

$$\left(\varepsilon : \left(\frac{7}{\pi} + \right) \right) \times \frac{x}{4} \pi^{-1} =$$

$$+ \sqrt{x} \times \left(\right) + \frac{3}{10} + \left(5 \right)$$

PABLO JENSEN

Pourquoi
la société ne se
laisse pas mettre
en équations

$$N \times \left(\right) = \infty^0$$

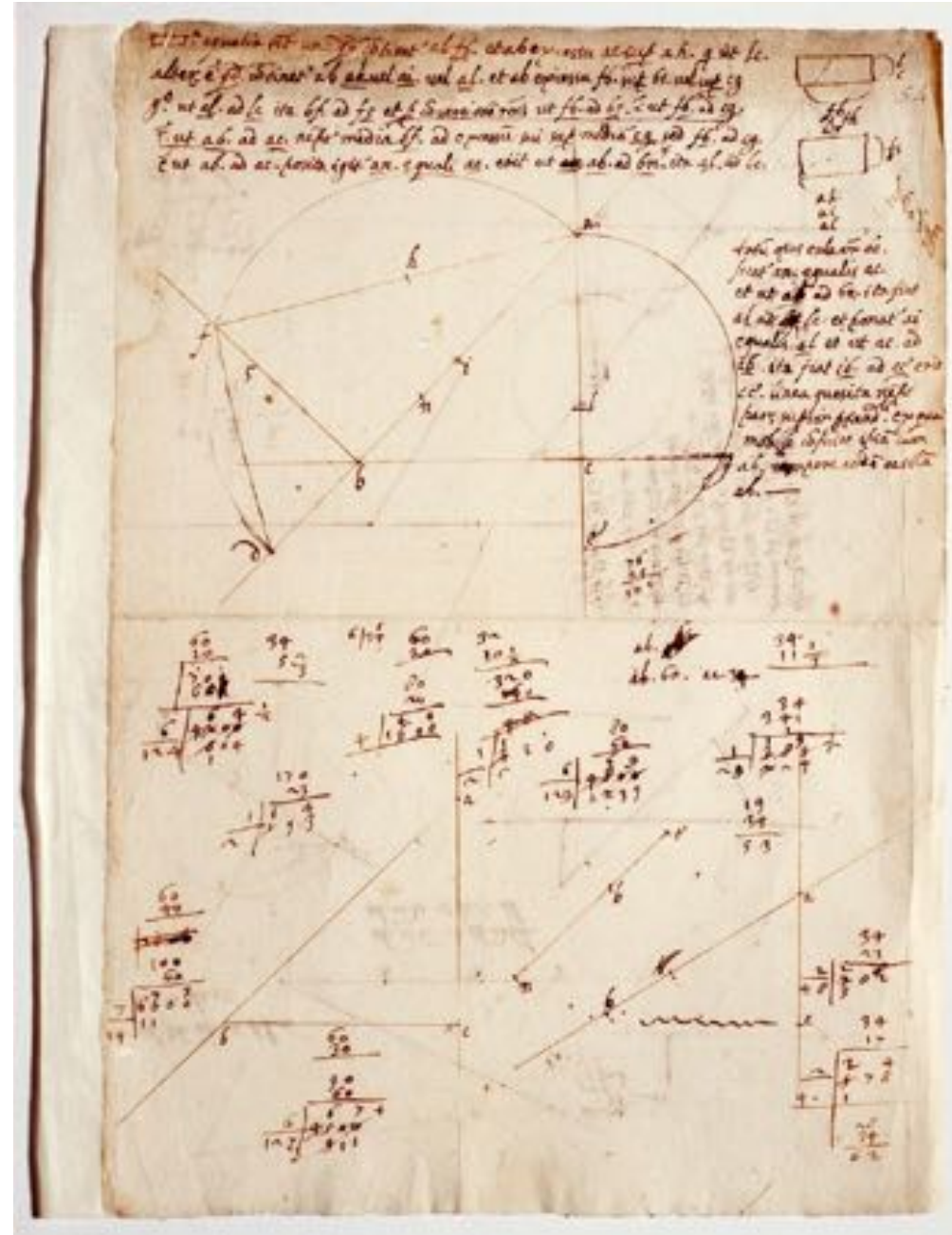
$$+ \sqrt{x} \times \left(\right) + \frac{2}{10} + \left(6 \right)$$

CNRS
Laboratoire
de physique



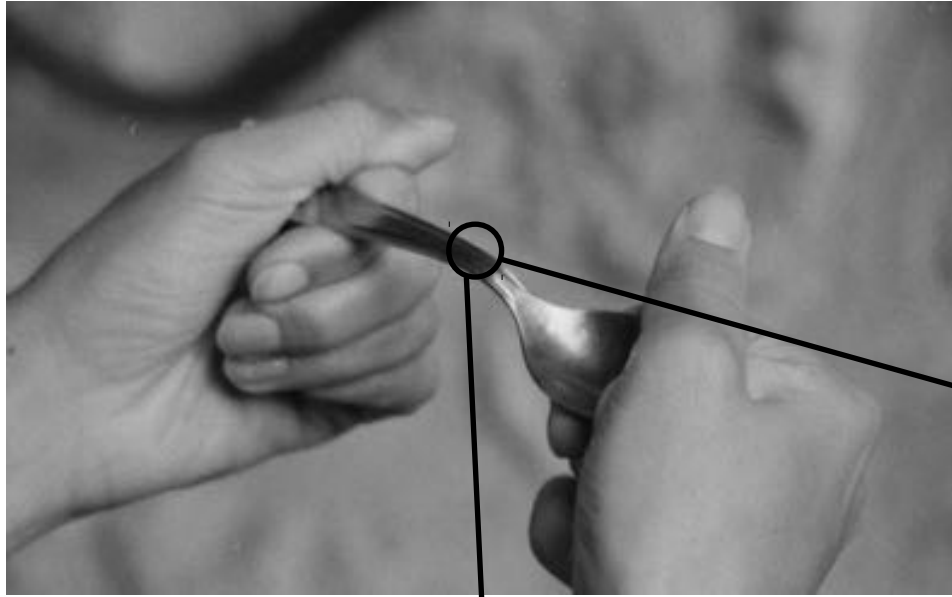
Expliquer, pour un physicien...

- Expliquer, c'est **transformer** un fait physique en un problème mathématique, puis le résoudre en utilisant les outils mathématiques
- Galilée l'applique au mouvement des corps :
 - Pendule
 - Trajectoires (parabole)
 - Distance \sim temps²
- Transformation par **idéalis**ation, pour ne garder que **grandeurs mathématiques**

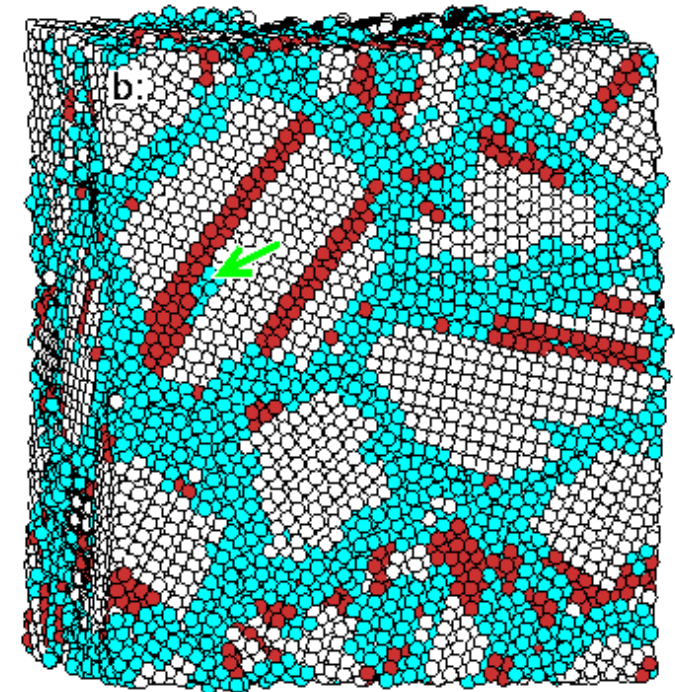
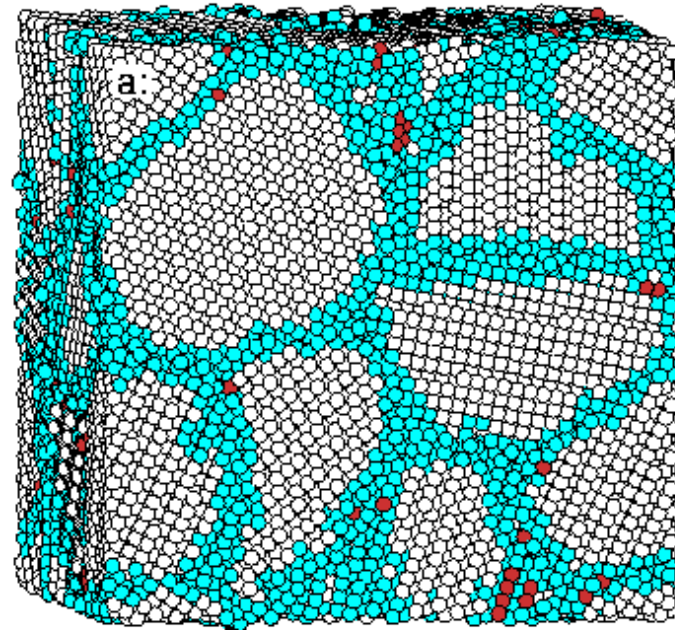


Manuscrit de Galilée, autour de 1600

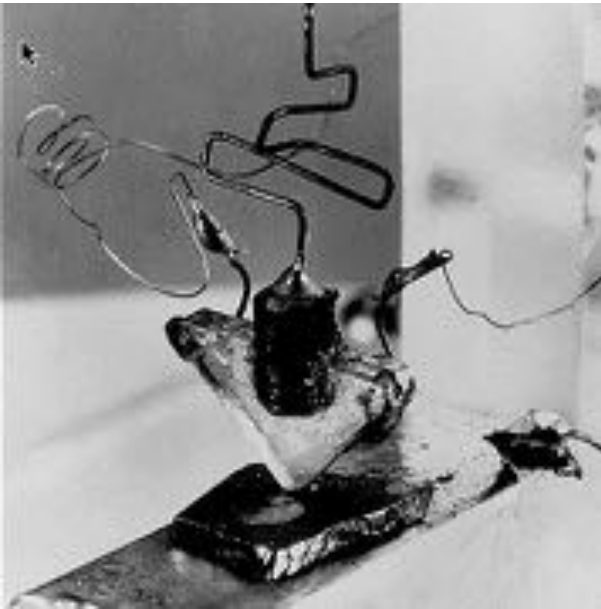
Comprendre grâce aux atomes ?



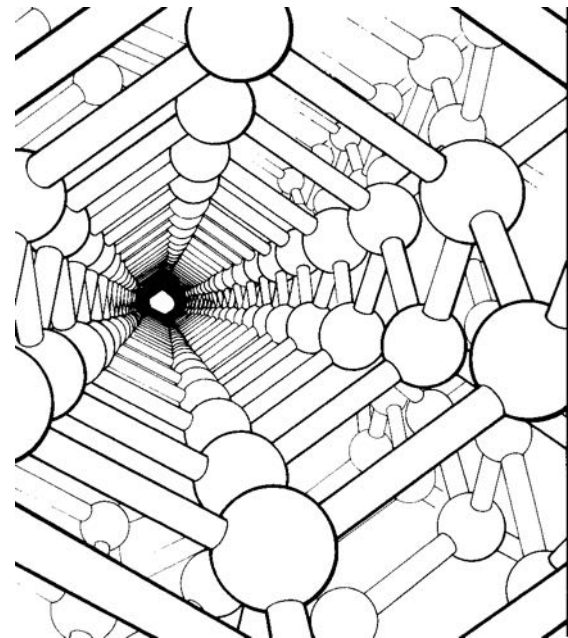
Too complex !



L'électronique, triomphe de la physique




Premier transistor (Bell, 1948)



- Semi conducteurs d'abord **prédiction théorique** (1931) de la mécanique quantique
- Chercheurs de la *Bell* **calculent** des amplis, mais dispositifs **réels** échouent !
- Très grande **purification** → salle blanche



Le rêve du tigre (dis)continuité

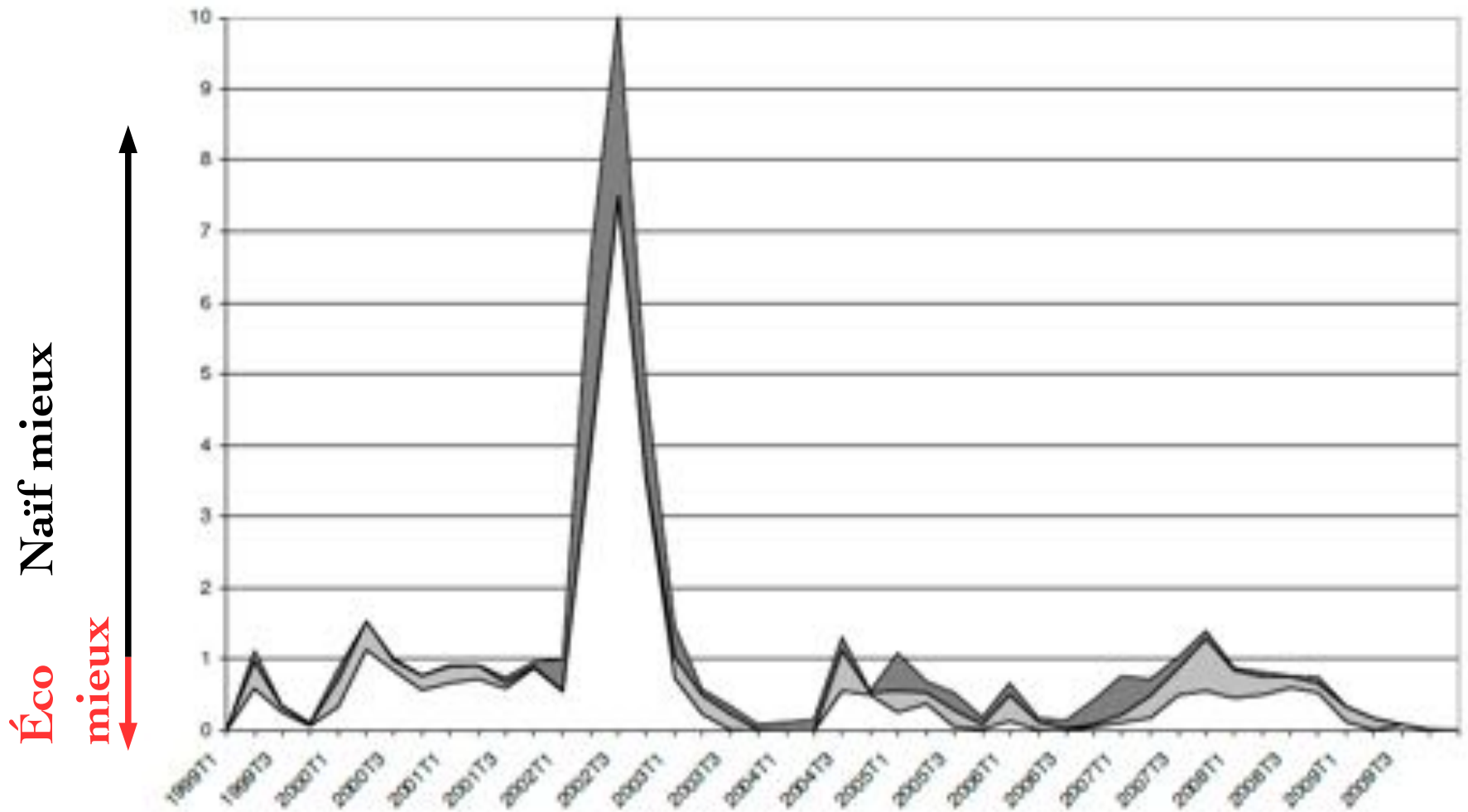
A photograph of a tiger walking through a grassy field. The tiger is the central focus, moving from left to right. Its orange and black stripes are clearly visible. The background is a soft-focus green field.

Construire une explication en physique, c'est comme transformer un tigre **sauvage**, sautant dans la jungle, en un tigre **dompté**, sautant dans un cerceau de feu dans un cirque. On sélectionne et stabilise une partie des sauts potentiels par un investissement lourd en équipements et institutions. Dompter le tigre différent de "découvrir le monde", responsabilité des chercheurs: dans quel sens on l'a dompté?

Et le tigre rêve souvent de retourner sauter dans la jungle...

Mettre la société en équations ?

- Prédire la croissance l'année prochaine par:
 - Modèles économiques complexes ou
 - Un modèle naïf: croissance année prochaine = cette année



$$\left(\varepsilon : \text{person} \frac{7}{\pi} + \text{person} \right) \times \frac{x}{4} \text{person} \pi^{-1} =$$

$$\text{person} + \sqrt{x} \times (\text{person} \text{person}) + \frac{3}{10} + \text{person} \text{house}$$

PABLO JENSEN

Pourquoi
la société ne se
laisse pas mettre
en algorithmes ??

$$N \times (\text{person} \text{person}) = \infty^0$$

$$\text{person}^n + \text{person} \sqrt{i} \times (\text{person} \text{person}) + \frac{2}{10} + \text{person} \text{house}$$

AlphaZero Chess champion

Kasparov : I admit that I was pleased to see that AlphaZero had a *dynamic*, open style like my own... AlphaZero **prioritizes piece activity over material**, preferring positions that to my eye looked risky and aggressive. Programs usually reflect priorities and prejudices of programmers, but because AlphaZero programs itself, I would say that its style reflects *the truth*.”

AlphaZero - Stockfish (2017), London ENG, Dec-04
Queen's Indian Defense: Riumin Variation (E16) • 1-0

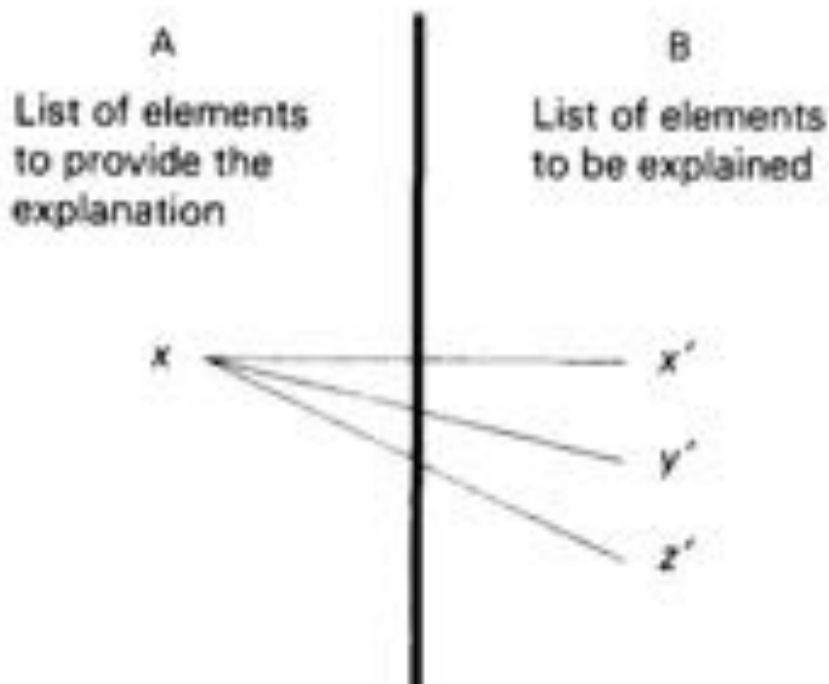


Les prédictions sociales ne sont pas fiables

- **Complexité de la causalité sociale**
 - Enormément de variables, hétérogénéité des humains...
 - Aussi en physique (modèles météo) → méthode *analytique* !
Pas si utile en sciences sociales, effet d'une cause dépend contexte (prix étage élevé, âge et chômage : ça dépend...) + *pas de relation stable* (conservation énergie...)
- **Politique de la modélisation**
 - Réflexivité des humains, qui réagissent aux prévisions
 - Dompter les humains pour les modéliser?!
 - Modèles → plus de pouvoir aux puissants → creuse inégalités

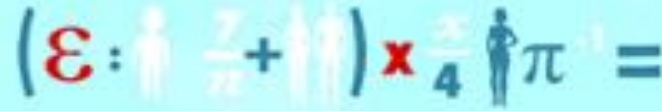
Politics of explanation

- Expliquer = agir à partir d'un centre, bâtir un empire!
 - Si on reste en B, pas besoin d'aller en A, « pratique »
 - Si en A et indifférent à B, pas besoin de lien, « théorie »
 - Si en A mais veut *agir en B* : besoin d'aller-retour fiable
- Explication renforce pouvoir des centres, réduit B
- Quelle **vision société/individus** charriée par explications (A)?



B Latour (1988)

SCIENCE
OUVERTE
Seuil


$$(\epsilon : \text{person} + \frac{7}{\pi}) \times \frac{\pi}{4} \text{person} \pi =$$


$$+ \text{person} \sqrt{x} \times (\text{person}) + \frac{3}{10} + \text{house}$$

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Dompter le
monde
palpitant

C&F éditions
2020

THE PERCEPTRON: A PROBABILISTIC MODEL FOR INFORMATION STORAGE AND ORGANIZATION IN THE BRAIN¹

F. ROSENBLATT

Cornell Aeronautical Laboratory

Seen from this viewpoint, the most suggestive work, from the standpoint of the following theory, is that of Hebb and Hayek.

The position, elaborated by Hebb (7), Hayek (6), Uttley (16), and Ashby (1), in particular, upon which the theory of the perceptron is based, can be summarized by the following assumptions:

Hayek ?



- Friedrich Hayek, 1899 - 1992, « Nobel » en 1974
- (ultra-néo)-libéral, contre perturbation marchés
- Justifie le coup d'état de Pinochet dans un journal chilien : « Personally, I prefer a liberal dictator to a democratic government that lacks liberalism ».
- Existe-t-il un lien entre l'idéologie (ultra-néo)-libérale et réseaux de neurones ou « accident » historique ?

THE SENSORY ORDER

*An Inquiry into the Foundations
of Theoretical Psychology*

By

F. A. HAYEK

*Professor of Social and Moral Science in the Committee on
Social Thought, University of Chicago*

With an Introduction by

HEINRICH KLÜVER

*Professor of Experimental Psychology in the Division
of Biological Sciences, University of Chicago*

1952

Sensory Order

- Mystère : aucune allusion à l'économie...
- Hayek économiste libéral classique, mais ~ 1940
controverse sur le calcul socialiste : économie planifiée,
centralisée, plus performante que libérale avec marchés
décentralisés ?
 - Refondation de l'économie à partir de la
psychologie individuelle, adapter règles à agents
- « It was concern with the logical character of social
theory which forced me to re-examine systematically
my ideas on theoretical psychology »

Sensory Order

- How we put order in our world perceptions, creating a « sensory order » out of a « physical order »
- Our brain builds a « world map », reproducing the stable relations learnt by our experience : When we cut ourselves with a knife, our brain perceives both the cut and the pain, associates them in its world map, thus avoiding a new cut
- The map is formed by strengthening connections between neurons activated simultaneously
- Hypothesis "essential to account for conditioned reflexes" (Pavlov)
- "**Connexionist**" vision of the brain that inspired Rosenblatt, explaining citation !

Link Sensory Order – Liberalism ?

- What social theory derives from *Sensory Order* ?
- Different people have "similar but not identical" maps because different experiences → isolated individuals
- All our knowledge is connections → much remains tacit and even unconscious
- How can such *imperfect* beings *coordinate* to create an effective social order?
 - scattering of information makes centralized planning impossible, as it needs explicit knowledge
 - Hayek's solution : submit to an order formed **spontaneously**, greater than anyone of us can fully comprehend → liberalism

Link connexionism – liberalism

Doubly spontaneous order

- Hayek: only market rules are able to spontaneously coordinate *ignorant* individuals (connexionist brain) to build a society as complex as ours (products require a complex entanglement of distributed, implicit knowledge)
- Market rules emerged "spontaneously" and are adapted through selection, because "the groups that applied [the right rules] prospered more than others and grew"
 - stronger legitimacy than (arbitrary) rules issued by governments, even democratic ones → dictators...

Hayek's link connexionism – liberalism

- For Hayek, deep connection: competitive markets and brains rely on a spontaneous order to tame a complex world
- Markets better than "any deliberate social construction"

Hayek: In both cases we have complex phenomena in which there is a need for a method of utilizing widely dispersed knowledge. The essential point is that each member (neuron, or buyer, or seller) is induced to do what in the total circumstances benefits the system. Each member can be used to serve needs of which it doesn't know anything at all.

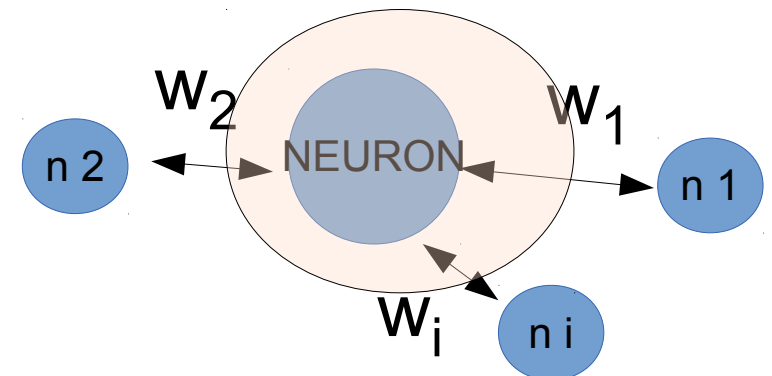
Is Hayek right ?

1. Take the **complexity** (*'widely dispersed knowledge'*) of the real world seriously & tame it thanks to 'spontaneous order' ?
2. Prices set by competitive markets **efficient** (*'benefit the system'*) ?
3. Politics : artificial **ignorance** (*'induced', 'serve needs'*)

1 – Taking complexity seriously ?

neural nets

- Networks respect the *complexity* of their inputs: a cat cannot be caught by explicit definition: *four legs, pointed ears, moustaches...*
 - Hinton: "if there were any simple rules for deciding whether an image contains a pedestrian or not, it would have been a solved problem ages ago".
- We do not pre-define the weights by hand, but trust their *spontaneous* emergence during learning.
- After learning, each neuron will be surrounded by a "bubble" - its connected neurons - that influences its state, *'inducing'* it to *'benefit the system'*, the objective function.



1 – Taking complexity seriously ?

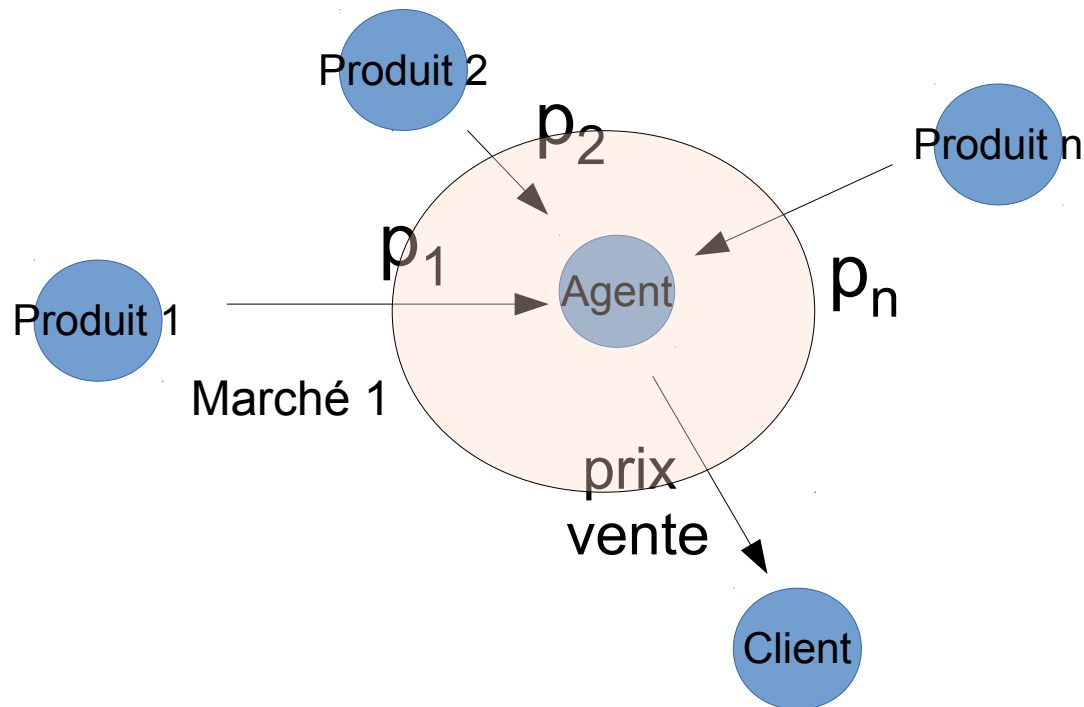
markets, 1st step, fixing prices ~ learning

- Compared to neoclassical eco or central planning, respects *complexity*.
The 'widely dispersed knowledge' of economic entities cannot be explicitly centralized (defined?) : preferences, costs, opportunities, variations...
- Prices are not fixed / imposed by an external calculation. They emerge from market's architecture (rules for bids, who enters...) and agents' actions (bids, collusion...). They transform private, *dispersed* information
→ explicit and public
- Vickrey's auction *'forces' to reveal true estimation* (best strategy).
winner = highest bidder ; *price* = bid of 2nd highest bidder
- **Market design** (not 'spontaneous from evolution') → construit dans un but spécifique (affectant aussi les prix obtenus) :
 - Dutch or descending clock auction → clearing in a fixed time
 - posted-price market → reduces personal interaction in the marketplace
 - computerized limit order book → public record in real time
 - sealed-bid → secrecy of prospective buyers

1 – Taking complexity seriously ?

markets, 2nd step, 'inducing behavior'

- Prices emerging from several markets create a *'bubble'* that *induces* agent's behavior (~ NN prediction). Can use **explicit** information on the different goods, compute costs to make decisions... that *'benefit the system'* ??



2 – Benefits the system ? *neural nets*

- Good results ***only if appropriate*** net architecture (pruning, dropout...) ***and*** database !
 - Overfitting
 - Intelligence we do not understand → limits ?
 - Vulnerabilities with “adversarial attacks”
 - Do not predict, only reproduce the past

Ok for a « framed » world (chess, closed environments...)

2 – Benefits the system ? *markets' prices*

- Hayek affirme que « meilleur que toute construction sociale délibérée »... mais ne le prouve/discute jamais !
- Prices from markets ~ emergence of weights during learning ?
 - But *internal* input (agents' desires, etc.) instead of external (images...), important for economic war, (ecological) **externalities**...
 - Prices are continuously evolving (different from two phases : learning then predicting)
- Market 'efficiency' in revealing private information can only be *proved* if private information is... explicit, and then markets no longer useful !
- More generally, Hayek's (useful) notion of 'radical ignorance' cannot be used to show (formally) that markets > anything else

3 – Politics : artificial *ignorance*

- Individu néolibéral n'est plus cet atome de la liberté, ce point de référence respecté par libéralisme face à pouvoirs, mais devient « éminemment gouvernable » (Foucault).
- Hayek construit une « ignorance artificielle » (Mirowski) des humains, pour justifier mainmise des marchés
 - Individus ~ neurones, obéir à dessein extérieur sur lequel ils n'ont rien à dire. Liberté limitée à leur contexte local
 - Freedom cannot be extended from the use of knowledge *in* society to the use of knowledge *about* society
- « It was men's submission to the impersonal forces of the market that in the past has made possible the growth of a civilisation which without this could not have developed... »
(Road to Serfdom, 210).

Conclusions : quantifier société

- Lien *conceptuel* IA \leftrightarrow libéralisme, réseaux neurones et marchés. Pour contrôler monde complexe, pas décider trop vite de sa représentation car perdrait trop d'information, celle qu'on ne sait pas expliciter.
- Plus efficace de s'imbiber de cette complexité pour faire émerger une représentation approchée : apprentissage par neurones, choix des agents économiques guidés par prix des marchés, employés trouvant les moyens de profiter des circonstances pour gagner de l'argent.
- Lien *politique* ?
 - IA au service état centralisé (crédit social Chine)
 - IA moderniste : contrôle légitimé par transition écologique, pour limiter pollution.

Three world views

	Representation	Framed	Palpitating
AI - brain	symbolic AI	connexionnist AI	human intelligence
Complexity	apparent	shallow	deep
Knowledge	equations, laws of nature	'grown' algorithms	research, heuristics, stable island
Knowledge	explicit, high generality	explicit black-box, low generality	implicit, specific
Politics	plan	markets	radical liberalism
Politics	impose	fixed objective function → bubble	experimental process, no invariant
Icons	Lenin, God, Minsky	Hayek, Hinton ?	Dewey

