-desired effects of a Community regulation
- ◆ In 2005, Dupont payed 107 million \$ to residents bordering his factory of Teflon because the company would have hidden certain health hazards to the surrounding population.



Serendipity, creativity and information

- ◆ Léonard de Vinci 13 000 Codex
- ◆ Thomas Edison (1093 patents) 1887, innovative laboratory
 - 5 000 000 documents; 390,000 objects, US\$1.5 million for the listing.
 - \$60 million capital campaign to support preservation and curation.
- ◆ Wright brothers: « how to make a plane fly ?? »
 - Worldwide documentation before starting project
- ◆ Walt Disney: shoes boxes to stock the ideas presented to him
- ◆ Thomson Corporation
 - leader in providing integrated information solutions
 - 2005 revenues of \$8.7 billion, is a.
 - 20 million users in the fields of law, tax, accounting, financial services, higher education, reference information, corporate e-learning and assessment, scientific research and healthcare.
 - 40,000 employees, 130 countries
 - Common shares are listed on the New York and Toronto stock exchanges (NYSE: TOC; Toronto)

Serendipity & methodology to seek information

- Don R. Swanson, PhD University of Chicago, Division of the Humanities:
http://arrowsmith.psych.uic.edu/arrowsmith_uic/index.html
- Dou, H., Hassanaly, P., Quoniam, L., La Tela, A. Competitive technology assesment. Strategic clusters obtained with non-boolean logic. World Patent Information. , v.12, p.222 - 229, 1990.
<http://quoniam.univ-tln.fr/articles.shtml>
- Doctorate Thesis : Jean-Dominique Pierret
<http://quoniam.univ-tln.fr/theses/Pierret/These.pdf>



Non Boolean logic : competencies procurement

Look for companies with several fields of competence and with R & D

Bread, Wine, Cheese

The answer is in formal data bases but
the traditional Boolean operators are not the good methodology

SS 1?

~wine and bread and cheese

OCCURS	TERM
5195	WINE
6339	BREAD
5343	CHEESE

SS 1 RESULT (5)

SS 2?

~wine or bread or cheese

OCCURS	TERM
5195	WINE
6339	BREAD
5343	CHEESE

SS 2 RESULT (16593)

Boolean logic is restrictive!!!

AN - 88-096323/14

XRAM- C88-043414

TI - Rat attractant - contains alcohol e.g. sake, wine etc. impregnated into food

DC - C03 P14

PA - (MURA/) MURAKAMI H

NP - 2

PN - J63048205-A 88.02.29 (8814) {JP}

CN8704002-A 88.02.10 (8913)

PR - 86.08.19 86JP-193677 86.06.03 86JP-U84682 86.06.10 86JP-135192
86.07.30 86JP-V17378

AP - 86.08.19 86JP-193677

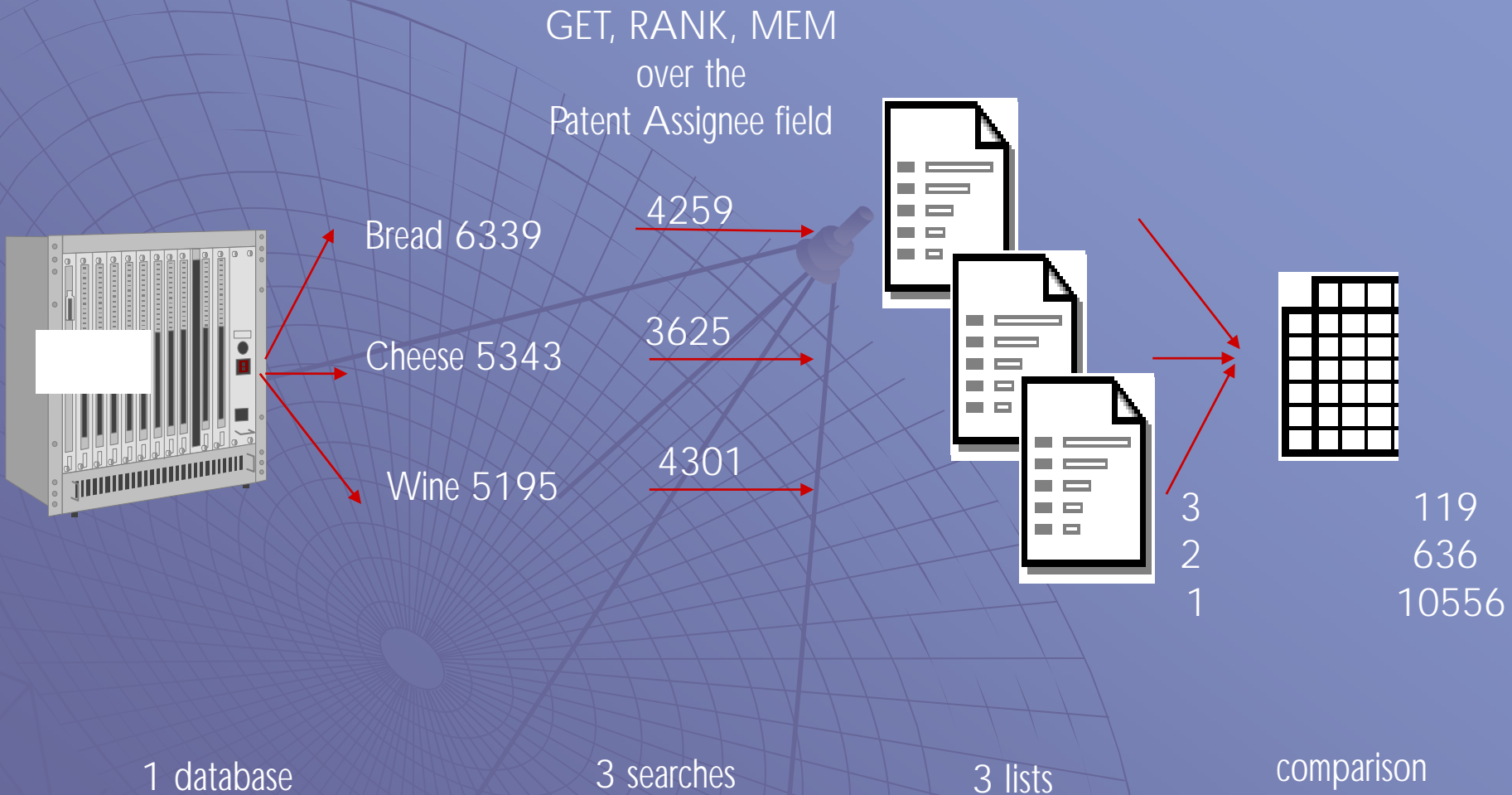
IC - A01N-031/04 A01N-063/00 A01M-023/16

AB - (J63048205)

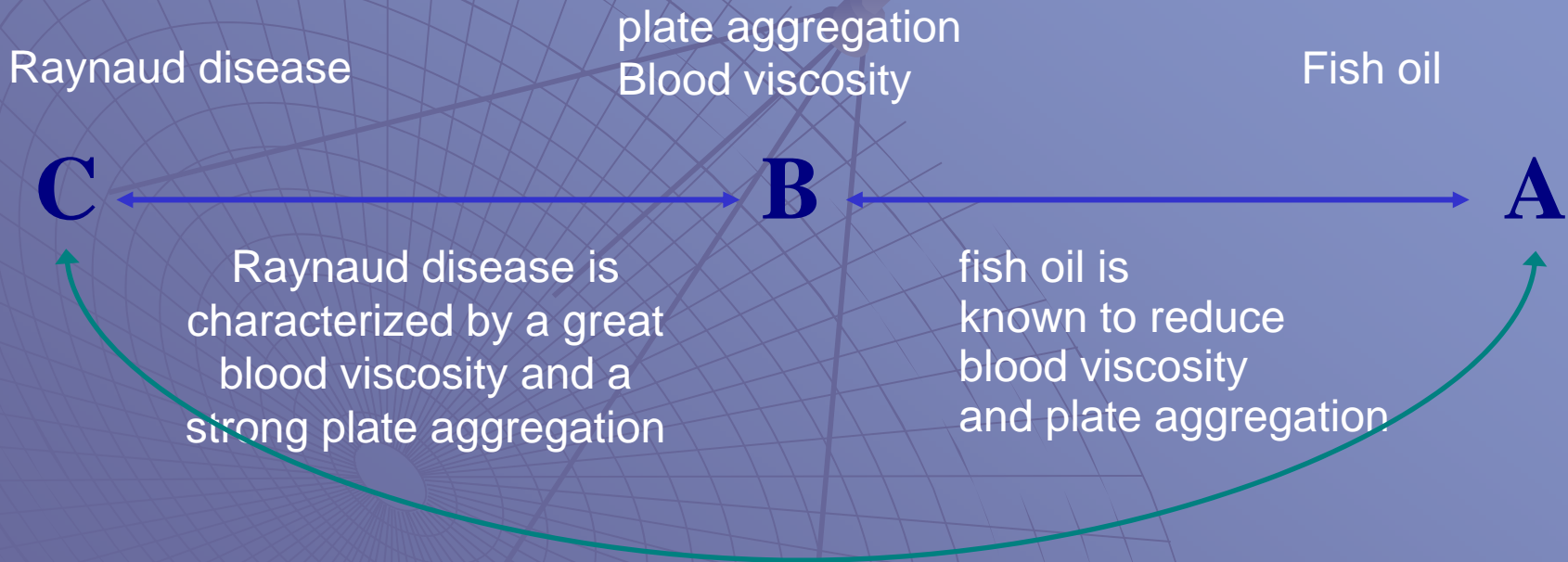
Pref. alcohol is Japanese sake, wine, brandy, etc., and is impregnated on bread, sweet potato, cheese, soybean, peanut, etc.

ADVANTAGE - Attracts rats continuously, and it is possible to catch rats continuously. Rats which have taken the attractant become drunk and the warning reaction of rats is reduced. (2pp Dwg.No.0/0)

Solution



Non Boolean logic : Swanson model

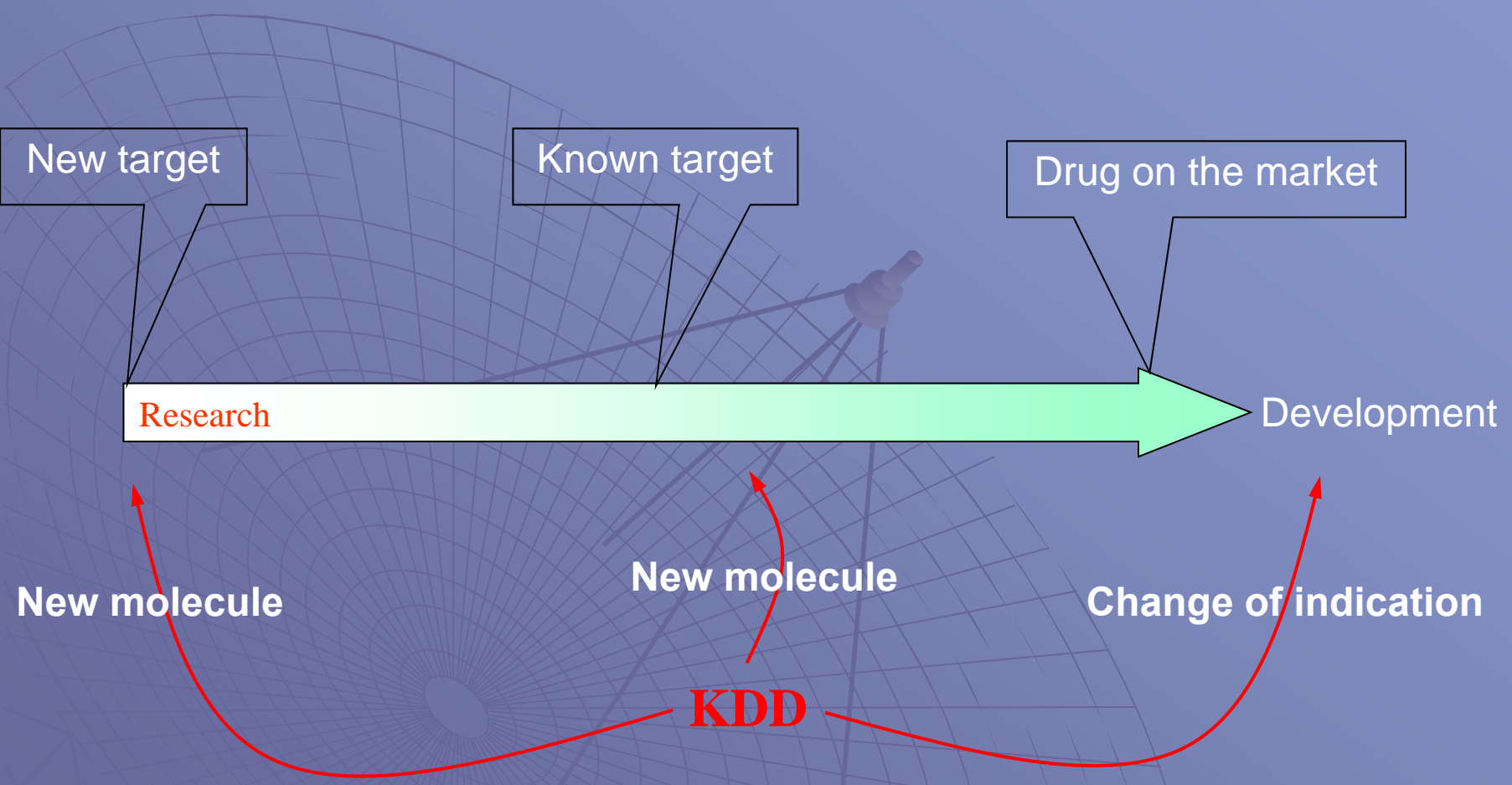


Until 1985, these two data were not linked by researchers, but were linked in literature

R&D for drug

- ◆ expensive: 820 million US\$ per drug (18% turnover sale for R & D)
- ◆ risky: 1 molecule out of 10.000 will become a drug
- ◆ Long time: 10 years of efforts to create a drug

 KDD uses for the creation of new treatments



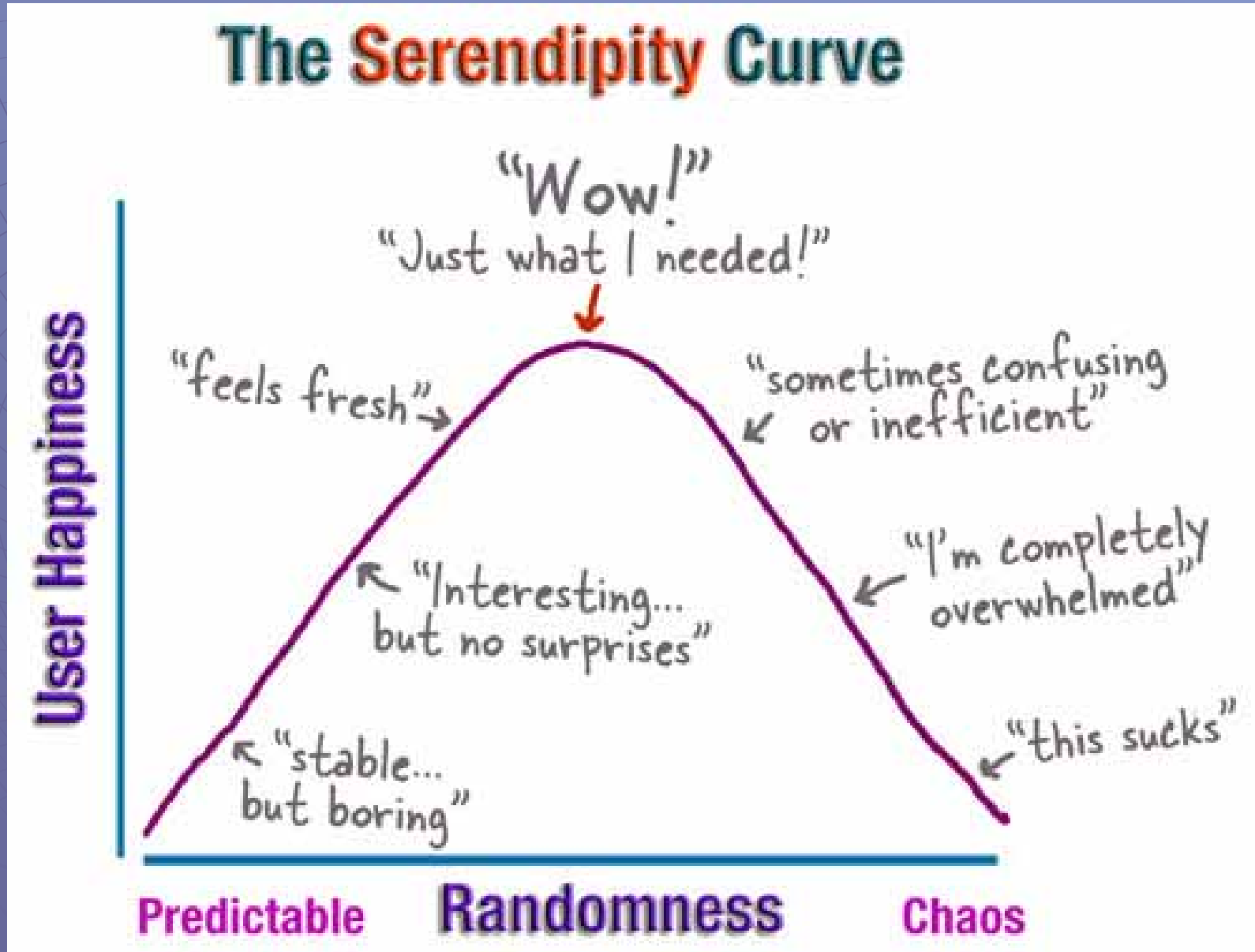
Knowledge Discovery in Databases
4 written patents

Pierret (2005)

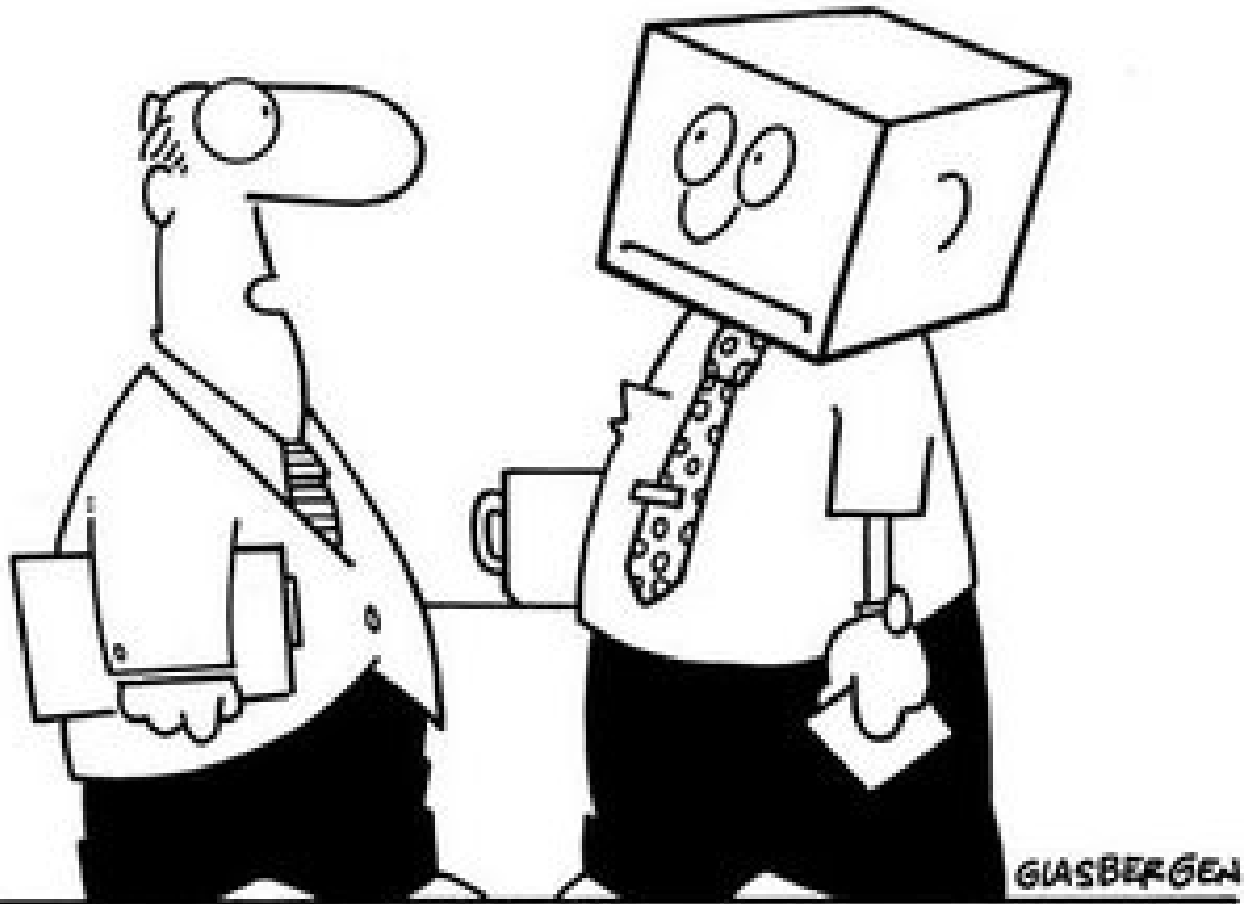
KDD: Knowledge database discovery

- ◆ Use of AZASETRON for the treatment of Rosacea and pharmaceutical compositions
WO2007138234 (A1)(2007-12-06)
PIERRET Jean-Dominique [FR]; DOLFI Fabrizio [FR]; LOESCHE Christian [FR]; TREMEL Nadege [FR]
GALDERMA RES & DEV [FR]
- ◆ Use of GRANISETRON for the treatment of sub-types of rosacea, and pharmaceutical compositions
WO2007138232 (A2) (2007-12-06)
PIERRET Jean-Dominique [FR]; DOLFI Fabrizio [FR]; LOESCHE Christian [FR]; TREMEL Nadege [FR]
GALDERMA RES & DEV [FR]
- ◆ Method of treating inflammatory skin diseases using TROPISETRON, and pharmaceutical compositions thereof
WO2007099069 (A1) (2007-09-07)
TREMEL Nadege [FR]; PIERRET Jean-Dominique [FR]; DOLFI Fabrizio [FR]; LOESCHE Christian [FR]
GALDERMA RES & DEV [FR]
- ◆ Treating inflammation with ONDANSETRON and pharmaceutical compositions comprised thereof
US2007148197 (A1) (2007-06-28)
DOLFI Fabrizio [FR]; TREMEL Nadege [FR]

The serentipity curve



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**“Thinking outside of the box is difficult
for some people. Keep trying.”**